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777-200/-200ER/-200LR/-200F
/-300/ -300ER

Flight Crew Operations Manual

The Boeing Company

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Preface**Table of Contents****Chapter 0****Section TOC****Volume 1**

Title Page	0
Model Identification	0.1
Introduction	0.2
Abbreviations	0.3
Revision Record	0.4
V1V2 List of Effective Pages	0.5
Bulletin Record	0.6
Limitations	L
Normal Procedures -200 & -300 Series	NP
Supplementary Procedures -200 & -300 Series	SP
Performance Dispatch	PD
Performance Inflight	PI
777-8 & -9 Incorporation Notice	0

Volume 2

Airplane General, Emergency Equipment, Doors, Windows -200 & -300 Series (tab).	1
Air Systems	2
Anti-Ice, Rain.	3
Automatic Flight	4
Communications -200 & -300 Series.	5
Electrical	6
Engines, APU.	7
Fire Protection	8
Flight Controls	9
Flight Instruments, Displays -200 & -300 Series.	10
Flight Management, Navigation -200 & -300 Series.	11
Fuel.	12
Hydraulics	13

General

The airplanes listed in the table below are covered in this manual. 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.

The table permits flight crew correlation of configuration differences by Registry Number in alpha/numeric order within an operator's fleet for airplanes covered in this manual. 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(s) reflect the most current information supplied by the operator to the Boeing Company through the SRM 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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
200	777-200	7200	WY200
200ER	777-200ER	7250	WY250
200LR	777-200LR	7260	WY260
300	777-300	7300	WY300
300ER	777-300ER	7350	WY350
777F	777F	7270	WY270

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General

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

- provide the limitations and operational information, procedures, performance, and systems information the flight crew needs to safely and efficiently operate the 777 airplane during all anticipated airline operations
- serve as a comprehensive reference for use during transition training for the 777 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.

The manual is structured in a two-volume format with a Quick Reference Handbook (QRH). Volume 1 includes limitations and operational information, normal and supplementary procedures, and dispatch performance data. Volume 2 contains systems information. The QRH contains all checklists necessary for normal and non-normal procedures as well as in-flight 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 manual does not contain basic flight information that is considered prerequisite training.

Please submit all correspondence regarding content or use of this manual, including bulletin status, through the Service Requests Application (SR App) 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 limitations and operational information 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 chapter contains performance information necessary for self dispatch.
- Performance Inflight chapter contains performance information necessary for inflight use.

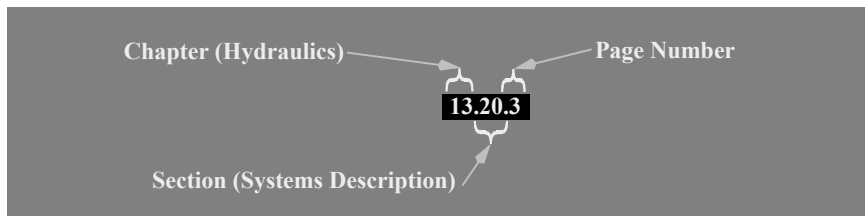
Volume 2 – Chapters 1 through 15 contain general airplane and systems information. These chapters are generally subdivided into sections covering controls and indicators and systems descriptions.

Quick Reference Handbook (QRH) – The QRH contains normal checklists, non-normal checklists, operational information, performance information necessary for inflight use 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.

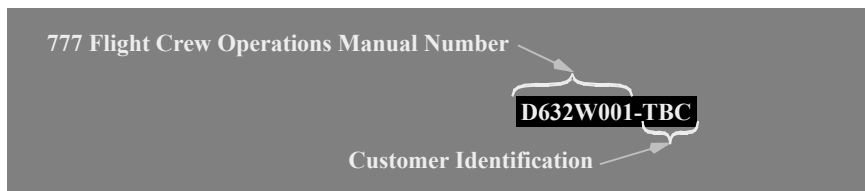
Example Page Number



Page Identification

Each page is identified by a customer document number and a page date. The customer document number is composed of the general 777 FCOM number, D632W001–, and is followed by the customer identification.

Example Page Identification



Warnings, Cautions, and Notes

The following levels of written advisories are used throughout the FCOM and are not to be confused with EICAS messages, which are separately identified in the text.

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.

Options

[TBC only]

The following terms, enclosed in brackets, are used in this manual:

- [Airline Selectable Option] – this indicates a system feature basic to an airplane system that can be activated or deactivated by an airline.
- [Option] – this indicates a system or certification option. This term will not usually appear in a manual unless the customer configuration information is incomplete when the manual goes to print.

Airplane Effectivities

Differences in airplane configuration are shown by use of airplane effectivities throughout Volumes 1 and 2, and the Quick Reference Handbook. The following rules are used to express airplane effectivities:

- Airplane effectivities are listed in alpha-numeric order. A range of airplanes is defined by a dash, e.g. N-MA - N-PQ includes all "M" series airplanes and all "P" series aircraft through N-PQ. A comma in the effectivity range indicates a break in the range, e.g. N-FA - N-FC, N-FE - N-FG; airplane N-FD is excluded from the range.
- Airplane effectivities apply only to the paragraph, illustration, operational note, procedural step, etc. and to subordinate items (if any).

Example (with subordinate items):

N-AA - N-BB

CABIN CREW COMMUNICATIONS.....ESTABLISH

Evacuate lower crew rest compartment and close hatches.

Plan to land at the nearest suitable airport

In this example, the effectivity N-AA - N-BB applies to the first procedural step (CABIN CREW.....) and further indented/subordinate step (Evacuate....). The effectivity does not apply to the next equivalently indented step (Plan to land.....).

Example (without subordinate items):

N-XX - N-YY

NOTE: Slats will extend beyond midrange when airspeed is below 246 knots. For go-around, do not exceed 246 knots until slats retract to midrange.

NOTE: Use flaps 20 and VREF20 for landing.

In this example, the effectivity N-XX - N-YY applies to the first operational note only. The effectivity does not apply to the next equivalently indented note.

When airplane effectivities are centered immediately below a checklist title, the entire checklist applies to the listed airplanes. In the following example, the PACK L, R checklist is applicable to N-XX - N-YY only:



When Boeing has been notified airplanes are to be modified by service bulletin (SB), the effectivity statement will include the range of airplanes being modified in parentheses. Depending upon the modification, there may be both a ‘before’ and ‘after’ version.

The text before the semicolon in the parentheses lists the range of airplanes being modified. The text after the semicolon indicates the ‘before’ or ‘after’ version and briefly describes what the SB does. The following examples illustrate this:

Example (‘before’ version):

(N-AA - N-BB ; before SB, ELMS software update not installed)

On the ground:

The C2 pump may be load shed by the electrical load management system.

“N-AA - N-BB” ; before SB,” means the incorporation of the SB (i.e. installation of ELMS software update in this example) is scheduled to begin for airplanes N-AA - N-BB. The words “before SB, SB ELMS software update not installed” indicate the associated content applies to N-AA - N-BB until the SB has been incorporated.

Example ('after' version):

N-XX - N-YY

(N-AA - N-BB ; SB installs ELMS software update)

On the ground:

With only a single ground power source, including the APU, the C2 pump will not run if the C1 pump is selected.

For airplanes N-XX - N-YY, the SB (i.e. installation of the ELMS software update in this example) has been incorporated. The associated content applies to N-XX - N-YY.

“N-AA - N-BB ; SB” means the incorporation of the SB (i.e. installation of ELMS software update in this example) is scheduled to begin for airplanes N-AA - N-BB. The words “installs ELMS software update” indicate the associated content will apply to N-AA - N-BB when the SB has been completed.

When Boeing is notified of SB status updates, the effectivity statements will be updated as appropriate in the next FCOM revision. When Boeing is notified the SB has been completed on all airplanes, the effectivity statement in parentheses and before SB content is removed.

777-8 & -9 Incorporation Notice

To accommodate incorporation of 777-8 and 777-9 into the FCOM/QRH, some minor changes will appear in all customer manuals.

Specifically, some PDF bookmarks now indicate applicability to minor models. In addition, new abbreviations applicable to the 777-8 and -9 are incorporated. Some of these abbreviations may affect all minor models.

The changes can appear in all manuals, regardless of airplane fleet configuration. Some, but not all, 777-8 and 777-9 changes will be identified by revision bars and associated revision highlights. Examples of changes not identified by revision bars and highlights would be those generated by page formatting, page header and footer content, TOC entries, and bookmarks. All changes that affect chapter content will be identified with revision bars and highlights.

Administrative Information

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

Preface
Abbreviations**Chapter 0**
Section 3**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.

A	
ABS	Absolute
ABV	Above
AC	Alternating Current
ACARS	Aircraft Communications Addressing and Reporting System
ACE	Actuator Control Electronics
ACP	Audio Control Panel
ACPT	Accept
ACT	Active
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
ADIRS	Air Data Inertial Reference System
ADIRU	Air Data Inertial Reference Unit
ADJ	Adjust
ADRS	Air Data Reference System

AFDS	Autopilot Flight Director System
AFE	Above Field Elevation
AFM	Airplane Flight Manual (FAA approved)
AGL	Above Ground Level
AHRU	Attitude Heading Reference Unit
AIL	Aileron
AIMS	Airplane Information Management System
ALT	Altitude
ALTN	Alternate
AM	Amplitude Modulation
AMI	Airline Modifiable Information
ANP	Actual Navigational Performance
ANT	Antenna
AOA	Angle of Attack
AOIP	ACARS over IP
A/P	Autopilot
APP	Approach
APU	Auxiliary Power Unit
AR	Authorization Required

ARINC	Aeronautical Radio, Incorporated
ARPT	Airport
ARR	Arrival
ASYM	Asymmetry
A/T	Autothrottle
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATN	Aeronautical Telecommunication Network
ATT	Attitude
ATP	Alerting and Transponder Control Panel
ATSP	Air Traffic Service Provider
AUTO	Automatic
AUX	Auxiliary
AVAIL	Available
B	
BARO	Barometric
BAT	Battery
B/CRS	Back Course
BFO	Beat Frequency Oscillator
BLD	Bleed
BLW	Below
BRG	Bearing
BRT	Bright
BTL	Bottle

C	
C	Captain Celsius Center Cool
CAB	Cabin
CAC	Cabin Air Compressor
CACTCS	Cabin Air Conditioning and Temperature Control System
CAM	Camera
CANC	Cancel
CAPT	Captain
CB	Circuit Breaker
CCD	Cursor Control Device
CDU	Control Display Unit
CG	Center of Gravity
CHKL	Checklist
CHR	Chronograph
CL	Close
CLB	Climb
CLR	Clear
CMF	Communication Management Function
CO	Company
COMM	Communication
COMP	Compensation
COMPT	Compartment
CON	Continuous
CONFIG	Configuration
CONT	Control

777 Flight Crew Operations Manual

CPDLC	Controller-Pilot Data Link Communications
CRS	Course
CRZ	Cruise
CTL	Control
CTR	Center
CVR	Cockpit Voice Recorder
D	
DA(H)	Decision Altitude (Height)
DC	Direct Current
DDG	Dispatch Deviations Guide
DEL	Delete
DEM	Demand
DEP	Departure
DEPR	Depressurization
DES	Descent
DEST	Destination
DISC	Disconnect
DISCH	Discharge
DK	Deck
DME	Distance Measuring Equipment
DN	Down
DR	Door
DSP	Display Select Panel
DSPL	Display
DTG	Distance To Go
DU	Display Unit
E	

E	East
EAI	Engine Anti-Ice
ECL	Electronic Checklist
E/D	End of Descent
E/E	Electrical/Electronic
EEC	Electronic Engine Control
EFB	Electronic Flight Bag
EFIS	Electronic Flight Instrument System
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
ELEC	Electrical
ELEV	Elevator
ELMS	Electrical Load Management System
ELT	Emergency Locator Transmitter
EMER	Emergency
ENG	Engine
ENT	Entry
EO	Engine Out
EPR	Engine Pressure Ratio
EQUIP	Equipment
EST	Estimate
ET	Elapsed Time
ETA	Estimated Time of Arrival
ETOPS	Extended Operations
EVAC	Evacuation

EXEC	Execute
EXT	Extend External Extension Exterior
F	
F	Fahrenheit
FANS	Future Air Navigation System
FCOM	Flight Crew Operations Manual
FCTL	Flight Control System
F/D	Flight Deck
FD, F/D or FLT DIR	Flight Director
FDEVSS	Flight Deck Entry Video Surveillance System
FF	Fuel Flow
FLCH	Flight Level Change
FLT	Flight
FMA	Flight Mode Annunciations
FMC	Flight Management Computer
FMS	Flight Management System
F/O	First Officer
FPA	Flight Path Angle
FPM	Feet Per Minute
FPV	Flight Path Vector
FREQ	Frequency
FT	Feet
FWD	Forward

G	
GA	Go-Around
GEN	Generator
GND	Ground
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
G/S	Glide Slope
GS	Ground Speed
H	
HDG	Heading
HF	High Frequency
HFDL	High Frequency Datalink
HI	High
HLD	Hold
HYD	Hydraulic
I	
IAF	Initial Approach Fix
IAN	Integrated Approach Navigation
IAS	Indicated Airspeed
ICA	Ice Crystal Anti-Ice
ICI	Ice Crystal Icing
IDENT	Identification
IDG	Integrated Drive Generator
IFE	Inflight Entertainment
IGN	Ignition
IND LTS	Indicator Lights

777 Flight Crew Operations Manual

INIT	Initialization
ILS	Instrument Landing System
INBD	Inboard
IND	Indicator
INOP	Inoperative
INT or INTPH	Interphone
INT	Interior Intermittent
INTC	Intercept
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	International Standard Atmosphere
ISFD	Integrated Standby Flight Display
ISLN	Isolation
ITP	In-Trail Procedures
K	
KGS	Kilograms
KT or KTS	Knots
L	
L	Left
LAV	Lavatory
LBS	Pounds
LDA	Localizer-type Directional Aid
LDG	Landing
LIM	Limit
LKD	Locked

LNAV	Lateral Navigation
LO	Low
LOC	Localizer
LOM	Locator Outer Marker
LPV	Localizer Performance with Vertical Guidance
LRC	Long Range Cruise
LT	Light
M	
M	Mach Meters
MAG	Magnetic
MAN	Manual
MAX	Maximum
MCP	Mode Control Panel
MDA(H)	Minimum Descent Altitude (Height)
MEL	Minimum Equipment List
MFD	Multifunction Display
MIC	Microphone
MIN	Minimum
MISC	Miscellaneous
MKR	Marker
MLG	Main Landing Gear
MLS	Microwave Landing System
MLW	Maximum Landing Weight
MMO	Maximum Mach Operating Speed
MOD	Modified Modify

MSG	Message
N	
N	Normal North
NAV	Navigation
ND	Navigation Display Nose Down
NDB	Non-Directional Beacon
ND	Navigation Display
NM	Nautical Miles
NORM	Normal
NPS	Navigation Performance Scales
NU	Nose Up
N1	Low Pressure Rotor Speed
N2	High Pressure Rotor Speed (Pratt & Whitney engines) Intermediate Pressure Rotor Speed (Rolls-Royce engines)
N3	High Pressure Rotor Speed (Rolls-Royce engines)
O	
OAT	Outside Air Temperature
OFST	Offset
OP	Open
OUTBD	Outboard
OVHD	Overhead
OVHT	Overheat
OVRD	Override
OXY	Oxygen

P	
PA	Passenger Address
PASS	Passenger
PED	Personal Electronic Device
PERF	Performance
PF	Pilot Flying
PFD	Primary Flight Display
PM	Pilot Monitoring
PNL	Panel
POS	Position
PPOS	Present Position
PRES or PRESS	Pressure
PREV	Previous
PROG	Progress
PROX	Proximity
PSI	Pounds Per Square Inch
PTH	Path
PTT	Push To Talk
PWR	Power
PWS	Predictive Windshear System
Q	
QFE	Local Station Pressure
QNH	Local Station Pressure corrected to MSL
QTY	Quantity
R	
R	Right

777 Flight Crew Operations Manual

RA	Radio Altitude Radio Altimeter Resolution Advisory
RAAS	Runway Awareness and Advisory System
RAD	Radio
RAT	Ram Air Turbine
RECIR or RECIRC	Recirculation
REF	Reference
REV	Reverse Reverser
RF	Radius-to-Fix Refill
RNAV	Area Navigation (RNAV)
RNP	Required Navigational Performance
RPM	Revolutions Per Minute
RST	Reset
R/T	Radio Transmitter
RTA	Required Time of Arrival
RTE	Route
RTO	Rejected Takeoff
RVSM	Reduced Vertical Separation Minimum
S	
S	South
SAT	Satellite Communication Static Air Temperature
SATCOM	Satellite Communication
SB	Service Bulletin
S/C	Step Climb

SDF	Simplified Directional Facility
SEL	Select
SELCAL	Selective Calling
SENS	Sensitivity
SERV	Service
SPD	Speed
STAB	Stabilizer
STAT	Status
STBY	Standby
SYS	System
SUPR or SUPRNMRY	Supernumerary
T	
TA	Traffic Advisory
TAI	Thermal Anti-Ice
TAT	Total Air Temperature
T/C	Top of Climb
TCAS	Traffic Alert and Collision Avoidance System
T/D	Top of Descent
TEMP	Temperature
TERR	Terrain
TFC	Traffic
TFR	Transfer
TGT	Target
THR	Throttle Thrust
TK or TRK	Track
TO or T/O	Takeoff
TO/GA	Takeoff/Go-Around

TRU	True Transformer Rectifier Unit
TURB	Turbine Turbulence
U	
UNLK or UNLKD	Unlocked
USB	Upper Side Band Universal Serial Bus
UTC	Coordinated Universal Time
UTIL	Utility
V	
VA	Design maneuvering Speed
VHF	Very High Frequency
VIB	Vibration
VMO	Maximum Operating Speed
VNAV	Vertical Navigation
VOC	Volatile Organic Compounds
VOR	VHF Omnidirectional Range
VR	Rotation Speed
VREF	Reference Speed
VSD	Vertical Situation Display
VSI	Vertical Speed Indicator
V/S	Vertical Speed
VTK	Vertical Track
V1	Takeoff Decision Speed
V2	Takeoff Safety Speed

W	
W	Warm West
WAI	Wing Anti-Ice
WHL	Wheel
WPT	Waypoint
WT	Weight
WXR	Weather Radar
X	
XFER	Transfer
XMIT	Transmit
XPDR or XPDR	Transponder
XTK	Cross Track

Preface**Revision Record****Chapter 0****Section 4****Revision Transmittal Letter**

To: All holders of The Boeing Company 777 Flight Crew Operations Manual (FCOM), Boeing Document Number D632W001-TBC.

Subject: Flight Crew Operations Manual Revision.

This revision reflects the most current information available to The Boeing Company 60 days prior to the subject revision date.

General information below explains the use of revision bars to identify new or revised information. Highlights in the Revision Highlights section explain the revision bar changes in this revision.

Revision Record

No.	Revision Date	Date Filed
56	June 15, 2015	
58	June 15, 2016	
60	June 15, 2017	
62	June 15, 2018	
64	June 15, 2019	
66	February 28, 2020	
68	December 15, 2020	

No.	Revision Date	Date Filed
57	December 15, 2015	
59	December 15, 2016	
61	December 15, 2017	
63	December 15, 2018	
65	December 15, 2019	
67	June 15, 2020	
69	June 15, 2021	

General

The Boeing Company issues Flight Crew Operations Manual (FCOM) revisions to provide new or revised procedures and information. Formal revisions also incorporate appropriate information from previously issued flight crew operations manual bulletins.

The revision date is the approximate date the manual is mailed to the customer. This manual is effective upon receipt and supersedes any previous revision of this manual.

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 manual 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

Generally, revision bars are displayed adjacent to all technical and non-technical changes. However, highlights are written only for technical revisions.

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 for these airplane effectivity updates are not supplied.

Preface**Revision Highlights****Chapter 0****Section 4****Chapter 0 - Title Page****Section 3 - Abbreviations****General**

0.3.4 - Revised formatting, no change in content.

Section 6 - Bulletin Record**General**

0.6.3 - Revised to reflect current bulletin status.

0.6.5 - Revised to reflect current bulletin status.

0.6.5 - Revised to reflect current bulletin status.

Chapter L - Limitations**Section 10 - Limitations and Operational Information****Airplane General**

L.10.2 - Added maximum field elevation to reflect AFM limitations.

Chapter NP - Normal Procedures -200 & -300 Series**Section 21 - Amplified Procedures****Preliminary Preflight Procedure – Captain or First Officer**

NP.21.1 - Added step to verify that only expected alert and memo messages are shown. This increases the likelihood of noticing unexpected messages such as a VMO GEAR DOWN memo message.

Preflight Procedure – First Officer

NP.21.17 - Added step “EMERGENCY/TEST selector....Normal (non-emergency)”. This control setting was not addressed.

Preflight Procedure – Captain

NP.21.22 - Added step “EMERGENCY/TEST selector....Normal (non-emergency)”. This control setting was not addressed.

Before Start Procedure

NP.21.26 - Changed “alert messages” to “alert and memo messages”. This increases the likelihood of noticing unexpected messages such as a VMO GEAR DOWN memo message.

Before Taxi Procedure

NP.21.29 - Changed “alert messages” to “alert and memo messages”. This increases the likelihood of noticing unexpected messages such as a VMO GEAR DOWN memo message.

Descent Procedure

NP.21.34 - Changed “alert messages” to “alert and memo messages”. This increases the likelihood of noticing unexpected messages such as a VMO GEAR DOWN memo message.

Go-Around and Missed Approach Procedure

NP.21.40 - The step to “verify that the thrust increases” has been moved earlier. This is in accordance with recent recommendations from an accident investigation. Flaps setting has been changed to ""FLAPS 20" or "FLAPS __" as needed". Boeing’s intent is to separate the flaps 20 call from the go-around call. This is based on data where 60% of real world go-arounds are initiated at Flaps 20 or less.

Chapter SP - Supplementary Procedures -200 & -300 Series

Section 11 - Flight Management, Navigation

RNP Manual Entry

SP.11.9 - Revised formatting, no change in content.

Section 16 - Adverse Weather

Cold Weather Operations

SP.16.12 - Reordered a step in Cold Temperature Altitude Corrections. Setting the MCP altitude now comes after entering the table to determine the correction.

SP.16.12 - Reordered a step in Cold Temperature Altitude Corrections. Setting the MCP altitude now comes after entering the table to determine the correction.

Ice Crystal Icing (ICI)

SP.16.27 - Added guidance to exit ice crystal icing conditions laterally.

Performance Package 10**777-200 GE90-76B KG M JAA****Section 13 - Gear Down****Takeoff/Approach or Landing Climb Limited Weight**

PD.13.1 - Updated text section title from "Takeoff/Landing Climb Limit Weight" to "Takeoff/Approach or Landing Climb Limited Weight" to correspond with the PD table title change.

Performance Package 70**777F GE90-110B1L KG M EASA TALPA****Section 72 - Advisory Information****Recommended Brake Cooling Schedule**

PI.72.40 - Included additional text to ensure gear is not approached for one hour when in fuse plug melt zone.

**Chapter 1 - Airplane General, Emergency Equipment, Doors, Windows
-200 & -300 Series (tab)****Section 40 - Systems Description****Lighting Systems**

1.40.5 - Added "feet" to altitude callout.

Section 50 - Doors, Windows, Seats**Flight Deck Seats**

1.50.18 - Revised formatting, no change in content.

1.50.18 - Added description of standard seat adjustments.

Chapter 2 - Air Systems**Section 10 - Controls and Indicators****Pressurization System**

2.10.12 - Revised to reflect airplane configuration.

Chapter 3 - Anti-Ice, Rain

Section 20 - System Description

Anti-Icing Systems

- 3.20.1 - Added description of anti-ice system deicing cycles prior to activation.
- 3.20.1 - Added description of anti-ice system deicing cycles prior to activation.
- 3.20.1 - Added description of anti-ice system deactivation.
- 3.20.2 - Added description of ground operation of wing anti-ice valve.
- 3.20.2 - Revised description about wing anti-ice operation with the WING ANTI-ICE Selector ON.
- 3.20.2 - Revised description about system logic for asymmetrical wing anti-ice operation.
- 3.20.2 - Removed Wing Anti-Ice System Leak Detection because all leak detection occurs prior to the Wing Anti-Ice valve.

Section 30 - EICAS Messages

EICAS Alert Messages

- 3.30.1 - Deleted panel for 777-9 airplanes.

Chapter 4 - Automatic Flight

Section 10 - Controls and Indicators

Mode Control Panel (MCP)

- 4.10.8 - Added list item for clarity and cross model standardization.
- 4.10.9 - Added list item for clarity and cross model standardization.
- 4.10.9 - Added Glide Slope Capture not Inhibit Before Localizer Capture Option.
- 4.10.10 - Revised formatting, no change in content.
- 4.10.10 - Added list item for clarity and cross model standardization.
- 4.10.12 - Added list item for clarity and cross model standardization.
- 4.10.13 - Revised formatting, no change in content.
- 4.10.13 - Added list item for clarity and cross model standardization.
- 4.10.15 - Added list item for clarity and cross model standardization.
- 4.10.17 - Added list item for clarity and cross model standardization.

PFD Flight Mode Annunciations (FMAs)

4.10.20 - Revised formatting to split Note into two.

4.10.20 - Added PFD Flight Mode Annunciation note.

Section 20 - System Description**Autopilot Flight Director System**

4.20.9 - Revised formatting, no change in content.

Chapter 6 - Electrical**Section 20 - System Description****AC Electrical System**

6.20.5 - Revised to add "main" to clarify right main DC bus.

Backup AC Electrical System

6.20.7 - Revised description of inoperative item.

Cabin Systems and Utility Power

6.20.15 - Revised system description to add PED.

Chapter 9 - Flight Controls**Section 20 - System Description****Normal Mode Roll Control**

9.20.17 - Added Maneuver Load Alleviation function description.

Spoilers

9.20.23 - Added Landing Attitude Modifier description for cross model standardization.

Chapter 10 - Flight Instruments, Displays -200 & -300 Series**Section 10 - Controls and Indicators****Primary Flight Display (PFD)**

10.10.15 - Updated EICAS message to "NAV UNABLE RNP."

Display Brightness Controls

10.10.52 - Added Inboard Display (INBD DSPL) Brightness control callout description to reflect Look-Ahead Terrain Alerting installed.

10.10.52 - Added "AS INSTALLED" annotation to depiction of Center Panel Brightness Control Panel.

10.10.53 - Added "AS INSTALLED" annotation to depiction of Center Panel Brightness Control Panel.

10.10.53 - Added "or (LWR DSPL/WXR)" to title of Callout Number 2 for Center Panel Brightness Control Panel.

10.10.53 - Added Lower Display (LWR DSPL) Brightness control callout description to reflect Look-Ahead Terrain Alerting installed.

Chapter 11 - Flight Management, Navigation -200 & -300 Series

Section 20 - Navigation Systems Description

Radio Navigation Systems

11.20.13 - Added "Back Course" approach previously removed.

Section 31 - Flight Management System Operation

Lateral Navigation (LNAV)

11.31.17 - Revised formatting, no change in content.

11.31.22 - Replaced "displays" with "shows" for cross model standardization.

11.31.22 - Replaced "displays" with "shows" for cross model standardization.

11.31.22 - Add missed approach bullet for clarity.

11.31.22 - Revised description for clarity.

11.31.22 - Replaced "displays" with "shows" for cross model standardization.

Vertical Navigation (VNAV)

11.31.36 - Revised formatting, no change in content.

11.31.38 - Revised title for clarity.

11.31.38 - Revised description for clarity.

Section 43 - FMC Descent and Approach

Descent

11.43.2 - Revised description for clarity.

11.43.3 - Replaced "is blank" with "blanks" for cross model standardization.

11.43.4 - Replaced "displays" with "shows" for cross model standardization.

11.43.4 - Replaced "displays" with "shows" for cross model standardization.

11.43.4 - Replaced "displays" with "shows" for cross model standardization.

11.43.4 - Replaced "displays" with "shows" for cross model standardization.

11.43.4 - Replaced "is blank" with "blanks" for cross model standardization.

11.43.4 - Replaced "displays" with "shows" for cross model standardization.

777 Flight Crew Operations Manual

- 11.43.4 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.4 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.5 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.5 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.5 - Revised description for clarity and for cross model standardization.
- 11.43.5 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.5 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.5 - Revised description for clarity and for cross model standardization.
- 11.43.6 - Revised description for clarity and for cross model standardization.
- 11.43.6 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.6 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.6 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.6 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.6 - Replaced "displays" with "shows" for cross model standardization.

Alternate Airport Diversions

- 11.43.26 - Rephrased for clarity and cross model standardization.
- 11.43.26 - Replaced "displays" with "shows" for cross model standardization also rephrased for clarity.
- 11.43.26 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.26 - Replaced "displays" with "shows" for cross model standardization.
- 11.43.26 - Replaced "blank" with "blanks".
- 11.43.26 - Replaced "blank" with "blanks"

Section 60 - EICAS Messages**FMC Alerting Messages**

- 11.60.4 - Note rephrased for clarity.
- 11.60.5 - Relocated message from the FMC Entry Error Message.
- 11.60.7 - Added list item for Software update 17A or later.
- 11.60.7 - Added Software update 17A or later note.

FMC Entry Error Messages

- 11.60.11 - Removed section to FMC Alerting Message section.

Chapter 12 - Fuel

Section 10 - Controls and Indicators

Fuel Indications

12.10.9 - Revised callout description.

Chapter 15 - Warning Systems

Section 10 - Controls and Indicators

Master WARNING/CAUTION Reset Switches and Lights

15.10.6 - Revised to reflect airplane configuration.

Section 20 - System Description

Traffic Alert and Collision Avoidance System (TCAS)

15.20.21 - Revised TCAS Non-Normal system description.

Ground Proximity Warning System (GPWS) and Predictive Windshear (PWS)

15.20.28 - Modified PWS Alerting System reflect airplane configuration.

15.20.28 - Modified PWS Alerting System reflect airplane configuration.

15.20.29 - Revised to reflect airplane configuration.

15.20.29 - Revised to reflect airplane configuration.

Section 30 - EICAS Messages

EICAS Alert Messages

15.30.1 - Modified EICAS Alert Message CONFIG DOORS Message Logic description.

Preface

Chapter 0

V1V2 List of Effective Pages

Section 5

Volume 1		Bulletins (tab)	
* Title Page 1-2	June 15, 2021	* 0.6.1-6	June 15, 2021
0.TOC.1-2	June 15, 2019	B.50.1	June 15, 2014
Model Identification		B.50.2	June 15, 2014
0.1.1-2	February 28, 2020	B.52.1	February 28, 2020
Introduction		B.52.2	June 15, 2014
0.2.1	June 15, 2018	B.56.1	June 15, 2014
0.2.2	June 15, 2018	B.56.2	June 15, 2014
0.2.3	December 15, 2014	B.58.1	June 15, 2014
0.2.4	June 15, 2015	B.58.2	June 15, 2014
0.2.5	June 15, 2015	B.62.1	February 28, 2020
0.2.6	June 15, 2019	B.62.2	June 15, 2014
Abbreviations		B.65.1	June 15, 2014
0.3.1	February 28, 2020	B.65.2	June 15, 2014
0.3.2	February 28, 2020	B.68.1	June 15, 2014
0.3.3	February 28, 2020	B.68.2	June 15, 2014
* 0.3.4	June 15, 2021	B.72.1	February 28, 2020
* 0.3.5	June 15, 2021	B.72.2	June 15, 2014
* 0.3.6	June 15, 2021	B.73.1	February 28, 2020
* 0.3.7	June 15, 2021	B.73.2	June 15, 2014
* 0.3.8	June 15, 2021	B.73.3	February 28, 2020
Revision Record (tab)		B.73.4	February 28, 2020
* 0.4.1	June 15, 2021	B.73.5	February 28, 2020
* 0.4.2	June 15, 2021	B.73.6	February 28, 2020
Revision Highlights		B.75.1	June 15, 2014
* 0.4.3	June 15, 2021	B.75.2	June 15, 2014
* 0.4.4	June 15, 2021	B.79.1	February 28, 2020
* 0.4.5	June 15, 2021	B.79.2	June 15, 2014
* 0.4.6	June 15, 2021	B.80.1	February 28, 2020
* 0.4.7	June 15, 2021	B.80.2	June 15, 2014
* 0.4.8	June 15, 2021	B.81.1	February 28, 2020
* 0.4.9	June 15, 2021	B.81.2	June 15, 2014
* 0.4.10	June 15, 2021	B.81.3	June 15, 2014
* 0.4.11-26	Deleted	B.81.4	June 15, 2014
V1V2 List of Effective Pages		B.83.1	February 28, 2020
* 0.5.1-32	June 15, 2021	B.83.2	June 15, 2014
		B.83.3	June 15, 2014
		B.83.4	June 15, 2014
		B.85.1	February 28, 2020
		B.85.2	February 28, 2020
		B.87.1	February 28, 2020
		B.87.2	December 15, 2017
		B.92.1	February 28, 2020

* = Revised, Added, or Deleted

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B.92.2	June 15, 2014	B.127.2	June 15, 2015
B.96.1	February 28, 2020	B.128.1	June 15, 2017
B.96.2	June 15, 2014	B.128.2	December 15, 2017
B.96.3	June 15, 2014	B.129.1	February 28, 2020
B.96.4	June 15, 2014	B.129.2	December 15, 2017
B.99.1	June 15, 2015	B.131.1	February 28, 2020
B.99.2	June 15, 2015	B.131.2	June 15, 2016
B.100.1	February 28, 2020	B.132.1	February 28, 2020
B.100.2	June 15, 2015	B.132.2	December 15, 2017
B.100.3	June 15, 2015	B.132.3	December 15, 2017
B.100.4	June 15, 2014	B.132.4	June 15, 2014
B.101.1	February 28, 2020	B.133.1	December 15, 2018
B.101.2	June 15, 2014	B.133.2	December 15, 2018
B.102.1	February 28, 2020	B.135.1	December 15, 2017
B.102.2	June 15, 2015	B.135.2	June 15, 2015
B.102.3	December 15, 2017	B.136.1	February 28, 2020
B.102.4	June 15, 2014	B.136.2	June 15, 2020
B.103.1	February 28, 2020	B.137.1	February 28, 2020
B.103.2	June 15, 2014	B.137.2	December 15, 2014
B.104.1	June 15, 2014	B.137.3	December 15, 2017
B.104.2	June 15, 2014	B.137.4	December 15, 2014
B.105.1	February 28, 2020	B.141.1	February 28, 2020
B.105.2	June 15, 2015	B.141.2	June 15, 2015
B.107.1	June 15, 2014	B.141.3	February 28, 2020
B.107.2	June 15, 2014	B.141.4	June 15, 2015
B.108.1	February 28, 2020	B.142.1	February 28, 2020
B.108.2	June 15, 2014	B.142.2	June 15, 2019
B.114.1	February 28, 2020	B.143.1	February 28, 2020
B.114.2	June 15, 2014	B.143.2	February 28, 2020
B.115.1	February 28, 2020	B.144.1	December 15, 2017
B.115.2	June 15, 2018	B.144.2	February 28, 2020
B.116.1	February 28, 2020	B.145.1	February 28, 2020
B.116.2	June 15, 2014	B.145.2	December 15, 2017
B.117.1	February 28, 2020	B.147.1	June 15, 2020
B.117.2	June 15, 2015	B.147.2	February 28, 2020
B.117.3	December 15, 2017	B.150.1	February 28, 2020
B.117.4	June 15, 2014	B.150.2	June 15, 2018
* B.118.1-2	Deleted	B.151.1	February 28, 2020
B.119.1	June 15, 2014	B.151.2	June 15, 2018
B.119.2	June 15, 2014	B.153.1	February 28, 2020
B.120.1	February 28, 2020	B.153.2	June 15, 2019
B.120.2	June 15, 2015	B.154.1	February 28, 2020
B.121.1	February 28, 2020	B.154.2	June 15, 2019
B.121.2	June 15, 2015	B.156.1	December 15, 2020
B.126.1	February 28, 2020	B.156.2	December 15, 2020
B.126.2	December 15, 2017	B.156.3	December 15, 2020
B.127.1	December 15, 2017	B.156.4	December 15, 2020

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777 Flight Crew Operations Manual

B.156.5	December 15, 2020	NP.21.11	June 15, 2019
B.156.6	December 15, 2020	NP.21.12	June 15, 2020
* B.157.1	June 15, 2021	NP.21.13	June 15, 2020
* B.157.2	June 15, 2021	NP.21.14	June 15, 2020
* B.157.3	June 15, 2021	NP.21.15	June 15, 2020
* B.157.4	June 15, 2021	NP.21.16	June 15, 2020
* B.158.1	June 15, 2021	* NP.21.17	June 15, 2021
B.158.2	June 15, 2020	NP.21.18	June 15, 2020
* B.158.3	June 15, 2021	NP.21.19	June 15, 2020
B.158.4	June 15, 2020	NP.21.20	June 15, 2020
Limitations (tab)		NP.21.21	June 15, 2020
L.TOC.1-2	June 15, 2020	* NP.21.22	June 15, 2021
L.10.1	June 15, 2018	* NP.21.23	June 15, 2021
* L.10.2	June 15, 2021	* NP.21.24	June 15, 2021
L.10.3	June 15, 2020	* NP.21.25	June 15, 2021
L.10.4	June 15, 2020	* NP.21.26	June 15, 2021
L.10.5	June 15, 2020	* NP.21.27	June 15, 2021
L.10.6	June 15, 2020	* NP.21.28	June 15, 2021
L.10.7	February 28, 2020	* NP.21.29	June 15, 2021
L.10.8	February 28, 2020	* NP.21.30	June 15, 2021
L.10.9	February 28, 2020	* NP.21.31	June 15, 2021
L.10.10	February 28, 2020	* NP.21.32	June 15, 2021
L.10.11	February 28, 2020	NP.21.33	February 28, 2020
L.10.12	June 15, 2019	* NP.21.34	June 15, 2021
Normal Procedures -200 & -300 Series (tab)		NP.21.35	February 28, 2020
NP.TOC.1-2	December 15, 2018	NP.21.36	February 28, 2020
NP.11.1	June 15, 2013	NP.21.37	December 15, 2020
NP.11.2	June 15, 2013	NP.21.38	February 28, 2020
NP.11.3	June 15, 2013	NP.21.39	June 15, 2020
NP.11.4	June 15, 2015	* NP.21.40	June 15, 2021
NP.11.5	June 15, 2015	* NP.21.41	June 15, 2021
NP.11.6	June 15, 2015	* NP.21.42	June 15, 2021
NP.11.7	June 15, 2017	* NP.21.43	June 15, 2021
NP.11.8	June 15, 2017	* NP.21.44	June 15, 2021
* NP.21.1	June 15, 2021	* NP.21.45	June 15, 2021
NP.21.2	February 28, 2020	NP.21.46	February 28, 2020
NP.21.3	June 15, 2019	Supplementary Procedures -200 & -300 Series (tab)	
NP.21.4	December 15, 2018	* SP.TOC.1-4	June 15, 2021
NP.21.5	December 15, 2018	SP.05.1	December 15, 2008
NP.21.6	February 28, 2020	SP.05.2	June 12, 2006
NP.21.7	December 15, 2018	SP.1.1	June 15, 2017
NP.21.8	December 15, 2018	SP.1.2	June 15, 2017
NP.21.9	December 15, 2018	SP.1.3	June 15, 2017
NP.21.10	December 15, 2018	SP.1.4	June 15, 2017
		SP.2.1	June 15, 2015

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777 Flight Crew Operations Manual

SP.2.2	December 15, 2018	SP.16.5	June 15, 2020
SP.2.3	December 15, 2018	SP.16.6	June 15, 2018
SP.2.4	December 15, 2008	SP.16.7	June 15, 2018
SP.3.1	December 15, 2018	SP.16.8	December 15, 2017
SP.3.2	June 12, 2006	SP.16.9	December 15, 2017
SP.4.1	December 11, 2006	SP.16.10	December 15, 2017
SP.4.2	June 26, 2000	SP.16.11	December 15, 2017
* SP.4.3	June 15, 2021	* SP.16.12	June 15, 2021
* SP.4.4	June 15, 2021	SP.16.13	December 15, 2017
* SP.4.5	June 15, 2021	SP.16.14	December 15, 2017
* SP.4.6	June 15, 2021	SP.16.15	December 15, 2017
* SP.4.7	June 15, 2021	SP.16.16	December 15, 2017
* SP.4.8	June 15, 2021	SP.16.17	December 15, 2017
* SP.4.9	June 15, 2021	SP.16.18	December 15, 2017
* SP.4.10	June 15, 2021	SP.16.19	December 15, 2017
* SP.4.11	June 15, 2021	SP.16.20	December 15, 2017
* SP.4.12	June 15, 2021	SP.16.21	December 15, 2017
* SP.4.13	June 15, 2021	SP.16.22	December 15, 2017
* SP.4.14	June 15, 2021	SP.16.23	December 15, 2017
SP.5.1	June 13, 2011	SP.16.24	June 15, 2019
SP.5.2	December 16, 2002	SP.16.25	June 15, 2020
SP.6.1	June 15, 2018	SP.16.26	December 15, 2017
SP.6.2	June 15, 2017	* SP.16.27	June 15, 2021
SP.7.1	June 15, 2015	SP.16.28	December 15, 2017
SP.7.2	February 28, 2020	Performance Dispatch (tab)	
SP.7.3	December 15, 2015	PD.TOC.1-2	June 15, 2020
SP.7.4	December 15, 2015	777-200 GE90-76B KG M JAA	
SP.10.1	June 15, 2016	PD.TOC.10.1-2	December 15, 2020
SP.10.2	June 15, 2016	PD.ModID.10.1-2	December 15, 2015
SP.11.1	June 15, 2015	PD.10.1	December 15, 2020
SP.11.2	June 15, 2015	PD.10.2	December 15, 2014
SP.11.3	June 15, 2015	PD.10.3	December 15, 2014
* SP.11.4	June 15, 2021	PD.10.4	December 15, 2014
* SP.11.5	June 15, 2021	PD.10.5	December 15, 2014
* SP.11.6	June 15, 2021	PD.10.6	December 15, 2014
* SP.11.7	June 15, 2021	PD.10.7	December 15, 2014
* SP.11.8	June 15, 2021	PD.10.8	December 15, 2014
* SP.11.9	June 15, 2021	PD.10.9	December 15, 2014
* SP.11.10	June 15, 2021	PD.10.10	December 15, 2014
SP.12.1	June 15, 2020	PD.11.1	December 15, 2014
SP.12.2	June 17, 2002	PD.11.2	December 15, 2014
SP.15.1	December 14, 2009	PD.11.3	June 15, 2015
SP.15.2	December 14, 2009	PD.11.4	December 15, 2014
SP.16.1	February 28, 2020	PD.11.5	December 15, 2014
SP.16.2	February 28, 2020	PD.11.6	December 15, 2014
SP.16.3	February 28, 2020	PD.11.7	December 15, 2014
SP.16.4	February 28, 2020		

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777 Flight Crew Operations Manual

PD.11.8	December 15, 2014	PD.21.9	December 15, 2020
PD.11.9	December 15, 2014	PD.21.10	December 15, 2020
PD.11.10	December 15, 2014	PD.22.1	February 28, 2020
PD.12.1	December 15, 2014	PD.22.2	February 28, 2020
PD.12.2	December 15, 2020	PD.22.3	December 15, 2020
PD.12.3	December 15, 2014	PD.22.4	February 28, 2020
PD.12.4	December 15, 2014	PD.22.5	February 28, 2020
* PD.13.1	June 15, 2021	PD.22.6	February 28, 2020
PD.13.2	December 15, 2014	PD.23.1	February 28, 2020
PD.13.3	December 15, 2014	PD.23.2	December 15, 2020
PD.13.4	December 15, 2014	PD.23.3	February 28, 2020
PD.13.5	December 15, 2014	PD.23.4	February 28, 2020
PD.13.6	December 15, 2014	PD.23.5	February 28, 2020
PD.13.7	December 15, 2014	PD.23.6	February 28, 2020
PD.13.8	December 15, 2014	PD.23.7	February 28, 2020
PD.13.9	December 15, 2014	PD.23.8	February 28, 2020
PD.13.10	December 15, 2014	PD.23.9	February 28, 2020
PD.14.1	December 15, 2014	PD.23.10	February 28, 2020
PD.14.2	December 15, 2020	PD.24.1	February 28, 2020
PD.14.3	December 15, 2014	PD.24.2	December 15, 2020
PD.14.4	December 15, 2020	PD.24.3	December 15, 2020
PD.14.5	December 15, 2014	PD.24.4	February 28, 2020
PD.14.6	December 15, 2020	PD.24.5	February 28, 2020
PD.14.7	December 15, 2020	PD.24.6	December 15, 2020
PD.14.8	December 15, 2020	PD.24.7	December 15, 2020
		PD.24.8	February 28, 2020
777-200ER TRENT892 KG M FAA TALPA		777-200LR GE90-110BIL KG M FAA TO1-10 TO2-20	
PD.TOC.20.1-2	December 15, 2020	PD.TOC.30.1-2	December 15, 2020
PD.ModID.20.1-2	February 28, 2020	PD.ModID.30.1-2	February 28, 2020
PD.20.1	February 28, 2020	PD.30.1	December 15, 2020
PD.20.2	February 28, 2020	PD.30.2	December 15, 2020
PD.20.3	February 28, 2020	PD.30.3	February 28, 2020
PD.20.4	February 28, 2020	PD.30.4	February 28, 2020
PD.20.5	February 28, 2020	PD.30.5	February 28, 2020
PD.20.6	February 28, 2020	PD.30.6	February 28, 2020
PD.20.7	February 28, 2020	PD.30.7	February 28, 2020
PD.20.8	February 28, 2020	PD.30.8	February 28, 2020
PD.20.9	February 28, 2020	PD.30.9	February 28, 2020
PD.20.10	February 28, 2020	PD.30.10	February 28, 2020
PD.21.1	February 28, 2020	PD.30.11	February 28, 2020
PD.21.2	February 28, 2020	PD.30.12	February 28, 2020
PD.21.3	February 28, 2020	PD.30.13	February 28, 2020
PD.21.4	February 28, 2020	PD.30.14	February 28, 2020
PD.21.5	February 28, 2020	PD.30.15	February 28, 2020
PD.21.6	February 28, 2020	PD.30.16	February 28, 2020
PD.21.7	December 15, 2020	PD.31.1	February 28, 2020
PD.21.8	December 15, 2020		

* = Revised, Added, or Deleted

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777 Flight Crew Operations Manual

PD.31.2	February 28, 2020	PD.41.1	February 28, 2020
PD.31.3	February 28, 2020	PD.41.2	February 28, 2020
PD.31.4	February 28, 2020	PD.41.3	February 28, 2020
PD.31.5	February 28, 2020	PD.41.4	February 28, 2020
PD.31.6	February 28, 2020	PD.41.5	February 28, 2020
PD.31.7	February 28, 2020	PD.41.6	February 28, 2020
PD.31.8	February 28, 2020	PD.41.7	February 28, 2020
PD.31.9	February 28, 2020	PD.41.8	February 28, 2020
PD.31.10	February 28, 2020	PD.41.9	February 28, 2020
PD.32.1	February 28, 2020	PD.41.10	February 28, 2020
PD.32.2	February 28, 2020	PD.42.1	February 28, 2020
PD.32.3	December 15, 2020	PD.42.2	February 28, 2020
PD.32.4	February 28, 2020	PD.42.3	December 15, 2020
PD.32.5	February 28, 2020	PD.42.4	February 28, 2020
PD.32.6	February 28, 2020	PD.42.5	February 28, 2020
PD.33.1	February 28, 2020	PD.42.6	February 28, 2020
PD.33.2	December 15, 2020	PD.43.1	February 28, 2020
PD.33.3	February 28, 2020	PD.43.2	December 15, 2020
PD.33.4	February 28, 2020	PD.43.3	February 28, 2020
PD.33.5	February 28, 2020	PD.43.4	February 28, 2020
PD.33.6	February 28, 2020	PD.43.5	February 28, 2020
PD.33.7	February 28, 2020	PD.43.6	February 28, 2020
PD.33.8	February 28, 2020	PD.43.7	February 28, 2020
PD.33.9	February 28, 2020	PD.43.8	February 28, 2020
PD.33.10	February 28, 2020	PD.43.9	February 28, 2020
PD.34.1	February 28, 2020	PD.43.10	February 28, 2020
PD.34.2	December 15, 2020	PD.44.1	February 28, 2020
PD.34.3	February 28, 2020	PD.44.2	December 15, 2020
PD.34.4	December 15, 2020	PD.44.3	December 15, 2020
PD.34.5	February 28, 2020	PD.44.4	February 28, 2020
PD.34.6	February 28, 2020	PD.44.5	February 28, 2020
PD.34.7	December 15, 2020	PD.44.6	December 15, 2020
PD.34.8	December 15, 2020	PD.44.7	December 15, 2020
		PD.44.8	February 28, 2020
777-300 PW4090 LB FT FAA TO1-10 TO2-20 TAL-PA		777-300ER GE90-115B LB FT FAA TO1-10 TO2-20 TALPA	
PD.TOC.40.1-2	December 15, 2020	PD.TOC.50.1-2	December 15, 2020
PD.ModID.40.1-2	February 28, 2020	PD.ModID.50.1-2	June 15, 2020
PD.40.1	February 28, 2020	PD.50.1	June 15, 2020
PD.40.2	February 28, 2020	PD.50.2	June 15, 2020
PD.40.3	February 28, 2020	PD.50.3	June 15, 2020
PD.40.4	February 28, 2020	PD.50.4	June 15, 2020
PD.40.5	February 28, 2020	PD.50.5	June 15, 2020
PD.40.6	February 28, 2020	PD.50.6	December 15, 2020
PD.40.7	February 28, 2020	PD.50.7	December 15, 2020
PD.40.8	February 28, 2020	PD.50.8	June 15, 2020
PD.40.9	February 28, 2020	PD.50.9	June 15, 2020
PD.40.10	February 28, 2020		

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777 Flight Crew Operations Manual

PD.50.10	June 15, 2020	PD.60.3	December 15, 2020
PD.50.11	June 15, 2020	PD.60.4	December 15, 2020
PD.50.12	June 15, 2020	PD.60.5	June 15, 2020
PD.50.13	June 15, 2020	PD.60.6	June 15, 2020
PD.50.14	June 15, 2020	PD.60.7	June 15, 2020
PD.51.1	June 15, 2020	PD.60.8	June 15, 2020
PD.51.2	June 15, 2020	PD.60.9	December 15, 2020
PD.51.3	June 15, 2020	PD.60.10	December 15, 2020
PD.51.4	June 15, 2020	PD.60.11	June 15, 2020
PD.51.5	June 15, 2020	PD.60.12	June 15, 2020
PD.51.6	June 15, 2020	PD.60.13	June 15, 2020
PD.51.7	June 15, 2020	PD.60.14	June 15, 2020
PD.51.8	June 15, 2020	PD.60.15	June 15, 2020
PD.51.9	June 15, 2020	PD.60.16	June 15, 2020
PD.51.10	June 15, 2020	PD.61.1	June 15, 2020
PD.51.11	June 15, 2020	PD.61.2	June 15, 2020
PD.51.12	June 15, 2020	PD.61.3	June 15, 2020
PD.52.1	June 15, 2020	PD.61.4	June 15, 2020
PD.52.2	June 15, 2020	PD.61.5	June 15, 2020
PD.52.3	June 15, 2020	PD.61.6	June 15, 2020
PD.52.4	December 15, 2020	PD.61.7	June 15, 2020
PD.52.5	June 15, 2020	PD.61.8	June 15, 2020
PD.52.6	June 15, 2020	PD.61.9	June 15, 2020
PD.53.1	June 15, 2020	PD.61.10	June 15, 2020
PD.53.2	December 15, 2020	PD.61.11	June 15, 2020
PD.53.3	June 15, 2020	PD.61.12	June 15, 2020
PD.53.4	June 15, 2020	PD.62.1	June 15, 2020
PD.53.5	June 15, 2020	PD.62.2	June 15, 2020
PD.53.6	June 15, 2020	PD.62.3	June 15, 2020
PD.53.7	June 15, 2020	PD.62.4	December 15, 2020
PD.53.8	June 15, 2020	PD.62.5	June 15, 2020
PD.53.9	June 15, 2020	PD.62.6	June 15, 2020
PD.53.10	June 15, 2020	PD.63.1	June 15, 2020
PD.54.1	June 15, 2020	PD.63.2	December 15, 2020
PD.54.2	December 15, 2020	PD.63.3	June 15, 2020
PD.54.3	December 15, 2020	PD.63.4	June 15, 2020
PD.54.4	December 15, 2020	PD.63.5	June 15, 2020
PD.54.5	December 15, 2020	PD.63.6	June 15, 2020
PD.54.6	December 15, 2020	PD.63.7	June 15, 2020
PD.54.7	December 15, 2020	PD.63.8	June 15, 2020
PD.54.8	June 15, 2020	PD.63.9	June 15, 2020
777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA		PD.63.10	June 15, 2020
PD.TOC.60.1-2	December 15, 2020	PD.64.1	June 15, 2020
PD.ModID.60.1-2	June 15, 2020	PD.64.2	December 15, 2020
PD.60.1	June 15, 2020	PD.64.3	December 15, 2020
PD.60.2	December 15, 2020	PD.64.4	December 15, 2020
		PD.64.5	December 15, 2020

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777 Flight Crew Operations Manual

PD.64.6	December 15, 2020	PD.73.9	June 15, 2020
PD.64.7	December 15, 2020	PD.73.10	June 15, 2020
PD.64.8	June 15, 2020	PD.74.1	June 15, 2020
777F GE90-110B1L KG M EASA TALPA		PD.74.2	June 15, 2020
PD.TOC.70.1-2	December 15, 2020	PD.74.3	December 15, 2020
PD.ModID.70.1-2	June 15, 2020	PD.74.4	December 15, 2020
PD.70.1	June 15, 2020	PD.74.5	June 15, 2020
PD.70.2	December 15, 2020	PD.74.6	June 15, 2020
PD.70.3	June 15, 2020	PD.74.7	June 15, 2020
PD.70.4	June 15, 2020	PD.74.8	December 15, 2020
PD.70.5	June 15, 2020	PD.74.9	December 15, 2020
PD.70.6	June 15, 2020	PD.74.10	June 15, 2020
PD.70.7	June 15, 2020	Performance Inflight (tab)	
PD.70.8	June 15, 2020	PI.TOC.1-2	June 15, 2020
PD.70.9	June 15, 2020	777-200 GE90-76B KG M JAA	
PD.70.10	June 15, 2020	PI.TOC.10.1-4	December 15, 2020
PD.70.11	June 15, 2020	PI.ModID.10.1-2	December 15, 2015
PD.70.12	June 15, 2020	PI.10.1	December 15, 2020
PD.70.13	June 15, 2020	PI.10.2	December 15, 2020
PD.70.14	June 15, 2020	PI.10.3	December 15, 2020
PD.70.15	June 15, 2020	PI.10.4	December 15, 2020
PD.70.16	June 15, 2020	PI.10.5	December 15, 2020
PD.71.1	June 15, 2020	PI.10.6	December 15, 2020
PD.71.2	June 15, 2020	PI.10.7	December 15, 2020
PD.71.3	June 15, 2020	PI.10.8	December 15, 2020
PD.71.4	June 15, 2020	PI.10.9	December 15, 2020
PD.71.5	June 15, 2020	PI.10.10	December 15, 2020
PD.71.6	June 15, 2020	PI.10.11	December 15, 2020
PD.71.7	June 15, 2020	PI.10.12	December 15, 2020
PD.71.8	June 15, 2020	PI.11.1	December 15, 2014
PD.71.9	June 15, 2020	PI.11.2	December 15, 2014
PD.71.10	June 15, 2020	PI.11.3	December 15, 2014
PD.72.1	June 15, 2020	PI.11.4	December 15, 2014
PD.72.2	June 15, 2020	PI.11.5	December 15, 2014
PD.72.3	December 15, 2020	PI.11.6	December 15, 2014
PD.72.4	June 15, 2020	PI.11.7	December 15, 2014
PD.72.5	June 15, 2020	PI.11.8	December 15, 2014
PD.72.6	June 15, 2020	PI.12.1	December 15, 2020
PD.73.1	June 15, 2020	PI.12.2	December 15, 2020
PD.73.2	December 15, 2020	PI.12.3	December 15, 2020
PD.73.3	June 15, 2020	PI.12.4	December 15, 2015
PD.73.4	June 15, 2020	PI.12.5	December 15, 2015
PD.73.5	June 15, 2020	PI.12.6	December 15, 2015
PD.73.6	June 15, 2020	PI.12.7	December 15, 2015
PD.73.7	June 15, 2020	PI.12.8	December 15, 2015
PD.73.8	June 15, 2020	PI.12.9	December 15, 2015

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777 Flight Crew Operations Manual

PI.12.10	December 15, 2015	PI.15.3	December 15, 2014
PI.12.11	December 15, 2015	PI.15.4	December 15, 2014
PI.12.12	December 15, 2015	PI.15.5	December 15, 2014
PI.12.13	December 15, 2015	PI.15.6	December 15, 2014
PI.12.14	December 15, 2015	PI.16.1	December 15, 2020
PI.12.15	December 15, 2015	PI.16.2	December 15, 2020
PI.12.16	December 15, 2015	PI.16.3	December 15, 2020
PI.12.17	December 15, 2015	PI.16.4	December 15, 2020
PI.12.18	December 15, 2015	PI.16.5	December 15, 2020
PI.12.19	December 15, 2015	PI.16.6	December 15, 2020
PI.12.20	December 15, 2015	PI.16.7	December 15, 2020
PI.12.21	December 15, 2015	PI.16.8	December 15, 2020
PI.12.22	December 15, 2015	PI.16.9	December 15, 2020
PI.12.23	December 15, 2015	PI.16.10	December 15, 2020
PI.12.24	December 15, 2015	PI.16.11	June 15, 2015
PI.12.25	December 15, 2015	PI.16.12	December 15, 2014
PI.12.26	December 15, 2015	777-200ER TRENT892 KG M FAA TALPA	
PI.12.27	December 15, 2015	PI.TOC.20.1-4	December 15, 2020
PI.12.28	December 15, 2015	PI.ModID.20.1-2	February 28, 2020
PI.12.29	December 15, 2015	PI.20.1	December 15, 2020
PI.12.30	December 15, 2015	PI.20.2	December 15, 2020
PI.12.31	December 15, 2015	PI.20.3	December 15, 2020
PI.12.32	December 15, 2015	PI.20.4	December 15, 2020
PI.12.33	December 15, 2020	PI.20.5	December 15, 2020
PI.12.34	December 15, 2015	PI.20.6	December 15, 2020
PI.12.35	December 15, 2015	PI.20.7	December 15, 2020
PI.12.36	December 15, 2015	PI.20.8	December 15, 2020
PI.13.1	December 15, 2014	PI.20.9	December 15, 2020
PI.13.2	December 15, 2014	PI.20.10	December 15, 2020
PI.13.3	December 15, 2014	PI.20.11	December 15, 2020
PI.13.4	December 15, 2014	PI.20.12	December 15, 2020
PI.13.5	December 15, 2014	PI.20.13	December 15, 2020
PI.13.6	December 15, 2014	PI.20.14	December 15, 2020
PI.13.7	December 15, 2014	PI.20.15	December 15, 2020
PI.13.8	December 15, 2014	PI.20.16	December 15, 2020
PI.13.9	December 15, 2014	PI.21.1	February 28, 2020
PI.13.10	December 15, 2014	PI.21.2	February 28, 2020
PI.13.11	December 15, 2020	PI.21.3	February 28, 2020
PI.13.12	December 15, 2014	PI.21.4	February 28, 2020
PI.14.1	December 15, 2015	PI.21.5	February 28, 2020
PI.14.2	December 15, 2015	PI.21.6	February 28, 2020
PI.14.3	December 15, 2015	PI.21.7	February 28, 2020
PI.14.4	December 15, 2015	PI.21.8	February 28, 2020
PI.14.5	December 15, 2015	PI.21.9	February 28, 2020
PI.14.6	December 15, 2015	PI.21.10	February 28, 2020
PI.15.1	December 15, 2014	PI.22.1	December 15, 2020
PI.15.2	December 15, 2014		

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777 Flight Crew Operations Manual

PI.22.2	February 28, 2020	PI.23.9	February 28, 2020
PI.22.3	December 15, 2020	PI.23.10	February 28, 2020
PI.22.4	February 28, 2020	PI.23.11	February 28, 2020
PI.22.5	December 15, 2020	PI.23.12	February 28, 2020
PI.22.6	February 28, 2020	PI.24.1	December 15, 2020
PI.22.7	December 15, 2020	PI.24.2	February 28, 2020
PI.22.8	February 28, 2020	PI.24.3	February 28, 2020
PI.22.9	February 28, 2020	PI.24.4	February 28, 2020
PI.22.10	February 28, 2020	PI.24.5	February 28, 2020
PI.22.11	February 28, 2020	PI.24.6	February 28, 2020
PI.22.12	February 28, 2020	PI.25.1	February 28, 2020
PI.22.13	February 28, 2020	PI.25.2	February 28, 2020
PI.22.14	February 28, 2020	PI.25.3	February 28, 2020
PI.22.15	February 28, 2020	PI.25.4	February 28, 2020
PI.22.16	February 28, 2020	PI.25.5	February 28, 2020
PI.22.17	February 28, 2020	PI.25.6	February 28, 2020
PI.22.18	February 28, 2020	PI.26.1	February 28, 2020
PI.22.19	February 28, 2020	PI.26.2	February 28, 2020
PI.22.20	February 28, 2020	PI.26.3	February 28, 2020
PI.22.21	February 28, 2020	PI.26.4	February 28, 2020
PI.22.22	February 28, 2020	PI.26.5	February 28, 2020
PI.22.23	February 28, 2020	PI.26.6	February 28, 2020
PI.22.24	February 28, 2020	PI.26.7	February 28, 2020
PI.22.25	February 28, 2020	PI.26.8	February 28, 2020
PI.22.26	February 28, 2020	PI.27.1	February 28, 2020
PI.22.27	February 28, 2020	PI.27.2	February 28, 2020
PI.22.28	February 28, 2020	PI.27.3	February 28, 2020
PI.22.29	February 28, 2020	PI.27.4	February 28, 2020
PI.22.30	February 28, 2020	PI.27.5	February 28, 2020
PI.22.31	February 28, 2020	PI.27.6	February 28, 2020
PI.22.32	February 28, 2020	PI.28.1	December 15, 2020
PI.22.33	February 28, 2020	PI.28.2	December 15, 2020
PI.22.34	February 28, 2020	PI.28.3	December 15, 2020
PI.22.35	February 28, 2020	PI.28.4	December 15, 2020
PI.22.36	February 28, 2020	PI.28.5	December 15, 2020
PI.22.37	December 15, 2020	PI.28.6	December 15, 2020
PI.22.38	February 28, 2020	PI.28.7	December 15, 2020
PI.22.39	December 15, 2020	PI.28.8	December 15, 2020
PI.22.40	February 28, 2020	PI.28.9	December 15, 2020
PI.23.1	February 28, 2020	PI.28.10	December 15, 2020
PI.23.2	February 28, 2020	PI.28.11	December 15, 2020
PI.23.3	February 28, 2020	PI.28.12	December 15, 2020
PI.23.4	February 28, 2020	PI.28.13	December 15, 2020
PI.23.5	February 28, 2020	PI.28.14	February 28, 2020
PI.23.6	February 28, 2020	<hr/> 777-200LR GE90-110B1L KG M FAA TO1-10 TO2-20	
PI.23.7	February 28, 2020		
PI.23.8	February 28, 2020	PI.TOC.30.1-4	December 15, 2020

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777 Flight Crew Operations Manual

PI.ModID.30.1-2	February 28, 2020	PI.32.5	February 28, 2020
PI.30.1	December 15, 2020	PI.32.6	February 28, 2020
PI.30.2	December 15, 2020	PI.32.7	February 28, 2020
PI.30.3	December 15, 2020	PI.32.8	February 28, 2020
PI.30.4	December 15, 2020	PI.32.9	February 28, 2020
PI.30.5	December 15, 2020	PI.32.10	February 28, 2020
PI.30.6	December 15, 2020	PI.32.11	February 28, 2020
PI.30.7	December 15, 2020	PI.32.12	February 28, 2020
PI.30.8	December 15, 2020	PI.32.13	February 28, 2020
PI.30.9	December 15, 2020	PI.32.14	February 28, 2020
PI.30.10	December 15, 2020	PI.32.15	February 28, 2020
PI.30.11	December 15, 2020	PI.32.16	February 28, 2020
PI.30.12	December 15, 2020	PI.32.17	February 28, 2020
PI.30.13	December 15, 2020	PI.32.18	February 28, 2020
PI.30.14	December 15, 2020	PI.32.19	February 28, 2020
PI.30.15	December 15, 2020	PI.32.20	February 28, 2020
PI.30.16	December 15, 2020	PI.32.21	February 28, 2020
PI.30.17	December 15, 2020	PI.32.22	February 28, 2020
PI.30.18	December 15, 2020	PI.32.23	February 28, 2020
PI.30.19	December 15, 2020	PI.32.24	February 28, 2020
PI.30.20	December 15, 2020	PI.32.25	February 28, 2020
PI.30.21	December 15, 2020	PI.32.26	February 28, 2020
PI.30.22	December 15, 2020	PI.32.27	February 28, 2020
PI.30.23	December 15, 2020	PI.32.28	February 28, 2020
PI.30.24	December 15, 2020	PI.32.29	February 28, 2020
PI.30.25	December 15, 2020	PI.32.30	February 28, 2020
PI.30.26	December 15, 2020	PI.32.31	February 28, 2020
PI.30.27	December 15, 2020	PI.32.32	February 28, 2020
PI.30.28	December 15, 2020	PI.32.33	December 15, 2020
PI.30.29	December 15, 2020	PI.32.34	December 15, 2020
PI.30.30	December 15, 2020	PI.32.35	February 28, 2020
PI.30.31	December 15, 2020	PI.32.36	December 15, 2020
PI.30.32	December 15, 2020	PI.33.1	February 28, 2020
PI.31.1	February 28, 2020	PI.33.2	February 28, 2020
PI.31.2	February 28, 2020	PI.33.3	February 28, 2020
PI.31.3	February 28, 2020	PI.33.4	February 28, 2020
PI.31.4	February 28, 2020	PI.33.5	February 28, 2020
PI.31.5	February 28, 2020	PI.33.6	February 28, 2020
PI.31.6	February 28, 2020	PI.33.7	February 28, 2020
PI.31.7	February 28, 2020	PI.33.8	February 28, 2020
PI.31.8	February 28, 2020	PI.33.9	February 28, 2020
PI.31.9	February 28, 2020	PI.33.10	February 28, 2020
PI.31.10	February 28, 2020	PI.33.11	December 15, 2020
PI.32.1	December 15, 2020	PI.33.12	December 15, 2020
PI.32.2	December 15, 2020	PI.34.1	February 28, 2020
PI.32.3	December 15, 2020	PI.34.2	February 28, 2020
PI.32.4	February 28, 2020	PI.35.1	February 28, 2020

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777 Flight Crew Operations Manual

PI.35.2	February 28, 2020	PI.40.21	December 15, 2020
PI.35.3	February 28, 2020	PI.40.22	December 15, 2020
PI.35.4	February 28, 2020	PI.40.23	December 15, 2020
PI.35.5	February 28, 2020	PI.40.24	December 15, 2020
PI.35.6	February 28, 2020	PI.40.25	December 15, 2020
PI.35.7	February 28, 2020	PI.40.26	December 15, 2020
PI.35.8	February 28, 2020	PI.41.1	February 28, 2020
PI.36.1	February 28, 2020	PI.41.2	February 28, 2020
PI.36.2	February 28, 2020	PI.41.3	February 28, 2020
PI.36.3	February 28, 2020	PI.41.4	February 28, 2020
PI.36.4	February 28, 2020	PI.41.5	February 28, 2020
PI.37.1	December 15, 2020	PI.41.6	February 28, 2020
PI.37.2	December 15, 2020	PI.41.7	February 28, 2020
PI.37.3	December 15, 2020	PI.41.8	February 28, 2020
PI.37.4	December 15, 2020	PI.41.9	February 28, 2020
PI.37.5	December 15, 2020	PI.41.10	February 28, 2020
PI.37.6	December 15, 2020	PI.42.1	December 15, 2020
PI.37.7	December 15, 2020	PI.42.2	February 28, 2020
PI.37.8	December 15, 2020	PI.42.3	December 15, 2020
PI.37.9	December 15, 2020	PI.42.4	February 28, 2020
PI.37.10	December 15, 2020	PI.42.5	December 15, 2020
PI.37.11	December 15, 2020	PI.42.6	February 28, 2020
PI.37.12	December 15, 2020	PI.42.7	December 15, 2020
777-300 PW4090 LB FT FAA TO1-10 TO2-20 TAL-PA		PI.42.8	February 28, 2020
PI.TOC.40.1-4	December 15, 2020	PI.42.9	February 28, 2020
PI.ModID.40.1-2	February 28, 2020	PI.42.10	February 28, 2020
PI.40.1	December 15, 2020	PI.42.11	February 28, 2020
PI.40.2	December 15, 2020	PI.42.12	February 28, 2020
PI.40.3	December 15, 2020	PI.42.13	February 28, 2020
PI.40.4	December 15, 2020	PI.42.14	February 28, 2020
PI.40.5	December 15, 2020	PI.42.15	February 28, 2020
PI.40.6	December 15, 2020	PI.42.16	February 28, 2020
PI.40.7	December 15, 2020	PI.42.17	February 28, 2020
PI.40.8	December 15, 2020	PI.42.18	February 28, 2020
PI.40.9	December 15, 2020	PI.42.19	February 28, 2020
PI.40.10	December 15, 2020	PI.42.20	February 28, 2020
PI.40.11	December 15, 2020	PI.42.21	February 28, 2020
PI.40.12	December 15, 2020	PI.42.22	February 28, 2020
PI.40.13	December 15, 2020	PI.42.23	February 28, 2020
PI.40.14	December 15, 2020	PI.42.24	February 28, 2020
PI.40.15	December 15, 2020	PI.42.25	February 28, 2020
PI.40.16	December 15, 2020	PI.42.26	February 28, 2020
PI.40.17	December 15, 2020	PI.42.27	February 28, 2020
PI.40.18	December 15, 2020	PI.42.28	February 28, 2020
PI.40.19	December 15, 2020	PI.42.29	February 28, 2020
PI.40.20	December 15, 2020	PI.42.30	February 28, 2020
		PI.42.31	February 28, 2020

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777 Flight Crew Operations Manual

PI.42.32	February 28, 2020	* PI.48.1	June 15, 2021
PI.42.33	February 28, 2020	PI.48.2	December 15, 2020
PI.42.34	February 28, 2020	PI.48.3	December 15, 2020
PI.42.35	February 28, 2020	PI.48.4	December 15, 2020
PI.42.36	February 28, 2020	PI.48.5	December 15, 2020
PI.42.37	December 15, 2020	PI.48.6	December 15, 2020
PI.42.38	February 28, 2020	PI.48.7	December 15, 2020
PI.42.39	February 28, 2020	PI.48.8	December 15, 2020
PI.42.40	February 28, 2020	PI.48.9	February 28, 2020
PI.43.1	February 28, 2020	PI.48.10	February 28, 2020
PI.43.2	February 28, 2020	PI.48.11	December 15, 2020
PI.43.3	February 28, 2020	PI.48.12	February 28, 2020
PI.43.4	February 28, 2020	PI.48.13	February 28, 2020
PI.43.5	February 28, 2020	PI.48.14	February 28, 2020
PI.43.6	February 28, 2020		
PI.43.7	February 28, 2020		
PI.43.8	February 28, 2020		
PI.43.9	February 28, 2020		
PI.43.10	February 28, 2020		
PI.43.11	February 28, 2020		
PI.43.12	February 28, 2020		
PI.43.13	February 28, 2020		
PI.43.14	February 28, 2020		
PI.44.1	December 15, 2020		
PI.44.2	February 28, 2020		
PI.44.3	February 28, 2020		
PI.44.4	February 28, 2020		
PI.44.5	February 28, 2020		
PI.44.6	February 28, 2020		
PI.45.1	February 28, 2020		
PI.45.2	February 28, 2020		
PI.45.3	February 28, 2020		
PI.45.4	February 28, 2020		
PI.46.1	February 28, 2020		
PI.46.2	February 28, 2020		
PI.46.3	February 28, 2020		
PI.46.4	February 28, 2020		
PI.46.5	February 28, 2020		
PI.46.6	February 28, 2020		
PI.46.7	February 28, 2020		
PI.46.8	February 28, 2020		
PI.47.1	February 28, 2020		
PI.47.2	February 28, 2020		
PI.47.3	February 28, 2020		
PI.47.4	February 28, 2020		
PI.47.5	February 28, 2020		
PI.47.6	February 28, 2020		
		777-300ERGE90-115B LB FT FAA TO1-10 TO2-20	
		TALPA	
		PI.TOC.50.1-4	December 15, 2020
		PI.ModID.50.1-2	June 15, 2020
		PI.50.1	December 15, 2020
		PI.50.2	December 15, 2020
		PI.50.3	December 15, 2020
		PI.50.4	December 15, 2020
		PI.50.5	December 15, 2020
		PI.50.6	December 15, 2020
		PI.50.7	December 15, 2020
		PI.50.8	December 15, 2020
		PI.50.9	December 15, 2020
		PI.50.10	December 15, 2020
		PI.50.11	December 15, 2020
		PI.50.12	December 15, 2020
		PI.50.13	December 15, 2020
		PI.50.14	December 15, 2020
		PI.50.15	December 15, 2020
		PI.50.16	December 15, 2020
		PI.50.17	December 15, 2020
		PI.50.18	December 15, 2020
		PI.50.19	December 15, 2020
		PI.50.20	December 15, 2020
		PI.50.21	December 15, 2020
		PI.50.22	December 15, 2020
		PI.50.23	December 15, 2020
		PI.50.24	December 15, 2020
		PI.50.25	December 15, 2020
		PI.50.26	December 15, 2020
		PI.50.27	December 15, 2020
		PI.50.28	December 15, 2020
		PI.50.29	December 15, 2020

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PI.50.30	December 15, 2020	PI.52.33	June 15, 2020
PI.50.31	December 15, 2020	PI.52.34	June 15, 2020
PI.50.32	December 15, 2020	PI.52.35	June 15, 2020
PI.51.1	June 15, 2020	PI.52.36	June 15, 2020
PI.51.2	June 15, 2020	PI.52.37	December 15, 2020
PI.51.3	June 15, 2020	PI.52.38	December 15, 2020
PI.51.4	June 15, 2020	PI.52.39	June 15, 2020
PI.51.5	June 15, 2020	PI.52.40	December 15, 2020
PI.51.6	June 15, 2020	PI.53.1	June 15, 2020
PI.51.7	June 15, 2020	PI.53.2	June 15, 2020
PI.51.8	June 15, 2020	PI.53.3	June 15, 2020
PI.51.9	June 15, 2020	PI.53.4	June 15, 2020
PI.51.10	June 15, 2020	PI.53.5	June 15, 2020
PI.51.11	June 15, 2020	PI.53.6	June 15, 2020
PI.51.12	June 15, 2020	PI.53.7	June 15, 2020
PI.52.1	December 15, 2020	PI.53.8	June 15, 2020
PI.52.2	June 15, 2020	PI.53.9	June 15, 2020
PI.52.3	December 15, 2020	PI.53.10	June 15, 2020
PI.52.4	June 15, 2020	PI.53.11	December 15, 2020
PI.52.5	December 15, 2020	PI.53.12	December 15, 2020
PI.52.6	June 15, 2020	PI.54.1	June 15, 2020
PI.52.7	December 15, 2020	PI.54.2	June 15, 2020
PI.52.8	June 15, 2020	PI.55.1	June 15, 2020
PI.52.9	June 15, 2020	PI.55.2	June 15, 2020
PI.52.10	June 15, 2020	PI.55.3	June 15, 2020
PI.52.11	June 15, 2020	PI.55.4	June 15, 2020
PI.52.12	June 15, 2020	PI.55.5	June 15, 2020
PI.52.13	June 15, 2020	PI.55.6	June 15, 2020
PI.52.14	June 15, 2020	PI.55.7	June 15, 2020
PI.52.15	June 15, 2020	PI.55.8	June 15, 2020
PI.52.16	June 15, 2020	PI.56.1	June 15, 2020
PI.52.17	June 15, 2020	PI.56.2	June 15, 2020
PI.52.18	June 15, 2020	PI.56.3	June 15, 2020
PI.52.19	June 15, 2020	PI.56.4	June 15, 2020
PI.52.20	June 15, 2020	PI.56.5	June 15, 2020
PI.52.21	June 15, 2020	PI.56.6	June 15, 2020
PI.52.22	June 15, 2020	PI.57.1	December 15, 2020
PI.52.23	June 15, 2020	PI.57.2	December 15, 2020
PI.52.24	June 15, 2020	PI.57.3	December 15, 2020
PI.52.25	June 15, 2020	PI.57.4	December 15, 2020
PI.52.26	June 15, 2020	PI.57.5	December 15, 2020
PI.52.27	June 15, 2020	PI.57.6	December 15, 2020
PI.52.28	June 15, 2020	PI.57.7	December 15, 2020
PI.52.29	June 15, 2020	PI.57.8	December 15, 2020
PI.52.30	June 15, 2020	PI.57.9	December 15, 2020
PI.52.31	June 15, 2020	PI.57.10	December 15, 2020
PI.52.32	June 15, 2020	PI.57.11	December 15, 2020

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777 Flight Crew Operations Manual

PI.57.12	June 15, 2020	PI.61.11	June 15, 2020
777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA		PI.61.12	June 15, 2020
PI.TOC.60.1-4	December 15, 2020	PI.62.1	December 15, 2020
PI.ModID.60.1-2	June 15, 2020	PI.62.2	June 15, 2020
PI.60.1	December 15, 2020	PI.62.3	December 15, 2020
PI.60.2	December 15, 2020	PI.62.4	June 15, 2020
PI.60.3	December 15, 2020	PI.62.5	December 15, 2020
PI.60.4	December 15, 2020	PI.62.6	June 15, 2020
PI.60.5	December 15, 2020	PI.62.7	December 15, 2020
PI.60.6	December 15, 2020	PI.62.8	June 15, 2020
PI.60.7	December 15, 2020	PI.62.9	June 15, 2020
PI.60.8	December 15, 2020	PI.62.10	June 15, 2020
PI.60.9	December 15, 2020	PI.62.11	June 15, 2020
PI.60.10	December 15, 2020	PI.62.12	June 15, 2020
PI.60.11	December 15, 2020	PI.62.13	June 15, 2020
PI.60.12	December 15, 2020	PI.62.14	June 15, 2020
PI.60.13	December 15, 2020	PI.62.15	June 15, 2020
PI.60.14	December 15, 2020	PI.62.16	June 15, 2020
PI.60.15	December 15, 2020	PI.62.17	June 15, 2020
PI.60.16	December 15, 2020	PI.62.18	June 15, 2020
PI.60.17	December 15, 2020	PI.62.19	June 15, 2020
PI.60.18	December 15, 2020	PI.62.20	June 15, 2020
PI.60.19	December 15, 2020	PI.62.21	June 15, 2020
PI.60.20	December 15, 2020	PI.62.22	June 15, 2020
PI.60.21	December 15, 2020	PI.62.23	June 15, 2020
PI.60.22	December 15, 2020	PI.62.24	June 15, 2020
PI.60.23	December 15, 2020	PI.62.25	June 15, 2020
PI.60.24	December 15, 2020	PI.62.26	June 15, 2020
PI.60.25	December 15, 2020	PI.62.27	June 15, 2020
PI.60.26	December 15, 2020	PI.62.28	June 15, 2020
PI.60.27	December 15, 2020	PI.62.29	June 15, 2020
PI.60.28	December 15, 2020	PI.62.30	June 15, 2020
PI.60.29	December 15, 2020	PI.62.31	June 15, 2020
PI.60.30	December 15, 2020	PI.62.32	June 15, 2020
PI.60.31	December 15, 2020	PI.62.33	June 15, 2020
PI.60.32	December 15, 2020	PI.62.34	June 15, 2020
PI.61.1	June 15, 2020	PI.62.35	June 15, 2020
PI.61.2	June 15, 2020	PI.62.36	June 15, 2020
PI.61.3	June 15, 2020	PI.62.37	December 15, 2020
PI.61.4	June 15, 2020	PI.62.38	December 15, 2020
PI.61.5	June 15, 2020	PI.62.39	June 15, 2020
PI.61.6	June 15, 2020	PI.62.40	June 15, 2020
PI.61.7	June 15, 2020	PI.63.1	June 15, 2020
PI.61.8	June 15, 2020	PI.63.2	June 15, 2020
PI.61.9	June 15, 2020	PI.63.3	June 15, 2020
PI.61.10	June 15, 2020	PI.63.4	June 15, 2020
		PI.63.5	June 15, 2020

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PI.63.6	June 15, 2020	PI.70.9	June 15, 2020
PI.63.7	June 15, 2020	PI.70.10	June 15, 2020
PI.63.8	June 15, 2020	PI.70.11	June 15, 2020
PI.63.9	June 15, 2020	PI.70.12	December 15, 2020
PI.63.10	June 15, 2020	PI.70.13	June 15, 2020
PI.63.11	December 15, 2020	PI.70.14	June 15, 2020
PI.63.12	December 15, 2020	PI.70.15	December 15, 2020
PI.64.1	June 15, 2020	PI.70.16	December 15, 2020
PI.64.2	June 15, 2020	PI.70.17	December 15, 2020
PI.65.1	June 15, 2020	PI.70.18	December 15, 2020
PI.65.2	June 15, 2020	PI.71.1	June 15, 2020
PI.65.3	June 15, 2020	PI.71.2	June 15, 2020
PI.65.4	June 15, 2020	PI.71.3	June 15, 2020
PI.65.5	June 15, 2020	PI.71.4	June 15, 2020
PI.65.6	June 15, 2020	PI.71.5	June 15, 2020
PI.65.7	June 15, 2020	PI.71.6	June 15, 2020
PI.65.8	June 15, 2020	PI.71.7	June 15, 2020
PI.66.1	June 15, 2020	PI.71.8	June 15, 2020
PI.66.2	June 15, 2020	PI.71.9	June 15, 2020
PI.66.3	June 15, 2020	PI.71.10	June 15, 2020
PI.66.4	June 15, 2020	PI.72.1	December 15, 2020
PI.66.5	June 15, 2020	PI.72.2	June 15, 2020
PI.66.6	June 15, 2020	PI.72.3	December 15, 2020
PI.67.1	December 15, 2020	PI.72.4	June 15, 2020
PI.67.2	December 15, 2020	PI.72.5	December 15, 2020
PI.67.3	December 15, 2020	PI.72.6	June 15, 2020
PI.67.4	December 15, 2020	PI.72.7	December 15, 2020
PI.67.5	December 15, 2020	PI.72.8	June 15, 2020
PI.67.6	December 15, 2020	PI.72.9	June 15, 2020
PI.67.7	December 15, 2020	PI.72.10	June 15, 2020
PI.67.8	December 15, 2020	PI.72.11	June 15, 2020
PI.67.9	December 15, 2020	PI.72.12	June 15, 2020
PI.67.10	December 15, 2020	PI.72.13	June 15, 2020
PI.67.11	December 15, 2020	PI.72.14	June 15, 2020
PI.67.12	June 15, 2020	PI.72.15	June 15, 2020
777F GE90-110B1L KG M EASA TALPA		PI.72.16	June 15, 2020
PI.TOC.70.1-4	December 15, 2020	PI.72.17	June 15, 2020
PI.ModID.70.1-2	June 15, 2020	PI.72.18	June 15, 2020
PI.70.1	December 15, 2020	PI.72.19	June 15, 2020
PI.70.2	December 15, 2020	PI.72.20	June 15, 2020
PI.70.3	June 15, 2020	PI.72.21	June 15, 2020
PI.70.4	June 15, 2020	PI.72.22	June 15, 2020
PI.70.5	June 15, 2020	PI.72.23	June 15, 2020
PI.70.6	June 15, 2020	PI.72.24	June 15, 2020
PI.70.7	June 15, 2020	PI.72.25	June 15, 2020
PI.70.8	June 15, 2020	PI.72.26	June 15, 2020
		PI.72.27	June 15, 2020

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777 Flight Crew Operations Manual

PI.72.28	June 15, 2020	PI.77.9	June 15, 2020
PI.72.29	June 15, 2020	PI.77.10	June 15, 2020
PI.72.30	June 15, 2020	PI.77.11	December 15, 2020
PI.72.31	June 15, 2020	PI.77.12	June 15, 2020
PI.72.32	June 15, 2020	0.1.1-2	June 15, 2019
PI.72.33	June 15, 2020	(blank tab)	
PI.72.34	June 15, 2020	Volume 2	
PI.72.35	June 15, 2020	Airplane General, Emergency Equipment, Doors, Windows -200 & -300 Series (tab)	
PI.72.36	June 15, 2020	* 1.TOC.1-6	June 15, 2021
PI.72.37	December 15, 2020	1.10.1	December 15, 2015
PI.72.38	December 15, 2020	1.10.2	December 15, 2015
PI.72.39	June 15, 2020	1.10.3	December 15, 2015
* PI.72.40	June 15, 2021	1.10.4	December 15, 2015
PI.73.1	June 15, 2020	1.10.5	December 15, 2015
PI.73.2	June 15, 2020	1.10.6	June 15, 2018
PI.73.3	June 15, 2020	1.10.7	June 15, 2018
PI.73.4	June 15, 2020	1.10.8	June 15, 2018
PI.73.5	June 15, 2020	1.10.9	June 15, 2018
PI.73.6	June 15, 2020	1.10.10	June 15, 2018
PI.73.7	June 15, 2020	1.20.1	June 15, 2014
PI.73.8	June 15, 2020	1.20.2	June 26, 2000
PI.73.9	June 15, 2020	1.21.1	June 14, 2010
PI.73.10	June 15, 2020	1.21.2	June 14, 2010
PI.73.11	December 15, 2020	1.21.3	June 14, 2010
PI.73.12	December 15, 2020	1.21.4	December 14, 2009
PI.74.1	June 15, 2020	1.22.1	June 26, 2000
PI.74.2	June 15, 2020	1.22.2	June 26, 2000
PI.75.1	June 15, 2020	1.22.3	June 26, 2000
PI.75.2	December 15, 2020	1.22.4	June 16, 2003
PI.75.3	June 15, 2020	1.22.5	June 16, 2003
PI.75.4	June 15, 2020	1.22.6	June 14, 2010
PI.75.5	June 15, 2020	1.22.7	June 16, 2003
PI.75.6	June 15, 2020	1.22.8	June 16, 2003
PI.75.7	June 15, 2020	1.23.1	June 14, 2010
PI.75.8	June 15, 2020	1.23.2	June 14, 2010
PI.76.1	June 15, 2020	1.23.3	June 14, 2010
PI.76.2	June 15, 2020	1.23.4	December 14, 2009
PI.76.3	June 15, 2020	1.30.1	June 14, 2010
PI.76.4	June 15, 2020	1.30.2	June 13, 2011
* PI.77.1	June 15, 2021	1.30.3	December 15, 2015
PI.77.2	December 15, 2020	1.30.4	December 15, 2015
PI.77.3	December 15, 2020		
PI.77.4	December 15, 2020		
PI.77.5	June 15, 2020		
PI.77.6	December 15, 2020		
PI.77.7	June 15, 2020		
PI.77.8	December 15, 2020		

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1.30.5	December 15, 2015	1.45.10	June 15, 2020
1.30.6	December 15, 2015	1.45.11	June 15, 2020
1.30.7	December 15, 2015	1.45.12	June 15, 2020
1.30.8	December 15, 2015	1.45.13	June 15, 2020
1.30.9	December 15, 2015	1.45.14	June 15, 2020
1.30.10	June 15, 2013	1.46.1	February 28, 2020
1.30.11	December 15, 2013	1.46.2	February 28, 2020
1.30.12	February 28, 2020	1.46.3	February 28, 2020
1.30.13	February 28, 2020	1.46.4	February 28, 2020
1.30.14	February 28, 2020	1.46.5	February 28, 2020
1.30.15	February 28, 2020	1.46.6	February 28, 2020
1.30.16	February 28, 2020	1.46.7	February 28, 2020
1.30.17	June 15, 2020	1.46.8	February 28, 2020
1.30.18	February 28, 2020	1.46.9	February 28, 2020
1.30.19	February 28, 2020	1.46.10	February 28, 2020
1.30.20	February 28, 2020	1.46.11	February 28, 2020
1.30.21	February 28, 2020	1.46.12	February 28, 2020
1.30.22	February 28, 2020	1.46.13	February 28, 2020
1.30.23	February 28, 2020	1.46.14	February 28, 2020
1.30.24	February 28, 2020	1.46.15	February 28, 2020
1.30.25	February 28, 2020	1.46.16	February 28, 2020
1.30.26	February 28, 2020	1.46.17	February 28, 2020
1.30.27	February 28, 2020	1.46.18	February 28, 2020
1.30.28	February 28, 2020	1.46.19	February 28, 2020
1.40.1	December 13, 2010	1.46.20	February 28, 2020
1.40.2	June 13, 2011	1.46.21	February 28, 2020
1.40.3	December 15, 2008	1.46.22	February 28, 2020
1.40.4	June 15, 2014	1.46.23	February 28, 2020
* 1.40.5	June 15, 2021	1.46.24	February 28, 2020
* 1.40.6	June 15, 2021	1.46.25	February 28, 2020
1.40.7	June 15, 2014	1.46.26	June 15, 2020
1.40.8	December 15, 2012	1.46.27	February 28, 2020
1.40.9	June 16, 2008	1.46.28	February 28, 2020
1.40.10	December 15, 2012	1.46.29	February 28, 2020
1.40.11	December 15, 2012	1.46.30	February 28, 2020
1.40.12	June 15, 2020	1.46.31	February 28, 2020
1.40.13	February 28, 2020	1.46.32	February 28, 2020
1.40.14	June 13, 2011	1.46.33	February 28, 2020
1.45.1	June 15, 2020	1.46.34	February 28, 2020
1.45.2	February 28, 2020	1.46.35	February 28, 2020
1.45.3	February 28, 2020	1.46.36	February 28, 2020
1.45.4	February 28, 2020	1.46.37	February 28, 2020
1.45.5	June 15, 2020	1.46.38	February 28, 2020
1.45.6	June 15, 2020	1.46.39	February 28, 2020
1.45.7	June 15, 2020	1.46.40	February 28, 2020
1.45.8	June 15, 2020	1.46.41	February 28, 2020
1.45.9	June 15, 2020	1.46.42	February 28, 2020

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777 Flight Crew Operations Manual

1.46.43	February 28, 2020	1.60.2	December 15, 2015
1.46.44	February 28, 2020	1.60.3	February 28, 2020
1.47.1	June 15, 2014	1.60.4	February 28, 2020
1.47.2	December 15, 2014	Air Systems (tab)	
1.47.3	June 15, 2015	2.TOC.1-2	June 15, 2020
1.47.4	June 15, 2015	2.10.1	June 26, 2000
1.47.5	December 15, 2013	2.10.2	December 13, 2010
1.47.6	December 15, 2013	2.10.3	December 12, 2011
1.47.7	December 15, 2013	2.10.4	December 13, 2010
1.47.8	December 15, 2013	2.10.5	December 12, 2011
1.47.9	December 15, 2013	2.10.6	December 15, 2012
1.47.10	December 15, 2013	2.10.7	February 28, 2020
1.47.11	June 15, 2015	2.10.8	June 15, 2019
1.47.12	December 15, 2020	2.10.9	June 15, 2019
1.47.13	February 28, 2020	2.10.10	June 15, 2015
1.47.14	February 28, 2020	* 2.10.11	June 15, 2021
1.47.15	February 28, 2020	* 2.10.12	June 15, 2021
1.47.16	February 28, 2020	* 2.10.13	June 15, 2021
1.47.17	February 28, 2020	2.10.14	June 15, 2019
1.47.18	February 28, 2020	2.10.15	June 15, 2019
1.47.19	February 28, 2020	2.10.16	June 15, 2019
1.47.20	February 28, 2020	2.10.17	June 15, 2020
1.47.21	February 28, 2020	2.10.18	June 15, 2020
1.47.22	February 28, 2020	2.20.1	June 15, 2020
1.47.23	February 28, 2020	2.20.2	June 15, 2020
1.47.24	February 28, 2020	2.20.3	June 15, 2020
1.50.1	February 28, 2020	2.20.4	June 15, 2020
1.50.2	February 28, 2020	2.20.5	June 15, 2020
1.50.3	February 28, 2020	2.20.6	June 15, 2020
1.50.4	December 15, 2012	2.20.7	June 15, 2020
1.50.5	June 13, 2011	2.20.8	June 15, 2020
1.50.6	February 28, 2020	2.20.9	February 28, 2020
1.50.7	February 28, 2020	2.20.10	February 28, 2020
1.50.8	February 28, 2020	2.20.11	June 15, 2020
1.50.9	February 28, 2020	2.20.12	February 28, 2020
1.50.10	February 28, 2020	2.20.13	February 28, 2020
1.50.11	February 28, 2020	2.20.14	February 28, 2020
1.50.12	February 28, 2020	2.30.1	June 15, 2019
1.50.13	February 28, 2020	2.30.2	February 28, 2020
1.50.14	February 28, 2020	2.30.3	February 28, 2020
1.50.15	February 28, 2020	2.30.4	December 15, 2017
1.50.16	June 15, 2020	2.40.1	February 28, 2020
1.50.17	December 15, 2020	2.40.2	June 15, 2019
* 1.50.18	June 15, 2021	2.40.3	February 28, 2020
1.50.19	December 15, 2020	2.40.4	June 15, 2020
1.50.20	December 15, 2020	2.40.5	February 28, 2020
1.60.1	December 15, 2012		

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2.40.6	February 28, 2020	4.20.3	February 28, 2020
2.50.1	June 15, 2020	4.20.4	June 15, 2019
2.50.2	June 15, 2020	4.20.5	June 15, 2019
2.50.3	June 15, 2020	4.20.6	June 15, 2019
2.50.4	June 15, 2020	4.20.7	February 28, 2020
Anti-Ice, Rain (tab)		4.20.8	June 15, 2019
* 3.TOC.1-2	June 15, 2021	* 4.20.9	June 15, 2021
3.10.1	June 15, 2019	* 4.20.10	June 15, 2021
3.10.2	June 15, 2019	* 4.20.11	June 15, 2021
3.10.3	June 15, 2019	* 4.20.12	June 15, 2021
3.10.4	December 14, 2009	* 4.20.13	June 15, 2021
* 3.20.1	June 15, 2021	* 4.20.14	June 15, 2021
* 3.20.2	June 15, 2021	* 4.20.15	June 15, 2021
3.20.3	June 15, 2019	* 4.20.16	June 15, 2021
3.20.4	June 15, 2019	* 4.20.17	June 15, 2021
* 3.30.1	June 15, 2021	* 4.20.18	June 15, 2021
* 3.30.2	June 15, 2021	* 4.20.19	June 15, 2021
Automatic Flight (tab)		* 4.20.20	June 15, 2021
* 4.TOC.1-2	June 15, 2021	* 4.20.21	June 15, 2021
4.10.1	February 28, 2020	* 4.20.22	June 15, 2021
4.10.2	June 15, 2020	* 4.20.23	June 15, 2021
4.10.3	June 15, 2020	* 4.20.24	June 15, 2021
4.10.4	December 15, 2020	4.30.1	June 15, 2020
4.10.5	December 15, 2020	4.30.2	February 28, 2020
* 4.10.6	June 15, 2021	Communications -200 & -300 Series (tab)	
4.10.7	December 15, 2020	5.TOC.1-6	February 28, 2020
* 4.10.8	June 15, 2021	5.10.1	December 13, 2010
* 4.10.9	June 15, 2021	5.10.2	February 28, 2020
* 4.10.10	June 15, 2021	5.10.3	December 13, 2010
* 4.10.11	June 15, 2021	5.10.4	February 28, 2020
* 4.10.12	June 15, 2021	5.10.5	February 28, 2020
* 4.10.13	June 15, 2021	5.10.6	February 28, 2020
4.10.14	December 15, 2020	5.10.7	December 12, 2011
* 4.10.15	June 15, 2021	5.10.8	February 28, 2020
4.10.16	December 15, 2020	5.10.9	February 28, 2020
* 4.10.17	June 15, 2021	5.10.10	February 28, 2020
4.10.18	December 15, 2020	5.10.11	February 28, 2020
4.10.19	December 15, 2020	5.10.12	February 28, 2020
* 4.10.20	June 15, 2021	5.10.13	February 28, 2020
4.10.21	December 15, 2020	5.10.14	February 28, 2020
4.10.22	December 15, 2020	5.10.15	December 13, 2010
4.10.23	December 15, 2020	5.10.16	June 15, 2016
4.10.24	December 15, 2020	5.10.17	June 15, 2018
4.20.1	February 28, 2020	5.10.18	June 15, 2016
4.20.2	December 15, 2020	5.10.19	December 13, 2010

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777 Flight Crew Operations Manual

5.10.20	December 13, 2010	5.40.23	June 15, 2015
5.10.21	December 15, 2012	5.40.24	June 15, 2015
5.10.22	December 15, 2012	5.40.25	June 15, 2015
5.10.23	December 15, 2016	5.40.26	December 15, 2014
5.10.24	June 15, 2015	5.40.27	December 15, 2014
5.20.1	February 28, 2020	5.40.28	December 15, 2014
5.20.2	February 28, 2020	5.40.29	December 15, 2014
5.20.3	February 28, 2020	5.40.30	December 15, 2014
5.20.4	February 28, 2020	5.40.31	December 15, 2014
5.20.5	February 28, 2020	* 5.40.32	June 15, 2021
5.20.6	February 28, 2020	5.40.33	December 15, 2014
5.20.7	February 28, 2020	5.40.34	December 15, 2014
5.20.8	February 28, 2020	5.40.35	December 15, 2014
5.20.9	February 28, 2020	5.40.36	December 15, 2014
5.20.10	February 28, 2020	5.40.37	December 15, 2014
5.30.1	December 15, 2015	5.40.38	December 15, 2014
5.30.2	December 15, 2016	5.40.39	December 15, 2014
5.30.3	December 15, 2015	5.40.40	December 15, 2014
5.30.4	December 15, 2015	5.40.41	June 15, 2015
5.30.5	December 15, 2015	5.40.42	December 15, 2015
5.30.6	December 15, 2015	5.40.43	June 15, 2015
5.30.7	June 15, 2019	5.40.44	June 15, 2015
5.30.8	June 15, 2013	5.40.45	December 15, 2015
5.30.9	June 14, 2010	* 5.40.46	June 15, 2021
5.30.10	December 10, 2007	* 5.40.47	June 15, 2021
5.40.1	June 14, 2010	5.40.48	December 15, 2014
5.40.2	December 7, 2001	5.40.49	June 15, 2018
5.40.3	December 15, 2013	5.40.50	June 15, 2015
5.40.4	June 15, 2015	5.40.51	June 15, 2015
5.40.5	June 15, 2015	5.40.52	December 15, 2014
5.40.6	December 15, 2012	5.40.53	December 15, 2014
5.40.7	December 15, 2012	5.40.54	December 15, 2014
5.40.8	December 15, 2012	5.40.55	December 15, 2015
5.40.9	June 15, 2013	5.40.56	December 15, 2014
5.40.10	June 15, 2013	5.40.57	December 15, 2014
5.40.11	December 15, 2014	5.40.58	December 15, 2014
5.40.12	June 15, 2013	5.40.59	December 15, 2014
5.40.13	December 15, 2014	5.40.60	June 15, 2015
5.40.14	December 15, 2014	5.40.61	December 15, 2014
5.40.15	December 15, 2014	5.40.62	December 15, 2014
5.40.16	December 15, 2014	5.40.63	December 15, 2014
5.40.17	December 15, 2014	* 5.40.64	June 15, 2021
5.40.18	June 15, 2015	* 5.40.65	June 15, 2021
5.40.19	December 15, 2014	5.40.66	June 15, 2015
5.40.20	December 15, 2014	5.40.67	December 15, 2014
5.40.21	December 15, 2014	5.40.68	December 15, 2014
5.40.22	December 15, 2014	5.40.69	December 15, 2014

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777 Flight Crew Operations Manual

5.40.70	December 15, 2014	6.20.10	June 15, 2020
5.40.71	December 15, 2014	6.20.11	June 15, 2020
5.40.72	December 15, 2014	6.20.12	February 28, 2020
5.40.73	June 15, 2015	6.20.13	February 28, 2020
5.40.74	June 15, 2015	6.20.14	December 15, 2020
5.40.75	June 15, 2015	* 6.20.15	June 15, 2021
5.40.76	June 15, 2015	* 6.20.16	June 15, 2021
5.40.77	June 15, 2015	6.30.1	February 28, 2020
5.40.78	June 15, 2015	6.30.2	February 28, 2020
5.40.79	June 15, 2015	Engines, APU (tab)	
5.40.80	February 28, 2020	7.TOC.1-4	June 15, 2020
5.40.81	June 15, 2015	7.10.1	June 26, 2000
5.40.82	June 15, 2015	7.10.2	February 28, 2020
5.40.83	June 15, 2015	7.10.3	December 15, 2015
5.40.84	June 15, 2017	7.10.4	December 15, 2015
5.40.85	June 15, 2015	7.10.5	June 15, 2020
5.40.86	June 15, 2015	7.10.6	June 15, 2020
5.40.87	June 15, 2015	7.10.7	June 15, 2020
5.40.88	June 15, 2015	7.10.8	June 15, 2020
5.40.89	June 15, 2015	7.10.9	June 15, 2020
5.40.90	June 15, 2015	7.10.10	June 15, 2020
5.50.1	December 15, 2008	7.10.11	February 28, 2020
5.50.2	December 15, 2012	7.10.12	February 28, 2020
5.50.3	December 15, 2012	7.10.13	June 15, 2015
5.50.4	December 15, 2012	7.10.14	June 15, 2015
Electrical (tab)		7.10.15	June 15, 2015
6.TOC.1-2	December 15, 2020	7.10.16	June 15, 2019
6.10.1	December 15, 2020	7.10.17	June 15, 2015
6.10.2	February 28, 2020	7.10.18	February 28, 2020
6.10.3	June 15, 2020	7.10.19	June 15, 2015
6.10.4	June 15, 2020	7.10.20	December 15, 2015
6.10.5	December 15, 2020	7.10.21	June 15, 2019
6.10.6	February 28, 2020	7.10.22	December 15, 2015
6.10.7	December 15, 2020	7.10.23	December 15, 2012
6.10.8	December 15, 2020	7.10.24	December 15, 2012
6.10.9	December 15, 2020	7.10.25	June 15, 2019
6.10.10	December 15, 2020	7.10.26	February 28, 2020
6.20.1	June 15, 2016	7.10.27	December 15, 2013
6.20.2	June 15, 2020	7.10.28	February 28, 2020
6.20.3	June 15, 2020	7.10.29	February 28, 2020
6.20.4	June 15, 2020	7.10.30	December 15, 2012
* 6.20.5	June 15, 2021	7.20.1	June 15, 2020
6.20.6	June 15, 2019	7.20.2	June 15, 2020
* 6.20.7	June 15, 2021	7.20.3	February 28, 2020
6.20.8	June 15, 2019	7.20.4	June 15, 2017
6.20.9	June 15, 2020	7.20.5	June 15, 2017

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777 Flight Crew Operations Manual

7.20.6	June 15, 2017	8.20.2	February 28, 2020
7.20.7	June 15, 2017	8.20.3	June 15, 2019
7.20.8	June 15, 2019	8.20.4	December 15, 2012
7.20.9	February 28, 2020	8.20.5	February 28, 2020
7.20.10	February 28, 2020	8.20.6	February 28, 2020
7.20.11	June 15, 2020	8.20.7	June 15, 2020
7.20.12	February 28, 2020	8.20.8	February 28, 2020
7.20.13	February 28, 2020	8.20.9	February 28, 2020
7.20.14	February 28, 2020	8.20.10	February 28, 2020
7.20.15	June 15, 2019	8.20.11	February 28, 2020
7.20.16	February 28, 2020	8.20.12	June 15, 2015
7.20.17	February 28, 2020	8.30.1	June 15, 2019
7.20.18	February 28, 2020	8.30.2	June 15, 2019
7.20.19	June 15, 2019	8.30.3	February 28, 2020
7.20.20	June 15, 2019	8.30.4	February 28, 2020
7.20.21	June 15, 2019	Flight Controls (tab)	
7.20.22	June 15, 2019	* 9.TOC.1-4	June 15, 2021
7.20.23	February 28, 2020	9.10.1	June 15, 2019
7.20.24	June 15, 2019	* 9.10.2	June 15, 2021
7.20.25	June 15, 2019	* 9.10.3	June 15, 2021
7.20.26	June 15, 2019	* 9.10.4	June 15, 2021
7.20.27	June 15, 2019	* 9.10.5	June 15, 2021
7.20.28	June 15, 2019	* 9.10.6	June 15, 2021
7.20.29	February 28, 2020	* 9.10.7	June 15, 2021
7.20.30	June 15, 2019	* 9.10.8	June 15, 2021
7.30.1	February 28, 2020	* 9.10.9	June 15, 2021
7.30.2	June 15, 2019	* 9.10.10	June 15, 2021
7.30.3	February 28, 2020	* 9.10.11	June 15, 2021
7.30.4	June 26, 2000	* 9.10.12	June 15, 2021
7.40.1	February 28, 2020	* 9.10.13	June 15, 2021
7.40.2	February 28, 2020	* 9.10.14	June 15, 2021
7.40.3	February 28, 2020	* 9.10.15	June 15, 2021
7.40.4	June 15, 2019	* 9.10.16	June 15, 2021
Fire Protection (tab)		* 9.10.17	June 15, 2021
8.TOC.1-2	February 28, 2020	* 9.10.18	June 15, 2021
8.10.1	February 28, 2020	* 9.10.19	June 15, 2021
8.10.2	February 28, 2020	* 9.10.20	June 15, 2021
8.10.3	February 28, 2020	* 9.20.1	June 15, 2021
* 8.10.4	June 15, 2021	* 9.20.2	June 15, 2021
8.10.5	February 28, 2020	* 9.20.3	June 15, 2021
8.10.6	February 28, 2020	* 9.20.4	June 15, 2021
8.10.7	February 28, 2020	* 9.20.5	June 15, 2021
8.10.8	June 15, 2019	* 9.20.6	June 15, 2021
8.10.9	June 15, 2019	* 9.20.7	June 15, 2021
8.10.10	December 10, 2007	* 9.20.8	June 15, 2021
8.20.1	February 28, 2020	* 9.20.9	June 15, 2021

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* 9.20.10	June 15, 2021	10.10.21	February 28, 2020
* 9.20.11	June 15, 2021	10.10.22	February 28, 2020
* 9.20.12	June 15, 2021	10.10.23	February 28, 2020
* 9.20.13	June 15, 2021	10.10.24	February 28, 2020
* 9.20.14	June 15, 2021	10.10.25	February 28, 2020
* 9.20.15	June 15, 2021	10.10.26	February 28, 2020
* 9.20.16	June 15, 2021	10.10.27	February 28, 2020
* 9.20.17	June 15, 2021	10.10.28	February 28, 2020
* 9.20.18	June 15, 2021	10.10.29	February 28, 2020
* 9.20.19	June 15, 2021	10.10.30	February 28, 2020
* 9.20.20	June 15, 2021	10.10.31	February 28, 2020
* 9.20.21	June 15, 2021	10.10.32	February 28, 2020
* 9.20.22	June 15, 2021	10.10.33	February 28, 2020
* 9.20.23	June 15, 2021	10.10.34	February 28, 2020
* 9.20.24	June 15, 2021	10.10.35	February 28, 2020
* 9.20.25	June 15, 2021	10.10.36	February 28, 2020
* 9.20.26	June 15, 2021	10.10.37	February 28, 2020
* 9.20.27	June 15, 2021	10.10.38	February 28, 2020
* 9.20.28	June 15, 2021	10.10.39	February 28, 2020
* 9.20.29	June 15, 2021	10.10.40	February 28, 2020
* 9.20.30	June 15, 2021	10.10.41	June 15, 2020
9.30.1	June 15, 2019	10.10.42	June 15, 2020
9.30.2	June 15, 2019	10.10.43	February 28, 2020
Flight Instruments, Displays -200 & -300 Series (tab)		10.10.44	February 28, 2020
* 10.TOC.1-6	June 15, 2021	10.10.45	February 28, 2020
10.10.1	June 12, 2006	10.10.46	February 28, 2020
10.10.2	June 15, 2018	10.10.47	February 28, 2020
10.10.3	December 14, 2009	10.10.48	February 28, 2020
10.10.4	December 15, 2012	10.10.49	February 28, 2020
10.10.5	June 15, 2013	10.10.50	February 28, 2020
10.10.6	February 28, 2020	* 10.10.51	June 15, 2021
10.10.7	June 15, 2015	* 10.10.52	June 15, 2021
10.10.8	June 15, 2015	* 10.10.53	June 15, 2021
10.10.9	June 15, 2015	* 10.10.54	June 15, 2021
10.10.10	December 15, 2014	* 10.10.55	June 15, 2021
10.10.11	December 15, 2014	* 10.10.56	June 15, 2021
10.10.12	December 13, 2010	* 10.10.57	June 15, 2021
10.10.13	December 15, 2012	* 10.10.58	June 15, 2021
10.10.14	June 15, 2017	* 10.10.59	June 15, 2021
* 10.10.15	June 15, 2021	* 10.10.60	June 15, 2021
10.10.16	February 28, 2020	* 10.10.61	June 15, 2021
10.10.17	February 28, 2020	* 10.10.62	June 15, 2021
10.10.18	February 28, 2020	* 10.10.63	June 15, 2021
10.10.19	February 28, 2020	* 10.10.64	June 15, 2021
10.10.20	February 28, 2020	* 10.10.65	June 15, 2021
		* 10.10.66	June 15, 2021
		* 10.10.67	June 15, 2021

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777 Flight Crew Operations Manual

* 10.10.68	June 15, 2021	10.40.5	February 28, 2020
* 10.10.69	June 15, 2021	10.40.6	February 28, 2020
* 10.10.70	June 15, 2021	10.40.7	February 28, 2020
* 10.10.71	June 15, 2021	10.40.8	February 28, 2020
* 10.10.72	June 15, 2021	10.40.9	February 28, 2020
* 10.10.73	June 15, 2021	10.40.10	February 28, 2020
* 10.10.74	June 15, 2021	10.40.11	February 28, 2020
10.20.1	June 13, 2011	10.40.12	February 28, 2020
10.20.2	June 14, 2004	10.40.13	February 28, 2020
10.20.3	June 14, 2004	10.40.14	February 28, 2020
10.20.4	June 15, 2014	10.40.15	February 28, 2020
10.20.5	December 15, 2012	10.40.16	February 28, 2020
10.20.6	June 13, 2005	10.40.17	February 28, 2020
10.20.7	June 26, 2000	10.40.18	February 28, 2020
10.20.8	June 26, 2000	10.40.19	February 28, 2020
10.20.9	June 26, 2000	10.40.20	February 28, 2020
10.20.10	June 15, 2014	10.40.21	February 28, 2020
10.20.11	December 14, 2009	10.40.22	February 28, 2020
10.20.12	December 15, 2015	10.40.23	February 28, 2020
10.20.13	December 15, 2015	10.40.24	February 28, 2020
10.20.14	December 15, 2017	10.40.25	June 15, 2020
10.20.15	December 15, 2017	10.40.26	February 28, 2020
10.20.16	December 15, 2017	10.40.27	February 28, 2020
10.20.17	December 15, 2017	10.40.28	February 28, 2020
10.20.18	December 15, 2017	10.50.1	June 15, 2015
10.30.1	June 14, 2010	10.50.2	June 15, 2015
10.30.2	February 28, 2020	10.50.3	June 15, 2014
10.30.3	June 15, 2009	10.50.4	June 15, 2014
10.30.4	December 15, 2012	10.50.5	June 15, 2014
10.30.5	December 15, 2012	10.50.6	June 15, 2015
10.30.6	December 15, 2012	10.50.7	June 15, 2015
10.30.7	June 15, 2015	10.50.8	December 15, 2013
10.30.8	June 15, 2015	10.50.9	June 15, 2014
10.30.9	June 15, 2015	10.50.10	June 15, 2015
10.30.10	June 15, 2015	10.50.11	June 15, 2015
10.30.11	June 15, 2015	10.50.12	December 15, 2013
10.30.12	June 15, 2015	10.50.13	December 15, 2013
10.30.13	June 15, 2015	10.50.14	June 15, 2015
10.30.14	June 15, 2015	10.50.15	June 15, 2015
10.30.15	June 15, 2015	10.50.16	June 15, 2015
10.30.16	June 15, 2015	10.50.17	June 15, 2015
10.30.17	June 15, 2015	10.50.18	June 15, 2015
10.30.18	June 15, 2015	10.60.1	June 15, 2014
10.40.1	December 11, 2000	10.60.2	June 15, 2014
10.40.2	December 11, 2000	10.60.3	June 15, 2014
10.40.3	February 28, 2020	10.60.4	June 15, 2014
10.40.4	February 28, 2020	10.60.5	June 15, 2014

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10.60.6	June 15, 2014	10.70.1	June 15, 2015
10.60.7	June 15, 2014	10.70.2	June 15, 2014
10.60.8	June 15, 2014	Flight Management, Navigation -200 & -300 Series (tab)	
10.60.9	June 15, 2014	* 11.TOC.1-8	June 15, 2021
10.60.10	June 15, 2016	11.10.1	June 17, 2002
10.60.11	June 15, 2016	11.10.2	June 17, 2002
10.60.12	June 15, 2016	11.10.3	June 17, 2002
10.65.1	June 15, 2009	11.10.4	June 13, 2011
10.65.2	December 14, 2009	* 11.10.5	June 15, 2021
10.65.3	December 15, 2003	* 11.10.6	June 15, 2021
10.65.4	June 15, 2016	* 11.10.7	June 15, 2021
10.65.5	June 15, 2016	* 11.10.8	June 15, 2021
10.65.6	June 15, 2016	* 11.10.9	June 15, 2021
10.65.7	June 15, 2016	* 11.10.10	June 15, 2021
10.65.8	June 15, 2016	* 11.10.11	June 15, 2021
10.65.9	June 15, 2016	* 11.10.12	June 15, 2021
10.65.10	June 15, 2016	* 11.10.13	June 15, 2021
10.65.11	June 15, 2016	* 11.10.14	June 15, 2021
10.65.12	June 15, 2016	* 11.10.15	June 15, 2021
10.65.13	June 15, 2016	* 11.10.16	June 15, 2021
10.65.14	June 15, 2016	* 11.10.17	June 15, 2021
10.65.15	June 15, 2016	* 11.10.18	June 15, 2021
10.65.16	June 15, 2016	* 11.10.19	June 15, 2021
10.65.17	June 15, 2016	* 11.10.20	June 15, 2021
10.65.18	June 15, 2016	* 11.10.21	June 15, 2021
10.65.19	June 15, 2016	* 11.10.22	June 15, 2021
10.65.20	June 15, 2016	* 11.10.23	June 15, 2021
10.65.21	June 15, 2018	* 11.10.24	June 15, 2021
10.65.22	June 15, 2016	* 11.10.25	June 15, 2021
10.65.23	June 15, 2016	* 11.10.26	June 15, 2021
10.65.24	June 15, 2016	* 11.10.27	June 15, 2021
10.65.25	June 15, 2016	* 11.10.28	June 15, 2021
10.65.26	June 15, 2016	* 11.10.29	June 15, 2021
10.65.27	June 15, 2016	* 11.10.30	June 15, 2021
10.65.28	June 15, 2016	* 11.20.1	June 15, 2021
10.65.29	June 15, 2016	* 11.20.2	June 15, 2021
10.65.30	June 15, 2016	* 11.20.3	June 15, 2021
10.65.31	June 15, 2016	* 11.20.4	June 15, 2021
10.65.32	June 15, 2016	* 11.20.5	June 15, 2021
10.65.33	June 15, 2016	* 11.20.6	June 15, 2021
10.65.34	June 15, 2016	* 11.20.7	June 15, 2021
10.65.35	June 15, 2016	* 11.20.8	June 15, 2021
10.65.36	June 15, 2016	* 11.20.9	June 15, 2021
10.65.37	June 15, 2016	* 11.20.10	June 15, 2021
10.65.38	June 15, 2016	* 11.20.11	June 15, 2021
10.65.39	June 15, 2016		
10.65.40	June 15, 2016		

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777 Flight Crew Operations Manual

* 11.20.12	June 15, 2021	* 11.31.37	June 15, 2021
* 11.20.13	June 15, 2021	* 11.31.38	June 15, 2021
* 11.20.14	June 15, 2021	* 11.31.39	June 15, 2021
* 11.20.15	June 15, 2021	* 11.31.40	June 15, 2021
* 11.20.16	June 15, 2021	* 11.31.41	June 15, 2021
* 11.20.17	June 15, 2021	* 11.31.42	June 15, 2021
* 11.20.18	June 15, 2021	11.32.1	December 13, 2010
* 11.30.1	June 15, 2021	11.32.2	February 28, 2020
* 11.30.2	June 15, 2021	* 11.32.3	June 15, 2021
* 11.30.3	June 15, 2021	* 11.32.4	June 15, 2021
* 11.30.4	June 15, 2021	* 11.32.5	June 15, 2021
11.31.1	June 15, 2013	* 11.32.6	June 15, 2021
11.31.2	June 15, 2013	* 11.32.7	June 15, 2021
11.31.3	December 15, 2020	* 11.32.8	June 15, 2021
* 11.31.4	June 15, 2021	* 11.32.9	June 15, 2021
* 11.31.5	June 15, 2021	* 11.32.10	June 15, 2021
* 11.31.6	June 15, 2021	11.33.1	June 26, 2000
* 11.31.7	June 15, 2021	11.33.2	June 26, 2000
* 11.31.8	June 15, 2021	11.34.1	June 26, 2000
* 11.31.9	June 15, 2021	* 11.34.2	June 15, 2021
* 11.31.10	June 15, 2021	* 11.34.3	June 15, 2021
* 11.31.11	June 15, 2021	* 11.34.4	June 15, 2021
* 11.31.12	June 15, 2021	* 11.34.5	June 15, 2021
* 11.31.13	June 15, 2021	* 11.34.6	June 15, 2021
* 11.31.14	June 15, 2021	* 11.34.7	June 15, 2021
* 11.31.15	June 15, 2021	* 11.34.8	June 15, 2021
* 11.31.16	June 15, 2021	* 11.34.9	June 15, 2021
* 11.31.17	June 15, 2021	* 11.34.10	June 15, 2021
* 11.31.18	June 15, 2021	* 11.34.11	June 15, 2021
* 11.31.19	June 15, 2021	* 11.34.12	June 15, 2021
* 11.31.20	June 15, 2021	* 11.34.13	June 15, 2021
* 11.31.21	June 15, 2021	* 11.34.14	June 15, 2021
* 11.31.22	June 15, 2021	11.40.1	June 13, 2011
* 11.31.23	June 15, 2021	* 11.40.2	June 15, 2021
* 11.31.24	June 15, 2021	* 11.40.3	June 15, 2021
* 11.31.25	June 15, 2021	11.40.4	June 12, 2006
* 11.31.26	June 15, 2021	11.40.5	June 26, 2000
* 11.31.27	June 15, 2021	11.40.6	February 28, 2020
* 11.31.28	June 15, 2021	11.40.7	February 28, 2020
* 11.31.29	June 15, 2021	11.40.8	February 28, 2020
* 11.31.30	June 15, 2021	11.40.9	February 28, 2020
* 11.31.31	June 15, 2021	11.40.10	February 28, 2020
* 11.31.32	June 15, 2021	11.40.11	February 28, 2020
* 11.31.33	June 15, 2021	11.40.12	February 28, 2020
* 11.31.34	June 15, 2021	11.40.13	February 28, 2020
* 11.31.35	June 15, 2021	11.40.14	February 28, 2020
* 11.31.36	June 15, 2021	11.40.15	February 28, 2020

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11.40.16	February 28, 2020	11.41.3	June 15, 2013
11.40.17	February 28, 2020	11.41.4	June 15, 2013
11.40.18	February 28, 2020	11.41.5	June 15, 2013
11.40.19	February 28, 2020	11.41.6	December 15, 2012
11.40.20	February 28, 2020	11.41.7	December 15, 2013
11.40.21	February 28, 2020	11.41.8	December 15, 2012
11.40.22	February 28, 2020	11.41.9	December 15, 2013
11.40.23	February 28, 2020	11.41.10	December 15, 2012
11.40.24	February 28, 2020	11.41.11	December 15, 2012
* 11.40.25	June 15, 2021	11.41.12	June 15, 2013
* 11.40.26	June 15, 2021	11.41.13	June 15, 2013
* 11.40.27	June 15, 2021	11.41.14	June 15, 2013
* 11.40.28	June 15, 2021	11.41.15	June 15, 2013
* 11.40.29	June 15, 2021	11.41.16	June 15, 2013
* 11.40.30	June 15, 2021	11.42.1	December 15, 2012
* 11.40.31	June 15, 2021	* 11.42.2	June 15, 2021
* 11.40.32	June 15, 2021	* 11.42.3	June 15, 2021
* 11.40.33	June 15, 2021	* 11.42.4	June 15, 2021
* 11.40.34	June 15, 2021	* 11.42.5	June 15, 2021
* 11.40.35	June 15, 2021	* 11.42.6	June 15, 2021
* 11.40.36	June 15, 2021	* 11.42.7	June 15, 2021
* 11.40.37	June 15, 2021	* 11.42.8	June 15, 2021
* 11.40.38	June 15, 2021	* 11.42.9	June 15, 2021
* 11.40.39	June 15, 2021	* 11.42.10	June 15, 2021
* 11.40.40	June 15, 2021	* 11.42.11	June 15, 2021
* 11.40.41	June 15, 2021	* 11.42.12	June 15, 2021
* 11.40.42	June 15, 2021	* 11.42.13	June 15, 2021
* 11.40.43	June 15, 2021	* 11.42.14	June 15, 2021
* 11.40.44	June 15, 2021	* 11.42.15	June 15, 2021
* 11.40.45	June 15, 2021	* 11.42.16	June 15, 2021
* 11.40.46	June 15, 2021	* 11.42.17	June 15, 2021
* 11.40.47	June 15, 2021	* 11.42.18	June 15, 2021
* 11.40.48	June 15, 2021	* 11.42.19	June 15, 2021
* 11.40.49	June 15, 2021	* 11.42.20	June 15, 2021
* 11.40.50	June 15, 2021	* 11.42.21	June 15, 2021
* 11.40.51	June 15, 2021	* 11.42.22	June 15, 2021
* 11.40.52	June 15, 2021	* 11.42.23	June 15, 2021
* 11.40.53	June 15, 2021	* 11.42.24	June 15, 2021
* 11.40.54	June 15, 2021	* 11.42.25	June 15, 2021
* 11.40.55	June 15, 2021	* 11.42.26	June 15, 2021
* 11.40.56	June 15, 2021	* 11.42.27	June 15, 2021
* 11.40.57	June 15, 2021	* 11.42.28	June 15, 2021
* 11.40.58	June 15, 2021	* 11.42.29	June 15, 2021
* 11.40.59	June 15, 2021	* 11.42.30	June 15, 2021
* 11.40.60	June 15, 2021	* 11.42.31	June 15, 2021
11.41.1	December 14, 2009	* 11.42.32	June 15, 2021
11.41.2	December 15, 2013	* 11.42.33	June 15, 2021

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777 Flight Crew Operations Manual

* 11.42.34	June 15, 2021	* 11.43.19	June 15, 2021
* 11.42.35	June 15, 2021	* 11.43.20	June 15, 2021
* 11.42.36	June 15, 2021	* 11.43.21	June 15, 2021
* 11.42.37	June 15, 2021	* 11.43.22	June 15, 2021
* 11.42.38	June 15, 2021	* 11.43.23	June 15, 2021
* 11.42.39	June 15, 2021	* 11.43.24	June 15, 2021
* 11.42.40	June 15, 2021	* 11.43.25	June 15, 2021
* 11.42.41	June 15, 2021	* 11.43.26	June 15, 2021
* 11.42.42	June 15, 2021	* 11.43.27	June 15, 2021
* 11.42.43	June 15, 2021	* 11.43.28	June 15, 2021
* 11.42.44	June 15, 2021	* 11.43.29	June 15, 2021
* 11.42.45	June 15, 2021	* 11.43.30	June 15, 2021
* 11.42.46	June 15, 2021	* 11.43.31	June 15, 2021
* 11.42.47	June 15, 2021	* 11.43.32	June 15, 2021
* 11.42.48	June 15, 2021	* 11.43.33	June 15, 2021
* 11.42.49	June 15, 2021	* 11.43.34	June 15, 2021
* 11.42.50	June 15, 2021	* 11.43.35	June 15, 2021
* 11.42.51	June 15, 2021	* 11.43.36	June 15, 2021
* 11.42.52	June 15, 2021	* 11.43.37	June 15, 2021
* 11.42.53	June 15, 2021	* 11.43.38	June 15, 2021
* 11.42.54	June 15, 2021	* 11.50.1	June 15, 2021
* 11.42.55	June 15, 2021	* 11.50.2	June 15, 2021
* 11.42.56	June 15, 2021	* 11.50.3	June 15, 2021
* 11.42.57	June 15, 2021	* 11.50.4	June 15, 2021
* 11.42.58	June 15, 2021	* 11.50.5	June 15, 2021
* 11.42.59	June 15, 2021	* 11.50.6	June 15, 2021
* 11.42.60	June 15, 2021	* 11.50.7	June 15, 2021
* 11.42.61	June 15, 2021	* 11.50.8	June 15, 2021
* 11.42.62	June 15, 2021	* 11.50.9	June 15, 2021
* 11.43.1	June 15, 2021	* 11.50.10	June 15, 2021
* 11.43.2	June 15, 2021	11.60.1	February 28, 2020
* 11.43.3	June 15, 2021	11.60.2	February 28, 2020
* 11.43.4	June 15, 2021	* 11.60.3	June 15, 2021
* 11.43.5	June 15, 2021	* 11.60.4	June 15, 2021
* 11.43.6	June 15, 2021	* 11.60.5	June 15, 2021
* 11.43.7	June 15, 2021	* 11.60.6	June 15, 2021
* 11.43.8	June 15, 2021	* 11.60.7	June 15, 2021
* 11.43.9	June 15, 2021	* 11.60.8	June 15, 2021
* 11.43.10	June 15, 2021	* 11.60.9	June 15, 2021
* 11.43.11	June 15, 2021	* 11.60.10	June 15, 2021
* 11.43.12	June 15, 2021	* 11.60.11	June 15, 2021
* 11.43.13	June 15, 2021	* 11.60.12	June 15, 2021
* 11.43.14	June 15, 2021	* 11.60.13	June 15, 2021
* 11.43.15	June 15, 2021	* 11.60.14	June 15, 2021
* 11.43.16	June 15, 2021	Fuel (tab)	
* 11.43.17	June 15, 2021	12.TOC.1-2	February 28, 2020
* 11.43.18	June 15, 2021		

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777 Flight Crew Operations Manual

12.10.1	June 15, 2019	13.10.3	December 15, 2020
12.10.2	June 15, 2019	13.10.4	February 28, 2020
12.10.3	June 15, 2019	13.10.5	June 15, 2019
12.10.4	June 15, 2019	13.10.6	June 15, 2020
12.10.5	June 15, 2019	13.20.1	June 15, 2019
12.10.6	June 15, 2019	13.20.2	February 28, 2020
12.10.7	February 28, 2020	13.20.3	June 15, 2020
12.10.8	February 28, 2020	13.20.4	February 28, 2020
* 12.10.9	June 15, 2021	13.20.5	February 28, 2020
12.10.10	June 15, 2019	13.20.6	June 15, 2018
12.10.11	June 15, 2019	13.30.1	February 28, 2020
12.10.12	June 15, 2019	13.30.2	February 28, 2020
12.10.13	June 15, 2019	13.30.3	February 28, 2020
12.10.14	June 15, 2019	13.30.4	June 15, 2019
12.10.15	June 15, 2019		
12.10.16	June 15, 2019		
12.20.1	February 28, 2020		
12.20.2	February 28, 2020		
12.20.3	February 28, 2020		
12.20.4	February 28, 2020		
12.20.5	February 28, 2020		
12.20.6	June 15, 2020		
12.20.7	February 28, 2020		
12.20.8	February 28, 2020		
12.20.9	February 28, 2020		
12.20.10	February 28, 2020		
12.20.11	February 28, 2020		
12.20.12	February 28, 2020		
12.20.13	February 28, 2020		
12.20.14	February 28, 2020		
12.20.15	February 28, 2020		
12.20.16	February 28, 2020		
12.20.17	February 28, 2020		
12.20.18	February 28, 2020		
12.20.19	February 28, 2020		
12.20.20	February 28, 2020		
12.20.21	February 28, 2020		
12.20.22	February 28, 2020		
12.30.1	June 15, 2019		
12.30.2	December 15, 2013		
12.30.3	December 15, 2013		
12.30.4	December 15, 2013		
Hydraulics (tab)		Landing Gear (tab)	
13.TOC.1-2	February 28, 2020	14.TOC.1-2	February 28, 2020
13.10.1	February 28, 2020	14.10.1	June 15, 2019
13.10.2	December 15, 2020	14.10.2	June 15, 2020
		14.10.3	June 15, 2019
		14.10.4	February 28, 2020
		14.10.5	February 28, 2020
		14.10.6	February 28, 2020
		14.10.7	February 28, 2020
		14.10.8	June 26, 2000
		14.20.1	February 28, 2020
		14.20.2	December 15, 2015
		14.20.3	June 15, 2020
		14.20.4	February 28, 2020
		14.20.5	February 28, 2020
		14.20.6	February 28, 2020
		14.20.7	February 28, 2020
		14.20.8	June 15, 2019
		14.20.9	December 13, 2010
		14.20.10	December 13, 2010
		14.30.1	June 15, 2020
		14.30.2	June 15, 2020
		Warning Systems (tab)	
		* 15.TOC.1-4	June 15, 2021
		15.10.1	June 15, 2020
		15.10.2	June 15, 2020
		15.10.3	June 15, 2020
		15.10.4	June 15, 2020
		15.10.5	June 15, 2020
		* 15.10.6	June 15, 2021
		15.10.7	June 15, 2020

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777 Flight Crew Operations Manual

15.10.8	June 15, 2020	* 15.20.31	June 15, 2021
15.10.9	June 15, 2020	* 15.20.32	June 15, 2021
15.10.10	June 15, 2020	* 15.20.33	June 15, 2021
15.10.11	December 15, 2020	* 15.20.34	June 15, 2021
15.10.12	December 15, 2020	* 15.20.35	June 15, 2021
15.10.13	June 15, 2020	* 15.20.36	June 15, 2021
15.10.14	June 15, 2020	* 15.20.37	June 15, 2021
15.10.15	June 15, 2020	* 15.20.38	June 15, 2021
15.10.16	June 15, 2020	* 15.20.39	June 15, 2021
15.10.17	June 15, 2020	* 15.20.40	June 15, 2021
15.10.18	June 15, 2020	* 15.20.41	June 15, 2021
15.10.19	June 15, 2020	* 15.20.42	June 15, 2021
15.10.20	June 15, 2020	* 15.20.43	June 15, 2021
15.10.21	June 15, 2020	* 15.20.44	June 15, 2021
15.10.22	December 15, 2020	* 15.20.45	June 15, 2021
15.10.23	December 15, 2020	* 15.20.46	June 15, 2021
15.10.24	June 15, 2020	* 15.30.1	June 15, 2021
15.20.1	June 15, 2019	15.30.2	December 15, 2018
15.20.2	June 15, 2018	15.30.3	December 15, 2018
15.20.3	June 15, 2018	15.30.4	December 14, 2009
15.20.4	June 15, 2020	(blank tab)	
15.20.5	June 15, 2020		
15.20.6	June 15, 2020		
15.20.7	February 28, 2020		
15.20.8	February 28, 2020		
15.20.9	February 28, 2020		
15.20.10	February 28, 2020		
15.20.11	February 28, 2020		
15.20.12	June 15, 2020		
15.20.13	June 15, 2020		
15.20.14	June 15, 2020		
15.20.15	June 15, 2020		
15.20.16	December 15, 2020		
15.20.17	December 15, 2020		
15.20.18	February 28, 2020		
15.20.19	February 28, 2020		
15.20.20	February 28, 2020		
* 15.20.21	June 15, 2021		
15.20.22	February 28, 2020		
15.20.23	February 28, 2020		
15.20.24	February 28, 2020		
15.20.25	February 28, 2020		
15.20.26	February 28, 2020		
15.20.27	February 28, 2020		
* 15.20.28	June 15, 2021		
* 15.20.29	June 15, 2021		
* 15.20.30	June 15, 2021		

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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 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. When appropriate, the next formal Flight Crew Operations Manual revision will include an updated bulletin record page to reflect current bulletin status.

Each bulletin identifies airplanes affected by the bulletin. The airplane effectivity is defined as follows:

- Effectivity range - effectivities in parentheses indicate the corrective service bulletin is planned to be accomplished and some airplanes may be complete
- All Airplanes - the bulletin applies to all airplanes in an Operator's fleet
- Descriptive statement - the bulletin applies to airplanes with specific equipment

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-50 R2	Predictive Windshear Warnings at Kansai Airport, Osaka, Japan	January 19, 2001	IE
TBC-52 R1	ILS/GPS Multi-Mode Receiver (MMR) Failure	April 23, 1999	IE
TBC-56 R1	Cabin Pressure Control System Outflow Valve (OFV) Manual Operation	June 14, 2001	IE
TBC-58	Nuisance EICAS Message WINDSHEAR SYS	April 29, 1999	IE
TBC-62 R2	Uncommanded Weather Radar Activation	June 30, 2006	IE
TBC-65 R1	Loss of Engine Response to Thrust Lever Commands on GE90 Engines	September 7, 2001	IE
TBC-68 R2	GPWS Voice Callouts	December 13, 2010	IE
TBC-72 R1	Uncommanded Movement of Cargo Containers During Power Switching	April 20, 2001	IE
TBC-73 R5	STABILIZER GREENBAND Nuisance EICAS Message	September 26, 2019	IE
TBC-75 R1	Electronic Checklist (ECL) Line Items not Completing Correctly	June 30, 2006	IE
TBC-79 R1	APU Start Failures Due to APU Start Switch	July 1, 2002	IE
TBC-80 R2	NO LAND 3 EICAS Advisory Messages During Cruise Operations	December 13, 2010	IE
TBC-81 R3	ADIRU Heading Error Anomaly	January 9, 2006	IE
TBC-83 R2	Electrical Load Management System (ELMS) ARINC Communication Faults	September 15, 2003	IE
TBC-85 R2	777 FMC Calculation of Reduced Thrust Takeoff Anomaly	February 11, 2020	IE
TBC-87 R4	777 Fuel Quantity Indicating System Fluctuations	June 21, 2017	IE

777 Flight Crew Operations Manual

Number	Subject	Date	Status
TBC-92 R2	Fuel Temperature Blanking Indication	August 31, 2006	IE
TBC-96 R1	False Engine-Out Indication	December 10, 2007	IE
TBC-99 R1	GE90-94B Autostart Logic During High Altitude Ground Starts	June 15, 2012	IE
TBC-100 R1	Flight Control Anomaly	January 9, 2006	IE
TBC-101 R2	FMC Performance Predictions Anomaly	June 13, 2011	IE
TBC-102 R3	Fuel Quantity Blanking on the Progress 2/3 Page of the Control Display Unit (CDU)	June 21, 2017	IE
TBC-103	Fuel Flow Blanking with GE90-100 Series Engines	February 3, 2006	IE
TBC-104 R1	Generator OFF Light ON After Engine Start With No EICAS Message	December 15, 2013	IE
TBC-105 R3	Incorrect TAKEOFF REF data following a TAKEOFF REF Uplink	June 13, 2011	IE
TBC-107 R3	FMC Minimum V1, VR, V2 Speed Entry Limits for 777-200LR and 777-300ER Models	June 13, 2011	IE
TBC-108 R3	Honeywell Flight Management Computer Anomaly.	June 13, 2011	IE
TBC-114 R2	FMC Failure When Programming a "step-down" Descent	June 13, 2011	IE
TBC-115 R8	Uncommanded Autothrottle Movement During Cruise Flight	February 27, 2018	IE
TBC-116 R2	Incorrect Display of Crossbleed (X-BLD) Start Indication	June 13, 2011	IE
TBC-117 R4	Loss of Datalink Function on the Primary VHF Data Radio	June 16, 2017	IE
TBC-118 R5	Uncommanded Turns When LNAV is in Use	July 28, 2020	CANC

777 Flight Crew Operations Manual

Number	Subject	Date	Status
TBC-119 R1	777 Fuel Quantity Indicating System Fluctuations or Blanking Due to Wiring Harness Problem	June 15, 2012	IE
TBC-120 R2	Nuisance Visual and Aural Smoke Alarm Annunciations in Lavatories, Crew Rest Compartments and Other Cabin Compartments	December 15, 2013	IE
TBC-121 R1	Nuisance EICAS Message: SMOKE BAND UPR DR2	May 20, 2015	IE
TBC-126 R3	FMC Distance to Waypoint Anomaly	June 16, 2017	IE
TBC-127 R3	Latching Dual FMC Failures	May 20, 2015	IE
TBC-128 R1	Control Panel (MCP) Altitude Window Changing Without Pilot Action	June 15, 2017	IE
TBC-129 R1	Engine Anti-Ice Valve Sticking Due to Debris	June 16, 2017	IE
TBC-131 R1	Delayed Release of Landing Gear Lever Lock	February 26, 2013	IE
TBC-132 R1	System anomalies to be corrected with a future software revision	June 16, 2017	IE
TBC-133 R5	Invalid Fuel Spar Valve Indication	July 10, 2018	IE
TBC-135 R2	Loss of Datalink	May 20, 2015	IE
TBC-136 R3	Altimeter Setting While in VNAV	February 27, 2020	IE
TBC-137 R1	Multi-Mode Receiver (MMR) ILS Frequency Disagreement	June 16, 2017	IE
TBC-141 R1	Flight at Low Gross Weight	December 15, 2014	IE
TBC-142 R2	Uncommanded Autothrottle Movement on the Ground	March 21, 2019	IE
TBC-143 R2	B777F - CARGO HEAT BULK EICAS Advisory Message	February 10, 2020	IE
TBC-144 R3	Transient TRANSPONDER EICAS advisory message when selecting Approach Mode on the MCP	February 10, 2020	IE

777 Flight Crew Operations Manual

Number	Subject	Date	Status
TBC-145 R2	Route Full Condition	June 16, 2017	IE
TBC-147 R2	VNAV Descent on Approach Without a Valid Descent Path	February 10, 2020	IE
TBC-150	Automatic Re-Boot of Electronic Flight Bag (EFB)	December 18, 2017	IE
TBC-151	Conflict with Duplicate Waypoints with the Same Identifier in the Navigation Database	January 10, 2018	IE
TBC-153 R2	Collins Multiscan Weather Radar Display Anomaly	June 25, 2018	IE
TBC-154	Setting STEP Size to Zero When No Further Step Climbs Are Planned	January 23, 2019	IE
TBC-156 R1	Erroneous Autopilot Flight Director System (AFDS) Guidance when Instrument Landing System (ILS) Signal Interference Occurs	July 15, 2020	IE
TBC-157 R1	Potential for Loading an Incorrect Air Traffic Control (ATC) Uplink Clearance into the Flight Management Computer (FMC)	January 15, 2021	IE
TBC-158 R1	Autothrottle Fails to Disconnect during Balked Landing	January 15, 2021	IE

Number	Subject	Date	Status



Flight Crew Operations Manual Bulletin for The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207



Number: TBC-50 R2

IssueDate: January 19, 2001

Airplane Effectivity: 777 Airplanes with Allied Signal PWS 066-50008-0405,
Rockwell Collins PWS 622-5132-631, or Rockwell
Collins PWS 622-5132-633 installed

Subject: Predictive Windshear Warnings at Kansai Airport, Osaka, Japan

Reason: To inform flight crews of false PWS warnings

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 that the Allied Signal Predictive Windshear System (PWS) Part Number 066-50008-0405 and the Rockwell Collins PWS Part Numbers 622-5132-631 and 622-5132-633 delivered on some 777 airplanes, have produced nuisance alerts at Kansai Airport (RJBB), Osaka, Japan. These nuisance alerts may occur during takeoff on RW06 and approach to RW24, and may include the PWS caution (MONITOR RADAR DISPLAY audio alert – approach and takeoff) and the PWS warning (GO AROUND WINDSHEAR AHEAD audio alert – approach, WINDSHEAR AHEAD WINDSHEAR AHEAD audio alert – takeoff). The GPWC Mode 7 reactive windshear system (RWS) warning (WINDSHEAR WINDSHEAR WINDSHEAR audio alert) is not affected by this nuisance condition.

Operating Instructions

Boeing recommends continued use of the PWS. When crews experience a PWS caution or warning alert at Kansai as described above, the alert should be regarded as false and should be ignored by the crew as long as there are no other signs of possible windshear conditions and the reactive windshear system is operational. If in doubt, the crew should treat all predictive windshear warnings as valid. All reactive windshear system warnings should always be treated as valid.

Administrative Information

This bulletin replaces bulletin TBC-50 R1 dated January 19, 2001. Discard TBC-50 R1. Revise the Bulletin Record to show TBC-50 R1 "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-50 R2 as "In Effect" (IE) .

For Allied Signal PWS Part Number 066-50008-0405, this condition is corrected by incorporation of Allied Signal Service Bulletin M-4469 (RTA-4B-34-16) which provides a revised PWS database, or Allied Signal Service Bulletin M-4508 (RTA-4B-34-97) which converts the part number from 066-5008-0405 to 066-5008-0406.

For the Rockwell Collins PWS Part Number 622-5132-631, this condition is corrected by incorporation of Rockwell Collins Service Bulletins BH and 217 which install PWS Part Number 622-5132-633 Mod SB217. For the Rockwell Collins PWS Part Number 622-5132-633, this condition is corrected by incorporation of Rockwell Collins Service Bulletin 217 which installs PWS Part Number 622-5132-633 Mod SB217.

This bulletin will be cancelled after Boeing is notified that all affected airplanes have been modified.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-52 R1

IssueDate: April 23, 1999

Airplane Effectivity: 777-200 - 777-300, 777F

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

Reason: To inform the flight crew of the lack of failure indications associated with a Multi-Mode Receiver (MMR) system processor card failure

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 Collins MMR combines ILS and GPS functions in a single electronic component. Flight testing has shown certain internal MMR failures can occur leaving the associated ILS and/or GPS inoperative, but without specific MMR failure indications. When this occurs, the approach reference on the PFD (ILS station identifier, or frequency and DME, as appropriate), and localizer/glideslope deviation indicators and scales will not display. The MMR failure may result in a GPS L or GPS R status message. (Status messages are checked prior to flight to determine dispatchability of the airplane and are checked after the flight for possible maintenance action.) The MMR failure may also be indicated by display of the GPS EICAS advisory message. However, this failure may occur and result in no EICAS messages (status or advisory) for the crew

Operating Instructions

If any of the following conditions are observed, the left and/or right ILS receiver(s) may be failed:

- the GPS L or GPS R EICAS status message is observed during preflight on the ground
- the GPS EICAS advisory message is displayed
- absence of the ILS station identifier or frequency and the absence of ILS deviation pointers and ILS scales when the ILS is tuned.

To verify ILS receiver operation:

- Enter an ILS frequency on the FMS-CDU NAV RADIO page (if a frequency is not already entered):
 - Place the captain's and first officer's navigation displays (NDs) in approach (APP) mode and verify the appropriate ILS frequency is displayed on the NDs.
 - If either the captain's or first officer's ILS receiver source is C (center), then the L or R ILS receiver is failed.
 - Failure flags will not be displayed.
 - The NO LAND 3 EICAS message will be displayed on approach.
 - If the captain's or first officer's ILS frequency is not displayed, then multiple ILS receivers are failed.
 - Failure flags will not be displayed
 - The NO AUTOLAND EICAS message will be displayed on approach.
- Once this test is complete, delete the manually entered ILS frequency, if necessary, to allow ILS autotuning.

If the approach reference is not displayed, assume ILS receiver failure. Triple channel autoland will not be available. Consider the effect on approach minimums and select an appropriate course of action.

Administrative Information

This bulletin replaces bulletin TBC-52 dated April 23, 1999. Discard TBC-52. Revise the Bulletin Record to show TBC-52 "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-52 R1 as "In Effect" (IE) .

This condition is temporary until the system is modified. Incorporation of Collins GLU-920 Service Bulletin (8) and Service Bulletins (10 - 15) together constitute the terminating action for the MMR condition.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-56 R1

IssueDate: June 14, 2001

Airplane Effectivity: 777-200, 777-200ER, 777-300

Subject: Cabin Pressure Control System Outflow Valve (OFV) Manual
Operation

Reason: To provide flight crews with additional information regarding outflow
valve manual 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

Based on two depressurization events, Boeing feels additional information regarding manual mode operations is warranted.

There is a failure mode that can cause an outflow valve to drive in the direction opposite to the command. The incorrect valve movement is detected and stopped in less than one second. However, cycling between auto and manual mode will reset the fault and allow the outflow valve to drive in the wrong direction each time (automatically in auto and when commanded in manual). Repeated resets could drive an outflow valve progressively further open until airplane pressurization could no longer be maintained

Operating Instructions

If the EICAS advisory message OUTFLOW VALVE AFT or OUTFLOW VALVE FWD is displayed follow the non-normal checklist and close the affected outflow valve in manual mode. If the valve moves in the wrong direction, or does not move after six seconds of switch activation, leave the affected valve in manual mode and do not make any further attempt to drive the valve in either direction. Depending on the position of the affected outflow valve, the other outflow valve may not be able to maintain cabin pressurization.

Administrative Information

This bulletin replaces bulletin TBC-56 dated June 14, 2001. Discard TBC-56. Revise the Bulletin Record to show TBC-56 "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-56 R1 as "In Effect" (IE) .

This bulletin will be cancelled after Boeing is notified that all affected airplanes have been modified by PRR 61777-105 (Parts A & B) or Service Bulletin 777-21A0041.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-58

IssueDate: April 29, 1999

Airplane Effectivity: All Airplanes

Subject: Nuisance EICAS Message WINDSHEAR SYS

Reason: To inform flight crews of predictive windshear system operational conditions that can cause the subject message to be displayed for airplanes with the Allied Signal/Bendix weather radar system receiver-transmitter part number 066-50008-0405 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

This bulletin 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).

Flight testing and customer reports have confirmed that a nuisance WINDSHEAR SYS EICAS advisory message 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 above 60% N1 and the indicated airspeed is increasing.

The WINDSHEAR SYS message will annunciate prior to 80 KIAS or after 400 feet AGL. The message will extinguish approximately 30 seconds after appearing.

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-58 as "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). This service bulletin converts the weather radar RT unit part number from 066-50008-0405 to 066-50008-0406.

If you modify your fleet using a different Allied Signal/Bendix service bulletin (for example, the RT units are converted from the -405 to the -407 or later configuration), please advise Boeing so this operations manual bulletin can be cancelled.

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 777 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-62 R2

IssueDate: June 30, 2006

Airplane Effectivity: All Airplanes

Subject: Uncommanded Weather Radar Activation

Reason: To inform flight crews of a condition in which the weather radar transmitter may turn on without crew input following an electrical power interrupt.

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 system anomaly has been found where the weather radar may automatically start transmitting following a power interrupt. This may occur in flight or on the ground. This anomaly only occurs with Allied Signal/Bendix weather radar with predictive windshear system.

Operating Instructions

To prevent the weather radar from automatically transmitting following a power interrupt on ground, leave the weather radar mode selector in TEST until after engine start. Also, position the weather radar mode selector to TEST after landing.

These procedures have been incorporated into the Normal Procedures chapter.

Administrative Information

This bulletin replaces bulletin TBC-62 R1 dated June 30, 2006. Discard TBC-62 R1. Revise the Bulletin Record to show TBC-62 R1 "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-62 R2 as "In Effect" (IE) .

This condition is corrected with installation of Boeing Service Bulletin SB 777-23-0145. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet have been modified.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-65 R1

IssueDate: September 7, 2001

Airplane Effectivity: 777-200, 777-300

Subject: Loss of Engine Response to Thrust Lever Commands on GE90 Engines

Reason: To inform flight crews of the possibility of temporary loss of engine response to thrust lever commands due to an engine sensor problem on GE90 engines, and to provide recommendations to the crew if engine thrust control is not regained prior to landing

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 temporary loss of engine response to thrust lever commands resulting from a loss of the combustion chamber burner pressure signal to the EECs. The loss of the burner pressure signal is due to accumulated moisture freezing in the sensing line to the EEC. When this happens, the engine may not respond to thrust lever commands, may only partially respond to thrust lever commands, or may be limited to idle thrust.

To date, there have been six reported events in the 777 GE90 fleet. Four of the six reported events occurred in flight. In each of the four in-flight events, the engine self-recovered during cruise or descent when the accumulated ice in the burner pressure sensing line subsequently thawed. In three of these four in-flight events, engine thrust control restored when the airplane descended to a lower altitude.

There is no direct action the flight crew can take (such as selecting the EEC mode switch to ALTN) that can cause the engine to recover.

Operating Instructions

If loss of thrust lever response is observed on the ground following engine start or if autostart fails to start the engine, do not dispatch. Maintenance action is necessary to purge the burner pressure sensing line of moisture and ice.

If loss of thrust lever response occurs in flight and EGT indications are normal and not increasing, disconnect the autothrottle on the affected engine. Do not retard the thrust lever or shut down the engine as long as thrust levels are acceptable.

If thrust levels become unacceptable, consider a diversion and landing at the nearest suitable airport.

If high engine thrust levels interfere with airspeed control during descent, use speedbrakes and/or landing gear. If engine thrust cannot be reduced to idle prior to landing, the engine should be shutdown. If the engine is above ground idle after landing, the engine should be shutdown.

Administrative Information

This bulletin replaces bulletin TBC-65 dated September 7, 2001. Discard TBC-65. Revise the Bulletin Record to show TBC-65 "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-65 R1 as "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 number 777-73A0006.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-68 R2

IssueDate: December 13, 2010

Airplane Effectivity: Airplanes with Faulty Radio Altimeters

Subject: GPWS Voice Callouts

Reason: To inform flight crews of the possibility of missing the 2500 foot radio altitude voice callout.

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 voice callout TWENTY FIVE HUNDRED (or RADIO ALTIMETER) may not occur. This callout normally occurs at 2500 feet. However a recent change in the Collins LRA 900 radio altimeter resulted in the unit not reporting 2500 feet to GPWS when over water.

Not all Collins LRA 900 radio altimeters are affected by this problem. For airplanes equipped with Collins LRA 900 radio altimeters not affected by the problem, the voice callout TWENTY FIVE HUNDRED (or RADIO ALTIMETER) will occur correctly at 2500 feet.

Operating Instructions

Do not rely on the voice callout TWENTY FIVE HUNDRED (or RADIO ALTIMETER) during an approach over water.

This bulletin applies to airplanes Boeing delivered with faulty radio altimeters. Airlines may also want to apply this bulletin if they have installed any Collins LRA-900 radio altimeters Part Number 822-0334-002 with serial numbers prior to 780W.

Administrative Information

This bulletin replaces bulletin TBC-68 R1 dated August 31, 2001. Discard TBC-68 R1. Revise the Bulletin Record to show TBC-68 R1 “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-68 R2 as "In Effect" (IE) .

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Collins LRA-900 Service Bulletin No. 3 titled “Strong Signal Processing Improvement”, dated 7 April 2000. 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 777 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-72 R1

IssueDate: April 20, 2001

Airplane Effectivity: 777-200, 777-200ER, 777-300

Subject: Uncommanded Movement of Cargo Containers During Power Switching

Reason: To inform flight crews of possible uncommanded cargo container movement when switching between ground electrical power and airplane electrical power.

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

One operator has reported cases of uncommanded cargo movement when the airplane electrical power was switched from ground power to airplane power during cargo loading operations. Switching power during cargo loading or unloading may cause the Power Drive Units (PDUs) to retract and allow cargo that has not been restrained to move forward causing a hazard to personnel in the cargo compartment.

Operating Instructions

Do not switch power sources between ground power and airplane power (APU) during cargo loading or unloading without coordinating with ground personnel.

Administrative Information

This bulletin replaces bulletin TBC-72 dated April 20, 2001. Discard TBC-72. Revise the Bulletin Record to show TBC-72 "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-72 R1 as "In Effect" (IE) .

This condition is temporary until Service Bulletin 777-25-0181 or production equivalent is installed. This Service Bulletin is expected to be available in the first quarter of 2002.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-73 R5

IssueDate: September 26, 2019

Airplane Effectivity: 777-200, 777-200ER, 777-300, 777-300ER

Subject: STABILIZER GREENBAND Nuisance EICAS Message

Reason: To inform flight crews of nuisance STAB GREENBAND alerts.

Revised the legend for Stab Greenband Nuisance Region for use with 777-300 PW 4090 and TRENT-892 engines. Added RATINGS AND LESS ONLY to legend. Modified correspondence address in 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

Boeing has received reports of nuisance STAB GREENBAND advisory alerts on 777 airplanes. These nuisance alerts occur prior to departure (at the gate or during taxi for takeoff) after FMC gross weight (GW) and center of gravity (CG) data are entered which result in a nose down forward greenband stabilizer trim calculation. Dispatch delays have resulted.

Preliminary investigation indicates that STAB GREENBAND nuisance alerts occur in a small region of the GW and CG envelope where the greenband system has the least margin against nuisance alerts. Boeing has determined that many nuisance messages in the nose down forward greenband can be eliminated by using a fixed and/or assumed temperature derate greater than 15%. Alternatively, the airplane would still be safe to takeoff in this region should the STAB GREENBAND alert be accurate and a real mistrim result. Should a worst case mistrim occur in this range, the column rotation force would be approximately 30-35 pounds. Normal column rotation force is approximately 20-25 pounds.

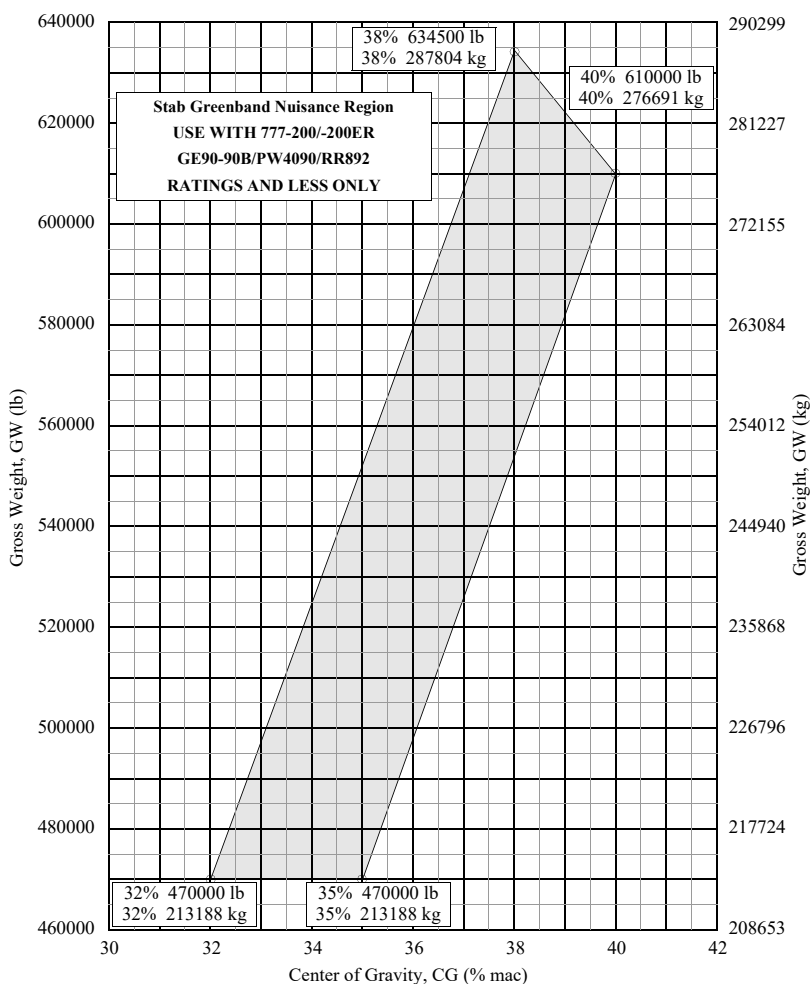
Operating Instructions

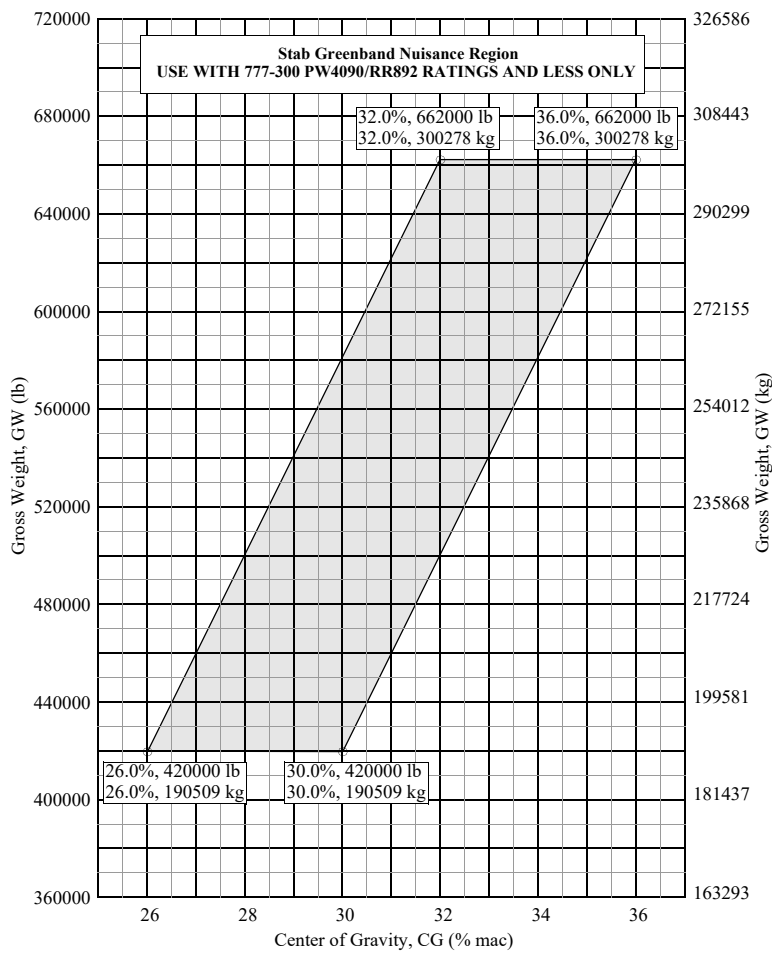
Boeing recommends continued use of the stabilizer greenband monitor and alert. When crews experience a STAB GREENBAND alert after loading is complete:

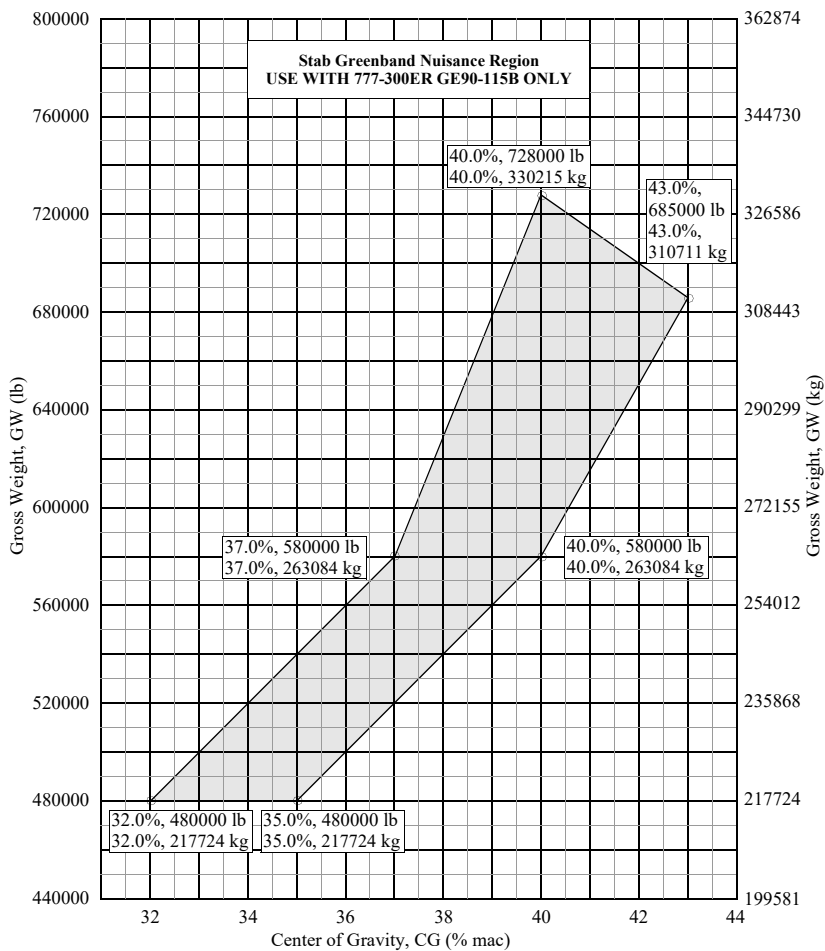
- verify the FMC takeoff data has been correctly entered (takeoff thrust, takeoff flaps, gross weight, and center of gravity)
- verify the stabilizer trim is properly set

If the aircraft GW and CG fall within the Stab Greenband Known Nuisance Region on the following GW-CG charts, the STAB GREENBAND advisory alert may be considered a nuisance and takeoff may be safely conducted.

Otherwise, or if in doubt, the alert should be considered valid and the actual loading of the airplane should be verified.







Administrative Information

This bulletin replaces bulletin TBC-73 R4 dated June 15, 2009. Discard TBC-73 R4. Revise the Bulletin Record to show TBC-73 R4 “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-73 R5 as "In Effect" (IE) .

For airplanes with Nose Gear Pressure Transducers (NGPT), the condition in this bulletin is corrected when SB 777-31-0106 has been incorporated. For airplanes with Nose Gear Pressure Switches (NGPS), the condition in this bulletin is corrected when both SB 777-31-0106 or SB 777-31-0152, and SB 777-27-0075 have been incorporated. This OMB will be cancelled when Boeing is notified that all airplanes in the customer fleet have the appropriate Service Bulletins incorporated.

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



Number: TBC-75 R1

IssueDate: June 30, 2006

Airplane Effectivity: All Airplanes

Subject: Electronic Checklist (ECL) Line Items not Completing Correctly

Reason: To inform flight crews of a problem with ECL line items not completing correctly and appropriate crew response

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 ECL closed loop line items not completing correctly (not changing from white to green) when performing a normal checklist despite the respective switch being selected to the correct position and system operating normally. Boeing engineering has determined that the contacts within the switch which provide switch position to ECL may be intermittent. The affected contacts do not control the system component or function associated with the switch. Switch contact faults can cause ECL line item problems in both normal and non-normal checklists. However, they are most likely when several frequently-used switches must be correctly positioned for the line item to turn green. This occurs with the HYDRAULICS or FUEL items that some operators add to their customized normal checklists. The failure of a switch contact to close or open cannot complete an ECL closed loop line item.

Operating Instructions

If an ECL closed loop line item does not complete as expected, confirm that the switch is positioned correctly. If the system is functioning normally, or is otherwise operating as expected, override the line item and continue with the checklist. The failure of a line item to automatically complete is not indicative of an ECL fault. Therefore, the ECL should continue to be used for all checklists.

Administrative Information

This bulletin replaces bulletin TBC-75 dated June 30, 2006. Discard TBC-75. Revise the Bulletin Record to show TBC-75 "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-75 R1 as "In Effect" (IE) .

A vendor design improvement of the push button switches has corrected the problem. Details may be found in Boeing Service Letter 777-SL-31-021. This bulletin will be cancelled when Boeing is notified that the push button switches have been replaced according to the service letter.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-79 R1

IssueDate: July 1, 2002

Airplane Effectivity: 777-200

Subject: APU Start Failures Due to APU Start Switch

Reason: To advise flight crew when starting the APU to manually position APU Start Switch to ON after selecting START.

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 Selector has caused failed APU starts on 777 airplanes. Testing of the APU selector has shown that the internal contacts may not make a proper connection when the selector is momentarily placed to the START position and allowed to spring back to the ON position. This condition can be avoided if the pilot manually places the APU Selector to ON after selecting START.

Operating Instructions

When starting the APU, position the APU selector to the START position and hold it there for one second. Then, position the APU selector to ON manually. Do not allow the APU selector to spring back to the ON position.

Administrative Information

This bulletin replaces bulletin TBC-79 dated July 1, 2002. Discard TBC-79. Revise the Bulletin Record to show TBC-79 "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-79 R1 as "In Effect" (IE) .

Boeing Service Letter 777-SL-49-012, dated 22 May, 2002, “APU Start Failure due to APU Start Switch” provides instructions on how to replace the faulty switch. This bulletin will be cancelled when Boeing is notified that the switch has been replaced. A Service Bulletin will not be issued.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-80 R2

IssueDate: December 13, 2010

Airplane Effectivity: All Airplanes

Subject: NO LAND 3 EICAS Advisory Messages During Cruise Operations

Reason: To notify flight crews of nuisance NO LAND 3 EICAS alerts

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 a number of reports of “NO LAND 3” EICAS advisory messages during cruise. The condition responsible for generating this message has been found to occur randomly, usually when the autopilot is engaged during LNAV or VNAV (or both) mode operation. It occurs when a single Primary Flight Computer (PFC) identifies a fault in an Autopilot Flight Director Computer (AFDC) and inhibits it from operation. This results in the “NO LAND 3” EICAS alert.

Boeing has not yet determined the root cause, however the anomaly is of a temporary nature, and of a magnitude which is not detectable by the self monitoring functions within the AFDCs themselves. Maintenance investigations performed after these events consistently show no faults in the affected AFDC. Boeing is actively cooperating with several airlines to capture data related to these occurrences to expedite addressing this problem.

Operating Instructions

If a NO LAND 3 alert occurs during flight, disengage and re-engage the autopilot. If the condition was caused by the fault described above, this procedure will restore LAND 3 autoland capability and eliminate the NO LAND 3 message. This procedure to restore autoland capability should only be attempted once during a flight.

If the “NO LAND 3” Advisory is caused by some other failure (sensor, LRU etc.), this procedure will not result in clearing the EICAS advisory or restoring Autoland capability.

Administrative Information

This bulletin replaces bulletin TBC-80 R1 dated April 15, 2002. Discard TBC-80 R1. Revise the Bulletin Record to show TBC-80 R1 “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-80 R2 as "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 777-22-0013.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-81 R3

IssueDate: January 9, 2006

Airplane Effectivity: All Airplanes

Subject: ADIRU Heading Error Anomaly

Reason: To inform flight crews of possible heading errors following on-ground automatic realignment of the ADIRU.

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

If the ADIRU is navigating and the airplane stops for a predetermined period of time (between 5 and 15 minutes depending on latitude), the ADIRU conducts an automatic realignment designed to remove navigation errors by updating attitude, heading, and velocity.

Analysis of a recent event has shown that if the airplane is moved precisely at the moment automatic realignment completes, the updated information will be saved and subsequently implemented if the airplane becomes motionless again for more than one minute. The heading update will be implemented regardless of the actual airplane heading at the time of update. Heading errors of up to 180 degrees may be introduced by the update. Smaller, less noticeable attitude and/or heading errors affecting navigation functions may also be introduced during the update. However, ADIRU attitude outputs to the Primary Flight Displays will not be adversely affected.

The ADIRU heading error anomaly can only occur on the ground, and may be detected by comparing the airplane's heading with a known heading.

This anomaly has an extremely low probability of occurrence and has only been reported once in-flight.

In-flight, symptoms of this problem may include one or more of the following:

- Erroneous headings up to 180 degrees from actual heading
- NAV ADIRU INERTIAL caution alert, if the magnitude of the errors are large enough for the ADIRU to detect the fault
- if NAV ADIRU INERTIAL alert is displayed, passenger entry flight locks will disengage and the status message DOOR FLIGHT LOCK XX for each door will be set
- angular difference in the displayed airplane track and the active leg while in LNAV
- LNAV difficulty in precisely tracking the active leg, particularly during turns, resulting in cross-track errors
- ETA to the active waypoint may be inaccurate
- presence of an erroneous crosswind on the navigation display
- NO AUTOLAND (caution) or AUTOPILOT alert messages and/or absence of FLARE arm or ROLLOUT arm indications when an automatic approach is attempted. F/D operation will be similarly affected and may not display appropriate commands
- degraded or inoperative SATCOM, TCAS and ACARS may be affected. SATCOM, TCAS, and DATALINK LOST alerts may be displayed
- NO AUTOLAND (advisory), GROUND PROX SYS, ALT CALLOUTS, and WINDSHEAR SYS alerts may be displayed.

The magnitude and effect of the above symptoms may vary as the flight progresses.

ADIRU air data functions will not be affected. The FMC will use GPS position if it is available. ANP will not be affected and the LNAV path displayed on the ND will be accurate and reliable if GPS is the FMC update source.

Operating Instructions

Prior to takeoff, align the airplane with the runway and check the displayed heading is within +/- 10 degrees of the runway magnetic heading. If the heading is not within +/- 10 degrees of the runway magnetic heading exit the runway, set the parking brake and perform a complete ADIRU alignment.

If the problem is detected after airborne, LNAV may be used as long as course tracking is satisfactory. If autopilot course or heading control is unsatisfactory, disconnect the autopilot, turn off the F/Ds and fly the airplane manually with reference to the standby magnetic compass and the displayed course. If heading errors are significant, consider landing at the nearest suitable airport.

Accomplish the NAV ADIRU INERTIAL checklist as appropriate. Autoland should be monitored for proper operation. If autoland operation is not satisfactory, disconnect the autopilot, turn off the F/Ds and accomplish a manual approach using raw data.

Administrative Information

This bulletin replaces bulletin TBC-81 R2 dated January 9, 2006. Discard TBC-81 R2. Revise the Bulletin Record to show TBC-81 R2 “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-81 R3 as "In Effect" (IE) .

This bulletin was previously cancelled with the incorporation of Service Bulletin 777-34-0082. However, bulletin TBC-100 identifies an anomaly that is corrected with the incorporation of Boeing Alert Service Bulletin SB 777-34A0137. When SB 777-34A0137 is incorporated, the anomaly described in this bulletin applies again. This bulletin is re-issued to cover those cases where SB 777-34A0137 has been incorporated.

Boeing Alert Service Bulletin SB 777-34A0138 corrects the anomaly associated with this bulletin and corrects for the impact of incorporating SB 777-34A0137. This bulletin will be cancelled when Boeing is notified that SB 777-34A0138 has been incorporated in the customer fleet.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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



Number: TBC-83 R2

IssueDate: September 15, 2003

Airplane Effectivity: All Airplanes

Subject: Electrical Load Management System (ELMS) ARINC Communication Faults

Reason: To inform flight crews of a problem where ELMS ARINC communication data is lost.

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 a significant increase in EICAS ELMS P110, P210 and P310 status messages. These messages display when ARINC 629 output data from the respective ELMS panel is lost. The ELMS panels continue to receive data over the ARINC 629 bus and are able to control their various systems even though the panel output is not being transmitted on the ARINC 629 bus. Because of the lack of output data on the bus, some airplane systems will appear faulted when they are not, and some airplane systems may not display EICAS alert or status messages when faults actually occur.

Operating Instructions

If the EICAS status message ELMS P110 PANEL displays:

The following EICAS messages will also display and should be considered valid messages:

EICAS ADVISORY message

- CARGO HEAT AFT
- EICAS STATUS messages

- AIR/GROUND L
- CARGO EXH FAN FWD
- EQUIP VENT FAN
- IFES COOLING FAN
- LAV-GALLEY FAN L
- RECIRC FAN
- SATCOM COOLING FAN L

Note: Some messages above may not apply depending on airplane configuration.

Should the associated system fault occur while the ELMS P110 PANEL status message is displayed, the following EICAS messages will NOT display because of the ELMS ARINC communication fault:

EICAS ADVISORY messages

- FUEL CROSSFEED FWD
- FUEL PUMP CENTER L
- FUEL PUMP L AFT
- FUEL PUMP R FWD

The electrical synoptic will indicate that the left and right main AC bus and left transfer bus are not powered even though they are powered.

The fuel synoptic indications and flow bars for the left aft fuel pump, right forward fuel pump, left center fuel pump and forward crossfeed valve will be blank.

During fuel jettison, the synoptic indications and flow bars for the left main jettison pump, the left jettison isolation valve, and the left jettison nozzle valve indications will be blank. Fuel jettison will be normal unless the system is not fully operational.

The fuel imbalance pointer will not flash if fuel balancing is going in the wrong direction.

On the overhead panel, the left aft, right forward and left center pump “PRESS” lights will not illuminate. The forward crossfeed and the left jettison nozzle valve “VALVE” lights will not illuminate.

If the EICAS status message ELMS P210 PANEL displays:

The following EICAS messages will also display and should be considered valid messages:

EICAS ADVISORY message

- CARGO HEAT BULK
- EICAS STATUS messages
- AIR/GROUND R
- CARGO VENT FAN BULK

- RAT GEN HEAT
- RECIRC FAN

Note: Some messages above may not apply depending on airplane configuration.

Should the associated system fault occur while the ELMS P210 PANEL status message is displayed, the following EICAS messages will NOT display because of the ELMS ARINC communication fault:

EICAS ADVISORY messages

- FUEL PUMP CENTER R
- FUEL PUMP R AFT

The electrical synoptic will indicate that the right main AC bus and right transfer bus are not powered even though they are powered.

The fuel synoptic indications and flow bars for the right aft fuel pump and right center fuel pump will be blank.

During fuel jettison, the synoptic indications and flow bars for the right main jettison pump, the right jettison isolation valve, and the right jettison nozzle valve indications will be blank.

The fuel imbalance pointer will not flash if fuel balancing is going in the wrong direction.

On the overhead panel, the right aft and right center pump “PRESS” lights will not illuminate. The right jettison nozzle valve “VALVE” light will not illuminate.

If the EICAS status message ELMS P310 PANEL displays:

The following EICAS messages will also display and should be considered valid messages:

EICAS ADVISORY message

- NO LAND 3

EICAS STATUS messages

- AIR/GROUND R
- NO LAND 3

Should the associated system fault occur while the ELMS P310 PANEL status message is displayed, the following EICAS messages will NOT display because of the ELMS ARINC communication fault:

EICAS ADVISORY messages

- ELEC BATTERY OFF
- ELEC STANDBY SYS
- FUEL CROSSFEED AFT
- FUEL PUMP L FWD

- FUEL VALVE APU
- MAIN BATTERY DISCH
- PASS OXYGEN ON

The electrical synoptic indication “CHG/DISCH” for the main battery will not display.

The fuel synoptic indications and flow bars for the left forward fuel pump and aft crossfeed valve will be blank.

The fuel imbalance pointer will not flash if fuel balancing is going in the wrong direction.

On the overhead panel, the left forward pump “PRESS” light will not illuminate. The aft crossfeed valve “VALVE” light will not illuminate. The passenger oxygen “ON” light will not illuminate.

Operating Instructions

If EICAS alert messages display, perform the associated non-normal checklist as required.

During fuel balancing, make sure fuel is being balanced in the correct direction.

Once fuel jettison is initiated, it must be terminated by manually turning off the fuel jettison nozzle valves if the EICAS status messages ELMS P110 PANEL or ELMS P210 PANEL display. Automatic shutoff of the fuel jettison system is inoperative.

Fuel jettison is not possible if both EICAS status messages ELMS P110 PANEL and ELMS P210 PANEL are displayed.

Do not use synoptic displays to perform procedures.

Administrative Information

This bulletin replaces bulletin TBC-83 R1 dated September 15, 2003. Discard TBC-83 R1. Revise the Bulletin Record to show TBC-83 R1 “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-83 R2 as "In Effect" (IE) .

This bulletin will be cancelled after Boeing is notified that all affected airplanes have been modified by Service Bulletin 777-24-0087.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-85 R2

IssueDate: February 11, 2020

Airplane Effectivity: 777-200 - 777-200LR, 777F

Subject: 777 FMC Calculation of Reduced Thrust Takeoff Anomaly

Reason: To inform flight crews of a thrust setting anomaly associated with derated thrust takeoff selection.

Revised to update corrective action, Service Bulletin information, and correspondence address.

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 anomalous FMC calculation of derate takeoff (TO 1 or TO 2) thrust settings. The percent thrust reduction associated with TO 1 and TO 2 on the FMC THRUST LIM page can display zero (0). This anomaly seems to occur at power up, after a data load, or after FMC reset. When this occurs, selection of TO 1 or TO 2 does not result in derated thrust. The Takeoff EPR/N1 Limit displayed on line 1R of the FMC THRUST LIM page is full rated thrust (TO); however, FMC V speeds may be based on the selected derate. If an assumed temperature has been entered, the resulting thrust reduction is relative to full rated thrust, not the intended derate.

Operating Instructions

Takeoffs using full rated thrust are not affected by this anomaly. If intending to use derates TO 1 or TO 2, verify the appropriate percentage thrust reduction displays under TO 1 or TO 2 on the FMC THRUST LIM page. If the displayed percentage thrust reduction associated with TO 1 and TO 2 is zero (0), FMC selection of derates is not available. Flight crew action should be based on airline policy; however, the following thrust setting options are available:

- Use full rated thrust (TO) with appropriate V speeds, if conditions permit.
- Use the assumed temperature method with full rated thrust (TO) and appropriate V speeds, if conditions permit.
- Set EPR/N1 manually for the intended derate. Derate thrust settings and appropriate V speeds can be obtained from company airport analysis or from the Flight Planning and Performance Manual, Section 1.3.

Administrative Information

This bulletin replaces bulletin TBC-85 R1 dated June 16, 2017. Discard TBC-85 R1. Revise the Bulletin Record to show TBC-85 R1 "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-85 R2 as "In Effect" (IE) .

This condition will be corrected with the installation of AIMS-1 BP V16 or AIMS-2 BP V17 or higher. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet have completed the following Service Bulletins or equivalent:

- AIMS-1 hardware airplanes - BP V16 - SB 777-31-0191
- AIMS-2 hardware airplanes - BP V17.1 - SB 777-31-0227

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-87 R4

IssueDate: June 21, 2017

Airplane Effectivity: All Airplanes

Subject: 777 Fuel Quantity Indicating System Fluctuations

Reason: To inform flight crews of fuel quantity indicating system fluctuations.

Revised to update 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

777 operators report FUEL IMBALANCE EICAS advisory messages and/or FUEL DISAGREE-PROG 2/3 FMC messages in flight due to fluctuating fuel quantity indications. Fluctuating indications are due to an internal FQIS anomaly and will usually result in a constant rate decrease of approximately 600 lbs / 270 kgs per minute in the Left Main, Right Main, or Center fuel tank quantity. Typical cruise fuel flow is approximately 125 lbs / 55 kgs per minute per engine. The erroneous fuel indications and resultant messages have been observed to recover within several minutes, but may repeat throughout the flight.

Operating Instructions

If any of the following are observed, flight crews should accomplish the FUEL LEAK CHECKLIST:

- Visual observation of fuel spray from strut/engine
- Excessive engine fuel flow
- Control wheel deflection to maintain lateral trim

One or more of the following may also be evidence of a fuel leak or the FQIS anomaly described above:

- Total fuel quantity decreasing at an abnormal rate
- FUEL IMBALANCE message on EICAS
- FUEL QTY LOW message on EICAS
- FUEL DISAGREE –PROG 2/3 message on CDU scratchpad (pre-AIMS 05)
- FUEL DISAGREE message on EICAS (AIMS 05 and later)
- INSUFFICIENT FUEL message on CDU scratchpad

A fuel quantity decrease of approximately 600 lbs / 270 kgs per minute in one tank may be the result of the subject FQIS anomaly. This anomaly could trigger the FUEL IMBALANCE, FUEL DISAGREE, FUEL QTY LOW, and/or INSUFFICIENT FUEL messages. Allow 15 minutes for the FQIS to recover and display accurate fuel quantities. If the message(s) remain after this time, consider them valid and take appropriate action.

Note: Should fuel jettison be required with erroneous fuel indications, the fuel jettison system will use the indicated totalizer fuel to determine when to cease jettisoning at the fuel TO REMAIN value set by the crew. Therefore, if the indicated fuel quantity indications are in error, the crew should use the FMC calculated fuel value and determine the jettison time using the jettison rates of 5400 lbs / 2500 kgs per minute with fuel in the center tank, or 3100 lbs / 1400 kgs per minute with center tank empty.

Administrative Information

This bulletin replaces bulletin TBC-87 R3 dated July 10, 2006. Discard TBC-87 R3. Revise the Bulletin Record to show TBC-87 R3 “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-87 R4 as "In Effect" (IE) .

This condition is corrected by Boeing Service Bulletin SB 777-28-0043 or SB 777-28-0048 or SB 777-28-0067.

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-92 R2

IssueDate: August 31, 2006

Airplane Effectivity: All Airplanes

Subject: Fuel temperature blanking indication.

Reason: To inform flight crews of a Fuel Quantity Processor Unit (FQPU) anomaly that may cause blanking of the fuel temperature indication.

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 fuel temperature indication may blank on certain 777 airplanes, accompanied by the EICAS status message FUEL TEMP INDICATION.

Smiths recently introduced new Fuel Quantity Processor Unit (FQPU) part numbers 0335KPU01 and 0330KPU01 and Boeing incorporated them in production at line positions 423, 429, 466, and 477 and on (refer to Service Letter 777-SL-28-016). The subject problem is associated with the new FQPUs.

Operating Instructions

In the event of inflight blanking of the fuel temperature indication, use Total Air Temperature (TAT) as a conservative indication of fuel temperature.

The FUEL TEMP LOW EICAS advisory message will not display when the fuel temperature indication is blank. Therefore, maintain TAT greater than 3 degrees C above the fuel freeze point.

Administrative Information

This bulletin replaces bulletin TBC-92 R1 dated August 31, 2006. Discard TBC-92 R1. Revise the Bulletin Record to show TBC-92 R1 "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-92 R2 as "In Effect" (IE) .

This condition is corrected with FQPU modifications provided in Smiths Aerospace Service Bulletin 0330KPU01-28-0437 or 0335KPU01-28-438, depending on the installed FQPU part number. This bulletin will be cancelled when Boeing is notified all affected airplanes in the customer fleet are modified by appropriate Smiths Aerospace service bulletin.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-96 R1

IssueDate: December 10, 2007

Airplane Effectivity: 777-200ER

Subject: False Engine-Out Indication

Reason: To inform pilots of a Loss of N3 Indication (Dedicated Generator) anomaly on Rolls-Royce engines.

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 in-service events in which the N3 Engine Display arc blanks and the digital N3 displays "0.0." No EICAS alert level messages are present, but several status level messages may result (ENG CONTROL, ENG EEC C1, ENG OPU and ENG TURB OVSP SYS, for example).

This condition is caused by a failure within the engine Dedicated Generator. The Dedicated Generator (DG) is a small generator on the engine gearbox which powers various engine components and provides the N3 signal to the EEC and airplane.

During a recent DG failure, the engine continued to provide normal thrust response. However, the FMC and Autopilot interpreted the N3 signal loss as an engine-out condition. When this condition exists, the Autothrottle may command slow thrust fluctuations to accommodate the false engine-out condition when above approximately FL200. These thrust fluctuations can cause the airspeed to vary between EO Speed and a protective margin below VMO/MMO. At lower altitudes or during climbs and descents at any altitude, autothrottle operation is normal. Additionally, the Autopilot may add a rudder input during LAND 2 / LAND 3 operations. However, because the engines are still operating normally and thrust is symmetrical, the rudder is compensated by aileron input and a slight "cross control" condition may occur when LAND 2 / LAND 3 is annunciated.

FMC performance predictions will approximate the all-engine performance. However, the FMC's CALCULATED fuel value on the PROGRESS 2/x page will lag the TOTALIZER until the FUEL DISAGREE EICAS message (AIMS BLOCK POINT 05) or the FUEL DISAGREE - PROG 2/3 CDU scratchpad message (AIMS BLOCK POINT 03 and earlier) is displayed. Selection of the TOTALIZER will ensure that fuel and ETA predictions reflect the all-engine configuration.

Additionally, the loss of N3 following a DG failure will inhibit an in-flight engine start should the respective engine fail. Crews should be aware that the combined probability of loss of N3 due to a DG failure and an engine failure is extremely remote.

Boeing and Rolls Royce are investigating an improved Dedicated Generator to resolve this issue.

Operating Instructions

If one of the N3 Engine Display arcs blank and the respective digital N3 value displays "0.0," but all other engine indications are normal:

1. Operations above approximately FL200: Climbs and descents are not affected. During cruise, disconnect the autothrottle and set power for the desired speed or Mach.
2. Approach to an Autoland (LAND 2 / LAND 3): The 777 Autopilot has been demonstrated to safely land and rollout with an engine out. Therefore, should an autoland be required and this false engine-out condition exists, continue the approach and landing. Manual landings are not affected.

Administrative Information

This bulletin replaces bulletin TBC-96 dated December 10, 2007. Discard TBC-96. Revise the Bulletin Record to show TBC-96 "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-96 R1 as "In Effect" (IE).

An interim software update to improve the EEC response to this anomaly will be available in December 2005. However, the airplane level effects described in this bulletin will continue until new Dedicated Generator hardware is available.

This bulletin will be cancelled after Boeing is notified that all affected airplanes have been modified by vendor (RR) Service Bulletin RB.211-72-E845.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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



Number: TBC-99 R1

IssueDate: June 15, 2012

Airplane Effectivity: 777-200

Subject: GE90-94B Autostart Logic during High Altitude Ground Starts

Reason: To inform flight crews of the need to monitor, and take possible action, during engine ground autostarts at high altitude airports.

Revised to add corrective 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

This bulletin applies only to aircraft equipped with GE90-94B engines.

A GE90-94B powered 777 operator experienced several hot starts in Mexico City, a high altitude airport. These hot starts were a result of an engine that exceeded its serviceability limits (high cycle engine with high pressure compressor problems) combined with high altitude airport and high ambient temperature. Flight crews reported they manually interrupted the auto start sequence when EGT exceeded the ground start limit of 750 degrees C. In one case, EGT reached 770 degrees C by the time the flight crew manually aborted the autostart. QAR data revealed that the engine had stalled each time before exceeding the start EGT limit.

EGT in excess of 750 degrees C during an engine start is abnormal, regardless of cause, and must be investigated prior to flight. Normally, in case of a hot start, the autostart logic stops fuel to the engine if/when EGT exceeds 740 degrees C, so it automatically protects against exceedances of the 750 degrees C Start Redline limit. Therefore, the Engine Start procedure described in the Operations Manual does not require crew action during autostart (except for low oil pressure).

However, in the high-altitude conditions of the reported incidents, the autostart logic did not protect the start EGT limit. Analysis confirmed that at high airport altitudes the EEC logic may turn off the autostart EGT protection features prior to reaching idle. In these circumstances, the normal sub-idle stall logic will still protect against exceedances of 800 degrees C, but the control will not automatically protect against exceedance of the 750 deg C start EGT limit.

A future version of EEC software will contain logic changes to ensure that, for all conditions, the autostart EGT protection features remain active until the start is complete. Prior to the availability of this software, flight crews should monitor EGT during autostarts, and manually abort the start if EGT exceeds the Start Redline limit.

Operating Instructions

The flight crew should monitor EGT during an autostart with GE90-94B engines, and manually abort the start for any EGT exceedance of 750 degrees C or when EGT is observed rapidly approaching 750 degrees C.

Administrative Information

This bulletin replaces bulletin TBC-99 dated July 11, 2005. Discard TBC-99. Revise the Bulletin Record to show TBC-99 "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-99 R1 as "In Effect" (IE) .

Service Bulletin 777-73-0024 installs updated EEC software. This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 777-73-0024.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-100 R1

IssueDate: January 9, 2006

Airplane Effectivity: 777-200ER

Subject: Flight Control Anomaly

Reason: To inform flight crews of a pitch up anomaly during climb.

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 777-200ER recently experienced a significant nose-up pitch event while climbing through FL360. The event was accompanied by: indication, warning, autopilot, autothrottle, and flight control anomalies. The flight crew disconnected the autopilot and autothrottle and stabilized the airplane using nose down control column force, during which time the airplane climbed above 41000 feet, decelerated to a minimum airspeed of 158 knots and activated the stick shaker.

During this flight, the flight crew observed the following anomalies:

- Airspeed indicator amber band displayed up to the MMO limit.
- Airspeed indicator trend vector displaying much greater than actual acceleration.
- Slip-skid indicator showing incorrect full scale deflection.
- Undesired autothrottle re-engagement due to high amber band indication.
- Control forces initially exceeding approximately 30 pounds, decreasing gradually to normal levels.
- Windshear warning.
- Position trend vector displaying an incorrect sharp turn on the navigation display.
- Erratic autobrake activity.

The flight returned safely to the origin airport. This is the first 777 airplane that has experienced this type of event. Investigations by Boeing and Honeywell have revealed the primary cause of the event to be a false acceleration signal from the ADIRU which caused both the autopilot (while engaged) and the primary flight control system to increase the airplane pitch attitude in response to the false acceleration signal. The SAARU, which was operating normally on the incident airplane, provided inputs to the flight control system that significantly reduced the severity of the event. Until corrective action is complete, crews should be aware of the following in the unlikely event this anomaly should reoccur:

- The airplane may pitch up or down depending on the nature of the false ADIRU signal.
- Pitch attitude can be controlled with enough force on the control column.
- The control forces will begin to decrease within approximately 10 seconds then gradually, over a period of approximately two minutes, decrease to near normal.
- The autothrottle may automatically re-engage if current speed is below the top of the amber band.
- The autopilot and flight director may provide erroneous guidance and control.
- Primary airspeed, altitude, vertical speed and attitude indications remain accurate.
- DIRECT control laws are not affected.

Boeing and Honeywell are aggressively developing an ADIRU software fix in coordination with the NTSB and the FAA.

Boeing is recommending operators not permit SAARU-inoperative dispatch until the ADIRU software fix is incorporated.

Operating Instructions

In the event that an airplane upset should occur, flight crews are advised to cross-check all available flight instruments and follow the published Upset Recovery procedure. If the upset is accompanied by the indications described above, flight crews should take the following additional actions if recovery is not immediate:

Apply as much control force as needed to establish a normal pitch attitude, to include both pilots pushing or pulling together. Although initial manual control forces may be high, the affects of the ADIRU anomaly on manual control forces are expected to diminish within 10 seconds and should be back to near normal within 2 minutes.

If undesired autothrottle behavior occurs:

A/T Arm switches OFF

Do not attempt to re-engage the autopilot or autothrottle.

If recovery is not progressing satisfactorily:

PFC Disconnect SwitchDISCONNECT
Continue with the Upset Recovery procedure.

Plan to land at the nearest suitable airport.

Do not use Autobrakes for landing.

Administrative Information

This bulletin replaces bulletin TBC-100 dated January 9, 2006. Discard TBC-100. Revise the Bulletin Record to show TBC-100 “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-100 R1 as "In Effect" (IE) .

This condition is temporary until the system is modified. This bulletin will be cancelled when Boeing alert service bulletin SB 777-34A0137 is incorporated.

While incorporation of SB 777-34A0137 corrects the anomaly associated with this bulletin, it also causes the anomalies associated with two previous bulletins “ADIRU Heading Error Anomaly” and “Incorrect Display of Drift Angle” to apply again. If SB 777-34A0137 has not been incorporated, it is recommended that SB 777-34A0138 be incorporated instead to correct the anomalies associated with all three bulletins. This bulletin, however, will be cancelled when Boeing is notified that either SB 777-34A0137 or SB 777-34A1038 is incorporated in the customer fleet.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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



Number: TBC-101 R2

IssueDate: June 13, 2011

Airplane Effectivity: All Airplanes

Subject: FMC Performance Predictions Anomaly

Reason: To inform flight crews of an FMC performance prediction anomaly following ABEAM PTS selection.

Revised to add service bulletin information about AIMS-2 BPV15.

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 erroneous FMC performance predictions following execution of the ABEAM PTS function on the LEGS page. When OAT values have been previously entered in LSK 5R on the WIND page, and the ABEAM PTS feature is then selected following a "direct-to" flight plan modification, the OAT value on the WIND page erroneously changes to "0" degrees. Subsequently, the fuel predictions are erroneously calculated based upon 0 degrees instead of the previously entered value for the respective cruise altitude. Operators have reported display of INSUFFICIENT FUEL FMC alert messages and fuel predictions much lower than planned. Additionally, there are no flight deck annunciations or alerts to the crew to indicate the OAT value on the WIND page has changed.

Operating Instructions

Following selection of the ABEAM PTS feature, review the ALT/OAT value on the respective WIND page. Re-enter the correct altitude and the indicated SAT (from PROGRESS page 2) on the ALT/OAT line for the next waypoint, if required. This data will propagate to all down track waypoints. Following reentry of OAT, FMC fuel predictions should be near those on the flight plan.

Administrative Information

This bulletin replaces bulletin TBC-101 R1 dated June 14, 2010. Discard TBC-101 R1. Revise the Bulletin Record to show TBC-101 R1 “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-101 R2 as "In Effect" (IE) .

This condition exists on airplanes that do not have AIMS BPV14 software installed. This condition is corrected with the installation of AIMS BPV14 or AIMS BPV15 software. The applicable Boeing service bulletin depends on the AIMS hardware installation:

- AIMS-1 hardware airplanes - SB 777-31A0179.
- AIMS-2 hardware airplanes - SB 777-31A0150.
- AIMS-2 hardware airplanes - SB 777-31-0167 or 777-31-0183.

This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet have the applicable service bulletin(s) incorporated.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-102 R3

IssueDate: June 21, 2017

Airplane Effectivity: All Airplanes

Subject: Fuel Quantity Blanking on the Progress 2/3 Page of the Control Display Unit (CDU)

Reason: To inform flight crews of an FMC fuel blanking anomaly.

Revised to update 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

Operators have reported no fuel quantity display on the Progress Page 2/3 during preflight checks. This can occur when the Fuel Quantity Processor Unit (FQPU) operates in Reversionary Mode. The FQIS still provides fuel quantity on Primary EICAS and the Fuel Synoptic but fuel quantity data is not displayed on the CDU for TOTALIZER and CALCULATED fuel quantity. All fuel quantity displays on primary EICAS and the fuel synoptic will be unaffected. Once the FQPU begins operating in reversionary mode, it will stay in this condition until FQPU power is cycled. If the FQPU begins operating in reversionary mode after engine start, only the TOTALIZER fuel quantity display will blank on the Progress Page 2/3 and the CALCULATED fuel quantity display will be unaffected.

Operating Instructions

If the TOTALIZER and CALCULATED fuel quantity displays are blank on the Progress 2/3 page of the CDU on the ground prior to engine start, and a box prompt exists below the Fuel header on the Perf Init page of the CDU, and the indicated fuel quantity on EICAS shows the correct quantity compared to airplane loading information, then flight crews should accomplish the following:

- Manually enter the fuel quantity from EICAS on the PERF INIT page of the CDU. MANUAL will be displayed next to the entered fuel quantity.
- Verify the fuel quantity entered above is displayed under the CALCULATED fuel quantity display on the Progress Page 2/3.

The FMC will now provide accurate fuel predictions. Once entered, the MANUAL fuel quantity cannot be deleted on the Perf Init page, Automatic jettison capability to a selected quantity remaining is inoperative. The flight crew must monitor the fuel quantity during jettison and terminate jettison manually by selecting the jettison nozzle switches OFF. The TOTALIZER display will remain blank on the Progress Page 2/3, and the FUEL DISAGREE message will be inhibited.

Note: The absence of a box prompt on the Perf Init page during the condition identified in this bulletin indicates a separate problem with the engine fuel flow meter system. This condition must be investigated by maintenance.

If jettison is required during this condition, the following procedure applies:

Fuel Jettison Arm Switch ARMED

Note: The FUEL AUTO JETTISON message will display on EICAS.

Determine the fuel quantity to remain after jettison.

The crew can calculate the jettison time from the total fuel quantity using the jettison rates of 5400 lbs / 2500 kgs per minute with fuel in the center tank, or 3100 lbs / 1400 kgs per minute with center tank empty.

Note: VNAV is not available during jettison due to no fuel quantity being available - CALC fuel and TOTALIZER fuel already will not display in the FMC due to this condition.

Fuel Jettison Nozzle Switches (both)..... ON

When the desired remaining fuel is reached:

Fuel Jettison Nozzle Switches (both)..... OFF

Fuel Jettison Arm Switch OFF

Wait five minutes after fuel jettison arm switch was positioned OFF

[Manual entry of fuel quantity is not possible until 5 minutes after jettison is complete.]

Enter final post-jettison fuel quantity into the box prompt on the Perf Init page to re-initialize the CALCULATED fuel quantity display and enable VNAV to function again.

Administrative Information

This bulletin replaces bulletin TBC-102 R2 dated January 9, 2006. Discard TBC-102 R2. Revise the Bulletin Record to show TBC-102 R2 “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-102 R3 as "In Effect" (IE) .

This condition will be corrected with new FQPU software which will be installed by Boeing Service Bulletin 777-28-0048 or SB 777-28-0067. This operations manual bulletin will be cancelled when Boeing is notified that SB 777-28-0048 or SB 777-28-0067 is installed on all airplanes in the customer fleet.

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.

Intentionally
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Flight Crew Operations Manual Bulletin for The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207



Number: TBC-103

IssueDate: February 3, 2006

Airplane Effectivity: 777-200LR, 777-300ER, 777F

Subject: Fuel Flow Blanking with GE90-100 Series Engines

Reason: To inform flight crews of fuel flow blanking at minimum idle during descent.

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

Note: This bulletin applies to 777 airplanes equipped with GE90-100 series engines only.

Boeing has received reports of fuel flow indications blanking on GE90-100 series engines at or near minimum idle during descent. If the fuel flow display returns to normal at thrust levels above minimum idle, these blanking events can be considered a nuisance fault. Blanking at thrust levels at or above approach idle should be considered a valid fault which requires maintenance action and/or MEL relief.

Operating Instructions

No flight crew action is required, provided the fuel flow indication blanking occurs only at or near minimum idle thrust.

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-103 as "In Effect" (IE) .

This condition is temporary until the system is modified. This bulletin will be cancelled when GE service bulletins GE90-100 SB 73-0025 and GE90-100 SB 73-0026 are incorporated.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-104 R1

IssueDate: December 15, 2013

Airplane Effectivity: All Airplanes

Subject: Generator OFF Light ON After Engine Start With No EICAS Message

Reason: To inform flight crews of potential generator off line with no alert message.

Revised to add 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 normal operation, if a main generator drops off line for any reason, the associated generator OFF light illuminates, and an EICAS Advisory message ELEC GEN OFF L, R is shown.

During an engine start if a generator does not reach a minimum frequency of 380 Hz the generator will not come on line and the generator OFF light will remain illuminated. However, the ELEC GEN OFF L, R EICAS message may not show. This lack of an EICAS message is known to have occurred on two or more occasions during engine starts only.

The Generator Control Unit supplier, Hamilton Sundstrand, is studying the feasibility of incorporating a change which will assure the ELEC GEN OFF L, R message is displayed on EICAS if the generator fails to come on line during engine start.

Operating Instructions

After engine start, flight crews should check that the generator OFF lights on the electrical panel are not illuminated. If a generator OFF light is illuminated, maintenance action is required.

Administrative Information

This bulletin replaces bulletin TBC-104 dated September 29, 2006. Discard TBC-104. Revise the Bulletin Record to show TBC-104 "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-104 R1 as "In Effect" (IE) .

This condition is corrected by Service Bulletins 777-24-0113 and 777-24-0117. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet are modified with Service Bulletins 777-24-0113 and 777-24-0117.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-105 R3

IssueDate: June 13, 2011

Airplane Effectivity: All Airplanes

Subject: Incorrect TAKEOFF REF data following a TAKEOFF REF Uplink.

Reason: To inform pilots of an FMC Takeoff Datalink anomaly.

Revised to add service bulletin information about AIMS-2 BPV15.

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 events where old TAKEOFF REF page data (THRUST, RW, V speeds, etc.) appeared on the TAKEOFF REF page 1 following an updated TAKEOFF REF uplink just prior to takeoff. In each event, the flight crew reported that the incorrect data appeared to be from the previous leg. Boeing has replicated the behavior and discovered a software anomaly that allows old TAKEOFF REF uplinks to remain in memory between flights. When this anomaly occurs, the old data appears on the TAKEOFF REF page following a TAKEOFF REF uplink that contains only partial takeoff data (CG for example).

Operating Instructions

Do not accept partial TAKEOFF REF page uplinks (only an updated GC, for example) unless you have previously received and accepted a complete TAKEOFF REF page (all data fields contain data) for the intended flight leg. If a partial uplink is received and any fields on the TAKEOFF REF page are blank, dashes, or boxes, reject the uplink and select the REQUEST prompt on the TAKEOFF REF page to get a complete TAKEOFF REF uplink or enter the TAKEOFF REF data manually.

Administrative Information

This bulletin replaces bulletin TBC-105 R2 dated June 14, 2010. Discard TBC-105 R2. Revise the Bulletin Record to show TBC-105 R2 “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-105 R3 as "In Effect" (IE) .

This condition is corrected with the installation of AIMS BPV14 or AIMS BPV15 software. The applicable Boeing service bulletin depends on the AIMS hardware installation:

- AIMS-1 hardware airplanes - SB 777-31A0179.
- AIMS-2 hardware airplanes - SB 777-31A0150.
- AIMS-2 hardware airplanes - SB 777-31-0167 or 777-31-0183.

This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet have the applicable service bulletin(s) incorporated.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-107 R3

IssueDate: June 13, 2011

Airplane Effectivity: 777-200LR, 777-300ER

Subject: FMC Minimum V1, VR, V2 Speed Entry Limits for 777-200LR and 777-300ER Models

Reason: To inform flight crews of reduced FMC capability to detect erroneous manual and uplinked V1, VR and V2 entries.

Revised to add service bulletin information about AIMS-2 BPV15.

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 condition exists only on the 777-200LR and 777-300ER airplanes.

An AIMS OPC option is enabled for all 777-200LR and 777-300ER models which results in the deactivation of minimum value checking for uplinked or manually entered V1, VR and V2 speeds. Flight crews are advised that the FMC will accept uplinked or manually entered V-speeds as low as 80 knots. "MINV1", "MINVR", and "MINV2" do not display in the associated header lines, and the value of MINV1, MINVR, and MINV2 do not display in the data lines on the TAKEOFF REF page.

Operating Instructions

Flight crews should ensure that manually entered V speeds are entered correctly on the TAKEOFF REF page of the CDU.

Administrative Information

This bulletin replaces bulletin TBC-107 R2 dated June 14, 2010. Discard TBC-107 R2. Revise the Bulletin Record to show TBC-107 R2 “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-107 R3 as "In Effect" (IE) .

This condition exists in 777-200LR and 777-300ER airplanes that do not have AIMS BPV14 or later software installed. This condition is corrected with the installation of AIMS BPV14 or AIMS BPV15 software. The applicable Boeing service bulletin depends on the AIMS hardware installation:

- AIMS-1 hardware airplanes - SB 777-31A0179.
- AIMS-2 hardware airplanes - SB 777-31A0150.
- AIMS-2 hardware airplanes - SB 777-31-0167 or 777-3100187.

This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer’s fleet have the applicable service bulletin(s) incorporated.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-108 R3

IssueDate: June 13, 2011

Airplane Effectivity: All Airplanes

Subject: Honeywell Flight Management Computer Anomaly

Reason: To inform flight crews of a Honeywell FMC anomaly that incorrectly deletes a speed constraint. Revised to reflect AT-OR-BELOW is not a factor in this anomaly.

Revised to add service bulletin information about AIMS-2 BPV15.

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 confirmed operator reports of a Honeywell FMC anomaly that incorrectly deletes a speed constraint. Some SIDs are designed to limit turn radius to maintain clearance with other traffic or restricted airspace. Some of these procedures also have an AT-OR-ABOVE altitude restriction in conjunction with the speed constraint. Typically, the airplane will be required to limit speed until passing the respective waypoint as well as climb above the altitude constraint. In these procedures, VNAV will incorrectly delete the speed constraint prior to reaching the waypoint if the altitude constraint has been satisfied. When this happens, VNAV will command speed to accelerate to ECON speed (or SEL speed) prior to reaching the constrained waypoint. This anomaly exists on all Boeing 747 / 757 / 767 / 777 airplanes equipped with the Honeywell FMC.

Honeywell is aware of this anomaly and has planned changes for the 777.

Operating Instructions

To prevent exceeding a speed restriction when accompanied by an AT-OR-ABOVE altitude constraint, use speed intervention (enter speed constraint in the MCP Speed Window) until the constrained waypoint is sequenced. After passing the waypoint, select VNAV as desired.

Administrative Information

This bulletin replaces bulletin TBC-108 R2 dated June 14, 2010. Discard TBC-108 R2. Revise the Bulletin Record to show TBC-108 R2 “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-108 R3 as "In Effect" (IE) .

This condition exists on airplanes that do not have AIMS BPV14 or later software installed. This condition is corrected with the installation of AIMS BPV14 or AIMS BPV15 software. The applicable Boeing service bulletin depends on the AIMS hardware installation:

- AIMS-1 hardware airplanes - SB 777-31A0179.
- AIMS-2 hardware airplanes - SB 777-31A0150.
- AIMS-2 hardware airplanes - SB 777-31-0167 or 777-31-0183.

This bulletin will be cancelled when Boeing is notified that all affected airplanes in a customer’s fleet have the applicable service bulletin(s) incorporated.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-114 R2

IssueDate: June 13, 2011

Airplane Effectivity: All Airplanes

Subject: FMC Failure When Programming a "step-down" Descent.

Reason: To inform flight crews of an FMC anomaly.

Revised to add second service bulletin number.

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 dual FMC failures when a "planned step" to a lower than current cruise altitude is entered and executed on the LEGS page. Frequently, the "planned step down" entry was followed by route changes executed on the RTE page. Boeing has confirmed that when a LEGS page entry such as "/FL230S" is executed, and that altitude is below the current cruise altitude displayed on the ACT CRZ page, both FMCs may momentarily reset to resolve the planned "step down" in the flight plan route.

Operating Instructions

Do not enter a planned step altitude (in the format FLxxxS) that is below the current cruise altitude. When a descent is required to a new cruise altitude, enter a new cruise altitude in line 1L on the CRZ page and perform a cruise descent.

Administrative Information

This bulletin replaces bulletin TBC-114 R1 dated December 13, 2010. Discard TBC-114 R1. Revise the Bulletin Record to show TBC-114 R1 “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-114 R2 as "In Effect" (IE) .

The anomaly addressed in this bulletin is corrected with an AIMS upgrade. The AIMS upgrade version and associated service bulletin is dependant on the AIMS hardware installation:

- AIMS-1 hardware airplanes - BP V14 - SB 777-31A0179
- AIMS-2 hardware airplanes - BP V15 - SB 777-31-0167 or 777-31-0183

This bulletin will be cancelled when Boeing is notified that all affected airplanes in a customer’s fleet have the applicable service bulletin(s) incorporated.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-115 R8

IssueDate: February 27, 2018

Airplane Effectivity: All Airplanes

Subject: Uncommanded Autothrottle Movement During Cruise Flight.

Reason: To inform flight crews of an autothrottle anomaly.

AIMS upgrade BP V16 corrects the condition described in this OMB in its entirety. The following statement was therefore removed from Administrative Information: The erroneous FUEL TEMP LOW advisory EICAS anomaly will be corrected in a succeeding AIMS OPS release.

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 several instances of uncommanded autothrottle movement during the cruise phase of flight.

In one case, the autothrottle advanced the thrust levers to full climb thrust even though the speed of the airplane was at the desired speed. While the thrust levers were moving forward, the EICAS message FUEL TEMP LOW appeared for approximately 2 seconds in most of the reported cases. On each event, the thrust levers returned to normal with no action by the flight crew. This condition was reported to happen multiple times during the same flight, each event lasting for approximately 3-10 seconds.

In another instance the autothrottles retarded during cruise flight while at the desired speed. The indications were similar to the thrust lever advance condition and after the event the thrust levers returned to normal with no action by the flight crew.

When investigating this condition, it was determined that a very short term data corruption between the two AIMS cabinets is the cause of the anomaly. Boeing and Honeywell plan to modify the AIMS OPS to resolve this condition and the condition of the display of the erroneous FUEL TEMP LOW advisory EICAS message.

Operating Instructions

To prevent the above described anomaly from occurring, prior to engine start, move the FMC selector switch to either L or R, then back to AUTO. Should cycling of the FMC selector switch be inadvertently overlooked prior to preflight, cycling of the switch inflight at any time will resolve or prevent the anomaly.

Note: After a company uplink is received, do not move the FMC selector switch until all pending company uplinks have been accepted or rejected.

Administrative Information

This bulletin replaces bulletin TBC-115 R7 dated May 19, 2015. Discard TBC-115 R7. Revise the Bulletin Record to show TBC-115 R7 "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-115 R8 as "In Effect" (IE) .

The condition of uncommanded autothrottle movement of the thrust levers is corrected with an AIMS upgrade. The AIMS upgrade version and associated service bulletin is dependant on the AIMS hardware installation:

- AIMS-1 hardware airplanes - BP V16 - SB 777-31-0191
- AIMS-2 hardware airplanes - BP V16 - SB 777-31-0190

This bulletin will be cancelled when Boeing is notified that all affected airplanes in a customer's fleet have the applicable service bulletin(s) incorporated.

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-116 R2

IssueDate: June 13, 2011

Airplane Effectivity: 777-200LR, 777F

Subject: Incorrect Display of Crossbleed (X-BLD) Start Indication for 777-200LR and 777F airplanes.

Reason: To inform flight crews that, when an engine is shut down in flight, the crossbleed start indication is not showing correctly.

Revised to add second service bulletin number.

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 condition exists only on 777-200LR and 777F airplanes.

When an engine is shut down in flight, the in-flight start envelope is shown on EICAS for the current flight level or the maximum flight level, whichever is less. The lowest airspeed for an in-flight windmill start is 270 knots. If the current airspeed is below 270 knots, X-BLD is displayed above the N2 display.

However, a software anomaly causes the X-BLD indication to be incorrectly removed at speeds greater than 260 knots, rather than 270 knots. Even though the X-BLD indication has been incorrectly removed, if the current airspeed is below 270 knots, a crossbleed start should be done. If the current airspeed is 270 knots or above, a windmill start should be done.

Operating Instructions

When operating 777-200LR and 777F airplanes, use the attached, revised ENG FAIL L, R; ENG IN-FLIGHT START L, R; ENG START VALVE L, R non-normal checklists as appropriate.

Operations Manual Information

Replace the affected pages in section 7 (Engines, APU) of the QRH with the associated attached pages. These pages may be reissued in the June 14, 2010 revision, at which time the EICAS Messages Index, Alphabetical Index and LEP will also be updated.

Administrative Information

This bulletin replaces bulletin TBC-116 R1 dated December 13, 2010. Discard TBC-116 R1. Revise the Bulletin Record to show TBC-116 R1 "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-116 R2 as "In Effect" (IE) .

This anomaly is corrected in AIMS upgrade BP V15, installed with service bulletins 777-31-0167 or 777-31-0183. This bulletin will be cancelled when Boeing is notified that the applicable service bulletin(s) have been incorporated into the customer's fleet.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-117 R4

IssueDate: June 16, 2017

Airplane Effectivity: All Airplanes

Subject: Loss of VHF Datalink Function on the Primary VHF Data Radio

Reason: To advise flight crews of a condition where the primary VHF Data Radio loses DATA mode and latches into voice mode.

Revised to remove AIMS-1 Service Bulletin information that is not applicable.

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 condition has been identified where the VHF datalink function can be lost on the primary VHF Data Radio (VDR). When this condition occurs, the primary VDR latches into voice mode, and DATA cannot be transferred from the STANDBY window to the ACTIVE window of the primary VDR's radio tuning panel. In addition, DATA mode cannot be selected for the primary VDR from the VHF page under the Flight Deck Communication Function (FDCF) MANAGER menu on the MFD.

Also, the EICAS advisory message VHF DATALINK appears, signifying VHF datalink is no longer available. If SATCOM is unavailable and HF datalink is not active, the EICAS advisory message DATALINK SYS appears instead.

This anomaly occurs only on 777 airplanes with AIMS-2 BP V14 and may be caused by a tuning mis-comparison between the Data Communications Management Function (DCMF) and the radio tuning panel, and a software error in the VHF sub-system in the DCMF.

This condition occurs most often during engine start, but also has been seen in other phases of flight.

Operating Instructions

Continue to perform datalink operations normally using SATCOM or HF (if HF datalink is activated) instead of VHF. This requires no pilot action because the DCMF will automatically use SATCOM as a backup air/ground medium as long as it is available. If SATCOM is unavailable and HF datalink is activated and available, the DCMF will use HF for datalink.

Alternately, it is possible to perform VHF datalink with the secondary VDR. This requires the following flight crew actions to switch to the alternate DCMF:

1. Select COMM on the DSP
2. Select MANAGER on the MFD
3. Select ACARS
4. Select PG 2
5. Deselect SATCOM
6. Deselect HF (if present)
7. Select RETURN
8. Select VHF
9. Select DEFAULT RADIO RIGHT (if switching from DCMF L to DCMF R) or DEFAULT RADIO CENTER (if switching from DCMF R to DCMF L)
10. Select DEFAULT RADIO MODE DATA
11. Select MANAGER
12. Select ACARS
13. Select PG 2
14. Reselect SATCOM
15. Reselect HF (if present)
16. Select RETURN

When the condition occurs on the ground, notify maintenance.

Administrative Information

This bulletin replaces bulletin TBC-117 R3 dated May 20, 2015. Discard TBC-117 R3. Revise the Bulletin Record to show TBC-117 R3 "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-117 R4 as "In Effect" (IE) .

The condition of the primary VDR losing DATA mode and latching into voice mode is corrected by installing AIMS BP V15A software (or later) or AIMS BP V16 software (or later). This bulletin will be cancelled when Boeing is notified that all airplanes in the customer fleet have the following Service Bulletin:

- V15A: 777-31-0196
- V16 AIMS 2: 777-31-0190

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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



Number: TBC-119 R1

IssueDate: June 15, 2012

Airplane Effectivity: All Airplanes

Subject: 777 Fuel Quantity Indicating System Fluctuations or Blanking Due to a Wiring Harness Problem

Reason: To inform flight crews of fuel quantity indicating system fluctuations
Revised to add corrective 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

777 operators report FUEL IMBALANCE EICAS advisory messages and/or the fuel quantity display blanking in flight due to fluctuating main and center tank fuel quantity indications. Fluctuating indications will usually result in a sudden fuel quantity increase or decrease of one main tank relative to the other main tank, but have occurred in the center tank also.

Erroneous fuel indications have been observed to either suddenly increase or decrease and recover within several minutes. The events can be a single occurrence or multiple events throughout the flight. To date, these occurrences have occurred during cruise flight, and with different fuel loads.

The condition normally does not result in any fuel system status messages and postflight troubleshooting does not reveal any discrepancies. Boeing and GE Aviation are currently in the process of formulating a retrofit program to replace discrepant FQIS wiring harnesses.

Operating Instructions

If the FUEL IMBALANCE EICAS advisory message occurs in flight, check fuel quantity readings to determine if the fuel quantity is fluctuating, or if a true imbalance or fuel leak exists.

If the fuel quantity fluctuates or suddenly increases or decreases and remains at a low level, and an imbalance or fuel leak is not suspected, consider the indications erroneous.

A steady increase in fuel imbalance or steadily increasing difference between fuel totalizer and calculated fuel quantities of approximately 1000 lbs / 500 kgs or more in 30 minutes should be considered a fuel leak.

To prevent unnecessary fuel balancing, do not accomplish the FUEL IMBALANCE checklist unless an actual fuel imbalance can be confirmed. An actual fuel imbalance can be confirmed by comparison of FMC calculated fuel used, comparison of respective engine fuel flows, or other evidence indicating a true imbalance exists.

Note: Should fuel jettison be required with erroneous fuel indications, the fuel jettison system will use the indicated totalizer fuel to determine when to cease jettisoning at the fuel TO REMAIN value set by the crew. Therefore, if the indicated fuel quantity indications are in error, the crew should use the FMC calculated fuel value and determine the jettison time using the jettison rates of 5400 lbs / 2500 kgs per minute with fuel in the center tank, or 3100 lbs / 1400 kgs per minute with center tank empty.

Administrative Information

This bulletin replaces bulletin TBC-119 dated December 24, 2010. Discard TBC-119. Revise the Bulletin Record to show TBC-119 "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-119 R1 as "In Effect" (IE) .

This bulletin will be cancelled when Boeing is notified that all airplanes in the customer fleet have Service Bulletin 777-28-0073 installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-120 R2

IssueDate: December 15, 2013

Airplane Effectivity: 777-300ER

Subject: Nuisance Visual and Aural Smoke Alarm Annunciations in Lavatories, Crew Rest Compartments and Other Cabin Compartments

Reason: To identify the smoke alarm annunciations as erroneous and reset them to prevent dispatch delays and in-flight diversions.

Revised to add 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 environmental regulations and parts obsolescence, ionization smoke detectors installed in the lavatories, crew rest compartments and other cabin compartments were replaced with photoelectric smoke detectors. This bulletin applies to 777 airplane line numbers 923-1102 with Kidde photoelectric smoke detector part number 474560-40, 474560-41, 474560-42, or 474560-50 installed.

On production test flights of 777 airplanes with the new photoelectric smoke detectors, erroneous smoke detector activation occurred after ground or in-flight power transfers. All occurrences were accompanied with the associated cabin aural and visual indications. Upon inspection, the smoke alarm events were verified to be erroneous as no smoke source was identified.

These nuisance alarm indications have been identified as an effect of a break power transfer, but do not occur frequently.

Few of these occurrences have been experienced to date on 777 production test flights and Boeing has not received any in-service reports about this anomaly.

Operating Instructions

In the event that a smoke alarm occurs, the following indications may be present:

- Master Caution indication and aural alarm in the flight deck.
- EICAS caution level message (for example, SMOKE REST UPR DR 1) or advisory level message (for example, SMOKE LAVATORY).
- Steady red indicator LED on each smoke detector, indicating an alarm state.
- Pulsating aural alarm from individual smoke detectors
- Pulsating aural alarm from remote horns in the crew rest.
- Flashing amber button light near the top to the entrance door of the affected lavatory or crew rest.
- Cabin Services System (CSS) chimes sounding in the main passenger cabin speakers (locations dependant on configuration).
- Flight Attendant Master Call light flashes.
- Cabin Services Control Panel messages (for example, 1. DOOR 1 UPR REST or LAV 1F-2L SMOKE DETECTED).
- Crew rest ventilation, overhead crew rest ventilation and aft galley power is disabled.

If any of these indications occur, the cabin crew should follow standard procedures for smoke detection. If no smoke source is present and the alarm occurred immediately after a power transfer, consider the alarm a nuisance occurrence. Consult the appropriate information in the Flight Attendant Manual or Flight Crew Operations Manual to reset the crew rest smoke detector function, which will also restore aft galley power and crew rest ventilation.

The ability of the detectors to sense smoke is not affected before or after a nuisance alarm. Nuisance alarms are not considered a safety-of-flight issue and do not require maintenance or MEL/DDG action. Such nuisance alarms are not considered reason to return to the gate, nor are they considered a reason to divert if the indications have been verified as a false alarm.

Administrative Information

This bulletin replaces bulletin TBC-120 R1 dated June 15, 2013. Discard TBC-120 R1. Revise the Bulletin Record to show TBC-120 R1 "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-120 R2 as "In Effect" (IE) .

This condition is corrected by Service Bulletin 777-26-0060. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet are modified with Service Bulletin 777-26-0060.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-121 R1

IssueDate: May 20, 2015

Airplane Effectivity: 777-200 - 777-300, 777F

Subject: Nuisance EICAS Message: SMOKE BBAND UPR DR2

Reason: To inform flight crews of nuisance SMOKE BBAND UPR DR2 cautions.

Revised to modify software update and 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 nuisance SMOKE BBAND UPR DR2 caution messages on 777 airplanes. The original purpose of this EICAS message was to alert the flight crew that a smoke detector installed above the Connexion LRU's detected smoke in the area.

Operating Instructions

The EICAS message SMOKE BBAND UPR DR2 may display even when no Connexion LRU's are installed on the airplane. This is a nuisance message. No flight crew action is required.

Operations Manual Information

The SMOKE BBAND UPR DR2 message is not referenced in the Flight Crew Operations Manual.

Administrative Information

This bulletin replaces bulletin TBC-121 dated August 31, 2011. Discard TBC-121. Revise the Bulletin Record to show TBC-121 "Cancelled" (CANC).

Insert this bulletin behind the Operations Manual Bulletin Record page in Volume 1 of your Operations Manual. Amend the Operations Manual Bulletin Record to show bulletin TBC-121 R1 "In Effect" (IE).

The SMOKE BBAND UPR DR2 EICAS message will be removed in the AIMS-1 BP V16 and AIMS-2 BP V17.1 software updates.

This bulletin will be cancelled when Boeing is notified that all airplanes in the customer fleet have the following Service Bulletin:

- V16 AIMS 1: 777-31-0191
- V17.1 AIMS 2: 777-31-0227

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-126 R3

IssueDate: June 16, 2017

Airplane Effectivity: 777-200 - 777-300, 777F

Subject: FMC Distance to Waypoint Anomaly

Reason: To inform flight crews of erroneous distance to waypoint anomaly and subsequent fly-over vs. fly-by waypoint in the route.

Revised to clarify that OMB is applicable to operators with AIMS-1 hardware prior to AIMS upgrade BP V16. Revised to add associated Service Bulletin 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

A customer reported an erroneous distance was shown for a flight plan waypoint after a departure procedure was added to the flight plan. This also results in LNAV overflying the waypoint in which the distance is incorrect. This anomaly occurs when moving a waypoint into the first line of the first LEGS page after the flight plan has been activated. Selecting a SID where the last waypoint of the SID is the first waypoint of the enroute flight plan results in an incorrect distance to the waypoint following the last waypoint of the SID.

Here is an example of the problem:

ZSSS is the origin. Enter the following fixes on the LEGS page:

JTN..NXD..TOL..ELNEX

Activate and execute the route. Select NXD to the scratchpad and place it into the first line.

Execute this mod.

The distance between NXD and TOL is shown correctly as 78 NM.

Select RW36 with the NXD02X SID. The last waypoint of the SID procedure is NXD. Now the distance between NXD and TOL is incorrectly shown as 121 NM.

Operating Instructions

If a flight plan leg appears to have an incorrect distance, push the line select key next to the waypoint with the incorrect distance twice and execute. Verify the distance is correct.

To prevent this anomaly from occurring, follow the Boeing Normal Procedures for entering Route, Runways and SIDs, included below for review.

RTE page:

1. Enter the route
2. Enter the FLIGHT NUMBER
3. Activate and execute the route.

Note: Do not perform a DIRECT TO to the first waypoint.

Departures page:

1. Select the runway and departure routing
2. Execute the runway and departure routing

Verify the route is correct on the RTE page. Check the LEGS page as needed to ensure compliance with the flight plan.

Administrative Information

This bulletin replaces bulletin TBC-126 R2 dated May 19, 2015. Discard TBC-126 R2. Revise the Bulletin Record to show TBC-126 R2 "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-126 R3 as "In Effect" (IE) .

The anomalies addressed in this bulletin will be corrected with an AIMS upgrade. The AIMS upgrade version and associated service bulletin is dependent on the AIMS hardware installation:

- AIMS-1 hardware airplanes - BP V16 - SB 777-31-0191
- AIMS-2 hardware airplanes - BP V17.1 - SB 777-31-0227

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-127 R3

IssueDate: May 20, 2015

Airplane Effectivity: 777-300

Subject: Latching Dual FMC Failures

Reason: To provide flight crews with information to prevent dual FMC failures on aircraft with AIMS-2 V16

Revised to modify software update and 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

Two conditions have resulted in several dual FMC failures in flight while performing ATC downlinks with the FMC Selector in AUTO. The first condition occurred when an entry was made in the DEP/ARR field on the ATC COMM – ROUTE REQUEST page. The second condition occurred when a slash (/) or a space (SP key) was entered into the EST field on the ATC COMM - POSITION REPORT page.

Subsequent lab testing has verified that FMC resets and latching dual FMC failures can occur under either of the following conditions:

- Entry of a slash (/) or a space (SP key) into fields on the following ATC COMM pages: POSITION REPORT, ROUTE REQUEST, EMERGENCY REPORT or ALTITUDE REQUEST.
- Entry of any data into the DEP/ARR field on the ATC COMM ROUTE REQUEST page.

Boeing Engineering analysis has shown that if the FMC Selector is in the L or R position prior to ATC downlink communications, inadvertent entry of the characters listed above will not result in a dual FMC failure.

Operating Instructions

If ATC downlink communications will be used in flight, the following procedure should be used during preflight operations:

- With the FMC Selector in the Auto position, display POS REF page 3/3 on either CDU.
- Determine which FMC is active by noting the FMC that is listed as (PRI). This FMC is chosen on initial power up and is based on available resources.
- Move the FMC Selector from the AUTO position to the active FMC (L or R) as indicated on POS REF page 3/3.

Note: After a company uplink is received, do not move the FMC selector switch until all pending company uplinks have been accepted or rejected.

If operating with the FMC Selector in L or R and the selected FMC fails, the FMC EICAS message will show. If this occurs, move the FMC Selector to the opposite FMC to restore FMC functionality.

After completion of the flight the FMC Selector should be moved back to the AUTO position.

Administrative Information

This bulletin replaces bulletin TBC-127 R2 dated November 6, 2013. Discard TBC-127 R2. Revise the Bulletin Record to show TBC-127 R2 "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-127 R3 as "In Effect" (IE) .

This anomaly will be corrected by the AIMS Block V17.1 software update. This bulletin will be cancelled when Boeing is notified that all airplanes in the customer fleet have Service Bulletin 777-31-0227 (or equivalent) installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-128 R1

IssueDate: June 15, 2017

Airplane Effectivity: All Airplanes

Subject: Control Panel (MCP) Altitude Window Changing Without Pilot Action

Reason: To inform flight crews that the altitude in the MCP altitude window may change indication without pilot action.

Revised to add 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 has experienced multiple occurrences of the MCP altitude window indication changing by 1000, 1500, 2000, and 4000 foot increments during climb, cruise, and descent. These changes occurred without flight crew input to the MCP. In addition when operating in VNAV, the altitude indication has changed after the altitude selector was pushed. This may allow the airplane to climb or descend above or below the desired altitude. Boeing and the equipment supplier are investigating the causes of these events. Initial findings suggest that electrostatic discharge introduced when the pilots touch the MCP may be causing the value in the altitude window to change. Testing has shown that if the Altitude Increment selector is in the AUTO position, the maximum altitude change was 1500 feet if a static discharge occurs.

Operating Instructions

The following may help minimize the effects and magnitude of uncommanded MCP altitude changes:

- Confirm all altitude changes on the MCP with both crew members
- Periodically check that the MCP altitude window and indication above the altitude display on the PFD remain at the desired value
- Use VNAV to the maximum extent possible
- Place Altitude increment selector in the AUTO position following use in the 1000s position

Administrative Information

This bulletin replaces bulletin TBC-128 dated December 12, 2012. Discard TBC-128. Revise the Bulletin Record to show TBC-128 “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-128 R1 as "In Effect" (IE) .

This condition is corrected by Service Bulletin 777-22-0034. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet are modified with Service Bulletin 777-22-0034.

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-129 R1

IssueDate: June 16, 2017

Airplane Effectivity: 777-200 - 777-200LR, 777F

Subject: Engine Anti-Ice Valve Sticking Due to Debris

Reason: To inform flight crews of additional actions which may allow the engine anti-ice system to operate.

Revised to add 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

Engine anti-ice valve malfunctions have occurred due to small particle debris in the valve.

The existing ANTI-ICE ENG L, R non-normal checklist directs the crew to cycle the engine anti-ice selector to OFF then ON one time.

Boeing Engineering has reported that additional cycling of the engine anti-ice valve may clear the debris causing the malfunction and allow continued engine anti-ice operation.

Operating Instructions

If the engine anti-ice system is not restored following completion of the ANTI-ICE ENG L, R NNC the following actions may restore the system:

Move the affected engine anti-ice selector to ON

If the ANTI-ICE ENG L, R message shows, wait 3 seconds and then cycle the engine anti-ice selector OFF then ON. This step may be repeated up to 5 times.

If these actions restore the system, move the engine anti-ice selector to the AUTO position after exiting icing conditions.

If these actions do not restore the system, the selector should be moved to OFF and icing conditions should be avoided.

After doing this procedure a maintenance log entry should be made.

Administrative Information

This bulletin replaces bulletin TBC-129 dated December 19, 2012. Discard TBC-129. Revise the Bulletin Record to show TBC-129 "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-129 R1 as "In Effect" (IE) .

This bulletin will be cancelled when Boeing is notified that all airplanes in the customer fleet have the applicable Service Bulletin(s) installed: SB 777-30-0017 (GE90-100 Series Engines), SB 777-30-0018 (Pratt and Whitney Engines), SB 777-30-0019 (GE90-76B, -85B, -90B and -94B Engines), or SB 777-30-0020 (Rolls Royce Engines).

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-131 R1

IssueDate: February 26, 2013

Airplane Effectivity: All Airplanes

Subject: Delayed Release of Landing Gear Lever Lock

Reason: To inform flight crews of the possibility the landing gear lever lock may not immediately release after takeoff.

Revised to reflect updated Service Bulletin and PRR fixes.

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 777 operators have reported occurrences in which flight crews were unable to raise the landing gear lever after takeoff. After the initial retraction attempt, crews were able to retract the gear by raising the landing gear lever after a short delay or by accomplishing the Gear Lever Locked Down NNC.

The Weight-On-Wheels (WOW) system engages the landing gear lever lock while on the ground and releases the lock after transition to the air mode. Analysis has shown the 777 WOW system can delay the ground-to-air transition if the take-off weight is light (< 490K lbs/220K kg) and the 2 preceding landing weights were heavy (> 525K lbs/240K kg). This delay can be as long as 17 seconds.

A delay or failure of the 777 landing gear lever lock to release when the airplane is in the air does not indicate the landing gear is out of configuration for retraction. In this case, overriding the gear lever lock and raising the landing gear will not cause damage to the landing gear.



Flight Crew Operations Manual Bulletin for The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207



Number: TBC-132 R1

IssueDate: June 16, 2017

Airplane Effectivity: All Airplanes

Subject: System anomalies to be corrected with a future FMC software revision.

Reason: To inform flight crews of existing anomalies and associated procedures.

Revised to include Service Bulletin information. Clarified that the AIMS upgrade version for operators of airplanes with AIMS-2 hardware is BP V17A.

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 FMC system anomalies have been identified that will be corrected in a future AIMS revision. Appropriate flight crew procedures have been developed to deal with these issues.

Steep Descent Path

Background Information

An operator reported a VNAV descent below a waypoint constraint altitude prior to arriving at the fix. This occurred after the flight crew performed an INTC CRS TO when in proximity to the approach intercept waypoint and significantly above the constraint altitude. Under these conditions, although VNAV was not engaged, the FMC computed the descent path required from the point where the modification was executed to the intercept waypoint, resulting in a steep descent path. When VNAV was subsequently engaged the FMC used the earlier computed descent profile which resulted in an altitude deviation.

Operating Instructions:

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February 28, 2020

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B-132 Page 1 of 4

If an INTC CRS TO was performed at an altitude significantly above the waypoint altitude constraint at the intercept waypoint, perform another INTC CRS TO just prior to engaging VNAV.

Incorrect VNAV Sequencing

Background Information

Several reports have been received of VNAV leveling off inside the Final Approach Fix (FAF) and departing the descent profile. These incidents occurred after performing a direct-to the Initial Approach Fix (IAF) waypoint of an approach with a track change of approximately 130-135 degrees. Depending on conditions (weight, wind, temperature, etc), the large track change may result in a curved path extending past the next waypoint in the flight plan. In this state, when the curved path transition extends beyond the next waypoint in the flight plan, VNAV will command level flight and not continue to follow the VNAV path. Although leveling off, VNAV will stay in VNAV PTH and will not transition to VNAV ALT.

Operating Instructions:

If a direct-to a waypoint on an approach using VNAV is being flown and the track change will be more than 100 degrees to the final approach course, the flight crew should do an INTC CRS TO the next desired waypoint if the waypoints have not sequenced correctly. Proper waypoint sequencing should be monitored throughout the approach.

Autothrottle Advance When Engaging VNAV on Approach

Background Information

Operators have reported autothrottle advances while sequencing the IAF. If VNAV is engaged when the aircraft is above path, within 150 ft of the VNAV path capture band, and the prior VNAV speed target was a higher value, the autothrottle internal speed target may be initialized to a higher value than the displayed VNAV speed target. If this occurs the autothrottles will then target the prior higher internal speed target and advance. The autothrottle internal speed target will subsequently decrease to the displayed VNAV speed target over a period of a few seconds.

Operating Instructions:

If VNAV will be engaged when on an approach, do not select the VNAV button on the MCP while sequencing the IAF.

Administrative Information

This bulletin replaces bulletin TBC-132 dated November 26, 2013. Discard TBC-132. Revise the Bulletin Record to show TBC-132 “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-132 R1 as "In Effect" (IE) .

The anomalies addressed in this bulletin will be corrected with an AIMS upgrade. The AIMS upgrade version and associated service bulletin is dependent on the AIMS hardware installation:

- AIMS-1 hardware airplanes - BP V16 - SB 777-31-0191
- AIMS-2 hardware airplanes - BP V17A - SB 777-31-0218

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



Number: TBC-133 R5

IssueDate: July 10, 2018

Airplane Effectivity: 777s with AIMS-2 BP V17 or V17.1 installed and without AIMS-2 BP V17A or later installed

Subject: Invalid Fuel Spar Valve Indication

Reason: To inform pilots of a fuel synoptic anomaly with AIMS-2 BP V17 or V17.1 installed and without AIMS-2 BP V17A or later installed.

Revised to reflect Airplane Effectivity.

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 flight test, following a power interrupt to the Left AC Bus the EICAS Fuel Synoptic page displayed the fuel spar valve as invalid (white circle) and the green fuel flow bars were replaced with white background lines.

This power interrupt caused a momentary loss of data which resulted in an invalid fuel spar valve indication. When the spar valve indication is invalid it is displayed in the color white, and the fuel flow bars to the engine show as white lines. The invalid fuel spar valve indication remains latched until it can be reset on the ground.

An invalid fuel spar valve symbol on the Fuel Synoptic indicates the valve position signal has received invalid data and is not an indication of a valve failure.

Operating Instructions

Anytime there is a power interrupt to the left AC bus, the Fuel Synoptic can give invalid indications and should not be used for situational awareness. Depending on conditions, the fuel synoptic page on the Captain's inboard display, First Officer's inboard display, and lower MFD can display different fuel spar valve indications.

Administrative Information

This bulletin replaces bulletin TBC-133 R4 dated July 10, 2017. Discard TBC-133 R4. Revise the Bulletin Record to show TBC-133 R4 "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-133 R5 as "In Effect" (IE) .

This anomaly is corrected with installation of AIMS-2 BP V17A or later software. This bulletin will be cancelled when Boeing is notified the applicable AIMS software upgrade Service Bulletin or equivalent listed below is incorporated in all affected airplanes:

- For AIMS-2 operators - SB 777-31-0218, PRR 61384-20

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-135 R2

IssueDate: May 20, 2015

Airplane Effectivity: 777-300

Subject: Loss of Datalink

Reason: To inform flight crews of possible loss of Datalink capability

Revised to modify software update and 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 AIMS -2 BP v17 update includes the FANS-1/LINK2000 Controller-Pilot Data Link Communications (CPDLC) application that will enable the use of ATN Datalink in European Airspace. During testing it was discovered that when communication transitions from one ATN ground station to another it is possible the VHF radio selected to DATA could revert to a non-data frequency. When this occurs the Radio Tuning Panel (RTP) associated with the radio that was in DATA will display a voice frequency in both the Active and Standby windows.

With no VHF radio in DATA mode, Datalink messages (such as Company messages) will be sent over alternate media such as SATCOM or High-Frequency Datalink. In European airspace, ATN CPDLC operates exclusively using VHF, so if the anomaly occurs in this region the existing ATN CPDLC connection will be lost and the EICAS Communications Message •ATC will display with the ATC COMM TERMINATED message displayed in the ATC Message Block. If in VHF voice mode when entering European enroute domestic airspace then ATN CPDLC connection is not possible.

Operating Instructions

If the radio selected for data transmission no longer displays DATA the flight crew can correct the issue by reselecting DATA to the ACTIVE frequency window. After selecting DATA on the RTP, a CPDLC connection may be established or reestablished using normal CPDLC Log-On procedures.

If unable to reestablish CPDLC communications the flight crew shall revert to Voice communications

Administrative Information

This bulletin replaces bulletin TBC-135 R1 dated February 10, 2014. Discard TBC-135 R1. Revise the Bulletin Record to show TBC-135 R1 "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-135 R2 as "In Effect" (IE) .

This condition will be corrected with the installation of AIMS-2 BP V17.1. This bulletin will be cancelled when Boeing is notified that all airplanes in the customer fleet have Service Bulletin 777-31-0227 (or equivalent) installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-136 R3

IssueDate: February 27, 2020

Airplane Effectivity: 777-200 - 777-300, 777F

Subject: Altimeter Setting While in VNAV

Reason: To inform the flight crew of possible aggressive pitch maneuvers when changing the barometric setting near transition altitude or transition level.

Revised corrective action from AIMS-2 BP V17A to AIMS-2 BP V17B. Revised 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 been made aware that overly aggressive pitch behavior may occur during altitude capture in VNAV when large changes to the barometric pressure reference are made.

The event involved clearance to hold at an altitude near the transition level. During the altitude capture the crew made a large barometric setting change. The barometric setting change shifted the reference altitude, which resulted in an aggressive VNAV maneuver to climb to the shifted altitude value.

Operating Instructions

When in VNAV and capturing an altitude at or near the transition level or transition altitude, select FLCH, V/S or Altitude HOLD prior to making the barometric setting change. After the level off is complete VNAV may be reengaged if desired.

During a continuous climb or descent in VNAV and the aircraft is nearing the transition altitude or transition level, select FLCH or V/S prior to making a barometric setting change of more than .20 inches of mercury or 7 hectopascals. After making the barometric setting change, VNAV may be reengaged if desired.

Administrative Information

This bulletin replaces bulletin TBC-136 R2 dated June 16, 2017. Discard TBC-136 R2. Revise the Bulletin Record to show TBC-136 R2 "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-136 R3 as "In Effect" (IE) .

This condition will be corrected with the installation of AIMS-2 BP V17B or later. This bulletin will be cancelled when Boeing is notified the applicable AIMS software upgrade Service Bulletin (or equivalent) listed below is incorporated in all affected airplanes:

For AIMS-2 operators - SB 777-31-0294

Please send all correspondence regarding Operations Manual Bulletins 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-137 R1

IssueDate: June 16, 2017

Airplane Effectivity: 777-200 - 777-300, 777F

Subject: Multi-Mode Receiver (MMR) ILS Frequency Disagreement

Reason: To inform flight crew of approach procedures in the event of a single MMR ILS frequency disagreement.

Revised to include 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 single Multi Mode Receiver (MMR) failures which can result in the ILS frequency output of the faulty MMR to be in disagreement with the valid ILS frequencies of the other two MMRs.

If an ILS frequency disagreement occurs due to a single MMR failure, the following indications will be shown:

- NO LAND 3 EICAS Advisory message, and can show prior to selecting an approach
- Amber ILS frequency with an amber horizontal line on the PFD when an approach is selected

The following indications may also show due to a single MMR failure:

- The LAND 2 AFDS annunciation can show below 1500 feet when both PFDs show the amber ILS frequency with amber horizontal line
- If the failed MMR is the left or right, the approach reference information on the failed side PFD can initially be either blank or missing the ILS frequency. The display should eventually transition to the center MMR and show an amber ILS frequency with an amber horizontal line.

Note: If the blank or missing approach information does not transition to the center MMR, the airplane is capable of a single channel ILS approach using the PFD to monitor the valid ILS frequency.

The localizer and glideslope pointers on the PFD are accurate when the ILS frequency is amber with an amber horizontal line.

When in alternate navigation mode, the amber frequency and amber horizontal line indicate the ILS frequencies manually entered in both CDU's do not match and should be verified.

Operating Instructions

After selecting an ILS approach and when in reception range, verify the ILS is correctly tuned and identified. Identify the ILS after the on side PFD displays the amber frequency.

- To verify the ILS frequency on the ND, select APP mode using the EFIS control panel. The ILS alpha identification is shown in the upper right corner.
- To verify the audio identification, select the approach receiver on the audio control panel corresponding to the ILS receiver shown on the ND (to the left of the ILS identification).

The ND mode may be changed after the ILS is verified.

If both PFD's show amber ILS frequencies with amber horizontal lines, the autoflight system may be capable of a LAND 2 autoland (fail passive) using the two valid MMRs. The LAND 2 annunciation shows on the PFD when below 1500 feet.

When one PFD is missing the ILS frequency or the approach reference information is blank, an ILS can be flown to CAT I minimums using the localizer and glideslope pointers on the PFD with the amber ILS frequency and an amber horizontal line. The ILS indications on the PFD missing the ILS frequency or approach reference information is not usable. If suitable visual reference is established at DA(H), disengage the autopilot in accordance with regulatory requirements.

Administrative Information

This bulletin replaces bulletin TBC-137 dated April 25, 2014. Discard TBC-137. Revise the Bulletin Record to show TBC-137 "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-137 R1 as "In Effect" (IE) .

This condition is corrected with installation of AIMS BP V17A. This bulletin will be cancelled when Boeing is notified the applicable AIMS software upgrade Service Bulletin listed below is incorporated in all affected airplanes:

- For AIMS-2 operators - SB 777-31-0218 or equivalent.

Please send all correspondence regarding Operations Manual Bulletins 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



Number: TBC-141 R1

IssueDate: December 15, 2014

Airplane Effectivity: 777F

Subject: Flight at Low Gross Weight

Reason: To inform flight crews of supplementary procedures and performance guidance during flight at low gross weight.

Revision corrects effectivity for customers with both Freighters and Passenger versions of the 777

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 are supplementary procedures to follow when flying at gross weights below 340,000 pounds.

When the airplane gross weight decreases below 340,000 pounds, the VREF and Flap maneuver speeds increase by up to 11 knots. The FMC and performance software will be updated to include accurate VREF speeds.

There are supplementary procedures to follow when flying at gross weights below 154,221 kilograms.

When the airplane gross weight decreases below 154,221 kilograms, the VREF and Flap maneuver speeds increase by up to 11 knots. The FMC and performance software will be updated to include accurate VREF speeds.

The updated software will be installed in production airplanes starting mid-November, 2014. Service Bulletins will be released late 2014.

The thrust available when flying at minimum weight can have excess performance capabilities.

Operating Instructions

Landing distances will be longer due to the higher VREF speed. For normal landing, increase the landing distance by 450 feet. For non-normal landing, increase the landing distance by 620 feet. These numbers are conservative and usable for all landing distance tables.

Landing distances will be longer due to the higher VREF speed. For normal landing, increase the landing distance by 135 meters. For non-normal landing, increase the landing distance by 190 meters. These numbers are conservative and usable for all landing distance tables.

CAUTION: The airplane accelerates and climbs rapidly due to excess thrust.

For takeoff and go-around, level off at 3,000' feet above field elevation or higher. A lower level off altitude can result in an overshoot of the assigned altitude.

If the airplane weight decreases below 340,000 pounds during takeoff or landing, flap maneuver speeds can increase. Follow the higher flap maneuver speeds.

If the airplane weight decreases below 154,221 kilograms during takeoff or landing, flap maneuver speeds can increase. Follow the higher flap maneuver speeds.

During nose high attitudes, the FUEL PUMP L/R FWD EICAS messages can show.

Takeoff

Do the normal takeoff procedure with the following considerations:

- Use the lowest reduced thrust and the largest flap setting possible
- Use a rolling takeoff
- Use derated climb thrust
- Do not use FMC calculated speeds below 340,000 pounds. FMC speeds are either incorrect or not available.
- Do not use FMC calculated speeds below 154,221 kilograms. FMC speeds are either incorrect or not available.

Landing

Do the normal landing procedure with the following considerations:

- The airplane has a tendency to float
- Approach reference speeds for Flaps 20, 25, and 30 will be the same
- Pitch attitude is lower than normal. Flaps 25 is recommended to increase the pitch attitude
- Use autothrottles, if available
- Use VREF + 5 for landing. Do not use wind additives.

VREF

Use the VREF speeds in the following table for landing.

Go Around and Missed Approach

Do not overpitch the airplane when initiating a go-around.

Full rated go-around thrust is not recommended.

Administrative Information

This bulletin replaces bulletin TBC-141 dated December 5, 2014. Discard TBC-141. Revise the Bulletin Record to show TBC-141 "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-141 R1 as "In Effect" (IE) .

This bulletin will remain in effect until the FMC software is updated, the QRH Performance Inflight section is updated and a Supplementary Procedure is added to the FCOM.

This bulletin will be cancelled after the FCOM and QRH are updated, and Boeing is notified all 777 freighter airplane FMC's have been updated by Boeing Service Bulletin 777-22-0036 or Boeing Service Bulletin 777-22-0037.

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



Number: TBC-142 R2

IssueDate: March 21, 2019

Airplane Effectivity: 777-200 - 777-200LR, 777F

Subject: Uncommanded Autothrottle Movement on the Ground.

Reason: To inform flight crews of an autothrottle advancement during ground operations.

Revised to add corrective 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 reports of uncommanded autothrottle advancement during ground operations. The majority of reports have occurred during taxi. In one report, the autothrottles advanced after landing before speedbrakes were retracted.

During investigation, it was determined these events were most likely caused by a short between grounding wires to the TO/GA switches. When this occurs, the aircraft senses the TO/GA switches have been pushed, the autothrottles activate in THR REF mode, and the thrust levers advance to set takeoff thrust.

The system will be revised to rewire the TO/GA switches, preventing uncommanded autothrottle movement on the ground.

Operating Instructions

Boeing recommends the pilot flying keeps a hand on the thrust levers as much as possible during ground operations. This action will allow the pilot to monitor the movement of thrust levers and prevent thrust from advancing during an uncommanded autothrottle advancement.

If there is uncommanded autothrottle movement, retard the thrust levers and disconnect the autothrottle.

On takeoff, the autothrottles will advance normally when the TO/GA switches are pushed.

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-142 R2 as "In Effect" (IE) .

This bulletin will remain in effect until the grounding for the TOGA switches is modified. This anomaly is corrected with service bulletin 777-22-0038. This bulletin will be cancelled when Boeing is notified that the applicable service bulletin has been incorporated into the customer's fleet.

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-143 R2

IssueDate: February 10, 2020

Airplane Effectivity: 777F

Subject: B777F - CARGO HEAT BULK EICAS Advisory Message

Reason: To inform flight crew of possible CARGO HEAT BULK nuisance message

Revised to include 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

A 777F experienced a CARGO HEAT BULK EICAS message which was accompanied with an ECS CARD R Status message. The 777F does not have bulk cargo compartment heat and a CARGO HEAT BULK EICAS message is only applicable to 777 passenger airplanes.

If there is a fault in the Right Environmental Control system Miscellaneous Card (ECSMC) then a corresponding CARGO HEAT BULK EICAS message will display. If this occurs, no additional crew procedures are required.

Operating Instructions

If a CARGO HEAT BULK message is shown on a 777F before dispatch, the appropriate DDG and maintenance procedures should be followed. If this message occurs after dispatch, the message may be regarded as nuisance.

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-143 R2 as "In Effect" (IE) .

This anomaly addressed in this bulletin will be corrected by AIMS-2 BP V17B. This condition is corrected by Service Bulletin 777-31-0294 or equivalent. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet are modified with Service Bulletin 777-31-0294 or equivalent.

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-144 R3

IssueDate: February 10, 2020

Airplane Effectivity: All 777 Airplanes After LN 1288 Equipped With Any of These Transponders: Honeywell 066-01127-1602, ACSS 7517800-11009, or Rockwell 822-1338-005

Subject: Transient TRANSPONDER EICAS advisory message when arming APP on the MCP

Reason: To inform flight crews that when arming APP on the MCP, a transient TRANSPONDER L and TCAS OFF message may show.

Revised to include Service Bulletin information for AIMS-2 BP V17B.

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 Boeing flight testing, the EICAS messages TRANSPONDER L and TCAS OFF momentarily showed when the approach mode was armed. The messages were displayed for approximately 2 seconds and then blanked. Investigation into the root cause is in process at Boeing. Possible causes are being looked at including power transients during electrical isolation switching or software timing issues. Actual system failures continue to annunciate properly.

Operating Instructions

The subject condition is considered a transient. If actual system failures occur, the EICAS message stays shown.

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-144 R3 as "In Effect" (IE) .

The anomaly addressed in this bulletin will be corrected by AIMS-2 BP V17B. This condition is corrected by Service Bulletin 777-31-0294 or equivalent. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet are modified with Service Bulletin 777-31-0294 or equivalent.

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-145 R2

IssueDate: June 16, 2017

Airplane Effectivity: 777-200 - 777-300, 777F

Subject: Route Full Condition

Reason: To inform flight crew of an FMC issue if greater than 150 waypoints are loaded.

Revised to add 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 777 FMC has a limit of 150 waypoints that may be loaded into a route. If a flight crew attempts to insert more than 150 waypoints into the FMC, a scratchpad message ROUTE FULL will show and it is not possible to load additional waypoints. If a flight plan with more than 150 waypoints is uplinked to the FMC, only the first 150 waypoints will be loaded followed by the FMC scratchpad message ROUTE FULL.

When the ROUTE FULL message is displayed and the loaded route contains a route discontinuity, it is possible to load additional waypoints beyond the system limit. The total number of flight legs can exceed 150 and the legs will overflow onto a 31st LEGS page. This may result in an FMC reset when the airplane sequences the next active waypoint and may deactivate or delete the route.

Operating Instructions

During all phases of flight, flight crew should ensure a maximum of 30 LEGS pages. If 30 LEGS pages are exceeded and the flight plan becomes inactive, the waypoints will be retained. Delete excess waypoints for a maximum of 30 LEGS pages and then the flight plan should be reactivated and executed. If the flight plan and performance data are deleted then all entries will need to be reloaded with a maximum of 30 LEGS pages.

Administrative Information

This bulletin replaces bulletin TBC-145 R1 dated February 19, 2016. Discard TBC-145 R1. Revise the Bulletin Record to show TBC-145 R1 "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-145 R2 as "In Effect" (IE) .

This condition is corrected by Service Bulletin 777-31-0218 which installs the AIMS-2 Blockpoint V17A software update. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet are modified with Service Bulletin 777-31-0218.

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-147 R2

IssueDate: February 10, 2020

Airplane Effectivity: 777-200 - 777-300, 777F

Subject: VNAV Descent on Approach Without a Valid Descent Path

Reason: To inform flight crews of a possible VNAV descent without a valid descent path when flying an approach.

Revised Airplane Effectivity and updated 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 a VNAV descent on a non-precision approach without a VNAV path after being vectored by ATC. The sequence of events leading up to the event were as follows:

1. The flight crew was vectored on a course parallel to the final approach course without intercepting the final approach course. The airplane flew abeam the runway without descending.
2. The airplane was close enough to the original final approach course that the FMC sequenced waypoints up to and including the Missed Approach Point (MAP) waypoint.
3. When the FMC sequenced the MAP, the VNAV page title changed from ACT XXXKT DES to ACT END OF DES removing the previous VNAV approach path.
4. The first missed approach waypoint then became the active waypoint on the legs page.

5. Then, ATC vectored the airplane for the same non-precision approach for a second time without the flight crew executing a go-around.

(In order to allow VNAV to transition from the approach phase to the missed approach phase, one of the following must occur; pushing either TO/GA switch, or climbing at a rate greater than 600 feet per minute.)

6. The flight crew re-selected and executed the same approach via a DIR/INTC to the Final Approach Fix (FAF). VNAV was selected and VNAV PTH was shown on the FMA. After the FAF was sequenced, VNAV mode changed to VNAV SPD and the airplane began a descent to the MAP even though no valid VNAV path existed.

In summary, if a missed approach is flown, and the airplane has not transitioned from the approach phase to the missed approach phase, subsequent approach selection and engagement of VNAV can result in a descent in VNAV SPD without a valid descent path.

Operating Instructions

In order to avoid the FMC VNAV transitioning to ACT END OF DES mode, do one of the following:

- Push either TO/GA switch for go-around, or
- Climb at a rate greater than 600 fpm, or
- After the MAP is sequenced, enter a cruise altitude on the VNAV CRZ page before selecting another approach

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-147 R2 as "In Effect" (IE) .

The anomaly addressed in this bulletin will be corrected by AIMS-2 BP V17B. This condition is corrected by Service Bulletin 777-31-0294 or equivalent. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet are modified with Service Bulletin 777-31-0294 or equivalent.

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-150

IssueDate: December 18, 2017

Airplane Effectivity: All Airplanes

Subject: Automatic Re-Boot of Electronic Flight Bag (EFB)

Reason: To inform flight crews that the First Officer's EFB system may re-boot when extending or raising the landing gear.

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 BP02 Electronic Flight Bag (EFB) system, has a known anomaly on the First Officer (FO) side installation which causes the entire FO EFB system to automatically re-boot during most gear extension and retraction cycles. This is caused by vibrations from the nose gear retraction and extension. The system normally re-boots successfully (approximately 3 mins), after which the EFB system may be used normally. For this condition, there is no need to record this anomaly in the Airplane Maintenance Log. No known issues have been identified with the Captain's side installations.

Operating Instructions

If the First Officer EFB system re-boots successfully during landing gear extension or retraction, no crew action is required. If the system does not regain normal operation automatically, an Airplane Maintenance Log entry should be made.

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-150 as "In Effect" (IE) .

This condition is corrected with the installation of Boeing Service Bulletin SB 777-46-0005. This bulletin will be cancelled when all affected airplanes in the customer fleet are modified.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 777 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-151

IssueDate: January 10, 2018

Airplane Effectivity: 777-200 - 777-200LR, 777F

Subject: Conflict with Duplicate Waypoints with the Same Identifier in the Navigation Database

Reason: To inform flight crews that two different waypoints with the same identifier cannot be entered into the route at the same time.

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

Airline operators have reported the FMC will not allow flight crews to enter two geographically different waypoints with the same identifier into the route. Once a waypoint identifier is in the route, the FMC recognizes a second entry of the same waypoint identifier as the same waypoint that was first entered and will not allow entry of the second waypoint. The following illustrates this issue:

The active route legs are: SEA - CTB - DIK - FAR - MSP. The flight crew would like to enter CTB (LAT/LON N 40 30.0 W 112 29.8) into the route after FAR waypoint. The CTB waypoint currently displayed on Line 2L is at LAT/LON N 48 33.6 W 122 20.6. If the crew manually enters CTB into the scratchpad and line selects it into Line 5L, the FMC recognize it as the same latitude and longitude as the CTB in 2L. This will result in the route: SEA - CTB - DIK - FAR - CTB - MSP, where the two CTB fixes are the same LAT/LON.

Operating Instructions

When entering two waypoints in the flight plan with the same identifier, enter the LAT/LON for the second waypoint in the flight plan instead of the waypoint identifier. After the first waypoint is sequenced, delete the LAT/LON entry and enter the duplicate identifier at the appropriate place in the flight plan by typing the name of the desired waypoint into the scratchpad and line selecting it into the desired location. Replacing the LAT/LON is not required; however, replacing the LAT/LON enables the use of the waypoint identifier for navaid updating.

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-151 as "In Effect" (IE) .

This is corrected in AIMS upgrade BP V16. For AIMS-1 hardware, the Service Bulletin is SB 777-31-0191. For AIMS-2 hardware, the Service Bulletin is SB 777-31-0190. This bulletin will be cancelled when Boeing is notified that the applicable service bulletin(s) have been incorporated into the customer's fleet.

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-153 R2

IssueDate: June 25, 2018

Airplane Effectivity: 777-200LR - 777-300ER

Subject: Collins Multiscan Weather Radar Display Anomaly

Reason: To provide flight crews with recommended actions for display of distant weather radar returns.

Updated Service Bulletin information in 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

An operator recently reported the new Collins Multiscan weather radar system operated in auto mode may not adequately display weather radar returns at range selections of 80 nm and beyond over oceanic regions. Operation in manual mode at increased gain was necessary to adequately display distant weather returns.

Operating Instructions

Over oceanic regions, operate the weather radar system in manual mode and adjust gain as required to evaluate weather returns.

Administrative Information

This bulletin replaces bulletin TBC-153 R1 dated June 15, 2018. Discard TBC-153 R1. Revise the Bulletin Record to show TBC-153 R1 “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-153 R2 as "In Effect" (IE) .

This Flight Crew Operations Manual Bulletin will be cancelled after Boeing has been notified all affected airplanes in your fleet have been modified by Rockwell Collins Service Bulletin 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



Number: TBC-154

IssueDate: January 23, 2019

Airplane Effectivity: 777-200 - 777-200LR, 777F

Subject: Setting STEP Size to Zero When No Further Step Climbs Are Planned.

Reason: Inaccurate FMC FUEL and ETA predictions.

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

Fuel and ETA predictions assume the airplane climbs at each predicted optimum step climb point as airplane weight decreases. FMC-predicted step climb increments are based on the default STEP size shown on the VNAV CRZ page. Entering a STEP size of zero causes the FMC to assume a constant altitude cruise.

Operating Instructions

When required to cruise at an altitude below optimum due to air traffic, atmospheric conditions, or non-normal procedures, and no further step climbs are planned, set the STEP (L4) size to zero on the ACT ECON CRZ page. This ensures best available FMC FUEL and ETA predictions.

Administrative Information

Insert this bulletin behind the Operations Manual Bulletin Record page in Volume 1 of your Operations Manual. Amend the Operations Manual Bulletin Record to show bulletin TBC-154 "In Effect" (IE).

This bulletin will be cancelled when Boeing is notified that all airplanes in the customer fleet have the following Service Bulletin (or equivalent):

- AIMS 1 BP V16: 777-31-0191
- AIMS-2 BP V17.1: 777-31-0227

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-156 R1

IssueDate: July 15, 2020

Airplane Effectivity: All Airplanes

Subject: Erroneous Autopilot Flight Director System (AFDS) Guidance when Instrument Landing System (ILS) Signal Interference Occurs

Reason: To inform flight crews about erroneous AFDS guidance during ILS approaches

This revision adds a warning and adds information on monitoring the approach and stabilized approach criteria.

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 is being distributed to operators of 747-400, 747-8, 757, 767, 777, and 787 airplanes.

Boeing has received several reports of unexpected pitch guidance when capturing or tracking the glideslope during an instrument landing system (ILS) approach. In each event for which data was provided, Boeing has determined that glideslope signal interference occurred at the time of the unexpected pitch guidance and, in most of these events, the unexpected pitch guidance occurred during glideslope capture. ILS signal interference can occur when vehicles, aircraft, or other factors affect the localizer or glideslope signal.

This bulletin describes the autopilot flight director system (AFDS) operation during periods of ILS signal degradation or instability, including false glideslope signals, and the possible flight deck effects during such an event.

The AFDS can detect the degradation or instability of radio signals that support specific autopilot modes. When the AFDS detects a degraded or unstable signal during an ILS approach with the autopilot engaged, the affected AFDS mode changes to an attitude stabilizing mode based on inertial data at the time of the signal degradation or instability. The purpose of the attitude stabilizing mode is to prevent large and abrupt pitch and roll changes during short periods of localizer or glideslope signal interference. When the localizer or glideslope signal stabilizes and the airplane is within parameters for capture, the AFDS returns to tracking the localizer or glideslope. Alternatively, if the localizer or glideslope signal does not stabilize or the airplane is not within parameters for capture, the attitude stabilizing mode remains active. In this case, the AFDS continues to provide guidance in the attitude stabilizing mode, *with possible high rates of descent and significant deviation from the localizer or glideslope*.

There is no direct indication to the pilot that the attitude stabilizing mode is active if the airplane is above 200 feet radio altitude and either:

- the localizer attitude stabilizing mode is active for less than 20 seconds or
- the glideslope attitude stabilizing mode is active for less than 15 seconds

If the airplane is above 200 feet radio altitude and the attitude stabilizing mode remains active for 20 seconds or more (for localizer) or 15 seconds or more (for glideslope):

- the AUTOPILOT message shows (if autopilot is engaged) and
- the flight director roll or pitch bar is removed (if flight director is on) and
- an amber line shows through the affected flight mode annunciation (FMA) (if autopilot is engaged)

Figure 1 shows the indications on a typical airplane model after an extended time in the attitude stabilizing mode.

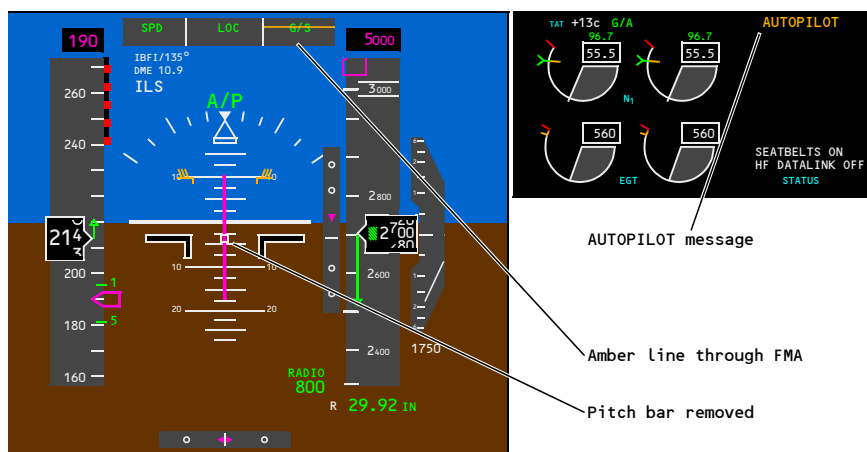


Figure 1 - Indications Following Extended Time in Attitude Stabilizing Mode on a Typical Airplane Model

Similarly, there is no indication to the pilot that the attitude stabilizing mode is active if the attitude stabilizing mode remains active for less than 4 seconds while the airplane is at or below 200 feet radio altitude. If the airplane is at or below 200 feet radio altitude and the attitude stabilizing mode remains active for 4 seconds or more, the indications in Figure 1 show.

When these indications show, if the pilot manually disconnects the autopilot, the AUTOPILOT message blanks, the flight director roll and pitch bars show, and the amber line through the affected FMA blanks. ***However, if G/S is the pitch mode and the airplane is not within the parameters for glideslope capture, the flight director pitch bar continues to provide guidance to the attitude stabilizing mode and not to the glideslope signal. This can lead to high rates of descent and significant deviation from the ILS glideslope. Pilot intervention is needed to return the airplane to the glideslope or to perform a go-around/missed approach.*** If the AFDS is in the attitude stabilizing mode and the pilot manually disconnects the autopilot before the indications in Figure 1 show, the same condition can occur and the same pilot intervention is needed.

Note that the autoland status annunciations such as LAND 2 or LAND 3 do not indicate proper AFDS localizer and glideslope tracking. These refer to the autopilot system level of redundancy only. A green LAND 2 or LAND 3 can be shown when the localizer or the glideslope signals are unreliable or the localizer or glideslope indication is at full deflection.

All of the reports Boeing has received regarding this issue have been for unexpected pitch guidance during glideslope capture or tracking. The AFDS manages localizer capture and tracking differently from glideslope capture and tracking. Boeing has not received similar reports of unexpected guidance during localizer capture and tracking.

Operating Instructions

While on an ILS approach, monitor localizer and glideslope raw data and call out any significant deviations. Perform an immediate go-around if not within the criteria to continue the approach.

It is essential to crosscheck altitude at the FAF and monitor pitch attitude and descent rate throughout the approach.

If a glideslope anomaly is suspected, an abnormal altitude range-distance relationship may exist. This can be identified by crosschecking distance to the runway with altitude or crosschecking the airplane position with waypoints indicated on the navigation display. The altitude should be approximately 300 feet height above touchdown per NM of distance to the runway for a 3° glideslope.

Landing Procedure - ILS

The following warning is being added to the Landing Procedure - ILS Normal Procedure to direct a go-around when presented with the indications of anomalous guidance described above:

WARNING: Interference with the glideslope signal can result in erroneous AFDS pitch guidance indicated by FMA mode degradation, the AUTOPILOT caution message, and removal of the F/D pitch bar. If this occurs, do a go-around unless suitable visual references can be established and maintained.

When equipped with an integrated cue, “pitch bar” is replaced by “flight director bar”.

Stabilized Approach

FCTM, section 5 discusses stabilized approach criteria. All approaches should be stabilized by 1,000 feet AFE in instrument meteorological conditions (IMC) and by 500 feet AFE in visual meteorological conditions (VMC). To promote early detection of anomalous glideslope guidance, crews should attempt to meet stabilized approach criteria as soon as possible after glideslope intercept with emphasis on the following items:

- the airplane is on the correct flight path
- sink rate is no greater than 1,000 fpm; if an approach requires a sink rate greater than 1,000 fpm, a special briefing should be conducted
- thrust setting is appropriate for the airplane configuration
- ILS approaches should be flown within one dot of the glide slope and localizer, or within the expanded localizer scale.

Mandatory Missed Approach

FCTM, section 5 discusses mandatory missed approach situations. For ILS approaches where suitable visual reference has not been established and maintained, execute an immediate missed approach when:

- a navigation radio or flight instrument failure occurs which affects the ability to safely complete the approach
- the navigation instruments show significant disagreement
- on ILS final approach and either the localizer or the glideslope indicator shows full deflection

Additionally, accomplish the appropriate maneuver in response to all GPWS alerts. Note that the GPWS “GLIDESLOPE” caution alert is not active until the airplane passes below 1000 feet.

Administrative Information

This bulletin replaces bulletin TBC-156 dated October 18, 2019. Discard TBC-156. Revise the Bulletin Record to show TBC-156 “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-156 R1 as "In Effect" (IE) .

This bulletin will be incorporated into the Flight Crew Operations Manual or Flight Crew Training Manual in future revisions.

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



Number: TBC-157 R1

IssueDate: January 15, 2021

Airplane Effectivity: 777-300ER

Subject: Potential for Loading an Incorrect Air Traffic Control (ATC) Uplink Clearance into the Flight Management Computer (FMC)

Reason: To inform flight crews about the potential for an incorrect ATC uplink clearance to be loaded into the FMC

Revised to include 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 777 AIMS Multi-Function Display (MFD) Communications Function is capable of receiving ATC uplink clearance messages with data for loading into the Flight Management Computer (FMC). When an ATC uplink message is received, the flight crew normally reviews the ATC uplink message by selecting the MFD NEW MESSAGES page and, if the ATC uplink message contains data for loading into the FMC, the flight crew has the option to select the “LOAD FMC” command key. Selecting the “LOAD FMC” command key normally transfers the correct data from the ATC uplink message to the FMC and creates an FMC modification.

Incorrect ATC uplink message data can be loaded into the FMC as a result of an anomaly introduced when software changes were made in AIMS-2 BP V17B. This anomaly only has the potential to occur when the following two conditions are met:

- An FMC modification is active when an ATC uplink message is received by the MFD Communications Function, and
- The FMC modification is still active when the ATC uplink message is selected or shown on the MFD NEW MESSAGES page.

If these conditions are met, subsequently selecting the “LOAD FMC” command key for that specific ATC uplink message results in incorrect data transfer to the FMC. The incorrect data transferred is an old uplink that can be from a previous flight. Other ATC uplink messages can be loaded into the FMC if the conditions resulting in the anomaly were not true for that specific ATC uplink message.

This anomaly does not exist for the following conditions:

- An FMC modification was not active when the ATC uplink message was received by the Communications Management Function, or
- Executing or erasing the FMC modification that was active at the time the ATC uplink message was received before selecting or showing the ATC uplink message on any MFD NEW MESSAGES page.

Operating Instructions

Accept or erase the FMC modification that was active when the ATC uplink message was received prior to selecting or showing the ATC uplink message on the MFD NEW MESSAGES page. This results in correct data transfer when selecting the “LOAD FMC” command key.

REJECT the clearance and use alternate means to communicate with ATC if an ATC uplink message was received and the ATC uplink message was selected or shown on the MFD NEW MESSAGES page at the same time an FMC modification existed.

Administrative Information

This bulletin replaces bulletin TBC-157 dated March 18, 2020. Discard TBC-157. Revise the Bulletin Record to show TBC-157 “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-157 R1 as "In Effect" (IE) .

This condition is corrected by Service Bulletin 777-31A0342 or equivalent which installs the AIMS-2 Blockpoint V17C software update. This bulletin will be cancelled when Boeing is notified that all affected airplanes in the customer fleet are modified with Service Bulletin 777-31A0342.

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



Number: TBC-158 R1

IssueDate: January 15, 2021

Airplane Effectivity: All Airplanes

Subject: Autothrottle Fails to Disconnect during Balked Landing

Reason: To inform flight crews that the autothrottle can fail to disconnect when thrust levers are advanced during a balked landing.

Updated corrective action in 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

Boeing has found that an autothrottle software anomaly was introduced with Airplane Information Management System (AIMS) V17B software which disables one element of the automatic autothrottle disconnect logic. In this anomaly, the autothrottle stays connected in the IDLE mode when the pilot advances the thrust levers to conduct a balked landing (a go-around initiated after touchdown but before thrust reverser selection). Once airborne, the autothrottle remains in IDLE and moves the thrust levers to idle. This causes a reduction in airspeed and possible stick shaker activation.

The autothrottle system can be disconnected manually by pushing either autothrottle disconnect switch, except during conditions that cause the autothrottle to automatically activate. The autothrottle can also be disconnected manually by positioning both A/T ARM switches to OFF. Positioning both A/T ARM switches to OFF prevents activation of all autothrottle modes.

Autothrottle disconnect occurs automatically:

- If a fault in the active autothrottle mode is detected, or
- When either reverse thrust lever is raised to reverse idle, or
- If the thrust levers are overridden during a manual landing, after the autothrottle has begun to retard the thrust levers to idle, or
- When both engines are shut down, or
- When one engine is shut down and EEC parameters are invalid or missing

When the autothrottle is connected during a manual landing, manually advancing the thrust levers after the autothrottle has transitioned to IDLE mode is designed to disconnect the autothrottle system. This is different from an autoland in the same conditions where the autothrottle remains connected in the IDLE mode unless the pilot disconnects the autopilot. In the case of an autoland, both the autopilot and autothrottle are designed to continue with the landing and rollout.

The anomaly that was introduced in AIMS V17B prevents the automatic autothrottle disconnect when the thrust levers are advanced during a manually flown bailed landing. This can cause a reduction of thrust after the airplane becomes airborne.

As described in the FCOM, when landing, the TO/GA switches are inhibited on the ground after landing. If the TO/GA switch is pushed while airborne (above 5 feet radio altitude), the TO/GA mode connects the autothrottle in the thrust mode (THR) and the thrust levers advance to provide a climb rate of at least 2,000 FPM, or go-around thrust, whichever occurs first. A second push of the TO/GA switch changes the autothrottle to the thrust reference mode (THR REF) and provides full go-around thrust.

This bulletin describes a single set of operating instructions that apply to bailed landings for both autolands and manual landings. This anomaly will be corrected in a future AIMS software update, however, these instructions are applicable for all software versions and will be retained even after the software anomaly has been addressed to ensure the thrust levers are not inadvertently moved to idle by the autothrottle system.

Operating Instructions

If a go-around is initiated after touchdown but before thrust reverser selection (balked landing):

- Disengage the autopilot and disconnect the autothrottle, while smoothly advancing the thrust levers to go-around thrust (the configuration warning siren sounds due to the landing flap configuration).
- Verify the speedbrakes retract and autobrakes disarm.
- Maintain landing flap configuration and smoothly rotate towards 15° go-around pitch attitude at no less than VREF.
- Once airborne, push the TO/GA switch. This will activate the F/D go-around mode and re-engage the autothrottle in the THR mode.
- When safely airborne with a positive rate of climb, continue the Go-Around and Missed Approach procedures as described in the FCOM/QRH.

Administrative Information

This bulletin replaces bulletin TBC-158 dated March 24, 2020. Discard TBC-158. Revise the Bulletin Record to show TBC-158 “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-158 R1 as "In Effect" (IE) .

The Operating Instructions in this bulletin have been incorporated in the Flight Crew Training Manual (FCTM). This bulletin will be cancelled in the December 15, 2021 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.

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**Limitations
Table of Contents****Chapter L
Section TOC**

Limitations and Operational Information	L.10
General	L.10.1
Airplane General	L.10.2
AFM Limitations	L.10.2
Door Mounted Power Assists and Escape Slides	L.10.2
Flight Deck Security Door	L.10.3
Lower Crew Rest Compartment	L.10.3
AFM Operational Information	L.10.3
Severe Turbulent Air Penetration Speed	L.10.3
Non-AFM Operational Information	L.10.3
RVSM Operations	L.10.3
Weight Limitations	L.10.4
AFM Limitations	L.10.4
Maximum Taxi Weight	L.10.4
Maximum Takeoff Weight	L.10.4
Maximum Landing Weight	L.10.5
Maximum Zero Fuel Weight	L.10.6
Autoflight	L.10.7
AFM Limitations	L.10.7
Autopilot/Flight Director System	L.10.7
Automatic Landing	L.10.7
Non-AFM Operational Information	L.10.7
Communications	L.10.8
AFM Limitations	L.10.8
Non-AFM Operational Information	L.10.8
Engines	L.10.8
AFM Limitations	L.10.8
Engine Limit Display Markings	L.10.8
Engine Oil System	L.10.8
Engine Fuel System	L.10.8
Reverse Thrust	L.10.8

Non-AFM Operational Information	L.10.9
APU	L.10.9
Flight Controls	L.10.9
AFM Limitations.....	L.10.9
Flap Operation	L.10.9
Flight Instruments, Displays.....	L.10.9
AFM Limitations.....	L.10.9
Electronic Flight Bag (EFB).....	L.10.9
AFM Operational Information	L.10.9
Ground Maneuver Camera System	L.10.9
Flight Management, Navigation.....	L.10.10
AFM Limitations.....	L.10.10
ADIRU.....	L.10.10
Fuel System	L.10.10
AFM Limitations.....	L.10.10
Fuel System - Loading.....	L.10.10
Warning Systems	L.10.10
AFM Limitations.....	L.10.10
GPWS - Look-Ahead Terrain Alerting	L.10.10
TCAS	L.10.11
Non-AFM Operational Information	L.10.11
Runway Awareness and Advisory System (RAAS)	L.10.11

Limitations**Chapter L****Limitations and Operational Information****Section 10****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 can not assure timely compliance, e.g., severe turbulence penetration speeds. 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.

Note: Limitations and operational information referring to airplane options and configuration differences are shown in [brackets]. These items are applicable to the –TBC operations manual only, and do not appear in customer Operations Manuals.

Airplane General

AFM Limitations

Runway slope	+/- 2%
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[Takeoff and Landing Tailwind Component - 10 knots basic.]

# Maximum Takeoff and Landing Tailwind Component	10 knots
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[Takeoff and Landing Tailwind Component - 15 knots option.]

# Maximum Takeoff and Landing Tailwind Component	15 knots
--	----------

Maximum Operating Altitude	43,100 feet pressure altitude
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[Maximum Takeoff and Landing Altitude - 8,400 feet basic.]

Maximum Takeoff and Landing Altitude	8,400 feet pressure altitude
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[Maximum Takeoff and Landing Altitude - 9,800 feet option.]

Maximum Takeoff and Landing Altitude	9,800 feet pressure altitude
--------------------------------------	------------------------------

Note: The capability of the airplane has been satisfactorily demonstrated for takeoff and landings with tailwinds up to 15 knots. This does not constitute operational approval to conduct takeoffs and landings with tailwind components in excess of 10 knots.

Note: The maximum field elevation is limited to 9,650 feet.

Door Mounted Power Assists and Escape Slides

[Option – Door Marker ARMED/DISARMED]

Main door emergency power assists and evacuation slide systems must be armed with the mode select handle in the ARMED position prior to taxi, takeoff and landing whenever passengers are carried.

Main door emergency power assists and evacuation slide systems must be armed with the mode select handle in the ARMED position prior to taxi, takeoff and landing whenever supernumeraries are carried.

[Option – Door Marked AUTO/MANUAL]

Main door emergency power assists and evacuation slide systems must be armed with the mode select handle in the AUTOMATIC position prior to taxi, takeoff and landing whenever passengers are carried.

Main door emergency power assists and evacuation slide systems must be armed with the mode select handle in the AUTOMATIC position prior to taxi, takeoff and landing whenever supernumeraries are carried.

[Option – Door Marked FLIGHT/PARK]

Main door emergency power assists and evacuation slide systems must be armed with the mode select handle in the FLIGHT position prior to taxi, takeoff and landing whenever passengers are carried.

Main door emergency power assists and evacuation slide systems must be armed with the mode select handle in the FLIGHT position prior to taxi, takeoff and landing whenever supernumeraries are carried.

Flight Deck Security Door

[Passenger]

Verify that an operational check of the Flight Deck Access System has been accomplished according to approved procedures once each flight day.

Lower Crew Rest Compartment

[Option]

The lower crew rest compartment may not be occupied, and the main entry hatch must be closed during taxi, takeoff, or landing.

AFM Operational Information

The maximum demonstrated takeoff and landing crosswind is 38 knots.

Severe Turbulent Air Penetration Speed

Severe turbulent air penetration speed (in severe turbulence) is defined as: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above. Maintain a minimum speed of 15 knots above the minimum maneuvering speed at all altitudes when airspeed is below 0.82 Mach.

Non-AFM Operational Information

Do not operate HF radios during refueling operations.

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.

RVSM Operations

Prior to takeoff the maximum allowable difference between Captain's or First Officer's altitude display and field elevation is 75 feet.

The standby altimeter does not meet altimeter accuracy requirements of RVSM airspace.

Note: The maximum weight limitations can be further limited as referenced in the WEIGHT LIMITATIONS section of the CERTIFICATE LIMITATIONS chapter of the AFM.

Maximum Taxi Weight

547,000 Pounds 248,115 Kilograms

652,000 Pounds 295,742 Kilograms

768,000 Pounds 348,358 Kilograms

768,800 Pounds 348,721 Kilograms

662,000 Pounds 300,278 Kilograms

777,000 Pounds 352,441 Kilograms

545,000 Pounds 247,208 Kilograms

Maximum Takeoff Weight

[777-200ER]

650,000 Pounds	294,835 Kilograms
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[777-200LR]

766,000 Pounds	347,451 Kilograms
----------------	-------------------

[777F]

766,800 Pounds	347,814 Kilograms
----------------	-------------------

[777-300]

660,000 Pounds	299,371 Kilograms
----------------	-------------------

[777-300ER]

775,000 Pounds	351,534 Kilograms
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Maximum Landing Weight

[777-200]

445,000 Pounds	201,849 Kilograms
----------------	-------------------

[777-200ER]

470,000 Pounds	213,188 Kilograms
----------------	-------------------

[777-200LR]

492,000 Pounds	223,167 Kilograms
----------------	-------------------

[777F]

575,000 Pounds	260,815 Kilograms
----------------	-------------------

Maximum Landing Weight

[777-300]

524,000 Pounds

237,682 Kilograms

[777-300ER]

554,000 Pounds

251,290 Kilograms

Maximum Zero Fuel Weight

[777-200]

420,000 Pounds

190,509 Kilograms

[777-200ER]

440,000 Pounds

199,581 Kilograms

[777-200LR]

461,000 Pounds

209,106 Kilograms

[777F]

547,000 Pounds

248,115 Kilograms

[777-300]

495,000 Pounds

224,528 Kilograms

[777-300ER]

529,000 Pounds

239,950 Kilograms

Autoflight

AFM Limitations

Autopilot/Flight Director System

[Option - Passenger airplanes with high altitude takeoff/landing capability]

Do not use the autopilot below 100 feet radio altitude at airport field elevations above 8,400 feet.

Do not use the autopilot below 100 feet radio altitude at airport field elevations above 8,500 feet.

The autopilot must not be engaged below a minimum engage altitude of 200 feet AGL after takeoff.

Without LAND 2 or LAND 3 annunciated, the autopilot must be disengaged below 200 feet AGL.

Automatic Landing

When landing weather minima are predicated on autoland operations the following limits apply:

[Autoland tailwind limitation - 10 knots basic, 15 knots option]

Maximum Allowable Wind Speeds	
# Headwind	25 knots
# Tailwind	10 knots
# Tailwind	15 knots
# Crosswind	25 knots

The maximum glideslope angle is 3.25 degrees.

The minimum glideslope angle is 2.5 degrees.

Automatic landings can be made using flaps 20 or 30, with both engines operative or one engine inoperative. The autopilot flight director system (AFDS) autoland status annunciation must display LAND 2 or LAND 3.

Non-AFM Operational Information

Do not use FLCH on final approach below 1,000 feet AFE.

Communications

AFM Limitations

Non-AFM Operational Information

Engines

AFM Limitations

Engine Limit Display Markings

Maximum and minimum limits are red.

Caution limits are amber.

Engine Oil System

[\[RR Engines\]](#)

Oil temperature must be greater than -40 degrees C for engine start and 50 degrees C before advancing thrust levers to takeoff power.

Engine Fuel System

The maximum tank fuel temperature is 49 degrees C.

[\[RR Engines\]](#)

After refueling and prior to takeoff, if fuel temperature is 0 degrees C or colder or if fuel temperature indication is inoperative, verify the approved fuel circulation procedure was performed.

Tank fuel temperature prior to takeoff must not be less than -40 degrees C or 3 degrees C above the fuel freezing point, whichever is higher. In-flight tank fuel temperature must be maintained at least 3 degrees C above the freezing point of the fuel being used. The use of Fuel System Icing Inhibitor additives does not change the minimum fuel tank temperature limit.

Reverse Thrust

Intentional selection of reverse thrust in flight is prohibited.

Backing the airplane with use of reverse thrust is prohibited.

[\[RR Engines\]](#)

After a rejected takeoff (RTO) is performed where thrust reversers were deployed, takeoff is prohibited until maintenance action is complete.

Non-AFM Operational Information

[\[GE90-115B, -115BL, or -110B engines\]](#)

For ground operation (exclusive of takeoff) in tailwinds and crosswinds between 30 and 45 knots, engine power should be limited to a maximum of 70% N1. Avoid thrust levels above that required for normal taxi operation in all tailwinds and crosswinds greater than 45 knots.

APU

The APU's starter motors duty cycle for the electric starter motor and air turbine starter is 3 starts attempts in a 60 minute period each.

APU start cycle restrictions are:

Between Starts	Electric Starter Motor wait:	Air Turbine Starter wait:
1 and 2	1 minute	1 minute
2 and 3	1 minute	1 minute

Flight Controls

AFM Limitations

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 V_A .

Flap Operation

The maximum altitude with flaps extended is 20,000 feet.

Flight Instruments, Displays

AFM Limitations

Electronic Flight Bag (EFB)

[\[Option\]](#)

The EFB portable keyboard and attaching cable must be stowed during takeoff and landing.

AFM Operational Information

Ground Maneuver Camera System

[\[777-300 and 777-300ER\]](#)

The ground maneuver cameras should not be used during takeoff, approach, and landing.

Flight Management, Navigation

AFM Limitations

ADIRU

ADIRU alignment must not be attempted at latitudes greater than 78 degrees, 14.75 minutes.

Fuel System

AFM Limitations

Main tanks must be scheduled to be full if center tank fuel is loaded.

[\[Basic – English Units\]](#)

Note: The center tank may contain up to 3000 pounds of fuel with less than full main tanks provided center tank fuel weight plus actual zero fuel weight does not exceed the maximum zero fuel weight, and center of gravity limits are observed.

[\[Option – Metric Units\]](#)

Note: The center tank may contain up to 1360 kilograms of fuel with less than full main tanks provided center tank fuel weight plus actual zero fuel weight does not exceed the maximum zero fuel weight, and center of gravity limits are observed.

Fuel System - Loading

If operating under the Alternate Method Of Compliance (AMOC) to AD 2016-11-03:

When center tank fuel is required for the mission, an additional 700 pounds (320 kilograms) of reserve fuel must be added to the center tank fuel load.

Warning Systems

AFM Limitations

GPWS - Look-Ahead Terrain Alerting

[\[Enhanced Ground Proximity Warning System with geometric altimetry. Geometric altimetry in the -212 EGPWC permits use of look-ahead terrain alerting during QFE operations\]](#)

Do not use the terrain display for navigation.

The use of look-ahead terrain alerting and terrain display functions is prohibited within 15 NM of takeoff, approach or landing at an airport or runway not contained in the GPWS terrain database. Refer to Honeywell Document 060-4267-000 for airports and runways contained in the installed GPWS database.

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TCAS

Pilots are authorized to deviate from their current ATC clearance to the extent necessary to comply with a TCAS II resolution advisory.

Non-AFM Operational Information

[\[Option – with Runway Awareness and Advisory System\]](#)

Runway Awareness and Advisory System (RAAS)

Do not use RAAS voice annunciations or alerts for navigation.

Do not use RAAS voice annunciations or alerts as a substitute for NOTAM or ATIS information.

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Normal Procedures**Chapter NP****Table of Contents****Section TOC**

Introduction	NP.11
General	NP.11.1
Normal Procedures Philosophy and Assumptions	NP.11.1
Configuration Check	NP.11.1
Crew Duties	NP.11.2
Control Display Unit (CDU) Procedures	NP.11.3
Autopilot Flight Director System (AFDS) Procedures	NP.11.3
Preflight and Postflight Scan Flow	NP.11.5
Areas of Responsibility - Captain as Pilot Flying or Taxiing	NP.11.7
Areas of Responsibility - First Officer as Pilot Flying or Taxiing	NP.11.8
Amplified Procedures	NP.21
Preliminary Preflight Procedure – Captain or First Officer	NP.21.1
CDU Preflight Procedure - Captain and First Officer	NP.21.3
Exterior Inspection	NP.21.5
Preflight Procedure – First Officer	NP.21.10
Preflight Procedure – Captain	NP.21.20
Before Start Procedure	NP.21.24
Pushback or Towing Procedure	NP.21.27
Engine Start Procedure	NP.21.27
Before Taxi Procedure	NP.21.28
Before Takeoff Procedure	NP.21.29
Takeoff Procedure	NP.21.30
Takeoff Flap Retraction Speed Schedule	NP.21.33
Climb and Cruise Procedure	NP.21.33

Normal Procedures**Chapter NP****Introduction****Section 11**

General

This chapter gives:

- 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 required, 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 required.

Configuration Check

It is the crew member's responsibility to verify correct system response. Before engine start, use lights or indications to verify each system's condition or configuration.

If there is an incorrect configuration or response:

- verify that the system controls are set correctly
- check the respective circuit breaker as required. Maintenance must first determine that it is safe to reset a tripped circuit breaker on the ground
- test the respective system light as required

Before engine start, review the EICAS alert messages and status display. If there are unexpected messages:

- 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, there is an alert message:

- do the respective non-normal checklist (NNC)
- on the ground, check the DDG or the operator equivalent

After engine start, EICAS alert messages are the primary means of alerting the flight crew to non-normal conditions or incorrect configurations.

After engine start, there is no need to check status messages. Any message that has an adverse affect on safe continuation of the flight appears as an EICAS alert message.

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 illustration 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:

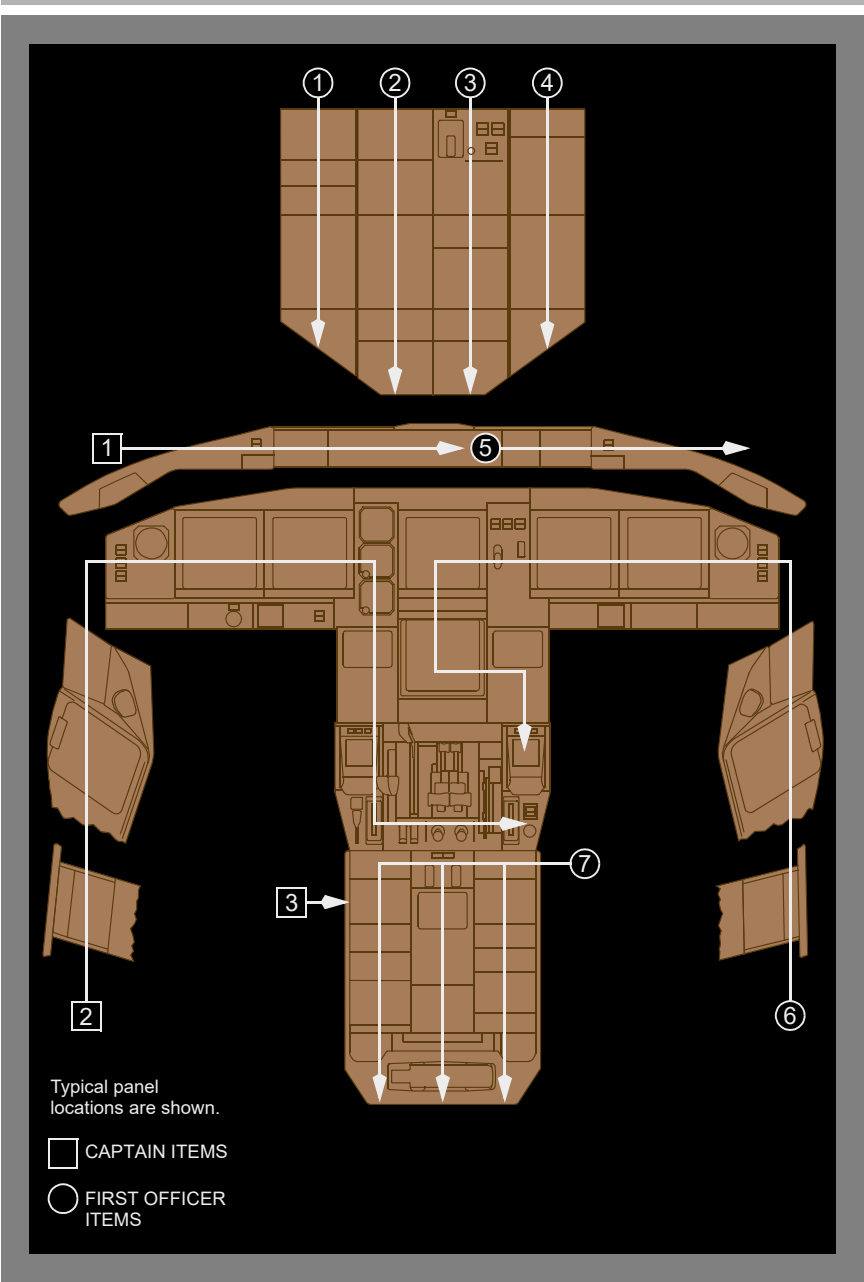
- course
- vertical path
- thrust
- speed

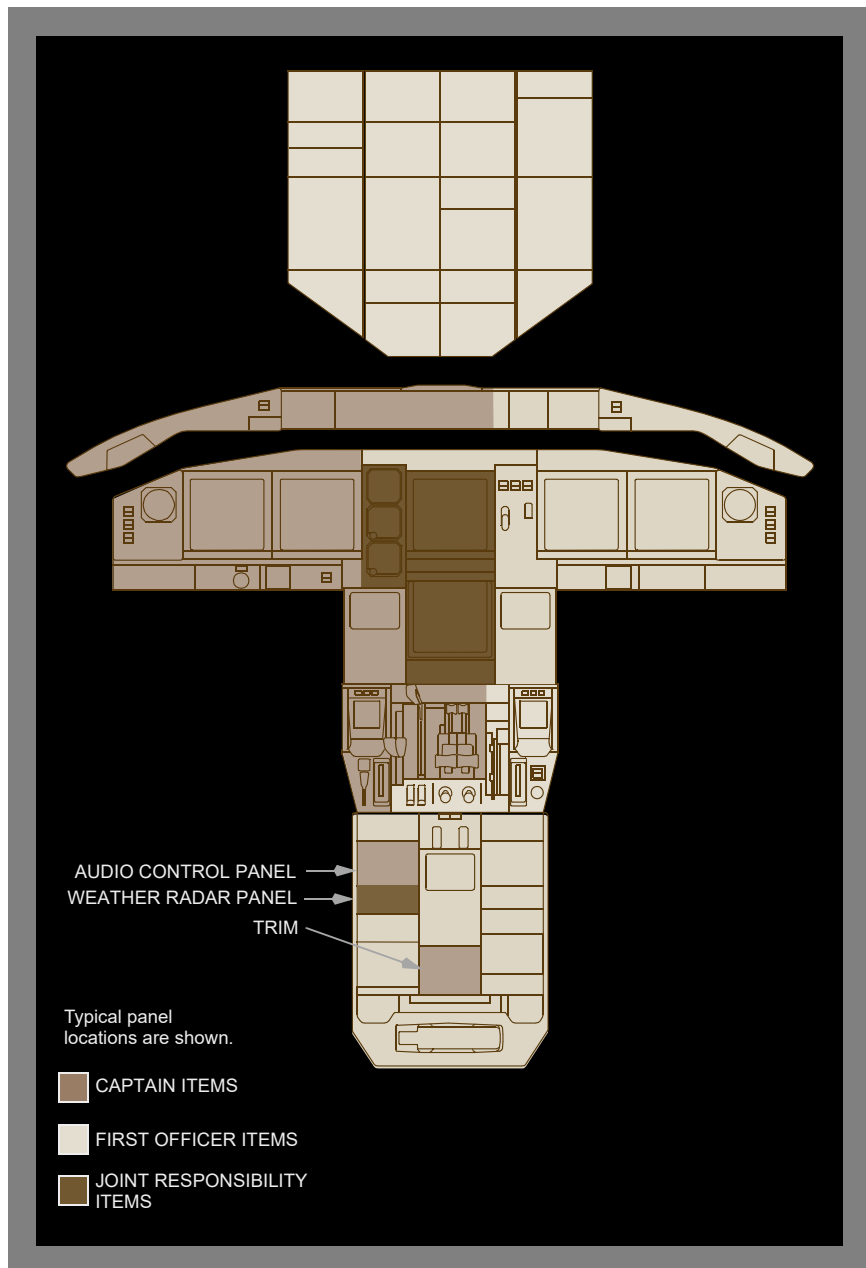
Announcing changes on the FMA and thrust mode display when they occur is a good CRM practice.

Preflight and Postflight Scan Flow

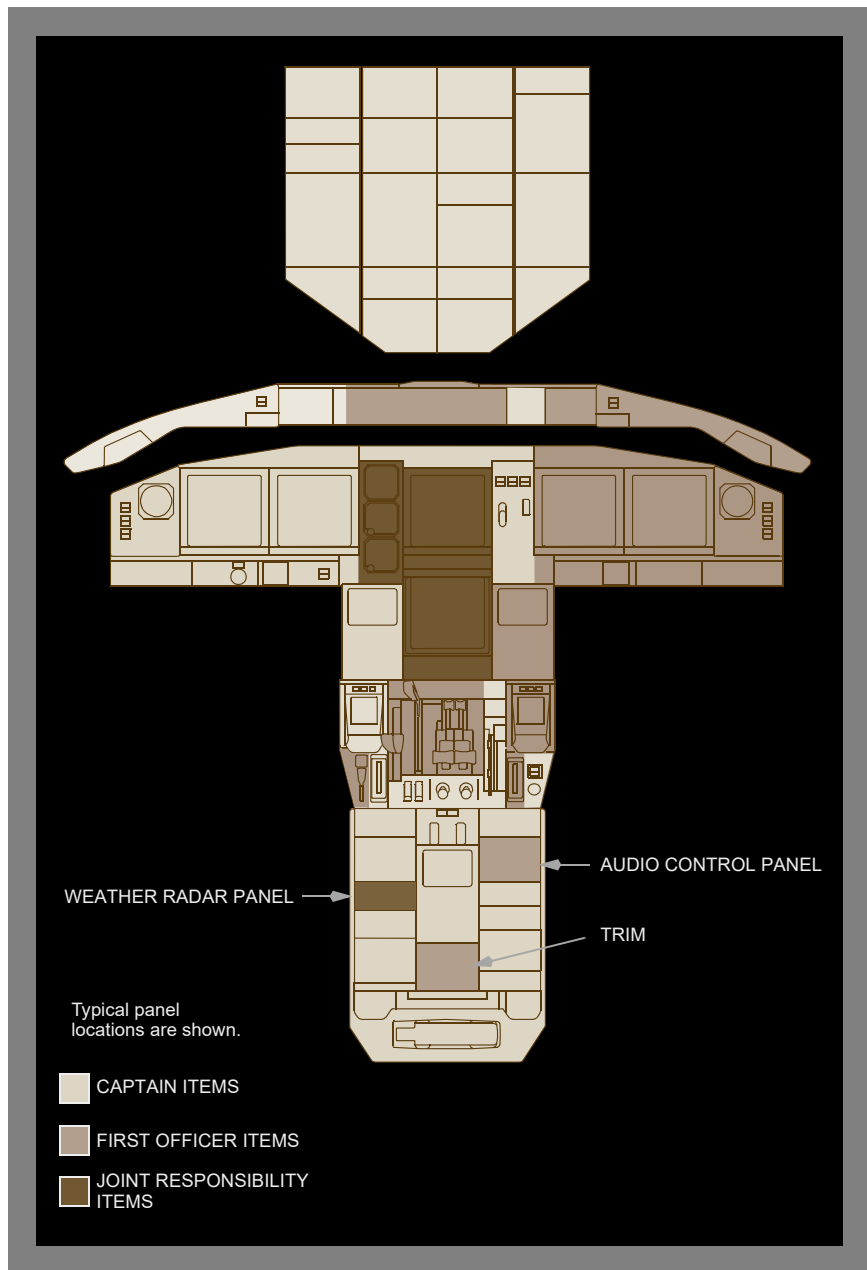
The scan flow and areas of responsibility diagrams shown below are representative and may not match the configuration(s) of your airplanes.

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.



Areas of Responsibility - Captain as Pilot Flying or Taxiing

Areas of Responsibility - First Officer as Pilot Flying or Taxiing



Preliminary Preflight Procedure – Captain or First Officer

The Preliminary Preflight Procedure assumes that the Electrical Power Up supplementary procedure is complete.

ADIRU switch OFF 30 seconds, then ON

Verify that the ON BAT light is extinguished.

Verify that the OFF light is extinguished.

[Option]

VOICE RECORDER switch As needed

STATUS display Check

Verify that only expected messages are shown.

Verify that the following are sufficient for flight:

- crew oxygen pressure

[Gaseous Passenger Oxygen]

- passenger oxygen pressure

[777 Freighter]

- supernumerary oxygen pressure
- hydraulic quantity
- engine oil quantity

EICAS display Check

Verify that only expected alert and memo messages are shown.

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.

Oxygen pressure drop Test

Oxygen mask Stowed and doors closed

Crew oxygen pressure Check STATUS display

Note oxygen pressure.

RESET/TEST switch Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

EMERGENCY/TEST selector..... Push and hold

While continuing to hold the RESET/TEST switch down, 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 50 PSIG.

If the oxygen cylinder valve is not in the full open position, pressure can:

- decrease rapidly, or
- decrease more than 50 PSIG, or
- increase slowly back to normal

RESET/TEST switch and
EMERGENCY/TEST selector (both) Release

Verify that the yellow cross does not show in the flow indicator.

Normal/100% selector 100%

[Gaseous Passenger Oxygen]

Crew oxygen pressure.....Check STATUS display

Verify that the pressure is sufficient for dispatch.

[Chemical Passenger Oxygen]

Crew oxygen pressure.....Check STATUS display

Verify that the pressure is sufficient for dispatch.

[777 Freighter]

Crew and supernumerary oxygen pressureCheck
STATUS display

Verify that the pressure is sufficient for dispatch.

Maintenance documents..... Check

[Flight Deck Security Door]

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

Overhead maintenance panel Guards closed
 Verify that all lights are extinguished.

[\[Medical Power Outlets\]](#)
 MEDICAL OUTLETS POWER switchesAs needed

CARGO TEMPERATURE selectorsAs needed

Circuit breakers..... Check

BROADBAND COM switchAs needed, guard closed

Parking brake As needed
 Set the parking brake to check the brake wear indicators during the exterior inspection.

CDU Preflight Procedure - Captain and First Officer

Start the CDU Preflight Procedure anytime 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 DataSet

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 INERTIAL POS line. Use the most accurate latitude and longitude.

Navigation Data Set

RTE page:

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.

Verify that the route is correct on the RTE page. Check the LEGS pages as needed to ensure compliance with the flight plan.

Verify the correct RNP for the departure.

NAV RADIO page:

Tune the navigation radios as needed.

Performance Data Set

PERF INIT page:

**CAUTION: Do not enter the ZFW into the GR WT boxes.
The FMC will calculate performance data with
significant errors.**

Enter the ZFW.

Verify that the FUEL on the CDU, the dispatch papers, and EICAS agree.

Verify that the fuel is sufficient for flight.

Verify that the GR WT on the CDU and the dispatch papers agree.

THRUST LIM page:

Select an assumed temperature, or a fixed derate takeoff, or both as needed.

[\[Option: APU to Pack Takeoff\]](#)

Select the APU to pack mode, if needed.

Select a full or a derated climb thrust as needed.

TAKEOFF REF page:

[\[Datalink T/O Pages\]](#)

Make data entries on page 2/2 before page 1/2.

[\[Non-Datalink T/O Pages\]](#)

Select or enter the takeoff V speeds.

Exterior Inspection

Before each flight the Captain, First Officer, or maintenance crew must verify that the airplane is satisfactory for flight.

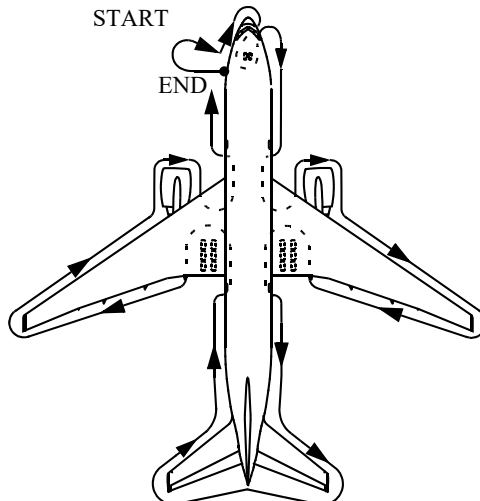
Items at each location may be checked in any sequence.

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 exterior 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.

Inspection Route



Left Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable) Check

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Radome	Check
Diverter strips	Secure
Forward access door	Secure

Tires and wheels	Check
Gear strut and doors	Check
Nose wheel steering assembly	Check
Gear pin	As needed
Nose gear towing lever	As needed
Nose gear towing lever pin	As needed
Exterior lights	Check
Wheel well light switches	As needed
Forward E and E door	Secure

Probes, sensors, ports, vents, and drains (as applicable).....	Check
Doors and access panels (not in use).....	Latched
Negative pressure relief vents	Closed

Probes, sensors, ports, vents, and drains (as applicable).....	Check
Exterior lights	Check
Pack inlet and pneumatic access doors	Secure
Leading edge flaps	Check

Right Engine

Access panels	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 slats	Check
Fuel measuring sticks	Flush and secure
Wing Surfaces	Check
Fuel tank vent	Check

Right Wing Tip and Trailing Edge

Navigation and strobe lights	Check
Static discharge wicks	Check
Fuel jettison nozzle	Check
Aileron, flaperon, 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 pins	As needed

Right Main Wheel Well

Wheel well	Check
------------------	-------

Right Aft Fuselage

Ram air turbine door	Check
Doors and access panels (not in use).....	Latched
Probes, sensors, ports, vents, and drains (as applicable).....	Check
[Gaseous Oxygen]	
Oxygen pressure relief green disc	In place

Tail

Vertical stabilizer and rudder	Check
[777-300, 777-300ER with tail skid installed]	
Tail skid	Check
Verify that the tail skid is not damaged.	
Horizontal stabilizer and elevator	Check
Static discharge wicks	Check
Strobe light	Check
APU exhaust outlet	Check

Left Aft Fuselage

Aft outflow valve	Check
Doors and access panels (not in use).....	Latched
Probes, sensors, ports, vents, and drains (as applicable).....	Check

Left Main Wheel Well

Wheel well	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 pins As needed

Left Wing Tip and Trailing Edge

Navigation and strobe lights Check

Static discharge wicks Check

Aileron, flaperon, and trailing edge flaps Check

Fuel jettison nozzle Check

Fuel tank vent Check

Left Wing and Leading Edge

Wing Surfaces Check

Fuel measuring sticks Flush and secure

Fuel tank vent Check

Leading edge slats Check

Access panels Latched

Left Engine

Exhaust area and tailcone Check

Thrust reverser Stowed

Probes, sensors, ports, vents, and drains (as applicable) Check

Access panels Latched

Fan blades, probes, and spinner Check

Left Wing Root, Pack, and Lower Fuselage

Probes, sensors, ports, vents, and drains (as applicable) Check

Exterior lights Check

Pack inlet and pneumatic access doors Secure

Negative pressure relief vents Closed

Positive pressure relief valves Closed

Leading edge flaps Check

Preflight Procedure – First Officer

The First Officer normally does this procedure. The Captain may do this procedure as needed.

THRUST ASYMMETRY COMPENSATION

switch AUTO

Verify that the OFF light is extinguished.

PRIMARY FLIGHT COMPUTERS

DISCONNECT switch Guard closed

Verify that the DISC light is extinguished.

ELECTRICAL panel Set

BATTERY switch ON

Verify that the OFF light is extinguished.

IFE/PASS SEATS power switch ON

Verify that the OFF light is extinguished.

CABIN/UTILITY power switch ON

Verify that the OFF light is extinguished.

APU GENERATOR switch ON

Verify that the OFF light is extinguished.

BUS TIE switches AUTO

Verify that the ISLN lights are extinguished.

GENERATOR CONTROL switches ON

Verify that the OFF lights are illuminated.

Verify that the DRIVE lights are illuminated.

BACKUP GENERATOR switches ON

The OFF lights stay illuminated until the respective engine is started.

APU selector (as needed) START, then ON

Do not allow the APU selector to spring back to the ON position.

Verify that the FAULT light is extinguished.

[777-300, 777-300ER]

CAMERA LIGHTS switch As needed

L WIPER selector OFF

[Option]

GROUND PROXIMITY RUNWAY OVERRIDE switch Off

[Option]

ELT switch Guard closed

EMERGENCY LIGHTS switch Guard closed

SERVICE INTERPHONE switch OFF

[Gaseous Passenger Oxygen]

Note: Do not set the PASSENGER OXYGEN switch to ON. The switch causes deployment of the passenger oxygen masks.

[Gaseous Passenger Oxygen]

PASSENGER OXYGEN SWITCH Guard closed

[Chemical Passenger Oxygen]

Note: Do not push the PASSENGER OXYGEN switch. The switch causes deployment of the passenger oxygen masks.

[Chemical Passenger Oxygen]

PASSENGER OXYGEN ON light Verify extinguished

[777 Freighter]

Note: Do not set the SUPRNMRY OXYGEN switch to ON. The switch causes deployment of the supernumerary oxygen masks.

[777 Freighter]

SUPRNMRY OXYGEN switch Guard closed

WINDOW HEAT switches ON

Verify that the INOP lights are extinguished.

WARNING: Do not push the RAM AIR TURBINE switch. The switch causes deployment of the ram air turbine.

RAM AIR TURBINE UNLOCKED light Verify extinguished

HYDRAULIC panel Set

LEFT and RIGHT ENGINE PRIMARY pump switches ON

Verify that the FAULT lights are illuminated.

Center 1 and Center 2 ELECTRIC PRIMARY pump switches OFF

Verify that the FAULT lights are illuminated.

DEMAND pump selectors OFF

Verify that the FAULT lights are illuminated.

[Passenger]

PASSENGER SIGNS panel Set

[Option]

NO SMOKING selector AUTO or ON

SEAT BELTS selector AUTO or ON

[777 Freighter]

SUPRNMRY SIGNS panel Set

[Option]

NO SMOKING selector AUTO or ON

SEAT BELTS selector AUTO or ON

Lighting panel Set

OVERHEAD panel light control Mid position

CIRCUIT BREAKER panel light control Mid position

MASTER BRIGHTNESS switch ON

MASTER BRIGHTNESS control As needed

GLARESHIELD PANEL light control Mid position

FLOOD light control Mid position

LANDING light switches OFF

APU fire panel Set

Verify that the APU BTL DISCH light is extinguished.

APU fire switch In

Verify that the APU fire warning light is extinguished.

[777 Passenger]

CARGO FIRE panel Set

CARGO FIRE ARM switches Off

Verify that the FWD and AFT fire warning lights are extinguished.

Verify that the cargo fire DISCH light is extinguished.

[777 Freighter]

CARGO FIRE panelSet

CARGO FIRE ARM switches Off

Verify that the MAIN, FWD and AFT fire warning lights are extinguished.

Verify that the cargo fire DISCH and DEPR lights are extinguished.

ENGINE panelSet

EEC MODE switches NORM

[GE Engines with CON Position, PW Engines]

START/IGNITION selectors NORM

[GE Engines without CON Position, RR Engines]

START selectors NORM

AUTOSTART switchON

Verify that the OFF light is extinguished.

FUEL JETTISON panelSet

FUEL JETTISON NOZZLE switches Off

Verify that the VALVE lights are extinguished.

FUEL TO REMAIN selector IN

FUEL JETTISON ARM switch Off

Verify that the FAULT light is extinguished.

FUEL panelSet

CROSSFEED switches OFF

Verify that the VALVE lights are extinguished.

FUEL PUMP switches OFF

Verify that the left forward pump PRESS light is extinguished if the APU is on or is illuminated if the APU is off.

Verify that the other left and right pump PRESS lights are illuminated.

Verify that the center pump PRESS lights are extinguished.

[Auxiliary Fuel Tank]

AUXILIARY FUEL switchOFF

Verify the auxiliary fuel switch PRESS light is extinguished.

ANTI-ICE panel Set

WING anti-ice selector AUTO

ENGINE anti-ice selectors AUTO

Lighting panel Set

BEACON light switchOFF

NAVIGATION light switch As needed

LOGO light switch..... As needed

WING light switch As needed

INDICATOR LIGHTS switch As needed

RUNWAY TURNOFF light switchesOFF

TAXI light switchOFF

STROBE light switchOFF

[Option]

FORWARD CARGO AIR CONDITIONING As needed

[777 Freighter]

LWR CARGO TEMP panel Set

FORWARD LOWER CARGO

AIR CONDITIONING control As needed

AFT LOWER CARGO AIR CONDITIONING control As needed

AIR CONDITIONING panel Set

[Flight Deck Humidification]

HUMIDIFICATION switch ON

EQUIPMENT COOLING switch AUTO

Verify that the OVRD light is extinguished.

[777 Freighter]

RECIRCULATION FANS switch ON

777 Flight Crew Operations Manual

[777 Freighter]

MAIN DECK FLOW control NORMAL

[777 Freighter]

ALTERNATE VENTILATION switch OFF

[Gasper Air]

GASPER switch ON

[777 Passenger]

RECIRCULATION FANS switches ON

FLIGHT DECK TEMPERATURE controlmid AUTO position

[777 Passenger]

CABIN TEMPERATURE control Mid position

[777 Freighter]

FORWARD MAIN DECK CARGO

TEMPERATURE controlAs needed

[777 Freighter]

AFT MAIN DECK CARGO

TEMPERATURE controlAs needed

PACK switches AUTO

Verify that the OFF lights are extinguished.

TRIM AIR switches ON

Verify that the FAULT lights are extinguished.

BLEED AIR panelSet

LEFT, CENTER and RIGHT ISOLATION switches AUTO

Verify that the CLOSED lights are extinguished.

ENGINE bleed switches ON

The OFF lights stay illuminated until the respective engine is started.

APU bleed switch AUTO

Verify that the OFF light is extinguished.

PRESSURIZATION panelSet

OUTFLOW VALVE switches AUTO

Verify that the MAN lights are extinguished.

LANDING ALTITUDE selector	IN
R WIPER selector	OFF
FLIGHT DIRECTOR switch	ON
Display select panel.....	Set
LOWER CENTER display switch	Push
EFIS control panel	Set
MINIMUMS reference selector	RADIO or BARO
MINIMUMS selector	Set decision height or altitude reference
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
ND mode selector	MAP
ND CENTER switch	As needed
ND range selector	As needed
ND TRAFFIC switch	As needed
WEATHER RADAR	Off
Verify that the weather radar indications are not shown on the ND.	
Map switches	As needed
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.	
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
Verify that the yellow cross does not show in the flow indicator.	
Normal/100% selector	100%
EMERGENCY/TEST selector	Normal (non-emergency)
[Option]	
ELECTRONIC FLIGHT BAG	Set
[Option]	
SIDE DISPLAY control	As needed
FORWARD PANEL BRIGHTNESS controls	Mid position
Instrument source select panel	Set
NAVIGATION source switch	Off
DISPLAY CONTROL source switch	Off
AIR DATA/ATT source switch	Off
Clock	Set
Time/date selector	UTC
INBOARD DISPLAY selector	MFD
FMC Selector	AUTO
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 takeoff V-speeds are selected	
Verify that the flight mode annunciations are correct:	
• autothrottle mode is blank	
• roll mode is TO/GA	
• pitch mode is TO/GA	
• AFDS status is FLT DIR	
Select the map mode.	

Landing gear panel	Set
Verify that the GND PROX light is extinguished.	
FLAP OVERRIDE switch	Off
GEAR OVERRIDE switch	Off
TERRAIN OVERRIDE switch	Off
Landing gear lever	DN
ALTERNATE GEAR switch	Guard closed
AUTOBRAKE selector	RTO
EICAS display	Check
Verify that the primary engine indications show existing conditions.	
Verify that no exceedance is shown.	
MFD	Check
Secondary ENGINE indications	
Verify that the secondary engine indications show existing conditions.	
Verify that no exceedance is shown.	
STATUS display switch	Push.
Check status messages.	
CHECKLIST display switch	Push
LOWER CENTER cursor location switch	
Verify that the lower center cursor location light is illuminated.	
RESETS	Select
[Dual Database]	
Verify the AIRLINE DATABASE is current.	
RESET ALL	Select
[Datalink NOT Automatically Reset]	
COMMUNICATION display switch	Push
MANAGER	Select

MASTER	Select
DATA LINK SYSTEM RESET	Select
CONFIRM RESET	Select
[AIMS BP V17 or later]	
MANAGER	Select
SYSTEM INFORMATION	Select
Verify TAIL NUMBER is correct.	
Center DISPLAY CONTROL source switch.....	Off
CENTER PANEL BRIGHTNESS controls	Mid position
Left radio tuning panel	Set
Verify that the OFF light is extinguished.	
WEATHER RADAR panel	Set
Center radio tuning panel	Set
Verify that the OFF light is extinguished.	
Observer's audio control panel	As needed
[777 Freighter - the step below is not applicable]	
Flight deck door panel	As needed
Engine fire panel.....	Set
Verify that the ENG BTL 1 DISCH and ENG BTL 2 DISCH lights are extinguished.	
Engine fire switches	In
Verify that the LEFT and RIGHT fire warning lights are extinguished.	
Center CDU	Set
Flight deck printer	Set
Verify that the PAPER light is extinguished.	
Right radio tuning panel	Set
Verify that the OFF light is extinguished.	
First Officer audio control panel	As needed

Transponder panel Set

[Option]

Evacuation COMMAND switch Guard closed

FLOOR LIGHTS switch As needed

OBSERVER AUDIO selector NORM

AISLE STAND PANEL light control Mid position

AISLE STAND FLOOD light control Mid position

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Seat Adjust

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. Stow the rudder pedal adjust crank.

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.

WARNING: If the rudder pedal adjust crank is not stowed after use the rudder pedals can move out of the desired position.

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.

EFIS control panel Set

MINIMUMS reference selector RADIO or BARO

MINIMUMS selector Set decision height or altitude reference

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
ND mode selector	MAP
ND CENTER switch	As needed
ND range selector	As needed
ND TRAFFIC switch	As needed
WEATHER RADAR	Off
Verify that the weather radar indications are not shown on the ND.	
Map switches	As needed
Mode control panel	Set
FLIGHT DIRECTOR switch	ON
AUTOTHROTTLE ARM switches	ARM
Autopilot DISENGAGE bar	UP
HEADING/TRACK reference switch	As needed
BANK LIMIT selector	AUTO
VERTICAL SPEED/FLIGHT PATH ANGLE reference switch ...	As needed
ALTITUDE increment selector	As needed
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.	
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

Verify that the yellow cross does not show in the flow indicator.

Normal/100% selector – 100%

EMERGENCY/TEST selector Normal (non-emergency)

[Option]

ELECTRONIC FLIGHT BAG Set

[Option]

SIDE DISPLAY control As needed

FORWARD PANEL BRIGHTNESS controls Mid position

Instrument source select panel Set

NAVIGATION source switch Off

DISPLAY CONTROL source switch Off

AIR DATA/ATTITUDE source switch Off

Clock Set

Time/date selector UTC

INBOARD DISPLAY selector MFD

HEADING REFERENCE switch NORM

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 takeoff V-speeds are selected

Verify that the flight mode annunciations are correct:

- autothrottle mode is blank
- roll mode is TO/GA

- pitch mode is TO/GA
- AFDS status is FLT DIR

Select the map mode.

[Standby Flight Instruments - non ISFD]

Standby instruments Check

Set local altimeter setting.

Verify that the flight instrument indications are correct.

Verify that no flags or messages are shown.

Verify not blank.

[Integrated Standby Flight Display - ISFD]

Integrated standby flight displaySet

Verify that the approach mode display is blank.

Set local altimeter setting.

Verify that the flight instrument indications are correct.

Verify that no flags or messages are shown.

ALTERNATE PITCH TRIM leversNeutral

SPEEDBRAKE lever DOWN

Reverse thrust levers Down

Forward thrust leversClosed

Flap leverSet

The flap position indicator does not show when the flaps are up.

Set the flap lever to agree with the flap position.

Parking brakeSet

Verify that the PARKING BRAKE SET message is shown.

Note: Do not assume that the parking brake can prevent airplane movement. Accumulator pressure can be insufficient.

STABILIZER cutout switches Guards closed

FUEL CONTROL switches CUTOFF

FUEL CONTROL switch fire warning lights Verify extinguished

ALTERNATE FLAPS panel Set

ALTERNATE FLAPS ARM switchOFF

ALTERNATE FLAPS selectorOFF

Captain audio control panel As needed

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Seat Adjust

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. Stow the rudder pedal adjust crank.

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.

WARNING: If the rudder pedal adjust crank is not stowed after use the rudder pedals can move out of the desired position.

Seat belt and shoulder harness Adjust

Call “PREFLIGHT CHECKLIST.”

Before Start Procedure

Start the Before Start Procedure after papers are on board.

[777 Freighter - the step below is not applicable]

Flight deck doorClosed and locked F/O

Verify that the LOCK FAIL light is extinguished.

Do the CDU Preflight ProcedurePerformance 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.

MCP	Set	C
IAS/MACH selector	Set V2	
Arm LNAV as needed.		
Arm VNAV.		
Initial heading or track	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.		
Exterior doors	Verify closed	F/O
Flight deck windows	Closed and locked	C, F/O
Verify that the WINDOW NOT CLOSED decal does not show.		
Verify that the orange indicator does not show.		
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:		
Nose gear steering	Verify locked out	C
HYDRAULIC panel	Set	F/O
WARNING: If the tow bar is connected, do not pressurize the hydraulic systems until the nose gear steering is locked out. Unwanted tow bar movement can occur.		
Note: Pressurize the right system first to prevent fluid transfer between systems.		
Right ELECTRIC DEMAND pump selector	AUTO	
Verify that FAULT light is extinguished.		

Center 1 and Center 2 ELECTRIC PRIMARY pump switches ON

Verify that the Center 1 FAULT light is extinguished.

The Center 2 FAULT light may stay illuminated until after engine start because of load shedding.

Left ELECTRIC DEMAND pump selector AUTO

Verify that the FAULT light is extinguished.

Center 1 and Center 2 AIR DEMAND pump selectors AUTO

Verify that the FAULT lights are extinguished.

Fuel panel Set F/O

LEFT and RIGHT FUEL PUMP switches ON

Verify that the PRESS lights are extinguished.

[After PRR 61998-2]

If the FUEL IN CENTER message shows:

CENTER FUEL PUMP switches ON

One or both PRESS lights may stay illuminated until after the engine start because of load shedding.

[Auxiliary Fuel Tank]

If there is more than 100 kilograms of fuel in the auxiliary tank:

AUXILIARY FUEL switch ON

Verify that the PRESS light is extinguished.

Note: Failure to push the auxiliary fuel switch ON may result in unusable fuel.

[Auxiliary Fuel Tank]

If there is more than 200 pounds of fuel in the auxiliary tank:

AUXILIARY FUEL switch ON

Verify that the PRESS light is extinguished.

Note: Failure to push the auxiliary fuel switch ON may result in unusable fuel.

BEACON light switch ON F/O

CANCEL/RECALL switch Push F/O

Verify that only the expected alert and memo messages are shown.

CANCEL/RECALL switch Push F/O

Verify that the messages cancel.

Trim Set C

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.

Ground handling personnel Establish communications C

CAUTION: Do not hold or turn the nose wheel tiller 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

Parking brake Set or release C or F/O

Set or release as directed by ground handling personnel.

When pushback or towing is complete:

Tow bar Verify not connected C

Nose gear steering Verify not locked out C

Engine Start Procedure

If there is no oil pressure indication after the EGT increases, do the ABORTED ENGINE START checklist

Select the secondary engine display. F/O

APU selector	OFF	F/O
ENGINE ANTI-ICE selectors	As needed	F/O
Verify that the ground equipment is clear.		C, F/O
Call “FLAPS___” as needed for takeoff.		C
Flap lever	Set takeoff flaps	F/O
Flight controls	Check	C
Make slow and deliberate inputs, one direction at a time.		
<p>Note: To avoid nuisance FLIGHT CONTROLS faults, a complete cycle of the control wheel during the flight control check should be done slowly (more than approximately 6 seconds) and not combined with the check of the pitch controls.</p>		
Move the control wheel and the control column to full travel in both directions and verify:		
<ul style="list-style-type: none"> • freedom of movement • that the controls return to center 		
Hold the nose wheel tiller 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

Transponder As needed F/O

Recall Check C, F/O

Verify that only expected alert and memo messages are shown.

[\[Electronic Flight Bag\]](#)

EFB AIRPORT MAP application Select C, F/O

Select map as desired.

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.

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

[\[PW Engines\]](#)

Engine warm up requirements:

- engine oil temperature must be above the lower amber band before takeoff

Engine warm up recommendations (there is no need to delay the takeoff for these recommendations):

- when the engines have been shut down more than 2 hours:
 - run the engines for 5 minutes
- when taxi time is expected to be less than 5 minutes, start the engines as early as feasible
- use a thrust setting normally used for taxi operations

[\[GE Engines\]](#)

Engine warm up requirements:

- engine oil temperature must be above the bottom of the temperature scale

Engine warm up recommendations:

- run the engines for at least 3 minutes
- use a thrust setting normally used for taxi operations

[RR Engines]

Engine warm up requirements:

- engine oil temperature must be above the lower amber band before takeoff

Engine warm up recommendations:

- when the engines have been shut down more than 1.5 hours:
 - run the engines for at least 5 minutes
- when the engines have been shut down 1.5 hours or less:
 - run the engines for at least 3 minutes
- use a thrust setting normally used for the taxi operations

Pilot Flying	Pilot Monitoring
	<p>[777 Passenger] Notify the cabin crew to prepare for takeoff. Verify that the cabin is secure.</p> <p>[777 Freighter] Notify the supernumeraries to prepare for takeoff.</p>
The pilot who will do the takeoff updates changes to the takeoff briefing as needed.	
Set the weather radar display as needed.	
Set the terrain display as needed.	
Call “BEFORE TAKEOFF CHECKLIST.”	Do the BEFORE TAKEOFF checklist.

Takeoff Procedure

Pilot Flying	Pilot Monitoring
Before entering the departure runway, verify that the runway and runway entry point are correct.	
	<p>When entering the departure runway, set the STROBE light switch to ON. Use other lights as needed.</p> <p>Set the transponder mode selector to TA/RA.</p>

Pilot Flying	Pilot Monitoring
Verify that the brakes are released. Align the airplane with the runway.	
Verify that the airplane heading agrees with the assigned runway heading.	
	When cleared for takeoff, set the LEFT and RIGHT LANDING light switches to ON.
[GE Engines] Advance the thrust levers to approximately 55% N1. [PW Engines, RR Engines] Advance the thrust levers to approximately 1.05 EPR. Allow the engines to stabilize.	
Push the TO/GA switch.	
Verify that the correct takeoff thrust is set.	
	Monitor the engine instruments during the takeoff. Call out any abnormal indications. Adjust takeoff thrust before 80 knots as needed. During strong headwinds, if the thrust levers do not advance to the planned takeoff thrust, manually advance the thrust levers by 80 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.”

Pilot Flying	Pilot Monitoring
At VR, rotate toward 15° pitch attitude.	At VR call “ROTATE.”
After liftoff, follow F/D commands.	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.
Verify that climb thrust is set.	
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 the ENGINE ANTI-ICE selectors to AUTO.
Call “AFTER TAKEOFF CHECKLIST.”	
	Do the AFTER TAKEOFF checklist.

Takeoff Flap Retraction Speed Schedule

Takeoff Flaps	At “Display”	Select Flaps
20 or 15	“20” or “15”	5
	“5”	1
	“1”	UP
5	“5”	1
	“1”	UP

Climb and Cruise Procedure

Complete the After Takeoff Checklist before starting the Climb and Cruise Procedure.

Note: Maintain at least 15 knots above minimum maneuver speed when climbing through FL200 to prevent the EICAS caution message, “AIRSPEED LOW” from occurring.

Note: Perform all step climbs using VNAV or maximum climb thrust.

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.
	[777 Passenger] Set the passenger signs as needed. [777 Freighter] Set the supernumerary signs as needed.
When climbing above transition altitude, set the altimeters to standard.	

Pilot Flying	Pilot Monitoring
	If the FUEL IN CENTER message shows, set both CENTER FUEL PUMP switches to ON. [Auxiliary Fuel Tank] When the FUEL LOW AUX message shows, set the AUXILIARY FUEL switch to OFF. When the FUEL LOW CENTER message shows, set both CENTER FUEL PUMP switches to OFF.
	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.

[\[RR Engines\]](#)

During initial descent, maintain idle thrust for a minimum of 30 seconds.

Pilot Flying	Pilot Monitoring
	During decent, verify the RNP as needed.
Review all alert and memo messages. Review all operational notes.	Recall and review all alert and memo messages. Recall and review all operational notes.
Check landing performance.	
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 the NAV RADIO page for the approach.

Pilot Flying	Pilot Monitoring
	Set the AUTOBRAKE selector 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

Pilot Flying	Pilot Monitoring
	During arrival and approach, verify the RNP as needed.
	[777 Passenger] Set the passenger signs as needed. [777 Freighter] Set the supernumerary signs as needed.
	At or above 10,000 feet MSL, set the LEFT and RIGHT LANDING light switches to ON.
When descending below the transition level, set the altimeters.	
Update changes to the arrival and approach procedures 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"	20	"20"
20	"20"	25 or 30	(VREF25 or VREF30) + wind additives

Landing Procedure - ILS

Pilot Flying	Pilot Monitoring
Initially: <ul style="list-style-type: none"> If on radar vectors <ul style="list-style-type: none"> HDG SEL Pitch mode (as needed) If enroute to a fix <ul style="list-style-type: none"> LNAV or other roll mode VNAV or other pitch mode 	
	[777 Passenger] Notify the cabin crew to prepare for landing. Verify that the cabin is secure. [777 Freighter] Notify the supernumeraries to prepare for landing.
Call "FLAPS ____" according to the flap extension schedule.	Set the flap lever as directed.
When on localizer intercept heading: <ul style="list-style-type: none"> verify that the ILS is tuned and identified verify that the LOC and G/S pointers are shown 	
Arm the APP mode.	

[\[G/S Capture NOT Inhibited Before LOC Capture\]](#)

WARNING: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it. The airplane can then descend on the glideslope with the localizer not captured.

Pilot Flying	Pilot Monitoring
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[G/S Capture Inhibited Before LOC Capture]

Note: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it.

Use LNAV, HDG SEL/TRK SEL or HDG HOLD /TRK HOLD to intercept the final approach course as needed.	
Verify that the localizer is captured. Verify the final approach course heading.	
	Call “GLIDESLOPE ALIVE.”
At glideslope alive, call: <ul style="list-style-type: none"> • “GEAR DOWN” • “FLAPS 20” 	
	Set the landing gear lever to DN. Set the flap lever to 20.
Set the speedbrake lever to ARMED.	
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.
WARNING: Interference with the glideslope signal can result in erroneous AFDS pitch guidance indicated by FMA mode degradation, the AUTOPILOT caution message, and removal of the F/D pitch bar. If this occurs, do a go-around unless suitable visual references can be established and maintained.	
WARNING: Interference with the glideslope signal can result in erroneous AFDS pitch guidance indicated by FMA mode degradation, the AUTOPILOT caution message, and removal of the F/D flight director bar. If this occurs, do a go around unless suitable visual references can be established and maintained.	
At the final approach fix or (LOM, MKR, DME) verify the crossing altitude.	
Monitor the approach. Verify the autoland status at 500 feet radio altitude.	

Landing Procedure - Instrument Approach Using VNAV

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: <ul style="list-style-type: none"> • If on radar vectors <ul style="list-style-type: none"> • HDG SEL • Pitch mode (as needed) • If enroute to a fix <ul style="list-style-type: none"> • LNAV or other roll mode • VNAV or other pitch mode 	
	[777 Passenger] Notify the cabin crew to prepare for landing. Verify that the cabin is secure. [777 Freighter] Notify the supernumeraries to prepare for landing.
Call “FLAPS __” according to the flap extension schedule.	Set the flap lever as directed.
The recommended roll modes for the final approach are: <ul style="list-style-type: none"> • for a 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 LOC 	
When on the final approach course intercept heading for LOC, LOC-BC, SDF, or LDA approaches: <ul style="list-style-type: none"> • verify that the localizer is tuned and identified [Option - Navigation Performance Scales] <ul style="list-style-type: none"> • verify that the anticipation cue or LOC pointer is shown 	
Arm the LNAV or LOC mode.	

Pilot Flying	Pilot Monitoring
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.	
Use LNAV, HDG SEL, TRK SEL, HDG HOLD, or TRK HOLD to intercept the final approach course as needed.	
Verify that LNAV is engaged or that the localizer is captured.	
Approximately 2 NM before the final approach fix and after ALT, VNAV PTH, or VNAV ALT is annunciated: <ul style="list-style-type: none"> • set DA(H) or MDA(H) on the MCP • select or verify VNAV • select or verify speed intervention 	Approximately 2 NM before the final approach fix, call “APPROACHING GLIDE PATH.”
Call: “GEAR DOWN” “FLAPS 20”	Set the landing gear lever to DN. Set the flap lever to 20
Set the SPEEDBRAKE lever to ARMED.	
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.	
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 MDA(H), DA(H), or the missed approach point, disengage the autopilot in accordance with regulatory requirements. Maintain the glide path to landing.	

Go-Around and Missed Approach Procedure

Pilot Flying	Pilot Monitoring
Push the TOGA switch.	
Verify that the thrust increases.	
Call "FLAPS 20" or "FLAPS ____" as needed.	Set the flap lever as directed.
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 "POSITIVE RATE."
Verify a positive rate of climb on the altimeter and call "GEAR UP."	
	Set the landing gear lever to UP.
Limit bank angle to 15 degrees if airspeed is below minimum maneuver speed.	
Above 400 feet radio altitude, select or verify a roll mode.	Verify that the missed approach altitude is set.
Verify that the missed approach route is tracked.	
At acceleration height, set speed to the maneuver speed for the planned flap setting.	
Call "FLAPS ____" according to the flap retraction schedule.	Set the flap lever as directed.
After flaps are set to the planned flap setting and at or above flap maneuvering speed, select FLCH or VNAV as needed.	
Verify that climb thrust is set.	
Verify that the missed approach altitude is captured.	
Call "AFTER TAKEOFF CHECKLIST."	Do the AFTER TAKEOFF checklist.

Landing Roll Procedure

Pilot Flying	Pilot Monitoring
Verify that the thrust levers are closed. Verify that the SPEEDBRAKE lever is UP.	Verify that the SPEEDBRAKE lever is UP. Call “SPEEDBRAKES UP.” If the SPEEDBRAKE lever is not UP, call “SPEEDBRAKES NOT UP.”
Monitor the rollout progress.	
Verify correct autobrake operation.	
WARNING: After the reverse thrust levers are raised, a full stop landing must be made. If an engine remains in reverse, safe flight is not possible.	
Without delay, raise 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 LEFT ENGINE” or “NO REVERSER RIGHT ENGINE”, or “NO REVERSERS”
By 60 knots, start movement of the reverse thrust levers to reach the reverse idle detent before taxi speed.	Call “60 KNOTS.”
After the engines are at reverse idle, move the reverse thrust levers to full down.	
Before taxi speed, disarm the autobrake. Use manual braking as needed.	
Before turning off the runway, disconnect the autopilot.	

Pilot Flying	Pilot Monitoring
--------------	------------------

[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.

After Landing Procedure

Start the After Landing Procedure when clear of the active runway.

[PW Engines]

Engine cooldown recommendations:

- Run the engines for at least 5 minutes
- Use a thrust setting no higher than that normally used for all engine taxi operations

[RR Engines]

Engine cooldown recommendations:

- Run the engines for at least 1 minute
- Use a thrust setting no higher than that normally used for all engine taxi operations

[GE Engines]

Engine cooldown recommendations:

- Run the engines for at least 3 minutes
- Use a thrust setting normally used for taxi operations

Pilot Flying	Pilot Monitoring
The Captain positions or verifies that the SPEEDBRAKE lever is DOWN.	
	Set the APU selector to START, then ON, as needed.
	Set the ENGINE ANTI-ICE selectors to ON, if needed.
	Set the exterior lights as needed.
Set the weather radar to off.	
	Set the AUTOBRAKE selector OFF.
	Set the flap lever to UP.

Pilot Flying	Pilot Monitoring
	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 SET message is shown.

Electrical power Set F/O

If APU power is needed:

Check that the APU RUNNING message is shown.

If external power is needed:

Verify that the PRIMARY EXTERNAL POWER AVAIL light is illuminated.

PRIMARY EXTERNAL POWER switch Push
Verify that the ON light is illuminated.

If the SECONDARY EXTERNAL POWER AVAIL light is illuminated:

SECONDARY EXTERNAL POWER switch Push
Verify that the ON light is illuminated.

FUEL CONTROL switches CUTOFF C

If towing is needed:

Ground handling personnel Establish communications C

WARNING: If the nose gear steering is not locked out, any change to hydraulic power with the tow bar connected may cause unwanted tow bar movement.

Nose gear steering Verify locked out C

CAUTION: Do not hold or turn the nose wheel tiller 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.

Parking brakeSet or release C or F/O
Set or release as directed by ground handling personnel.

SEAT BELTS selector OFF F/O

HYDRAULIC panel..... Set F/O

Note: Depressurize the right system last to prevent fluid transfer between systems.

Center 1, and Center 2 AIR DEMAND pump selectorsOFF

Left ELECTRIC DEMAND pump selectorOFF

Center 1 and Center 2 ELECTRIC PRIMARY pump switchesOFF

Right ELECTRIC DEMAND pump selectorOFF

FUEL PUMP switches OFF F/O

[\[Auxiliary Fuel Tank\]](#)

AUXILIARY FUEL switch OFF F/O

BEACON light switch OFF F/O

FLIGHT DIRECTOR switches OFF C, F/O

Transponder mode selector STBY F/O

[\[Electronic Flight Bag\]](#)

EFB CLOSE FLIGHTSelect C, F/O

Status messages Check F/O

Note: Disregard EICAS alert and status messages displayed during the PFC self test after hydraulic shutdown. Wait approximately 3 minutes after HYD PRESS SYS L+C+R message is shown before recording status and alert messages in the maintenance log.

After wheel chocks are in place:

Parking brakeRelease C

APU selectorAs needed F/O

777 Flight Crew Operations Manual

Call “SHUTDOWN CHECKLIST.”	C
Do the SHUTDOWN checklist.	F/O

Secure Procedure

ADIRU switch	OFF	F/O
EMERGENCY LIGHTS switch	OFF	F/O
PACK switches	OFF	F/O
[Electronic Flight Bag]		
EFB Display	Off	C, F/O
Call “SECURE CHECKLIST.”		C
Do the SECURE checklist.		F/O

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Supplementary Procedures
Table of Contents**Chapter SP**
Section TOC

Introduction	SP.05
General	SP.05.1
Airplane General, Emer. Equip., Doors, Windows	SP.1
Doors	SP.1.1
Entry/Service Door Closing	SP.1.1
Entry/Service Door Opening	SP.1.1
Oxygen	SP.1.2
Emergency Oxygen Use	SP.1.2
Flight Deck Door Access System Test	SP.1.2
Flight at Low Gross Weight	SP.1.3
General	SP.1.3
Takeoff	SP.1.3
Landing	SP.1.3
Go Around and Missed Approach	SP.1.4
Air Systems	SP.2
Air Conditioning Packs	SP.2.1
Ground Conditioned Air Use	SP.2.1
Packs Off Takeoff	SP.2.1
APU to Pack Takeoff	SP.2.2
Anti-Ice, Rain	SP.3
Anti-Ice Operation	SP.3.1
Windshield Wiper Use	SP.3.1
Automatic Flight	SP.4
AFDS	SP.4.1
AFDS Operation	SP.4.1
Heading Hold	SP.4.1
Heading Select	SP.4.1
Track Hold	SP.4.2
Track Select	SP.4.2
Altitude Hold	SP.4.2
Flight Level Change, Climb or Descent	SP.4.2

Vertical Speed, Climb or Descent	SP.4.3
Flight Path Angle, Climb or Descent	SP.4.3
Autothrottle Operation	SP.4.4
Instrument Approach - RNAV (RNP) AR	SP.4.5
Preflight Procedure	SP.4.5
Pre-approach Requirements	SP.4.5
Cruise Procedure	SP.4.6
Descent Procedure	SP.4.7
Approach Procedure	SP.4.7
Landing Procedure	SP.4.7
Instrument Approach Using Vertical Speed (V/S) or Flight Path Angle (FPA)	SP.4.10
Circling Approach	SP.4.13
Communications	SP.5
Flight Deck Communications System (Datalink)	SP.5.1
Pre-Departure Clearance	SP.5.1
Digital-Automatic Terminal Information Service	SP.5.1
Oceanic Clearances	SP.5.1
Weight and Balance	SP.5.1
Takeoff Data	SP.5.1
Electrical	SP.6
Electrical Power Down	SP.6.1
Electrical Power Up	SP.6.1
Engines, APU	SP.7
APU Ground Pneumatic Start	SP.7.1
Engine Battery Start	SP.7.1
Engine Crossbleed Start	SP.7.2
Engine Ground Pneumatic Start	SP.7.2
Manual Engine Start	SP.7.3
Manual Override Engine Start	SP.7.4
Flight Instruments, Displays	SP.10
Heading Reference Switch Operation	SP.10.1
QFE Operation	SP.10.1

Flight Management, Navigation	SP.11
Departure or Destination Airport Not in the FMC	
Navigation Database	SP.11.1
Departure Airport Not in the FMC Navigation Database	SP.11.1
Destination Airport Not in the FMC Navigation Database	SP.11.3
ADIRU Alignment/Position Update	SP.11.5
FMS Position Update	SP.11.6
Navaid Inhibit or Enable	SP.11.7
RNP Manual Entry	SP.11.9
Fuel	SP.12
Fuel Balancing	SP.12.1
Cold Fuel Operations	SP.12.1
Warning Systems	SP.15
Runway Awareness and Advisory System (RAAS) Override Operation	SP.15.1
Adverse Weather	SP.16
Introduction	SP.16.1
Takeoff - Wet or Contaminated Runway Conditions	SP.16.1
Cold Weather Operations	SP.16.2
Exterior Inspection	SP.16.2
Engine Start Procedure	SP.16.3
Engine Anti-ice Operation - On the Ground	SP.16.3
Before Taxi Procedure	SP.16.4
Taxi-Out	SP.16.4
De-icing / Anti-icing	SP.16.6
Before Takeoff Procedure	SP.16.7
Takeoff Procedure	SP.16.8
Engine Anti-ice Operation - In-flight	SP.16.8
Fan Ice Removal	SP.16.10
Wing Anti-ice Operation - In-flight	SP.16.10
Cold Temperature Altitude Corrections	SP.16.11
After Landing Procedure	SP.16.13
Secure Procedure	SP.16.14

Hot Weather Operation	SP.16.15
Moderate to Heavy Rain, Hail or Sleet	SP.16.16
Operation in a Sandy or Dusty Environment	SP.16.16
Exterior Inspection	SP.16.16
Preflight Procedure - First Officer	SP.16.17
Engine Start Procedure	SP.16.18
Before Taxi Procedure	SP.16.18
Taxi-Out	SP.16.19
Before Takeoff Procedure	SP.16.19
Takeoff	SP.16.20
Landing	SP.16.20
After Landing Procedure	SP.16.20
Taxi-In	SP.16.21
Secure Procedure	SP.16.21
Severe Turbulence	SP.16.22
Structural Considerations	SP.16.22
Climb, Cruise, and Descent Considerations	SP.16.22
Manual Flight in Severe Turbulence	SP.16.23
Windshear	SP.16.23
Avoidance	SP.16.23
Precautions	SP.16.23
Recovery	SP.16.25
Ice Crystal Icing (ICI)	SP.16.25
Recognizing Ice Crystal Icing	SP.16.26
Avoiding Ice Crystal Icing	SP.16.27
Ice Crystal Icing Suspected	SP.16.27

Supplementary Procedures
Introduction**Chapter SP**
Section 05

General

This chapter contains procedures (adverse weather operation, engine crossbleed start, and so on) that are accomplished as required rather than routinely performed on each flight. Systems tests are described in the System Description chapter of the applicable system.

Note: System tests are not normally a flight crew action.

Procedures accomplished in flight, or those that are an alternate means of accomplishing normal procedures (such as manual engine start), are usually accomplished by memory. Infrequently used procedures, not normally accomplished (such as engine crossbleed start) are usually accomplished by reference.

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.

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Supplementary Procedures

Chapter SP

Airplane General, Emer. Equip., Doors, Windows

Section 1

Doors

Entry/Service Door Closing

Gust lock latch Release

Door Close

Manually position the door aft and inboard to cover the entry.

Door handle Rotate

Rotate forward 180° to the closed position. The door lowers into position, latches, and locks.

[Option – ARMED/DISARMED Shown, AUTOMATIC/MANUAL Optional]

Mode select lever ARMED

Observe yellow forward and aft girt bar flags are in view.

Entry/Service Door Opening

Mode select lever (interior only)DISARMED

Note: Escape slide/raft and powered door opening is disarmed automatically when the door is opened from outside.

Door handle Rotate

Rotate aft 180° to the open position. The door is lifted clear of the pressure stops.

Door Open

Manually position the door outboard and forward to open. The gust lock latch automatically engages and locks door in the open position.

Emergency oxygen should be used when necessary to provide positive pressure in the masks and goggles to prevent or evacuate contaminants. When positive pressure is not required, but contamination of flight deck air exists, 100% oxygen must be used. If prolonged use is required and the situation permits, oxygen availability should be extended by selecting normal flow.

When oxygen use is no longer required, close the left hand oxygen compartment door, then push the RESET/TEST switch to restore normal boom microphone operation.

[Passenger - Enhanced security door]

Flight deck doorOpen

Flight deck access system switch OFF

Verify LOCK FAIL light illuminates.

Flight deck access system switch NORM

Guard - Down

Verify LOCK FAIL light extinguishes.

Flight deck door lock selector AUTO

Emergency access codeEnter

ENT key Push

Verify alert sounds.

Verify AUTO UNLK light illuminates.

Flight deck door lock selectorDENY

Verify AUTO UNLK light extinguishes.

Flight deck door lock selector UNLKD

Flight at Low Gross Weight

The following procedures should be used anytime the airplane weight is, or is expected to be, below 340,000 pounds.

The following procedures should be used anytime the airplane weight is, or is expected to be, below 154,221 kilograms.

General

CAUTION: The airplane accelerates and climbs rapidly due to excess thrust.

For takeoff and go-around, level off at 3,000 feet above field elevation or higher. A lower level off altitude can result in an overshoot of the assigned altitude.

If the airplane weight decreases below 340,000 pounds during takeoff or landing, flap maneuver speeds can increase. Follow the higher flap maneuver speeds.

If the airplane weight decreases below 154,221 kilograms during takeoff or landing, flap maneuver speeds can increase. Follow the higher flap maneuver speeds.

During nose high attitudes, the FUEL PUMP L/R FWD EICAS messages can show.

Takeoff

Do the normal takeoff procedure with the following considerations:

- Use the lowest reduced thrust and the largest flap setting possible
- Use a rolling takeoff
- Use derated climb thrust
- Do not use FMC calculated speeds below 340,000 pounds. FMC speeds are either incorrect or not available.
- Do not use FMC calculated speeds below 154,221 kilograms. FMC speeds are either incorrect or not available.

Landing

Do the normal landing procedure with the following considerations:

- The airplane has a tendency to float
- Reference speeds for Flaps 20, 25, and 30 will be the same
- Pitch attitude is lower than normal. Flaps 25 is recommended to increase the pitch attitude

- Use autothrottles, if available
- Use VREF + 5 for landing. Do not use wind additives

Go Around and Missed Approach

Do not over pitch the airplane when starting a go-around.

Full rated go-around thrust is not recommended.

Supplementary Procedures
Air Systems

Chapter SP
Section 2

Air Conditioning Packs

Ground Conditioned Air Use

Before connecting ground conditioned air:

- PACK switches (both) OFF
[Prevents pack operation when conditioned air is supplied to the airplane. The pack or pack components can be damaged if operated with conditioned air.]
- RECIRCULATION FANS switches (both) OFF
[This step allows conditioned air unit to operate at maximum efficiency.]
- RECIRCULATION FANS switch OFF
[This step allows conditioned air unit to operate at maximum efficiency.]

After disconnecting ground conditioned air:

- PACK switches (both) AUTO
- RECIRCULATION FANS switches (both) ON
- RECIRCULATION FANS switch ON

Packs Off Takeoff

Before takeoff:

- PACK switches (both) OFF

Wait 30 seconds before setting takeoff thrust.

[PW or RR Engines]

[This step allows packs to shut down and EECs time to recompute maximum EPR line and reference/target EPR indications.]

[GE Engines]

[This step allows packs to shut down and EECs time to recompute maximum N1 line and reference/target N1 indications.]

After takeoff:

PACK switches (both)..... AUTO

After engine thrust is reduced from takeoff to climb and before reaching 3000 feet above field elevation, position both pack switches to AUTO.

APU to Pack Takeoff

[Standard on 300ER and 200LR; option on all others]

Note: APU to Pack Takeoff is prohibited at airport altitudes above 6900 feet field elevation.

Before start:

PACK switches (both)..... AUTO

On the THRUST LIMIT Page, select one of the following takeoff thrust ratings:

- full thrust
- percent derate

[Increased Takeoff Thrust Rating]

- takeoff bump

Enter “APU” into the scratchpad and line select to the “SEL-APU” field. “APU” appears in small font representing the armed mode.

After engine start:

Leave APU running to supply air to the left pack.

Approximately one minute after second engine start, “APU” displays in large font representing the active mode.

Confirm proper configuration by noting a green “A-TO”, “A-TO1”, “A-TO2”, or “A-TOB” on EICAS.

Note: If cabin temperature becomes excessive during extended ground operation, establish dual pack operation by deleting the APU selection. To re-establish APU to Pack operation, enter “APU” into the scratchpad and line select to the “SEL-APU” field.

Note: If an engine is shutdown after selecting APU to Pack operation, the engine cannot be started until APU to Pack takeoff mode has been deleted. To re-establish APU to Pack operation after start, re-enter "APU" into the scratchpad and line select to the "SEL-APU" field.

After climb thrust reduction:

APU Selector Off.

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Supplementary Procedures
Anti-Ice, Rain**Chapter SP**
Section 3

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.

Windshield Wiper Use

CAUTION: Windshield scratching will occur if the windshield wipers are operated on a dry windshield.

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Supplementary Procedures
Automatic Flight

Chapter SP
Section 4

AFDS

AFDS Operation

FLIGHT DIRECTOR switchesON

Verify FLT DIR is displayed in the AFDS system status annunciator.

If the autopilot is desired:

AUTOPILOT engage switchPush

Verify A/P is displayed in the AFDS system status annunciator.

Heading Hold

If the airplane is operating in polar regions:

HEADING REFERENCE switchTRUE

HEADING/TRACK reference switchPush

Verify HDG is displayed in the HDG/TRK window.

Heading/track HOLD switchPush

Verify HDG HOLD is displayed in the roll mode annunciator.

Heading Select

Maintains the airplane heading the same as the selected heading.

If the airplane is operating in polar regions:

HEADING REFERENCE switchTRUE

HEADING/TRACK reference switchPush

Verify HDG is displayed in the HDG/TRK window.

Heading/track SELECT switchPush

Verify HDG SEL is displayed in the roll mode annunciator.

Heading/track selector Rotate

Set desired heading in the HDG/TRK window.

Track Hold

If the airplane is operating in polar regions:

HEADING REFERENCE switch TRUE

HEADING/TRACK switch Push

Verify TRK is displayed in the HDG/TRK window.

Heading/track HOLD switch Push

Verify TRK HOLD is displayed in the roll mode annunciator.

Track Select

Maintains the airplane track the same as the selected track.

If the airplane is operating in polar regions:

HEADING REFERENCE switch TRUE

HEADING/TRACK reference switch Push

Verify TRK is displayed in the HDG/TRK window.

Heading/track SELECT switch Push

Verify TRK SEL is displayed in the roll mode annunciator.

Heading/track selector Rotate

Set desired track in the HDG/TRK window.

Altitude Hold

Altitude HOLD switch Push

Verify ALT is displayed in the pitch mode annunciator.

Flight Level Change, Climb or Descent

ALTITUDE selector Rotate

Set the desired altitude in the MCP ALTITUDE window.

FLCH switch Push

Verify FLCH SPD is displayed in the pitch mode annunciator.

IAS/MACH selector Rotate

Set the desired speed in the IAS/MACH window.

Vertical Speed, Climb or Descent

ALTITUDE selector Rotate

Set the desired altitude in the MCP ALTITUDE window.

VERTICAL SPEED/FLIGHT PATH ANGLE reference switch Push

Verify V/S is displayed in the vertical speed/flight path angle window.

VERTICAL SPEED/FLIGHT PATH ANGLE switch Push

Verify V/S is displayed in the pitch mode annunciator.

VERTICAL SPEED/FLIGHT PATH ANGLE selector Rotate

Set the desired vertical speed in the VERTICAL SPEED/FLIGHT
PATH ANGLE window.

If a climb is desired:

Select climb thrust limit on the CDU THRUST LIM page.

Flight Path Angle, Climb or Descent

ALTITUDE selector Rotate

Set the desired altitude in the MCP ALTITUDE window.

VERTICAL SPEED/FLIGHT PATH ANGLE Reference switch Push

Verify FPA is displayed in the vertical speed/flight path angle
window.

VERTICAL SPEED/FLIGHT PATH ANGLE switch Push

Verify FPA is displayed in the pitch mode annunciator.

VERTICAL SPEED/FLIGHT PATH ANGLE selector Rotate

Set the desired flight path angle in the VERTICAL SPEED/FLIGHT
PATH ANGLE window.

If a climb is desired:

Select climb thrust limit on the CDU THRUST LIM page.

Autothrottle Operation

AUTOTHROTTLE ARM switches ARM

If the pitch mode is TO/GA:

TO/GA switch Push

Verify that THR REF is displayed in the autothrottle mode annunciator. THR REF changes to HOLD at 80 knots.

If the pitch mode is ALT, V/S, FPA, G/S, or no pitch mode:

AUTOTHROTTLE switch Push

Verify that SPD is displayed in the autothrottle mode annunciator.

If a constant speed is desired:

IAS/MACH selector Rotate

Set the desired speed in the IAS/MACH window.

If climb or continuous thrust is desired:

CLB CON switch Push

Verify that THR REF is displayed in the autothrottle mode annunciator.

If FLCH or VNAV is desired:

FLCH or VNAV switch Push

Verify that THR REF, THR, SPD, IDLE, or HOLD as appropriate is displayed in the autothrottle mode annunciator.

If TO/GA is desired:

TO/GA switch Push

The pitch mode will change to TO/GA. Verify that THR or THR REF is displayed in the autothrottle mode annunciator.

If the pitch mode is VNAV PTH, VNAV ALT, VNAV SPD, or FLCH SPD:

AUTOTHROTTLE switch Push

Verify THR REF, THR, SPD, IDLE, or HOLD as appropriate is displayed in the autothrottle mode annunciator.

Instrument Approach - RNAV (RNP) AR

Note: Operators need approval to conduct RNAV (RNP) AR Instrument Approaches.

Note: For RNAV (GPS) and RNAV (GNSS) procedures use the Landing Procedure - Instrument Approach using VNAV in Normal Procedures.

Note: This procedure is not authorized using QFE.

The procedure below supplements normal Preflight, Cruise, Descent and Approach Procedures and replaces the Landing Procedure.

Preflight Procedure

Review RNP availability predictions.

Pre-approach Requirements

Airplane equipment required to begin the approach:

- 2 CDUs
- EICAS Display
- [before AIMS BP V17A]
- 2 GPS Receivers
- 2 NDs
- 2 PFDs

Verify the following messages are not shown:

- [AIMS BP V17 or AIMS BP V16 with AIMS 1 Hardware]
- AIR DATA SYS
- [FMC L/R OPTION]
- FMC L or FMC R
- GND PROX SYS
- [AIMS BP V17A or later]
- GPS L or GPS R
- NAV ADIRU INERTIAL
- [before AIMS BP V17 or AIMS BP V16 with AIMS 1 Hardware]
- NAV AIR DATA SYS
- NAV UNABLE RNP
- SGL SOURCE RAD ALT
- SINGLE SOURCE F/D
- TERR POS

Note: Do the Go-around and Missed Approach Procedure if the NAV UNABLE RNP EICAS message or VERIFY POSITION FMC alert is shown unless suitable visual reference is established and maintained.

Do the following prior to starting the approach:

- verify the NAV UNABLE RNP alert is not displayed
- verify the approach RNP is equal to or greater than:
 - [before AIMS BP V16]
 - 0.11 (A/P)
 - 0.14 (F/D)
 - [AIMS BP V16 or later]
 - 0.11 (A/P or F/D)
- verify the winds are within limits published for the approach (if applicable)
- verify the reported airport temperature is within published limits for the approach
- review the maximum IAS for each segment of the approach as determined by aircraft category and applicable regulatory airspeed requirements
- set current local altimeter (remote altimeter settings not allowed)

Cruise Procedure

Pilot Flying	Pilot Monitoring
	<p>When selecting the approach from the navigation database verify ACT RTE LEGS page matches the charted approach.</p> <p>Verify displayed glidepath (GP) angle is not less than the charted value minus 0.01 degrees.</p> <p>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.</p>

Descent Procedure

Pilot Flying	Pilot Monitoring
In the approach briefing include speed and altitude restrictions, missed approach, engine failure, and unable RNP procedures.	[AIMS BP V14 or later] Verify RAD NAV INHIBIT - ON on the REF NAV DATA page.

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.

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

Pilot Flying	Pilot Monitoring
Initially: <ul style="list-style-type: none">• If on radar vectors<ul style="list-style-type: none">• HDG SEL• Pitch mode (as needed)• If enroute to a fix<ul style="list-style-type: none">• LNAV or other roll mode• VNAV or other pitch mode	

Pilot Flying	Pilot Monitoring
	<p>Notify the cabin crew to prepare for landing. Verify the cabin is secure.</p> <p>Notify the supernumeraries to prepare for landing.</p>
<p>Select TERR on map.</p> <p>Select ACT RTE LEGS page.</p>	<p>Select TERR or WXR on map.</p>
<p>Use LNAV and VNAV or other pitch mode for initial descent. VNAV is required FAF inbound.</p> <p>Some approach procedures can require use of VNAV from the IAF onward.</p> <p>On intercept heading, arm or verify LNAV.</p>	
<p>Call “FLAPS ____” according to the flap extension schedule or approach speed constraint.</p>	<p>Set the flap lever as directed.</p>
<p>Approximately 2 NM before the final approach fix and after ALT or VNAV PTH or VNAV ALT is annunciated:</p> <ul style="list-style-type: none"> • Set DA(H) on the MCP • Select or verify VNAV • Select or verify speed intervention 	<p>Call “APPROACHING GLIDE PATH.”</p>
<p>Maximum Lateral Deviation (XTK ERROR): NPS amber indication or 1 x RNP.</p> <p>Maximum Vertical Deviation - FAF to DA: 75 feet.</p> <p>Monitor NPS.</p>	
<p>Approaching glide path, call:</p> <ul style="list-style-type: none"> • “GEAR DOWN” • “FLAPS 20” 	<p>Set the landing gear lever to DN.</p> <p>Set the flap lever to 20.</p>
<p>Set the SPEEDBRAKE lever to ARM.</p>	
<p>Beginning the final approach descent, call “FLAPS ____” as needed for landing.</p>	<p>Set the flap lever as directed.</p>
<p>Call “LANDING CHECKLIST.”</p>	<p>Do the LANDING checklist.</p>
<p>At the final approach fix, verify the crossing altitude matches the charted value within 100 feet.</p>	

Pilot Flying	Pilot Monitoring
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), disengage the autopilot in accordance with regulatory requirements. Maintain the glide path to landing.	

Instrument Approach Using Vertical Speed (V/S) or Flight Path Angle (FPA)

Pilot Flying	Pilot Monitoring
Initially: <ul style="list-style-type: none">• If on radar vectors• HDG SEL• Pitch mode (as needed)• If enroute to a fix<ul style="list-style-type: none">• LNAV or other roll mode• VNAV or other pitch mode	
Call “FLAPS_____” according to the flap extension schedule.	Set the flap lever as directed.

Note: If required to remain at or above MDA(H) during the missed approach, missed approach must be initiated at least 50 feet above MDA(H).

Recommended roll modes:

- RNAV, GPS, LOC-BC, VOR or NDB approach: LNAV, TRK SEL, or HDG SEL
- LOC, SDF, or LDA approach: LOC or LNAV

Note: When using LNAV to intercept a localizer, LNAV might parallel the localizer without capturing it. Use HDG SEL/TRK or HDG HOLD/TRK HOLD to intercept the final approach course, if needed.

Ensure appropriate nav aids (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.	

Pilot Flying	Pilot Monitoring
<p>Approximately 2 NM before the final approach fix, set the first intermediate altitude constraint or MDA(H).</p> <p>Set the MCP altitude to the nearest 100 foot increment at or below each intermediate altitude constraint.</p> <p>When the current constraint is assured, set the next constraint before ALT is engaged to achieve a continuous descent path.</p> <p>Set the MCP altitude to the nearest 10 foot increment at or above the MDA(H).</p>	<p>Approximately 2 NM before the final approach fix, call “APPROACHING GLIDE PATH.”</p>
<p>Call:</p> <ul style="list-style-type: none"> • “GEAR DOWN” • “FLAPS 20” 	<p>Set the landing gear DN.</p> <p>Set the flap lever to 20.</p>
Set the speedbrake lever to ARMED.	

At descent point:

Pilot Flying	Pilot Monitoring
Call “FLAPS ____” as needed for landing.	Set the flap lever as directed.

V/S or FPA switchPush

Verify V/S or FPA mode annunciates.

Desired V/S or FPA Set

Set desired V/S or FPA to descend to MDA(H). Use a V/S or FPA that results in no level flight segment at MDA(H).

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.

Disengage autopilot in accordance with regulatory requirements.

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 20 (landing flaps optional)
- Speedbrake armed

MCP Altitude selectorSet

Accomplish an instrument approach, establish suitable visual reference, and level off at MDA(H).

Verify ALT or VNAV ALT mode annunciates.

Set ALT HOLD as needed.

MCP Altitude selectorSet Missed Approach Altitude

HDG SEL/HDG HOLD or

TRK SEL/TRK HOLD switchPush

Verify HDG SEL/HDG HOLD or TRK SEL/TRK HOLD mode annunciates.

Before starting the turn to base:

- Landing flaps (if not previously selected)
- Do the landing checklist

Intercepting the landing profile:

A/P Disconnect switchPush

Intentionally
Blank

**Supplementary Procedures
Communications****Chapter SP
Section 5****Flight Deck Communications System (Datalink)**

The following procedures are one means which may be used to verify Pre-Departure Clearance, Digital-Automatic Terminal Information Service (D-ATIS), Oceanic Clearances, Weight and Balance and Takeoff Data messages transmitted via the COMPANY format.

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 Terminal 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 value are different, or the alpha value is not present, the flight crew must verify the altimeter setting by other means.

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 that the Weight and Balance numeric and alphabetic values are identical. If the Weight and Balance numeric and alphabetic values are different, the flight crew must not accept the Weight and Balance data.

Takeoff Data

The flight crew shall verify that 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.

Intentionally
Blank

Supplementary Procedures
Electrical**Chapter SP**
Section 6

Electrical Power Down

The following procedure is accomplished to remove all electrical power from the airplane.

Before accomplishing the following steps, verify ADIRU, EMER LIGHTS, and PACK switches are off and HYD PRESS SYS L+C+R message is displayed.

APU selector and/or EXTERNAL POWER switch(es) OFF
External power sources Removed
Verify that the external power AVAIL lights are extinguished.
BATTERY switch OFF

Electrical Power Up

The following procedure is accomplished to permit safe application of electrical power.

BATTERY switch ON
C1 and C2 PRIMARY pump switches OFF
DEMAND pump selectors OFF
WIPER selectors OFF
Landing gear lever DN
ALTERNATE FLAPS selector OFF
Electrical power Establish
BUS TIE switches AUTO

If external power is desired:

PRIMARY EXTERNAL POWER AVAIL light.. Illuminated
PRIMARY EXTERNAL POWER switch..... Push

SECONDARY EXTERNAL POWER switch.....Push

APU GENERATOR switchON

APU selectorSTART, then ON

Supplementary Procedures
Engines, APU**Chapter SP**
Section 7

APU Ground Pneumatic Start

Duct pressure Observe

Observe duct pressure is a minimum of 15 PSI (less 1 PSI per 1000 feet of pressure altitude).

Accomplish normal APU start.

Engine Battery Start

Accomplish the normal Exterior Inspection and the normal Preliminary Preflight Procedure – Captain or First Officer through “Circuit breakers Check.”

BATTERY switch ON

C1 and C2 PRIMARY pump switches OFF

DEMAND pump selectors OFF

WIPER selectors OFF

Landing gear lever DN

ALTERNATE FLAPS selector OFF

STANDBY POWER switch
(overhead maintenance panel) Push to BAT, release to AUTO

Center bleed ISOLATION switch OFF

Ground pneumatic source (if available) Connect

If the APU is required for pneumatic power:

APU selector START, then ON

Speedbrake lever Down

Reverse thrust levers Down

Thrust levers Closed

Flap position indication and flap lever Agree

Parking brake Set

FUEL CONTROL switches CUTOFF

Captain’s audio control panel..... Set

Start the left engine using the normal Engine Start procedure. Bleed air is available only to the left engine.

Limit start attempts to one autostart or two manual start attempts.

After left engine is started:

Ground pneumatic source (if used)..... Disconnect

Center bleed ISOLATION switch AUTO

Complete the normal Preflight, Before Start, and Engine Start procedures.

Engine Crossbleed Start

Do not accomplish a crossbleed start during pushback.

The APU must be shut down or the APU Bleed switch must be turned off.

Verify the area behind the airplane is clear of equipment and personnel before increasing thrust on operating engine.

Thrust lever (operating engine) Advance

[GE, PW Engines]

Increase thrust until 5% N2 above idle (25 PSI minimum duct pressure).

[RR Engines]

Increase thrust until 5% N3 above idle (25 PSI minimum duct pressure).

Accomplish normal engine start.

Engine Ground Pneumatic Start

Duct pressure Observe

[Observe duct pressure is a minimum of 25 PSI (less 1 PSI per 1000 feet of pressure altitude)].

Accomplish normal engine start.

Manual Engine Start

Do the Aborted Engine Start checklist for the following abort start conditions:

- There is no oil pressure rise before selecting RUN.
- EGT exceeds limits.

[GE, PW Engines]

- The EGT does not increase by 20 seconds after the FUEL CONTROL switch is moved to RUN.

[RR Engines]

- The EGT does not increase by 30 seconds after the FUEL CONTROL switch is moved to RUN.

[GE Engines]

- There is no N1 rotation indicated by 50% N2.

[PW Engines]

- There is no N1 rotation indicated by 40% N2.

[RR Engines]

- There is no N1 rotation indicated by 45% N3.

[GE, PW Engines]

- N2 does not reach idle within two minutes after selecting RUN.

[RR Engines]

- N3 does not reach idle within two minutes after selecting RUN.

Select the secondary engine display. F/O

Start sequenceAnnounce C

AUTOSTART switchOFF F/O

Call "START ____ ENGINE" C

[GE Engines with CON Position, PW Engines]

Engine START/IGNITION selector START F/O

[GE Engines without CON Position, RR Engines]

Engine START selector START F/O

Verify that the oil pressure increases. C, F/O

[RR Engines]

Verify EGT less than 100 degrees C. C

[GE Engines]

When at maximum motoring (less than 1% increase in N2 for approximately 5 seconds):

FUEL CONTROL switch.....	RUN	C
--------------------------	-----	---

[PW Engines]

When at maximum motoring, 15% N2 minimum (less than 1% increase in N2 for approximately 5 seconds):

FUEL CONTROL switch.....	RUN	C
--------------------------	-----	---

[RR Engines]

When at maximum motoring (less than 1% increase in N3 for approximately 5 seconds), or N3 greater than 25%, whichever occurs first:

FUEL CONTROL switch.....	RUN	C
--------------------------	-----	---

Observe initial EGT rise and EGT within limits.	C, F/O
---	--------

After the engine is stabilized at idle:

If AUTOSTART is operative:

AUTOSTART switch	ON	F/O
------------------------	----	-----

The AUTOSTART switch may stay OFF between manual starts when both engines are to be started manually.

After the engine is stable at idle, start the other engine.

Manual Override Engine Start

Start the engine using normal engine start procedure, except direct the ground crew to:

[GE with CON IGN, PW Engines]

- manually open the start valve after positioning START/IGNITION selector to START

[GE with no CON IGN, RR Engines]

- manually open the start valve after positioning START selector to START

[GE Engines]

- manually close the start valve at 62% N2.

[PW Engines]

- manually close the start valve at 42% N2.

[RR Engines]

- manually close the start valve at 50% N3.

Heading Reference Switch Operation

Use TRUE when operating in regions where true referencing is needed.
Use NORM in all other regions.

HDG REF switch NORM or TRUE

Note: If using HDG SEL or TRK SEL and the HDG REF switch position is changed, the AFDS roll mode will change to HDG HOLD or TRK HOLD, respectively; HDG SEL or TRK SEL can be reselected.

Note: If the HDG REF switch position must be changed for an approach, it must be changed before the APP mode is armed.

If the HDG REF switch position is changed after the APP mode is armed:

- The AFDS roll mode will not change from HDG SEL or TRK SEL to HDG HOLD or TRK HOLD, respectively
- The AFDS will not follow the MCP-selected heading
- LOC capture and tracking performance may be degraded
- Exiting the APP mode restores normal operation of the HDG REF switch and the AFDS, APP mode can be reselected.

QFE Operation

Use this procedure when ATC altitude assignments are referenced to QFE altimeter settings.

Note: Do not use LNAV or VNAV.

INIT REF key Push

<INDEX Select

<APPROACH Select

LANDING REF key Select

Verify QFE selected.

[This sets the landing altitude to zero.]

Altimeters Set

Set altimeters to QFE when below transition altitude/level.

If the QFE altimeter setting is beyond the range of the altimeters, QNH procedures must be used with QNH set in the altimeters.

Departure or Destination Airport Not in the FMC Navigation Database

When departing from or landing at an airport that is not in the FMC navigation database, the following items are affected:

- Cabin pressurization schedule
- Availability of departure, arrival, and approach procedures in the FMC
- Automatic tuning of VOR, DME, and ILS radios for departure, arrival, and approach procedures
- Format of altitudes and flight levels on the ND and CDU
- Barometric transition altitude alerts (amber display and box) on the PFD

[Option - Landing Altitude Reference Bar]

- Landing altitude reference bar (white/amber bar) on the PFD altitude tape
- Landing altitude indication (amber crosshatched area) on the PFD altitude tape

Use the following procedures when departing from or landing at an airport that is not in the FMC navigation database.

Departure Airport Not in the FMC Navigation Database

CDU Preflight Procedure - Captain and First Officer

RTE keyPush

If ORIGIN contains an ICAO identifier:

The following steps clear the ORIGIN and erase the previous route.

INIT REF keyPush

<INDEXSelect

<IDENTSelect

Inactive date rangeSelect

ACTIVE date rangeSelect

Transfers the inactive navigation database to the ACTIVE line and removes the previously entered route.

Clear the NAV DATA OUT OF DATE scratchpad message.

Inactive date range Select

ACTIVE date range Select

Transfers the inactive navigation database to the ACTIVE line.

Verify the ACTIVE date range is current.

RTE key Push

Leave ORIGIN blank.

DESTEnter

RouteEnter

LEGS key Push

Enter the latitude and longitude of the departure airport as the first
waypoint on the route.

ACTIVATE and execute the route.

VNAV key Push

Displays the CLB page.

TRANS ALTEnter

NAV RAD key Push

Departure navaid frequency and CRS (as needed)Enter

LDG ALT selectorPull

Rotate to set the departure airport altitude manually. This reduces
crew workload in the event of a return to the departure airport.

Do not accomplish the following checklist:

LANDING ALTITUDE

After engine start, override the LANDING ALTITUDE checklist.

Note: The LDG ALT flag is shown on the PFD.

[Option - Landing Altitude Reference Bar]

Note: The landing altitude reference bar (white/amber bar) is not
shown on the PFD altitude tape.

Note: The landing altitude indication (amber crosshatched area) is not
shown on the PFD altitude tape.

When no longer needed, delete the departure navaid frequency and CRS.

Before Descent

LDG ALT selector Push

The FMC sets the destination altitude automatically.

VNAV key Push

NEXT PAGE key Push

FORECAST> Select

Displays the DESCENT FORECAST page.

TRANS LVL Enter

Overwrites the manually entered departure airport transition altitude.

Destination Airport Not in the FMC Navigation Database

CDU Preflight Procedure - Captain and First Officer

The following steps can also be done in flight.

LEGS key Push

Enter the latitude and longitude of the destination airport as the final waypoint on the route.

Enter a speed/altitude constraint for the final waypoint. The speed constraint should be the planned approach speed and the altitude constraint should be the destination airport elevation.

ACTIVATE (if needed) and execute the route.

Before Descent

VNAV key Push

NEXT PAGE key Push

FORECAST> Select

Displays the DESCENT FORECAST page.

TRANS LVL Enter

LDG ALT selector Pull

Rotate to set the destination airport altitude manually.

Do not accomplish the following checklist:

LANDING ALTITUDE

Override the LANDING ALTITUDE checklist.

Note: The LDG ALT flag displays on the PFD.

[Option - Landing Altitude Reference Bar]

Note: The landing altitude reference bar (white/amber bar) does not display on the PFD altitude tape during approach.

Note: The landing altitude indication (amber crosshatched area) does not display on the PFD altitude tape during landing.

Note: The ARRIVALS page is not available for the destination airport.

Before Approach

NAV RAD key Push

Destination navaid frequency and CRS (as needed)Enter

ND mode selector As needed

Select APP, VOR, or MAP based on the type of approach to be flown.

[Option - Enhanced FIX Pages]

Note: To create a reference on the ND map, on the FIX INFO page, enter the latitude and longitude of the runway threshold and enter the reciprocal of the final approach course as a bearing. This creates a dashed green line, aligned with the final approach course on the ND map.

ADIRU Alignment/Position Update

If an ADIRU position update is desired during an automatic realignment (on ground only):

CDU SET

When dash prompts appear on the SET INERTIAL POS line of the POS INIT page, enter the most accurate position.

If a manual ADIRU alignment is desired (on ground only):

ADIRU switch OFF 30 seconds, then ON

Wait an additional 30 seconds.

CDU SET

Enter the most accurate position in the boxes on the SET INERTIAL POS line of the POS INIT page.

Alignment requires from six to fifteen minutes depending on latitude (six minutes at the equator, ten minutes average).

FMS Position Update

When the FMC message VERIFY POSITION is displayed, the FMC position may require updating.

POS REF page 2/3 Select

POS REF 2/3 is the second page of POS INIT 1/3.

Compare the FMS positions with the displayed GPS, RADIO, and INERTIAL positions.

Select the most appropriate source for FMC position updating.

UPDATE ARM> Select

The ARM prompt changes to ARMED and NOW prompts appear to the right of the remaining position sources.

Appropriate source UPDATE NOW> Select

Navaid Inhibit or Enable

Note: For terminal operations, if the airspace, FMC database, and charts are not referenced to the WGS-84 datum, inhibit GPS updates unless other appropriate procedures are used.

To inhibit GPS:

INIT REF keyPush

<INDEXSelect

<POSSelect

Displays the POS INIT page 1/3.

PREV PAGE keyPush

Displays the POS REF page 3/3.

GPS NAVSelect

Verify OFF displays in large font.

Note: The FMC uses inertial inputs only.

To enable radio updating:

INIT REF keyPush

<INDEXSelect

NAV DATA>Select

Note: The default state of RAD NAV INHIBIT is ON; all radio updating is inhibited. ON displays.

RAD NAV INHIBITSelect

Selection enables all radio updating. Verify OFF displays.

Second selection inhibits VOR/DME updating. Verify VOR displays.
DME/DME updating is operable.

Third selection inhibits all radio updating; ON displays.

To inhibit VORs, VOR/DMEs, VORTACs, or DMEs:

INIT REF keyPush

<INDEXSelect

NAV DATA>Select

Navaid identifier (NAVAID INHIBIT line).....Enter

VOR identifier (VOR ONLY INHIBIT line).....Enter

RNP Manual Entry

The FMC automatically supplies default RNP values based on phase of flight. When the airplane is on a procedure or airway that has an RNP requirement, and does not have an RNP value stored in the navigation database, a manual RNP entry may be made.

POS REF page 2/3 Select
POS REF 2/3 is the second page of POS INIT 1/3.

If the displayed RNP is different from the RNP for the current airway or procedure:

RNP Enter

When the manually entered RNP is no longer required:

POS REF page 2/3 Select

RNP Delete

Intentionally
Blank

Supplementary Procedures**Fuel****Chapter SP****Section 12**

Fuel Balancing

If fuel leak is suspected:

Accomplish the FUEL LEAK checklist.

If fuel balancing is desired prior to display of the FUEL IMBALANCE alert message, accomplish the FUEL IMBALANCE non-normal checklist.

Cold Fuel Operations

[RR Engines]

CAUTION: Do not do this procedure and balance fuel at the same time. Balance fuel before or after doing the procedure.

Within 2 hours of top of descent (TD), but not less than 15 minutes before top of descent (TD), check fuel temperature.

If fuel temperature is colder than -10 degrees C, do one of the following:

- 1) Perform a step climb using maximum climb thrust (VNAV preferred), or
- 2) Select or verify CLB thrust on the thrust limit page and verify cruise speed is set to 0.84 Mach or less. Then,
 - manually advance thrust levers to maximum (autothrottles may be overridden). After reaching maximum climb thrust, hold for 10 seconds or until reaching 0.86 Mach, whichever occurs first,
 - check engines have achieved maximum climb thrust and respond normally,
 - retard thrust levers to cruise power and resume normal operations.

If fuel temperature is -10 degrees C or warmer, no crew action required.

Intentionally
Blank

Supplementary Procedures
Warning Systems**Chapter SP**
Section 15**Runway Awareness and Advisory System (RAAS) Override Operation**

[Option - With Runway Awareness and Advisory System]

If one or more of the following exist:

- The airport 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.

GROUND PROXIMITY RUNWAY OVERRIDE switch .OVRD

Intentionally
Blank

Supplementary Procedures
Adverse Weather**Chapter SP**
Section 16**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:

[\[Option - Airplanes with fixed derate option.\]](#)

- 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

[\[Option - Airplanes without fixed derate option.\]](#)

- For wet runways, reduced thrust (assumed temperature method) 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 (assumed temperature method) 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).

- visible moisture (clouds, fog with visibility of one statute mile (1600 m) 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.

Exterior Inspection

Do the normal Exterior Inspection with the following additional steps:

Surfaces Check

Takeoff with light coatings of frost, up to 1/8 inch (3mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, and upper wing surfaces 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.

Pitot probes and static ports Check

Verify that all pitot probes and static ports are 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 valves, are free of snow and ice.
- Engine inlets Check
Verify that the inlet cowling is free of snow and ice.
- Fuel tank vents Check
Verify that 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 must be free of snow and ice before APU start.

Engine Start Procedure

Do the normal Engine Start Procedure with the following considerations:

- If the engine has been cold soaked for more than four 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 fuel system components.
- Oil pressure may be slow to rise
- Initial oil pressure rise may be higher than normal
- Additional warm-up time may be needed to allow oil temperature to reach the normal range.
- Displays may require additional warm-up time before displayed engine indications accurately show changing values. Displays 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, except when the temperature is below -40°C OAT.

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:

ENGINE ANTI-ICE selectors ON F/O

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE selectors AUTO F/O

Before Taxi Procedure

Do the normal Before Taxi Procedure with the following modifications:

If there is snow or ice accumulation on the wing, consider delaying the flight control check until after de-icing/anti-icing is accomplished.

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 for takeoff. C

Flap leverSet takeoff flaps, as needed F/O

Taxi-Out

CAUTION: Taxi at a reduced speed. Use smaller tiller 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.

When engine anti-ice is required and the OAT is 3°C or below, do an engine run up, as needed, to minimize ice build-up. Use the following procedure: C

Check that the area behind the airplane is clear.

[\[PW Engines and GE Engines except 110B/115B\]](#)

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 15 minutes.

[\[RR Engines and GE 110B/115B engines\]](#)

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 60 minutes.

Engine Core Ice Shedding

[RR Engines]

Flight crews are to use the following core ice shed procedures for Trent 800 engines when freezing fog with visibility 300 meters or less is reported.

If takeoff can be achieved within 45 minutes total taxi time, accomplish the existing Engine Anti-Ice Operation - On the Ground Supplementary Procedures prior to brake release for takeoff. The core ice shed procedure is not required.

If takeoff cannot be achieved within 45 minutes total taxi time, accomplish the following core ice shed procedure within 45 minutes total taxi time to clear the core ice from the engine. Accomplish the following core ice shed procedure at subsequent intervals no greater than every 45 minutes prior to takeoff.

If OAT is 0 degrees C to -6 degrees C, run-up the engines to 50% N1 for 60 seconds every 45 minutes.

If OAT is -7 degrees C to -13 degrees C, run-up the engines to 59% N1 for 60 seconds every 45 minutes.

Note: Setting run-up thrust at 59% N1 is recommended as the Takeoff Configuration Warning may be annunciated at 60% N1.

CAUTION: Precautions must be taken for:

- Jet blast up to 900 feet (300 meters) behind the aircraft.
- Snow and ice at the edge of the taxi way that can be ingested by the engines.
- Slippery taxi surfaces.
- Airport noise restrictions.

If OAT is less than -13 degrees C, there is no effective run-up procedure and manual de-icing is required.

Regardless of temperature, if the core ice shedding procedure described above is not accomplished within 45 minutes total taxi time in freezing fog, but takeoff can be achieved within 60 minutes total taxi time in freezing fog, takeoff is permitted. A borescope inspection will be required within 10 flights. A note must be made in the log book of this condition.

Take off is not permitted if total taxi time in freezing fog with visibility 300 meters or less exceeds 60 minutes without having accomplished the above core ice shed procedure. The engine core must be manually de-iced.

Note: Crews must include taxi-in time from the previous flight if taxi-in occurred in freezing fog with visibility 300 meters or less and the temperature remains below freezing. The engine may be considered free of ice prior to engine start if:

- manually de-iced,
- visually inspected per the AMM, or
- the above core ice shed run-up procedure is conducted within 5 minutes before engine shutdown during taxi-in.

If the engine is considered free of ice prior to engine start, use only the total taxi-out time.

To avoid manual de-icing requirements, operators are encouraged to work with airport authorities to limit or eliminate exposure to extended taxi times when freezing fog conditions exist.

In all cases, accomplish the Engine Anti-Ice Use Supplementary Procedure, prior to brake release for takeoff when the conditions in the procedure are applicable.

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:

- BROADBAND COM switch.....OFF, guard closed
- APU As needed F/O
- The APU should be shut down unless APU operation is necessary.
- Call “FLAPS UP”. C

777 Flight Crew Operations Manual

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.

PACK switches	OFF	
---------------------	-----	--

Wait approximately 10 seconds after pack switches are off before positioning bleed switches to off to reduce pack wear.

ENGINE bleed switches (engines running)	OFF	F/O
---	-----	-----

Reduces the possibility of fumes entering the air conditioning system.

APU bleed switch (APU running)	OFF	F/O
--------------------------------------	-----	-----

Reduces the possibility of fumes entering the air conditioning system.

After de-icing / anti-icing is completed:

BROADBAND COM switch	As needed, guard closed	
----------------------------	-------------------------	--

APU	As needed	F/O
-----------	-----------	-----

Wait approximately one minute after de-icing is completed to restore engine and APU bleed air and pack operation to ensure all de-icing fluid has been cleared from the engines:

PACK switches	AUTO	F/O
---------------------	------	-----

ENGINE bleed switches	ON	F/O
-----------------------------	----	-----

APU bleed switch	AUTO	F/O
------------------------	------	-----

Flight Controls	Check, as needed	C
-----------------------	------------------	---

Before Takeoff Procedure

Do the normal Before Takeoff Procedure with the following modification:

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, standing water, or icing conditions, or because exterior de-icing / anti-icing.

[PW, RR engines]

Engine oil temperature Minimum 50°C PF

[RR engines]

Oil temperature must be at least 50°C before takeoff.

[PW engines]

Oil temperature must be at least 50°C before takeoff. Any subsequent drop in oil temperature does not affect engine performance.

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:

[PW, RR engines]

Run-up to a minimum of 50% N1 and confirm stable engine operation before the start of the takeoff roll.

[GE engines]

Note: Operation in icing conditions may result in engine vibration indications above the normal operating range during ice shedding.

[GE engines]

Run-up to as high a thrust setting as practical (minimum of 50% N1), confirm stable engine operation, and if vibration indications are available, ensure engine vibration indications are below 4 units before the start of the takeoff roll.

Engine Anti-ice Operation - In-flight

Engine anti-ice must be AUTO or ON during all flight operations when icing conditions exist or are anticipated, except when the temperature is below -40°C SAT.

CAUTION: Do not use engine anti-ice when TAT is above 10°C.

Manual Use of Engine Anti-ice

When using the engine anti-ice system manually in areas of possible icing, activate engine anti-ice before entering icing conditions.

WARNING: If using the engine anti-ice system manually, 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.

When manual use of engine anti-ice is needed:

ENGINE ANTI-ICE selectors ON PM

When manual use of engine anti-ice is no longer needed:

ENGINE ANTI-ICE selectors AUTO or OFF PM

Fan Ice Removal

CAUTION: Avoid prolonged operation in moderate to severe icing conditions.

If moderate to severe icing conditions are encountered:

[\[GE engines\]](#)

During flight in moderate to severe icing conditions for prolonged periods with N1 settings at or below 70%, or when fan icing is suspected due to high engine vibration, the fan blades must be cleared of any ice. Do the following procedure every 15 minutes on both engines, one engine at a time: reduce thrust toward idle then increase to a minimum of 70% N1 for 10 to 30 seconds.

[\[GE 110B, GE 115B engines\]](#)

Note: Operation in icing conditions may result in displayed vibration levels up to and exceeding the normal operating range. Extended operation at high vibration levels in icing conditions will not result in engine damage.

[\[PW engines\]](#)

During flight in moderate to severe icing conditions for prolonged periods with N1 settings at or below 70% and when fan icing is suspected due to high engine vibration, the fan blades must be cleared of any ice. Do the following procedure on both engines, one engine at a time: reduce thrust toward idle then increase to a minimum of 70% N1 for 15 seconds. Repeat this procedure as required to avoid high vibration.

[\[RR engines\]](#)

During flight in moderate to severe icing conditions for prolonged periods, if fan icing is suspected due to high engine vibration, the fan blades must be cleared of any ice. Do the following procedure on both engines, one engine at a time: quickly reduce thrust to idle for 5 seconds then restore the required thrust. If vibration persists, advance thrust lever to 90% N1 momentarily.

Wing Anti-ice Operation - In-flight

Ice accumulation on the flight deck window frames, windshield center post, or windshield wiper arm, or side windows may be used as an indication of structural icing conditions and the need to turn on wing anti-ice.

The wing anti-ice system may be used as a de-icer or anti-icer in flight only. The primary method is to use the automatic ice detection system which acts 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.

The secondary method is to select the WING ANTI-ICE selector ON when wing icing is possible and use the system as an anti-icer.

The airplane is capable of continued safe flight and landing in icing conditions in the event of an in-flight failure of the wing anti-ice system.

CAUTION: Do not use wing anti-ice when TAT is above 10°C.

Manual Use of Wing Anti-ice

When When manual use of wing anti-ice is needed:

WING ANTI-ICE switch ON PM

When manual use of wing anti-ice is no longer needed:

WING ANTI-ICE switch AUTO or OFF PM

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.

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 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 MTRS	90 MTRS	120 MTRS	150 MTRS	180 MTRS	210 MTRS	240 MTRS	270 MTRS	300 MTRS	450 MTRS	600 MTRS	900 MTRS
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

After Landing Procedure

CAUTION: Taxi at a reduced speed. Use smaller tiller 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.

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 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, except when the temperature is below -40°C OAT.

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:

ENGINE ANTI-ICE selectors ON F/O

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE selectors AUTO F/O

When engine anti-ice is required and the OAT is 3°C or below, do an engine run up, as needed, to minimize ice build-up. Use the following procedure: C

Check that the area behind the airplane is clear.

[PW Engines and GE Engines except 110B/115B]

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 15 minutes.

[RR Engines and GE 110B/115B engines]

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 60 minutes.

[RR Engines]

When engine anti-ice is required and the OAT is 0°C or below and freezing fog with visibility less than 300 meters (985 feet), do an engine run up, as needed, to minimize ice build-up. Use the following procedure:

Check that the area behind the airplane is clear. C

Reported OAT is 0°C to -6°C:

Run-up to a minimum of 50% N1 for 60 seconds every 45 minutes.

Reported OAT is -7°C to -13°C:

Run-up to a minimum of 59% N1 for 60 seconds every 45 minutes.

Note: Setting run-up thrust at 59% N1 is recommended as the takeoff Configuration Warning may be annunciated at 60% N1.

Reported OAT is below -13°C:

Manual de-icing required; there is no run-up procedure.

If the engine run-up is not accomplished within 5 minutes of engine shutdown, record taxi-in time since last engine run up.

Secure Procedure

Do the normal Secure Procedure with the following modifications:

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If the airplane will be attended:

PACK switches AUTO 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:

OUTFLOW VALVE switches MAN F/O

OUTFLOW VALVE MANUAL switches CLOSE F/O

Position the outflow valves 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 found in the approved Aircraft Maintenance Manual.

Hot Weather Operation

During extended ground operations prior to flight deck preparation, consideration should be given to reducing the heat being generated on the flight deck. Window heat, radar, and other electronic components which contribute to a high temperature level on the flight deck may be turned off. All the flight deck air outlets should be open.

[777 Passenger]

Both packs should be used (when possible) for maximum cooling. Recirculation fans should be on for maximum cooling capacity. To maximize the cooling capacity of the air conditioning system, the flight deck side windows and all doors, including cargo doors, should be kept closed as much as possible. All gasper outlets should be open and window shades on the hot (sun-exposed) side of the passenger cabin should be closed. Flight deck cooling can be improved by closing the flight deck door and lowering the side trays adjacent to the pilot seats.

[777 Freighter]

Both packs should be used (when possible) for maximum cooling. Recirculation fans should be on for maximum cooling capacity. To maximize the cooling capacity of the air conditioning system, the flight deck side windows and all doors, including cargo doors, should be kept closed as much as possible. Flight deck cooling can be improved by lowering the side trays adjacent to the pilot seats.

Note: If only cooling air from ground air conditioning cart is supplied (no pressurized air from the APU or ground external air), then the TAT probe is not aspirated. Because of high TAT probe temperatures, the FMCs may not accept an assumed temperature derate. Delay selecting an assumed temperature derate until after bleed air is available.

Moderate to Heavy Rain, Hail or Sleet

Flight should be conducted to avoid thunderstorms, hail activity or visible moisture over storm cells. To the maximum extent possible, moderate to heavy rain, hail or sleet should be avoided.

Operation in a Sandy or Dusty Environment

The main hazards of a sandy or dusty environment are airplane surface 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.

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.

Air conditioning inlets and exits Check

Verify that the air inlets and exits are free of sand and dust.

Verify that the cabin pressure outflow valves 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 inlet Check

Ensure that the APU inlet door is 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:

APUSTART, then ON F/O

Do not allow the APU selector to spring back to the ON position.

Note: Run the APU for one full minute before using it as a bleed air source.

ENG BLEED switchesOFF F/O

APU bleed switch AUTO 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 selector START F/O

Engine START/IGNITION selector START F/O

Verify that the N2 RPM increases. C, F/O

Allow maximum motoring for 2 minutes to help remove contaminants.

Note: Maximum motoring occurs when N2 acceleration is less than 1% in approximately 5 seconds.

Note: Maximum motoring occurs when N3 acceleration is less than 1% in approximately 5 seconds.

FUEL CONTROL switch RUN 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 running:

APU START, then ON F/O

Do not allow the APU selector to spring back to the ON position.

Note: Run the APU for one full minute before using it as a bleed air source.

ENG BLEED switches OFF F/O

APU bleed switch AUTO 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, if conditions allow, 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 a vortex during ground operations
- Use all engines during taxi and taxi at low speed. Limit ground speed to 10 knots and maintain thrust below 36% N1 whenever possible to avoid creating a vortex 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

Before Takeoff Procedure

Do the normal Before Takeoff Procedure with the following modification:

If APU bleed air was used:

ENG BLEED switches	ON	PM
APU selector	As needed	PM

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
- Avoid the use of "bump thrust"
- 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 allow
- Use maximum climb power to minimize time spent in dusty conditions

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
- If performance allows, 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 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:

APUSTART, then ON F/O
Do not allow the APU selector to spring back to the ON position.

Note: Run the APU for one full minute before using it as a bleed air source.

ENG BLEED switches	OFF	F/O
APU bleed switch	AUTO	F/O

Taxi-In

Do the following, if conditions allow, 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.
- Use all engines during taxi and taxi at low speed. Limit ground speed to 10 knots and maintain thrust below 36% N1 whenever possible to avoid creating a vortex 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

Secure Procedure

Do the normal Secure Procedure with the following modifications:

OUTFLOW VALVE switches (both).....	MAN	F/O
OUTFLOW VALVE MANUAL switches (both)	CLOSE	F/O

Position the outflow valves fully closed to inhibit the intake of sand and 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:

- Verify that engine covers, if applicable, are in place while the airplane is parked
- Verify that airplane doors are closed
- Verify that all openings are plugged or covered while the airplane is parked. Streamers should be used to remind personnel to remove before flight
- Ensure all compartments are closed

The recommended procedures for flight in severe turbulence are summarized below:

Passenger signs ON

Advise passengers to fasten seatbelts prior to entering areas of reported or anticipated turbulence. Instruct flight attendants to check all passengers' seat belts are fastened.

Supernumerary signs ON

Advise supernumeraries to fasten seatbelts prior to entering areas of reported or anticipated turbulence.

Structural Considerations

Flap extension in an area of known turbulence should be delayed as long as possible because the airplane can withstand higher gust loads in the clean configuration. Diversion to another airfield is recommended if severe turbulence persists in the area.

Climb, Cruise, and Descent Considerations

After takeoff, and when established in a clean climb configuration, use of the autoflight system is recommended for flight through turbulence.

During climb and descent, use of VNAV or flight level change may result in excessive pitch changes as the AFDS attempts to fly speed with the elevators. Therefore, vertical speed mode (speed on autothrottles) is recommended for climb and descent in severe turbulence.

During cruise, VNAV and altitude hold modes both fly speed on autothrottles and can be used in turbulence.

[PW or RR Engines]

In severe turbulence during cruise, it may be necessary to disconnect the autothrottles to prevent excessive thrust changes. Thrust setting guidance is available on EICAS when VNAV is engaged. Set EPR at or slightly above the magenta VNAV target EPR indication. Change thrust setting only if required to modify an unacceptable speed trend.

[GE Engines]

In severe turbulence during cruise, it may be necessary to disconnect the autothrottles to prevent excessive thrust changes. Thrust setting guidance is available on EICAS when VNAV is engaged. Set N1 at or slightly above the magenta VNAV target N1 indication. Change thrust setting only if required to modify an unacceptable speed trend.

Manual Flight in Severe Turbulence

If manual flight in severe turbulence becomes necessary, trim the airplane for the turbulent air penetration speed. Control the airplane pitch attitude with the elevators using the attitude indicator as the primary instrument. In extreme drafts, large altitude changes may occur. Do not make sudden large control inputs. Corrective actions to regain the desired attitude should be smooth and deliberate. Altitude variations are likely in severe turbulence and should be allowed to occur if terrain clearance is adequate. Control airplane attitude first, then make corrections for airspeed, altitude, and heading.

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 Non-Normal Maneuvers section 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 (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 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.
- Takeoff with full rated takeoff thrust is recommended, unless the use of ATM is required to meet a dispatch performance requirement.
- For optimum takeoff performance, use flaps 20 for takeoff unless limited by obstacle clearance and/or climb gradient. Flaps 15 may be used as a precautionary setting and will provide nearly equivalent performance to Flaps 20.
- Use the longest suitable runway provided it is clear of areas of known windshear.
- Use the flight director after takeoff.
- Consider increasing Vr speed to the performance limited gross weight rotation speed, not to exceed actual gross weight V_{r+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 build-up. Closely monitor vertical flight path instruments such as vertical speed and altimeters. The pilot monitoring should be especially aware of vertical 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 either Flaps 25 or 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 the 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 glide slope displacement. The pilot monitoring should call out any deviations from normal. Use of 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 this manual.

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.

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 aircraft surfaces.

Avoid ICI conditions. Flight in clouds containing high concentrations of ice crystals has been associated with engine vibration, engine power loss, engine damage, and airplane Total Air Temperature (TAT) probe icing.

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:

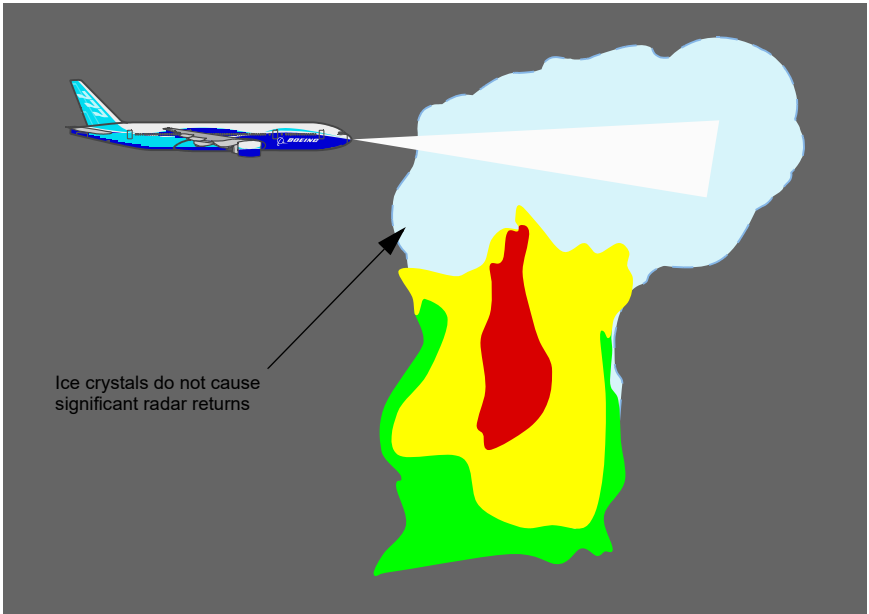
- Appearance of rain on the windshield at temperatures too cold for liquid water to exist. This is due to ice crystals melting on the heated windows (sounds different than rain)
- Airplane TAT indication remains near 0 degrees C due to TAT probe icing
- Areas of light to moderate turbulence
- In IMC 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 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)

Note: The icing conditions 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 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.

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DO NOT USE FOR FLIGHT

777 Flight Crew Operations Manual

Performance Dispatch

Table of Contents

Chapter PD

Section TOC

777-200 GE90-76B KG M JAA - - - - -	PD.10.1
777-200ER TRENT892 KG M FAA TALPA - - - - -	PD.20.1
777-200LR GE90-110B1L KG M FAA TO1-10 TO2-20 - - - - -	PD.30.1
777-300 PW4090 LB FT FAA TO1-10 TO2-20 TALPA - - - - -	PD.40.1
777-300ER GE90-115B LB FT FAA TO1-10 TO2-20 TALPA - - - - -	PD.50.1
777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA - - - - -	PD.60.1
777F GE90-110B1L KG M EASA TALPA - - - - -	PD.70.1

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Performance Dispatch**Chapter PD****Table of Contents****Section 10****777-200 GE90-76B KG M JAA****Pkg Model IdentificationPD.ModID.10.1****Takeoff..... PD.10.1**

Takeoff Field Corrections - Dry RunwayPD.10.1

Takeoff Field & Climb Limit Weights - Dry RunwayPD.10.2

Takeoff Field Corrections - Wet RunwayPD.10.4

Takeoff Field & Climb Limit Weights - Wet RunwayPD.10.5

Takeoff Obstacle Limit Weight.....PD.10.7

Takeoff Speeds - Dry RunwayPD.10.8

Takeoff Speeds - Wet RunwayPD.10.9

Enroute PD.11.1

Long Range Cruise Maximum Operating Altitude.....PD.11.1

Long Range Cruise Trip Fuel and TimePD.11.3

Long Range Cruise Step Climb Trip Fuel and TimePD.11.5

Short Trip Fuel and TimePD.11.6

Holding PlanningPD.11.7

Crew Oxygen Requirements.....PD.11.8

Net Level Off WeightPD.11.10

Landing PD.12.1

Landing Field Limit WeightPD.12.1

Approach or Landing Climb Limited Weight.....PD.12.2

Go-Around Climb GradientPD.12.3

Quick Turnaround Limit Weight.....PD.12.4

Gear Down..... PD.13.1

Takeoff/Approach or Landing Climb Limited WeightPD.13.1

Takeoff Obstacle Limit Weight.....PD.13.2

Long Range Cruise Altitude CapabilityPD.13.4

**Performance Dispatch
Pkg Model Identification****Chapter PD
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
200	777-200	7200	WY200

Intentionally
Blank

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	1210	1210	1210	1200	1200	1180	1150	1130	1100
1400	1430	1430	1420	1410	1400	1380	1350	1330	1300
1600	1660	1640	1630	1610	1600	1570	1540	1510	1480
1800	1880	1860	1840	1820	1800	1760	1720	1670	1630
2000	2110	2080	2050	2030	2000	1950	1890	1840	1780
2200	2330	2300	2260	2230	2200	2130	2070	2000	1940
2400	2550	2510	2480	2440	2400	2320	2250	2170	2090
2600	2780	2730	2690	2640	2600	2510	2420	2330	2250
2800	3000	2950	2900	2850	2800	2700	2600	2500	2400
3000	3220	3170	3110	3060	3000	2880	2770	2650	2540
3200	3450	3390	3320	3260	3200	3070	2940	2810	2680
3400	3670	3600	3540	3470	3400	3250	3110	2960	2810
3600	3900	3820	3750	3670	3600	3440	3280	3110	2950
3800	4120	4040	3960	3880	3800	3620	3450	3270	3090
4000	4340	4260	4170	4090	4000	3810	3610	3420	3230

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH(M)					
	WIND COMPONENT (KTS)					
	-10	0	10	20	30	40
1200	970	1200	1280	1360	1450	1540
1400	1140	1400	1490	1580	1670	1760
1600	1320	1600	1690	1790	1890	1990
1800	1500	1800	1900	2000	2100	2210
2000	1680	2000	2100	2210	2320	2430
2200	1860	2200	2310	2420	2540	2660
2400	2040	2400	2520	2640	2760	2880
2600	2220	2600	2720	2850	2980	3110
2800	2400	2800	2930	3060	3200	3330
3000	2580	3000	3140	3270	3410	3560
3200	2760	3200	3340	3490	3630	3780
3400	2940	3400	3550	3700	3850	4000
3600	3110	3600	3750	3910	4070	4230
3800	3290	3800	3960	4120	4290	4450
4000	3470	4000	4170	4330	4510	4680

Takeoff Field & Climb Limit Weights - Dry Runway**Flaps 15****Sea Level Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	(OAT)											
	°C	-40	14	18	22	25	29	31	33	42	46	50
	°F	-40	57	64	72	77	84	88	91	108	115	122
1200	185.7	165.0	163.6	162.2	161.2	159.8	159.1	158.3	147.1	141.3	135.3	
1400	201.7	182.4	181.1	179.8	178.8	177.5	176.9	176.1	165.7	160.2	154.7	
1600	217.1	197.3	196.0	194.6	193.7	192.4	191.7	190.9	180.2	174.6	168.9	
1800	231.4	210.6	209.1	207.7	206.7	205.3	204.6	203.8	192.5	186.7	180.6	
2000	243.5	222.1	220.6	219.1	218.1	216.7	216.0	215.1	203.5	197.4	191.2	
2200	255.1	233.0	231.5	230.0	228.9	227.4	226.7	225.8	213.9	207.6	201.2	
2400	266.2	243.4	241.8	240.3	239.2	237.7	236.9	236.0	223.7	217.3	210.7	
2600	276.7	253.3	251.6	250.1	248.9	247.4	246.6	245.7	233.0	226.4	219.6	
2800	286.7	262.5	260.8	259.2	258.0	256.4	255.6	254.7	241.6	234.8	227.8	
3000	296.0	271.0	269.3	267.6	266.3	264.7	263.9	262.9	249.3	242.3	235.1	
3200	304.9	279.1	277.3	275.6	274.3	272.6	271.8	270.7	256.8	249.5	242.0	
3400	313.4	286.8	285.0	283.2	281.9	280.1	279.3	278.2	263.9	256.3	248.7	
3600	321.5	294.2	292.4	290.5	289.2	287.4	286.5	285.4	270.6	262.9	255.0	
3800	329.3	301.3	299.4	297.5	296.1	294.3	293.4	292.3	277.1	269.2	261.1	
4000	336.6	308.0	306.0	304.1	302.7	300.8	299.9	298.8	283.3	275.2	267.0	
CLIMB LIMIT WT (1000 KG)	262.0	250.7	250.4	250.1	250.0	249.8	249.7	249.5	226.5	215.5	204.5	

1000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	(OAT)											
	°C	-40	14	18	22	25	29	31	33	42	46	50
	°F	-40	57	64	72	77	84	88	91	108	115	122
1200	181.3	160.8	159.4	158.0	157.0	155.7	154.9	152.7	140.8	135.0	128.5	
1400	197.6	178.4	177.1	175.8	174.9	173.7	172.9	170.9	159.7	154.4	148.3	
1600	212.9	193.3	191.9	190.6	189.7	188.4	187.7	185.6	174.1	168.6	162.4	
1800	226.9	206.3	204.9	203.5	202.5	201.2	200.4	198.2	186.1	180.3	173.8	
2000	238.9	217.6	216.2	214.8	213.7	212.4	211.5	209.3	196.9	190.9	184.2	
2200	250.4	228.4	227.0	225.5	224.4	223.0	222.2	219.8	207.0	200.9	193.9	
2400	261.3	238.7	237.2	235.7	234.6	233.1	232.3	229.9	216.7	210.4	203.2	
2600	271.7	248.4	246.9	245.3	244.2	242.7	241.8	239.3	225.8	219.2	211.9	
2800	281.5	257.5	255.9	254.3	253.1	251.6	250.7	248.1	234.2	227.4	219.9	
3000	290.6	265.8	264.2	262.5	261.3	259.7	258.7	256.1	241.6	234.7	226.8	
3200	299.4	273.8	272.0	270.3	269.1	267.5	266.5	263.7	248.8	241.6	233.6	
3400	307.7	281.4	279.6	277.8	276.5	274.9	273.8	271.0	255.7	248.3	239.9	
3600	315.7	288.6	286.8	285.0	283.7	281.9	280.9	278.0	262.2	254.6	246.1	
3800	323.3	295.5	293.7	291.8	290.5	288.7	287.6	284.7	268.5	260.7	252.0	
4000	330.5	302.1	300.2	298.3	296.9	295.1	294.0	291.0	274.5	266.5	257.6	
CLIMB LIMIT WT (1000 KG)	249.7	248.4	248.2	247.8	247.3	246.9	246.7	241.2	218.8	208.0	196.0	

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1500 kg.

With engine and wing anti-ice on, decrease field limit weight by 600 kg and climb limit weight by 900 kg.

Takeoff Field & Climb Limit Weights - Dry Runway**Flaps 15****2000 FT Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	(OAT)											
	°C	-40	14	18	22	25	29	31	33	42	46	50
	°F	-40	57	64	72	77	84	88	91	108	115	122
1200	176.6	156.5	155.2	153.9	152.9	151.4	149.2	146.9	134.4	128.7	121.9	
1400	193.2	174.5	173.2	172.0	171.1	169.7	167.6	165.5	153.8	148.4	142.1	
1600	208.4	189.2	187.9	186.7	185.7	184.3	182.2	180.0	168.1	162.6	156.1	
1800	222.3	202.0	200.7	199.3	198.4	196.9	194.6	192.3	179.7	173.9	167.1	
2000	234.1	213.3	211.9	210.5	209.5	208.0	205.6	203.3	190.3	184.3	177.2	
2200	245.4	223.9	222.5	221.1	220.0	218.5	216.1	213.6	200.3	194.1	186.8	
2400	256.2	234.1	232.6	231.1	230.1	228.5	226.0	223.5	209.7	203.4	195.9	
2600	266.4	243.6	242.1	240.6	239.5	237.9	235.3	232.7	218.6	212.0	204.3	
2800	276.1	252.6	251.0	249.5	248.3	246.6	244.0	241.4	226.8	220.0	212.1	
3000	285.0	260.7	259.1	257.5	256.3	254.6	251.8	249.1	234.0	227.0	218.8	
3200	293.6	268.5	266.8	265.2	264.0	262.1	259.3	256.5	240.9	233.7	225.2	
3400	301.8	275.9	274.2	272.5	271.3	269.4	266.5	263.6	247.5	240.1	231.4	
3600	309.6	283.0	281.3	279.5	278.2	276.3	273.3	270.4	253.9	246.2	237.3	
3800	317.0	289.8	288.0	286.2	284.9	282.9	279.9	276.8	259.9	252.1	243.0	
4000	324.1	296.3	294.4	292.6	291.2	289.2	286.1	283.0	265.7	257.7	248.4	
CLIMB LIMIT WT (1000 KG)	246.8	245.0	244.5	244.0	243.7	243.1	238.2	234.5	210.8	200.2	188.0	

3000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	(OAT)											
	°C -40	14	18	22	25	29	31	33	42	46	50	
	°F -40	57	64	72	77	84	88	91	108	115	122	
1200	171.7	152.0	150.7	149.4	148.4	144.4	142.2	139.7	127.4	121.3	114.7	
1400	188.6	170.3	169.0	167.8	166.9	163.2	161.1	158.7	147.3	141.6	135.5	
1600	203.7	184.9	183.6	182.4	181.5	177.7	175.5	173.1	161.4	155.5	149.3	
1800	217.3	197.5	196.1	194.8	193.9	189.8	187.6	185.1	172.7	166.5	159.9	
2000	229.0	208.6	207.2	205.8	204.8	200.7	198.3	195.8	183.0	176.7	169.8	
2200	240.1	219.1	217.7	216.3	215.3	211.0	208.6	205.9	192.8	186.2	179.2	
2400	250.7	229.1	227.6	226.2	225.2	220.8	218.3	215.5	202.0	195.3	188.0	
2600	260.8	238.5	237.0	235.6	234.5	229.9	227.4	224.6	210.7	203.7	196.3	
2800	270.3	247.3	245.8	244.3	243.1	238.5	235.8	232.9	218.6	211.4	203.8	
3000	279.0	255.3	253.7	252.1	250.9	246.1	243.4	240.4	225.5	218.1	210.2	
3200	287.4	262.9	261.2	259.6	258.4	253.4	250.6	247.5	232.2	224.5	216.4	
3400	295.4	270.1	268.4	266.8	265.5	260.4	257.5	254.3	238.6	230.7	222.2	
3600	303.0	277.1	275.3	273.6	272.4	267.1	264.1	260.8	244.6	236.6	227.9	
3800	310.3	283.7	281.9	280.2	278.9	273.5	270.4	267.1	250.5	242.2	233.3	
4000	317.2	290.0	288.2	286.4	285.1	279.6	276.4	273.0	256.1	247.6	238.5	
CLIMB LIMIT WT (1000 KG)	242.4	241.1	241.0	240.8	240.2	232.5	229.0	224.5	201.5	190.8	180.2	

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1500 kg.

With engine and wing anti-ice on, decrease field limit weight by 600 kg and climb limit weight by 900 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	1210	1210	1210	1200	1200	1180	1150	1130	1100
1400	1430	1430	1420	1410	1400	1370	1340	1310	1280
1600	1660	1640	1630	1610	1600	1560	1530	1490	1450
1800	1880	1860	1840	1820	1800	1760	1710	1670	1630
2000	2110	2080	2050	2030	2000	1950	1900	1850	1800
2200	2330	2300	2260	2230	2200	2140	2090	2030	1980
2400	2550	2510	2480	2440	2400	2340	2280	2210	2150
2600	2780	2730	2690	2640	2600	2530	2460	2390	2330
2800	3000	2950	2900	2850	2800	2730	2650	2580	2500
3000	3220	3170	3110	3060	3000	2920	2840	2760	2680
3200	3450	3390	3320	3260	3200	3110	3030	2940	2850
3400	3670	3600	3540	3470	3400	3310	3210	3120	3030
3600	3900	3820	3750	3670	3600	3500	3400	3300	3200
3800	4120	4040	3960	3880	3800	3690	3590	3480	3380
4000	4340	4260	4170	4090	4000	3890	3780	3660	3550

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)					
	WIND COMPONENT (KTS)					
	-10	0	10	20	30	40
1200	930	1200	1290	1380	1480	1580
1400	1100	1400	1490	1590	1700	1810
1600	1280	1600	1700	1810	1920	2040
1800	1460	1800	1910	2030	2150	2270
2000	1640	2000	2120	2240	2370	2500
2200	1820	2200	2330	2460	2590	2730
2400	1990	2400	2530	2670	2820	2960
2600	2170	2600	2740	2890	3040	3200
2800	2350	2800	2950	3100	3260	3430
3000	2530	3000	3160	3320	3490	3660
3200	2710	3200	3360	3530	3710	3890
3400	2880	3400	3570	3750	3930	4120
3600	3060	3600	3780	3960	4160	4350
3800	3240	3800	3990	4180	4380	4580
4000	3420	4000	4190	4400	4600	4820

Takeoff Field & Climb Limit Weights - Wet Runway**Flaps 15****Sea Level Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	(OAT)											
	°C	-40	14	18	22	25	29	31	33	42	46	50
	°F	-40	57	64	72	77	84	88	91	108	115	122
1200	185.7	165.0	163.6	162.2	161.2	159.8	159.1	158.3	147.1	141.3	135.3	
1400	201.4	181.9	180.6	179.3	178.3	177.1	176.4	175.7	165.5	160.2	154.7	
1600	215.9	195.8	194.4	193.0	192.0	190.7	190.0	189.3	178.8	173.3	167.8	
1800	229.6	208.2	206.7	205.3	204.2	202.8	202.1	201.3	190.2	184.4	178.5	
2000	242.3	219.7	218.1	216.6	215.5	214.0	213.3	212.4	200.7	194.6	188.4	
2200	254.3	230.6	229.0	227.4	226.2	224.7	223.9	223.0	210.7	204.3	197.8	
2400	265.6	240.9	239.2	237.5	236.3	234.7	233.9	232.9	220.1	213.4	206.6	
2600	276.3	250.6	248.8	247.1	245.8	244.1	243.3	242.3	228.9	222.0	215.0	
2800	286.4	259.8	258.0	256.2	254.9	253.1	252.2	251.2	237.4	230.2	222.9	
3000	296.0	268.4	266.5	264.7	263.3	261.5	260.6	259.5	245.2	237.8	230.3	
3200	304.9	276.7	274.8	272.9	271.4	269.6	268.7	267.5	252.8	245.1	237.3	
3400	313.4	284.7	282.7	280.7	279.3	277.3	276.4	275.2	260.0	252.1	244.1	
3600	321.5	292.4	290.3	288.3	286.8	284.8	283.8	282.6	267.0	258.9	250.6	
3800	329.3	299.7	297.6	295.5	294.0	292.0	291.0	289.7	273.7	265.3	256.9	
4000	336.6	306.7	304.5	302.4	300.8	298.8	297.7	296.5	280.0	271.5	262.8	
CLIMB LIMIT WT (1000 KG)	252.0	250.7	250.4	250.1	250.0	249.8	249.7	249.5	226.5	215.5	204.5	

1000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	(OAT)											
	°C	-40	14	18	22	25	29	31	33	42	46	50
	°F	-40	57	64	72	77	84	88	91	108	115	122
1200	181.3	160.8	159.4	158.0	157.0	155.7	154.9	152.7	140.8	135.0	128.5	
1400	197.2	177.9	176.6	175.3	174.4	173.2	172.4	170.5	159.7	154.4	148.3	
1600	211.6	191.6	190.2	188.9	187.9	186.7	185.9	183.9	172.7	167.4	161.5	
1800	225.0	203.8	202.4	201.0	199.9	198.6	197.7	195.6	183.7	178.1	171.8	
2000	237.4	215.0	213.5	212.0	211.0	209.5	208.6	206.4	193.9	187.9	181.3	
2200	249.2	225.7	224.1	222.6	221.4	219.9	219.0	216.6	203.5	197.3	190.3	
2400	260.2	235.8	234.1	232.5	231.3	229.7	228.8	226.3	212.6	206.1	198.8	
2600	270.7	245.3	243.5	241.9	240.6	239.0	238.0	235.4	221.2	214.4	206.9	
2800	280.7	254.3	252.5	250.8	249.5	247.8	246.8	244.1	229.4	222.3	214.5	
3000	290.0	262.7	260.9	259.1	257.7	256.0	254.9	252.2	236.9	229.7	221.6	
3200	299.0	270.8	268.9	267.1	265.7	263.9	262.8	259.9	244.2	236.7	228.4	
3400	307.7	278.6	276.7	274.8	273.3	271.5	270.4	267.4	251.2	243.5	234.9	
3600	315.7	286.1	284.1	282.2	280.7	278.8	277.6	274.6	257.9	250.0	241.1	
3800	323.3	293.3	291.3	289.2	287.7	285.8	284.6	281.5	264.4	256.2	247.1	
4000	330.5	300.2	298.1	296.0	294.4	292.4	291.2	288.0	270.5	262.1	252.8	
CLIMB LIMIT WT (1000 KG)	249.7	248.4	248.2	247.8	247.3	246.9	246.7	241.2	218.8	208.0	196.0	

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1500 kg.

With engine and wing anti-ice on, decrease field limit weight by 600 kg and climb limit weight by 900 kg.

Takeoff Field & Climb Limit Weights - Wet Runway**Flaps 15****2000 FT Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	(OAT)											
	°C	-40	14	18	22	25	29	31	33	42	46	50
	°F	-40	57	64	72	77	84	88	91	108	115	122
1200	176.6	156.5	155.2	153.9	152.9	151.4	149.2	146.9	134.4	128.7	121.9	
1400	192.8	173.9	172.7	171.4	170.5	169.2	167.1	165.1	153.8	148.4	142.1	
1600	207.0	187.5	186.2	184.9	183.9	182.5	180.4	178.3	166.7	161.4	155.3	
1800	220.2	199.4	198.0	196.6	195.6	194.2	191.9	189.7	177.4	171.7	165.2	
2000	232.3	210.4	209.0	207.5	206.4	204.9	202.5	200.1	187.2	181.2	174.4	
2200	243.9	220.9	219.3	217.8	216.7	215.0	212.6	210.1	196.5	190.2	183.1	
2400	254.7	230.7	229.1	227.5	226.3	224.6	222.1	219.5	205.3	198.8	191.3	
2600	264.9	240.0	238.3	236.7	235.5	233.7	231.0	228.3	213.6	206.8	199.0	
2800	274.7	248.9	247.1	245.4	244.2	242.3	239.5	236.7	221.4	214.4	206.4	
3000	283.8	257.1	255.3	253.5	252.2	250.3	247.4	244.6	228.7	221.5	213.2	
3200	292.6	265.0	263.2	261.4	260.0	258.0	255.1	252.1	235.8	228.3	219.7	
3400	301.1	272.7	270.8	268.9	267.5	265.5	262.4	259.3	242.5	234.8	225.9	
3600	309.2	280.0	278.0	276.1	274.7	272.6	269.4	266.3	249.0	241.0	231.9	
3800	317.0	287.0	285.0	283.0	281.5	279.4	276.2	272.9	255.2	247.0	237.7	
4000	324.1	293.7	291.6	289.6	288.1	285.9	282.6	279.3	261.1	252.7	243.2	
CLIMB LIMIT WT (1000 KG)	246.8	245.0	244.5	244.0	243.7	243.1	238.2	234.5	210.8	200.2	188.0	

3000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	(OAT)											
	°C °F	-40 -40	14 57	18 64	22 72	25 77	29 84	31 88	33 91	42 108	46 115	50 122
1200	171.7	152.0	150.7	149.4	148.4	144.4	142.2	139.7	127.4	121.3	114.7	
1400	188.2	169.7	168.4	167.2	166.3	162.7	160.7	158.5	147.3	141.6	135.5	
1600	202.2	183.1	181.8	180.5	179.6	175.9	173.8	171.5	160.1	154.6	149.2	
1800	215.1	194.7	193.4	192.0	191.1	187.1	184.8	182.4	170.4	164.5	158.7	
2000	226.9	205.5	204.1	202.6	201.6	197.4	195.1	192.5	179.8	173.6	167.5	
2200	238.2	215.7	214.2	212.7	211.6	207.2	204.7	202.1	188.8	182.3	175.9	
2400	248.7	225.3	223.7	222.2	221.1	216.5	213.9	211.1	197.2	190.5	183.8	
2600	258.8	234.4	232.8	231.2	230.0	225.2	222.5	219.6	205.2	198.2	191.2	
2800	268.3	243.0	241.3	239.7	238.5	233.5	230.7	227.7	212.8	205.5	198.3	
3000	277.2	251.1	249.3	247.6	246.4	241.2	238.4	235.2	219.8	212.2	204.8	
3200	285.8	258.8	257.0	255.3	253.9	248.7	245.7	242.5	226.5	218.7	211.0	
3400	294.0	266.3	264.4	262.6	261.2	255.8	252.7	249.4	232.9	224.9	217.0	
3600	302.0	273.4	271.5	269.6	268.2	262.6	259.5	256.0	239.1	230.9	222.7	
3800	309.6	280.2	278.3	276.4	274.9	269.2	266.0	262.4	245.1	236.6	228.2	
4000	316.8	286.8	284.8	282.8	281.3	275.4	272.1	268.5	250.8	242.1	233.5	
CLIMB LIMIT WT (1000 KG)	242.4	241.1	241.0	240.8	240.2	232.5	229.0	224.5	201.5	190.8	180.2	

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1500 kg.

With engine and wing anti-ice on, decrease field limit weight by 600 kg and climb limit weight by 900 kg.

Takeoff Obstacle Limit Weight**Flaps 15****Sea Level, 33°C & Below, Zero Wind****Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off**

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	227.9	246.2	257.8								
20	208.0	224.1	236.9	247.1	254.8	259.7					
40	190.8	205.7	218.7	229.2	237.7	245.0	250.8	254.7	257.9	260.6	262.9
60	177.9	193.0	205.7	216.3	225.0	232.2	238.1	243.2	248.7	251.9	254.6
80	168.0	183.0	195.4	205.8	214.7	222.1	228.4	233.8	238.4	242.5	246.7
100	159.3	174.4	186.8	197.1	205.9	213.5	220.1	225.7	230.6	234.8	238.6
120	151.2	167.0	179.2	189.5	198.3	205.9	212.6	218.5	223.5	228.0	232.0
140		160.3	172.5	182.8	191.6	199.2	205.9	211.9	217.2	221.8	226.0
160		154.0	166.4	176.7	185.5	193.2	199.9	206.0	211.3	216.1	220.4
180		148.1	160.9	171.1	179.9	187.7	194.5	200.5	206.0	210.9	215.3
200			155.7	166.0	174.8	182.6	189.5	195.6	201.0	205.9	210.5
220			150.8	161.3	170.1	177.8	184.8	190.9	196.4	201.4	205.9
240			146.2	156.9	165.7	173.4	180.3	186.6	192.1	197.1	201.7
260				152.7	161.6	169.3	176.2	182.4	188.1	193.1	197.7

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	140	160	180	200	220	240	260	280
33 & BELOW	0	0	0	0	0	0	0	0
34	-1.2	-1.5	-1.7	-2.0	-2.3	-2.6	-2.9	-3.1
36	-3.1	-3.9	-4.6	-5.4	-6.1	-6.9	-7.6	-8.4
38	-5.1	-6.3	-7.5	-8.7	-10.0	-11.2	-12.4	-13.6
40	-7.1	-8.7	-10.4	-12.1	-13.8	-15.5	-17.1	-18.8
42	-9.4	-11.7	-13.9	-16.1	-18.4	-20.6	-22.8	-25.1
44	-11.8	-14.6	-17.4	-20.2	-23.0	-25.8	-28.6	-31.4
46	-14.1	-17.5	-20.8	-24.2	-27.5	-30.9	-34.3	-37.6
48	-16.4	-20.4	-24.3	-28.2	-32.1	-36.0	-40.0	-43.9
50	-18.8	-23.3	-27.7	-32.2	-36.7	-41.2	-45.7	-50.2

Pressure Altitude Adjustment

ALT (FT)	TEMP CORR'D OBSTACLE LIMIT WEIGHT (1000 KG)							
	140	160	180	200	220	240	260	280
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-3.3	-4.1	-4.8	-5.6	-6.3	-7.0	-7.8	-8.5
2000	-7.3	-8.6	-9.9	-11.2	-12.5	-13.8	-15.1	-16.4
3000	-12.0	-14.3	-16.7	-19.0	-21.3	-23.6	-25.9	-28.3

Wind Adjustment

WIND (KTS)	TEMP & ALT CORR'D OBSTACLE LIMIT WEIGHT (1000 KG)							
	140	160	180	200	220	240	260	280
0	0	0	0	0	0	0	0	0
10 HW	4.0	3.6	3.2	2.9	2.5	2.1	1.8	1.4
20 HW	8.0	7.2	6.5	5.7	5.0	4.3	3.5	2.8
30 HW	12.0	10.9	9.8	8.7	7.6	6.4	5.3	4.2
40 HW	16.1	14.6	13.1	11.6	10.1	8.6	7.1	5.6

Takeoff Speeds - Dry Runway**Flaps 15****V1, VR, V2 for Max Takeoff Thrust**

WEIGHT (1000 KG)	KIAS		
	V1	VR	V2
250	144	148	153
240	139	145	151
230	137	141	148
220	133	138	145
210	129	134	142
200	124	131	138
190	119	127	135
180	114	123	132
170	109	119	129
160	103	114	125
150	98	110	122
140	91	106	118

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	1	2	3	-2	0	1	2	3	-2	0	1	2	3
50	122	5	7	8	9	11	2	3	3	3	4	-1	-1	-2	-2	-2
40	104	1	2	4	5	6	0	1	1	2	2	0	-1	-1	-1	-1
30	86	0	0	0	1	2	0	0	0	0	1	0	0	0	0	0
20	68	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
-40	-40	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-10	-5	0	10	20	30	40	
280	-5	-2	0	2	4	-1	-1	0	0	1	1	1	
260	-4	-2	0	2	3	-1	0	0	0	1	1	1	
240	-4	-2	0	2	3	-1	0	0	0	1	1	1	
220	-3	-1	0	2	3	-1	0	0	0	1	1	2	
200	-3	-1	0	2	3	-1	0	0	0	1	1	2	
180	-3	-1	0	2	3	-1	0	0	0	1	1	2	
160	-3	-1	0	2	3	-1	0	0	0	1	1	2	

*V1 not to exceed VR

V1(MCG)**Max Takeoff Thrust**

TEMP		PRESSURE ALTITUDE (FT)				
°C	°F	-2000	0	1000	2000	3000
50	122	110	107	105	103	102
40	104	115	113	112	110	108
30	86	117	117	117	116	113
20	68	117	117	117	116	116
-40	-40	118	118	118	117	116

Takeoff Speeds - Wet Runway**Flaps 15****V1, VR, V2 for Max Takeoff Thrust**

WEIGHT (1000 KG)	KIAS		
	V1	VR	V2
250	137	148	153
240	133	145	151
230	129	141	148
220	125	138	145
210	120	134	142
200	116	131	138
190	111	127	135
180	106	123	132
170	101	119	129
160	96	114	125
150	91	110	122
140	85	106	118

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	1	2	3	-2	0	1	2	3	-2	0	1	2	3
50	122	5	7	8	9	11	2	3	3	3	4	-1	-1	-2	-2	-2
40	104	1	2	4	5	6	0	1	1	2	2	0	-1	-1	-1	-1
30	86	0	0	0	1	2	0	0	0	0	1	0	0	0	0	0
20	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40	-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)						
	-2	-1	0	1	2	-10	-5	0	10	20	30	40
260	-5	-3	0	3	5	-2	-1	0	1	2	2	3
240	-5	-3	0	3	5	-3	-1	0	1	2	2	3
220	-5	-3	0	2	5	-3	-1	0	1	2	2	3
200	-5	-3	0	2	4	-3	-2	0	1	2	2	4
180	-5	-2	0	2	4	-3	-1	0	1	2	3	4
160	-4	-2	0	2	4	-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	1000	2000	3000
50	122	110	107	105	103	102
40	104	115	113	112	110	108
30	86	117	117	117	116	113
20	68	117	117	117	116	116
-40	-40	118	118	118	117	116

Intentionally
Blank

Performance Dispatch**Enroute****Chapter PD****Section 11****Long Range Cruise Maximum Operating Altitude****Max Climb Thrust****ISA + 10°C and Below**

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
300	30500	-2	33000*	32600	31100
290	31200	-3	34100*	33300	31800
280	32000	-5	35100*	34000	32600
270	32800	-7	35900*	34800	33300
260	33600	-9	36500*	35600	34200
250	34400	-11	37300*	36400	35000
240	35300	-12	38200*	37300	35800
230	36200	-14	39000*	38100	36700
220	37100	-14	39900*	39100	37600
210	38100	-14	40800*	40000	38600
200	39100	-14	41800*	41100	39600
190	40100	-14	42800*	42100	40700
180	41300	-14	43000	43000	41800
170	42500	-14	43000	43000	43000
160	43000	-14	43000	43000	43000
150	43000	-14	43000	43000	43000
140	43000	-14	43000	43000	43000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
300	30500	4	31400*	31400*	31100
290	31200	2	32700*	32700*	31800
280	32000	1	33900*	33900*	32600
270	32800	-1	35100*	34800	33300
260	33600	-3	35900*	35600	34200
250	34400	-5	36500*	36400	35000
240	35300	-7	37400*	37300	35800
230	36200	-9	38300*	38100	36700
220	37100	-9	39200*	39100	37600
210	38100	-9	40000*	40000	38600
200	39100	-9	40900*	40900*	39600
190	40100	-9	41900*	41900*	40700
180	41300	-9	42900*	42900*	41800
170	42500	-9	43000	43000	43000
160	43000	-9	43000	43000	43000
150	43000	-9	43000	43000	43000
140	43000	-9	43000	43000	43000

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
300	30500	10	26100*	26100*	26100*
290	31200	8	27600*	27600*	27600*
280	32000	6	31700*	31700*	31700*
270	32800	5	33400*	33400*	33300
260	33600	3	34900*	34900*	34200
250	34400	1	35800*	35800*	35000
240	35300	-1	36400*	36400*	35800
230	36200	-3	37300*	37300*	36700
220	37100	-3	38200*	38200*	37600
210	38100	-3	39200*	39200*	38600
200	39100	-3	40000*	40000*	39600
190	40100	-3	41000*	41000*	40700
180	41300	-3	42000*	42000*	41800
170	42500	-3	43000	43000	43000
160	43000	-3	43000	43000	43000
150	43000	-3	43000	43000	43000
140	43000	-3	43000	43000	43000

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

**Long Range Cruise Trip Fuel and Time
Ground to Air Miles Conversion**

AIR DISTANCE (NM)					GROUND DISTANCED (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
531	499	469	444	421	400	382	366	351	337	325
1056	993	936	886	841	800	766	735	706	679	656
1578	1485	1401	1327	1261	1200	1150	1104	1061	1022	986
2097	1977	1866	1768	1681	1600	1535	1473	1417	1365	1317
2616	2467	2330	2209	2100	2000	1919	1843	1772	1708	1648
3133	2955	2793	2649	2519	2400	2303	2212	2128	2051	1980
3649	3443	3255	3088	2938	2800	2687	2582	2484	2394	2311
4163	3930	3717	3527	3357	3200	3071	2951	2840	2737	2643
4676	4415	4178	3966	3775	3600	3455	3320	3195	3080	2974
5187	4900	4638	4404	4194	4000	3840	3690	3551	3423	3305
5697	5384	5097	4842	4612	4400	4224	4059	3906	3765	3636
6205	5866	5556	5280	5030	4800	4608	4429	4262	4108	3967
6712	6348	6015	5717	5448	5200	4992	4798	4618	4451	4299
7218	6829	6472	6154	5865	5600	5376	5167	4973	4794	4630
7723	7309	6930	6590	6283	6000	5761	5537	5329	5137	4961
8226	7788	7386	7026	6700	6400	6145	5906	5685	5480	5292
8729	8266	7842	7462	7117	6800	6529	6276	6040	5823	5623
9231	8744	8298	7898	7535	7200	6913	6645	6396	6166	5954
9733	9222	8754	8333	7952	7600	7297	7014	6751	6508	6285
10235	9700	9209	8769	8369	8000	7681	7383	7106	6851	6616

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37 & ABOVE	
	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	6.7	1:04	6.5	1:04	6.5	1:03	6.4	1:02	6.4	1:01
800	12.1	2:01	11.6	1:59	11.4	1:57	11.3	1:54	11.2	1:52
1200	17.5	2:57	16.8	2:54	16.5	2:50	16.3	2:46	16.0	2:42
1600	23.0	3:53	22.1	3:48	21.7	3:42	21.3	3:37	21.0	3:33
2000	28.5	4:48	27.4	4:42	26.8	4:35	26.4	4:29	25.9	4:23
2400	34.2	5:42	33.0	5:34	32.2	5:26	31.6	5:19	31.1	5:13
2800	39.9	6:36	38.5	6:27	37.6	6:18	36.9	6:09	36.3	6:02
3200	45.7	7:30	44.1	7:19	43.2	7:09	42.3	6:59	41.6	6:52
3600	51.7	8:22	49.9	8:11	48.8	7:59	47.9	7:49	47.0	7:42
4000	57.6	9:15	55.7	9:02	54.5	8:49	53.4	8:39	52.5	8:32
4400	63.9	10:06	61.7	9:53	60.4	9:39	59.2	9:28	58.3	9:21
4800	70.1	10:58	67.8	10:43	66.3	10:28	65.0	10:18	64.1	10:11
5200	76.5	11:49	74.0	11:33	72.4	11:18	71.0	11:07	70.2	11:01
5600	83.0	12:39	80.3	12:22	78.6	12:07	77.2	11:57	76.6	11:51
6000	89.5	13:29	86.7	13:11	84.8	12:56	83.4	12:46	82.9	12:41
6400	96.3	14:18	93.4	14:00	91.4	13:45	90.0	13:36		
6800	103.2	15:08	100.0	14:49	98.0	14:34	96.7	14:26		
7200	110.2	15:57	106.9	15:38	104.7	15:23				
7600	117.3	16:46	113.9	16:27	111.8	16:13				
8000	124.5	17:34	120.9	17:15	118.8	17:02				

Long Range Cruise Trip Fuel and Time Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	FUEL REQUIRED ADJUSTMENTS (1000 KG)				
	LANDING WEIGHT (1000 KG)				
	140	160	180	200	220
10	-1.3	-0.6	0.0	0.8	1.6
20	-2.4	-1.1	0.0	1.6	3.5
30	-3.5	-1.7	0.0	2.5	5.7
40	-4.7	-2.2	0.0	3.6	8.4
50	-5.8	-2.8	0.0	4.8	11.4
60	-7.0	-3.4	0.0	6.2	14.9
70	-8.3	-4.1	0.0	7.8	18.8
80	-9.6	-4.7	0.0	9.5	23.1
90	-10.9	-5.4	0.0	11.4	27.8
100	-12.2	-6.1	0.0	13.4	33.0
110	-13.6	-6.9	0.0	15.6	38.5
120	-15.0	-7.7	0.0	18.0	44.5
130	-16.5	-8.4	0.0	20.5	50.8

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

Long Range Cruise Step Climb 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
1038	980	928	881	839	800	765	733	703	676	651
1543	1459	1385	1317	1256	1200	1149	1102	1059	1019	982
2047	1939	1841	1753	1673	1600	1533	1471	1415	1362	1313
2552	2418	2298	2189	2090	2000	1917	1841	1770	1705	1644
3056	2898	2755	2626	2508	2400	2301	2210	2126	2048	1976
3561	3377	3212	3062	2925	2800	2685	2580	2482	2391	2307
4065	3857	3668	3498	3342	3200	3069	2949	2838	2734	2638
4570	4336	4125	3934	3760	3600	3453	3318	3193	3078	2970
5074	4815	4582	4370	4177	4000	3838	3688	3549	3421	3301
5578	5295	5038	4806	4594	4400	4222	4057	3905	3764	3633
6082	5774	5495	5242	5011	4800	4606	4427	4261	4107	3964
6586	6253	5951	5678	5428	5200	4990	4796	4617	4451	4296
7090	6732	6408	6114	5846	5600	5374	5166	4973	4794	4628
7594	7211	6864	6550	6263	6000	5758	5535	5329	5138	4959
8097	7689	7321	6986	6680	6400	6143	5905	5685	5481	5291
8600	8168	7777	7421	7097	6800	6527	6275	6041	5825	5623
9104	8646	8233	7857	7514	7200	6911	6644	6397	6168	5955
9607	9125	8689	8293	7931	7600	7295	7014	6754	6512	6287
10110	9603	9145	8729	8348	8000	7680	7384	7110	6856	6619

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)								TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)								
	140	150	160	170	180	190	200	210	
800	9.3	9.8	10.1	10.6	11.2	11.5	12.0	12.6	1:50
1200	13.3	13.8	14.4	15.2	15.9	16.5	17.3	18.1	2:40
1600	17.3	17.9	18.8	19.9	20.8	21.6	22.7	23.7	3:30
2000	21.3	22.2	23.3	24.6	25.7	26.8	28.2	29.5	4:20
2400	25.4	26.5	27.9	29.4	30.8	32.2	33.8	35.3	5:09
2800	29.6	31.0	32.6	34.4	36.0	37.7	39.5	41.3	5:59
3200	33.8	35.5	37.4	39.4	41.4	43.3	45.4	47.5	6:49
3600	38.2	40.2	42.3	44.6	46.9	49.1	51.4	53.8	7:38
4000	42.7	45.0	47.3	49.9	52.5	54.9	57.5	60.3	8:28
4400	47.3	49.8	52.4	55.4	58.2	60.9	63.9	66.9	9:18
4800	52.0	54.7	57.7	60.9	64.0	67.0	70.4	73.7	10:07
5200	56.8	59.8	63.1	66.6	70.0	73.3	77.0	80.6	10:57
5600	61.7	64.9	68.6	72.4	76.1	79.8	83.8	87.7	11:46
6000	66.6	70.3	74.2	78.3	82.3	86.4	90.7	94.9	12:35
6400	71.7	75.7	80.0	84.4	88.8	93.2	97.8	102.3	13:25
6800	77.0	81.3	85.8	90.6	95.4	100.1	105.0	109.9	14:14
7200	82.3	87.0	91.9	97.0	102.2	107.2	112.5	117.7	15:03
7600	87.9	92.8	98.0	103.6	109.0	114.4	120.0	125.6	15:53
8000	93.5	98.8	104.3	110.3	116.1	121.9	127.8	133.7	16:42

Based on 310/.84 climb, Long Range Cruise and .84/310/250 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
91	78	69	61	55	50	46	42	39	37	34
158	142	128	117	108	100	93	87	82	77	73
224	204	187	173	161	150	141	132	125	119	113
288	265	245	228	213	200	188	178	169	161	153
351	325	302	282	265	250	236	224	213	203	194
412	384	359	337	317	300	284	271	258	246	236
474	443	415	391	369	350	333	317	303	289	277
536	502	472	445	421	400	381	363	347	333	319
598	561	528	499	473	450	429	409	392	376	361
661	621	586	554	526	500	477	456	436	418	402

Trip Fuel and Time

AIR DIST (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		140	160	180	200	220	
50	FUEL (1000 KG)	1.4	1.5	1.6	1.7	1.8	0:14
	ALT (FT)	8000	8000	9000	6000	6000	
100	FUEL (1000 KG)	2.2	2.3	2.5	2.6	2.8	0:22
	ALT (FT)	14000	14000	14000	13000	12000	
150	FUEL (1000 KG)	2.9	3.1	3.3	3.5	3.7	0:30
	ALT (FT)	22000	21000	20000	19000	18000	
200	FUEL (1000 KG)	3.5	3.8	4.0	4.3	4.5	0:37
	ALT (FT)	27000	27000	26000	25p000	24000	
250	FUEL (1000 KG)	4.0	4.4	4.7	5.0	5.3	0:43
	ALT (FT)	33000	33000	32000	28000	28000	
300	FUEL (1000 KG)	4.6	4.9	5.3	5.7	6.0	0:49
	ALT (FT)	35000	35000	33000	30000	30000	
350	FUEL (1000 KG)	5.0	5.6	5.9	6.3	6.7	0:55
	ALT (FT)	40000	39000	37000	35000	31000	
400	FUEL (1000 KG)	5.5	6.0	6.5	7.0	7.4	1:01
	ALT (FT)	41000	41000	39000	36000	34000	
450	FUEL (1000 KG)	6.0	6.5	7.0	7.6	8.1	1:07
	ALT (FT)	41000	41000	39000	37000	36000	
500	FUEL (1000 KG)	6.5	7.1	7.6	8.2	8.8	1:13
	ALT (FT)	41000	41000	40000	37000	36000	

Holding Planning
Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
260	7210	7170	6960	6840	7040	7240	7440	7880		
240	6680	6610	6430	6300	6370	6740	6720	7070		
220	6160	6060	5910	5760	5760	5980	6070	6310	7020	
200	5670	5550	5410	5250	5220	5290	5430	5610	6080	
180	5190	5060	4930	4760	4720	4700	4860	4930	5290	5610
160	4720	4590	4470	4290	4240	4180	4170	4410	4690	4900
140	4260	4130	4010	3840	3780	3680	3700	3730	4000	4180

Flaps 1

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
260	7560	7530	7370	7260	7320
240	6970	6930	6800	6660	6690
220	6390	6320	6230	6090	6080
200	5830	5740	5670	5520	5490
180	5280	5180	5110	4970	4940
160	4740	4640	4560	4430	4400
140	4230	4130	4020	3920	3890

These tables include 5% additional fuel for holding in a racetrack pattern.

Crew Oxygen Requirements

Table 1

NUMBER OF CREW	OXYGEN REQUIRED (LITERS)
2	660
3	990
4	1320

Table 2

NUMBER OF CREW	OXYGEN REQUIRED FOR LEVEL OFF AT 14000 FT (LITERS)			
	TOTAL POST DECOMPRESSION TIME (HR)			
	2	3	4	5
2	660	960	1270	1570
3	980	1440	1900	2360
4	1310	1920	2530	3140

Table 3

NUMBER OF CREW	ADDITIONAL LITERS REQUIRED FOR EACH MINUTE HELD AT INTERMEDIATE ALTITUDE OTHER THAN 14000 FT				
	INTERMEDIATE PRESSURE ALTITUDE (FT)				
	UP TO 13999	14000	14001 TO 17999	18000 TO 21999	22000 TO 25000
	REGULATOR ON "NORMAL" OR (100%)				
2	0 (22)	0 (17)	1 (16)	3 (12)	6 (10)
3	0 (33)	0 (25)	2 (24)	5 (18)	8 (15)
4	0 (44)	0 (34)	2 (32)	6 (24)	11 (20)

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%.

Instructions:

1. Determine protective breathing requirements from Table 1.
2. Determine supplemental requirements for level off at 14000 ft from Table 2 and correct for level off altitudes other than 14000 ft using Table 3.
3. Flight crew system oxygen requirements are the larger of protective breathing (Table 1) or supplemental requirements (Table 2).

Crew Oxygen Requirements**Table 4 - Cylinder Volume to Pressure Conversion**

OXYGEN VOLUME (1000 LITERS)	CYLINDER PRESSURE AT 21°C (PSI)
.1	200
.3	300
.5	400
.7	500
.8	600
1.0	700
1.2	800
1.4	900
1.5	1000
1.7	1100
1.9	1200
2.1	1300
2.2	1400
2.4	1500
2.6	1600
2.7	1700
2.9	1800
3.1	1900
3.3	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 5 - 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
28	153.7	152.7	149.7
26	167.6	165.9	161.1
24	182.2	179.2	173.4
22	197.2	192.5	185.8
20	212.9	207.0	199.3
18	227.6	219.8	210.5
16	241.7	231.8	220.6
14	253.9	243.4	231.8
12	268.6	255.2	242.7
10	281.1	267.2	254.5
8	285.8	272.6	259.9
6	285.8	284.5	271.0

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)										
	PRESSURE ALTITUDE (1000 FT)										
	8	10	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-0.5	-1.1	-1.1	-0.8	-0.6	-0.2	-0.4	-1.0	-0.9	-1.0	-1.1
ENGINE AND WING	-4.2	-4.8	-4.4	-3.5	-3.5	-3.1	-3.0	-4.2	-4.0	-3.8	-3.8

Performance Dispatch**Chapter PD****Landing****Section 12****Landing Field Limit Weight****Flaps 30****Wind Corrected Field Length (M)**

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)				
	-10	0	10	20	30
1000	780	1000	1080	1150	1230
1100	880	1100	1180	1260	1340
1200	970	1200	1280	1360	1450
1300	1060	1300	1390	1470	1560
1400	1150	1400	1490	1580	1670
1500	1240	1500	1590	1680	1780
1600	1330	1600	1690	1790	1880
1700	1430	1700	1800	1890	1990
1800	1520	1800	1900	2000	2100
1900	1610	1900	2000	2100	2210
2000	1700	2000	2100	2210	2330
2100	1790	2100	2210	2320	2440
2200	1880	2200	2310	2430	2550
2300	1970	2300	2420	2530	2670
2400	2060	2400	2520	2640	2780
2500	2140	2500	2630	2750	2900
2600	2230	2600	2730	2860	3010
2700	2320	2700	2840	2970	3130
2800	2410	2800	2940	3080	3240
2900	2500	2900	3050	3190	3360

Field Limit Weight (1000 KG)

WIND CORRECTED FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)							
	0		1000		2000		3000	
	DRY	WET	DRY	WET	DRY	WET	DRY	WET
1100	125	102	122	99	118	96	114	93
1200	142	116	137	113	133	109	129	106
1300	158	130	153	126	149	122	144	119
1400	174	144	169	140	164	136	159	132
1500	191	159	186	154	180	149	175	145
1600	208	173	202	168	196	163	190	158
1700	223	187	218	182	212	177	206	171
1800	233	202	229	196	225	190	220	185
1900	243	217	238	211	234	204	230	198
2000	252	227	248	223	243	218	239	212
2100	261	236	257	232	252	228	248	223
2200	270	244	266	240	261	236	256	231
2300	279	252	275	248	270	243	265	239
2400	289	260	283	256	278	251	273	247
2500	298	268	292	263	287	259	282	254
2600	307	276	301	271	296	266	290	261
2700	316	284	310	279	304	274	298	269

Decrease field limit weight 10500 kg for each deactivated brake.

Decrease field limit weight 22000 kg when using manual speed brakes.

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	216.7	199.0				
52	126	221.7	206.6				
50	122	226.8	214.2	196.2			
48	118	231.9	219.9	202.5			
46	115	237.1	225.9	209.2	189.3		
44	111	242.4	232.0	214.8	195.1		
42	108	248.8	238.1	220.5	200.9	181.7	
40	104	253.9	244.4	226.5	206.1	187.1	
38	100	258.2	252.0	232.5	211.4	192.6	174.1
36	97	261.2	256.2	238.5	216.8	197.3	179.2
34	93	261.4	260.2	245.1	222.4	202.0	184.2
32	90	261.6	262.7	250.5	228.0	207.1	188.5
30	86	261.8	262.9	255.1	233.6	212.3	192.9
28	82	262.0	263.1	257.8	237.9	217.5	197.4
26	79	262.2	263.3	258.0	242.0	223.1	202.2
24	75	262.4	263.4	258.1	246.9	227.4	207.2
22	72	262.6	263.6	258.3	252.0	231.6	212.4
20	68	262.8	263.8	258.4	252.2	235.9	216.4
18	64	263.1	263.9	258.6	252.4	239.9	220.3
16	61	263.3	264.1	258.7	252.5	240.0	224.4
14	57	263.5	264.3	258.9	252.7	240.1	228.0
12	54	263.7	264.5	259.0	252.8	240.2	228.2
10	50	263.9	264.6	259.2	252.9	240.3	228.3
-40	-40	265.1	265.8	260.3	254.0	241.3	228.9

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1700 kg.

With engine and wing anti-ice on, decrease weight by 950 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 18600 kg.

ENGINE INOP**Go-Around Climb Gradient****Flaps 20, Gear Up****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	3.00					
50	3.91	2.64				
46	4.67	3.64	2.14			
42	5.38	4.38	3.12	1.67		
38	6.10	5.09	3.80	2.60	1.18	
34	6.61	5.81	4.46	3.23	2.09	0.94
30	6.78	6.35	5.11	3.83	2.67	1.59
26	6.80	6.52	5.65	4.44	3.21	2.09
22	6.82	6.54	6.17	4.96	3.77	2.54
18	6.84	6.56	6.19	5.47	4.24	2.98
14	6.87	6.58	6.20	5.48	4.69	3.40
10	6.89	6.60	6.22	5.50	4.70	3.81

Weight Adjustment

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)							
	1	2	3	4	5	6	7	8
220	-1.96	-2.15	-2.34	-2.54	-2.73	-2.92	-3.11	-3.31
200	-1.09	-1.20	-1.31	-1.42	-1.53	-1.64	-1.74	-1.84
180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
160	1.40	1.54	1.68	1.81	1.95	2.09	2.23	2.37
140	3.22	3.54	3.87	4.19	4.52	4.85	5.18	5.51

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)								
	0	1	2	3	4	5	6	7	8
VREF	-0.26	-0.27	-0.27	-0.28	-0.28	-0.28	-0.27	-0.27	-0.26
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF+10	0.16	0.16	0.16	0.16	0.15	0.14	0.14	0.14	0.14
VREF+20	0.31	0.30	0.29	0.28	0.24	0.21	0.18	0.18	0.19
VREF+30	0.30	0.25	0.21	0.17	0.09	0.02	-0.02	-0.03	-0.02

With engine bleed for packs off, increase gradient by 0.1%.**With engine anti-ice on, decrease gradient by 0.1%.****With engine and wing anti-ice on, decrease gradient by 0.2%.****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

Flaps 30 Limit Weight (1000 KG)

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	233.4				
50	122	234.9	226.0			
45	113	236.9	228.0	219.2		
40	104	238.9	229.9	221.0	212.6	
35	95	241.0	231.9	222.9	214.4	206.0
30	86	243.1	233.9	224.9	216.2	207.8
25	77	245.4	236.0	227.0	218.0	209.6
20	68	247.6	238.2	229.0	219.9	211.4
15	59	250.0	240.4	231.1	221.9	213.3
10	50	252.4	242.7	233.3	224.1	215.2
5	41	254.9	245.1	235.6	226.2	217.2
0	32	257.4	247.5	237.9	228.5	219.2
-5	23	259.9	250.1	240.3	230.8	221.4
-10	14	262.6	252.7	242.7	233.1	223.6
-15	5	265.3	255.3	245.3	235.5	226.0
-20	-4	268.1	258.0	247.9	238.0	228.4
-30	-22	273.9	263.6	253.5	243.3	233.4
-40	-40	280.0	269.6	259.3	248.9	238.7
-50	-58	286.0	275.6	265.3	254.9	
-54	-65	288.4	278.0	267.6	257.3	

Increase weight 2500 kg per 1% uphill slope. Decrease weight 4100 kg per 1% downhill slope.

Increase weight 6500 kg per 10 kts Headwind. Decrease weight 29000 kg per 10 kts tailwind.

Decrease weight 11800 kg with one brake deactivated. Decrease weight 24200 kg with two brakes deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Performance Dispatch**Chapter PD****Gear Down****Section 13****GEAR DOWN****Takeoff/Approach or Landing Climb Limited Weight**

AIRPORT OAT		CLIMB LIMIT WEIGHT (1000 KG)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	129	150.0	148.8	153.4	152.6
52	126	153.0	149.4	153.4	155.9
50	122	156.3	152.7	154.2	155.8
48	118	159.7	156.1	157.8	156.5
46	115	163.4	159.7	161.4	159.8
44	111	167.2	163.4	165.2	163.3
42	108	171.2	167.1	168.9	166.8
40	104	175.1	171.0	172.6	170.4
38	100	178.9	174.7	176.2	174.0
36	97	182.7	178.5	180.0	177.5
34	93	186.5	182.4	183.9	181.2
32	90	190.6	186.3	187.7	184.9
30	86	194.7	190.3	191.6	188.6
28	82	198.7	194.4	195.6	192.4
26	79	202.8	198.6	199.7	196.3
24	75	205.1	202.8	203.7	200.2
22	72	205.2	205.0	207.7	204.0
20	68	205.3	205.2	209.8	207.9
18	64	205.3	205.3	210.0	209.7
16	61	205.4	205.5	210.2	209.8
14	57	205.5	205.7	210.3	209.9
12	54	205.6	205.9	210.5	209.9
10 & BELOW	50 & BELOW	205.7	206.1	210.7	210.0

With engine bleed for packs off, increase weight by 700 kg.

With engine anti-ice on, decrease weight by 1650 kg.

With engine and wing anti-ice on, decrease weight by 4000 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 33°C & Below, Zero Wind

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

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	227.9	246.2	257.8									
20	208.0	224.1	236.9	247.1	254.8	259.7						
40	190.8	205.7	218.7	229.2	237.7	245.0	250.8	254.7	257.9	260.6	262.9	
60	177.9	193.0	205.7	216.3	225.0	232.2	238.1	243.2	248.7	251.9	254.6	
80	168.0	183.0	195.4	205.8	214.7	222.1	228.4	233.8	238.4	242.5	246.7	
100	159.3	174.4	186.8	197.1	205.9	213.5	220.1	225.7	230.6	234.8	238.6	
120	151.2	167.0	179.2	189.5	198.3	205.9	212.6	218.5	223.5	228.0	232.0	
140		160.3	172.5	182.8	191.6	199.2	205.9	211.9	217.2	221.8	226.0	
160		154.0	166.4	176.7	185.5	193.2	199.9	206.0	211.3	216.1	220.4	
180		148.1	160.9	171.1	179.9	187.7	194.5	200.5	206.0	210.9	215.3	
200			155.7	166.0	174.8	182.6	189.5	195.6	201.0	205.9	210.5	
220			150.8	161.3	170.1	177.8	184.8	190.9	196.4	201.4	205.9	
240			146.2	156.9	165.7	173.4	180.3	186.6	192.1	197.1	201.7	
260				152.7	161.6	169.3	176.2	182.4	188.1	193.1	197.7	
280				148.7	157.8	165.4	172.3	178.6	184.2	189.4	194.0	
300					154.1	161.7	168.6	174.9	180.6	185.7	190.5	

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)						
	140	160	180	200	220	240	260
33 & BELOW	0	0	0	0	0	0	0
34	-1.2	-1.5	-1.7	-2.0	-2.3	-2.6	-2.9
36	-3.1	-3.9	-4.6	-5.4	-6.1	-6.9	-7.6
38	-5.1	-6.3	-7.5	-8.7	-10.0	-11.2	-12.4
40	-7.1	-8.7	-10.4	-12.1	-13.8	-15.5	-17.1
42	-9.4	-11.7	-13.9	-16.1	-18.4	-20.6	-22.8
44	-11.8	-14.6	-17.4	-20.2	-23.0	-25.8	-28.6
46	-14.1	-17.5	-20.8	-24.2	-27.5	-30.9	-34.3
48	-16.4	-20.4	-24.3	-28.2	-32.1	-36.0	-40.0
50	-18.8	-23.3	-27.7	-32.2	-36.7	-41.2	-45.7

Pressure Altitude Adjustment

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	140	160	180	200	220	240	260	280
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-3.3	-4.1	-4.8	-5.6	-6.3	-7.0	-7.8	-8.5
2000	-7.3	-8.6	-9.9	-11.2	-12.5	-13.8	-15.1	-16.4
3000	-12.0	-14.3	-16.7	-19.0	-21.3	-23.6	-25.9	-28.3

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Wind Adjustment

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	140	160	180	200	220	240	260	280
15 TW	-18.6	-19.5	-20.3	-21.2	-22.0	-22.9	-23.8	-24.6
10 TW	-12.4	-13.0	-13.5	-14.1	-14.7	-15.3	-15.8	-16.4
5 TW	-6.2	-6.5	-6.8	-7.1	-7.3	-7.6	-7.9	-8.2
0	0	0	0	0	0	0	0	0
10 HW	4.0	3.6	3.2	2.9	2.5	2.1	1.8	1.4
20 HW	8.0	7.2	6.5	5.7	5.0	4.3	3.5	2.8
30 HW	12.0	10.9	9.8	8.7	7.6	6.4	5.3	4.2
40 HW	16.1	14.6	13.1	11.6	10.1	8.6	7.1	5.6

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
250	19200	16600	13800
240	20900	18400	15600
230	22600	20200	17600
220	24500	22000	19600
210	26100	24300	21400
200	27800	26400	23800
190	29500	28500	26400
180	30900	30500	28900
170	32100	32000	31200
160	33400	33300	32900
150	34800	34700	34600
140	36100	36100	36100

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
342	301	267	240	219	200	187	175	165	156	148
515	454	401	361	328	300	280	263	247	233	221
688	605	535	481	438	400	374	350	329	311	295
859	756	669	601	547	500	467	438	411	388	368
1029	906	802	721	656	600	561	525	494	466	442
1198	1056	935	841	766	700	654	613	576	544	515
1365	1204	1068	961	875	800	748	701	658	621	589
1532	1353	1200	1080	984	900	841	788	741	699	663
1698	1500	1331	1199	1093	1000	935	876	823	777	737
1863	1647	1463	1318	1202	1100	1028	964	906	855	811
2027	1794	1594	1437	1310	1200	1122	1052	989	934	886
2190	1939	1725	1556	1419	1300	1216	1140	1072	1012	960
2353	2085	1855	1674	1528	1400	1309	1228	1155	1090	1035
2515	2229	1985	1793	1636	1500	1403	1316	1238	1169	1110
2675	2373	2115	1911	1745	1600	1497	1404	1321	1247	1184
2836	2517	2244	2029	1853	1700	1591	1492	1404	1326	1259
2995	2660	2373	2146	1961	1800	1684	1580	1487	1405	1334
3154	2803	2502	2264	2070	1900	1778	1668	1570	1484	1409
3312	2946	2631	2382	2178	2000	1872	1756	1653	1563	1484
3469	3087	2760	2499	2286	2100	1966	1845	1737	1642	1560
3626	3229	2888	2616	2394	2200	2060	1933	1820	1721	1635
3782	3370	3015	2733	2502	2300	2154	2022	1904	1800	1710
3937	3510	3142	2850	2610	2400	2248	2111	1988	1880	1786
4092	3650	3270	2966	2717	2500	2342	2199	2072	1959	1861
4246	3789	3397	3083	2825	2600	2436	2288	2156	2039	1937
4399	3929	3523	3199	2933	2700	2530	2377	2240	2118	2013

GEAR DOWN

Long Range Cruise Trip Fuel and Time Reference Fuel and Time Required

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	6.6	0:54	6.4	0:51	6.0	0:49	5.8	0:47	5.7	0:46
300	9.8	1:19	9.3	1:15	8.7	1:10	8.3	1:07	8.2	1:05
400	13.1	1:44	12.3	1:39	11.4	1:32	10.8	1:28	10.6	1:24
500	16.3	2:09	15.3	2:02	14.2	1:53	13.4	1:48	13.0	1:43
600	19.5	2:34	18.3	2:26	16.9	2:15	15.9	2:08	15.4	2:02
700	22.8	2:58	21.4	2:49	19.7	2:36	18.5	2:28	17.9	2:21
800	26.2	3:22	24.5	3:12	22.4	2:57	21.1	2:48	20.4	2:40
900	29.5	3:47	27.6	3:35	25.2	3:19	23.7	3:08	22.9	2:58
1000	32.9	4:11	30.7	3:58	28.0	3:40	26.3	3:28	25.5	3:17
1100	36.3	4:34	33.9	4:20	30.9	4:01	29.0	3:48		
1200	39.8	4:58	37.1	4:43	33.8	4:21	31.7	4:07		
1300	43.3	5:21	40.3	5:05	36.6	4:42	34.4	4:27		
1400	46.7	5:45	43.5	5:27	39.5	5:03	37.2	4:47		
1500	50.3	6:07	46.9	5:49	42.5	5:23	40.0	5:06		
1600	53.9	6:30	50.2	6:11	45.5	5:43	42.8	5:25		
1700	57.5	6:53	53.5	6:32	48.5	6:03	45.6	5:45		
1800	61.1	7:15	56.9	6:54	51.5	6:24	48.5	6:04		
1900	64.8	7:37	60.3	7:15	54.6	6:43	51.4	6:23		
2000	68.6	7:60	63.8	7:36	57.7	7:03	54.3	6:42		

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	140	160	180	200	220
10	-0.6	0.0	0.6	1.3	2.1
15	-0.8	0.0	0.9	2.0	3.1
20	-1.1	0.0	1.2	2.7	4.2
25	-1.3	0.0	1.5	3.4	5.4
30	-1.6	0.0	1.9	4.1	6.6
35	-1.9	0.0	2.2	4.9	7.8
40	-2.2	0.0	2.6	5.7	9.1
45	-2.5	0.0	2.9	6.5	10.5
50	-2.8	0.0	3.3	7.3	11.9
55	-3.1	0.0	3.7	8.1	13.4
60	-3.5	0.0	4.2	9.0	14.9
65	-3.8	0.0	4.6	9.9	16.5
70	-4.1	0.0	5.0	10.9	18.2
75	-4.4	0.0	5.5	11.8	19.9
80	-4.7	0.0	5.9	12.8	21.6

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

GEAR DOWN**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
101	84	72	63	56	50	45	42	38	36	33
173	151	134	120	109	100	92	86	80	75	70
247	218	196	178	163	150	139	130	121	114	108
319	285	258	235	216	200	186	174	163	154	146
391	351	319	292	269	250	233	218	206	194	184
462	417	380	349	323	300	280	263	248	234	222
534	483	441	406	376	350	327	308	290	274	260
606	549	502	463	429	400	375	352	332	315	299
678	615	564	520	482	450	422	397	374	355	337
751	682	625	577	536	500	469	441	417	395	375

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		140	160	180	200	220	
50	FUEL (1000 KG)	1.8	1.9	2.1	2.2	2.4	0:15
	ALT (FT)	12000	12000	10000	10000	8000	
100	FUEL (1000 KG)	3.1	3.3	3.6	3.8	4.1	0:25
	ALT (FT)	24000	22000	18000	18000	16000	
150	FUEL (1000 KG)	4.2	4.6	4.9	5.3	5.7	0:35
	ALT (FT)	30000	26000	24000	22000	22000	
200	FUEL (1000 KG)	5.3	5.8	6.3	6.8	7.3	0:45
	ALT (FT)	32000	28000	26000	24000	22000	
250	FUEL (1000 KG)	6.3	6.9	7.6	8.2	8.8	0:54
	ALT (FT)	32000	30000	28000	26000	24000	
300	FUEL (1000 KG)	7.4	8.1	8.9	9.6	10.4	1:03
	ALT (FT)	32000	30000	28000	26000	24000	
350	FUEL (1000 KG)	8.4	9.3	10.2	11.0	12.0	1:12
	ALT (FT)	32000	30000	28000	26000	24000	
400	FUEL (1000 KG)	9.5	10.5	11.5	12.5	13.5	1:21
	ALT (FT)	32000	30000	28000	26000	24000	
450	FUEL (1000 KG)	10.6	11.7	12.8	13.9	15.1	1:31
	ALT (FT)	32000	30000	28000	26000	24000	
500	FUEL (1000 KG)	11.6	12.9	14.1	15.4	16.7	1:40
	ALT (FT)	32000	30000	28000	26000	24000	

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
260	11680	11330	11320	11410				
240	10880	10590	10530	10560	10720			
220	10110	9900	9760	9760	9800	10180		
200	9360	9220	9020	8960	8930	9160		
180	8630	8530	8310	8190	8310	8260	8680	
160	8070	7980	7760	7590	7570	7380	7630	
140	7320	7250	7050	6860	6820	6730	6740	7130

Flaps 1

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
260	11060	10760	10760	10870	11050
240	10250	10040	9970	10030	10110
220	9450	9340	9190	9190	9200
200	8670	8610	8430	8360	8340
180	8070	8030	7820	7720	7730
160	7300	7270	7070	6940	6950
140	6540	6510	6330	6200	6190

These tables include 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

Based on engine bleed for packs on and anti-ice off

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
18	150		
16	159	154	148
14	169	162	154
12	178	170	162
10	187	178	170
8	191	182	174
6	199	190	182
4	207	199	190

With engine anti-ice on, decrease level off weight by 1200 kg.

With engine and wing anti-ice on, decrease level off weight by 3600 kg.

Intentionally
Blank

Performance Dispatch**Text****Chapter PD****Section 14****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 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. To satisfy JAA requirements, data is provided when appropriate for wet runway operations. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb and Obstacle Limit Weights as determined from the following tables. Tire and Brake Energy Limits are not shown as they are not limiting for the range of conditions shown in this chapter. When determining a maximum weight for a wet runway, the dry runway limit weight must also be checked and the lower of the two weights used.

Regulations require 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. For the 180 degree turnaround case, adjustments are provided for a nominal 60 m runway pavement width. These values may be used when obtaining takeoff weights from the AFM 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
	MINIMUM LINE-UP DISTANCE (M)	NOMINAL LINE-UP DISTANCE (M) (60.0 M RUNWAY)
TORA & TODA	23	51
ASDA	49	77

Field Limit Weight - Slope and Wind Corrections

These tables for wet and dry runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction 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 condition 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

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct 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.

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 to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Normal takeoff speeds, V1, VR, and V2 are read from either the wet or dry table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than the minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). To find V1(MCG), enter the V1(MCG) table with 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 weight adjustment is required provided that the field length available exceeds the minimum field length required shown in the Field and Climb Limit Weight table.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle limit weight and the V1 must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 3100 kg for a dry runway or 2050 kg for a wet runway and the V1 associated with the reduced weight by one knot. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 6650 kg for a dry runway or 4200 kg for a wet runway and the V1 associated with the reduced weight by two knots. If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate stop distance available corrected for wind and slope exceeds approximately 1740m for one brake deactivated or 1830 m for two brakes deactivated. For wet runways, the corrected accelerate stop distance should exceed approximately 2140m for one brake deactivated or 2230 m for two brakes deactivated.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

One Thrust Reverser Inoperative

Wet runway takeoff performance presented for all brakes operating is based on the use of one thrust reverser during deceleration. When operating with a thrust reverser inoperative, the runway/obstacle limited takeoff weight and V1 speed must be reduced to account for the reduced deceleration capability. A simplified method which conservatively accounts for this is to reduce the normal wet runway/obstacle limited weight by 5400 kg and the V1 associated with the reduced weight by the amount shown in the table below.

THRUST REVERSER INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (M)	V1 ADJUSTMENTS (KIAS)
2000	- 4
2500	- 4
3000	- 3
3500	- 3
4000	- 3
4500	- 3

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 corrected for wind and slope exceeds approximately 2200 m.

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 these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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 fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time 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 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. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time 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

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 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%.

Oxygen Requirements

Flight Crew 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.

Tables are provided to determine the flight crew oxygen dispatch requirements. Table 1 shows minimum oxygen quantity necessary to ensure that protective breathing requirements are satisfied. Table 2 shows the supplemental oxygen requirement for loss of pressurization, emergency descent and total post decompression flight time above 10000 ft. Table 3 gives adjustments that must be applied to Table 2 crew member supplemental requirements in situations where the enroute altitude after decompression will exceed 14000 ft. The increments shown in Table 3 reflect only the increase in oxygen flow rate associated with periods of post decompression flight at altitudes other than 14000 ft. Hence, this time must also be included in the Table 2 time value used.

Table 2 and Table 3 values are based on “NORMAL” regulator setting. Table 3 also shows “100%” regulator setting adjustments that can be used if the operator chooses to schedule oxygen dispatch requirements based on pure oxygen availability.

Additional adjustments for more extensive than normal crew usage can be made by adding 2.05 liters/person/minute (1.2 psi/person/minute for the single cylinder system) or 13 liters/person/minute (8 psi/person/minute) if 100% oxygen is selected during normal usage.

After determining the total volume (liters) required for the flight crew by using the larger value from Table 1 or Table 2, obtain the dispatch pressure required from the Cylinder Volume to Pressure Conversion table (Table 4). Adjust this reading for cylinder temperature as required, using the adjustments given (Table 5).

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 Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited 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 engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table 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, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

Performance Dispatch**Chapter PD****Table of Contents****Section 20****777-200ER TRENT892 KG M FAA TALPA****Pkg Model IdentificationPD.ModID.20.1****Takeoff..... PD.20.1**

Takeoff Field CorrectionsPD.20.1

Takeoff Field & Climb Limit WeightsPD.20.2

Takeoff Obstacle Limit Weight.....PD.20.5

Brake Energy Limits VMBEPD.20.7

Takeoff SpeedsPD.20.8

Enroute PD.21.1

Long Range Cruise Maximum Operating Altitude.....PD.21.1

Long Range Cruise Trip Fuel and TimePD.21.3

Long Range Cruise Step Climb Trip Fuel and TimePD.21.5

Short Trip Fuel and TimePD.21.6

Holding PlanningPD.21.7

Crew Oxygen Requirements.....PD.21.8

Net Level Off WeightPD.21.9

Landing PD.22.1

Landing Field Limit Weight - Dry RunwayPD.22.1

Landing Field Limit Weight - Wet RunwayPD.22.2

Approach or Landing Climb Limited Weight.....PD.22.3

Go-Around Climb GradientPD.22.4

Quick Turnaround Limit Weight.....PD.22.5

Gear Down..... PD.23.1

Takeoff Climb Limit Weight.....PD.23.1

Approach or Landing Climb Limited Weight.....PD.23.2

Takeoff Obstacle Limit Weight.....PD.23.3

Long Range Cruise Altitude CapabilityPD.23.5

**Performance Dispatch
Pkg Model Identification****Chapter PD
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
200ER	777-200ER	7250	WY250

Intentionally
Blank

Performance Dispatch

Chapter PD

Takeoff

Section 20

Takeoff Field Corrections
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	1220	1220	1210	1210	1200	1180	1150	1130	1100
1400	1450	1440	1420	1410	1400	1370	1330	1300	1270
1600	1670	1660	1640	1620	1600	1560	1520	1480	1430
1800	1900	1880	1850	1830	1800	1750	1700	1650	1600
2000	2120	2090	2060	2030	2000	1940	1880	1820	1760
2200	2340	2310	2270	2240	2200	2130	2060	2000	1930
2400	2560	2520	2480	2440	2400	2320	2250	2170	2090
2600	2780	2740	2690	2650	2600	2510	2430	2340	2260
2800	3000	2950	2900	2850	2800	2710	2610	2520	2420
3000	3220	3170	3110	3060	3000	2890	2790	2680	2580
3200	3440	3380	3320	3260	3200	3080	2970	2850	2730
3400	3660	3600	3530	3470	3400	3270	3140	3020	2890
3600	3880	3810	3740	3670	3600	3460	3320	3180	3040
3800	4100	4030	3950	3880	3800	3650	3500	3350	3200
4000	4320	4240	4160	4080	4000	3840	3680	3520	3360
4200	4540	4460	4370	4290	4200	4030	3860	3680	3510
4400	4760	4670	4580	4490	4400	4220	4030	3850	3670
4600	4980	4890	4790	4700	4600	4410	4210	4020	3820
4800	5200	5100	5000	4900	4800	4600	4390	4190	3980
5000	5420	5320	5210	5110	5000	4780	4570	4350	4140

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	1270	1350	1440	1530
1400	1000	1140	1270	1400	1480	1570	1660	1760
1600	1170	1310	1460	1600	1690	1780	1880	1980
1800	1340	1490	1650	1800	1900	2000	2100	2210
2000	1510	1670	1840	2000	2100	2210	2320	2440
2200	1680	1850	2030	2200	2310	2430	2540	2660
2400	1850	2030	2220	2400	2520	2640	2770	2890
2600	2010	2210	2400	2600	2730	2860	2990	3120
2800	2180	2390	2590	2800	2930	3070	3210	3350
3000	2350	2570	2780	3000	3140	3290	3430	3570
3200	2520	2750	2970	3200	3350	3500	3650	3800
3400	2690	2930	3160	3400	3560	3710	3870	4030
3600	2860	3100	3350	3600	3770	3930	4090	4250
3800	3030	3280	3540	3800	3970	4140	4310	4480
4000	3190	3460	3730	4000	4180	4360	4530	4710
4200	3360	3640	3920	4200	4390	4570	4750	4930
4400	3530	3820	4110	4400	4600	4790	4980	5160
4600	3700	4000	4300	4600	4800	5000	5200	5390
4800	3870	4180	4490	4800	5010	5220	5420	5610
5000	4040	4360	4680	5000	5220	5430	5640	5840

Takeoff Field & Climb Limit Weights**Flaps 15****Sea Level Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	OAT											
	°C	-40	14	18	22	23	25	27	29	30	40	50
	°F	-40	57	64	72	73	77	81	84	86	104	122
1470	224.7	204.2	202.9	201.6	201.3	200.6	200.0	199.4	198.7	189.0	175.5	
1600	235.2	213.9	212.6	211.3	210.9	210.3	209.6	209.0	208.3	198.2	184.2	
1800	249.8	227.5	226.1	224.7	224.3	223.7	223.0	222.3	221.6	211.0	196.4	
2000	263.2	240.0	238.5	237.1	236.7	236.0	235.3	234.6	233.9	222.8	207.7	
2200	275.7	251.7	250.2	248.7	248.3	247.6	246.9	246.2	245.3	233.9	218.2	
2400	287.6	262.8	261.2	259.7	259.3	258.5	257.8	257.0	256.2	244.4	228.2	
2600	298.9	273.4	271.7	270.1	269.7	268.9	268.2	267.4	266.5	254.4	237.6	
2800	309.8	283.5	281.8	280.2	279.8	279.0	278.2	277.4	276.5	264.0	246.7	
3000	317.5	292.6	290.9	289.2	288.8	287.9	287.1	286.3	285.4	272.5	254.7	
3200	317.5	301.1	299.3	297.6	297.1	296.3	295.5	294.6	293.7	280.5	262.3	
3400	317.5	309.2	307.3	305.6	305.1	304.3	303.4	302.6	301.6	288.1	269.5	
3600	317.5	316.9	315.0	313.2	312.8	311.9	311.0	310.1	309.2	295.4	276.4	
3800	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.3	316.3	302.3	283.0	
4000	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	309.0	289.3	
4200	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	315.3	295.3	
4400	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	301.1	
4600	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	306.6	
4800	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	311.9	
CLIMB LIMIT WT (1000 KG)	294.2	293.1	293.0	292.9	292.9	292.8	292.8	292.8	291.8	271.9	242.4	

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	OAT											
	°C	-40	14	18	22	23	25	27	29	30	40	50
	°F	-40	57	64	72	73	77	81	84	86	104	122
1470	211.3	191.9	190.7	189.5	189.2	188.6	187.3	185.7	184.9	175.4	162.9	
1600	221.4	201.2	199.9	198.7	198.4	197.7	196.4	194.8	193.9	184.1	171.1	
1800	235.3	214.2	212.8	211.5	211.2	210.6	209.2	207.5	206.6	196.2	182.7	
2000	248.1	226.2	224.8	223.4	223.1	222.4	221.0	219.2	218.3	207.5	193.4	
2200	260.1	237.4	236.0	234.5	234.2	233.5	232.0	230.1	229.2	218.0	203.4	
2400	271.5	248.0	246.5	245.0	244.7	243.9	242.4	240.5	239.5	228.0	212.9	
2600	282.3	258.1	256.5	255.0	254.6	253.9	252.3	250.3	249.3	237.4	221.9	
2800	292.7	267.8	266.2	264.6	264.2	263.5	261.8	259.8	258.7	246.5	230.5	
3000	302.1	276.4	274.8	273.1	272.7	272.0	270.3	268.2	267.1	254.5	238.0	
3200	310.8	284.5	282.8	281.2	280.8	279.9	278.2	276.1	275.0	262.1	245.2	
3400	317.5	292.2	290.5	288.8	288.4	287.6	285.8	283.6	282.5	269.3	252.0	
3600	317.5	299.6	297.8	296.1	295.7	294.9	293.1	290.8	289.7	276.2	258.6	
3800	317.5	306.6	304.8	303.1	302.6	301.8	300.0	297.7	296.5	282.8	264.9	
4000	317.5	313.3	311.5	309.7	309.2	308.4	306.5	304.2	303.0	289.1	270.8	
4200	317.5	317.5	317.5	316.0	315.6	314.7	312.8	310.5	309.3	295.1	276.6	
4400	317.5	317.5	317.5	317.5	317.5	317.5	317.5	316.5	315.3	300.9	282.1	
4600	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	306.4	287.3	
4800	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	317.5	311.7	292.3	
CLIMB LIMIT WT (1000 KG)	278.2	277.1	277.1	277.0	277.0	276.9	274.8	271.7	270.1	250.9	224.7	

With engine bleed for packs off, increase field limit weight by 280 kg and climb limit weight by 800 kg.

With engine anti-ice on, decrease field limit weight by 30 kg.

With engine and wing anti-ice on, decrease field limit weight by 750 kg and climb limit weight by 1250 kg.

Takeoff Field & Climb Limit Weights**Flaps 15****4000 FT Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	OAT											
	°C	-40	14	18	22	23	25	27	29	30	40	50
	°F	-40	57	64	72	73	77	81	84	86	104	122
1470	197.3	179.1	177.9	176.4	175.8	174.4	173.0	171.3	170.5	161.3	151.6	
1600	206.8	187.9	186.7	185.1	184.4	183.0	181.6	179.9	179.0	169.4	159.3	
1800	220.1	200.3	199.0	197.4	196.6	195.1	193.6	191.8	190.9	180.9	170.4	
2000	232.3	211.7	210.4	208.7	207.9	206.4	204.8	202.9	202.0	191.5	180.6	
2200	243.7	222.4	221.0	219.3	218.5	216.9	215.3	213.3	212.3	201.5	190.2	
2400	254.5	232.5	231.1	229.2	228.4	226.8	225.1	223.1	222.1	210.9	199.2	
2600	264.8	242.1	240.6	238.7	237.9	236.2	234.5	232.4	231.3	219.8	207.8	
2800	274.7	251.3	249.8	247.8	247.0	245.2	243.5	241.3	240.2	228.4	215.9	
3000	283.5	259.4	257.9	255.9	255.0	253.2	251.4	249.2	248.0	235.8	223.0	
3200	291.8	267.1	265.5	263.5	262.6	260.7	258.9	256.6	255.4	242.9	229.8	
3400	299.7	274.4	272.8	270.8	269.8	267.9	266.0	263.7	262.5	249.8	236.4	
3600	307.2	281.5	279.8	277.7	276.8	274.8	272.9	270.5	269.3	256.3	242.6	
3800	314.3	288.1	286.5	284.3	283.3	281.4	279.4	277.0	275.8	262.5	248.6	
4000	317.5	294.5	292.8	290.6	289.6	287.6	285.6	283.2	281.9	268.4	254.3	
4200	317.5	300.6	298.9	296.7	295.7	293.6	291.6	289.1	287.9	274.1	259.8	
4400	317.5	306.5	304.7	302.5	301.4	299.4	297.3	294.8	293.5	279.6	265.0	
4600	317.5	312.1	310.3	308.0	307.0	304.9	302.8	300.2	298.9	284.8	270.0	
4800	317.5	317.4	315.6	313.3	312.2	310.1	308.0	305.4	304.1	289.8	274.8	
CLIMB LIMIT WT (1000 KG)	259.6	258.6	258.6	257.6	256.5	254.1	251.5	248.3	246.7	228.8	209.8	

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	OAT											
	°C	-40	14	18	22	23	25	27	29	30	40	50
	°F	-40	57	64	72	73	77	81	84	86	104	122
1470	183.9	166.8	165.5	163.7	163.3	161.8	160.3	158.7	157.9	149.4	140.1	
1600	192.9	175.1	173.8	171.9	171.5	170.0	168.4	166.7	165.9	157.1	147.4	
1800	205.5	186.9	185.5	183.5	183.1	181.5	179.8	178.1	177.2	168.0	157.9	
2000	217.1	197.8	196.3	194.3	193.8	192.1	190.4	188.6	187.7	178.2	167.6	
2200	228.0	208.0	206.4	204.4	203.9	202.1	200.3	198.5	197.5	187.7	176.7	
2400	238.3	217.6	216.0	213.9	213.4	211.6	209.7	207.8	206.8	196.6	185.3	
2600	248.0	226.7	225.1	222.9	222.4	220.5	218.6	216.6	215.6	205.1	193.4	
2800	257.4	235.5	233.8	231.5	231.0	229.1	227.1	225.1	224.0	213.2	201.2	
3000	265.8	243.1	241.4	239.1	238.5	236.5	234.5	232.4	231.3	220.2	207.8	
3200	273.6	250.4	248.6	246.3	245.7	243.7	241.6	239.5	238.4	226.9	214.3	
3400	281.1	257.4	255.6	253.2	252.6	250.5	248.4	246.2	245.1	233.4	220.5	
3600	288.2	264.1	262.2	259.8	259.2	257.1	254.9	252.7	251.5	239.6	226.4	
3800	295.0	270.5	268.6	266.0	265.4	263.3	261.1	258.8	257.7	245.5	232.1	
4000	301.5	276.5	274.6	272.0	271.4	269.2	267.0	264.7	263.5	251.2	237.5	
4200	307.7	282.4	280.4	277.8	277.2	275.0	272.7	270.3	269.1	256.6	242.7	
4400	313.7	287.9	285.9	283.3	282.7	280.4	278.1	275.7	274.5	261.8	247.7	
4600	317.5	293.3	291.2	288.5	287.9	285.6	283.3	280.9	279.6	266.7	252.4	
4800	317.5	298.3	296.3	293.6	292.9	290.6	288.2	285.8	284.5	271.4	256.9	
CLIMB LIMIT WT (1000 KG)	242.2	241.4	240.8	238.8	238.3	235.6	232.7	229.7	228.2	212.1	195.7	

With engine bleed for packs off, increase field limit weight by 280 kg and climb limit weight by 800 kg.

With engine anti-ice on, decrease field limit weight by 30 kg.

With engine and wing anti-ice on, decrease field limit weight by 750 kg and climb limit weight by 1250 kg.

Takeoff Field & Climb Limit Weights

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)											
	OAT											
	°C	-40	14	18	22	23	25	27	29	30	40	50
	°F	-40	57	64	72	73	77	81	84	86	104	122
1470	171.7	155.5	153.4	151.4	150.9	149.7	148.2	146.6	145.8	137.2	128.4	
1600	180.2	163.4	161.2	159.1	158.6	157.4	155.9	154.2	153.3	144.4	135.2	
1800	192.2	174.6	172.3	170.1	169.6	168.3	166.7	164.9	164.0	154.7	145.1	
2000	203.3	185.0	182.6	180.3	179.8	178.5	176.8	174.9	174.0	164.3	154.4	
2200	213.7	194.7	192.2	189.9	189.3	188.0	186.3	184.3	183.4	173.3	163.0	
2400	223.5	203.9	201.3	198.9	198.3	196.9	195.1	193.1	192.2	181.8	171.1	
2600	232.8	212.6	210.0	207.5	206.9	205.4	203.6	201.5	200.5	189.8	178.8	
2800	241.8	220.9	218.2	215.6	215.0	213.5	211.6	209.5	208.4	197.4	186.1	
3000	249.6	228.2	225.4	222.7	222.1	220.5	218.6	216.4	215.3	203.9	192.3	
3200	257.1	235.1	232.2	229.5	228.9	227.3	225.3	223.1	221.9	210.3	198.4	
3400	264.2	241.8	238.8	236.0	235.4	233.8	231.7	229.5	228.3	216.4	204.2	
3600	271.0	248.1	245.1	242.3	241.6	240.0	237.9	235.6	234.4	222.3	209.9	
3800	277.5	254.2	251.1	248.3	247.6	245.9	243.8	241.4	240.2	227.9	215.2	
4000	283.7	260.0	256.9	254.0	253.3	251.6	249.4	247.0	245.8	233.2	220.4	
4200	289.6	265.6	262.4	259.4	258.7	257.0	254.8	252.3	251.1	238.4	225.3	
4400	295.3	270.9	267.7	264.6	263.9	262.2	260.0	257.5	256.2	243.3	230.0	
4600	300.8	276.0	272.7	269.6	268.9	267.2	264.9	262.4	261.1	248.0	234.5	
4800	305.9	280.8	277.5	274.4	273.7	271.9	269.6	267.0	265.7	252.4	238.8	
CLIMB LIMIT WT (1000 KG)	227.3	226.1	223.2	220.5	219.8	217.8	215.0	212.2	210.8	196.0	180.9	

With engine bleed for packs off, increase field limit weight by 280 kg and climb limit weight by 800 kg.

With engine anti-ice on, decrease field limit weight by 30 kg.

With engine and wing anti-ice on, decrease field limit weight by 750 kg and climb limit weight by 1250 kg.

Takeoff Obstacle Limit Weight**Flaps 15**

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off
Sea Level, 29°C & Below, Zero Wind

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	254.1	275.8	292.9	303.6	312.1						
20	235.0	254.0	269.9	283.1	293.5	300.5	306.0	310.5			
40	216.9	234.6	249.7	262.7	273.7	282.8	290.2	295.8	300.1	303.7	306.8
60	202.3	220.3	235.5	248.2	258.9	268.0	275.9	282.6	288.2	292.9	296.6
80	192.3	208.8	223.9	236.5	247.2	256.3	264.2	271.1	277.1	282.4	286.9
100	184.1	199.1	214.0	226.5	237.2	246.4	254.4	261.3	267.4	273.0	277.8
120	175.6	191.8	205.1	217.7	228.4	237.6	245.7	252.8	259.0	264.5	269.6
140	167.9	185.2	197.4	209.8	220.5	229.8	238.0	245.2	251.5	257.2	262.2
160	160.9	178.4	191.4	202.4	213.4	222.7	230.9	238.2	244.6	250.4	255.6
180	154.4	171.9	185.8	196.3	206.7	216.1	224.4	231.7	238.3	244.2	249.5
200		166.0	180.1	191.1	200.6	210.0	218.4	225.8	232.4	238.4	243.8
220		160.4	174.6	186.1	195.4	204.3	212.7	220.2	226.9	232.9	238.4
240		155.2	169.5	181.2	190.7	199.0	207.4	215.0	221.7	227.8	233.3
260			164.6	176.5	186.2	194.5	202.4	210.0	216.8	222.9	228.6
280			160.0	171.9	181.9	190.3	197.8	205.3	212.1	218.3	224.0
300			155.6	167.6	177.8	186.3	193.8	200.8	207.7	214.0	219.7

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	180	200	220	240	260	280	300	320
29 & BELOW	0	0	0	0	0	0	0	0
30	-1.1	-1.2	-1.4	-1.5	-1.6	-1.7	-1.9	-2.0
32	-3.3	-3.7	-4.1	-4.4	-4.8	-5.2	-5.6	-6.0
34	-5.5	-6.1	-6.8	-7.4	-8.0	-8.7	-9.3	-9.9
36	-7.7	-8.6	-9.5	-10.4	-11.3	-12.1	-13.0	-13.9
38	-9.9	-11.1	-12.2	-13.3	-14.5	-15.6	-16.7	-17.9
40	-12.1	-13.5	-14.9	-16.3	-17.7	-19.1	-20.5	-21.8
42	-15.7	-17.5	-19.4	-21.2	-23.0	-24.9	-26.7	-28.5
44	-19.3	-21.5	-23.8	-26.1	-28.4	-30.6	-32.9	-35.2
46	-22.8	-25.6	-28.3	-31.0	-33.7	-36.4	-39.1	-41.9
48	-26.4	-29.6	-32.7	-35.9	-39.0	-42.2	-45.4	-48.5
50	-30.0	-33.6	-37.2	-40.8	-44.4	-48.0	-51.6	-55.2

Pressure Altitude Adjustment

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	180	200	220	240	260	280	300	320
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-6.7	-7.4	-8.1	-8.7	-9.4	-10.1	-10.8	-11.4
2000	-13.4	-14.8	-16.1	-17.5	-18.8	-20.2	-21.5	-22.9
3000	-20.6	-22.8	-25.0	-27.2	-29.4	-31.6	-33.8	-36.0
4000	-27.7	-30.8	-33.9	-36.9	-40.0	-43.0	-46.1	-49.2
5000	-33.8	-37.5	-41.3	-45.0	-48.7	-52.4	-56.1	-59.8
6000	-39.9	-44.3	-48.7	-53.0	-57.4	-61.8	-66.1	-70.5
7000	-45.4	-50.4	-55.4	-60.4	-65.4	-70.4	-75.4	-80.4
8000	-50.8	-56.5	-62.1	-67.8	-73.4	-79.1	-84.7	-90.4

Takeoff Obstacle Limit Weight

Flaps 15

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

Wind Adjustment

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	180	200	220	240	260	280	300	320
15 TW	-28.4	-27.9	-27.5	-27.0	-26.5	-26.1	-25.6	-25.2
10 TW	-18.9	-18.6	-18.3	-18.0	-17.7	-17.4	-17.1	-16.8
5TW	-9.5	-9.3	-9.2	-9.0	-8.8	-8.7	-8.5	-8.4
0	0	0	0	0	0	0	0	0
10 HW	3.2	3.0	2.8	2.6	2.3	2.1	1.9	1.7
20 HW	6.4	5.9	5.5	5.1	4.7	4.3	3.9	3.4
30 HW	9.8	9.1	8.5	7.8	7.1	6.5	5.8	5.2
40 HW	13.2	12.3	11.4	10.5	9.6	8.7	7.8	6.9

With engine bleed for packs off, increase weight by 300 kg.

With engine and wing anti-ice on, decrease weight by 1400 kg.

Brake Energy Limits VMBE**Maximum Brake Energy Speed**

OAT (°C)	REFERENCE VMBE (KIAS)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	198	190				
50	198	191	184			
46	199	191	185	178		
42	200	192	185	179	172	
38	200	193	186	180	173	167
34	202	194	187	180	174	168
30	203	194	188	181	175	169
26	205	196	189	182	176	170
22	207	198	190	184	177	171
18	208	199	192	185	178	172
14	210	201	194	186	180	173
10	210	203	195	188	181	174
6	210	205	197	190	183	176
2	210	207	199	191	184	177
-2	210	209	201	193	186	179
-6	210	210	202	195	188	180
-10	210	210	204	197	189	182

Weight Adjusted VMBE

WEIGHT (1000 KG)	REFERENCE VMBE (KIAS)										
	160	165	170	175	180	185	190	195	200	205	210
160	205	210	210	210	210	210	210	210	210	210	210
170	196	202	209	210	210	210	210	210	210	210	210
180	188	194	201	207	210	210	210	210	210	210	210
190	182	188	194	200	206	210	210	210	210	210	210
200	177	183	188	194	200	206	210	210	210	210	210
210	172	178	183	189	194	200	205	210	210	210	210
220	168	173	178	184	189	195	200	205	210	210	210
230	164	169	174	179	184	190	195	200	205	210	210
240	160	165	170	175	180	185	190	195	200	205	210
250	156	161	166	171	176	181	185	190	195	200	205
260	153	158	162	167	172	177	181	186	191	195	200
270	150	155	159	164	168	173	177	182	187	191	196
280	147	152	156	161	165	169	174	178	183	187	192
290	145	149	153	158	162	166	171	175	179	183	188
300	142	147	151	155	159	163	167	172	176	180	184
310	140	144	148	152	156	161	165	169	173	177	181

Increase VMBE by 3 knots per 1% uphill runway slope. Decrease VMBE by 5 knots per 1% downhill runway slope.

Increase VMBE by 5 knots per 10 knots headwind. Decrease VMBE by 21 knots per 10 knots tailwind.

Decrease VMBE by 10 knots for one brake deactivated and 20 knots for two brakes deactivated.

Decrease brake release weight by 1600 kg for each knot V1 exceeds VMBE.

Determine normal V1, VR, V2 speeds for lower brake release weight.

Takeoff Speeds

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 15		
	V1	VR	V2
300	157	162	168
290	153	159	165
280	150	156	163
270	147	153	160
260	144	150	157
250	140	146	154
240	137	143	152
230	133	139	149
220	129	136	146
210	126	132	143
200	121	129	140
190	117	125	136
180	112	121	133
170	107	117	130
160	103	113	126
150	98	108	123
140	93	104	119

Check V1(MCG) and Minimum VR.

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	-2	0	2	4	6	8	-2	0	2	4	6	8
60	140	7	8	10	12			3	4	5	6			-2	-2	-3	-3		
50	122	4	5	7	9	11	13	2	2	3	4	5	6	-1	-1	-2	-2	-3	-3
40	104	1	2	4	7	8	10	1	1	2	3	4	5	0	-1	-1	-2	-2	-3
30	86	0	0	2	5	7	9	0	0	1	2	4	5	0	0	-1	-1	-2	-2
20	68	0	0	1	3	6	7	0	0	1	2	3	4	0	0	0	-1	-1	-2
-60	-76	0	0	1	3	5	7	0	0	1	2	3	4	0	0	0	-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
300	-5	-2	0	2	4		-2	-1	-1	0	0	1	1	2
280	-4	-2	0	2	4		-2	-1	0	0	0	1	1	2
260	-4	-2	0	2	3		-2	-1	0	0	0	1	1	2
240	-3	-1	0	2	3		-2	-1	0	0	0	1	1	2
220	-3	-1	0	2	3		-2	-1	0	0	0	1	1	2
200	-3	-1	0	2	3		-2	-1	0	0	0	1	1	2
180	-3	-1	0	2	3		-2	-1	0	0	1	1	2	2
160	-3	-1	0	2	3		-2	-1	0	0	1	1	2	2
140	-3	-1	0	2	3		-2	-1	0	0	1	1	2	2

*V1 not to exceed VR

Takeoff Speeds**Flaps 15****V1(MCG), Minimum VR****Max Takeoff Thrust**

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	113	114	109	111	108	109	106	108	104	106	101	104
50	122	115	116	112	114	108	110	106	108	104	106	101	104
40	104	121	122	118	119	114	115	109	110	105	107	101	104
30	86	123	124	122	123	118	119	113	114	108	110	104	106
20	68	123	124	123	123	119	120	115	117	111	113	107	109
-60	-76	124	124	124	124	120	121	116	117	112	113	109	110

Minimum V2**Max Takeoff Thrust**

PRESSURE ALTITUDE (FT)	-2000	0	2000	4000	6000	8000
SPEED (KIAS)	119	118	116	115	113	111

Intentionally
Blank

Performance Dispatch
Enroute

Chapter PD
Section 21

Long Range Cruise Maximum Operating Altitude

Max Climb 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°)
300	30300	-1	33500*	33500*	33500*	33400	31900
290	31100	-3	34300*	34300*	34300*	34100	32700
280	31800	-5	35200*	35200*	35200*	34900	33400
270	32600	-7	36100*	36100*	36100*	35600	34200
260	33400	-8	36800*	36800*	36800*	36400	35000
250	34200	-10	37600*	37600*	37600*	37200	35800
240	35100	-12	38400*	38400*	38400*	38100	36600
230	36000	-14	39300*	39300*	39300*	39000	37500
220	36900	-14	40200*	40200*	40200*	39900	38500
210	37900	-14	41100*	41100*	41100*	40900	39400
200	38900	-14	42100*	42100*	42100*	41900	40400
190	40000	-14	43000	43000	43000	42900	41500
180	41100	-14	43000	43000	43000	43000	42600
170	42300	-14	43000	43000	43000	43000	43000
160	43000	-14	43000	43000	43000	43000	43000
150	43000	-14	43000	43000	43000	43000	43000
140	43000	-14	43000	43000	43000	43000	43000

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°)
300	30300	4	32500*	32500*	32500*	32500*	31900
290	31100	3	33400*	33400*	33400*	33400*	32700
280	31800	1	34300*	34300*	34300*	34300*	33400
270	32600	-1	35200*	35200*	35200*	35200*	34200
260	33400	-3	36100*	36100*	36100*	36100*	35000
250	34200	-5	36900*	36900*	36900*	36900*	35800
240	35100	-7	37700*	37700*	37700*	37700*	36600
230	36000	-9	38600*	38600*	38600*	38600*	37500
220	36900	-9	39500*	39500*	39500*	39500*	38500
210	37900	-9	40400*	40400*	40400*	40400*	39400
200	38900	-9	41400*	41400*	41400*	41400*	40400
190	40000	-9	42400*	42400*	42400*	42400*	41500
180	41100	-9	43000	43000	43000	43000	42600
170	42300	-9	43000	43000	43000	43000	43000
160	43000	-9	43000	43000	43000	43000	43000
150	43000	-9	43000	43000	43000	43000	43000
140	43000	-9	43000	43000	43000	43000	43000

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust
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°)
300	30300	10	31100*	31100*	31100*	31100*	31100*
290	31100	8	32100*	32100*	32100*	32100*	32100*
280	31800	7	33100*	33100*	33100*	33100*	33100*
270	32600	5	34100*	34100*	34100*	34100*	34100*
260	33400	3	35100*	35100*	35100*	35100*	35000
250	34200	1	36100*	36100*	36100*	36100*	35800
240	35100	-1	36800*	36800*	36800*	36800*	36600
230	36000	-3	37700*	37700*	37700*	37700*	37500
220	36900	-3	38600*	38600*	38600*	38600*	38500
210	37900	-3	39500*	39500*	39500*	39500*	39400
200	38900	-3	40500*	40500*	40500*	40500*	40400
190	40000	-3	41500*	41500*	41500*	41500*	41500
180	41100	-3	42600*	42600*	42600*	42600*	42600
170	42300	-3	43000	43000	43000	43000	43000
160	43000	-3	43000	43000	43000	43000	43000
150	43000	-3	43000	43000	43000	43000	43000
140	43000	-3	43000	43000	43000	43000	43000

*Denotes altitude thrust limited in level flight, 300 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
1051	990	934	885	840	800	767	736	707	680	656
1571	1480	1398	1325	1260	1200	1151	1105	1062	1023	987
2089	1971	1863	1766	1680	1600	1535	1474	1417	1366	1318
2606	2459	2325	2206	2099	2000	1919	1843	1773	1708	1649
3121	2946	2787	2645	2517	2400	2303	2213	2129	2051	1980
3635	3433	3248	3084	2936	2800	2688	2583	2485	2394	2311
4147	3918	3709	3523	3355	3200	3072	2952	2840	2737	2643
4657	4402	4169	3961	3773	3600	3456	3321	3196	3080	2974
5166	4885	4628	4398	4191	4000	3839	3690	3551	3423	3305
5674	5367	5086	4836	4609	4400	4224	4059	3907	3766	3636
6181	5849	5545	5273	5027	4800	4608	4429	4262	4108	3967
6686	6329	6002	5709	5444	5200	4992	4798	4617	4451	4298
7190	6809	6459	6146	5862	5600	5376	5167	4973	4794	4629
7693	7288	6915	6582	6279	6000	5761	5537	5329	5137	4960
8196	7766	7371	7017	6696	6400	6145	5906	5684	5479	5291
8698	8244	7827	7453	7113	6800	6528	6275	6039	5822	5622
9200	8721	8282	7888	7530	7200	6913	6644	6395	6164	5953
9702	9199	8738	8323	7947	7600	7297	7014	6751	6508	6285
10204	9677	9194	8759	8365	8000	7681	7383	7106	6850	6615

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME
	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)
800	12.4	2:00	12.1	1:58	11.9	1:56	11.7	1:54	11.5	1:52
1200	17.9	2:56	17.4	2:52	17.1	2:49	16.8	2:45	16.5	2:42
1600	23.6	3:51	23.0	3:46	22.5	3:41	22.0	3:36	21.6	3:32
2000	29.4	4:45	28.6	4:39	27.9	4:32	27.3	4:27	26.8	4:22
2400	35.2	5:39	34.2	5:31	33.4	5:24	32.7	5:17	32.1	5:12
2800	41.3	6:32	40.1	6:23	39.1	6:14	38.2	6:07	37.5	6:02
3200	47.4	7:24	46.0	7:14	44.9	7:05	43.8	6:57	43.1	6:52
3600	53.5	8:17	52.0	8:05	50.7	7:55	49.5	7:47	48.7	7:42
4000	59.9	9:08	58.2	8:56	56.7	8:44	55.4	8:36	54.6	8:32
4400	66.3	9:59	64.4	9:46	62.8	9:34	61.4	9:26	60.6	9:22
4800	72.9	10:50	70.8	10:36	68.9	10:23	67.5	10:16	66.8	10:12
5200	79.6	11:40	77.3	11:25	75.3	11:13	73.8	11:05	73.3	11:02
5600	86.4	12:29	83.9	12:14	81.8	12:02	80.3	11:55		
6000	93.3	13:19	90.6	13:03	88.5	12:51	86.9	12:45		
6400	100.4	14:08	97.6	13:52	95.3	13:40	93.8	13:35		
6800	107.6	14:57	104.6	14:41	102.3	14:30	101.0	14:25		
7200	114.9	15:46	111.8	15:30	109.5	15:19	108.4	15:15		
7600	122.4	16:35	119.3	16:19	116.9	16:09				
8000	130.1	17:23	126.8	17:08	124.6	16:58				

Long Range Cruise Trip Fuel and Time Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	140	160	180	200	220
10	-1.2	-0.6	0.0	0.8	1.6
20	-2.4	-1.1	0.0	1.7	3.6
30	-3.6	-1.8	0.0	2.7	6.0
40	-4.8	-2.4	0.0	3.8	8.7
50	-6.0	-3.0	0.0	5.0	11.7
60	-7.3	-3.7	0.0	6.4	15.0
70	-8.6	-4.3	0.0	7.9	18.7
80	-9.9	-5.0	0.0	9.6	22.8
90	-11.2	-5.7	0.0	11.3	27.1
100	-12.6	-6.4	0.0	13.2	31.9
110	-14.0	-7.1	0.0	15.2	36.9
120	-15.4	-7.8	0.0	17.4	42.3
130	-16.9	-8.6	0.0	19.7	48.0
140	-18.3	-9.3	0.0	22.1	54.1

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

**Long Range Cruise Step Climb 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
1040	981	928	881	839	800	765	732	703	675	650
1545	1461	1386	1318	1256	1200	1149	1102	1058	1018	981
2050	1941	1843	1754	1673	1600	1533	1471	1414	1361	1312
2555	2421	2300	2190	2091	2000	1917	1840	1769	1704	1643
3060	2900	2757	2627	2508	2400	2301	2209	2125	2047	1974
3564	3380	3214	3063	2925	2800	2685	2579	2481	2390	2306
4069	3859	3670	3499	3343	3200	3069	2948	2837	2733	2637
4573	4339	4127	3935	3760	3600	3453	3318	3192	3076	2968
5078	4818	4584	4371	4177	4000	3837	3687	3548	3419	3300
5582	5297	5040	4807	4595	4400	4221	4056	3904	3763	3631
6086	5776	5497	5243	5012	4800	4605	4426	4260	4106	3963
6590	6256	5953	5679	5429	5200	4990	4795	4616	4449	4294
7094	6735	6410	6115	5846	5600	5374	5165	4972	4792	4626
7598	7214	6867	6551	6264	6000	5758	5534	5328	5136	4957
8103	7693	7323	6987	6681	6400	6142	5904	5683	5479	5289
8607	8173	7780	7423	7098	6800	6526	6273	6039	5822	5620
9111	8652	8237	7859	7515	7200	6910	6643	6395	6165	5952
9616	9131	8693	8296	7933	7600	7294	7012	6751	6508	6283
10121	9611	9150	8732	8350	8000	7678	7381	7107	6852	6614

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)									TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)									
	140	150	160	170	180	190	200	210	220	
800	9.6	10.1	10.4	11.0	11.5	11.9	12.4	13.0	13.5	1:51
1200	13.6	14.2	14.9	15.7	16.4	17.1	17.9	18.7	19.4	2:41
1600	17.7	18.5	19.5	20.5	21.4	22.4	23.5	24.6	25.4	3:31
2000	21.9	22.9	24.2	25.5	26.6	27.9	29.3	30.6	31.7	4:21
2400	26.1	27.5	28.9	30.5	31.9	33.5	35.1	36.7	38.1	5:11
2800	30.5	32.1	33.8	35.6	37.4	39.2	41.1	42.9	44.7	6:00
3200	35.0	36.8	38.8	40.9	43.0	45.1	47.2	49.4	51.5	6:50
3600	39.5	41.7	43.9	46.4	48.7	51.1	53.5	56.0	58.4	7:40
4000	44.2	46.6	49.2	51.9	54.5	57.2	60.0	62.8	65.5	8:29
4400	49.0	51.7	54.6	57.6	60.5	63.5	66.6	69.8	72.7	9:19
4800	53.9	56.8	60.1	63.5	66.6	70.0	73.5	76.9	80.2	10:09
5200	58.9	62.2	65.7	69.4	72.9	76.6	80.4	84.2	87.8	10:58
5600	64.0	67.7	71.5	75.5	79.3	83.4	87.6	91.6	95.7	11:48
6000	69.2	73.3	77.4	81.7	85.9	90.4	94.9	99.3	103.7	12:37
6400	74.6	79.0	83.4	88.1	92.7	97.5	102.4	107.2		13:27
6800	80.2	84.8	89.6	94.7	99.7	104.8	110.1	115.4		14:17
7200	85.8	90.8	96.0	101.5	106.8	112.3				15:06
7600	91.6	96.9	102.5	108.4	114.1	120.0				15:56
8000	97.5	103.2	109.3	115.5	121.6	127.9				16:46

Based on 310/.84 climb, LRC and .84/310/250 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	79	69	61	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	133	125	119	113
287	264	245	228	213	200	189	178	169	161	153
349	324	301	282	265	250	237	224	214	204	195
411	382	358	336	317	300	285	271	258	247	236
472	441	414	390	369	350	333	317	303	290	278
534	500	471	445	421	400	381	364	348	333	320
597	560	528	499	473	450	429	410	392	376	361
661	621	586	554	526	500	477	456	436	418	402

Trip Fuel and Time Required

AIR DISTANCE (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		140	160	180	200	220	
50	FUEL (1000 KG)	1.5	1.6	1.7	1.8	1.9	0:14
	ALT (FT)	10000	10000	9000	8000	8000	
100	FUEL (1000 KG)	2.3	2.4	2.6	2.7	2.9	0:22
	ALT (FT)	19000	18000	17000	16000	15000	
150	FUEL (1000 KG)	3.0	3.2	3.4	3.6	3.8	0:30
	ALT (FT)	27000	25000	24000	22000	21000	
200	FUEL (1000 KG)	3.6	3.9	4.1	4.4	4.6	0:36
	ALT (FT)	34000	31000	29000	28000	26000	
250	FUEL (1000 KG)	4.2	4.5	4.8	5.1	5.4	0:43
	ALT (FT)	39000	36000	34000	32000	30000	
300	FUEL (1000 KG)	4.7	5.0	5.4	5.8	6.2	0:48
	ALT (FT)	43000	40000	37000	35000	33000	
350	FUEL (1000 KG)	5.1	5.6	6.0	6.5	6.9	0:54
	ALT (FT)	43000	42000	39000	36000	34000	
400	FUEL (1000 KG)	5.6	6.1	6.6	7.1	7.6	1:00
	ALT (FT)	43000	42000	39000	36000	34000	
450	FUEL (1000 KG)	6.1	6.6	7.2	7.8	8.3	1:06
	ALT (FT)	43000	42000	39000	36000	34000	
500	FUEL (1000 KG)	6.6	7.2	7.8	8.4	9.1	1:13
	ALT (FT)	43000	42000	39000	36000	34000	

Holding Planning
Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
300	8700	8640	8370	8470	8880	9070	9420			
280	8110	8030	7780	7780	8110	8350	8600	9090		
260	7540	7450	7370	7150	7470	7650	7850	8110		
240	7120	7020	6920	6700	6750	6970	7120	7410		
220	6560	6460	6340	6280	6100	6330	6430	6620	7170	
200	6020	5920	5780	5700	5520	5600	5750	5900	6260	
180	5640	5390	5260	5160	5100	4940	5150	5210	5530	5750
160	5130	5020	4760	4650	4580	4520	4430	4640	4880	5110
140	4660	4530	4390	4160	4070	4010	3880	3950	4190	4340

Flaps 1

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
300	9360	9070	9040	9070	9130
280	8700	8630	8370	8390	8430
260	8070	7980	7710	7710	7870
240	7440	7350	7260	7180	7190
220	6970	6880	6760	6540	6540
200	6360	6270	6160	6070	5900
180	5910	5680	5570	5470	5290
160	5340	5230	5000	4900	4820
140	4800	4670	4550	4340	4250

These tables include 5% additional fuel for holding in a racetrack pattern.

Crew Oxygen Requirements

Required Pressure (PSI) for One 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

For more extensive than normal crew usage, add 1.2 psi/person/minute.

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
29	151.8		
28	159.5		
27	167.5	151.6	
		159.5	151.3
26	175.8	167.6	159.2
25	184.4	176.1	167.4
24	192.4	183.7	174.7
23	200.6	191.7	182.1
22	209.1	199.9	189.8
21	218.0	208.4	197.8
20	227.1	217.2	206.1
19	236.0	225.9	214.5
18	245.2	234.8	223.2
17	254.6	244.0	232.1
16	264.3	253.5	241.4
15	272.4	261.5	248.8
14	280.8	269.5	256.4
13	289.2	277.7	264.2
12	297.8	285.8	272.1
11	305.6	292.9	278.6
10	313.5	300.0	284.7
9		306.8	290.2
8		313.4	295.8
7			301.3
6			306.6
5			311.8
4			316.2

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALTITUDE (1000 FT)								
	10	12	14	16	18	20	22	24	26
ENGINE ONLY	-4.3	-3.8	-3.3	-2.7	-1.9	-1.1	-1.4	-1.2	-0.9
ENGINE AND WING	-5.7	-5.2	-4.7	-4.2	-3.4	-2.6	-3.2	-3.0	-2.8

Intentionally
Blank

Performance Dispatch	Chapter PD
Landing	Section 22

Landing Field Limit Weight - Dry Runway

Flaps 30

Wind Adjusted Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200		1030	1120	1200	1280	1350	1430	1500
1400	1090	1190	1300	1400	1480	1570	1650	1730
1600	1240	1360	1480	1600	1690	1780	1880	1970
1800	1380	1520	1660	1800	1900	2000	2100	2200
2000	1530	1680	1840	2000	2110	2220	2330	2430
2200	1670	1850	2020	2200	2320	2430	2550	2670
2400	1820	2010	2210	2400	2530	2650	2780	2900
2600	1960	2170	2390	2600	2730	2870	3000	3130
2800	2110	2340	2570	2800	2940	3080	3230	3370
3000	2250	2500	2750	3000	3150	3300	3450	3600
3200	2400	2660	2930	3200	3360	3520	3680	3830
3400	2540	2830	3110	3400	3570	3730	3900	4070
3600	2690	2990	3300	3600	3780	3950	4130	4300
3800	2830	3150	3480	3800	3980	4170	4350	4530
4000	2980	3320	3660	4000	4190	4380	4580	4770
4200	3120	3480	3840	4200	4400	4600	4800	
4400	3270	3640	4020	4400	4610			
4600	3410	3810	4200	4600				
4800	3560	3970	4390	4800				
5000	3700	4130	4570					

Field Limit Weight (1000 KG)

WIND CORRECTED FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)				
	0	2000	4000	6000	8000
1400	177.2	166.9	156.9	144.9	138.2
1600	210.9	198.6	186.7	175.4	164.8
1800	234.8	226.6	217.2	204.1	191.8
2000	253.9	245.1	236.4	227.9	219.2
2200	273.6	262.8	253.5	244.5	235.7
2400	292.2	281.6	271.2	260.4	251.0
2600	309.6	299.0	287.9	276.9	266.6
2800	326.5	314.9	303.7	292.2	281.1
3000			315.8	304.2	293.0
3200			327.0	314.3	302.9
3400				324.3	312.0
3600					320.7

With 1 brake deactivated, decrease weight by 16200 kg.
With 2 brakes deactivated, decrease weight by 34700 kg.
With manual speedbrakes, decrease weight by 18050 kg.

Landing Field Limit Weight - Wet Runway

Flaps 30

Wind Adjusted Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1280	1360	1440	1520
1400		1200	1300	1400	1490	1570	1660	1750
1600	1250	1360	1480	1600	1700	1790	1890	1980
1800	1390	1530	1660	1800	1900	2010	2110	2220
2000	1540	1690	1850	2000	2110	2220	2340	2450
2200	1680	1850	2030	2200	2320	2440	2560	2680
2400	1830	2020	2210	2400	2530	2660	2790	2910
2600	1970	2180	2390	2600	2740	2870	3010	3150
2800	2120	2340	2570	2800	2950	3090	3240	3380
3000	2260	2510	2750	3000	3150	3310	3460	3610
3200	2410	2670	2940	3200	3360	3520	3690	3850
3400	2550	2830	3120	3400	3570	3740	3910	4080
3600	2700	3000	3300	3600	3780	3960	4140	4310
3800	2840	3160	3480	3800	3990	4170	4360	4550
4000	2990	3320	3660	4000	4200	4390	4590	4780
4200	3130	3490	3840	4200	4400	4610	4810	5010
4400	3280	3650	4030	4400	4610	4820	5040	5250
4600	3420	3810	4210	4600	4820	5040	5260	5480
4800	3570	3980	4390	4800	5030	5260	5490	
5000	3710	4140	4570	5000	5240	5470		

Field Limit Weight (1000 KG)

WIND CORRECTED FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)				
	0	2000	4000	6000	8000
1600	175.8	165.5	155.6	139.4	137.0
1800	205.0	193.0	181.5	170.5	160.1
2000	228.7	219.3	207.9	195.4	183.5
2200	245.7	237.2	228.7	219.9	207.2
2400	262.7	252.9	244.0	235.2	226.7
2600	279.3	268.8	258.6	249.4	240.4
2800	295.3	284.7	274.1	263.4	253.6
3000	310.3	299.7	288.6	277.6	267.3
3200	325.0	313.5	302.4	290.9	279.9
3400		327.2	313.4	301.8	290.6
3600			323.1	310.9	299.5
3800				319.6	307.7
4000					315.4
4200					323.0

With 1 brake deactivated, decrease weight by 16200 kg.

With 2 brakes deactivated, decrease weight by 34700 kg.

With manual speedbrakes, decrease weight by 18050 kg.

Approach or Landing Climb Limited Weight**Valid for approach with flaps 20 and landing with flaps 25 or 30**

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	258.6	243.7				
52	126	264.6	249.6				
50	122	270.9	255.3	236.3			
48	118	277.2	261.0	242.0			
46	115	283.6	266.6	247.5	227.9		
44	111	289.9	272.9	253.0	232.3		
42	108	294.5	279.4	258.3	236.5	219.7	
40	104	298.9	285.7	263.4	240.9	223.4	
38	100	303.1	290.9	268.8	244.9	226.8	209.6
36	97	307.2	296.1	273.9	249.0	230.3	212.9
34	93	311.2	300.9	278.2	253.1	233.7	216.1
32	90	311.3	305.3	282.4	256.9	237.2	219.3
30	86	311.3	309.7	286.6	260.6	240.8	222.4
28	82	311.4	309.7	290.4	264.4	244.5	225.8
26	79	311.4	309.7	294.1	267.9	248.0	229.2
24	75	311.5	309.8	294.9	271.1	251.4	232.5
22	72	311.6	309.8	294.9	274.2	253.5	234.1
20	68	311.6	309.9	294.9	274.8	254.5	235.5
18	64	311.6	309.9	295.0	274.9	255.6	237.2
16	61	311.6	310.0	295.1	274.9	256.1	239.0
14	57	311.7	310.0	295.1	275.0	256.1	240.5
12	54	311.7	310.1	295.2	275.0	256.2	240.6
10	50	311.8	310.2	295.2	275.1	256.2	240.7
-40	-40	312.9	311.5	296.6	276.3	257.3	241.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.**With engine bleed for packs off, increase weight by 900 kg.****With engine and wing anti-ice on, decrease weight by 1450 kg.****When operating in icing conditions during any part of the flight with forecast landing temperature is below 10°C, decrease weight by 20800 kg.**

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 20, Gear Up

Based on engine bleed for packs on or off, engine anti-ice on or off and wing anti-ice off.

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	6.55	5.65					
50	7.31	6.40	5.22				
46	8.10	7.13	5.96	4.72			
42	8.73	7.92	6.64	5.24	4.18		
38	9.28	8.57	7.23	5.73	4.61	3.55	
34	9.78	9.11	7.74	6.22	5.03	3.95	
30	9.79	9.64	8.20	6.67	5.46	4.32	3.27
26	9.80	9.66	8.58	7.06	5.83	4.69	3.60
22	9.81	9.67	8.62	7.38	6.14	4.95	3.87
18	9.81	9.68	8.63	7.44	6.27	5.13	3.99
14	9.82	9.68	8.64	7.45	6.32	5.35	4.15
10	9.83	9.69	8.64	7.45	6.32	5.36	4.38

Weight Adjustment

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)									
	0	1	2	3	4	5	6	7	8	9
280	-2.98	-3.42	-3.87	-4.31	-4.75	-5.13	-5.50	-5.88	-6.27	-6.65
260	-3.06	-3.33	-3.61	-3.88	-4.15	-4.46	-4.79	-5.12	-5.46	-5.80
240	-2.50	-2.72	-2.94	-3.16	-3.38	-3.65	-3.92	-4.19	-4.46	-4.74
220	-1.88	-2.03	-2.18	-2.33	-2.48	-2.67	-2.88	-3.07	-3.28	-3.48
200	-1.13	-1.19	-1.25	-1.31	-1.37	-1.49	-1.61	-1.72	-1.83	-1.94
180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
160	1.16	1.30	1.44	1.57	1.71	1.85	1.99	2.13	2.29	2.45
140	2.57	2.92	3.26	3.60	3.95	4.27	4.59	4.94	5.31	5.70

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)									
	0	1	2	3	4	5	6	7	8	9
VREF	-0.27	-0.28	-0.29	-0.30	-0.31	-0.32	-0.32	-0.33	-0.33	-0.32
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF+10	0.16	0.16	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.15
VREF+15	0.27	0.26	0.26	0.26	0.27	0.28	0.28	0.26	0.24	0.22
VREF+20	0.33	0.32	0.32	0.33	0.34	0.35	0.34	0.32	0.28	0.23
VREF+25	0.35	0.34	0.33	0.34	0.35	0.36	0.35	0.31	0.26	0.20
VREF+30	0.32	0.30	0.29	0.28	0.29	0.28	0.26	0.22	0.17	0.11

With engine and wing anti-ice on, decrease gradient by 0.1%.

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**Flaps 30 Limit Weight (1000 KG)**

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	235.4	226.3			
50	122	237.0	227.9	219.0	210.8	
45	113	238.9	229.8	220.9	212.5	204.5
40	104	241.0	231.8	222.7	214.3	206.3
35	95	243.1	233.8	224.7	216.0	208.0
30	86	245.2	235.9	226.6	217.9	209.7
25	77	247.4	238.0	228.7	219.7	211.4
20	68	249.7	240.1	230.8	221.7	213.3
15	59	252.0	242.4	232.9	223.7	215.1
10	50	254.5	244.6	235.1	225.8	217.1
5	41	257.0	247.0	237.4	228.0	219.0
0	32	259.5	249.4	239.7	230.2	221.1
-5	23	262.1	252.0	242.1	232.5	223.3
-10	14	265.6	254.6	244.5	234.9	225.5
-15	5	268.5	257.3	247.1	237.3	227.8
-20	-4	271.4	260.0	249.7	239.8	230.3
-30	-22	277.6	266.5	255.2	245.0	235.3
-40	-40	284.2	272.7	261.1	250.6	240.6
-50	-58	291.0	279.3	268.0	256.6	246.2
-54	-65	293.9	282.1	270.6	259.1	248.4

Increase weight by 2100 kg per 1% uphill slope. Decrease weight by 5100 kg per 1% downhill slope.

Increase weight by 5800 kg per 10 knots headwind. Decrease weight by 35200 kg per 10 knots tailwind.

Decrease weight by 13200 kg when one brake is deactivated. Decrease weight by 27300 kg when two brakes are deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Intentionally
Blank

Performance Dispatch
Gear Down

Chapter PD
Section 23

GEAR DOWN

Takeoff Climb Limit Weight
Flaps 15

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	178.8	171.4	164.4	155.0	145.9
52	126	183.8	171.4	164.3	154.9	145.9
50	122	188.6	172.3	164.3	154.9	145.8
48	118	193.3	176.8	164.2	154.8	145.8
46	115	198.1	181.1	165.1	154.8	145.7
44	111	202.7	185.5	169.3	154.7	145.7
42	108	207.3	189.7	173.2	155.6	145.7
40	104	211.9	194.0	177.1	159.5	145.6
38	100	216.8	198.1	181.0	163.3	146.5
36	97	221.7	202.3	184.9	167.1	150.1
34	93	226.5	207.4	188.8	170.8	153.7
32	90	231.3	212.5	192.7	174.5	157.3
30	86	236.1	217.4	197.8	178.2	160.9
28	82	240.7	222.2	202.8	182.0	164.5
26	79	245.3	226.9	207.7	186.9	168.1
24	75	247.6	231.4	212.5	191.7	171.7
22	72	247.6	235.9	217.0	196.4	176.4
20	68	247.6	238.1	221.5	200.9	181.0
18	64	247.6	238.1	225.8	205.3	185.4
16	61	247.6	238.1	227.8	209.6	189.7
14	57	247.6	238.0	227.7	212.9	193.9
12	54	247.6	238.0	227.7	212.9	198.0
10	50	247.6	238.0	227.7	212.9	199.9
-40	-40	246.8	237.3	226.5	213.7	200.6

With engine bleeds for packs off, increase weight by 100 kg.
With engine anti-ice on, decrease weight by 4000 kg.
With engine and wing anti-ice on, decrease weight by 4900 kg.

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	211.0				
52	126	216.1				
50	122	221.2	205.2			
48	118	226.2	210.1			
46	115	231.0	214.9	198.0		
44	111	236.1	219.5	201.6		
42	108	241.3	224.0	205.1	190.5	
40	104	246.6	228.2	208.5	193.5	
38	100	250.4	232.3	211.9	196.4	181.6
36	97	254.2	236.0	215.3	199.3	184.4
34	93	258.0	239.4	218.6	202.1	187.1
32	90	261.7	242.7	221.8	204.9	189.7
30	86	265.4	245.9	224.8	207.8	192.3
28	82	265.3	248.7	227.8	210.6	194.9
26	79	265.4	251.6	230.4	213.5	197.6
24	75	265.4	252.2	232.9	216.3	200.2
22	72	265.5	252.2	235.3	218.0	201.4
20	68	265.5	252.2	235.8	218.8	202.5
18	64	265.5	252.3	235.9	219.7	204.0
16	61	265.6	252.3	235.9	220.1	205.7
14	57	265.6	252.4	235.9	220.1	207.2
12	54	265.7	252.4	236.0	220.2	207.2
10	50	265.8	252.4	236.0	220.2	207.2
-40	-40	266.9	253.5	237.0	221.1	208.0

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

With engine bleed for packs off, increase weight by 700 kg.

With engine and wing anti-ice on, decrease weight by 1150 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 26300 kg.

GEAR DOWN**Takeoff Obstacle Limit Weight**

Based on engine bleed for packs on, engine anti-ice off and wing anti-ice off

Flaps 15

Sea Level, 29°C & Below, Zero Wind

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	240.0										
20	228.8	240.0	240.0								
40	211.3	225.9	237.1	240.0							
60	197.8	212.7	224.2	233.3	240.0	240.0					
80	186.9	201.7	213.5	223.0	230.7	237.1	240.0	240.0			
100	177.7	192.3	204.3	214.1	222.1	228.8	234.5	239.1	240.0		
120	169.7	184.2	196.1	206.1	214.4	221.3	227.3	232.4	236.8	240.0	240.0
140	162.7	177.0	188.9	198.9	207.4	214.6	220.7	226.1	230.7	234.8	238.4
160	156.4	170.5	182.3	192.4	200.9	208.3	214.7	220.2	225.0	229.3	233.1
180	150.7	164.6	176.3	186.4	195.1	202.5	209.0	214.8	219.7	224.2	228.1
200		159.2	170.9	180.9	189.6	197.2	203.8	209.6	214.8	219.3	223.4
220		154.2	165.8	175.8	184.5	192.2	198.9	204.8	210.0	214.7	218.9
240		149.6	161.2	171.1	179.8	187.5	194.2	200.2	205.6	210.4	214.7
260			156.8	166.7	175.4	183.0	189.9	195.9	201.3	206.2	210.6
280			152.7	162.5	171.2	178.9	185.7	191.8	197.3	202.3	206.7
300			148.8	158.6	167.3	174.9	181.8	188.0	193.5	198.5	203.0

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)						
	140	160	180	200	220	240	260
29 & BELOW	0	0	0	0	0	0	0
30	-1.1	-1.3	-1.6	-1.8	-2.1	-2.3	-2.6
32	-2.7	-3.6	-4.5	-5.3	-6.2	-7.1	-8.0
34	-4.3	-5.8	-7.3	-8.8	-10.3	-11.9	-13.4
36	-5.9	-8.1	-10.2	-12.3	-14.5	-16.6	-18.8
38	-7.5	-10.3	-13.1	-15.8	-18.6	-21.4	-24.1
40	-9.2	-12.5	-15.9	-19.3	-22.7	-26.1	-29.5
42	-10.5	-14.5	-18.6	-22.7	-26.8	-30.9	-35.0
44	-11.8	-16.5	-21.3	-26.1	-30.9	-35.7	-40.5
46	-13.1	-18.5	-24.0	-29.5	-35.0	-40.5	-46.0
48	-14.4	-20.5	-26.7	-32.9	-39.1	-45.3	-51.4
50	-15.7	-22.5	-29.4	-36.3	-43.2	-50.0	-56.9

Pressure Altitude Adjustment

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)						
	140	160	180	200	220	240	260
S.L. & BELOW	0	0	0	0	0	0	0
1000	-5.4	-6.1	-6.9	-7.7	-8.4	-9.2	-10.0
2000	-10.8	-12.3	-13.8	-15.3	-16.9	-18.4	-19.9
3000	-15.7	-18.2	-20.6	-23.0	-25.4	-27.8	-30.3
4000	-20.7	-24.0	-27.3	-30.6	-34.0	-37.3	-40.6
5000	-24.8	-29.3	-33.7	-38.1	-42.5	-46.9	-51.3
6000	-29.0	-34.5	-40.0	-45.5	-51.0	-56.5	-62.0
7000	-32.5	-39.3	-46.0	-52.8	-59.5	-66.2	-73.0
8000	-36.0	-44.0	-52.0	-60.0	-68.0	-76.0	-84.0

GEAR DOWN

Takeoff Obstacle Limit Weight

Based on engine bleed for packs on, engine anti-ice off and wing anti-ice off

Wind Adjustment

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)						
	140	160	180	200	220	240	260
15 TW	-20.8	-20.6	-20.5	-20.4	-20.2	-20.1	-20.0
10 TW	-13.8	-13.8	-13.7	-13.6	-13.5	-13.4	-13.3
5 TW	-6.9	-6.9	-6.8	-6.8	-6.8	-6.7	-6.7
0	0	0	0	0	0	0	0
10 HW	3.5	3.0	2.5	2.0	1.5	1.0	0.5
20 HW	7.0	6.0	5.0	4.0	3.0	2.0	1.0
30 HW	10.5	9.0	7.5	6.0	4.5	3.0	1.5
40 HW	14.0	12.0	10.0	8.0	6.0	4.0	2.0

With engine bleed for packs off, increase weight by 300 kg.

With engine anti-ice on, decrease weight by 1000 kg.

With engine and wing anti-ice on, decrease weight by 1700 kg.

GEAR DOWN

Long Range Cruise Altitude Capability
Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
300	13000	10400	7300
290	14600	12000	9100
280	16200	13700	11000
270	17800	15500	12800
260	19500	17200	14600
250	21100	18900	16400
240	22500	20500	18200
230	24000	22000	20100
220	25300	23600	21700
210	26300	25100	23300
200	27300	26100	25000
190	28300	27100	26000
180	29400	28200	27100
170	30600	29300	28200
160	32100	30500	29300
150	33800	32100	30600
140	35700	34000	32300

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
329	292	261	236	216	200	187	175	165	156	148
497	441	393	356	326	300	281	263	247	234	222
663	589	526	476	435	400	374	351	330	312	296
828	736	657	595	544	500	468	438	412	389	370
992	882	788	714	653	600	561	526	495	468	444
1155	1028	918	832	762	700	655	614	578	546	519
1317	1172	1048	950	870	800	748	702	661	625	593
1478	1317	1178	1068	978	899	841	790	743	702	667
1638	1461	1308	1186	1086	999	935	877	826	781	742
1797	1603	1437	1304	1194	1100	1029	966	910	860	818
1955	1746	1565	1421	1303	1200	1124	1055	993	939	893
2112	1887	1693	1538	1410	1300	1218	1143	1077	1018	968
2269	2028	1821	1655	1519	1400	1312	1232	1160	1097	1043
2426	2170	1950	1773	1627	1500	1406	1320	1244	1177	1119
2582	2311	2078	1890	1736	1600	1500	1409	1328	1256	1194
2736	2451	2205	2007	1843	1700	1594	1497	1411	1335	1269
2890	2591	2332	2124	1951	1800	1688	1586	1495	1415	1345
3043	2730	2459	2240	2059	1900	1782	1675	1579	1494	1421
3196	2868	2585	2356	2166	2000	1876	1764	1663	1574	1497
3348	3007	2711	2472	2274	2100	1970	1853	1747	1654	1573
3499	3144	2837	2588	2382	2200	2065	1942	1831	1734	1649
3650	3281	2962	2704	2489	2300	2159	2031	1916	1814	1725
3800	3418	3087	2819	2596	2400	2253	2120	2000	1894	1801
3949	3555	3213	2935	2704	2500	2347	2208	2083	1973	1877
4098	3691	3338	3050	2811	2600	2440	2296	2167	2053	1953
4247	3827	3462	3166	2918	2700	2534	2385	2251	2133	2029

GEAR DOWN**Long Range Cruise Trip Fuel and Time****Reference Fuel and Time Required**

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	7.5	0:52	7.2	0:50	6.9	0:48	6.7	0:47	6.6	0:46
300	11.1	1:16	10.6	1:13	10.1	1:10	9.7	1:07	9.5	1:05
400	14.8	1:40	14.0	1:35	13.3	1:31	12.7	1:27	12.3	1:24
500	18.5	2:03	17.5	1:58	16.6	1:52	15.8	1:47	15.2	1:43
600	22.2	2:27	20.9	2:20	19.8	2:13	18.8	2:07	18.1	2:02
700	26.0	2:50	24.5	2:42	23.1	2:33	22.0	2:26	21.1	2:20
800	29.8	3:13	28.0	3:03	26.4	2:54	25.1	2:46	24.0	2:38
900	33.7	3:36	31.7	3:25	29.8	3:14	28.2	3:05		
1000	37.5	3:59	35.3	3:46	33.2	3:34	31.4	3:24		
1100	41.5	4:21	39.0	4:07	36.7	3:55	34.7	3:44		
1200	45.4	4:43	42.7	4:28	40.2	4:15	38.0	4:03		
1300	49.5	5:05	46.5	4:49	43.7	4:35	41.3	4:22		
1400	53.5	5:27	50.3	5:10	47.2	4:54	44.6	4:40		
1500	57.7	5:49	54.1	5:31	50.8	5:14	48.0	4:59		
1600	61.8	6:10	58.0	5:51	54.5	5:33	51.4	5:18		
1700	66.1	6:31	61.9	6:11	58.1	5:53				
1800	70.3	6:53	65.9	6:31	61.8	6:12				
1900	74.6	7:13	69.9	6:51	65.6	6:31				
2000	78.9	7:34	73.9	7:11	69.3	6:50				

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	140	160	180	200	220
10	-1.2	-0.6	0.0	0.7	1.4
15	-1.8	-0.9	0.0	1.0	2.1
20	-2.4	-1.2	0.0	1.4	2.8
25	-3.0	-1.5	0.0	1.7	3.4
30	-3.6	-1.8	0.0	2.0	4.1
35	-4.2	-2.1	0.0	2.4	4.9
40	-4.8	-2.4	0.0	2.7	5.6
45	-5.4	-2.7	0.0	3.0	6.3
50	-6.0	-3.0	0.0	3.4	7.1
55	-6.6	-3.3	0.0	3.7	7.9
60	-7.2	-3.6	0.0	4.1	8.6
65	-7.8	-3.9	0.0	4.4	9.4
70	-8.4	-4.2	0.0	4.8	10.3
75	-9.1	-4.6	0.0	5.2	11.1

Based on VREF30+80 climb, Long Range Cruise and VREF30+80 descent.

GEAR DOWN

**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
103	85	72	63	56	50	45	41	38	35	33
176	152	135	121	109	100	92	85	79	74	70
249	220	197	178	163	150	139	129	121	114	107
321	286	258	235	216	200	186	174	163	154	145
392	352	320	292	270	250	233	218	205	194	183
463	418	380	349	323	300	280	263	248	234	222
534	483	441	406	376	350	327	308	290	274	260
606	549	502	463	429	400	375	352	332	315	299
678	615	564	520	482	450	422	397	375	355	337
751	682	625	577	536	500	469	441	417	395	375

Trip Fuel and Time

AIR DIST (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		140	160	180	200	220	
50	FUEL (1000 KG)	1.8	2.0	2.2	2.3	2.5	0:15
	ALT (FT)	14000	12000	10000	10000	8000	
100	FUEL (1000 KG)	3.2	3.5	3.8	4.1	4.4	0:26
	ALT (FT)	24000	22000	20000	18000	16000	
150	FUEL (1000 KG)	4.4	4.8	5.2	5.7	6.2	0:36
	ALT (FT)	30000	26000	24000	22000	20000	
200	FUEL (1000 KG)	5.5	6.1	6.6	7.3	7.9	0:46
	ALT (FT)	30000	28000	26000	24000	20000	
250	FUEL (1000 KG)	6.6	7.3	8.1	8.8	9.6	0:56
	ALT (FT)	30000	28000	26000	24000	20000	
300	FUEL (1000 KG)	7.8	8.6	9.5	10.4	11.4	1:05
	ALT (FT)	30000	28000	26000	24000	20000	
350	FUEL (1000 KG)	8.9	9.9	10.9	12.1	13.2	1:15
	ALT (FT)	30000	28000	26000	22000	20000	
400	FUEL (1000 KG)	10.1	11.2	12.3	13.7	14.9	1:24
	ALT (FT)	30000	28000	26000	22000	20000	
450	FUEL (1000 KG)	11.3	12.5	13.8	15.3	16.7	1:34
	ALT (FT)	30000	28000	26000	22000	20000	
500	FUEL (1000 KG)	12.4	13.8	15.2	17.0	18.9	1:44
	ALT (FT)	30000	28000	26000	22000	18000	

GEAR DOWN

Holding Planning
Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
300	14180	14180	14220	14420			
280	13230	13230	13240	13350			
260	12320	12300	12290	12350	12610		
240	11430	11390	11370	11370	11500		
220	10580	10510	10480	10460	10510	10790	
200	10010	9680	9620	9590	9590	9730	
180	9200	8880	8790	8760	8730	8770	9030
160	8540	8440	8130	8090	8050	8050	8190
140	8230	8120	7800	7740	7820	7660	7750

Flaps 1

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
300	13520	13510	13520	13640	
280	12630	12620	12600	12660	12940
260	11770	11740	11720	11750	11920
240	10910	10850	10830	10820	10910
220	10060	9990	9940	9920	9960
200	9460	9140	9070	9050	9050
180	8630	8530	8230	8200	8180
160	7920	7840	7530	7610	7580
140	7530	7450	7280	7190	7170

These tables include 5% additional fuel for holding in a racetrack pattern.

Performance Dispatch

Text

Chapter PD

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 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 data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Brake Energy, and Obstacle Limit Weights as determined from the following tables. Tire Limit is not shown as it is not limiting for the range of conditions shown in this chapter.

Field Limit Weight - Slope and Wind Corrections

These tables provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction 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 show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude 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.

Obstacle Limit Weight

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct 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.

Brake Energy Limits VMBE

Tables are presented to determine the Maximum Brake Energy Speed VMBE. Compliance with this limitation is required to ensure that the brakes have enough capacity to execute a maximum effort stop from V1 without the use of thrust reversers. Enter the upper table with pressure altitude and OAT to determine the reference VMBE. Then enter the lower table with the reference VMBE and brake release weight to determine VMBE for a specific takeoff. Adjust for slope, wind and deactivated brakes as described below the table. The resulting VMBE must be greater than or equal to V1. If VMBE is less than V1, brake release weight must be decreased by the amount shown below the table.

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 to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Normal takeoff speeds, V1, VR, and V2 are read from the table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR 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 Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle and brake energy limit weights and the V1 and VMBE must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 3500 kg and the V1 associated with the reduced weight by one knot. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 7300 kg and the V1 associated with the reduced weight by three knots. If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate stop distance available corrected for wind and slope exceeds approximately 1540m for one brake deactivated or 1610 m for two brakes deactivated.

For brake(s) deactivated, reduce VMBE by the amount shown on the Brake Energy Limit VMBE Chart. If the resulting VMBE is less than V1, the brake release weight must be reduced according to the instructions on the brake energy limit chart. The resulting V1 must not be less than V1(MCG). Determine VR and V2 for the actual weight.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

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 these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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 fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time 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 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. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time 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

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 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%.

Oxygen Requirements

Flight Crew 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 these requirements is achieved with the minimum dispatch oxygen cylinder pressure. Enter the Crew Oxygen Requirements table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate bottle temperature.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 2.05 liters/person/minute (1.2 psi/person/minute for the single cylinder system), or 13 liters/person/minute (8 psi/person/minute) if 100% oxygen is selected during normal usage.

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 Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited 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 engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table 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, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

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Performance Dispatch

Chapter PD

Table of Contents

Section 30

777-200LR GE90-110B1L KG M FAA TO1-10 TO2-20

Pkg Model IdentificationPD.ModID.30.1

Takeoff..... PD.30.1

Minimum Weight for FMC Takeoff Speeds Calculation ...PD.30.1

Takeoff Field Corrections - Dry RunwayPD.30.2

Takeoff Field & Climb Limit Weights - Dry RunwayPD.30.3

Takeoff Field Corrections - Wet RunwayPD.30.6

Takeoff Field & Climb Limit Weights - Wet RunwayPD.30.7

Takeoff Obstacle Limit Weight.....PD.30.10

Tire Speed Limit.....PD.30.12

Takeoff Speeds - Dry RunwayPD.30.13

Takeoff Speeds - Wet RunwayPD.30.15

Enroute PD.31.1

Long Range Cruise Maximum Operating Altitude.....PD.31.1

Long Range Cruise Trip Fuel and TimePD.31.3

Long Range Cruise Step Climb Trip Fuel and TimePD.31.5

Short Trip Fuel and TimePD.31.6

Holding PlanningPD.31.7

Crew Oxygen Requirements.....PD.31.8

Net Level Off WeightPD.31.9

Landing PD.32.1

Landing Field Limit Weight - Dry RunwayPD.32.1

Landing Field Limit Weight - Wet RunwayPD.32.2

Approach or Landing Climb Limited Weight.....PD.32.3

Go-Around Climb GradientPD.32.4

Quick Turnaround Limit Weight.....PD.32.5

**Performance Dispatch
Pkg Model Identification****Chapter PD
Section 30****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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
200LR	777-200LR	7260	WY260

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Performance Dispatch Takeoff	Chapter PD Section 30
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Minimum Weight for FMC Takeoff Speeds Calculation
Weight Limit (1000 KG)

Flaps 15

Based on engine bleed for packs on and anti-ice off.

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)								
	S.L. & BELOW	1000	2000	3000	4000	5000	6000	7000	8000 & ABOVE
50	159.8								
45	169.6	162.9	155.7						
40	179.0	172.0	164.8	158.3					
35	187.6	180.4	172.9	166.2	159.6				
30	190.0	186.2	179.6	172.7	166.0	159.7			
25	190.2	186.4	182.0	177.3	171.4	165.7	158.3		
20	190.5	186.6	182.1	177.4	172.8	168.1	161.8	154.4	
15	190.7	186.7	182.3	177.6	172.9	168.3	162.8	156.3	
10	190.9	186.9	182.4	177.7	173.0	168.4	162.9	156.4	
0 & BELOW	191.2	187.2	182.7	178.0	173.3	168.6	163.1	156.5	

The FMC may not be able to calculate takeoff speeds for light weight takeoffs at GE90-110B1L thrust rating. For takeoff at weights below the Minimum Weight for FMC Takeoff Speeds Calculation, takeoff speeds may be obtained using available performance software. Use of a lower thrust rating and/or assumed temperature method of thrust reduction may also be necessary.

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	1250	1240	1220	1210	1200	1190	1180	1160	1150
1400	1470	1450	1430	1420	1400	1380	1350	1330	1310
1600	1690	1670	1640	1620	1600	1570	1530	1500	1470
1800	1910	1880	1850	1830	1800	1760	1710	1670	1620
2000	2120	2090	2060	2030	2000	1950	1890	1840	1780
2200	2340	2310	2270	2240	2200	2130	2070	2000	1940
2400	2560	2520	2480	2440	2400	2320	2250	2170	2100
2600	2780	2730	2690	2640	2600	2510	2430	2340	2250
2800	3000	2950	2900	2850	2800	2700	2610	2510	2410
3000	3220	3160	3110	3050	3000	2890	2780	2680	2570
3200	3440	3380	3320	3260	3200	3080	2960	2850	2730
3400	3650	3590	3530	3460	3400	3270	3140	3010	2890
3600	3870	3800	3740	3670	3600	3460	3320	3180	3040
3800	4090	4020	3950	3870	3800	3650	3500	3350	3200
4000	4310	4230	4160	4080	4000	3840	3680	3520	3360
4200	4530	4450	4360	4280	4200	4030	3860	3690	3520
4400	4750	4660	4570	4490	4400	4220	4040	3860	3670
4600	4970	4870	4780	4690	4600	4410	4220	4020	3830
4800	5180	5090	4990	4900	4800	4600	4390	4190	3990
5000	5400	5300	5200	5100	5000	4790	4570	4360	4150

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	890	990	1100	1200	1270	1350	1430	1510
1400	1060	1170	1290	1400	1480	1560	1650	1740
1600	1220	1350	1470	1600	1690	1770	1870	1960
1800	1390	1530	1660	1800	1890	1990	2080	2180
2000	1550	1700	1850	2000	2100	2200	2300	2400
2200	1720	1880	2040	2200	2300	2410	2520	2630
2400	1890	2060	2230	2400	2510	2620	2730	2850
2600	2050	2230	2420	2600	2710	2830	2950	3070
2800	2220	2410	2610	2800	2920	3040	3170	3300
3000	2380	2590	2790	3000	3130	3250	3380	3520
3200	2550	2770	2980	3200	3330	3460	3600	3740
3400	2710	2940	3170	3400	3540	3680	3820	3970
3600	2880	3120	3360	3600	3740	3890	4040	4190
3800	3050	3300	3550	3800	3950	4100	4250	4410
4000	3210	3470	3740	4000	4150	4310	4470	4630
4200	3380	3650	3930	4200	4360	4520	4690	4860
4400	3540	3830	4110	4400	4560	4730	4900	5080
4600	3710	4010	4300	4600	4770	4940	5120	5300
4800	3880	4180	4490	4800	4980	5150	5340	5530
5000	4040	4360	4680	5000	5180	5370	5560	5750

Takeoff Field & Climb Limit Weights - Dry Runway**Flaps 15****Sea Level Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1690	279.8	252.1	250.5	248.5	247.3	246.5	244.6	239.4	231.6	225.0	218.2
1800	289.9	261.2	259.5	257.5	256.3	255.5	253.5	248.1	240.0	233.2	226.2
2000	306.0	275.8	274.0	271.8	270.6	269.7	267.7	261.9	253.5	246.3	238.9
2200	321.8	290.2	288.3	286.1	284.8	283.9	281.7	275.7	266.9	259.4	251.6
2400	337.2	304.4	302.5	300.2	298.8	297.9	295.6	289.4	280.2	272.4	264.4
2600	351.3	317.4	315.3	312.9	311.5	310.6	308.3	301.8	292.3	284.2	275.9
2800	364.0	329.0	326.9	324.4	322.9	322.0	319.6	312.9	303.1	294.8	286.2
3000	375.3	339.2	337.0	334.5	333.0	332.0	329.5	322.6	312.5	303.9	295.1
3200	378.7	348.9	346.7	344.0	342.5	341.5	338.9	331.9	321.4	312.6	303.5
3400	378.7	358.2	355.9	353.2	351.6	350.6	348.0	340.7	330.0	320.9	311.6
3600	378.7	367.1	364.8	362.0	360.4	359.3	356.6	349.2	338.2	328.9	319.3
3800	378.7	375.4	373.0	370.2	368.5	367.4	364.7	357.1	345.9	336.4	326.7
4000	378.7	378.7	378.7	378.1	376.4	375.3	372.5	364.8	353.4	343.7	333.8
4200	378.7	378.7	378.7	378.7	378.7	378.7	378.7	372.3	360.7	350.9	340.8
4400	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	367.9	357.9	347.6
4600	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	374.9	364.8	354.3
4800	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	371.5	360.9
5000	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.1	367.4
CLIMB LIMIT WT (1000 KG)	351.5	350.9	350.7	350.4	350.2	350.1	349.7	336.8	319.5	305.3	290.6

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1690	263.3	238.9	237.4	235.5	234.4	233.7	227.8	222.3	214.7	208.1	201.0
1800	272.8	247.5	246.0	244.1	243.0	242.2	236.1	230.4	222.6	215.7	208.4
2000	287.9	261.4	259.7	257.7	256.6	255.7	249.4	243.4	235.1	227.9	220.1
2200	302.9	275.2	273.4	271.3	270.1	269.3	262.6	256.3	247.7	240.1	232.1
2400	317.6	288.8	287.0	284.9	283.6	282.7	275.8	269.3	260.3	252.5	244.1
2600	331.0	301.2	299.4	297.1	295.8	294.9	287.7	281.0	271.7	263.6	254.9
2800	343.1	312.3	310.4	308.1	306.7	305.8	298.4	291.4	281.8	273.4	264.5
3000	353.7	322.0	320.0	317.6	316.2	315.3	307.7	300.5	290.6	282.0	272.7
3200	363.8	331.2	329.2	326.7	325.3	324.3	316.4	309.0	298.9	290.0	280.5
3400	373.5	340.0	337.9	335.4	333.9	332.9	324.9	317.2	306.8	297.7	287.9
3600	378.7	348.5	346.3	343.7	342.2	341.2	332.9	325.1	314.4	305.1	295.1
3800	378.7	356.4	354.2	351.6	350.0	348.9	340.5	332.6	321.7	312.1	301.9
4000	378.7	364.1	361.9	359.2	357.6	356.5	347.9	339.8	328.7	319.0	308.6
4200	378.7	371.6	369.3	366.6	365.0	363.9	355.2	346.9	335.6	325.7	315.1
4400	378.7	378.7	376.7	373.9	372.2	371.1	362.2	353.9	342.3	332.3	321.5
4600	378.7	378.7	378.7	378.7	378.7	378.2	369.2	360.7	349.0	338.8	327.8
4800	378.7	378.7	378.7	378.7	378.7	378.7	376.0	367.3	355.5	345.1	334.0
5000	378.7	378.7	378.7	378.7	378.7	378.7	378.7	373.9	361.9	351.4	340.1
CLIMB LIMIT WT (1000 KG)	335.7	335.5	335.4	335.2	335.1	334.9	322.6	310.6	294.2	280.3	266.6

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 2050 kg and climb limit weight by 2100 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1690	246.9	225.1	223.7	221.9	219.6	217.6	211.6	206.3	198.5	192.1	186.3
1800	255.8	233.3	231.8	230.0	227.6	225.5	219.3	213.8	205.8	199.2	193.2
2000	270.1	246.4	244.8	242.9	240.4	238.2	231.7	225.9	217.4	210.5	204.2
2200	284.3	259.5	257.9	255.9	253.2	250.9	244.1	238.1	229.2	222.0	215.4
2400	298.3	272.6	270.9	268.8	266.0	263.7	256.6	250.4	241.1	233.7	226.8
2600	311.0	284.4	282.6	280.5	277.6	275.2	267.9	261.4	251.8	244.1	237.0
2800	322.4	294.9	293.1	290.9	287.9	285.4	277.9	271.2	261.3	253.3	246.0
3000	332.4	304.1	302.2	300.0	296.9	294.3	286.5	279.6	269.4	261.2	253.6
3200	341.9	312.7	310.8	308.5	305.3	302.7	294.7	287.6	277.1	268.6	260.8
3400	351.1	321.0	319.1	316.7	313.5	310.7	302.5	295.2	284.4	275.8	267.7
3600	359.8	329.0	327.1	324.6	321.3	318.5	310.0	302.6	291.5	282.6	274.4
3800	367.9	336.6	334.5	332.0	328.6	325.8	317.2	309.6	298.3	289.2	280.8
4000	375.8	343.9	341.8	339.3	335.8	332.9	324.1	316.3	304.9	295.6	287.1
4200	378.7	351.0	348.9	346.3	342.8	339.8	330.9	323.0	311.3	301.9	293.2
4400	378.7	358.1	355.9	353.3	349.7	346.7	337.6	329.6	317.7	308.1	299.3
4600	378.7	364.9	362.8	360.1	356.4	353.4	344.1	336.0	323.9	314.2	305.2
4800	378.7	371.7	369.5	366.7	363.0	359.9	350.6	342.3	330.1	320.2	311.1
5000	378.7	378.3	376.0	373.3	369.5	366.4	356.9	348.5	336.1	326.1	316.9
CLIMB LIMIT WT (1000 KG)	317.5	317.3	317.2	317.1	313.2	309.7	297.2	286.7	271.5	259.0	248.1

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1690	231.6	211.1	209.8	206.5	203.2	200.6	194.9	190.0	183.2	177.6	172.2
1800	240.0	218.9	217.5	214.1	210.6	208.0	202.0	197.0	189.9	184.2	178.6
2000	253.5	231.2	229.7	226.2	222.5	219.8	213.5	208.2	200.7	194.7	188.8
2200	266.9	243.6	242.1	238.4	234.6	231.7	225.1	219.6	211.8	205.5	199.4
2400	280.2	256.1	254.5	250.7	246.7	243.7	236.9	231.1	223.1	216.5	210.2
2600	292.3	267.3	265.7	261.7	257.6	254.5	247.4	241.5	233.1	226.3	219.8
2800	303.1	277.3	275.6	271.5	267.3	264.0	256.8	250.6	242.0	235.0	228.2
3000	312.5	285.9	284.2	280.0	275.6	272.3	264.8	258.4	249.5	242.3	235.3
3200	321.4	294.1	292.3	287.9	283.4	280.0	272.3	265.7	256.6	249.2	242.0
3400	330.0	301.9	300.0	295.6	290.9	287.4	279.5	272.8	263.4	255.7	248.4
3600	338.2	309.4	307.5	302.9	298.2	294.6	286.5	279.6	270.0	262.2	254.6
3800	345.9	316.5	314.6	309.9	305.1	301.4	293.1	286.1	276.3	268.3	260.6
4000	353.4	323.4	321.5	316.7	311.8	308.1	299.6	292.5	282.5	274.3	266.4
4200	360.7	330.2	328.3	323.4	318.4	314.6	306.0	298.7	288.5	280.2	272.2
4400	367.9	336.9	334.9	330.0	324.9	321.0	312.2	304.8	294.5	286.1	277.9
4600	374.9	343.5	341.4	336.4	331.2	327.3	318.4	310.9	300.4	291.8	283.6
4800	378.7	349.9	347.8	342.7	337.5	333.5	324.5	316.8	306.2	297.5	289.1
5000	378.7	356.2	354.1	348.9	343.6	339.6	330.4	322.7	311.9	303.1	294.6
CLIMB LIMIT WT (1000 KG)	297.9	297.9	297.8	293.5	287.5	282.8	272.4	263.5	250.7	240.1	230.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 2050 kg and climb limit weight by 2100 kg.

Takeoff Field & Climb Limit Weights - Dry Runway**Flaps 15****8000 FT Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1690	214.4	194.4	191.9	187.2	183.8	181.7	176.4	171.6	165.2	160.2	155.2
1800	222.3	201.5	199.0	194.1	190.6	188.4	183.0	178.0	171.3	166.1	161.0
2000	234.8	212.9	210.2	205.1	201.5	199.2	193.4	188.1	181.2	175.7	170.3
2200	247.4	224.5	221.7	216.4	212.6	210.2	204.2	198.6	191.4	185.6	180.0
2400	260.0	236.3	233.4	227.8	223.9	221.4	215.1	209.4	201.9	195.9	190.1
2600	271.3	246.8	243.8	238.1	234.0	231.4	224.9	219.0	211.2	205.0	199.0
2800	281.4	256.1	253.0	247.1	242.9	240.2	233.5	227.4	219.3	213.0	206.7
3000	290.2	264.1	260.9	254.8	250.4	247.7	240.8	234.5	226.2	219.6	213.2
3200	298.5	271.6	268.3	262.0	257.5	254.7	247.6	241.1	232.5	225.8	219.2
3400	306.4	278.8	275.4	268.9	264.3	261.4	254.2	247.5	238.7	231.8	224.9
3600	314.0	285.8	282.3	275.7	271.0	268.0	260.5	253.7	244.7	237.6	230.6
3800	321.3	292.4	288.9	282.1	277.3	274.2	266.6	259.7	250.5	243.2	236.1
4000	328.3	298.9	295.3	288.4	283.5	280.4	272.6	265.5	256.1	248.8	241.5
4200	335.2	305.2	301.6	294.5	289.6	286.4	278.5	271.3	261.7	254.3	246.9
4400	341.9	311.5	307.7	300.6	295.6	292.3	284.3	277.0	267.3	259.7	252.1
4600	348.5	317.7	313.8	306.6	301.5	298.2	290.1	282.6	272.7	265.0	257.3
4800	355.0	323.7	319.8	312.5	307.3	303.9	295.7	288.1	278.1	270.3	262.5
5000	361.4	329.6	325.7	318.2	313.0	309.6	301.2	293.6	283.4	275.5	267.6
CLIMB LIMIT WT (1000 KG)	273.7	273.7	270.5	262.7	256.7	253.2	243.8	234.7	222.5	213.2	204.0

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 2050 kg and climb limit weight by 2100 kg.

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	1230	1220	1210	1200	1190	1170	1160	1150
1400	1470	1450	1430	1420	1400	1380	1360	1340	1320
1600	1690	1670	1640	1620	1600	1570	1550	1520	1490
1800	1910	1880	1850	1830	1800	1770	1730	1700	1660
2000	2130	2100	2060	2030	2000	1960	1920	1880	1840
2200	2350	2310	2270	2240	2200	2150	2100	2060	2010
2400	2570	2530	2480	2440	2400	2350	2290	2240	2180
2600	2790	2740	2690	2650	2600	2540	2480	2420	2350
2800	3010	2960	2900	2850	2800	2730	2660	2600	2530
3000	3230	3170	3120	3060	3000	2930	2850	2780	2700
3200	3450	3390	3330	3260	3200	3120	3040	2950	2870
3400	3670	3600	3540	3470	3400	3310	3220	3130	3050
3600	3890	3820	3750	3670	3600	3500	3410	3310	3220
3800	4110	4030	3960	3880	3800	3700	3600	3490	3390
4000	4330	4250	4170	4080	4000	3890	3780	3670	3560
4200	4550	4460	4380	4290	4200	4080	3970	3850	3740
4400	4770	4680	4590	4490	4400	4280	4150	4030	3910
4600	4990	4900	4800	4700	4600	4470	4340	4210	4080
4800	5210	5110	5010	4900	4800	4660	4530	4390	4250
5000	5430	5330	5220	5110	5000	4860	4710	4570	4430

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	1450	1540
1400	1020	1150	1270	1400	1480	1570	1670	1770
1600	1190	1330	1460	1600	1690	1790	1890	2000
1800	1360	1510	1650	1800	1890	2000	2110	2220
2000	1530	1680	1840	2000	2100	2210	2320	2450
2200	1690	1860	2030	2200	2300	2420	2540	2680
2400	1860	2040	2220	2400	2510	2630	2760	2910
2600	2030	2220	2410	2600	2710	2840	2980	3140
2800	2190	2400	2600	2800	2920	3050	3200	3360
3000	2360	2570	2790	3000	3120	3260	3420	3590
3200	2530	2750	2980	3200	3320	3470	3630	3820
3400	2690	2930	3160	3400	3530	3680	3850	4050
3600	2860	3110	3350	3600	3730	3890	4070	4280
3800	3030	3290	3540	3800	3940	4100	4290	4500
4000	3200	3460	3730	4000	4140	4310	4510	4730
4200	3360	3640	3920	4200	4350	4520	4730	4960
4400	3530	3820	4110	4400	4550	4730	4940	5190
4600	3700	4000	4300	4600	4750	4940	5160	5420
4800	3860	4180	4490	4800	4960	5150	5380	5640
5000	4030	4350	4680	5000	5160	5360	5600	5870

Takeoff Field & Climb Limit Weights - Wet Runway**Flaps 15****Sea Level Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	320.5	286.5	284.5	282.1	280.7	279.8	277.5	271.1	261.7	253.9	245.8
2400	331.8	296.6	294.5	292.1	290.6	289.6	287.2	280.6	270.9	262.8	254.4
2600	348.4	311.6	309.4	306.9	305.3	304.3	301.8	294.9	284.8	276.3	267.6
2800	362.9	324.5	322.3	319.6	318.0	316.9	314.3	307.1	296.6	287.7	278.6
3000	375.1	335.1	332.8	330.0	328.3	327.2	324.5	317.0	306.0	296.8	287.3
3200	378.7	345.7	343.3	340.4	338.6	337.5	334.7	326.9	315.4	305.8	296.0
3400	378.7	356.0	353.5	350.5	348.7	347.5	344.6	336.5	324.6	314.7	304.5
3600	378.7	366.0	363.4	360.3	358.4	357.2	354.2	345.8	333.6	323.3	312.7
3800	378.7	375.5	372.8	369.6	367.7	366.5	363.4	354.7	342.2	331.6	320.7
4000	378.7	378.7	378.7	378.7	376.7	375.4	372.3	363.4	350.5	339.6	328.5
4200	378.7	378.7	378.7	378.7	378.7	378.7	378.7	371.9	358.6	347.5	336.1
4400	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	366.6	355.2	343.6
4600	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	374.3	362.7	350.8
4800	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	370.0	357.8
5000	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	377.0	364.7
5200	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	371.3
5400	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	377.8
5600	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7
CLIMB LIMIT WT (1000 KG)	351.5	350.9	350.7	350.4	350.2	350.1	349.7	336.8	319.5	305.3	290.6

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	299.0	270.3	268.5	266.3	265.0	264.1	257.1	250.5	241.5	234.0	226.5
2400	309.6	279.9	278.0	275.7	274.3	273.4	266.1	259.2	250.0	242.2	234.4
2600	325.1	294.1	292.2	289.7	288.3	287.4	279.7	272.6	262.9	254.7	246.6
2800	338.6	306.3	304.2	301.7	300.3	299.2	291.3	283.8	273.7	265.2	256.8
3000	349.8	316.2	314.0	311.4	309.9	308.8	300.5	292.8	282.3	273.4	264.6
3200	361.1	326.0	323.8	321.0	319.4	318.3	309.7	301.6	290.7	281.5	272.3
3400	371.9	335.6	333.3	330.5	328.8	327.7	318.7	310.3	299.0	289.4	279.9
3600	378.7	344.9	342.5	339.6	337.9	336.7	327.4	318.8	307.1	297.2	287.4
3800	378.7	353.8	351.3	348.3	346.6	345.4	335.9	327.0	314.9	304.8	294.7
4000	378.7	362.4	359.9	356.8	355.0	353.8	344.0	334.9	322.6	312.2	301.8
4200	378.7	370.8	368.3	365.1	363.3	362.0	352.0	342.7	330.1	319.4	308.8
4400	378.7	378.7	376.4	373.2	371.3	370.0	359.8	350.3	337.3	326.4	315.6
4600	378.7	378.7	378.7	378.7	378.7	377.8	367.4	357.6	344.4	333.3	322.2
4800	378.7	378.7	378.7	378.7	378.7	378.7	374.8	364.8	351.3	340.0	328.7
5000	378.7	378.7	378.7	378.7	378.7	378.7	378.7	371.8	358.1	346.5	334.9
5200	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.6	364.6	352.8	341.0
5400	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	370.9	358.9	347.0
5600	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	377.1	364.9	352.8
CLIMB LIMIT WT (1000 KG)	335.7	335.5	335.4	335.2	335.1	334.9	322.6	310.6	294.2	280.3	266.6

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 2200 kg and climb limit weight by 2100 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	280.1	253.7	252.0	249.9	247.1	244.7	237.6	231.7	223.4	216.7	210.6
2400	290.0	262.6	260.8	258.6	255.7	253.2	245.9	239.7	231.2	224.2	217.8
2600	304.7	276.0	274.2	272.0	268.9	266.3	258.6	252.2	243.3	236.0	229.3
2800	317.3	287.4	285.5	283.2	280.0	277.3	269.3	262.6	253.3	245.7	238.7
3000	327.6	296.5	294.5	292.1	288.8	286.0	277.6	270.6	260.9	253.1	245.8
3200	337.9	305.6	303.5	300.9	297.5	294.6	285.9	278.6	268.5	260.4	252.8
3400	347.9	314.4	312.3	309.6	306.0	303.0	294.0	286.5	276.0	267.5	259.7
3600	357.6	323.0	320.8	318.0	314.3	311.2	301.9	294.1	283.3	274.6	266.4
3800	366.9	331.3	329.0	326.2	322.4	319.2	309.6	301.6	290.5	281.5	273.2
4000	375.9	339.3	337.0	334.1	330.2	326.9	317.1	308.9	297.5	288.3	279.8
4200	378.7	347.2	344.8	341.9	337.9	334.5	324.5	316.1	304.4	294.9	286.2
4400	378.7	354.9	352.4	349.4	345.3	341.9	331.6	323.0	311.1	301.4	292.5
4600	378.7	362.4	359.9	356.8	352.6	349.1	338.6	329.8	317.6	307.7	298.6
4800	378.7	369.6	367.1	363.9	359.7	356.1	345.4	336.4	324.0	313.9	304.6
5000	378.7	376.7	374.1	370.9	366.6	362.9	352.0	342.9	330.2	319.9	310.4
5200	378.7	378.7	378.7	377.7	373.3	369.5	358.4	349.1	336.2	325.7	316.0
5400	378.7	378.7	378.7	378.7	378.7	376.0	364.6	355.2	342.1	331.4	321.6
5600	378.7	378.7	378.7	378.7	378.7	378.7	370.7	361.1	347.7	336.9	326.9
CLIMB LIMIT WT (1000 KG)	317.5	317.3	317.2	317.1	313.2	309.7	297.2	286.7	271.5	259.0	248.1

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	261.6	237.0	235.4	231.6	228.1	225.4	219.2	214.1	206.9	201.0	195.3
2400	270.8	245.3	243.6	239.7	236.0	233.2	226.8	221.5	214.0	207.9	202.0
2600	284.7	258.0	256.3	252.2	248.3	245.4	238.7	233.1	225.3	219.0	212.8
2800	296.4	268.6	266.8	262.6	258.5	255.5	248.5	242.7	234.6	227.9	221.5
3000	305.9	276.9	275.0	270.6	266.4	263.2	256.0	249.9	241.5	234.5	227.8
3200	315.3	285.1	283.2	278.6	274.2	270.9	263.4	257.1	248.3	241.0	234.1
3400	324.5	293.2	291.2	286.4	281.9	278.5	270.6	264.1	255.0	247.5	240.3
3600	333.4	301.1	299.0	294.1	289.4	285.9	277.8	271.0	261.6	253.9	246.4
3800	342.0	308.8	306.7	301.6	296.8	293.1	284.8	277.9	268.2	260.2	252.6
4000	350.4	316.3	314.1	308.9	304.0	300.2	291.7	284.6	274.6	266.5	258.6
4200	358.5	323.6	321.4	316.0	311.0	307.1	298.4	291.1	281.0	272.6	264.5
4400	366.4	330.7	328.4	323.0	317.8	313.9	305.0	297.5	287.1	278.6	270.3
4600	374.1	337.7	335.3	329.8	324.5	320.5	311.4	303.8	293.1	284.4	276.0
4800	378.7	344.5	342.1	336.4	331.0	326.9	317.6	309.8	299.0	290.1	281.5
5000	378.7	351.0	348.6	342.8	337.3	333.1	323.7	315.8	304.7	295.6	286.9
5200	378.7	357.4	355.0	349.1	343.5	339.2	329.6	321.5	310.3	301.0	292.1
5400	378.7	363.7	361.1	355.2	349.5	345.1	335.3	327.1	315.7	306.3	297.2
5600	378.7	369.7	367.1	361.1	355.3	350.9	340.9	332.6	320.9	311.4	302.1
CLIMB LIMIT WT (1000 KG)	297.9	297.9	297.8	293.5	287.5	282.8	272.4	263.5	250.7	240.1	230.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 2200 kg and climb limit weight by 2100 kg.

Takeoff Field & Climb Limit Weights - Wet Runway**Flaps 15****8000 FT Pressure Altitude**

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	241.3	218.5	215.8	210.8	207.3	205.0	199.5	194.3	187.5	182.2	177.0
2400	249.7	226.1	223.3	218.1	214.4	212.1	206.3	201.0	194.0	188.5	183.1
2600	262.7	238.0	235.1	229.6	225.8	223.3	217.3	211.7	204.4	198.7	193.0
2800	273.5	247.7	244.7	239.0	235.0	232.5	226.2	220.4	212.7	206.7	200.9
3000	282.0	255.2	252.0	246.1	241.9	239.3	232.7	226.7	218.7	212.5	206.4
3200	290.4	262.5	259.2	253.1	248.8	246.0	239.2	232.9	224.6	218.1	211.7
3400	298.7	269.8	266.4	260.0	255.5	252.6	245.6	239.0	230.4	223.7	217.1
3600	306.8	276.9	273.4	266.8	262.1	259.2	251.9	245.1	236.2	229.3	222.5
3800	314.6	283.9	280.3	273.5	268.7	265.7	258.2	251.3	242.1	235.0	228.0
4000	322.3	290.8	287.1	280.1	275.2	272.1	264.4	257.3	247.9	240.6	233.4
4200	329.7	297.5	293.7	286.5	281.5	278.4	270.5	263.2	253.6	246.1	238.7
4400	337.0	304.0	300.1	292.8	287.7	284.5	276.4	269.0	259.1	251.4	243.9
4600	344.1	310.4	306.4	299.0	293.7	290.4	282.2	274.6	264.5	256.7	249.0
4800	351.0	316.6	312.5	304.9	299.6	296.2	287.8	280.1	269.8	261.8	254.0
5000	357.7	322.6	318.5	310.8	305.3	301.9	293.3	285.4	275.0	266.8	258.8
5200	364.2	328.5	324.3	316.4	310.9	307.4	298.6	290.6	280.0	271.7	263.5
5400	370.6	334.2	330.0	322.0	316.3	312.7	303.9	295.7	284.9	276.4	268.1
5600	376.7	339.8	335.5	327.3	321.6	317.9	308.9	300.6	289.6	281.0	272.6
CLIMB LIMIT WT (1000 KG)	273.7	273.7	270.5	262.7	256.7	253.2	243.8	234.7	222.5	213.2	204.0

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 2200 kg and climb limit weight by 2100 kg.

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 33°C & Below, Zero Wind

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or Auto

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	294.9	319.3	342.2	358.7								
20	274.3	297.3	315.6	330.9	344.4	355.8	362.6					
40	253.2	275.8	293.8	309.0	321.8	332.6	342.4	350.6	356.2	360.7	364.6	
60	238.8	258.5	277.5	293.1	305.8	316.6	325.7	333.7	340.6	347.7	352.5	
80	227.0	245.4	263.8	279.7	292.7	303.6	312.9	320.9	328.0	334.2	339.8	
100	214.9	235.9	252.1	267.8	281.2	292.3	301.8	310.1	317.3	323.7	329.3	
120	204.5	227.2	242.6	257.4	270.8	282.3	292.0	300.5	307.9	314.5	320.3	
140	195.3	218.0	234.8	248.2	261.4	273.0	283.1	291.7	299.3	306.1	312.1	
160		209.5	227.3	240.6	253.0	264.6	274.7	283.7	291.5	298.4	304.6	
180		201.8	219.8	233.9	245.3	256.8	267.0	276.1	284.1	291.2	297.5	
200		194.6	212.7	227.5	239.0	249.6	259.9	269.0	277.2	284.5	291.0	
220			206.1	221.0	233.1	243.3	253.2	262.4	270.6	278.1	284.7	
240			199.9	215.0	227.4	237.7	247.0	256.2	264.5	272.0	278.8	
260			194.1	209.2	221.8	232.4	241.6	250.3	258.7	266.2	273.1	
280				203.7	216.5	227.3	236.6	244.9	253.2	260.8	267.7	
300				198.5	211.4	222.4	231.8	240.1	248.0	255.6	262.5	

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)						
	160	200	240	280	320	360	400
33 & BELOW	0	0	0	0	0	0	0
34	-1.0	-1.3	-1.6	-1.8	-2.1	-2.4	-2.7
36	-3.9	-5.0	-6.0	-7.1	-8.2	-9.2	-10.3
38	-6.8	-8.7	-10.5	-12.4	-14.2	-16.1	-18.0
40	-9.7	-12.4	-15.0	-17.6	-20.3	-22.9	-25.6
42	-13.0	-16.4	-19.9	-23.4	-26.8	-30.3	-33.8
44	-16.2	-20.5	-24.8	-29.1	-33.3	-37.6	-41.9
46	-19.4	-24.5	-29.6	-34.8	-39.9	-45.0	-50.1
48	-22.7	-28.6	-34.5	-40.5	-46.4	-52.3	-58.2
50	-25.9	-32.7	-39.4	-46.2	-52.9	-59.7	-66.4

Pressure Altitude Adjustment

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)						
	160	200	240	280	320	360	400
S.L. & BELOW	0	0	0	0	0	0	0
1000	-6.8	-8.3	-9.8	-11.3	-12.9	-14.4	-15.9
2000	-13.5	-16.6	-19.6	-22.7	-25.7	-28.8	-31.8
3000	-19.3	-23.8	-28.3	-32.7	-37.2	-41.6	-46.1
4000	-25.2	-31.0	-36.9	-42.8	-48.6	-54.5	-60.4
5000	-31.2	-38.4	-45.6	-52.8	-60.0	-67.2	-74.5
6000	-37.2	-45.8	-54.3	-62.9	-71.4	-80.0	-88.6
7000	-43.6	-53.8	-64.1	-74.3	-84.5	-94.8	-105.0
8000	-50.0	-61.9	-73.8	-85.7	-97.6	-109.5	-121.4

Takeoff Obstacle Limit Weight**Flaps 15****Wind Adjustment**

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)						
	160	200	240	280	320	360	400
15 TW	-34.2	-34.0	-33.7	-33.5	-33.2	-33.0	-32.7
10 TW	-22.8	-22.7	-22.5	-22.3	-22.2	-22.0	-21.8
5 TW	-11.4	-11.3	-11.2	-11.2	-11.1	-11.0	-10.9
0	0	0	0	0	0	0	0
10 HW	3.9	3.6	3.3	2.9	2.6	2.3	2.0
20 HW	7.9	7.2	6.5	5.9	5.2	4.6	3.9
30 HW	12.2	11.1	10.1	9.0	7.9	6.9	5.8
40 HW	16.5	15.0	13.6	12.1	10.6	9.2	7.7

With engine bleed for packs off, increase weight by 900 kg.

With engine and wing anti-ice on, decrease weight by 2500 kg.

Tire Speed Limit

Flaps 15

AIRPORT OAT		TIRE SPEED LIMIT WEIGHT (1000 KG)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	378.7	365.2	330.4	305.8	283.4
52	126	378.7	367.2	332.4	307.6	285.0
50	122	378.7	369.2	334.5	309.3	286.6
48	118	378.7	371.3	336.6	311.1	288.3
46	115	378.7	373.3	338.7	312.9	290.0
44	111	378.7	375.2	340.9	314.7	291.6
42	108	378.7	377.5	350.8	316.5	293.4
40	104	378.7	378.7	352.8	318.3	295.1
38	100	378.7	378.7	354.8	320.2	296.8
36	97	378.7	378.7	356.9	322.2	298.6
34	93	378.7	378.7	358.9	324.1	300.4
32	90	378.7	378.7	360.8	325.9	302.1
30	86	378.7	378.7	362.7	327.7	303.7
28	82	378.7	378.7	364.6	329.6	305.4
26	79	378.7	378.7	366.7	331.6	307.1
24	75	378.7	378.7	368.7	333.6	308.8
22	72	378.7	378.7	370.9	335.8	310.5
20	68	378.7	378.7	373.2	338.0	312.3
18	64	378.7	378.7	375.4	340.6	314.1
16	61	378.7	378.7	377.7	350.3	316.0
14	57	378.7	378.7	378.7	352.5	317.9
12	54	378.7	378.7	378.7	354.7	320.0
10	50	378.7	378.7	378.7	356.9	322.0
-40	-40	378.7	378.7	378.7	378.7	378.7

Increase tire speed limit weight by 2450 kg per knot headwind.

Decrease tire speed limit weight by 5600 kg per knot tailwind.

Takeoff Speeds - Dry Runway**Flaps 15****V1, VR, V2 for Max Takeoff Thrust**

WEIGHT (1000 KG)	KIAS		
	V1	VR	V2
360	167	174	178
340	164	170	176
320	158	165	171
300	152	158	166
280	146	152	161
260	138	145	156
240	130	138	151
220	122	131	145
200	113	123	139
180	103	114	132
160	93	105	125
140	82	96	118

Check V1(MCG), Minimum V2, and Minimum Takeoff Weight.

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	-2	0	2	4	6	8	-2	0	2	4	6	8
70	158	12	15					6	7					-2	-3				
60	140	8	10	13	15			4	5	7	8			-2	-2	-2	-3		
50	122	4	6	8	11	14	17	2	3	5	6	7	9	-1	-1	-2	-2	-2	-3
40	104	1	2	5	7	10	14	1	1	3	4	6	8	0	-1	-1	-1	-2	-2
30	86	0	0	2	4	7	11	0	0	1	3	4	6	0	0	0	-1	-1	-2
20	68	0	0	1	3	5	9	0	0	1	2	3	5	0	0	0	-1	-1	-2
-60	-76	0	0	1	3	5	8	0	0	1	2	3	4	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		
360	-4	-2	0	3	6		-3	-2	0	0	1	2	3	4		
340	-4	-1	0	3	5		-3	-2	0	0	1	2	3	3		
320	-3	-1	0	3	5		-2	-1	0	0	1	2	3	3		
300	-3	-1	0	3	4		-2	-1	0	0	1	2	3	3		
280	-3	-1	0	3	4		-2	-1	0	0	1	2	2	3		
260	-2	-1	0	2	4		-2	-1	0	0	1	2	2	3		
240	-2	0	0	2	4		-1	-1	0	0	1	2	3	3		
220	-2	0	0	2	4		-1	0	0	0	1	2	3	3		
200	-2	0	0	3	4		-1	0	0	0	1	2	3	3		
180	-1	0	0	3	4		-1	0	1	0	1	3	3	4		
160	-1	0	0	3	4		-1	0	1	0	1	3	3	4		
140	-1	0	0	3	4		-1	0	1	0	1	3	4	4		

*V1 not to exceed VR

Takeoff Speeds - Dry Runway

Flaps 15

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
60	140	125	121	119	117		
50	122	128	125	119	117	115	110
40	104	136	133	127	122	116	110
30	86	138	137	133	127	122	115
20	68	138	138	134	130	126	119
-60	-76	140	139	135	131	127	121

Minimum V2

Max Takeoff Thrust

PRESSURE ALTITUDE (FT)	-2000	0	2000	4000	6000	8000
SPEED (KIAS)	135	133	131	128	126	123

Takeoff Speeds - Wet Runway**Flaps 15****V1, VR, V2 for Max Takeoff Thrust**

WEIGHT (1000 KG)	KIAS		
	V1	VR	V2
360	159	174	178
340	155	170	176
320	148	165	171
300	141	158	166
280	134	152	161
260	126	145	156
240	118	138	151
220	110	131	145
200	100	123	139
180	92	114	132
160	81	105	125
140	71	96	118

Check V1(MCG), Minimum V2, and Minimum Takeoff Weight.

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	-2	0	2	4	6	8	-2	0	2	4	6	8
70	158	14	17					6	7					-2	-3				
60	140	9	11	14	16			4	5	7	8			-2	-2	-2	-3		
50	122	5	7	9	12	14	18	2	3	5	6	7	9	-1	-1	-2	-2	-2	-3
40	104	1	2	5	8	11	15	1	1	3	4	6	8	0	-1	-1	-1	-2	-2
30	86	0	0	2	5	8	12	0	0	1	3	4	6	0	0	0	-1	-1	-2
20	68	0	0	1	3	6	9	0	0	1	2	3	5	0	0	0	-1	-1	-2
-60	-76	0	0	1	3	5	8	0	0	1	2	3	4	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		
360	-6	-3	0	3	6		-4	-3	-1	0	1	2	3	4		
340	-6	-3	0	3	6		-4	-3	-1	0	1	2	3	4		
320	-6	-3	0	3	6		-5	-3	-1	0	1	2	3	4		
300	-5	-3	0	3	5		-5	-3	-1	0	1	2	3	4		
280	-5	-2	0	3	5		-5	-3	-1	0	1	2	3	4		
260	-4	-2	0	3	5		-5	-3	-1	0	1	3	4	5		
240	-4	-2	0	3	5		-5	-3	-1	0	1	3	4	5		
220	-3	-1	0	3	5		-4	-2	-1	0	2	3	4	5		
200	-3	-1	0	3	5		-4	-2	0	0	2	4	5	6		
180	-2	0	0	4	6		-3	-1	0	0	2	4	5	6		
160	-1	1	0	4	6		-2	-1	1	0	2	5	6	7		
140	0	2	0	5	6		-2	0	2	0	3	5	6	7		

*V1 not to exceed VR

Takeoff Speeds - Wet Runway

Flaps 15

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
60	140	125	121	119	117		
50	122	128	125	119	117	115	110
40	104	136	133	127	122	116	110
30	86	138	137	133	127	122	115
20	68	138	138	134	130	126	119
-60	-76	140	139	135	131	127	121

Minimum V2

Max Takeoff Thrust

PRESSURE ALTITUDE (FT)	-2000	0	2000	4000	6000	8000
SPEED (KIAS)	135	133	131	128	126	123

Performance Dispatch
Enroute

Chapter PD
Section 31

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	5	30400	28800	27200
350	27900	4	31000	29400	27800
340	28500	3	31700	30000	28500
330	29200	1	32200	30500	29000
320	29900	0	32700	31000	29500
310	30600	-2	33200	31600	30000
300	31300	-4	33700	32100	30600
290	32000	-5	34300	32700	31200
280	32800	-7	34900	33300	31800
270	33600	-9	35500	33900	32400
260	34400	-11	36100	34500	33100
250	35200	-12	36800	35200	33800
240	36000	-14	37500	35900	34500
230	36900	-15	38200	36600	35200
220	37800	-15	39000	37400	36000
210	38800	-15	39800	38200	36800
200	39800	-15	40600	39000	37700
190	40900	-15	41500	39900	38600
180	42000	-15	42500	40900	39600
170	43100	-15	43100	42100	40800
160	43100	-15	43100	43100	42000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	11	30400	28800	27200
350	27900	10	31000	29400	27800
340	28500	8	31700	30000	28500
330	29200	7	32200	30500	29000
320	29900	5	32700	31000	29500
310	30600	4	33200	31600	30000
300	31300	2	33700	32100	30600
290	32000	0	34300	32700	31200
280	32800	-1	34900	33300	31800
270	33600	-3	35500	33900	32400
260	34400	-5	36100	34500	33100
250	35200	-7	36800	35200	33800
240	36000	-9	37500	35900	34500
230	36900	-9	38200	36600	35200
220	37800	-9	39000	37400	36000
210	38800	-9	39800	38200	36800
200	39800	-9	40600	39000	37700
190	40900	-9	41500	39900	38600
180	42000	-9	42500	40900	39600
170	43100	-9	43100	42100	40800
160	43100	-9	43100	43100	42000

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust
ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	17	30400	28800	27200
350	27900	15	31000	29400	27800
340	28500	14	31700	30000	28500
330	29200	12	32200	30500	29000
320	29900	11	32700	31000	29500
310	30600	9	33200	31600	30000
300	31300	8	33700	32100	30600
290	32000	6	34300	32700	31200
280	32800	4	34900	33300	31800
270	33600	3	35500	33900	32400
260	34400	1	36100	34500	33100
250	35200	-1	36800	35200	33800
240	36000	-3	37500	35900	34500
230	36900	-3	38200	36600	35200
220	37800	-3	39000	37400	36000
210	38800	-3	39800	38200	36800
200	39800	-3	40600	39000	37700
190	40900	-3	41500	39900	38600
180	42000	-3	42500	40900	39600
170	43100	-3	43100	42100	40800
160	43100	-3	43100	43100	42000

**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
665	625	588	556	526	500	479	458	440	423	407
1320	1242	1171	1108	1052	1000	958	919	883	850	820
1973	1857	1752	1660	1576	1500	1438	1381	1327	1278	1233
2623	2471	2333	2211	2101	2000	1918	1842	1771	1706	1647
3271	3083	2913	2761	2625	2500	2398	2304	2216	2135	2061
3915	3693	3491	3311	3149	3000	2879	2766	2661	2564	2475
4556	4301	4068	3860	3672	3500	3359	3228	3106	2993	2890
5195	4906	4643	4407	4195	4000	3840	3690	3551	3422	3304
5831	5510	5216	4954	4717	4500	4320	4152	3995	3851	3719
6465	6112	5788	5500	5240	5000	4800	4613	4440	4280	4133
7096	6712	6360	6046	5762	5500	5280	5075	4885	4709	4547
7726	7311	6931	6591	6283	6000	5761	5537	5329	5137	4961
8354	7909	7501	7136	6805	6500	6240	5998	5773	5565	5375
8981	8506	8070	7680	7326	7000	6720	6460	6217	5993	5788
9607	9102	8639	8224	7847	7500	7201	6921	6661	6421	6201
10233	9698	9208	8768	8368	8000	7681	7382	7105	6849	6614
10858	10294	9777	9312	8890	8500	8161	7844	7549	7277	7028
11483	10890	10345	9856	9411	9000	8641	8305	7993	7705	7441
12108	11486	10914	10399	9932	9500	9121	8766	8437	8133	7854
12732	12081	11482	10943	10453	10000	9601	9228	8881	8561	8267

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)
500	8.6	1:19	8.4	1:18	8.4	1:17	8.3	1:15	8.2	1:14
1000	15.8	2:30	15.5	2:28	15.2	2:24	14.9	2:20	14.6	2:17
1500	23.2	3:40	22.7	3:36	22.2	3:29	21.8	3:23	21.3	3:20
2000	30.7	4:50	29.9	4:43	29.3	4:34	28.6	4:27	27.9	4:23
2500	38.4	5:58	37.4	5:49	36.6	5:38	35.7	5:29	34.9	5:25
3000	46.1	7:06	45.0	6:55	43.9	6:42	42.8	6:32	41.8	6:27
3500	54.2	8:11	52.8	7:58	51.5	7:44	50.2	7:34	49.1	7:29
4000	62.3	9:17	60.6	9:02	59.1	8:47	57.6	8:36	56.4	8:31
4500	70.7	10:21	68.8	10:04	67.0	9:48	65.3	9:38	64.0	9:34
5000	79.1	11:25	76.9	11:07	74.9	10:50	73.1	10:39	71.7	10:36
5500	87.8	12:27	85.4	12:08	83.1	11:51	81.2	11:41	79.9	11:38
6000	96.6	13:29	93.8	13:10	91.3	12:53	89.3	12:42	88.1	12:40
6500	105.7	14:30	102.7	14:11	100.0	13:54	97.9	13:44	97.0	13:43
7000	114.8	15:32	111.5	15:11	108.6	14:55	106.5	14:46	105.8	14:46
7500	124.3	16:32	120.7	16:12	117.8	15:56	115.8	15:48	115.6	15:49
8000	133.8	17:33	130.0	17:13	126.9	16:57	125.1	16:50	125.3	16:52
8500	143.9	18:33	139.8	18:13	136.7	17:58	135.3	17:52		
9000	153.9	19:33	149.7	19:14	146.5	19:00	145.5	18:54		
9500	164.4	20:33	160.1	20:15	157.2	20:01	156.8	19:57		
10000	175.0	21:33	170.5	21:15	167.9	21:03	168.0	21:00		

**Long Range Cruise Trip Fuel and Time
Fuel Required Adjustment (1000 KG)**

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	160	180	200	220	240
20	-2.1	-1.1	0.0	1.2	2.7
30	-3.1	-1.6	0.0	1.9	4.3
40	-4.2	-2.1	0.0	2.7	6.2
50	-5.3	-2.7	0.0	3.6	8.3
60	-6.4	-3.2	0.0	4.7	10.7
70	-7.5	-3.8	0.0	5.9	13.4
80	-8.7	-4.4	0.0	7.2	16.3
90	-9.8	-5.0	0.0	8.6	19.5
100	-11.0	-5.6	0.0	10.2	23.0
110	-12.2	-6.2	0.0	11.9	26.7
120	-13.4	-6.8	0.0	13.7	30.7
130	-14.6	-7.5	0.0	15.7	35.0
140	-15.9	-8.1	0.0	17.8	39.5
150	-17.1	-8.8	0.0	20.0	44.3
160	-18.4	-9.5	0.0	22.3	49.4
170	-19.7	-10.2	0.0	24.8	54.7
180	-21.0	-10.9	0.0	27.3	60.3

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

**Long Range Cruise Step Climb 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
1292	1221	1157	1099	1047	1000	957	917	881	847	816
1923	1820	1728	1645	1569	1500	1437	1379	1325	1276	1229
2554	2420	2299	2190	2091	2000	1917	1840	1770	1704	1643
3185	3020	2871	2735	2612	2500	2397	2302	2214	2133	2057
3816	3619	3442	3281	3134	3000	2877	2764	2659	2562	2472
4446	4218	4012	3826	3656	3500	3357	3225	3104	2991	2886
5077	4817	4583	4371	4177	4000	3837	3687	3548	3420	3300
5707	5416	5154	4916	4699	4500	4317	4149	3993	3849	3715
6336	6015	5724	5461	5220	5000	4798	4611	4438	4278	4129
6966	6613	6295	6006	5742	5500	5278	5073	4883	4707	4544
7595	7212	6865	6550	6263	6000	5758	5535	5329	5137	4959
8224	7810	7435	7095	6784	6500	6238	5997	5774	5566	5373
8853	8408	8005	7640	7306	7000	6719	6459	6219	5996	5788
9481	9006	8575	8184	7827	7500	7199	6921	6664	6426	6204
10110	9603	9145	8729	8348	8000	7679	7384	7110	6855	6619
10738	10201	9715	9273	8870	8500	8160	7846	7555	7285	7034
11366	10798	10284	9817	9391	9000	8640	8308	8001	7715	7449
11993	11395	10854	10362	9912	9500	9121	8771	8446	8145	7865
12621	11992	11423	10906	10433	10000	9601	9233	8892	8575	8280

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)									TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)									
	150	160	170	180	190	200	210	220	230	
1000	11.8	12.2	12.7	13.3	13.8	14.5	14.9	15.5	16.0	2:16
1500	16.9	17.6	18.3	19.1	20.0	20.9	21.6	22.4	23.3	3:18
2000	22.1	23.0	24.1	25.2	26.4	27.5	28.5	29.6	30.9	4:20
2500	27.4	28.6	29.9	31.4	32.9	34.3	35.6	37.1	38.6	5:23
3000	32.9	34.4	36.0	37.8	39.5	41.3	42.9	44.7	46.5	6:25
3500	38.5	40.3	42.3	44.3	46.4	48.4	50.4	52.5	54.6	7:27
4000	44.2	46.3	48.7	51.0	53.4	55.8	58.1	60.5	63.0	8:29
4500	50.1	52.6	55.2	57.9	60.6	63.4	66.0	68.8	71.5	9:31
5000	56.2	59.0	61.9	64.9	68.1	71.2	74.1	77.2	80.3	10:33
5500	62.5	65.6	68.8	72.2	75.7	79.2	82.5	85.9	89.4	11:34
6000	68.9	72.3	75.9	79.7	83.6	87.4	91.0	94.8	98.8	12:36
6500	75.4	79.2	83.2	87.4	91.6	95.8	99.8	104.1	108.5	13:38
7000	82.1	86.3	90.8	95.3	99.9	104.4	108.9	113.6	118.4	14:39
7500	89.0	93.6	98.5	103.4	108.3	113.3	118.2	123.4	128.6	15:40
8000	96.1	101.2	106.4	111.7	117.0	122.5	127.9	133.4	139.0	16:42
8500	103.4	108.9	114.5	120.2	126.1	132.0	137.8	143.8	149.8	17:43
9000	111.0	116.8	122.8	129.0	135.3	141.7	148.0	154.4	160.9	18:44
9500	118.7	124.9	131.4	138.0	144.9	151.7	158.4	165.3	172.2	19:45
10000	126.6	133.3	140.2	147.4	154.7	162.0	169.2	176.5	183.9	20:46

Based on 310/.84 climb, Long Range Cruise and .84/310/250 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	143	129	118	108	100	93	87	82	77	73
225	205	187	173	161	150	141	132	125	118	113
288	264	245	228	213	200	189	178	169	161	153
349	323	301	282	265	250	237	225	214	204	195
410	382	357	336	317	300	285	271	258	247	237
471	440	414	390	369	350	333	317	303	290	279
532	499	470	444	421	400	381	364	348	334	320
595	559	527	499	473	450	429	410	393	376	362
660	621	585	554	526	500	477	456	436	419	402

Trip Fuel and Time

AIR DIST (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		160	180	200	220	240	
50	FUEL (1000 KG)	1.6	1.8	1.9	2.0	2.1	0:14
	ALT (FT)	11000	9000	9000	7000	5000	
100	FUEL (1000 KG)	2.4	2.6	2.7	2.8	3.0	0:23
	ALT (FT)	15000	13000	13000	13000	13000	
150	FUEL (1000 KG)	3.2	3.4	3.5	3.7	3.9	0:30
	ALT (FT)	21000	21000	21000	21000	21000	
200	FUEL (1000 KG)	3.8	4.1	4.3	4.5	4.8	0:37
	ALT (FT)	27000	27000	27000	25000	25000	
250	FUEL (1000 KG)	4.4	4.7	5.0	5.3	5.6	0:43
	ALT (FT)	37000	31000	29000	29000	29000	
300	FUEL (1000 KG)	5.0	5.3	5.6	6.0	6.3	0:48
	ALT (FT)	41000	39000	37000	35000	33000	
350	FUEL (1000 KG)	5.5	5.9	6.2	6.6	7.0	0:54
	ALT (FT)	43000	39000	37000	35000	35000	
400	FUEL (1000 KG)	6.0	6.4	6.9	7.3	7.8	1:00
	ALT (FT)	43000	39000	37000	37000	35000	
450	FUEL (1000 KG)	6.5	7.0	7.5	8.0	8.5	1:06
	ALT (FT)	43000	41000	39000	37000	35000	
500	FUEL (1000 KG)	7.0	7.6	8.1	8.7	9.2	1:13
	ALT (FT)	43000	41000	39000	37000	35000	

Holding Planning
Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
360	9310	9240	9140	9180	9690	10040	10600			
340	8810	8730	8620	8620	9080	9360	9780			
320	8250	8160	8050	8030	8430	8630	8950	9950		
300	7720	7630	7510	7480	7600	7980	8260	8850		
280	7250	7150	7030	6970	7000	7380	7620	8060		
260	6790	6670	6530	6470	6470	6800	6990	7250	8510	
240	6350	6220	6060	5980	5970	6030	6380	6590	7270	
220	5940	5790	5610	5530	5490	5490	5770	5960	6450	7070
200	5590	5430	5230	5140	5070	5040	5150	5350	5660	6020
180	5270	5100	4900	4800	4710	4760	4650	4750	5000	5210
160	5120	4940	4750	4610	4500	4440	4330	4310	4460	4560

Flaps 1

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
360	10290	10260	10210	10300	10530
340	9680	9630	9570	9620	9830
320	9080	9030	8960	8980	9160
300	8510	8450	8370	8380	8520
280	7940	7870	7770	7770	7860
260	7390	7300	7190	7190	7240
240	6860	6740	6630	6600	6620
220	6340	6200	6070	6010	6020
200	5880	5720	5550	5470	5430
180	5480	5300	5110	5020	4960
160	5260	5080	4860	4760	4660

These tables include 5% additional fuel for holding in a racetrack pattern.

Crew Oxygen Requirements

Required Pressure (PSI) for Two 114/115 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	325	435	545
45	113	320	430	540
40	104	315	420	530
35	95	310	415	520
30	86	305	410	510
25	77	300	400	505
20	68	295	395	495
15	59	290	390	485
10	50	285	380	480
5	41	280	375	470
0	32	275	370	460
-5	23	270	360	455
-10	14	265	355	445

For more extensive than normal crew usage, add 0.6 psi/person/minute.

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
32	166.0	164.5	161.0
30	183.7	181.5	175.5
28	197.9	193.2	185.8
26	213.1	207.2	199.2
24	229.4	222.1	213.9
22	246.8	238.7	230.1
20	271.4	264.3	254.0
18	293.8	284.5	273.3
16	318.2	306.9	294.9
14	339.7	326.4	313.5
12	361.3	347.4	334.2

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALTITUDE (1000 FT)								
	14	16	18	20	22	24	26	28	30
ENGINE ONLY	-0.7	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE AND WING	-2.7	-2.0	-1.6	-1.2	-1.3	-1.4	-1.5	-1.5	-1.5

Intentionally
Blank

Performance Dispatch**Chapter PD****Landing****Section 32****Landing Field Limit Weight - Dry Runway****Flaps 30****Wind Corrected Field Length (M)**

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1400			1280	1400	1450	1520	1580	1640
1600	1300	1360	1460	1600	1670	1750	1820	1900
1800	1440	1520	1640	1800	1880	1980	2070	2170
2000	1580	1680	1820	2000	2090	2210	2310	2430
2200	1720	1840	2000	2200	2310	2430	2550	2690
2400	1860	2010	2180	2400	2520	2660	2800	2950
2600	2010	2170	2360	2600	2730	2890	3040	3210
2800	2150	2330	2540	2800	2940	3120	3290	3470
3000	2290	2490	2720	3000	3160	3350	3530	3740
3200	2430	2650	2900	3200	3370	3580	3770	4000
3400	2570	2810	3080	3400	3580	3800	4020	4260
3600	2710	2980	3260	3600	3790	4030	4260	4520
3800	2860	3140	3440	3800	4010	4260	4500	4780
4000	3000	3300	3620	4000	4220	4490	4750	5050
4200	3140	3460	3800	4200	4430	4720	4990	5310
4400	3280	3620	3980	4400	4650	4950	5230	5570

Field Limit Weight (1000 KG)

WIND CORRECTED FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)						
	0	2000	4000	6000	8000	9000	9800
1400	188.7	176.8	166.1	155.9			
1600	227.3	213.3	200.0	187.5	175.6	169.8	165.4
1800	263.8	249.9	234.4	219.5	205.4	198.8	193.6
2000	293.0	277.5	265.6	252.5	236.4	228.5	222.3
2200	309.3	301.2	292.7	276.4	264.6	258.4	251.4
2400	322.0	313.1	305.0	296.9	287.0	280.4	273.0
2600	334.7	324.6	315.2	307.0	298.7	294.6	290.3
2800	345.8	336.1	325.8	316.1	307.8	303.6	300.3
3000	357.7	346.0	336.3	325.9	316.1	311.8	308.5
3200	369.1	356.7	345.3	335.3	324.9	319.8	316.0
3400	380.0	366.9	354.8	343.8	333.5	328.1	324.0
3600		376.4	363.8	352.1	341.5	336.2	331.8
3800		385.9	372.3	360.1	348.4	343.3	339.3
4000			380.5	367.6	355.9	350.2	345.6
4200			388.7	374.8	362.6	356.9	352.5
4400				381.7	369.0	363.1	358.6

With manual speedbrakes, decrease weight by 21450 kg.

With 1 brake deactivated, decrease weight by 20600 kg.

With 2 brakes deactivated, decrease weight by 41900 kg.

Landing Field Limit Weight - Wet Runway

Flaps 30

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1400				1400	1450	1510	1560	1610
1600			1460	1600	1660	1740	1800	1870
1800	1460	1530	1640	1800	1870	1960	2050	2140
2000	1600	1690	1820	2000	2090	2190	2290	2400
2200	1750	1850	2000	2200	2300	2420	2540	2660
2400	1890	2010	2180	2400	2510	2650	2780	2920
2600	2030	2180	2360	2600	2730	2880	3020	3180
2800	2170	2340	2540	2800	2940	3110	3270	3450
3000	2310	2500	2720	3000	3150	3330	3510	3710
3200	2460	2660	2900	3200	3360	3560	3750	3970
3400	2600	2820	3080	3400	3580	3790	4000	4230
3600	2740	2980	3260	3600	3790	4020	4240	4490
3800	2880	3150	3440	3800	4000	4250	4480	4760
4000	3020	3310	3620	4000	4210	4480	4730	5020
4200	3160	3470	3800	4200	4430	4700	4970	5280
4400	3310	3630	3980	4400	4640	4930	5220	5540

Field Limit Weight (1000 KG)

WIND CORRECTED FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)						
	0	2000	4000	6000	8000	9000	9800
1400	153.4						
1600	187.0	175.2	164.6	154.6			
1800	220.6	206.9	194.1	182.0	170.4	164.8	160.5
2000	253.4	238.7	223.8	209.7	196.3	189.9	185.0
2200	278.4	266.6	253.6	238.1	222.9	215.5	209.7
2400	300.4	291.1	275.9	263.7	250.0	241.6	235.0
2600	313.2	305.1	296.8	285.0	269.5	264.8	260.1
2800	324.2	315.0	306.8	298.7	289.3	284.1	278.1
3000	335.2	325.1	315.7	307.4	299.1	295.0	290.9
3200	344.9	335.1	324.9	315.4	307.0	302.9	299.5
3400	355.0	344.1	334.0	323.8	314.3	310.1	306.7
3600	365.2	353.0	342.5	332.1	321.8	316.8	313.4
3800	374.8	362.1	350.2	340.0	329.4	324.2	320.1
4000	384.2	370.6	358.4	346.6	336.7	331.3	327.1
4200		378.9	366.0	354.2	343.2	338.2	333.8
4400		387.1	373.4	361.1	349.4	344.1	340.2

With manual speedbrakes, decrease weight by 21450 kg.

With 1 brake deactivated, decrease weight by 20600 kg.

With 2 brakes deactivated, decrease weight by 41900 kg.

Approach or Landing Climb Limited Weight**Valid for approach with flaps 20 and landing with flaps 30**

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	297.3	279.1				
52	126	306.3	287.0				
50	122	315.2	294.5	269.7			
48	118	323.5	303.4	276.9			
46	115	331.8	312.4	284.1	259.6		
44	111	340.4	321.1	291.5	267.7		
42	108	352.1	329.0	299.1	275.0	251.6	
40	104	359.1	337.3	307.2	281.4	257.0	
38	100	366.2	349.6	316.0	287.8	262.8	233.8
36	97	369.0	356.4	323.2	293.4	269.2	238.4
34	93	369.3	363.2	330.4	299.7	274.4	243.0
32	90	369.5	365.7	338.2	306.4	278.7	247.1
30	86	369.8	365.9	346.1	312.9	282.9	250.9
28	82	370.1	366.0	352.5	318.7	287.3	254.6
26	79	370.3	366.1	352.7	322.6	292.2	258.2
24	75	370.6	366.3	352.8	326.0	297.0	263.1
22	72	370.8	366.4	352.9	327.4	300.3	268.1
20	68	371.1	366.5	352.9	327.5	302.5	272.4
18	64	371.3	366.7	353.0	327.6	304.7	275.2
16	61	371.6	366.8	353.1	327.6	304.7	276.9
14	57	371.8	366.9	353.2	327.7	304.8	278.5
12	54	372.0	367.0	353.3	327.8	304.9	278.6
10	50	372.2	367.2	353.3	327.9	304.9	278.7
8	46	372.3	367.3	353.4	327.9	304.9	278.7
6	43	372.5	367.4	350.4	328.0	304.9	272.8
4	40	372.6	367.4	341.5	313.7	286.7	254.9
2	36	372.7	367.5	341.6	313.8	286.8	254.9
0	32	372.8	367.5	341.6	313.8	286.8	255.0
-40	-40	373.4	367.8	341.6	313.8	286.8	255.0

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.**With engine bleed for packs off, increase weight by 1250 kg.****With engine anti-ice on, decrease weight by 150 kg.****With engine and wing anti-ice on, decrease weight by 2350 kg.****When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 26950 kg.**

ADVISORY INFORMATION

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	9.16	7.98	6.54	5.32	4.09	2.49
50	10.10	8.98	7.32	5.99	4.73	3.07
46	11.06	9.95	8.21	6.69	5.39	3.66
42	11.98	10.90	9.09	7.48	6.08	4.27
38	12.83	11.81	9.96	8.25	6.75	4.90
34	13.01	12.64	10.76	8.97	7.32	5.49
30	13.03	12.79	11.43	9.64	7.87	5.98
26	13.06	12.80	11.74	10.19	8.48	6.46
22	13.08	12.81	11.75	10.46	8.89	6.98
18	13.10	12.83	11.75	10.47	9.15	7.33
14	13.13	12.84	11.76	10.47	9.15	7.55
10	13.15	12.85	11.77	10.48	9.16	7.55

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)											
	2	3	4	5	6	7	8	9	10	11	12	13
320	-4.29	-4.77	-5.26	-5.74	-6.13	-6.59	-7.04	-7.50	-7.95	-8.45	-8.92	-9.39
300	-4.02	-4.44	-4.89	-5.32	-5.66	-6.08	-6.49	-6.90	-7.32	-7.77	-8.21	-8.64
280	-3.56	-3.94	-4.33	-4.72	-5.01	-5.38	-5.74	-6.10	-6.47	-6.89	-7.28	-7.67
260	-3.12	-3.43	-3.77	-4.11	-4.34	-4.66	-4.96	-5.26	-5.58	-5.95	-6.29	-6.63
240	-2.44	-2.67	-2.95	-3.23	-3.39	-3.64	-3.88	-4.11	-4.37	-4.68	-4.96	-5.23
220	-1.61	-1.76	-1.97	-2.17	-2.26	-2.43	-2.58	-2.74	-2.93	-3.15	-3.36	-3.52
200	-0.61	-0.66	-0.76	-0.81	-0.85	-0.91	-0.97	-1.03	-1.12	-1.20	-1.25	-1.28
190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
180	0.66	0.75	0.85	0.88	0.94	1.00	1.07	1.17	1.26	1.30	1.33	1.36
160	2.37	2.67	2.86	3.00	3.20	3.44	3.71	3.95	4.13	4.22	4.33	4.44

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	-2	0	2	4	6	8	10	12	14	16	18
VREF	-0.23	-0.24	-0.25	-0.27	-0.28	-0.27	-0.23	-0.16	-0.07	0.03	0.10
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF+10	0.17	0.18	0.19	0.20	0.21	0.19	0.15	0.07	-0.03	-0.11	-0.14
VREF+20	0.38	0.40	0.42	0.43	0.44	0.37	0.23	-0.01	-0.24	-0.42	-0.56
VREF+30	0.43	0.44	0.44	0.43	0.40	0.28	0.05	-0.28	-0.61	-0.90	-1.12

When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 1.2%.

Quick Turnaround Limit Weight**Flaps 30 Limit Weight (1000 KG)**

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	235.5				
50	122	237.0	228.2			
45	113	239.0	230.0	221.4		
40	104	240.9	231.9	223.2	214.8	
35	95	242.9	233.9	225.1	216.6	208.1
30	86	245.0	235.9	227.0	218.4	209.9
25	77	247.1	237.9	228.9	220.3	211.7
20	68	249.2	240.0	231.0	222.2	213.6
15	59	251.5	242.2	233.0	224.1	215.6
10	50	253.8	244.4	235.2	226.2	217.5
5	41	256.2	246.6	237.4	228.3	219.5
0	32	258.6	248.9	239.6	230.4	221.5
-5	23	261.0	251.3	241.9	232.6	223.6
-10	14	262.9	253.8	244.2	234.9	225.8
-15	5	264.8	256.4	246.7	237.3	228.1
-20	-4	266.8	259.0	249.2	239.7	230.4
-30	-22	270.8	263.5	254.4	244.7	235.3
-40	-40	276.0	267.7	260.0	250.1	240.4
-50	-58	282.2	272.0	264.6	255.7	245.8
-54	-65	284.7	274.4	266.4	258.1	248.0

Increase weight by 2100 kg per 1% uphill slope. Decrease weight by 3450 kg per 1% downhill slope.

Increase weight by 6100 kg per 10 knots headwind. Decrease weight by 29450 kg per 10 knots tailwind.

Decrease weight by 12600 kg when one brake is deactivated. Decrease weight by 24950 kg when two brakes are deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Intentionally
Blank

Performance Dispatch**Chapter PD****Gear Down****Section 33****GEAR DOWN****Takeoff Climb Limit Weight****Flaps 15****Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off**

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	0	2000	4000	6000	8000	9000	9800
54	129	236.9	225.2	209.9	189.5	159.7		
52	126	242.3	226.1	214.7	195.1	166.9		
50	122	248.1	227.3	217.1	200.5	173.2	159.6	
48	118	254.1	232.9	217.0	205.8	178.4	166.2	156.4
46	115	259.9	238.4	218.2	206.1	183.5	171.2	162.0
44	111	264.7	243.7	223.0	206.0	188.5	176.1	166.9
42	108	269.1	249.0	227.9	207.1	191.2	180.9	171.6
40	104	273.8	254.4	233.0	211.6	191.1	183.4	176.3
38	100	280.0	260.2	238.4	216.4	192.3	183.3	177.6
36	97	286.2	264.9	243.9	221.5	196.7	184.5	177.5
34	93	292.5	269.6	249.6	226.7	201.3	188.9	179.5
32	90	298.3	274.8	255.0	231.8	206.2	193.4	183.9
30	86	303.7	280.9	260.5	237.2	211.1	198.2	188.3
28	82	308.6	286.8	265.2	242.4	215.9	203.0	193.1
26	79	308.7	292.3	269.3	247.6	221.0	207.6	197.8
24	75	308.8	296.1	273.6	252.7	225.9	212.5	202.3
22	72	308.9	296.2	278.0	256.7	231.0	217.2	207.1
20	68	309.0	296.2	280.6	260.0	235.5	222.2	211.6
18	64	309.1	296.3	280.7	262.7	239.0	226.4	216.1
16	61	309.2	296.3	280.7	263.7	240.7	229.5	220.1
14	57	309.3	296.4	280.7	263.7	242.0	230.8	222.8
12	54	309.4	296.4	280.7	263.7	242.1	232.0	224.0
10	50	309.5	296.5	280.7	263.7	242.1	232.0	224.8
-40	-40	309.8	296.5	280.9	263.7	242.0	232.0	224.9

With engine bleed for packs off, increase weight by 800 kg.**With engine anti-ice on, decrease weight by 900 kg.****With engine and wing anti-ice on, decrease weight by 2250 kg.**

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	249.4				
52	126	256.6				
50	122	264.0	241.5			
48	118	272.0	247.4			
46	115	278.7	254.0	234.8		
44	111	285.5	260.6	240.6		
42	108	291.8	268.0	246.3	227.7	
40	104	298.7	274.5	252.1	232.7	
38	100	305.4	280.9	257.9	237.6	211.3
36	97	312.2	286.5	263.0	241.7	215.6
34	93	318.6	292.0	268.8	245.7	219.8
32	90	320.7	297.6	273.8	249.3	223.5
30	86	320.8	302.8	278.7	253.2	226.8
28	82	320.9	307.5	283.1	257.2	230.1
26	79	321.1	307.6	286.4	261.7	233.4
24	75	321.2	307.7	288.9	266.2	237.0
22	72	321.3	307.7	289.9	269.2	240.7
20	68	321.4	307.8	290.0	271.0	243.8
18	64	321.5	307.9	290.0	272.8	246.0
16	61	321.6	308.0	290.1	272.8	247.5
14	57	321.8	308.0	290.1	272.9	248.9
12	54	321.9	308.1	290.1	272.9	249.0
10	50	322.0	308.2	290.2	272.9	249.0
-40	-40	322.5	308.5	290.5	273.1	249.2

With engine bleed for packs off, increase weight 1600 kg.

With engine and wing anti-ice on, decrease weight by 2150 kg.

When operating in icing conditions during any part of the flight when forecast landing temperature is below 10°C, decrease weight by 29150 kg.

GEAR DOWN**Takeoff Obstacle Limit Weight****Flaps 15****Sea Level, 33°C & Below, Zero Wind****Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or Auto**

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	291.3										
20	268.3	287.6									
40	248.0	266.7	281.2	292.1							
60	235.1	251.1	265.7	277.4	286.6	294.1					
80	223.5	239.5	253.0	265.0	274.8	282.9	289.5	295.0			
100	212.0	230.2	242.8	254.4	264.5	272.9	280.1	286.1	291.2	295.6	298.2
120	201.9	220.7	234.4	245.1	255.3	264.0	271.5	277.9	283.4	288.1	292.3
140		211.8	226.7	237.7	247.1	256.0	263.6	270.3	276.1	281.2	285.6
160		203.7	218.9	230.8	240.1	248.5	256.4	263.3	269.3	274.6	279.3
180		196.2	211.6	224.0	233.9	242.1	249.8	256.8	263.0	268.5	273.3
200			204.8	217.5	227.9	236.4	243.7	250.7	257.0	262.7	267.7
220			198.4	211.3	222.1	230.9	238.4	245.1	251.4	257.2	262.4
240			192.4	205.5	216.4	225.6	233.3	240.0	246.1	252.0	257.3
260				199.9	211.1	220.5	228.4	235.3	241.4	247.1	252.5
280				194.7	205.9	215.5	223.7	230.8	237.0	242.6	247.9
300					201.0	210.8	219.2	226.4	232.7	238.4	243.6

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	180	200	220	240	260	280	300	320
33 & BELOW	0	0	0	0	0	0	0	0
34	-1.2	-1.4	-1.5	-1.7	-1.8	-2.0	-2.1	-2.3
36	-4.7	-5.3	-5.9	-6.5	-7.1	-7.7	-8.2	-8.8
38	-8.3	-9.3	-10.3	-11.3	-12.3	-13.3	-14.3	-15.4
40	-11.8	-13.2	-14.7	-16.1	-17.6	-19.0	-20.4	-21.9
42	-15.0	-16.8	-18.7	-20.5	-22.4	-24.2	-26.0	-27.9
44	-18.2	-20.5	-22.7	-24.9	-27.2	-29.4	-31.6	-33.8
46	-21.5	-24.1	-26.7	-29.3	-32.0	-34.6	-37.2	-39.8
48	-24.7	-27.7	-30.7	-33.7	-36.8	-39.8	-42.8	-45.8
50	-27.9	-31.3	-34.7	-38.1	-41.6	-45.0	-48.4	-51.8

Pressure Altitude Adjustment

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	180	200	220	240	260	280	300	320
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-7.1	-7.9	-8.6	-9.4	-10.2	-10.9	-11.7	-12.4
2000	-14.3	-15.8	-17.3	-18.8	-20.3	-21.8	-23.3	-24.9
3000	-20.8	-23.0	-25.2	-27.4	-29.6	-31.8	-34.0	-36.2
4000	-27.3	-30.2	-33.1	-36.0	-38.9	-41.8	-44.7	-47.6
5000	-33.9	-37.5	-41.2	-44.8	-48.5	-52.1	-55.8	-59.4
6000	-40.5	-44.9	-49.3	-53.7	-58.0	-62.4	-66.8	-71.2
7000	-47.6	-52.8	-58.1	-63.3	-68.5	-73.7	-78.9	-84.1
8000	-54.8	-60.8	-66.8	-72.9	-78.9	-85.0	-91.0	-97.0

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Wind Adjustment

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	180	200	220	240	260	280	300	320
15 TW	-34.2	-33.2	-32.1	-31.1	-30.1	-29.1	-28.0	-27.0
10 TW	-22.8	-22.1	-21.4	-20.7	-20.1	-19.4	-18.7	-18.0
5 TW	-11.4	-11.1	-10.7	-10.4	-10.0	-9.7	-9.3	-9.0
0	0	0	0	0	0	0	0	0
10 HW	4.2	3.6	3.0	2.4	1.8	1.1	0.5	0.0
20 HW	8.5	7.2	6.0	4.8	3.5	2.2	1.0	0.0
30 HW	12.8	10.9	9.0	7.1	5.2	3.4	1.5	0.0
40 HW	17.0	14.5	12.0	9.5	7.0	4.5	2.0	0.0

With engine bleed for packs off, increase weight by 500 kg.
With engine and wing anti-ice on, decrease weight by 3000 kg.

GEAR DOWN

Long Range Cruise Altitude Capability
Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	18500	16600	14200
350	19200	17300	14800
340	19700	18000	15500
330	20600	18900	16300
320	21700	20100	17600
310	22800	21300	19000
300	23900	22400	20300
290	25000	23500	21800
280	26000	24600	23000
270	27100	25900	24300
260	28200	27200	25700
250	29400	28600	27100
240	30400	30000	28500
230	31200	30800	29900
220	32000	31700	31000
210	32800	32600	32000
200	33500	33200	32700
190	34000	33900	33400
180	34600	34500	34100
170	35200	35100	34700
160	35800	35700	35300

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
326	291	261	237	217	200	188	177	167	158	150
488	436	391	355	326	300	282	266	251	238	227
649	580	521	473	434	400	376	354	335	318	303
809	724	650	591	543	500	470	443	419	398	380
968	867	779	709	651	600	565	533	504	479	456
1127	1009	908	826	759	700	659	622	589	559	533
1285	1152	1036	944	867	800	754	712	673	639	609
1442	1293	1165	1061	975	900	848	801	758	720	686
1599	1435	1293	1178	1083	1000	943	890	843	800	763
1755	1576	1421	1295	1191	1100	1037	980	928	881	840
1910	1716	1548	1412	1299	1200	1131	1069	1012	962	917
2065	1856	1675	1529	1407	1300	1226	1158	1097	1042	994
2219	1996	1802	1646	1515	1400	1320	1248	1182	1123	1072
2373	2135	1929	1762	1623	1500	1415	1337	1267	1204	1149
2526	2274	2056	1878	1730	1600	1509	1427	1352	1285	1226
2679	2413	2182	1994	1838	1700	1604	1516	1437	1366	1304
2831	2551	2308	2110	1945	1800	1699	1606	1522	1447	1382
2982	2689	2434	2226	2053	1900	1793	1696	1608	1529	1459
3133	2826	2559	2342	2160	2000	1888	1786	1693	1610	1537

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME
	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)
200	7.8	0:51	7.4	0:49	7.2	0:47	7.0	0:46	6.9	0:44
300	11.4	1:13	10.8	1:10	10.4	1:07	10.0	1:05	9.7	1:03
400	15.0	1:36	14.2	1:32	13.6	1:28	13.0	1:25	12.6	1:22
500	18.6	1:59	17.6	1:53	16.7	1:48	16.0	1:44	15.4	1:40
600	22.3	2:21	21.1	2:14	20.0	2:08	19.1	2:03	18.4	1:58
700	26.1	2:43	24.6	2:35	23.3	2:28	22.2	2:22	21.3	2:17
800	29.8	3:05	28.1	2:56	26.6	2:48	25.3	2:41	24.2	2:35
900	33.6	3:27	31.6	3:17	29.9	3:08	28.4	3:00	27.2	2:53
1000	37.3	3:49	35.1	3:38	33.2	3:28	31.5	3:20	30.1	3:11
1100	41.3	4:10	38.8	3:59	36.7	3:48	34.7	3:38	33.2	3:29
1200	45.2	4:32	42.4	4:19	40.1	4:07	37.9	3:57	36.2	3:47
1300	49.1	4:53	46.1	4:39	43.5	4:27	41.2	4:15	39.3	4:04
1400	53.0	5:14	49.8	5:00	47.0	4:46	44.4	4:34	42.4	4:22
1500	57.0	5:36	53.4	5:20	50.4	5:05	47.6	4:52	45.5	4:40
1600	61.1	5:56	57.3	5:40	54.0	5:24	51.0	5:11	48.7	4:57
1700	65.2	6:17	61.1	5:59	57.6	5:43	54.4	5:29	51.9	5:15
1800	69.3	6:37	64.9	6:19	61.1	6:02	57.8	5:47	55.2	5:32
1900	73.4	6:58	68.7	6:39	64.7	6:21	61.2	6:05	58.4	5:49
2000	77.5	7:19	72.6	6:58	68.3	6:40	64.6	6:23	61.6	6:07

GEAR DOWN**Long Range Cruise Trip Fuel and Time****Fuel Required Adjustments (1000 KG)**

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	160	180	200	220	240
5	-0.4	-0.2	0.0	0.3	0.7
10	-0.9	-0.5	0.0	0.6	1.3
15	-1.3	-0.7	0.0	0.9	2.0
20	-1.8	-1.0	0.0	1.3	2.7
25	-2.3	-1.3	0.0	1.6	3.5
30	-2.8	-1.6	0.0	2.0	4.2
35	-3.3	-1.9	0.0	2.3	5.0
40	-3.9	-2.1	0.0	2.7	5.9
45	-4.4	-2.4	0.0	3.1	6.7
50	-4.9	-2.7	0.0	3.5	7.6
55	-5.4	-2.9	0.0	3.9	8.5
60	-6.0	-3.2	0.0	4.4	9.4
65	-6.5	-3.5	0.0	4.8	10.4
70	-7.0	-3.7	0.0	5.2	11.3
75	-7.6	-4.0	0.0	5.7	12.3
80	-8.1	-4.2	0.0	6.2	13.4

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

GEAR DOWN

**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
101	84	72	63	56	50	45	42	38	36	33
171	150	133	120	109	100	92	86	80	75	71
242	215	194	177	162	150	139	130	122	115	109
311	280	255	233	215	200	187	175	165	156	147
380	344	315	290	268	250	234	220	207	196	186
448	408	374	346	321	300	281	265	250	237	225
517	472	434	402	374	350	329	310	293	278	265
586	536	494	458	427	400	376	355	336	319	304
655	600	554	514	480	450	423	400	379	360	343
726	666	615	571	533	500	471	445	421	400	381

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		160	180	200	220	240	
50	FUEL (1000 KG)	2.2	2.3	2.5	2.6	2.7	0:15
	ALT (FT)	13000	11000	11000	11000	11000	
100	FUEL (1000 KG)	3.7	3.9	4.1	4.3	4.5	0:25
	ALT (FT)	23000	21000	21000	19000	19000	
150	FUEL (1000 KG)	5.0	5.2	5.5	5.8	6.2	0:34
	ALT (FT)	29000	27000	25000	25000	23000	
200	FUEL (1000 KG)	6.2	6.5	6.9	7.3	7.8	0:43
	ALT (FT)	31000	29000	29000	27000	25000	
250	FUEL (1000 KG)	7.4	7.8	8.3	8.8	9.4	0:51
	ALT (FT)	33000	31000	29000	27000	25000	
300	FUEL (1000 KG)	8.6	9.1	9.6	10.3	11.0	1:00
	ALT (FT)	33000	31000	31000	29000	27000	
350	FUEL (1000 KG)	9.8	10.3	11.0	11.7	12.6	1:08
	ALT (FT)	33000	33000	31000	29000	27000	
400	FUEL (1000 KG)	11.0	11.6	12.3	13.2	14.2	1:16
	ALT (FT)	33000	33000	31000	29000	27000	
450	FUEL (1000 KG)	12.2	12.9	13.7	14.7	15.8	1:25
	ALT (FT)	33000	33000	31000	29000	27000	
500	FUEL (1000 KG)	13.4	14.2	15.1	16.2	17.5	1:33
	ALT (FT)	33000	33000	31000	29000	27000	

GEAR DOWN

**Holding Planning
Flaps Up**

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
360	15490						
340	14720	14710					
320	13780	13740					
300	12760	12730	12670				
280	11940	11920	11840				
260	11030	11010	10930	10980			
240	10300	10270	10190	10210			
220	9600	9550	9460	9460	9550		
200	9210	9140	9050	9030	9100	9210	
180	8900	8820	8720	8690	8750	8840	9040
160	8630	8540	8430	8390	8430	8510	8690

Flaps 1

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
360	15330	15400	15380	15620	16410
340	14470	14510	14490	14690	15250
320	13540	13550	13540	13670	14090
300	12540	12540	12530	12650	12900
280	11680	11670	11630	11750	11960
260	10760	10730	10680	10790	10930
240	9970	9920	9860	9940	10050
220	9210	9140	9070	9110	9210
200	8700	8610	8520	8540	8620
180	8290	8190	8090	8090	8140
160	7950	7850	7720	7710	7730

These tables include 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	171.5	171.5	166.7
18	182.0	180.0	175.8
16	194.2	192.5	188.4
14	207.3	206.6	201.2
12	223.4	221.2	214.5
10	239.5	236.8	229.8
8	256.5	252.7	246.2
6	275.8	268.7	258.8
4	292.6	281.7	268.8
2	306.2	293.1	279.3
0	318.4	303.7	288.9

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	20
ENGINE ONLY	0.0	-0.7	-1.2	-1.2	-1.1	-0.9	-0.7	-0.2	0.0	0.0	0.0
ENGINE AND WING	-2.3	-3.0	-3.0	-3.2	-2.7	-2.4	-1.9	-1.6	-1.3	-1.0	-0.7

Performance Dispatch**Text****Chapter PD****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 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 data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Tire Speed, and Obstacle Limit Weights as determined from the following tables. Brake Energy Limit is not shown as it is not limiting for the range of conditions shown in this chapter. When determining a maximum weight for a wet runway, the dry runway limit weight must also be checked and the lower of the two weights used.

Minimum Weight for FMC Takeoff Speeds Calculation

The FMC may not be able to calculate takeoff speeds for light weight takeoffs at GE90-110B1L thrust rating. For takeoff at weights below the Minimum Weight for FMC Takeoff Speeds Calculation, takeoff speeds may be obtained using available performance software. Use of a lower thrust rating and/or assumed temperature method of thrust reduction may also be necessary.

Field Limit Weight - Slope and Wind Corrections

These tables for wet and dry runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction 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 condition 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

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct 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

Maximum tire speed limited weights are presented for 235 MPH tires. To determine the tire speed limit weight, enter the table with OAT, move to airport pressure altitude and read the tire speed limit weight. Adjust the tire speed limit weight according to the notes below the table to account for wind.

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 to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. 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.

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 below those shown in the Minimum Weight for FMC Takeoff Speeds Calculation table. In those cases where the required speed increase exceeds the maximum speed increase built into the FMC, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. This typically occurs at high rated thrust, high flaps setting and light weights. To obtain speeds for the takeoff in these situations, the options are to use available performance software, or select a smaller flaps setting, or use reduced takeoff thrust and/or add weight. Selecting derate thrust is the preferred method of reduced takeoff thrust as this will reduce the minimum control speeds.

Normal takeoff speeds, V1, VR, and V2 are read from either the wet or dry table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than the minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). To find V1(MCG), enter the V1(MCG) table with 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 weight adjustment is required provided that the field length available exceeds the minimum field length required shown in the Field and Climb Limit Weight table.

Minimum V2

Minimum takeoff safety speeds (V2) are provided to ensure an adequate margin between the normal operating speed and the in-air minimum control speed is maintained for directional control with high thrust asymmetry during a light weight takeoff.

Data are presented as a function of airport pressure altitude and are valid for all temperatures. To obtain the proper V2 speed for takeoff, first determine the normal takeoff V2 using the takeoff speeds tables provided, adjusted for pressure altitude, temperature, and VR correction (if applicable). Compare this V2 with the minimum V2. If the calculated V2 is less than the minimum V2, set V2 equal to minimum V2 and determine a new VR by adding the difference between calculated V2 and minimum V2 to the original VR obtained from the V1, VR, V2 Adjustments table or Minimum VR table (if applicable).

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle limit weight and the V1 must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 3700 kg for a dry runway or 2200 kg for a wet runway and the V1 associated with the reduced weight by 2 knots. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 7250 kg for a dry runway or 4550 kg for a wet runway and the V1 associated with the reduced weight by 5 knots for a dry runway or 3 knots for a wet runway. If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate stop distance available corrected for wind and slope exceeds approximately 1800 m for one brake deactivated or 1900 m for two brakes deactivated. For wet runways, the corrected accelerate stop distance should exceed approximately 2350 m for one brake deactivated or 2450 m for two brakes deactivated.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

One Thrust Reverser Inoperative

Wet runway takeoff performance presented for all brakes operating is based on the use of one thrust reverser during deceleration. When operating with a thrust reverser inoperative, the runway/obstacle limited takeoff weight and V1 speed must be reduced to account for the reduced deceleration capability. A simplified method which conservatively accounts for this is to reduce the normal wet runway/obstacle limited weight by 6900 kg and the V1 associated with the reduced weight by 3 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 corrected for wind and slope exceeds approximately 2400 m.

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 these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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 fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time 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 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. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time 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

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 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%.

Oxygen Requirements

Flight Crew 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 these requirements is achieved with the minimum dispatch oxygen cylinder pressure. Enter the Crew Oxygen Requirements table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate bottle temperature.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 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.

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 Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited 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 engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table 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, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

Performance Dispatch

Chapter PD

Table of Contents

Section 40

777-300 PW4090 LB FT FAA TO1-10 TO2-20 TALPA

Pkg Model IdentificationPD.ModID.40.1

Takeoff..... PD.40.1

Takeoff Field CorrectionsPD.40.1

Takeoff Field & Climb Limit WeightsPD.40.2

Takeoff Obstacle Limit Weight.....PD.40.5

Tire Speed Limit.....PD.40.7

Brake Energy Limits VMBEPD.40.8

Takeoff SpeedsPD.40.9

Enroute PD.41.1

Long Range Cruise Maximum Operating Altitude.....PD.41.1

Long Range Cruise Trip Fuel and TimePD.41.3

Long Range Cruise Step ClimbPD.41.5

Short Trip Fuel and TimePD.41.6

Holding PlanningPD.41.7

Crew Oxygen Requirements.....PD.41.8

Net Level Off WeightPD.41.9

Landing PD.42.1

Landing Field Limit WeightPD.42.1

Approach or Landing Climb Limited Weight.....PD.42.3

Go-Around Climb GradientPD.42.4

Quick Turnaround Limit Weight.....PD.42.5

Gear Down..... PD.43.1

Takeoff Climb Limit Weight.....PD.43.1

Approach or Landing Climb Limited Weight.....PD.43.2

Takeoff Obstacle Limit Weight.....PD.43.3

Long Range Cruise Altitude CapabilityPD.43.5

**Performance Dispatch
Pkg Model Identification****Chapter PD
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
777F	777F	7270	WY270

Intentionally
Blank

Performance Dispatch
Takeoff

Chapter PD
Section 40

Takeoff Field Corrections
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	4310	4280	4260	4230	4200	4110	4020	3930	3840
4600	4730	4700	4670	4630	4600	4510	4410	4320	4220
5000	5150	5110	5080	5040	5000	4900	4800	4700	4600
5400	5570	5530	5490	5440	5400	5300	5190	5090	4980
5800	5990	5940	5900	5850	5800	5690	5580	5470	5360
6200	6430	6370	6320	6260	6200	6080	5970	5850	5740
6600	6890	6820	6750	6670	6600	6480	6350	6230	6110
7000	7350	7260	7180	7090	7000	6870	6740	6610	6480
7400	7810	7710	7610	7500	7400	7260	7120	6980	6850
7800	8270	8150	8040	7920	7800	7650	7510	7360	7220
8200	8720	8590	8460	8330	8200	8040	7880	7720	7560
8600	9150	9010	8870	8740	8600	8420	8240	8060	7880
9000	9580	9430	9290	9140	9000	8800	8600	8400	8200
9400	10010	9850	9700	9550	9400	9180	8960	8740	8520
9800	10440	10280	10120	9960	9800	9560	9320	9080	8840
10200	10880	10710	10540	10370	10200	9940	9680	9420	9160
10600	11330	11140	10960	10780	10600	10320	10040	9760	9480
11000	11780	11580	11390	11190	11000	10700	10400	10100	9800
11400	12230	12020	11810	11610	11400	11080	10760	10440	10120
11800	12680	12460	12240	12020	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	2930	3350	3780	4200	4390	4620	4860	5140
4600	3290	3730	4160	4600	4810	5050	5310	5610
5000	3650	4100	4550	5000	5220	5480	5760	6080
5400	4010	4470	4940	5400	5640	5910	6210	6550
5800	4370	4850	5320	5800	6050	6340	6660	7020
6200	4720	5210	5710	6200	6460	6770	7110	7490
6600	5050	5560	6080	6600	6880	7200	7550	7960
7000	5380	5920	6460	7000	7290	7630	8000	8430
7400	5710	6270	6840	7400	7700	8060	8450	8900
7800	6040	6620	7210	7800	8120	8490	8900	9370
8200	6370	6980	7590	8200	8540	8920	9350	9830
8600	6700	7330	7970	8600	8960	9360	9800	10280
9000	7030	7680	8340	9000	9380	9800	10250	10730
9400	7360	8040	8720	9400	9810	10240	10700	11180
9800	7690	8390	9100	9800	10230	10680	11140	11630
10200	8020	8740	9470	10200	10650	11120	11590	12090
10600	8350	9100	9850	10600	11060	11550	12040	12560
11000	8680	9450	10230	11000	11480	11980	12490	13030
11400	9010	9800	10600	11400	11890	12410	12940	13500
11800	9340	10160	10980	11800	12310	12840	13390	13970

Takeoff Field & Climb Limit Weights

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)											
	OAT											
	°C	-40	15	20	22	24	28	30	32	36	44	50
	°F	-40	59	68	72	75	82	86	90	97	111	122
4000	413.1	373.1	370.0	368.8	367.6	365.2	364.0	360.5	352.5	331.7	314.4	
4200	425.0	384.0	380.8	379.5	378.3	375.8	374.6	371.0	362.8	341.6	323.9	
4600	447.6	404.8	401.5	400.2	398.9	396.4	395.1	391.3	382.8	360.6	342.2	
5000	468.8	424.4	421.0	419.6	418.3	415.6	414.3	410.4	401.5	378.5	359.4	
5400	488.1	442.3	438.7	437.3	436.0	433.2	431.9	427.8	418.7	395.0	375.2	
5800	506.5	459.4	455.8	454.3	452.9	450.1	448.7	444.6	435.1	410.8	390.5	
6200	523.9	475.7	471.9	470.5	469.0	466.1	464.7	460.4	450.8	425.8	405.0	
6600	540.6	491.2	487.4	485.9	484.4	481.4	480.0	475.7	465.8	440.2	418.9	
7000	556.8	506.3	502.4	500.9	499.3	496.3	494.8	490.4	480.3	454.2	432.4	
7400	572.4	520.8	516.8	515.3	513.7	510.6	509.1	504.6	494.3	467.6	445.3	
7800	587.6	535.0	530.9	529.3	527.7	524.5	523.0	518.3	507.8	480.6	457.9	
8200	602.7	549.0	544.8	543.2	541.6	538.4	536.8	532.1	521.3	493.5	470.3	
8600	617.2	562.5	558.2	556.6	554.9	551.6	550.0	545.2	534.2	505.9	482.3	
9000	630.6	574.8	570.5	568.8	567.1	563.8	562.1	557.2	546.1	517.2	493.1	
9400	643.0	586.3	581.8	580.1	578.4	575.0	573.3	568.3	557.0	527.6	503.1	
9800	655.1	597.4	592.9	591.1	589.4	585.9	584.2	579.2	567.6	537.7	512.8	
10200	666.7	608.1	603.6	601.8	600.0	596.5	594.8	589.6	577.9	547.5	522.3	
10600	677.9	618.5	613.9	612.1	610.3	606.8	605.0	599.8	587.9	557.1	531.5	
CLIMB LIMIT WT (1000 LB)	660.6	658.8	658.6	658.5	658.4	658.2	658.1	649.8	630.7	578.2	532.5	

1000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)											
	OAT											
	°C	-40	15	20	22	24	28	30	32	36	44	50
	°F	-40	59	68	72	75	82	86	90	97	111	122
4000	400.0	361.1	358.1	356.9	355.8	353.4	350.3	347.0	339.0	319.3	302.6	
4200	411.5	371.7	368.6	367.4	366.2	363.8	360.6	357.2	349.0	328.9	311.8	
4600	433.6	392.1	388.8	387.6	386.3	383.8	380.5	376.9	368.4	347.4	329.5	
5000	454.3	411.2	407.8	406.5	405.2	402.6	399.1	395.5	386.6	364.8	346.3	
5400	473.1	428.6	425.2	423.8	422.5	419.8	416.2	412.4	403.3	380.8	361.7	
5800	491.0	445.4	441.8	440.4	439.0	436.3	432.6	428.7	419.3	396.2	376.6	
6200	508.1	461.3	457.6	456.2	454.8	452.0	448.2	444.2	434.5	410.8	390.7	
6600	524.4	476.5	472.8	471.3	469.8	467.0	463.1	459.0	449.1	424.9	404.4	
7000	540.2	491.2	487.4	485.9	484.4	481.5	477.6	473.4	463.3	438.5	417.5	
7400	555.5	505.4	501.5	500.0	498.5	495.5	491.5	487.2	476.9	451.6	430.1	
7800	570.3	519.2	515.3	513.7	512.1	509.1	505.0	500.6	490.1	464.2	442.3	
8200	585.1	533.0	528.9	527.3	525.7	522.6	518.4	514.0	503.2	476.9	454.5	
8600	599.3	546.1	542.0	540.4	538.7	535.6	531.3	526.8	515.8	488.9	466.1	
9000	612.3	558.2	553.9	552.3	550.6	547.4	543.1	538.5	527.3	499.9	476.7	
9400	624.4	569.3	565.0	563.3	561.6	558.3	553.9	549.2	537.8	510.0	486.3	
9800	636.2	580.1	575.8	574.1	572.3	569.0	564.5	559.7	548.1	519.8	495.7	
10200	647.5	590.6	586.2	584.5	582.7	579.3	574.8	569.9	558.1	529.4	504.9	
10600	658.5	600.8	596.3	594.5	592.8	589.3	584.7	579.8	567.9	538.7	514.0	
CLIMB LIMIT WT (1000 LB)	643.3	641.6	641.4	641.3	641.2	640.7	633.8	626.2	607.0	557.1	512.9	

With engine bleed for packs off, increase field limit weight by 1400 lb and climb limit weight by 4400 lb.

With engine anti-ice on, decrease field limit weight by 200 lb and climb limit weight by 1100 lb.

With engine and wing anti-ice on, decrease field limit weight by 2300 lb and climb limit weight by 4600 lb.

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Takeoff Field & Climb Limit Weights

Flaps 15

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)											
	OAT											
	°C	-40	15	20	22	24	28	30	32	36	44	50
	°F	-40	59	68	72	75	82	86	90	97	111	122
4000	386.9	349.2	346.2	345.1	343.9	339.6	337.0	333.9	326.2	307.1	290.2	
4200	398.1	359.5	356.5	355.3	354.1	349.7	347.0	343.8	336.0	316.4	299.1	
4600	419.6	379.3	376.1	374.9	373.7	369.0	366.3	363.0	354.8	334.3	316.3	
5000	439.7	397.9	394.6	393.4	392.1	387.3	384.4	381.0	372.4	351.2	332.5	
5400	458.0	414.9	411.6	410.3	409.0	404.0	401.0	397.5	388.7	366.8	347.6	
5800	475.6	431.3	427.8	426.5	425.1	420.0	417.0	413.3	404.3	381.8	362.0	
6200	492.3	446.8	443.3	441.9	440.5	435.3	432.2	428.4	419.2	396.1	375.8	
6600	508.2	461.7	458.1	456.7	455.3	449.9	446.7	442.9	433.4	409.9	389.1	
7000	523.7	476.2	472.5	471.0	469.6	464.1	460.8	456.9	447.2	423.1	401.9	
7400	538.6	490.0	486.3	484.8	483.3	477.7	474.4	470.4	460.5	435.8	414.1	
7800	553.1	503.5	499.6	498.1	496.6	490.9	487.5	483.4	473.3	448.2	426.0	
8200	567.5	516.9	513.0	511.4	509.9	504.1	500.6	496.4	486.1	460.5	437.9	
8600	581.3	529.8	525.7	524.2	522.6	516.6	513.1	508.9	498.4	472.2	449.2	
9000	594.0	541.5	537.4	535.8	534.2	528.1	524.5	520.2	509.5	482.9	459.4	
9400	605.8	552.3	548.2	546.5	544.9	538.7	535.1	530.7	519.8	492.6	468.7	
9800	617.2	562.9	558.6	557.0	555.3	549.0	545.3	540.8	529.8	502.2	477.8	
10200	628.3	573.1	568.8	567.1	565.4	559.0	555.3	550.7	539.5	511.5	486.8	
10600	639.0	583.0	578.7	577.0	575.3	568.8	565.0	560.4	549.0	520.6	495.6	
CLIMB LIMIT WT (1000 LB)	624.8	623.2	623.0	622.8	622.6	615.2	610.0	603.1	584.3	535.2	491.8	

Takeoff Field & Climb Limit Weights

Flaps 15

3000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)											
	OAT											
	°C	-40	15	20	22	24	28	30	32	36	44	50
	°F	-40	59	68	72	75	82	86	90	97	111	122
4000	373.8	337.2	334.3	332.6	330.7	326.4	323.8	320.8	313.7	295.2	278.4	
4200	384.6	347.2	344.3	342.5	340.5	336.1	333.5	330.4	323.1	304.2	287.1	
4600	405.5	366.5	363.4	361.6	359.5	354.9	352.2	349.0	341.3	321.6	303.7	
5000	425.1	384.6	381.4	379.5	377.4	372.6	369.8	366.4	358.5	338.0	319.5	
5400	443.0	401.2	398.0	396.0	393.8	388.9	386.0	382.5	374.4	353.2	334.1	
5800	460.2	417.2	413.9	411.8	409.6	404.5	401.5	398.0	389.6	367.8	348.1	
6200	476.4	432.4	429.0	426.9	424.6	419.4	416.3	412.7	404.1	381.8	361.6	
6600	492.0	447.0	443.5	441.3	438.9	433.6	430.5	426.8	418.0	395.2	374.5	
7000	507.1	461.0	457.5	455.3	452.9	447.4	444.2	440.4	431.4	408.1	387.0	
7400	521.7	474.6	470.9	468.7	466.2	460.7	457.4	453.5	444.3	420.5	399.0	
7800	535.8	487.7	484.0	481.7	479.2	473.5	470.2	466.2	456.8	432.5	410.5	
8200	549.9	500.8	497.0	494.7	492.1	486.4	483.0	478.9	469.3	444.5	422.1	
8600	563.4	513.4	509.5	507.1	504.5	498.6	495.1	491.0	481.2	455.9	433.0	
9000	575.7	524.8	520.8	518.4	515.7	509.7	506.2	502.0	492.0	466.3	443.0	
9400	587.2	535.3	531.3	528.8	526.1	520.0	516.4	512.1	502.0	475.7	452.0	
9800	598.3	545.6	541.5	538.9	536.2	530.0	526.3	522.0	511.7	485.0	460.8	
10200	609.1	555.5	551.4	548.8	546.0	539.7	536.0	531.6	521.1	494.0	469.5	
10600	619.5	565.3	561.0	558.4	555.6	549.2	545.5	541.0	530.4	502.9	478.1	
CLIMB LIMIT WT (1000 LB)	606.5	605.0	604.5	602.2	599.5	592.3	586.9	579.8	562.5	514.5	474.8	

With engine bleed for packs off, increase field limit weight by 1400 lb and climb limit weight by 4400 lb.

With engine anti-ice on, decrease field limit weight by 200 lb and climb limit weight by 1100 lb.

With engine and wing anti-ice on, decrease field limit weight by 2300 lb and climb limit weight by 4600 lb.

Takeoff Obstacle Limit Weight

Flaps 15

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off
Sea Level, 30°C & Below, Zero Wind

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	522.3	580.8	628.0	664.2	685.1	703.4			
50	493.7	547.0	590.7	625.5	653.7	671.4	685.7	698.3	708.8
100	465.5	515.2	556.5	590.3	618.3	642.2	660.8	673.2	683.8
150	440.7	489.7	529.4	563.8	592.9	616.6	636.2	652.5	664.6
200	419.6	468.4	507.8	542.5	571.4	595.4	615.2	632.0	646.2
250	401.2	448.9	489.9	523.9	552.6	576.8	597.0	614.1	628.8
300	384.8	433.0	474.1	507.3	535.8	560.0	580.7	598.1	613.1
350	370.0	418.7	459.4	492.4	520.6	544.9	565.7	583.6	598.9
400	357.5	405.6	445.7	478.9	506.8	531.0	551.9	570.0	585.8
450	346.2	393.5	433.0	466.4	494.0	518.1	539.1	557.4	573.5
500		382.3	421.3	454.4	482.3	506.2	527.2	545.7	561.9
550		371.9	410.4	443.2	471.3	495.0	516.0	534.6	551.0
600		362.2	400.2	432.7	460.7	484.6	505.5	524.1	540.6
650		353.0	390.6	422.8	450.7	474.8	495.6	514.3	530.9
700		344.4	381.5	413.5	441.2	465.5	486.3	504.9	521.5
750		346.6	373.0	404.6	432.2	456.4	477.4	495.9	512.7
800			364.8	396.2	423.6	447.7	469.0	487.5	504.2
850			357.1	388.2	415.5	439.5	460.7	479.4	496.1
900			349.7	380.6	407.7	431.6	452.8	471.7	488.3
950			342.7	373.4	400.3	424.0	445.2	464.2	480.9
1000				366.4	393.1	416.8	437.9	456.9	473.8

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)						
	400	450	500	550	600	650	700
30 & Below	0	0	0	0	0	0	0
32	-6.0	-6.8	-7.5	-8.3	-9.1	-9.9	-10.6
34	-12.0	-13.5	-15.1	-16.6	-18.2	-19.7	-21.3
36	-18.0	-20.3	-22.6	-25.0	-27.3	-29.6	-31.9
38	-24.0	-27.1	-30.2	-33.3	-36.4	-39.5	-42.6
40	-30.0	-33.9	-37.7	-41.6	-45.5	-49.3	-53.2
42	-37.4	-42.5	-47.7	-52.8	-57.9	-63.0	-68.2
44	-44.8	-51.2	-57.6	-64.0	-70.3	-76.7	-83.1
46	-52.2	-59.8	-67.5	-75.1	-82.8	-90.4	-98.1
48	-59.6	-68.5	-77.4	-86.3	-95.2	-104.1	-113.0
50	-67.0	-77.2	-87.3	-97.5	-107.7	-117.8	-128.0

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	400	450	500	550	600	650	700
S.L. & Below	0	0	0	0	0	0	0
1000	-14.9	-16.7	-18.5	-20.2	-22.0	-23.8	-25.6
2000	-29.7	-33.1	-36.5	-39.9	-43.3	-46.7	-50.1
3000	-43.6	-48.8	-54.0	-59.1	-64.3	-69.5	-74.6

Takeoff Obstacle Limit Weight

Flaps 15

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	400	450	500	550	600	650	700
15 TW	-57.6	-57.6	-57.6	-57.6	-57.6	-57.6	-57.5
10 TW	-38.4	-38.4	-38.4	-38.4	-38.4	-38.4	-38.4
5 TW	-19.2	-19.2	-19.2	-19.2	-19.2	-19.2	-19.2
0	0	0	0	0	0	0	0
10 HW	8.2	7.7	7.1	6.5	6.0	5.4	4.8
20 HW	16.5	15.3	14.2	13.1	11.9	10.8	9.6
30 HW	25.8	23.8	21.9	20.0	18.1	16.1	14.2
40 HW	35.1	32.4	29.6	26.9	24.2	21.5	18.7

With engine bleed for packs off, increase weight by 1700 lb.

With engine anti-ice on, decrease weight by 1000 lb.

With engine and wing anti-ice on, decrease weight by 3200 lb.

Tire Speed Limit Flaps 15

AIRPORT		TIRE SPEED LIMIT WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	715.0	701.8	651.8	602.8	556.8	514.0
52	126	715.0	705.6	655.7	606.3	560.1	517.0
50	122	715.0	709.4	659.5	609.8	563.3	519.9
48	118	715.0	711.6	663.2	613.5	566.7	523.0
46	115	715.0	713.8	666.9	617.1	570.1	526.1
44	111	715.0	715.0	670.7	620.8	573.6	529.3
42	108	715.0	715.0	674.5	624.5	577.0	532.6
40	104	715.0	715.0	678.2	628.2	580.5	535.9
38	100	715.0	715.0	682.3	632.1	584.1	539.2
36	97	715.0	715.0	686.3	636.0	587.7	542.5
34	93	715.0	715.0	690.4	640.0	591.3	545.9
32	90	715.0	715.0	694.7	644.2	595.2	549.6
30	86	715.0	715.0	699.1	648.6	599.3	553.4
28	82	715.0	715.0	703.7	653.1	603.4	557.3
26	79	715.0	715.0	708.4	657.7	607.7	561.2
24	75	715.0	715.0	713.1	662.5	612.1	565.1
22	72	715.0	715.0	715.0	667.0	616.5	569.2
20	68	715.0	715.0	715.0	671.6	621.0	573.4
18	64	715.0	715.0	715.0	676.3	625.6	577.6
16	61	715.0	715.0	715.0	681.1	630.2	581.8
14	57	715.0	715.0	715.0	686.0	634.9	586.2
12	54	715.0	715.0	715.0	691.0	639.7	590.6
10	50	715.0	715.0	715.0	696.0	644.7	595.0
-40	-40	715.0	715.0	715.0	715.0	715.0	715.0

Increase tire speed limit weight by 5200 lb per knot headwind.

Decrease tire speed limit weight by 6600 lb per knot tailwind.

777 Flight Crew Operations Manual

Brake Energy Limits VMBE

Maximum Brake Energy Speed

OAT (°C)	REFERENCE VMBE (KIAS)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	195	188				
50	196	189	182			
46	196	189	182	176		
42	196	189	183	176	170	
38	197	190	183	176	170	164
34	199	190	184	177	171	165
30	200	191	184	178	172	165
26	202	193	185	179	173	167
22	204	194	187	180	174	168
18	206	196	189	182	175	169
14	208	198	190	183	176	170
10	210	200	192	185	178	171
6	210	202	194	186	179	173
2	210	204	196	188	181	174
-2	210	206	198	190	183	176
-6	210	208	200	192	185	178
-10	210	210	202	194	186	179

Weight Adjusted VMBE

WEIGHT (1000 LB)	REFERENCE VMBE (KIAS)										
	160	165	170	175	180	185	190	195	200	205	210
420	185	191	197	204	210	210	210	210	210	210	210
440	180	186	192	198	204	210	210	210	210	210	210
460	175	181	187	192	198	204	210	210	210	210	210
480	171	176	182	187	193	199	204	210	210	210	210
500	167	172	178	183	188	194	199	204	210	210	210
520	163	168	174	179	184	189	194	200	205	210	210
540	160	165	170	175	180	185	190	195	200	205	210
560	157	162	167	171	176	181	186	191	196	200	205
580	154	159	163	168	173	177	182	187	191	196	201
600	151	156	160	165	169	174	178	183	187	192	197
620	149	153	157	162	166	171	175	179	184	188	193
640	146	151	155	159	164	168	172	176	181	185	189
660	144	148	153	157	161	165	169	173	177	182	186

Increase VMBE by 3 knots per 1% uphill runway slope. Decrease VMBE by 6 knots per 1% downhill runway slope.

Increase VMBE by 5 knot per 10 knots headwind. Decrease VMBE by 23 knots per 10 knots tailwind.

Decrease VMBE by 11 knots for one brake deactivated and 22 knots for two brakes deactivated.

Decrease brake release weight by 5200 lb for each knot V1 exceeds VMBE.

Determine normal V1, VR, V2 speeds for lower brake release weight.

Takeoff Speeds

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
680	170	179	184
660	167	176	181
640	164	173	179
620	161	170	176
600	158	167	174
580	154	164	171
560	151	161	169
540	147	157	166
520	144	154	163
500	140	151	160
480	136	147	158
460	132	143	155
440	127	140	151
420	122	136	148
400	117	132	145
380	113	128	142
360	108	124	138
340	102	119	134

Check V1(MCG) and minimum VR.

V1, VR, V2 Adjustments*

TEMP		V1					VR					V2				
		PRESS ALT (FT)					PRESS ALT (FT)					PRESS ALT (FT)				
°C	°F	-2000	0	1000	2000	3000	-2000	0	1000	2000	3000	-2000	0	1000	2000	3000
50	122	5	8	9	11	12	2	3	4	4	5	-1	-2	-2	-2	-2
40	104	0	4	5	6	8	0	2	2	3	3	0	-1	-1	-1	-1
30	86	0	0	2	3	5	0	0	1	2	2	0	0	0	-1	-1
20	68	0	0	1	2	3	0	0	1	1	1	0	0	0	0	-1
-40	-40	0	0	1	2	3	0	0	1	1	1	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
680	-5	-2	0	3	5	-3	-1	-1	0	0	1	1	2
660	-5	-2	0	3	5	-3	-1	-1	0	0	1	1	2
620	-4	-2	0	3	5	-2	-1	0	0	1	2	2	2
580	-3	-1	0	3	5	-1	0	0	0	1	2	2	2
540	-3	-1	0	3	4	-1	0	0	0	1	2	2	3
500	-2	0	0	3	4	-1	0	0	0	1	2	2	3
460	-2	0	0	3	4	-1	0	0	0	1	2	2	3
420	-2	0	0	3	4	-1	0	0	0	1	2	2	3
380	-2	0	0	3	4	-1	0	0	0	1	2	2	3
340	-2	0	0	3	4	-1	0	0	0	1	2	2	3

*V1 not to exceed VR

Takeoff Speeds

Flaps 15

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)									
		-2000		0		1000		2000		3000	
°C	°F	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR
50	122	104	109	100	105	98	104	96	102	95	101
40	104	110	114	106	111	104	109	102	107	100	105
30	86	110	115	110	115	108	113	106	111	103	109
20	68	110	115	110	115	108	113	107	112	105	110
-40	-40	111	115	111	115	109	113	107	112	106	110

Performance Dispatch Enroute

Chapter PD Section 41

Long Range Cruise Maximum Operating Altitude

Max Climb 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°)
660	29500	0	32800*	32800*	32800*	32800*	32200
640	30100	-1	33600*	33600*	33600*	33600*	32900
620	30800	-3	34300*	34300*	34300*	34300*	33500
600	31500	-4	35100*	35100*	35100*	35100*	34200
580	32300	-6	35800*	35800*	35800*	35800*	35000
560	33000	-8	36300*	36300*	36300*	36300*	35700
540	33800	-9	37000*	37000*	37000*	37000*	36400
520	34600	-11	37800*	37800*	37800*	37800*	37200
500	35400	-13	38600*	38600*	38600*	38600*	38000
480	36300	-14	39400*	39400*	39400*	39400*	38900
460	37200	-14	40200*	40200*	40200*	40200*	39800
440	38100	-14	41100*	41100*	41100*	41100*	40700
420	39100	-14	42000*	42000*	42000*	42000*	41700
400	40100	-14	43000*	43000*	43000*	43000*	42700
380	41100	-14	43100	43100	43100	43100	43100
360	42300	-14	43100	43100	43100	43100	43100
340	43100	-14	43100	43100	43100	43100	43100

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°)
660	29500	6	31800*	31800*	31800*	31800*	31800*
640	30100	5	32600*	32600*	32600*	32600*	32600*
620	30800	3	33400*	33400*	33400*	33400*	33400*
600	31500	1	34300*	34300*	34300*	34300*	34200
580	32300	0	35100*	35100*	35100*	35100*	35000
560	33000	-2	35800*	35800*	35800*	35800*	35700
540	33800	-4	36400*	36400*	36400*	36400*	36400
520	34600	-5	37200*	37200*	37200*	37200*	37200
500	35400	-7	38000*	38000*	38000*	38000*	38000
480	36300	-9	38800*	38800*	38800*	38800*	38800*
460	37200	-9	39600*	39600*	39600*	39600*	39600*
440	38100	-9	40500*	40500*	40500*	40500*	40500*
420	39100	-9	41400*	41400*	41400*	41400*	41400*
400	40100	-9	42300*	42300*	42300*	42300*	42300*
380	41100	-9	43100	43100	43100	43100	43100
360	42300	-9	43100	43100	43100	43100	43100
340	43100	-9	43100	43100	43100	43100	43100

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

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°)
660	29500	12	30300*	30300*	30300*	30300*	30300*
640	30100	10	31200*	31200*	31200*	31200*	31200*
620	30800	9	32100*	32100*	32100*	32100*	32100*
600	31500	7	33000*	33000*	33000*	33000*	33000*
580	32300	6	34000*	34000*	34000*	34000*	34000*
560	33000	4	34900*	34900*	34900*	34900*	34900*
540	33800	2	35600*	35600*	35600*	35600*	35600*
520	34600	0	36200*	36200*	36200*	36200*	36200*
500	35400	-2	37000*	37000*	37000*	37000*	37000*
480	36300	-3	37800*	37800*	37800*	37800*	37800*
460	37200	-3	38700*	38700*	38700*	38700*	38700*
440	38100	-3	39500*	39500*	39500*	39500*	39500*
420	39100	-3	40400*	40400*	40400*	40400*	40400*
400	40100	-3	41300*	41300*	41300*	41300*	41300*
380	41100	-3	42300*	42300*	42300*	42300*	42300*
360	42300	-3	43100	43100	43100	43100	43100
340	43100	-3	43100	43100	43100	43100	43100

*Denotes altitude thrust limited in level flight, 300 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
527	496	468	443	420	400	382	366	351	337	324
1041	982	929	882	839	800	766	735	706	679	655
1553	1468	1390	1320	1258	1200	1150	1104	1061	1022	987
2063	1952	1850	1758	1676	1600	1534	1473	1417	1365	1318
2572	2435	2309	2196	2094	2000	1919	1843	1773	1708	1649
3079	2916	2767	2633	2512	2400	2303	2213	2129	2051	1980
3584	3397	3224	3070	2929	2800	2687	2582	2485	2395	2312
4089	3877	3681	3506	3347	3200	3072	2952	2841	2738	2644
4594	4356	4138	3942	3764	3600	3456	3322	3197	3082	2976
5097	4835	4594	4378	4182	4000	3840	3692	3553	3425	3308
5599	5313	5050	4814	4599	4400	4225	4061	3909	3769	3640
6101	5791	5506	5249	5016	4800	4609	4431	4265	4112	3972
6603	6269	5961	5685	5433	5200	4994	4801	4622	4456	4304
7105	6746	6417	6120	5850	5600	5378	5170	4978	4800	4636
7607	7224	6873	6556	6267	6000	5762	5540	5334	5143	4968
8109	7703	7329	6991	6684	6400	6147	5910	5690	5486	5299
8612	8181	7785	7427	7101	6800	6531	6280	6046	5830	5631
9114	8659	8241	7863	7519	7200	6915	6649	6402	6173	5963
9617	9138	8696	8298	7936	7600	7300	7019	6758	6517	6295
10119	9616	9152	8734	8353	8000	7684	7389	7114	6860	6627

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	29		31		33		35 & 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)
400	16.1	1:02	16.1	1:02	15.9	1:02	15.9	1:02
800	29.3	1:56	28.8	1:56	28.4	1:56	28.1	1:56
1200	42.6	2:48	41.8	2:48	41.0	2:48	40.5	2:48
1600	56.2	3:40	55.0	3:40	53.9	3:40	53.2	3:40
2000	69.8	4:31	68.2	4:31	66.8	4:31	65.9	4:31
2400	83.9	5:22	81.9	5:22	80.3	5:22	79.4	5:22
2800	98.1	6:12	95.7	6:12	93.8	6:12	92.8	6:12
3200	112.5	7:02	109.8	7:02	107.7	7:02	106.8	7:02
3600	127.3	7:52	124.3	7:52	122.0	7:52	121.2	7:52
4000	142.0	8:41	138.7	8:41	136.3	8:41	135.7	8:41
4400	157.5	9:30	153.9	9:30	151.5	9:30	151.6	9:30
4800	172.9	10:19	169.1	10:19	166.7	10:19	167.5	10:19
5200	188.7	11:08	184.8	11:08	182.6	11:08		
5600	204.9	11:57	200.9	11:57	199.1	11:57		
6000	221.1	12:45	217.0	12:45	215.6	12:45		
6400	238.1	13:34	234.2	13:34				
6800	255.0	14:23	251.4	14:23				
7200	272.6	15:11						
7600	290.9	16:00						
8000	309.1	16:49						

Long Range Cruise Trip Fuel and Time Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	350	400	450	500	550
20	-2.5	-1.3	0.0	1.5	3.1
40	-4.9	-2.5	0.0	3.0	6.5
60	-7.3	-3.6	0.0	4.7	10.3
80	-9.8	-4.9	0.0	6.5	14.7
100	-12.3	-6.1	0.0	8.6	19.4
120	-14.9	-7.5	0.0	10.8	24.7
140	-17.5	-8.8	0.0	13.2	30.4
160	-20.2	-10.2	0.0	15.7	36.5
180	-23.0	-11.7	0.0	18.4	43.1
200	-25.8	-13.2	0.0	21.3	50.2
220	-28.6	-14.7	0.0	24.4	57.7
240	-31.6	-16.3	0.0	27.6	65.7
260	-34.5	-17.9	0.0	31.0	74.2
280	-37.5	-19.6	0.0	34.5	83.1
300	-40.6	-21.4	0.0	38.3	92.5
320	-43.8	-23.1	0.0	42.2	102.3
340	-46.9	-25.0	0.0	46.3	112.6

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

Long Range Cruise Step Climb
Ground to Air Miles Conversion

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
1293	1221	1157	1100	1047	1000	957	917	880	847	815
1923	1820	1728	1645	1569	1500	1437	1379	1325	1276	1230
2553	2419	2299	2190	2091	2000	1917	1841	1770	1705	1644
3183	3018	2869	2735	2612	2500	2397	2302	2215	2134	2058
3812	3617	3440	3280	3134	3000	2877	2764	2660	2563	2473
4442	4215	4010	3824	3655	3500	3358	3226	3105	2992	2888
5072	4814	4581	4369	4177	4000	3838	3688	3550	3422	3302
5701	5412	5151	4914	4698	4500	4318	4150	3995	3851	3717
6331	6011	5722	5459	5219	5000	4798	4612	4440	4280	4131
6961	6610	6292	6004	5741	5500	5278	5074	4885	4709	4546
7591	7208	6863	6549	6262	6000	5759	5536	5330	5139	4961
8221	7807	7433	7094	6784	6500	6239	5998	5775	5568	5375
8851	8406	8004	7639	7306	7000	6719	6460	6220	5997	5789
9481	9005	8575	8184	7827	7500	7199	6921	6664	6426	6204
10112	9605	9146	8729	8349	8000	7679	7383	7109	6855	6618

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB)					TIME (HRS:MIN)
	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	
1000	28.6	31.9	34.6	37.7	40.8	2:16
1500	41.2	46.0	50.4	55.0	59.6	3:18
2000	54.2	60.6	66.6	72.7	79.0	4:20
2500	67.6	75.5	83.3	91.0	98.9	5:22
3000	81.4	90.9	100.4	109.8	119.4	6:24
3500	95.5	106.9	118.0	129.2	140.4	7:25
4000	110.1	123.3	136.1	149.2	162.0	8:27
4500	125.0	140.1	154.8	169.6	184.3	9:29
5000	140.4	157.5	174.0	190.6	207.4	10:31
5500	156.3	175.3	193.8	212.2	231.2	11:32
6000	172.7	193.6	214.2	234.6	256.0	12:34
6500	189.6	212.5	235.0	257.6	282.3	13:36
7000	206.9	232.0	256.5	281.5	308.5	14:38
7500	224.7	252.0	278.7	306.2	337.5	15:40
8000	243.0	272.6	301.5	331.9	366.4	16:43

Based on 310/.84 climb, LRC and .84/310/250 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
94	80	69	61	55	50	46	42	39	36	34
159	142	129	118	108	100	93	87	82	77	73
224	204	187	173	161	150	141	132	125	119	113
287	264	245	228	213	200	189	178	169	161	153
349	324	301	282	265	250	237	224	214	204	195
411	382	358	336	317	300	285	271	258	247	236
472	441	414	390	369	350	333	317	303	290	278
534	500	471	445	421	400	381	364	348	333	320
597	560	528	499	473	450	429	410	392	376	361
661	621	586	554	526	500	477	456	436	418	402

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 LB)					TIME (HRS:MIN)
		350	400	450	500	550	
50	FUEL (1000 LB)	3.5	3.8	4.0	4.3	4.6	0:14
	ALT (FT)	11000	9000	9000	9000	9000	
100	FUEL (1000 LB)	5.4	5.7	6.0	6.4	6.8	0:22
	ALT (FT)	17000	17000	17000	15000	15000	
150	FUEL (1000 LB)	7.1	7.5	8.0	8.5	9.0	0:30
	ALT (FT)	21000	21000	21000	21000	19000	
200	FUEL (1000 LB)	8.6	9.1	9.7	10.4	11.0	0:36
	ALT (FT)	29000	25000	25000	23000	23000	
250	FUEL (1000 LB)	10.0	10.7	11.4	12.2	13.0	0:43
	ALT (FT)	31000	29000	27000	27000	25000	
300	FUEL (1000 LB)	11.3	12.2	13.1	13.9	14.9	0:48
	ALT (FT)	37000	35000	31000	29000	27000	
350	FUEL (1000 LB)	12.5	13.5	14.6	15.6	16.7	0:54
	ALT (FT)	39000	37000	35000	31000	29000	
400	FUEL (1000 LB)	13.7	14.9	16.1	17.3	18.5	1:00
	ALT (FT)	39000	37000	35000	33000	31000	
450	FUEL (1000 LB)	15.0	16.3	17.6	18.9	20.3	1:06
	ALT (FT)	39000	37000	35000	33000	31000	
500	FUEL (1000 LB)	16.2	17.6	19.1	20.6	22.1	1:13
	ALT (FT)	41000	37000	35000	33000	31000	

Holding Planning
Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
660	19330	19010	18750	18570	19100	19500	20510			
620	18120	17920	17630	17320	17650	18150	18860			
580	17220	17070	16770	16380	16200	16850	17340	18550		
540	16100	15890	15690	15270	15110	15570	15920	16790		
500	15010	14740	14610	14190	13860	14190	14590	15210		
460	13930	13670	13490	13130	12760	12800	13330	13690	15160	
420	12860	12620	12370	12090	11790	11770	12050	12300	13340	
380	11810	11580	11320	11060	10850	10610	10850	11020	11700	12440
340	10800	10550	10320	10050	9910	9610	9540	9850	10220	10760

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
660	20100	19880	19700	19200	19370
620	18840	18630	18490	17990	17990
580	17910	17670	17470	17040	16580
540	16710	16460	16270	15860	15590
500	15510	15260	15070	14720	14440
460	14320	14090	13880	13580	13320
420	13140	12930	12720	12460	12240
380	11970	11770	11590	11350	11190
340	10850	10640	10470	10270	10160

These tables include 5% additional fuel for holding in a racetrack pattern.

Crew Oxygen Requirements

Required Pressure (PSI) for One 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

For more extensive than normal crew usage, add 1.2 psi/person/minute.

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
27	351.2	347.7	
26	365.9	363.7	350.5
25	380.6	380.3	365.9
24	395.8	393.6	378.6
23	411.3	407.3	391.9
22	427.4	421.2	405.6
21	444.0	435.3	419.4
20	460.9	449.9	433.4
19	486.0	468.2	447.7
18	512.1	487.1	461.8
17	532.5	506.1	478.7
16	553.5	525.6	495.9
15	575.1	545.8	513.5
14	597.4	566.5	531.4
13	621.6	589.5	554.4
12	646.5	613.4	578.3
11	654.0	620.6	585.8
10	661.1	623.5	590.8
9	675.1	637.0	603.6
8	686.8	649.8	616.1
7	697.7	661.9	628.7
6	709.0	673.1	641.3
5	715.0	683.9	653.5
4	715.0	693.8	663.6

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)										
	PRESSURE ALTITUDE (1000 FT)										
	6	8	10	12	14	16	18	20	22	24	26
ENGINE ONLY	-12.6	-9.2	-7.6	-5.7	-4.4	-5.1	-6.2	-7.4	-7.2	-7.1	-6.7
ENGINE AND WING	-19.6	-15.8	-13.0	-10.2	-8.6	-9.2	-10.3	-11.9	-11.6	-11.2	-10.3

Intentionally
Blank

Performance Dispatch
Landing

Chapter PD
Section 42

Landing Field Limit Weight

Flaps 30

Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000			2650	3000	3210	3430	3640	3850
3400		2690	3010	3400	3610	3840	4070	4310
3800	2740	3030	3370	3800	4010	4250	4500	4770
4200	3070	3380	3740	4200	4420	4670	4930	5230
4600	3400	3730	4110	4600	4840	5100	5380	5680
5000	3730	4080	4480	5000	5250	5530	5820	6140
5400	4060	4430	4850	5400	5670	5960	6270	6600
5800	4390	4790	5220	5800	6090	6390	6710	7050
6200	4720	5140	5590	6200	6500	6820	7160	7510
6600	5050	5490	5960	6600	6920	7250	7610	7980
7000	5380	5850	6330	7000	7330	7680	8050	8440
7400	5710	6200	6700	7400	7740	8110	8520	8960
7800	6040	6550	7070	7800	8150	8550	8990	9470
8200	6370	6900	7440	8200	8560	8980	9450	9990
8600	6710	7260	7820	8600	8970	9410	9920	10500
9000	7040	7610	8190	9000	9390	9860	10400	11020
9400	7370	7960	8560	9400	9820	10310	10880	11510
9800	7660	8280	8920	9800	10250	10760	11350	12010
10200	7930	8590	9280	10200	10670	11210	11820	12500
10600	8200	8900	9640	10600	11100	11660	12290	12990

Landing Field Limit Weight

Flaps 30

Field Limit Weight (1000 LB)[illegible]

With manual speedbrakes, decrease weight by 36800 lb.

With 1 brake deactivated, decrease weight by 36200 lb.

With 2 brakes deactivated, decrease weight by 73800 lb.

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	129	509.5			
52	126	524.1	504.0		
50	122	539.1	519.0	497.5	
48	118	555.3	533.9	512.5	493.3
46	115	571.0	549.5	526.9	506.8
44	111	586.0	564.3	541.8	520.4
42	108	600.7	578.4	555.9	533.9
40	104	614.6	591.8	569.1	546.8
38	100	628.0	604.4	581.5	559.3
36	97	640.3	616.1	592.9	570.6
34	93	651.1	627.0	603.2	581.0
32	90	660.2	636.1	612.5	588.7
30	86	668.7	644.0	619.6	596.1
28	82	668.8	651.9	625.1	601.9
26	79	668.9	652.0	630.4	606.1
24	75	669.0	652.2	633.1	610.0
22	72	669.2	652.3	633.3	612.9
20	68	669.3	652.4	633.4	615.3
18	64	669.4	652.5	633.5	615.4
16	61	669.5	652.6	633.6	615.5
14	57	669.6	652.8	633.7	615.6
12	54	669.8	652.9	633.8	615.7
10 & BELOW	50 & BELOW	669.9	653.0	634.0	615.9

Based on engine bleed for 2 packs on and engine anti-ice on or off and wing anti-ice off.

With engine bleed for packs off, increase weight by 4800 lb.

With engine anti-ice on, decrease weight by 1100 lb.

With engine and wing anti-ice on, decrease weight by 4800 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 43300 lb.

ADVISORY INFORMATION

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

Quick Turnaround Limit Weight

Flaps 30 Limit Weight (1000 LB)

AIRPORT OAT		PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	512				
50	122	516	496			
45	113	520	500	481		
40	104	525	504	484	466	
35	95	530	509	489	470	452
30	86	534	513	493	474	456
25	77	539	518	497	478	460
20	68	544	523	502	482	464
15	59	550	528	507	486	468
10	50	555	533	512	491	472
5	41	560	538	517	496	476
0	32	566	544	522	501	480
-5	23	572	549	527	506	485
-10	14	578	555	533	511	490
-15	5	584	561	538	516	495
-20	-4	591	567	544	522	500
-30	-22	604	580	556	534	511
-40	-40	618	594	570	546	523
-50	-58	633	608	584	560	536
-54	-65	640	614	589	565	541

Increase weight by 4800 lb per 1% uphill slope. Decrease weight by 10700 lb per 1% downhill slope.
 Increase weight by 13000 lb per 10 knots headwind. Decrease weight by 74000 lb per 10 knots tailwind.

Decrease weight by 28000 lb when one brake is deactivated. Decrease weight by 57300 lb when two brakes are deactivated.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Intentionally
Blank

Performance Dispatch

Chapter PD

Gear Down

Section 43

GEAR DOWN

Takeoff Climb Limit Weight

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 LB)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	129	369.1	361.1	358.5	355.6
52	126	378.8	363.3	358.5	355.4
50	122	388.5	374.1	360.7	355.4
48	118	398.2	384.9	371.0	357.6
46	115	408.3	395.5	381.6	367.5
44	111	418.0	406.3	391.5	377.0
42	108	427.0	416.2	401.2	386.5
40	104	435.8	425.5	410.9	395.9
38	100	444.7	434.7	420.0	405.0
36	97	453.5	443.6	428.8	413.8
34	93	462.5	451.9	436.7	422.4
32	90	471.6	459.9	444.4	429.9
30	86	480.4	467.2	451.7	437.2
28	82	489.6	474.0	457.9	443.3
26	79	498.2	481.7	464.1	448.9
24	75	502.6	489.0	470.7	454.1
22	72	502.6	492.3	477.1	459.9
20	68	502.6	492.3	480.2	465.6
18	64	502.6	492.3	480.2	468.0
16	61	502.6	492.3	480.2	468.0
14	57	502.6	492.3	479.9	468.0
12	54	502.9	492.3	479.9	468.0
10	50	502.9	492.3	479.9	468.0

With engine anti-ice on, decrease weight by 17000 lb.
With engine and wing anti-ice on, decrease weight by 23100 lb.

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	129	439.8			
52	126	452.1	435.0		
50	122	464.7	447.8	429.5	
48	118	478.5	460.6	442.5	426.2
46	115	491.7	473.6	454.8	437.8
44	111	504.3	485.9	467.1	449.3
42	108	516.7	497.6	478.7	460.3
40	104	528.6	509.1	489.7	470.9
38	100	540.4	520.0	500.4	481.3
36	97	551.1	530.0	510.1	490.9
34	93	560.0	539.0	518.4	499.5
32	90	567.8	546.8	526.3	506.0
30	86	575.2	553.7	532.6	512.3
28	82	575.3	560.2	537.3	517.0
26	79	575.4	560.3	541.7	520.4
24	75	575.6	560.4	544.0	523.6
22	72	575.7	560.5	544.1	526.0
20	68	575.7	560.6	544.2	528.0
18	64	575.8	560.7	544.3	528.1
16	61	575.9	560.8	544.3	528.1
14	57	576.0	560.9	544.4	528.2
12	54	576.2	561.0	544.5	528.3
10	50	576.3	561.1	544.6	528.4
-40	-40	578.0	562.8	546.3	530.0

Based on engine bleed for 2 packs on, APU on or off, engine anti-ice off and wing anti-ice off.

With engine bleed for packs off, increase weight by 4000 lb.

With engine anti-ice on, decrease weight by 1000 lb.

With engine and wing anti-ice on, decrease weight by 4200 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 57600 lb.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 30°C & Below, Zero Wind

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	506.0	542.7	573.4	598.1					
50	484.0	517.4	544.5	566.1	582.9	595.6			
100	455.7	494.1	520.0	540.9	557.8	571.3	582.0	590.6	597.5
150	431.8	474.1	500.6	521.5	538.5	552.5	564.0	573.5	581.3
200	412.1	453.8	484.4	505.1	522.3	536.8	548.8	558.8	567.3
250	395.1	436.0	468.0	490.8	508.2	522.9	535.3	545.9	554.9
300	380.0	420.4	452.4	477.6	495.4	510.4	523.2	534.1	543.6
350	366.5	406.5	438.3	464.0	484.0	499.0	512.0	523.3	533.1
400	354.3	393.8	425.5	451.3	472.3	488.5	501.7	513.3	523.3
450	343.1	382.2	413.7	439.6	461.0	478.6	492.1	503.9	514.2
500	343.9	371.4	402.9	428.7	450.3	468.4	483.2	495.0	505.6
550		361.4	392.7	418.6	440.3	458.6	474.1	486.8	497.4
600		352.1	383.2	409.1	430.9	449.4	465.2	478.7	489.7
650		343.4	374.3	400.2	422.0	440.7	456.7	470.5	482.3
700			365.9	391.7	413.6	432.4	448.6	462.6	474.8
750			357.9	383.7	405.6	424.5	440.8	455.0	467.5
800			350.3	376.0	398.0	416.9	433.4	447.8	460.4
850			343.2	368.8	390.7	409.7	426.2	440.8	453.6
900				361.8	383.8	402.8	419.4	434.0	447.0
950				355.2	377.1	396.2	412.9	427.6	440.6
1000				348.8	370.7	389.8	406.5	421.3	434.5

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 LB)							
	340	380	420	460	500	540	580	620
30 & Below	0	0	0	0	0	0	0	0
32	-4.9	-5.6	-6.4	-7.2	-7.9	-8.7	-9.4	-10.2
34	-9.8	-11.3	-12.8	-14.3	-15.8	-17.3	-18.8	-20.3
36	-14.7	-16.9	-19.2	-21.5	-23.7	-26.0	-28.2	-30.5
38	-19.6	-22.6	-25.6	-28.6	-31.6	-34.6	-37.6	-40.6
40	-24.5	-28.2	-32.0	-35.8	-39.5	-43.3	-47.0	-50.8
42	-31.6	-36.4	-41.2	-45.9	-50.7	-55.5	-60.2	-65.0
44	-38.7	-44.5	-50.3	-56.1	-61.9	-67.7	-73.5	-79.2
46	-45.9	-52.7	-59.5	-66.3	-73.1	-79.9	-86.7	-93.5
48	-53.0	-60.8	-68.6	-76.4	-84.2	-92.1	-99.9	-107.7
50	-60.1	-68.9	-77.8	-86.6	-95.4	-104.3	-113.1	-121.9

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	340	380	420	460	500	540	580	620
S.L. & Below	0	0	0	0	0	0	0	0
1000	-12.7	-14.2	-15.6	-17.1	-18.6	-20.0	-21.5	-23.0
2000	-26.6	-29.5	-32.3	-35.2	-38.0	-40.9	-43.7	-46.5
3000	-39.8	-44.1	-48.3	-52.6	-56.8	-61.1	-65.3	-69.6

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	340	380	420	460	500	540	580	620
15 TW	-54.4	-51.7	-49.0	-46.4	-43.7	-41.0	-38.4	-35.7
10 TW	-36.3	-34.5	-32.7	-30.9	-29.1	-27.4	-25.6	-23.8
5 TW	-18.1	-17.2	-16.3	-15.5	-14.6	-13.7	-12.8	-11.9
0	0	0	0	0	0	0	0	0
10 HW	8.0	7.2	6.3	5.5	4.7	3.8	3.0	2.2
20 HW	16.0	14.3	12.7	11.0	9.3	7.7	6.0	4.3
30 HW	24.0	21.7	19.3	17.0	14.7	12.3	10.0	7.7
40 HW	32.0	29.0	26.0	23.0	20.0	17.0	14.0	11.0

With engine bleed for packs off, increase weight by 300 lb.

With engine anti-ice on, decrease weight by 2400 lb.

With engine and wing anti-ice on, decrease weight by 3500 lb.

GEAR DOWN

Long Range Cruise Altitude Capability
Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	14400	14300	12000
640	15800	15700	13600
620	17100	17000	15100
600	18400	18300	16500
580	19700	19600	17900
560	20800	20700	19300
540	21900	21800	20500
520	23000	22900	21700
500	24200	24100	22800
480	25300	25200	24000
460	26300	26100	25100
440	27300	27100	26200
420	28300	28000	27200
400	29400	29100	28300
380	30600	30100	29400
360	31500	31200	30600
340	32200	31900	31500

GEAR DOWN

**Long Range Cruise Trip Fuel and Time
Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	350	400	450	500	550
20	-2.4	-1.2	0.0	1.6	3.3
40	-4.6	-2.3	0.0	3.2	6.6
60	-6.7	-3.4	0.0	4.8	10.1
80	-8.9	-4.5	0.0	6.5	13.7
100	-11.2	-5.6	0.0	8.2	17.4
120	-13.5	-6.8	0.0	10.1	21.3
140	-15.8	-8.0	0.0	12.0	25.4
160	-18.1	-9.2	0.0	14.0	29.7
180	-20.5	-10.4	0.0	16.0	34.0
200	-22.9	-11.7	0.0	18.2	38.6
220	-25.4	-12.9	0.0	20.4	43.3
240	-27.9	-14.2	0.0	22.6	48.2
260	-30.4	-15.5	0.0	24.9	53.2

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

GEAR DOWN

**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
99	83	71	62	55	50	46	42	39	36	33
174	152	134	121	109	100	92	85	80	75	70
249	220	197	178	163	150	139	129	121	114	107
323	287	259	236	216	200	186	174	163	153	145
396	354	321	293	270	250	233	218	205	193	183
468	421	382	350	323	300	280	262	247	233	221
541	488	444	407	377	350	327	307	289	273	259
614	554	506	465	430	400	374	351	331	313	297
687	622	568	522	483	450	421	395	373	353	335
762	690	630	580	537	500	468	440	414	392	372

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)					TIME (HRS:MIN)
		300	350	400	450	500	
50	FUEL (1000 LB)	4.2	4.6	4.9	5.3	5.7	0:15
	ALT (FT)	14000	12000	10000	10000	8000	
100	FUEL (1000 LB)	7.2	7.8	8.5	9.2	9.9	0:26
	ALT (FT)	22000	18000	18000	16000	16000	
150	FUEL (1000 LB)	9.8	10.8	11.8	12.8	13.9	0:36
	ALT (FT)	26000	22000	20000	20000	18000	
200	FUEL (1000 LB)	12.3	13.7	15.0	16.4	17.8	0:46
	ALT (FT)	28000	26000	24000	22000	20000	
250	FUEL (1000 LB)	14.8	16.5	18.1	19.8	21.6	0:55
	ALT (FT)	30000	28000	24000	22000	20000	
300	FUEL (1000 LB)	17.3	19.3	21.3	23.3	25.5	1:05
	ALT (FT)	30000	28000	24000	22000	20000	
350	FUEL (1000 LB)	19.8	22.1	24.5	26.9	29.4	1:14
	ALT (FT)	30000	28000	26000	22000	20000	
400	FUEL (1000 LB)	22.3	24.9	27.7	30.4	33.3	1:24
	ALT (FT)	30000	28000	26000	22000	20000	
450	FUEL (1000 LB)	24.8	27.8	30.9	34.0	37.2	1:33
	ALT (FT)	30000	28000	26000	22000	20000	
500	FUEL (1000 LB)	27.3	30.6	34.1	37.6	41.2	1:43
	ALT (FT)	30000	28000	26000	22000	20000	

GEAR DOWN

**Holding Planning
Flaps Up**

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
660	30550	30000	30290	31040			
620	28790	28170	28320	28710			
580	27230	26590	26570	26740	28330		
540	25720	25160	24930	24950	25940		
500	24120	23720	23360	23190	23690		
460	22510	22210	21830	21490	21710	23080	
420	20910	20590	20290	19770	19850	20560	
380	19320	18980	18770	18150	18100	18490	20080
340	18050	17720	17440	16880	16410	16660	17400

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
660	29330	28790	29140	29660	
620	27540	26970	27120	27400	
580	25860	25370	25270	25430	26620
540	24250	23930	23630	23640	24270
500	22600	22330	22030	21840	22100
460	20980	20680	20460	20040	20160
420	19350	19040	18880	18300	18350
380	18020	17740	17510	16990	16620
340	16410	16160	15900	15460	15220

These tables include 5% additional fuel for holding in a racetrack pattern.
Do not hold at Flaps 1 in icing conditions.

Performance Dispatch Text

Chapter PD Section 44

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 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 data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Tire, Brake Energy and Obstacle Limit Weights as determined from the following tables.

Field Limit Weight - Slope and Wind Corrections

These tables provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction 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 show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude 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.

Obstacle Limit Weight

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct 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

Maximum tire speed limited weights are presented for 235 MPH tires. To determine the tire speed limit weight, enter the table with OAT, move to airport pressure altitude and read the tire speed limit weight. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limits VMBE

Tables are presented to determine the Maximum Brake Energy Speed VMBE. Compliance with this limitation is required to ensure that the brakes have enough capacity to execute a maximum effort stop from V1 without the use of thrust reversers. Enter the upper table with pressure altitude and OAT to determine the reference VMBE. Then enter the lower table with the reference VMBE and brake release weight to determine VMBE for a specific takeoff. Adjust for slope, wind and deactivated brakes as described below the table. The resulting VMBE must be greater than or equal to V1. If VMBE is less than V1, brake release weight must be decreased by the amount shown below the table.

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 to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Normal takeoff speeds, V1, VR, and V2 are read from the table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR 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 Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle and brake energy limit weights and the V1 and VMBE must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 8100 lb and the V1 associated with the reduced weight by one knot. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 17000 lb and the V1 associated with the reduced weight by three 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 corrected for wind and slope exceeds approximately 4200 ft for one brake deactivated or 4400 ft for two brakes deactivated.

For brake(s) deactivated, reduce VMBE by the amount shown on the Brake Energy Limit VMBE Chart. If the resulting VMBE is less than V1, the brake release weight must be reduced according to the instructions on the brake energy limit chart. The resulting V1 must not be less than V1(MCG). Determine VR and V2 for the actual weight.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

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 these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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 fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time 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 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. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time 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

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 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%.

Oxygen Requirements

Flight Crew 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 these requirements is achieved with the minimum dispatch oxygen cylinder pressure. Enter the Crew Oxygen Requirements table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate bottle temperature.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 2.05 liters/person/minute (1.2 psi/person/minute for the single cylinder system), or 13 liters/person/minute (8 psi/person/minute) if 100% oxygen is selected during normal usage.

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 Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited 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 engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table 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, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

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Performance Dispatch

Chapter PD

Table of Contents

Section 50

777-300ER GE90-115B LB FT FAA TO1-10 TO2-20 TALPA

Pkg Model IdentificationPD.ModID.50.1

Takeoff..... PD.50.1

Takeoff Field Corrections - Dry RunwayPD.50.1

Takeoff Field & Climb Limit Weights - Dry RunwayPD.50.2

Takeoff Field Corrections - Wet RunwayPD.50.5

Takeoff Field & Climb Limit Weights - Wet RunwayPD.50.6

Takeoff Obstacle Limit Weight.....PD.50.9

Tire Speed Limit.....PD.50.11

Takeoff Speeds - Dry RunwayPD.50.12

Takeoff Speeds - Wet RunwayPD.50.13

Enroute PD.51.1

Long Range Cruise Maximum Operating Altitude.....PD.51.1

Long Range Cruise Trip Fuel and TimePD.51.5

Long Range Cruise Step ClimbPD.51.7

Short Trip Fuel and TimePD.51.8

Holding PlanningPD.51.9

Crew Oxygen Requirements.....PD.51.10

Net Level Off WeightPD.51.11

Landing PD.52.1

Landing Field Limit Weight - Dry RunwayPD.52.1

Landing Field Limit Weight - Wet RunwayPD.52.3

Approach or Landing Climb Limited Weight.....PD.52.4

Go-Around Climb GradientPD.52.5

Quick Turnaround Limit Weight.....PD.52.6

Gear Down..... PD.53.1

Takeoff Climb Limit Weight.....PD.53.1

**Performance Dispatch
Pkg Model Identification****Chapter PD
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
300ER	777-300ER	7350	WY350

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Performance Dispatch

Chapter PD

Takeoff

Section 50

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	4380	4330	4290	4240	4200	4150	4110	4060	4020
4600	4810	4760	4700	4650	4600	4540	4480	4420	4360
5000	5240	5180	5120	5060	5000	4930	4850	4780	4710
5400	5670	5610	5540	5470	5400	5310	5230	5140	5050
5800	6110	6030	5950	5880	5800	5700	5600	5500	5390
6200	6540	6450	6370	6280	6200	6080	5970	5850	5740
6600	6970	6880	6790	6690	6600	6470	6340	6210	6080
7000	7400	7300	7200	7100	7000	6860	6710	6570	6430
7400	7840	7730	7620	7510	7400	7240	7090	6930	6770
7800	8270	8150	8030	7920	7800	7630	7460	7290	7120
8200	8700	8580	8450	8330	8200	8020	7830	7650	7460
8600	9130	9000	8870	8730	8600	8400	8200	8000	7800
9000	9570	9420	9280	9140	9000	8790	8570	8360	8150
9400	10000	9850	9700	9550	9400	9170	8950	8720	8490
9800	10430	10270	10110	9960	9800	9560	9320	9080	8840
10200	10860	10700	10530	10370	10200	9950	9690	9440	9180
10600	11290	11120	10950	10770	10600	10330	10060	9790	9530
11000	11730	11550	11360	11180	11000	10720	10440	10150	9870
11400	12160	11970	11780	11590	11400	11100	10810	10510	10210
11800	12590	12390	12200	12000	11800	11490	11180	10870	10560

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	3180	3520	3860	4200	4450	4700	4970	5250
4600	3510	3870	4240	4600	4860	5130	5410	5700
5000	3840	4230	4610	5000	5270	5550	5840	6150
5400	4170	4580	4990	5400	5680	5980	6280	6600
5800	4500	4940	5370	5800	6100	6400	6720	7050
6200	4840	5290	5750	6200	6510	6830	7160	7500
6600	5170	5650	6120	6600	6920	7250	7590	7950
7000	5500	6000	6500	7000	7330	7680	8030	8400
7400	5830	6360	6880	7400	7740	8100	8470	8850
7800	6170	6710	7260	7800	8160	8530	8910	9300
8200	6500	7070	7630	8200	8570	8950	9340	9750
8600	6830	7420	8010	8600	8980	9380	9780	10200
9000	7160	7780	8390	9000	9390	9800	10220	10650
9400	7500	8130	8770	9400	9810	10230	10660	11100
9800	7830	8490	9140	9800	10220	10650	11090	11550
10200	8160	8840	9520	10200	10630	11070	11530	12000
10600	8490	9190	9900	10600	11040	11500	11970	12450
11000	8820	9550	10270	11000	11460	11920	12410	12900
11400	9160	9900	10650	11400	11870	12350	12840	13350
11800	9490	10260	11030	11800	12280	12770	13280	13800

Takeoff Field & Climb Limit Weights - Dry Runway**Flaps 15****Sea Level Pressure Altitude**

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	550.3	494.8	491.5	488.3	485.2	482.1	472.4	460.7	447.7	434.3	420.9
5000	577.1	519.2	515.7	512.4	509.1	505.9	495.8	483.6	470.1	456.1	442.0
5400	602.5	542.2	538.7	535.2	531.8	528.4	517.9	505.2	491.1	476.6	462.0
5800	626.8	564.3	560.7	557.1	553.6	550.1	539.2	526.0	511.4	496.4	481.3
6200	650.2	585.7	581.9	578.2	574.5	571.0	559.7	546.1	531.1	515.5	499.9
6600	672.4	606.0	602.1	598.3	594.6	590.9	579.3	565.3	549.8	533.8	517.8
7000	693.5	625.4	621.4	617.5	613.6	609.8	598.0	583.5	567.7	551.2	534.7
7400	712.4	642.6	638.6	634.5	630.6	626.7	614.6	599.8	583.6	566.8	549.9
7800	731.6	660.2	656.0	651.9	647.9	643.9	631.5	616.4	599.8	582.6	565.3
8200	752.0	679.1	674.8	670.6	666.5	662.5	649.8	634.3	617.3	599.7	582.1
8600	772.3	697.8	693.4	689.1	684.9	680.8	667.8	652.0	634.7	616.7	598.6
9000	790.8	714.7	710.2	705.9	701.6	697.3	684.1	668.0	650.3	631.9	613.5
9400	806.4	728.7	724.2	719.7	715.3	711.0	697.5	681.1	663.0	644.3	625.5
9800	821.7	742.5	737.9	733.4	728.9	724.5	710.7	694.0	675.5	656.5	637.3
10200	835.0	756.3	751.5	746.9	742.3	737.9	723.8	706.8	688.0	668.5	649.0
10600	835.0	769.8	765.0	760.2	755.6	751.0	736.7	719.4	700.2	680.5	660.6
11000	835.0	783.0	778.1	773.3	768.5	763.9	749.4	731.7	712.2	692.1	671.9
CLIMB LIMIT WT (1000 LB)	823.7	823.5	823.2	822.9	822.6	822.2	794.7	763.2	728.8	695.6	662.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	512.3	464.6	461.5	458.5	455.6	447.3	438.0	426.8	414.6	399.9	386.1
5000	537.4	487.7	484.5	481.3	478.3	469.6	460.0	448.2	435.5	420.1	405.8
5400	561.2	509.4	506.1	502.9	499.7	490.7	480.6	468.4	455.2	439.2	424.3
5800	584.0	530.4	527.0	523.6	520.3	511.0	500.6	487.9	474.2	457.7	442.2
6200	606.0	550.6	547.1	543.6	540.2	530.6	519.8	506.8	492.6	475.5	459.6
6600	627.0	570.0	566.3	562.8	559.3	549.3	538.3	524.8	510.3	492.7	476.3
7000	646.8	588.4	584.6	580.9	577.3	567.1	555.8	542.0	527.0	509.0	492.1
7400	664.6	604.8	600.9	597.1	593.5	583.0	571.4	557.3	542.0	523.5	506.2
7800	682.7	621.5	617.5	613.7	609.9	599.2	587.4	572.9	557.3	538.4	520.7
8200	702.1	639.5	635.5	631.5	627.7	616.8	604.6	589.8	573.9	554.5	536.5
8600	721.2	657.3	653.2	649.2	645.3	634.1	621.7	606.6	590.2	570.5	552.0
9000	738.7	673.4	669.2	665.1	661.1	649.7	637.0	621.6	604.9	584.8	565.9
9400	753.2	686.6	682.3	678.1	674.0	662.4	649.5	633.7	616.7	596.2	576.9
9800	767.5	699.6	695.2	690.9	686.8	674.9	661.7	645.7	628.4	607.4	587.8
10200	781.7	712.5	708.0	703.7	699.4	687.3	673.9	657.6	639.9	618.5	598.6
10600	795.6	725.2	720.6	716.2	711.9	699.6	685.9	669.3	651.3	629.6	609.2
11000	809.3	737.6	733.0	728.5	724.1	711.6	697.7	680.8	662.5	640.3	619.7
CLIMB LIMIT WT (1000 LB)	779.4	779.1	778.8	778.5	778.3	756.6	733.5	704.0	673.0	640.0	610.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2100 lb and climb limit weight by 3900 lb.

Takeoff Field & Climb Limit Weights - Dry Runway**Flaps 15****4000 FT Pressure Altitude**

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	478.4	434.1	431.2	428.4	421.3	413.1	402.7	392.1	379.6	366.6	351.5
5000	502.0	455.8	452.9	449.9	442.6	433.9	423.2	412.0	399.0	385.4	369.7
5400	524.4	476.4	473.3	470.2	462.5	453.6	442.4	430.8	417.2	403.1	386.7
5800	545.9	496.1	492.9	489.7	481.8	472.5	460.9	448.9	434.9	420.2	403.3
6200	566.6	515.2	511.9	508.6	500.5	490.9	478.9	466.5	452.0	436.9	419.4
6600	586.4	533.6	530.2	526.8	518.3	508.5	496.1	483.4	468.5	452.9	434.9
7000	605.3	550.9	547.4	544.0	535.3	525.2	512.5	499.4	484.1	468.1	449.6
7400	622.1	566.5	562.9	559.3	550.5	540.1	527.1	513.7	498.1	481.7	462.8
7800	639.2	582.3	578.6	575.0	565.9	555.3	542.1	528.4	512.3	495.6	476.2
8200	657.6	599.4	595.7	592.0	582.7	571.9	558.3	544.3	527.9	510.8	491.0
8600	675.8	616.4	612.6	608.7	599.3	588.2	574.4	560.0	543.3	525.8	505.6
9000	692.2	631.6	627.7	623.8	614.2	602.9	588.7	574.1	557.0	539.1	518.5
9400	705.8	644.0	640.0	636.0	626.2	614.6	600.2	585.3	567.8	549.6	528.6
9800	719.2	656.1	652.1	648.0	638.0	626.2	611.5	596.3	578.5	560.0	538.5
10200	732.4	668.2	664.1	659.9	649.7	637.7	622.7	607.2	589.1	570.2	548.3
10600	745.5	680.1	675.9	671.7	661.3	649.1	633.8	618.0	599.6	580.3	558.1
11000	758.3	691.8	687.5	683.2	672.6	660.2	644.7	628.6	609.9	590.3	567.6
CLIMB LIMIT WT (1000 LB)	726.9	726.6	726.4	726.0	709.5	690.7	666.5	642.5	614.7	585.7	551.5

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	445.3	403.1	400.2	393.8	385.7	375.9	367.4	358.0	347.1	329.3	313.9
5000	467.6	423.5	420.5	413.9	405.3	395.2	386.2	376.5	365.1	346.5	330.5
5400	488.6	442.7	439.6	432.7	423.8	413.3	404.0	393.8	382.0	362.7	346.0
5800	508.8	461.3	458.0	450.9	441.7	430.7	421.1	410.6	398.4	378.3	361.1
6200	528.3	479.3	475.9	468.5	459.1	447.7	437.8	427.0	414.3	393.6	375.8
6600	547.0	496.5	493.1	485.5	475.7	464.1	453.9	442.7	429.7	408.4	390.0
7000	564.7	512.9	509.4	501.6	491.6	479.6	469.1	457.7	444.3	422.4	403.6
7400	580.6	527.5	523.9	515.9	505.7	493.4	482.7	471.0	457.3	434.9	415.6
7800	596.7	542.5	538.8	530.6	520.1	507.6	496.6	484.6	470.6	447.7	428.0
8200	614.2	558.7	554.9	546.6	535.9	523.1	511.9	499.6	485.3	461.9	441.7
8600	631.5	574.8	570.9	562.4	551.4	538.4	526.9	514.4	499.7	475.8	455.2
9000	647.0	589.1	585.2	576.5	565.3	552.0	540.3	527.5	512.5	488.1	467.1
9400	659.7	600.6	596.6	587.7	576.3	562.7	550.8	537.7	522.5	497.5	476.1
9800	672.1	612.0	607.9	598.8	587.2	573.3	561.1	547.8	532.3	506.9	485.0
10200	684.5	623.2	619.0	609.8	597.9	583.8	571.4	557.8	542.0	516.1	493.8
10600	696.7	634.3	630.0	620.6	608.6	594.2	581.5	567.7	551.6	525.3	502.6
11000	708.6	645.1	640.8	631.3	619.0	604.3	591.5	577.5	561.1	534.2	511.2
CLIMB LIMIT WT (1000 LB)	674.9	674.9	674.6	661.9	645.8	625.4	606.8	586.0	562.4	519.1	486.0

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2100 lb and climb limit weight by 3900 lb.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	409.2	369.5	364.1	357.0	348.0	339.8	331.4	322.5	302.9	286.9	276.7
5000	429.9	388.5	382.9	375.4	366.0	357.5	348.7	339.4	318.9	302.2	291.6
5400	449.3	406.3	400.5	392.7	382.9	374.1	365.0	355.3	334.0	316.6	305.6
5800	468.1	423.5	417.5	409.5	399.3	390.2	380.7	370.7	348.6	330.6	319.2
6200	486.3	440.3	434.1	425.8	415.3	405.9	396.1	385.8	362.9	344.4	332.5
6600	503.8	456.4	450.0	441.5	430.7	421.0	410.9	400.3	376.8	357.7	345.5
7000	520.4	471.7	465.1	456.4	445.3	435.3	425.0	414.1	390.0	370.4	357.8
7400	535.2	485.4	478.6	469.7	458.4	448.2	437.6	426.4	401.7	381.6	368.8
7800	550.3	499.4	492.5	483.3	471.7	461.3	450.5	439.0	413.8	393.2	380.1
8200	566.7	514.7	507.6	498.3	486.4	475.7	464.7	453.0	427.2	406.2	392.8
8600	583.0	529.8	522.5	513.0	500.9	490.0	478.7	466.7	440.4	418.9	405.2
9000	597.5	543.2	535.8	526.1	513.7	502.6	491.0	478.8	451.9	430.0	416.0
9400	609.2	553.7	546.2	536.3	523.6	512.3	500.5	488.1	460.6	438.3	424.0
9800	620.7	564.1	556.5	546.4	533.5	521.9	509.9	497.2	469.2	446.4	431.9
10200	632.1	574.5	566.7	556.4	543.2	531.4	519.2	506.3	477.8	454.6	439.7
10600	643.3	584.7	576.7	566.2	552.9	540.9	528.4	515.3	486.2	462.6	447.5
11000	654.3	594.7	586.6	575.9	562.3	550.1	537.5	524.1	494.5	470.5	455.1
CLIMB LIMIT WT (1000 LB)	620.6	620.4	610.6	598.2	578.9	561.8	543.3	524.9	476.0	440.5	421.0

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2100 lb and climb limit weight by 3900 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	4440	4380	4320	4260	4200	4150	4110	4060	4020
4600	4870	4800	4740	4670	4600	4540	4480	4420	4360
5000	5300	5230	5150	5080	5000	4930	4850	4780	4710
5400	5730	5650	5570	5480	5400	5310	5230	5140	5050
5800	6160	6070	5980	5890	5800	5700	5600	5500	5400
6200	6590	6490	6400	6300	6200	6090	5970	5860	5750
6600	7020	6920	6810	6710	6600	6470	6350	6220	6090
7000	7450	7340	7230	7110	7000	6860	6720	6580	6440
7400	7880	7760	7640	7520	7400	7250	7090	6940	6780
7800	8310	8180	8060	7930	7800	7630	7460	7300	7130
8200	8740	8610	8470	8340	8200	8020	7840	7660	7470
8600	9170	9030	8890	8740	8600	8410	8210	8020	7820
9000	9600	9450	9300	9150	9000	8790	8580	8370	8170
9400	10030	9870	9720	9560	9400	9180	8960	8730	8510
9800	10460	10300	10130	9970	9800	9560	9330	9090	8860
10200	10890	10720	10550	10370	10200	9950	9700	9450	9200
10600	11320	11140	10960	10780	10600	10340	10070	9810	9550
11000	11750	11560	11380	11190	11000	10720	10450	10170	9900
11400	12180	11990	11790	11600	11400	11110	10820	10530	10240
11800	12610	12410	12210	12000	11800	11500	11190	10890	10590

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	4470	4750	5040	5340
4600	3380	3790	4190	4600	4880	5170	5480	5800
5000	3720	4150	4570	5000	5290	5590	5920	6260
5400	4050	4500	4950	5400	5700	6020	6360	6720
5800	4390	4860	5330	5800	6110	6440	6800	7180
6200	4720	5210	5710	6200	6520	6860	7240	7640
6600	5060	5570	6090	6600	6930	7290	7680	8100
7000	5390	5930	6460	7000	7340	7710	8120	8560
7400	5730	6280	6840	7400	7750	8130	8560	9020
7800	6060	6640	7220	7800	8150	8550	9000	9480
8200	6390	7000	7600	8200	8560	8980	9440	9940
8600	6730	7350	7980	8600	8970	9400	9870	10400
9000	7060	7710	8350	9000	9380	9820	10310	10860
9400	7400	8070	8730	9400	9790	10240	10750	11320
9800	7730	8420	9110	9800	10200	10670	11190	11780
10200	8070	8780	9490	10200	10610	11090	11630	12240
10600	8400	9130	9870	10600	11020	11510	12070	12700
11000	8740	9490	10250	11000	11430	11940	12510	13160
11400	9070	9850	10620	11400	11840	12360	12950	13620
11800	9410	10200	11000	11800	12250	12780	13390	14080

Takeoff Field & Climb Limit Weights - Wet Runway**Flaps 15****Sea Level Pressure Altitude**

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	626.3	560.7	556.9	553.1	549.5	545.9	534.5	520.6	505.3	489.7	474.3
6200	643.2	575.8	571.9	568.0	564.3	560.5	548.8	534.5	518.9	502.8	486.9
6600	664.8	595.0	590.9	586.9	583.0	579.2	567.0	552.2	536.0	519.4	503.0
7000	685.7	613.5	609.3	605.2	601.2	597.2	584.6	569.4	552.6	535.4	518.5
7400	704.9	630.6	626.2	622.0	617.8	613.7	600.8	585.1	567.8	550.1	532.6
7800	724.7	648.2	643.7	639.4	635.1	630.9	617.6	601.4	583.6	565.4	547.4
8200	746.4	667.7	663.1	658.7	654.3	649.9	636.2	619.6	601.3	582.6	564.1
8600	768.0	687.2	682.5	677.9	673.4	669.0	654.9	637.8	619.1	599.8	580.8
9000	787.7	704.9	700.0	695.3	690.7	686.1	671.7	654.2	634.9	615.2	595.7
9400	804.0	719.1	714.2	709.3	704.6	699.9	685.1	667.2	647.4	627.2	607.3
9800	820.4	733.4	728.4	723.4	718.5	713.8	698.6	680.2	660.0	639.3	618.9
10200	835.0	748.3	743.1	738.0	733.0	728.1	712.6	693.8	673.1	651.9	631.0
10600	835.0	763.3	758.0	752.8	747.7	742.7	726.8	707.6	686.4	664.7	643.3
11000	835.0	777.9	772.5	767.2	762.0	756.9	740.7	721.0	699.4	677.2	655.3
11400	835.0	792.2	786.7	781.3	776.0	770.7	754.2	734.1	712.1	689.4	667.1
11800	835.0	806.2	800.5	795.0	789.6	784.3	767.4	746.9	724.4	701.4	678.6
12200	835.0	819.6	813.8	808.2	802.7	797.3	780.1	759.3	736.4	712.9	689.7
12600	835.0	832.6	826.7	821.0	815.4	809.9	792.4	771.3	748.0	724.1	700.6
CLIMB LIMIT WT (1000 LB)	823.7	823.5	823.2	822.9	822.6	822.2	794.7	763.2	728.8	695.6	662.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	580.6	524.9	521.4	517.9	514.5	504.7	493.9	480.8	466.9	451.7	437.6
6200	596.3	539.0	535.3	531.7	528.2	518.2	507.1	493.6	479.3	463.7	449.2
6600	616.2	556.9	553.1	549.4	545.7	535.3	523.8	509.9	495.0	478.9	463.9
7000	635.4	574.2	570.2	566.4	562.7	551.9	540.0	525.6	510.3	493.6	478.1
7400	653.1	590.0	586.0	582.0	578.1	567.0	554.8	540.0	524.1	506.9	491.0
7800	671.4	606.5	602.3	598.2	594.2	582.8	570.2	555.0	538.7	521.0	504.5
8200	691.6	624.8	620.5	616.3	612.3	600.5	587.6	571.9	555.1	537.0	520.1
8600	711.8	643.2	638.8	634.5	630.3	618.2	604.9	588.9	571.6	553.0	535.6
9000	730.0	659.7	655.2	650.7	646.4	634.1	620.4	603.9	586.3	567.1	549.3
9400	744.9	672.8	668.2	663.7	659.2	646.6	632.6	615.7	597.6	578.0	559.7
9800	759.8	686.0	681.3	676.6	672.1	659.1	644.8	627.5	609.0	588.9	570.2
10200	775.3	699.7	694.9	690.1	685.5	672.2	657.5	639.8	620.9	600.3	581.2
10600	790.9	713.6	708.6	703.8	699.1	685.5	670.5	652.3	632.9	611.9	592.3
11000	806.2	727.2	722.1	717.2	712.3	698.4	683.1	664.6	644.8	623.2	603.3
11400	821.1	740.4	735.3	730.2	725.3	711.1	695.4	676.5	656.3	634.4	613.9
11800	835.0	753.4	748.1	742.9	737.9	723.4	707.5	688.2	667.6	645.2	624.4
12200	835.0	765.8	760.5	755.2	750.1	735.4	719.1	699.5	678.5	655.7	634.6
12600	835.0	777.9	772.5	767.1	761.9	746.9	730.5	710.5	689.2	666.0	644.5
CLIMB LIMIT WT (1000 LB)	779.4	779.1	778.8	778.5	778.3	756.6	733.5	704.0	673.0	640.0	610.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Takeoff Field & Climb Limit Weights - Wet Runway**Flaps 15****4000 FT Pressure Altitude**

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	540.8	489.1	485.8	482.5	474.4	464.8	454.0	443.0	430.2	416.8	401.5
6200	555.3	502.1	498.8	495.4	487.0	477.2	466.1	454.8	441.5	427.8	412.0
6600	573.8	518.7	515.2	511.7	503.0	492.9	481.4	469.6	455.9	441.7	425.4
7000	591.6	534.7	531.1	527.5	518.5	508.0	496.2	484.0	469.9	455.2	438.4
7400	608.0	549.4	545.6	541.9	532.6	521.8	509.6	497.1	482.5	467.4	450.0
7800	625.0	564.6	560.8	556.9	547.4	536.3	523.7	510.9	495.8	480.2	462.4
8200	643.8	581.8	577.9	573.9	564.1	552.7	539.8	526.6	511.1	495.1	476.7
8600	662.7	599.0	595.0	590.9	580.9	569.1	555.9	542.3	526.4	510.0	491.2
9000	679.7	614.4	610.2	606.1	595.8	583.7	570.1	556.2	539.9	523.0	503.7
9400	693.3	626.4	622.1	617.9	607.3	595.0	581.0	566.7	550.1	532.8	513.0
9800	707.0	638.5	634.1	629.8	618.9	606.3	592.0	577.4	560.3	542.6	522.3
10200	721.2	651.1	646.6	642.1	631.0	618.1	603.5	588.5	571.0	552.9	532.2
10600	735.6	663.8	659.3	654.7	643.3	630.1	615.1	599.9	582.0	563.4	542.2
11000	749.7	676.3	671.6	667.0	655.4	641.9	626.6	610.9	592.7	573.7	552.0
11400	763.4	688.5	683.8	679.0	667.2	653.4	637.7	621.8	603.1	583.8	561.7
11800	776.8	700.4	695.6	690.7	678.7	664.6	648.7	632.4	613.4	593.7	571.1
12200	789.6	712.0	707.0	702.1	689.8	675.5	659.3	642.7	623.4	603.3	580.3
12600	802.1	723.2	718.1	713.1	700.6	686.1	669.6	652.8	633.1	612.7	589.3
CLIMB LIMIT WT (1000 LB)	726.9	726.6	726.4	726.0	709.5	690.7	666.5	642.5	614.7	585.7	551.5

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	502.2	454.1	451.1	444.4	435.9	425.8	417.0	407.4	396.1	377.9	362.9
6200	515.6	466.2	463.0	456.2	447.4	437.1	428.0	418.1	406.5	387.8	372.3
6600	532.6	481.5	478.2	471.1	462.1	451.3	441.9	431.6	419.7	400.3	384.3
7000	549.1	496.3	492.9	485.5	476.2	465.1	455.4	444.8	432.4	412.4	395.9
7400	564.2	509.7	506.2	498.7	489.0	477.6	467.6	456.7	443.9	423.3	406.2
7800	579.9	523.8	520.2	512.4	502.6	490.8	480.4	469.2	456.1	434.8	417.3
8200	597.5	539.9	536.2	528.2	518.0	505.9	495.3	483.8	470.3	448.4	430.4
8600	615.1	556.0	552.2	544.0	533.5	521.1	510.2	498.4	484.5	462.1	443.6
9000	630.9	570.2	566.3	557.9	547.2	534.5	523.3	511.1	496.9	473.9	455.0
9400	643.3	581.1	577.1	568.5	557.5	544.5	533.0	520.6	506.0	482.4	463.0
9800	655.8	592.1	588.0	579.2	568.0	554.6	542.9	530.1	515.2	491.0	471.1
10200	668.8	603.6	599.4	590.4	578.9	565.2	553.2	540.1	524.9	500.1	479.7
10600	682.0	615.3	611.0	601.7	590.0	576.0	563.7	550.3	534.7	509.4	488.6
11000	694.9	626.7	622.3	612.9	600.8	586.5	574.0	560.3	544.4	518.5	497.2
11400	707.4	637.9	633.4	623.8	611.5	596.9	584.1	570.1	553.9	527.5	505.7
11800	719.7	648.8	644.3	634.4	621.9	607.0	593.9	579.7	563.2	536.3	514.1
12200	731.6	659.4	654.8	644.8	632.0	616.9	603.6	589.1	572.2	544.8	522.3
12600	743.1	669.7	665.0	654.8	641.9	626.5	613.0	598.3	581.1	553.3	530.3
CLIMB LIMIT WT (1000 LB)	674.9	674.9	674.6	661.9	645.8	625.4	606.8	586.0	562.4	519.1	486.0

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	463.2	418.9	413.3	405.9	396.5	388.1	379.4	370.2	350.6	335.0	325.0
6200	475.5	429.9	424.1	416.6	406.9	398.2	389.3	379.9	359.7	343.7	333.3
6600	491.1	443.9	437.9	430.1	420.1	411.1	401.9	392.1	371.2	354.6	343.9
7000	506.3	457.5	451.3	443.2	432.9	423.6	414.0	403.9	382.3	365.2	354.2
7400	520.0	469.7	463.4	455.0	444.4	434.8	424.9	414.5	392.3	374.6	363.3
7800	534.4	482.7	476.1	467.5	456.6	446.7	436.6	425.9	403.0	384.8	373.1
8200	550.8	497.6	490.9	482.0	470.8	460.6	450.2	439.2	415.7	397.0	385.0
8600	567.2	512.6	505.6	496.6	485.0	474.6	463.9	452.6	428.5	409.3	396.9
9000	581.7	525.7	518.6	509.3	497.4	486.8	475.8	464.2	439.4	419.7	407.1
9400	592.9	535.5	528.2	518.7	506.5	495.6	484.4	472.5	447.1	426.9	413.9
9800	604.2	545.4	537.9	528.2	515.7	504.5	493.0	480.9	454.8	434.2	420.9
10200	615.9	555.8	548.1	538.1	525.4	513.9	502.1	489.7	463.1	441.9	428.3
10600	627.9	566.3	558.5	548.3	535.3	523.5	511.5	498.7	471.5	449.9	435.9
11000	639.6	576.7	568.7	558.2	545.0	533.0	520.6	507.6	479.8	457.7	443.5
11400	651.0	586.8	578.7	568.0	554.5	542.2	529.6	516.3	487.9	465.4	450.9
11800	662.2	596.8	588.5	577.6	563.8	551.3	538.5	524.9	495.9	472.9	458.1
12200	673.1	606.5	598.0	586.9	572.8	560.1	547.1	533.3	503.8	480.4	465.3
12600	683.6	615.9	607.3	596.0	581.7	568.8	555.6	541.5	511.6	487.8	472.4
CLIMB LIMIT WT (1000 LB)	620.6	620.4	610.6	598.2	578.9	561.8	543.3	524.9	476.0	440.5	421.0

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Takeoff Obstacle Limit Weight**Flaps 15****Sea Level, 30°C & Below, Zero Wind****Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off**

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	651.6	721.8	788.0	833.6					
50	621.4	687.0	741.4	790.3	824.7				
100	588.2	653.4	703.9	746.2	784.2	811.4	831.8		
150	560.5	625.1	674.4	714.9	749.2	780.3	802.9	821.4	
200	536.5	599.6	649.3	689.2	722.8	751.3	777.5	796.8	813.0
250	515.6	576.9	627.2	666.9	700.1	728.4	752.6	775.3	792.2
300	496.6	556.6	606.7	647.0	680.0	708.1	732.4	753.4	773.2
350	479.5	538.5	587.9	628.7	661.8	690.0	714.2	735.4	753.9
400	463.8	522.0	570.6	611.6	645.1	673.3	697.7	718.9	737.7
450	449.3	506.7	554.7	595.4	629.5	657.9	682.4	703.8	722.6
500	436.3	492.6	540.0	580.3	614.8	643.5	668.1	689.7	708.7
550	424.2	479.4	526.3	566.3	600.6	629.9	654.7	676.4	695.6
600	412.6	467.1	513.5	553.1	587.3	616.9	642.0	663.9	683.3
650	401.9	455.5	501.4	540.7	574.8	604.4	629.9	652.0	671.5
700	391.7	444.6	489.9	529.0	562.9	592.5	618.4	640.7	660.3
750	381.9	434.5	479.1	517.9	551.6	581.2	607.1	629.8	649.7
800	372.6	424.9	468.9	507.4	540.9	570.4	596.4	619.3	639.4
850		415.6	459.1	497.3	530.6	560.0	586.1	609.2	629.5
900		406.8	449.9	487.7	520.9	550.2	576.2	599.4	620.0
950		398.4	441.1	478.6	511.6	540.7	566.7	589.9	610.7
1000		390.3	432.8	469.8	502.6	531.7	557.6	580.8	601.6

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)						
	360	440	520	600	680	760	840
30 & BELOW	0	0	0	0	0	0	0
32	-6.2	-7.6	-9.0	-10.4	-11.9	-13.3	-14.7
34	-12.3	-15.2	-18.0	-20.9	-23.7	-26.5	-29.4
36	-18.5	-22.7	-27.0	-31.3	-35.6	-39.8	-44.1
38	-24.6	-30.3	-36.0	-41.7	-47.4	-53.1	-58.8
40	-30.8	-37.9	-45.0	-52.1	-59.3	-66.4	-73.5
42	-38.4	-46.9	-55.5	-64.1	-72.6	-81.2	-89.8
44	-46.0	-56.0	-66.0	-76.0	-86.0	-96.0	-106.0
46	-53.5	-65.0	-76.5	-87.9	-99.4	-110.8	-122.3
48	-61.1	-74.0	-86.9	-99.8	-112.7	-125.6	-138.6
50	-68.7	-83.1	-97.4	-111.8	-126.1	-140.5	-154.8

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
S.L. & BELOW	0	0	0	0	0	0	0
1000	-15.8	-18.7	-21.7	-24.6	-27.5	-30.5	-33.4
2000	-31.5	-37.4	-43.3	-49.2	-55.1	-61.0	-66.9
3000	-46.0	-54.9	-63.8	-72.6	-81.5	-90.4	-99.3
4000	-60.4	-72.3	-84.2	-96.1	-108.0	-119.9	-131.8
5000	-76.0	-90.8	-105.5	-120.2	-134.9	-149.7	-164.4
6000	-91.7	-109.2	-126.8	-144.3	-161.9	-179.5	-197.0
7000	-105.9	-126.4	-146.9	-167.4	-187.9	-208.4	-228.9
8000	-120.1	-143.5	-167.0	-190.5	-213.9	-237.4	-260.9

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
15 TW	-81.0	-82.2	-83.4	-84.6	-85.9	-87.1	-88.3
10 TW	-54.0	-54.8	-55.6	-56.4	-57.2	-58.1	-58.9
5 TW	-27.0	-27.4	-27.8	-28.2	-28.6	-29.0	-29.4
0	0	0	0	0	0	0	0
10 HW	8.6	8.2	7.8	7.4	7.1	6.7	6.3
20 HW	17.2	16.4	15.6	14.9	14.1	13.3	12.6
30 HW	27.3	25.9	24.6	23.2	21.9	20.6	19.2
40 HW	37.3	35.4	33.5	31.6	29.7	27.8	25.9

With engine bleed for packs off, increase weight by 1900 lb.

With engine and wing anti-ice on, decrease weight by 4400 lb.

Tire Speed Limit**Flaps 15**

AIRPORT OAT		TIRE SPEED LIMIT WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
(°C)	(°F)	0	2000	4000	6000	8000
54	129	818.4	746.3	690.8	640.6	593.4
52	126	822.8	750.6	694.6	644.3	596.8
50	122	827.2	755.0	698.4	648.0	600.2
48	118	830.3	765.0	702.2	651.4	603.8
46	115	833.4	775.1	706.0	654.8	607.3
44	111	835.0	782.2	710.0	658.2	610.6
42	108	835.0	786.6	714.1	661.7	613.5
40	104	835.0	790.9	718.2	665.3	616.5
38	100	835.0	795.5	722.9	669.3	620.0
36	97	835.0	800.0	727.5	673.3	623.5
34	93	835.0	804.7	732.2	677.5	627.3
32	90	835.0	809.6	737.0	681.8	631.2
30	86	835.0	814.7	741.9	686.1	635.3
28	82	835.0	819.8	747.0	690.5	639.4
26	79	835.0	825.0	752.2	695.0	643.6
24	75	835.0	830.7	758.3	699.6	647.9
22	72	835.0	835.0	777.0	704.3	652.1
20	68	835.0	835.0	782.5	709.3	656.6
18	64	835.0	835.0	788.1	714.2	661.1
16	61	835.0	835.0	793.8	719.6	665.8
14	57	835.0	835.0	799.5	725.4	670.5
12	54	835.0	835.0	805.4	731.2	675.6
10	50	835.0	835.0	811.3	737.1	680.7
-40	-40	835.0	835.0	835.0	835.0	835.0

Increase tire speed limit weight by 5700 lb per knot headwind.

Decrease tire speed limit weight by 12300 lb per knot tailwind.

Takeoff Speeds - Dry Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
840	175	184	189
800	170	179	185
760	167	175	182
720	162	170	178
680	157	164	174
640	152	159	170
600	146	153	165
560	139	146	160
520	132	140	155
480	125	134	150
440	117	126	145
400	108	119	139
360	98	111	133

Check V1(MCG), Minimum VR.

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	-2	0	2	4	6	8	-2	0	2	4	6	8
70	158	13	15					7	8					-4	-5				
60	140	9	10	13	15			5	6	7	9			-3	-3	-4	-5		
50	122	5	6	9	11	14	17	3	4	5	7	8	10	-2	-2	-3	-4	-4	-5
40	104	1	3	5	8	11	15	1	2	3	5	7	9	-1	-1	-2	-3	-3	-5
30	86	0	0	2	5	8	12	0	0	2	3	5	7	0	0	-1	-2	-3	-4
20	68	0	0	2	4	6	8	0	0	1	2	4	5	0	0	-1	-1	-2	-3
-60	-76	0	0	2	4	6	8	0	0	1	2	4	5	0	0	-1	-1	-2	-3

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)						WIND (KTS)											
	-2	-1	0	1	2		-15	-10	-5	0	10	20	30	40				
840	-4	-1	0	3	5		-2	-1	0	0	1	3	4	4				
760	-3	-1	0	3	4		-2	-1	0	0	1	2	3	3				
680	-3	-1	0	2	4		-2	-1	0	0	1	2	2	3				
600	-2	-1	0	2	3		-2	-1	0	0	1	2	2	3				
520	-2	0	0	2	3		-1	-1	0	0	1	2	3	3				
440	-1	0	0	3	4		-1	0	0	0	1	2	3	4				
360	-1	1	0	3	4		-1	0	1	0	2	3	4	5				

*V1 not to exceed VR

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111				
50	122	119	121	116	118	111	113	109	111	106	109	103	106
40	104	126	127	123	124	118	120	113	115	108	111	103	106
30	86	128	130	128	130	123	125	118	120	112	115	106	109
20	68	129	130	129	130	125	126	120	122	116	118	110	113
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114

Takeoff Speeds - Wet Runway**Flaps 15****V1, VR, V2 for Max Takeoff Thrust**

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
840	168	184	189
800	163	179	185
760	159	175	182
720	153	170	178
680	147	164	174
640	141	159	170
600	135	153	165
560	128	146	160
520	121	140	155
480	113	134	150
440	105	126	145
400	96	119	139
360	89	111	133

Check V1(MCG), Minimum VR.

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	-2	0	2	4	6	8	-2	0	2	4	6	8
70	158	15	17					7	8					-4	-5				
60	140	10	12	14	17			5	6	7	9			-3	-3	-4	-5		
50	122	6	7	10	12	15	19	3	4	5	7	8	10	-2	-2	-3	-4	-4	-5
40	104	1	3	6	9	12	16	1	2	3	5	7	9	-1	-1	-2	-3	-3	-5
30	86	0	0	3	6	9	13	0	0	2	3	5	7	0	0	-1	-2	-3	-4
20	68	0	0	2	4	6	9	0	0	1	2	4	5	0	0	-1	-1	-2	-3
-60	-76	0	0	2	4	6	9	0	0	1	2	4	5	0	0	-1	-1	-2	-3

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)									
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40		
840	-6	-3	0	3	6	-3	-2	-1	0	1	2	3	4		
760	-6	-3	0	3	5	-4	-3	-1	0	1	2	3	4		
680	-5	-3	0	2	5	-5	-3	-2	0	1	2	3	4		
600	-5	-2	0	2	4	-5	-3	-2	0	1	2	3	4		
520	-4	-1	0	3	4	-5	-3	-1	0	1	3	4	5		
440	-2	0	0	3	5	-4	-2	0	0	2	4	5	6		
360	-1	1	0	4	5	-3	-1	1	0	2	5	6	7		

*V1 not to exceed VR

V1(MCG), Minimum VR**Max Takeoff Thrust**

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111				
50	122	119	121	116	118	111	113	109	111	106	109	103	106
40	104	126	127	123	124	118	120	113	115	108	111	103	106
30	86	128	130	128	130	123	125	118	120	112	115	106	109
20	68	129	130	129	130	125	126	120	122	116	118	110	113
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114

Intentionally
Blank

Performance Dispatch**Enroute****Chapter PD****Section 51****Long Range Cruise Maximum Operating Altitude****Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)****ISA + 10°C and Below**

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	30800	29100	27600
760	28800	2	31300	29700	28200
740	29400	0	31800	30200	28700
720	30000	-1	32300	30700	29100
700	30700	-2	32800	31100	29600
680	31300	-4	33200	31600	30100
660	31900	-5	33700	32100	30600
640	32600	-7	34300	32700	31200
620	33300	-8	34800	33200	31700
600	34000	-10	35300	33800	32300
580	34700	-11	35900	34300	32900
560	35400	-13	36500	34900	33500
540	36200	-15	37100	35600	34100
520	37000	-15	37800	36200	34800
500	37800	-15	38400	36900	35500
480	38600	-15	39100	37600	36200
460	39500	-15	39900	38300	37000
440	40400	-15	40600	39100	37700
420	41400	-15	41400	39900	38600
400	42400	-15	42300	40800	39500
380	43100	-15	43100	41800	40500

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	30800	29100	27600
760	28800	8	31300	29700	28200
740	29400	6	31800	30200	28700
720	30000	5	32300	30700	29100
700	30700	3	32800	31100	29600
680	31300	2	33200	31600	30100
660	31900	1	33700	32100	30600
640	32600	-1	34300	32700	31200
620	33300	-2	34800	33200	31700
600	34000	-4	35300	33800	32300
580	34700	-6	35900	34300	32900
560	35400	-7	36500	34900	33500
540	36200	-9	37100	35600	34100
520	37000	-9	37800	36200	34800
500	37800	-9	38400	36900	35500
480	38600	-9	39100	37600	36200
460	39500	-9	39900	38300	37000
440	40400	-9	40600	39100	37700
420	41400	-9	41400	39900	38600
400	42400	-9	42300	40800	39500
380	43100	-9	43100	41800	40500

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	30800	29100	27600
760	28800	13	31300	29700	28200
740	29400	12	31800	30200	28700
720	30000	11	32300	30700	29100
700	30700	9	32800	31100	29600
680	31300	8	33200	31600	30100
660	31900	6	33700	32100	30600
640	32600	5	34300	32700	31200
620	33300	3	34800	33200	31700
600	34000	2	35300	33800	32300
580	34700	0	35900	34300	32900
560	35400	-2	36500	34900	33500
540	36200	-3	37100	35600	34100
520	37000	-3	37800	36200	34800
500	37800	-3	38400	36900	35500
480	38600	-3	39100	37600	36200
460	39500	-3	39900	38300	37000
440	40400	-3	40600	39100	37700
420	41400	-3	41400	39900	38600
400	42400	-3	42300	40800	39500
380	43100	-3	43100	41800	40500

Long Range Cruise Maximum Operating Altitude**Max Climb Thrust, Mid C.G. (30% MAC)****ISA + 10°C and Below**

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	31800	30200	28600
760	28800	2	32400	30700	29200
740	29400	0	32900	31300	29700
720	30000	-1	33300	31700	30200
700	30700	-2	33800	32200	30700
680	31300	-4	34300	32700	31200
660	31900	-5	34800	33200	31700
640	32600	-7	35300	33700	32200
620	33300	-8	35800	34200	32700
600	34000	-10	36300	34800	33300
580	34700	-11	36900	35300	33900
560	35400	-13	37500	35900	34500
540	36200	-15	38100	36600	35100
520	37000	-15	38800	37200	35800
500	37800	-15	39400	37900	36400
480	38600	-15	40100	38600	37100
460	39500	-15	40900	39300	37900
440	40400	-15	41600	40100	38700
420	41400	-15	42400	40900	39500
400	42400	-15	43100	41700	40300
380	43100	-15	43100	42800	41400

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	31800	30200	28600
760	28800	8	32400	30700	29200
740	29400	6	32900	31300	29700
720	30000	5	33300	31700	30200
700	30700	3	33800	32200	30700
680	31300	2	34300	32700	31200
660	31900	1	34800	33200	31700
640	32600	-1	35300	33700	32200
620	33300	-2	35800	34200	32700
600	34000	-4	36300	34800	33300
580	34700	-6	36900	35300	33900
560	35400	-7	37500	35900	34500
540	36200	-9	38100	36600	35100
520	37000	-9	38800	37200	35800
500	37800	-9	39400	37900	36400
480	38600	-9	40100	38600	37100
460	39500	-9	40900	39300	37900
440	40400	-9	41600	40100	38700
420	41400	-9	42400	40900	39500
400	42400	-9	43100	41700	40300
380	43100	-9	43100	42800	41400

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Mid C.G. (30% MAC)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	31700*	30200	28600
760	28800	13	32400	30700	29200
740	29400	12	32900	31300	29700
720	30000	11	33300	31700	30200
700	30700	9	33800	32200	30700
680	31300	8	34300	32700	31200
660	31900	6	34800	33200	31700
640	32600	5	35300	33700	32200
620	33300	3	35800	34200	32700
600	34000	2	36300	34800	33300
580	34700	0	36900	35300	33900
560	35400	-2	37500	35900	34500
540	36200	-3	38100	36600	35100
520	37000	-3	38800	37200	35800
500	37800	-3	39400	37900	36400
480	38600	-3	40100	38600	37100
460	39500	-3	40900	39300	37900
440	40400	-3	41600	40100	38700
420	41400	-3	42400	40900	39500
400	42400	-3	43100	41700	40300
380	43100	-3	43100	42800	41400

*Denotes altitude thrust limited in level flight, 300 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
1054	992	935	886	841	800	767	736	707	680	656
1576	1484	1401	1327	1261	1200	1151	1105	1062	1023	987
2096	1975	1866	1768	1680	1600	1535	1474	1417	1365	1318
2614	2465	2329	2208	2100	2000	1919	1843	1773	1708	1649
3130	2953	2791	2648	2519	2400	2303	2212	2128	2051	1980
3645	3440	3253	3087	2937	2800	2687	2582	2484	2394	2311
4157	3925	3714	3526	3356	3200	3071	2951	2840	2737	2643
4667	4409	4173	3964	3774	3600	3456	3321	3196	3080	2975
5176	4892	4633	4401	4192	4000	3840	3691	3552	3424	3306
5684	5374	5091	4839	4610	4400	4224	4060	3908	3767	3637
6190	5856	5549	5276	5028	4800	4608	4430	4263	4109	3968
6695	6336	6006	5712	5445	5200	4993	4799	4619	4453	4300
7200	6815	6463	6148	5863	5600	5377	5168	4975	4796	4632
7703	7294	6920	6584	6280	6000	5761	5538	5330	5139	4963
8205	7772	7375	7020	6697	6400	6145	5907	5686	5482	5294
8706	8250	7831	7455	7114	6800	6529	6277	6042	5825	5625
9207	8727	8286	7891	7531	7200	6913	6646	6397	6167	5956
9708	9204	8741	8326	7948	7600	7297	7015	6752	6510	6287
10208	9681	9196	8761	8365	8000	7681	7384	7107	6852	6618

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)
800	29.7	2:01	28.9	1:59	28.6	1:56	28.2	1:54	27.8	1:54
1200	43.5	2:57	42.2	2:54	41.5	2:49	40.9	2:45	40.1	2:45
1600	57.4	3:53	55.6	3:47	54.7	3:40	53.7	3:36	52.6	3:36
2000	71.3	4:48	69.1	4:41	67.8	4:32	66.5	4:27	65.1	4:27
2400	85.7	5:41	83.1	5:33	81.6	5:23	79.8	5:17	78.2	5:17
2800	100.1	6:35	97.2	6:25	95.3	6:14	93.2	6:07	91.2	6:07
3200	114.9	7:28	111.6	7:16	109.3	7:04	106.8	6:56	104.5	6:56
3600	130.0	8:20	126.2	8:07	123.5	7:54	120.8	7:46	118.1	7:46
4000	145.1	9:12	140.9	8:57	137.8	8:44	134.7	8:35	131.8	8:35
4400	160.9	10:02	156.2	9:47	152.7	9:33	149.2	9:25	146.1	9:25
4800	176.7	10:53	171.4	10:37	167.6	10:23	163.7	10:14	160.5	10:14
5200	192.8	11:43	187.0	11:26	182.7	11:12	178.6	11:03	175.5	11:03
5600	209.3	12:32	202.9	12:15	198.2	12:01	193.8	11:52	191.0	11:52
6000	225.7	13:22	218.8	13:04	213.7	12:50	209.1	12:42	206.6	12:42
6400	242.9	14:11	235.4	13:53	230.0	13:38	225.3	13:31	223.6	13:31
6800	260.0	15:00	252.0	14:42	246.2	14:27	241.6	14:20	240.6	14:20
7200	277.5	15:48	269.0	15:30	262.9	15:16	258.6	15:10	258.6	15:10
7600	295.3	16:36	286.3	16:19	280.0	16:05	276.4	15:59	277.5	15:59
8000	313.2	17:25	303.6	17:07	297.2	16:54	294.1	16:48	296.4	16:48

Long Range Cruise Trip Fuel and Time Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	600
20	-2.3	-1.1	0.0	1.6	2.9	4.5
40	-4.5	-2.3	0.0	2.6	5.7	10.0
60	-6.7	-3.5	0.0	4.0	9.1	16.4
80	-9.0	-4.7	0.0	5.6	13.1	23.7
100	-11.4	-5.9	0.0	7.5	17.7	31.8
120	-13.7	-7.1	0.0	9.7	22.9	40.8
140	-16.1	-8.3	0.0	12.2	28.7	50.7
160	-18.5	-9.6	0.0	15.0	35.2	61.5
180	-21.0	-10.8	0.0	18.1	42.2	73.1
200	-23.5	-12.1	0.0	21.4	49.8	85.6
220	-26.0	-13.3	0.0	25.0	58.0	99.1
240	-28.6	-14.6	0.0	28.9	66.9	113.3
260	-31.1	-15.9	0.0	33.1	76.3	128.5
280	-33.8	-17.2	0.0	37.6	86.4	144.6
300	-36.4	-18.5	0.0	42.4	97.0	161.5
320	-39.1	-19.8	0.0	47.4	108.3	179.3

Based on 310/.84 climb, Long Range Cruise and .84/310/250 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
1040	981	928	881	839	800	765	732	703	675	650
1545	1461	1386	1318	1256	1200	1149	1102	1058	1018	981
2050	1941	1843	1754	1673	1600	1533	1471	1414	1361	1312
2555	2421	2300	2190	2091	2000	1917	1840	1769	1704	1643
3060	2900	2757	2626	2508	2400	2301	2209	2125	2047	1974
3564	3380	3213	3063	2925	2800	2685	2579	2481	2390	2306
4068	3859	3670	3499	3343	3200	3069	2948	2837	2733	2637
4572	4338	4127	3935	3760	3600	3453	3318	3193	3077	2969
5076	4817	4583	4371	4177	4000	3837	3687	3549	3420	3300
5580	5296	5039	4807	4594	4400	4221	4057	3905	3763	3632
6083	5775	5496	5242	5011	4800	4606	4426	4261	4107	3964
6587	6253	5952	5678	5429	5200	4990	4796	4617	4450	4296
7090	6732	6408	6114	5846	5600	5374	5166	4973	4794	4628
7593	7210	6864	6550	6263	6000	5758	5536	5329	5138	4960
8095	7688	7320	6985	6680	6400	6143	5905	5686	5482	5292
8598	8166	7776	7421	7097	6800	6527	6275	6042	5826	5624
9100	8644	8231	7856	7514	7200	6911	6645	6398	6169	5956
9602	9122	8687	8292	7931	7600	7296	7015	6755	6513	6289
10104	9599	9142	8727	8348	8000	7680	7385	7111	6858	6621

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB)											TIME (HRS:MIN)
	LANDING WEIGHT (1000 LB)											
	360	380	400	420	440	460	480	500	520	540	560	
800	23.9	24.7	25.4	26.3	27.0	27.8	28.6	29.4	30.3	31.5	32.4	1:51
1200	34.2	35.3	36.5	37.8	38.7	39.9	41.0	42.3	43.9	45.6	46.9	2:41
1600	44.7	46.2	47.8	49.4	50.7	52.2	53.8	55.6	57.8	59.9	61.6	3:31
2000	55.3	57.3	59.2	61.2	62.9	64.8	66.8	69.2	72.0	74.5	76.6	4:21
2400	66.2	68.5	70.9	73.2	75.3	77.6	80.2	83.3	86.4	89.4	91.9	5:10
2800	77.3	80.0	82.7	85.4	87.9	90.7	94.0	97.6	101.2	104.6	107.6	6:00
3200	88.6	91.6	94.7	97.8	100.8	104.2	108.2	112.2	116.1	120.1	123.7	6:50
3600	100.0	103.5	107.0	110.5	114.0	118.2	122.6	127.0	131.5	136.0	140.2	7:39
4000	111.7	115.5	119.4	123.4	127.6	132.4	137.2	142.1	147.1	152.3	157.1	8:29
4400	123.5	127.8	132.1	136.7	141.6	146.8	152.1	157.5	163.2	169.1	174.4	9:18
4800	135.5	140.2	145.1	150.4	155.9	161.6	167.3	173.4	179.8	186.1	191.9	10:08
5200	147.8	153.0	158.5	164.5	170.4	176.5	182.9	189.7	196.7	203.5	209.8	10:57
5600	160.3	166.0	172.2	178.8	185.2	191.9	198.9	206.3	213.8	221.2	228.1	11:46
6000	173.0	179.3	186.3	193.4	200.3	207.6	215.3	223.3	231.4	239.3	246.8	12:35
6400	186.0	193.2	200.7	208.2	215.7	223.6	232.1	240.7	249.2	257.9	265.9	13:24
6800	199.4	207.3	215.3	223.4	231.5	240.2	249.2	258.3	267.5	276.7	285.5	14:13
7200	213.2	221.6	230.2	238.9	247.7	257.1	266.6	276.3	286.2	296.1	305.4	15:02
7600	227.3	236.3	245.4	254.7	264.3	274.3	284.4	294.8	305.3	315.9	325.7	15:51
8000	241.6	251.2	260.9	271.0	281.3	291.9	302.6	313.8	324.9	336.0	346.4	16:40

Based on 310/.84 climb, LRC and .84/310/250 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
88	77	68	61	55	50	46	43	40	37	35
155	140	127	117	108	100	93	88	82	78	74
221	202	186	172	160	150	141	133	126	119	114
284	262	243	227	213	200	189	179	170	162	154
346	321	300	281	265	250	237	225	214	205	196
408	380	357	335	317	300	285	271	259	248	237
469	439	413	390	369	350	333	318	304	291	279
531	499	470	444	421	400	381	364	348	334	321
595	559	527	498	473	450	429	410	393	377	362
659	620	585	554	525	500	477	456	437	419	403

Trip Fuel and Time Required

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)						TIME (HRS:MIN)
		360	400	440	480	520	560	
50	FUEL (1000 LB)	3.2	3.3	3.5	3.7	3.8	4.0	0:13
	ALT (FT)	9000	9000	7000	7000	5000	5000	
100	FUEL (1000 LB)	5.0	5.2	5.5	5.7	6.0	6.2	0:21
	ALT (FT)	13000	13000	13000	13000	13000	13000	
150	FUEL (1000 LB)	6.7	7.1	7.4	7.7	8.1	8.4	0:29
	ALT (FT)	21000	19000	21000	21000	21000	21000	
200	FUEL (1000 LB)	8.3	8.7	9.1	9.5	9.9	10.4	0:36
	ALT (FT)	27000	27000	27000	25000	25000	23000	
250	FUEL (1000 LB)	9.6	10.2	10.7	11.2	11.8	12.3	0:42
	ALT (FT)	35000	31000	29000	27000	27000	25000	
300	FUEL (1000 LB)	10.9	11.5	12.2	12.8	13.5	14.1	0:48
	ALT (FT)	37000	37000	37000	37000	35000	31000	
350	FUEL (1000 LB)	12.1	12.9	13.6	14.4	15.1	15.9	0:53
	ALT (FT)	37000	37000	37000	37000	35000	35000	
400	FUEL (1000 LB)	13.4	14.2	15.1	15.9	16.7	17.6	0:59
	ALT (FT)	37000	37000	37000	37000	37000	35000	
450	FUEL (1000 LB)	14.7	15.6	16.5	17.4	18.4	19.4	1:06
	ALT (FT)	37000	37000	37000	37000	37000	35000	
500	FUEL (1000 LB)	15.9	16.9	17.9	18.9	20.0	21.1	1:13
	ALT (FT)	37000	37000	37000	37000	37000	35000	

Holding Planning Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
800	21180	20960	21170	21720	22140	23170				
760	20120	19940	19990	20370	20920	21810				
720	19060	18900	18690	19130	19710	20410				
680	18020	17860	17570	18020	18500	18830	19770			
640	17010	16810	16530	16760	17240	17580	18440			
600	16020	15790	15520	15550	15960	16390	17120			
560	15060	14800	14510	14400	14840	15210	15650	16360		
520	14170	13860	13520	13380	13600	13990	14300	15010		
480	13330	12980	12600	12420	12380	12730	13090	13680		
440	12520	12140	11720	11540	11410	11620	11910	12230	13460	
400	11730	11340	10900	10710	10520	10460	10680	10970	12050	
360	11220	10820	10370	10130	9900	9750	9610	9810	10650	

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
800	23040	22980	22830	23130	23640
760	21760	21660	21480	21680	22160
720	20560	20430	20270	20380	20810
680	19380	19230	19070	19130	19490
640	18230	18060	17890	17920	18170
600	17110	16900	16710	16700	16840
560	16010	15770	15550	15510	15580
520	14970	14670	14410	14340	14360
480	13980	13640	13310	13200	13170
440	13020	12640	12260	12100	12030
400	12110	11700	11280	11080	10950
360	11460	11070	10590	10350	10190

These tables include 5% additional fuel for holding in a racetrack pattern.

Crew Oxygen Requirements

Required Pressure (PSI) for One 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

For more extensive than normal crew usage, add 1.2 psi/person/minute.

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	399.4	395.0	382.9
28	430.8	421.2	405.7
26	464.5	451.9	435.2
24	500.6	484.9	467.6
22	538.7	521.7	503.0
20	592.3	577.6	555.9
18	641.7	622.3	598.3
16	695.5	671.7	645.7
14	743.0	715.0	686.1
12	790.9	760.6	730.9
10	833.2	801.9	768.0

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)								
	PRESSURE ALTITUDE (1000 FT)								
	14	16	18	20	22	24	26	28	30
ENGINE ONLY	-1.4	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE AND WING	-5.6	-3.9	-3.2	-2.2	-2.5	-2.6	-2.6	-2.7	-2.6

Intentionally
Blank

Performance Dispatch

Chapter PD

Landing

Section 52

Landing Field Limit Weight - Dry Runway
Flaps 30

Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000			2750	3000	3070	3080	3140	3200
3400	2700	2870	3110	3400	3500	3540	3640	3730
3800	2990	3200	3470	3800	3930	4000	4130	4260
4200	3280	3530	3830	4200	4360	4460	4630	4790
4600	3570	3850	4190	4600	4790	4920	5120	5320
5000	3860	4180	4550	5000	5220	5380	5620	5860
5400	4150	4510	4910	5400	5650	5840	6120	6390
5800	4450	4840	5270	5800	6080	6300	6610	6920
6200	4740	5160	5630	6200	6500	6760	7110	7450
6600	5030	5490	5990	6600	6930	7210	7600	7980
7000	5320	5820	6350	7000	7360	7670	8100	8520
7400	5610	6150	6710	7400	7790	8130	8600	9050
7800	5900	6470	7070	7800	8220	8590	9090	9580
8200	6190	6800	7430	8200	8650	9050	9590	10110
8600	6480	7130	7790	8600	9080	9510	10080	10650
9000	6770	7450	8150	9000	9510	9970	10580	11180
9400	7060	7780	8510	9400	9940	10430	11080	11710
9800	7350	8110	8870	9800	10370	10890	11570	12240
10200	7650	8440	9230	10200	10800	11350	12070	12770
10600	7940	8760	9590	10600	11230	11800	12560	13310

Landing Field Limit Weight - Dry Runway

Flaps 30

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)				
	0	2000	4000	6000	8000
4600	403.3				
5000	451.4	423.9	397.7		
5400	502.1	470.6	440.9	413.4	387.0
5800	553.3	518.9	486.1	454.7	425.8
6200	605.0	567.7	532.0	498.0	465.5
6600	649.4	616.8	578.4	541.7	506.6
7000	670.9	653.4	625.1	585.6	548.0
7400	690.1	672.5	655.1	629.9	589.7
7800	706.4	687.6	669.9	652.2	629.6
8200	723.8	702.2	683.9	666.1	647.6
8600	740.7	718.2	697.1	679.0	661.0
9000	756.7	733.8	711.5	691.4	673.2
9400	779.5	748.8	725.9	703.6	684.6
9800	796.2	764.7	739.8	716.9	695.6
10200	812.3	784.9	753.2	729.9	707.1
10600	827.8	799.9	770.6	742.3	718.9
11000	843.1	814.3	786.5	754.3	730.6
11400		828.3	800.0	770.2	741.8
11800		842.1	813.1	784.9	752.6
12200			825.7	797.1	764.5
12600			838.0	808.9	780.5
13000			850.3	820.3	791.6
13400				831.5	802.2
13800				842.6	812.6
14200				853.7	822.8
14600					832.9

With manual speedbrakes, decrease weight by 47800 lb.

With 1 brake deactivated, decrease weight by 50200 lb.

With 2 brakes deactivated, decrease weight by 102100 lb.

Landing Field Limit Weight - Wet Runway

Flaps 30

Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000				3000	3050	3030	3050	3080
3400			3120	3400	3480	3490	3550	3610
3800	3020	3210	3480	3800	3910	3950	4050	4140
4200	3320	3540	3840	4200	4340	4410	4540	4670
4600	3610	3870	4200	4600	4770	4870	5040	5200
5000	3900	4200	4560	5000	5190	5320	5530	5740
5400	4190	4520	4920	5400	5620	5780	6030	6270
5800	4480	4850	5280	5800	6050	6240	6520	6800
6200	4770	5180	5640	6200	6480	6700	7020	7330
6600	5060	5500	6000	6600	6910	7160	7520	7870
7000	5350	5830	6360	7000	7340	7620	8010	8400
7400	5640	6160	6720	7400	7770	8080	8510	8930
7800	5930	6490	7080	7800	8200	8540	9010	9460
8200	6220	6810	7440	8200	8630	9000	9500	9990
8600	6520	7140	7800	8600	9060	9460	10000	10530
9000	6810	7470	8160	9000	9490	9910	10490	11060
9400	7100	7800	8520	9400	9920	10370	10990	11590
9800	7390	8120	8880	9800	10340	10830	11480	12120
10200	7680	8450	9240	10200	10770	11290	11980	12660
10600	7970	8780	9600	10600	11200	11750	12480	13190

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)				
	0	2000	4000	6000	8000
5400	414.8	389.4			
5800	456.9	428.9	402.4		
6200	501.0	469.6	440.0	412.5	386.2
6600	545.5	511.6	479.1	448.4	419.9
7000	590.3	553.9	519.0	485.7	454.1
7400	634.1	596.5	559.2	523.6	489.6
7800	659.4	638.5	599.7	561.7	525.4
8200	677.6	660.0	637.8	600.1	561.6
8600	693.1	675.5	658.0	635.2	597.9
9000	707.6	688.6	670.8	653.1	630.8
9400	722.7	701.2	683.0	665.2	646.4
9800	737.4	715.1	694.6	676.5	658.5
10200	751.5	728.8	706.7	687.4	669.2
10600	768.6	742.0	719.3	697.9	679.5
11000	786.5	754.8	731.7	709.2	689.2
11400	800.8	771.7	743.6	720.6	698.7
11800	814.7	787.2	755.1	731.8	708.9
12200	828.1	800.2	771.0	742.6	719.2
12600	841.5	812.8	785.0	753.0	729.4
13000	854.8	825.0	796.8	765.4	739.2
13400		837.0	808.3	780.3	748.7
13800		849.1	819.5	791.1	757.9
14200			830.2	801.5	772.2
14600			840.9	811.7	783.2

With manual speedbrakes, decrease weight by 47800 lb.

With 1 brake deactivated, decrease weight by 50200 lb.

With 2 brakes deactivated, decrease weight by 102100 lb.

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Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
(°C)	(°F)	-2000	0	2000	4000	6000	8000
54	129	672.3	628.0				
52	126	690.0	643.1				
50	122	707.9	659.3	605.6			
48	118	725.5	677.8	619.9			
46	115	743.7	696.5	635.4	581.4		
44	111	761.0	714.1	652.5	596.0		
42	108	780.4	732.3	671.6	610.3	559.0	
40	104	796.2	750.7	689.9	624.4	570.9	
38	100	812.3	772.2	707.1	638.3	582.6	521.9
36	97	826.7	788.8	722.9	650.1	593.9	531.2
34	93	835.0	804.3	739.6	664.3	603.4	540.4
32	90	835.0	820.0	753.4	678.3	612.5	550.1
30	86	835.0	833.7	766.6	692.9	621.8	558.8
28	82	835.0	834.0	778.6	704.3	631.8	567.1
26	79	835.0	834.2	790.6	714.0	642.3	575.8
24	75	835.0	834.4	790.8	722.9	651.2	585.1
22	72	835.0	834.6	790.9	732.3	660.0	595.0
20	68	835.0	834.9	791.1	732.6	667.3	602.2
18	64	835.0	835.0	791.3	732.8	675.5	607.4
16	61	835.0	835.0	791.5	732.9	675.6	612.2
14	57	835.0	835.0	791.6	733.1	675.8	617.4
12	54	835.0	835.0	791.8	733.3	675.9	617.7
10	50	835.0	835.0	792.0	733.4	675.9	617.8
8	46	835.0	835.0	792.1	733.6	676.0	617.8
6	43	835.0	835.0	792.2	733.7	676.0	617.7
4	40	835.0	835.0	781.7	706.7	645.9	570.8
2	36	835.0	835.0	781.9	706.7	646.0	570.9
0	32	835.0	835.0	781.9	706.8	646.1	570.9
-40	-40	835.0	835.0	781.9	706.8	646.1	571.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 2900 lb.

With engine and wing anti-ice on, decrease weight by 5000 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 51700 lb.

ENGINE INOP**ADVISORY INFORMATION****Go-Around Climb Gradient****Flaps 20, Gear Up****Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.**

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	6.09	5.12	3.80			
50	6.87	5.85	4.58	3.23	1.72	0.21
46	7.68	6.65	5.32	4.03	2.51	0.70
42	8.43	7.48	6.10	4.72	3.50	1.49
38	9.17	8.30	6.86	5.36	4.05	2.60
34	9.61	9.03	7.54	5.94	4.51	3.04
30	9.64	9.64	8.06	6.50	4.95	3.45
26	9.66	9.65	8.51	6.94	5.44	3.85
22	9.68	9.66	8.51	7.33	5.81	4.30
18	9.70	9.67	8.52	7.34	6.14	4.59
14	9.72	9.68	8.53	7.34	6.15	4.84
10	9.74	9.68	8.54	7.34	6.15	4.84

Weight Adjustment

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
800	-3.18	-3.58	-3.96	-4.37	-4.72	-5.18	-5.58	-6.02	-6.35	-6.83	-7.29
750	-2.88	-3.23	-3.58	-3.94	-4.25	-4.66	-5.02	-5.41	-5.70	-6.13	-6.54
700	-2.52	-2.82	-3.12	-3.43	-3.70	-4.05	-4.36	-4.68	-4.94	-5.31	-5.66
650	-2.15	-2.40	-2.64	-2.89	-3.11	-3.38	-3.64	-3.89	-4.11	-4.40	-4.67
600	-1.57	-1.75	-1.92	-2.10	-2.25	-2.45	-2.64	-2.82	-2.98	-3.19	-3.40
550	-0.86	-0.96	-1.05	-1.15	-1.24	-1.35	-1.45	-1.55	-1.63	-1.75	-1.87
500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450	1.05	1.17	1.29	1.41	1.52	1.66	1.77	1.90	2.01	2.16	2.30
400	2.41	2.68	2.96	3.24	3.49	3.80	4.06	4.35	4.61	4.95	5.29

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF	-0.24	-0.24	-0.23	-0.23	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.21
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF+10	0.08	0.07	0.07	0.07	0.08	0.10	0.11	0.09	0.08	0.08	0.09
VREF+20	0.15	0.13	0.13	0.14	0.15	0.17	0.13	0.12	0.14	0.06	0.08
VREF+30	0.12	0.08	0.10	0.06	0.02	-0.02	-0.05	-0.05	-0.02	-0.12	-0.12

With engine bleed for packs off, increase gradient by 0.1%.**With engine and wing anti-ice on, decrease gradient by 0.1%.****When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease gradient by 0.7%**

Quick Turnaround Limit Weight

Flaps 30 Limit Weight (1000 LB)

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	510.4				
50	122	513.7	494.5			
45	113	517.9	498.5	479.9		
40	104	522.2	502.6	483.7	465.1	
35	95	526.6	506.8	487.7	469.0	450.5
30	86	531.1	511.2	491.8	473.1	454.4
25	77	535.6	515.6	496.1	477.3	458.4
20	68	540.3	520.2	500.4	481.5	462.5
15	59	545.2	524.9	504.9	485.7	466.8
10	50	550.2	529.7	509.6	490.1	471.1
5	41	555.3	534.6	514.3	494.6	475.5
0	32	560.6	539.6	519.2	499.3	480.1
-5	23	566.1	544.8	524.3	504.1	484.6
-10	14	571.7	550.2	529.5	509.1	489.3
-15	5	577.5	555.7	534.7	514.2	494.2
-20	-4	583.4	561.5	540.1	519.5	499.2
-30	-22	595.8	573.4	551.6	530.5	509.8
-40	-40	608.4	586.1	563.8	542.1	521.1
-50	-58	622.0	599.4	576.8	554.5	532.9
-54	-65	627.7	604.9	582.2	559.8	537.7

Increase weight by 4800 lb per 1% uphill slope. Decrease weight by 7600 lb per 1% downhill slope.
Increase weight by 13200 lb per 10 knots headwind. Decrease weight by 69500 lb per 10 knots tailwind.

Decrease weight by 27600 lb when one brake is deactivated. Decrease weight by 56100 lb when two brakes are deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Performance Dispatch

Chapter PD

Gear Down

Section 53

GEAR DOWN

Takeoff Climb Limit Weight
Flaps 15

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	517.8	486.8	424.8		
52	126	529.7	493.8	436.5	372.8	
50	122	542.4	496.4	458.3	383.2	
48	118	555.5	508.7	473.4	393.8	
46	115	568.6	520.8	475.9	419.1	
44	111	581.5	532.6	486.8	448.7	
42	108	593.6	544.2	497.7	451.2	380.8
40	104	605.9	556.3	508.9	461.3	415.5
38	100	619.5	569.1	520.9	471.9	418.8
36	97	633.2	581.9	532.9	483.2	428.4
34	93	647.1	594.8	545.4	494.8	438.3
32	90	659.4	607.7	557.5	506.1	448.9
30	86	671.1	621.1	569.8	517.9	459.9
28	82	683.0	634.3	582.4	529.5	470.5
26	79	693.7	646.4	593.9	540.9	481.9
24	75	699.0	657.0	604.3	551.5	492.3
22	72	699.2	666.6	614.1	560.8	503.6
20	68	699.4	671.1	622.4	568.3	513.6
18	65	699.6	671.2	630.2	575.3	521.5
16	61	699.7	671.2	634.0	580.4	528.3
14	58	699.8	671.2	633.9	584.6	534.3
12	54	699.9	671.3	633.8	586.7	537.6
10	50	700.0	671.3	633.6	586.4	540.4
-40	-40	696.2	666.9	627.1	579.2	535.1

With engine bleed for packs off, increase weight by 1800 lb.
With engine anti-ice on, decrease weight by 4000 lb.
With engine and wing anti-ice on, decrease weight by 9200 lb.

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	565.1				
52	126	578.9				
50	122	592.7	544.9			
48	118	607.7	558.2			
46	115	623.2	572.8	523.5		
44	111	638.1	588.5	536.9		
42	108	653.6	603.6	549.8	503.4	
40	104	669.5	618.4	562.6	514.0	
38	100	684.8	631.1	575.2	524.5	468.9
36	97	699.4	643.8	585.6	534.4	477.3
34	93	714.0	657.3	596.5	542.8	485.6
32	90	727.3	668.9	606.6	551.0	494.3
30	86	740.1	679.3	617.8	559.3	501.9
28	82	740.3	688.4	626.9	568.5	509.4
26	79	740.5	698.7	635.0	577.9	517.3
24	75	740.7	698.8	642.4	585.9	526.0
22	72	740.9	698.9	650.0	592.6	534.8
20	68	741.1	699.1	650.3	598.3	541.5
18	64	741.3	699.3	650.4	604.6	546.2
16	61	741.5	699.4	650.5	604.7	550.5
14	57	741.6	699.6	650.6	604.8	555.2
12	54	741.7	699.8	650.6	604.8	555.5
10	50	741.8	699.9	650.7	604.8	555.6
-40	-40	742.4	700.4	651.4	605.4	555.9

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

With engine bleed for packs off, increase weight by 3900 lb.

With engine and wing anti-ice on, decrease weight by 3800 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 67100 lb.

GEAR DOWN**Takeoff Obstacle Limit Weight****Flaps 15****Sea Level, 30°C & Below, Zero Wind****Based on engine bleed for packs on, engine and wing anti-ice off**

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	647.4								
50	607.6	666.0							
100	570.3	627.8	668.5						
150	541.1	597.0	638.7	669.6					
200	516.9	571.3	613.6	645.4	670.2				
250	496.0	549.2	591.3	624.3	649.8	670.4			
300	477.5	529.7	571.5	605.0	631.6	652.9	670.4	681.7	681.7
350	460.9	512.3	553.8	587.5	614.8	636.9	655.0	670.2	681.0
400	445.9	496.5	537.7	571.4	599.1	622.0	640.8	656.6	670.0
450	432.4	482.0	522.9	556.6	584.6	608.0	627.4	643.7	657.7
500	419.8	468.6	509.2	542.9	571.0	594.7	614.8	631.6	646.0
550	408.1	456.2	496.5	530.0	558.3	582.3	602.7	620.1	634.9
600	397.2	444.7	484.5	518.1	546.4	570.6	591.3	609.0	624.3
650	387.0	434.0	473.3	506.8	535.1	559.4	580.4	598.5	614.2
700	377.4	423.9	462.8	496.1	524.5	548.9	570.0	588.4	604.4
750		414.4	452.8	486.0	514.4	538.8	560.1	578.7	594.9
800		405.3	443.5	476.4	504.7	529.2	550.6	569.4	585.9
850		396.7	434.7	467.2	495.5	520.1	541.6	560.4	577.1
900		388.5	426.2	458.5	486.7	511.3	532.9	551.9	568.7
950		380.7	418.2	450.1	478.3	502.9	524.5	543.6	560.6
1000		373.3	410.4	442.3	470.2	494.8	516.5	535.7	552.7

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)								
	360	400	440	480	520	560	600	640	680
30 & BELOW	0	0	0	0	0	0	0	0	0
32	-6.3	-7.1	-7.9	-8.8	-9.6	-10.4	-11.3	-12.1	-12.9
34	-12.6	-14.2	-15.9	-17.5	-19.2	-20.9	-22.5	-24.2	-25.8
36	-18.8	-21.3	-23.8	-26.3	-28.8	-31.3	-33.8	-36.3	-38.8
38	-25.1	-28.4	-31.8	-35.1	-38.4	-41.7	-45.0	-48.4	-51.7
40	-31.4	-35.5	-39.7	-43.8	-48.0	-52.2	-56.3	-60.5	-64.6
42	-37.5	-42.5	-47.5	-52.6	-57.6	-62.6	-67.6	-72.7	-77.7
44	-43.6	-49.5	-55.4	-61.3	-67.2	-73.1	-79.0	-84.9	-90.8
46	-49.6	-56.4	-63.2	-70.0	-76.8	-83.6	-90.3	-97.1	-103.9
48	-55.7	-63.4	-71.0	-78.7	-86.4	-94.0	-101.7	-109.3	-117.0
50	-61.8	-70.3	-78.9	-87.4	-96.0	-104.5	-113.0	-121.6	-130.1

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
S.L. & BELOW	0	0	0	0	0	0	0	0	0
1000	-15.8	-17.2	-18.6	-20.0	-21.4	-22.8	-24.3	-25.7	-27.1
2000	-31.5	-34.4	-37.2	-40.0	-42.8	-45.7	-48.5	-51.3	-54.2
3000	-45.4	-49.9	-54.4	-58.9	-63.4	-67.9	-72.4	-76.9	-81.4
4000	-59.2	-65.4	-71.6	-77.7	-83.9	-90.1	-96.2	-102.4	-108.6
5000	-74.8	-82.4	-90.0	-97.6	-105.2	-112.8	-120.4	-128.0	-135.6
6000	-90.4	-99.4	-108.5	-117.5	-126.5	-135.6	-144.6	-153.7	-162.7
7000	-104.9	-115.4	-125.9	-136.4	-146.8	-157.3	-167.8	-178.3	-188.8
8000	-119.4	-131.3	-143.3	-155.2	-167.1	-179.1	-191.0	-202.9	-214.9

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
15 TW	-40.0	-42.9	-45.7	-48.6	-51.4	-54.3	-57.1	-60.0	-62.9
10 TW	-26.7	-28.6	-30.5	-32.4	-34.3	-36.2	-38.1	-40.0	-41.9
5 TW	-13.3	-14.3	-15.2	-16.2	-17.1	-18.1	-19.0	-20.0	-21.0
0	0	0	0	0	0	0	0	0	0
10 HW	7.0	6.7	6.4	6.1	5.9	5.6	5.3	5.0	4.7
20 HW	14.0	13.4	12.9	12.3	11.7	11.1	10.6	10.0	9.4
30 HW	26.0	24.5	23.0	21.5	20.1	18.6	17.1	15.6	14.1
40 HW	38.0	35.6	33.2	30.8	28.4	26.0	23.6	21.2	18.8

With engine bleed for packs off, increase weight by 2100 lb.

With engine anti-ice on, decrease weight by 3600 lb.

With engine and wing anti-ice on, decrease weight by 8700 lb.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18500	16500	14100
760	19000	17100	14700
740	19600	17800	15400
720	20100	18400	16000
700	20900	19300	17100
680	21800	20400	18100
660	22800	21400	19300
640	23800	22400	20500
620	24900	23400	21800
600	25900	24500	23000
580	26900	25600	24100
560	27900	26900	25300
540	29000	28100	26600
520	30000	29400	27900
500	30800	30400	29300
480	31600	31200	30400
460	32400	32100	31500
440	33200	33000	32500
420	34000	33900	33600
400	34800	34700	34500
380	35700	35600	35400
360	36600	36400	36200

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
328	292	261	237	217	200	188	177	167	159	151
493	439	393	356	326	300	282	265	250	237	226
657	585	524	475	435	400	375	353	334	316	302
820	731	655	594	544	500	469	442	417	396	377
982	876	785	712	652	600	563	531	501	475	453
1144	1021	915	830	761	700	658	619	585	555	528
1305	1165	1045	948	869	800	752	708	669	634	604
1465	1309	1174	1066	978	900	846	797	753	714	680
1625	1452	1303	1184	1086	1000	940	886	837	794	756
1784	1595	1432	1302	1194	1100	1035	975	921	874	832
1942	1737	1561	1419	1302	1200	1129	1064	1006	954	908
2099	1879	1689	1536	1410	1300	1223	1153	1090	1034	985
2256	2020	1817	1653	1518	1400	1317	1242	1174	1114	1061
2412	2161	1944	1770	1626	1500	1412	1331	1259	1194	1138
2567	2302	2072	1887	1734	1600	1506	1420	1343	1275	1215
2722	2442	2199	2004	1842	1700	1600	1510	1428	1355	1292
2877	2581	2326	2121	1950	1800	1695	1599	1513	1436	1369
3030	2721	2453	2237	2058	1900	1789	1689	1598	1517	1446
3183	2860	2580	2353	2165	2000	1884	1778	1683	1598	1523

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME
	(1000 LB)	(HR:MIN)	(1000 LB)	(HR:MIN)	(1000 LB)	(HR:MIN)	(1000 LB)	(HR:MIN)	(1000 LB)	(HR:MIN)
200	16.8	0:51	16.2	0:49	15.7	0:47	15.4	0:45	15.3	0:44
300	24.8	1:14	23.7	1:11	22.9	1:08	22.2	1:05	21.7	1:02
400	32.9	1:38	31.3	1:33	30.0	1:29	28.9	1:24	28.2	1:21
500	40.9	2:01	38.8	1:55	37.1	1:49	35.7	1:44	34.7	1:39
600	49.3	2:24	46.7	2:17	44.6	2:10	42.7	2:03	41.4	1:57
700	57.6	2:47	54.5	2:38	52.0	2:30	49.7	2:22	48.1	2:15
800	65.9	3:10	62.3	3:00	59.4	2:50	56.8	2:41	54.8	2:33
900	74.3	3:32	70.2	3:21	66.8	3:11	63.8	3:01	61.6	2:51
1000	82.6	3:55	78.0	3:43	74.2	3:31	70.8	3:20	68.3	3:09
1100	91.3	4:17	86.2	4:04	81.9	3:51	78.2	3:38	75.4	3:26
1200	100.1	4:39	94.4	4:24	89.7	4:10	85.6	3:57	82.5	3:44
1300	108.8	5:01	102.6	4:45	97.4	4:30	92.9	4:15	89.6	4:01
1400	117.5	5:23	110.9	5:06	105.2	4:50	100.3	4:34	96.7	4:19
1500	126.3	5:45	119.1	5:27	113.0	5:09	107.7	4:52	103.8	4:36
1600	135.4	6:06	127.7	5:47	121.1	5:28	115.4	5:10	111.3	4:53
1700	144.5	6:27	136.3	6:07	129.2	5:47	123.2	5:28	118.8	5:10
1800	153.7	6:48	144.9	6:27	137.3	6:06	130.9	5:46	126.3	5:27
1900	162.8	7:09	153.5	6:47	145.4	6:25	138.7	6:04	133.8	5:44
2000	172.0	7:30	162.1	7:07	153.5	6:44	146.4	6:22	141.3	6:01

GEAR DOWN**Long Range Cruise Trip Fuel and Time****Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	600
20	-2.3	-1.2	0.0	1.5	2.9	4.4
40	-4.7	-2.4	0.0	2.9	5.9	9.0
60	-7.1	-3.6	0.0	4.4	8.9	13.7
80	-9.4	-4.8	0.0	5.9	11.9	18.5
100	-11.8	-6.0	0.0	7.4	15.1	23.5
120	-14.2	-7.2	0.0	9.0	18.3	28.5
140	-16.6	-8.4	0.0	10.5	21.5	33.6
160	-19.0	-9.6	0.0	12.1	24.9	38.9
180	-21.4	-10.8	0.0	13.7	28.2	44.3

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

GEAR DOWN

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
97	82	70	62	55	50	46	42	39	36	34
169	149	133	120	109	100	92	86	80	75	71
241	215	194	177	162	150	139	130	122	115	109
312	280	255	233	215	200	187	175	165	155	147
381	345	315	290	268	250	234	220	207	196	186
450	409	375	346	321	300	281	265	250	237	225
519	473	435	402	374	350	329	310	293	278	264
588	537	495	459	427	400	376	355	336	319	303
657	602	555	515	480	450	423	400	378	359	342
728	667	616	572	533	500	471	444	421	400	381

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)						TIME (HRS:MIN)
		360	400	440	480	520	560	
50	FUEL (1000 LB)	4.5	4.7	5.0	5.2	5.5	5.7	0:15
	ALT (FT)	9000	9000	9000	9000	9000	9000	
100	FUEL (1000 LB)	7.7	8.2	8.6	9.1	9.5	10.0	0:25
	ALT (FT)	21000	19000	19000	17000	17000	17000	
150	FUEL (1000 LB)	10.5	11.2	11.9	12.6	13.3	14.0	0:34
	ALT (FT)	27000	25000	23000	23000	21000	21000	
200	FUEL (1000 LB)	13.2	14.1	15.0	15.9	16.9	17.8	0:43
	ALT (FT)	31000	29000	27000	27000	25000	23000	
250	FUEL (1000 LB)	15.8	16.9	18.1	19.3	20.5	21.7	0:52
	ALT (FT)	33000	31000	29000	27000	25000	23000	
300	FUEL (1000 LB)	18.4	19.8	21.2	22.6	24.1	25.5	1:00
	ALT (FT)	33000	31000	29000	27000	27000	25000	
350	FUEL (1000 LB)	21.0	22.6	24.2	25.9	27.6	29.4	1:08
	ALT (FT)	33000	33000	31000	29000	27000	25000	
400	FUEL (1000 LB)	23.6	25.4	27.3	29.3	31.2	33.2	1:17
	ALT (FT)	33000	33000	31000	29000	27000	25000	
450	FUEL (1000 LB)	26.3	28.3	30.4	32.6	34.9	37.1	1:25
	ALT (FT)	33000	33000	31000	29000	27000	25000	
500	FUEL (1000 LB)	28.9	31.1	33.5	36.0	38.5	41.0	1:34
	ALT (FT)	33000	33000	31000	29000	27000	25000	

GEAR DOWN

Holding Planning
Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
800	34620						
760	33440	33530					
720	31620	31620					
680	29690	29650	29490				
640	27760	27720	27560				
600	26150	26110	25930				
560	24590	24540	24370	24560			
520	23070	22980	22830	22930	23160		
480	21640	21490	21350	21370	21590		
440	20190	19980	19830	19820	19980	20300	
400	18800	18570	18360	18350	18430	18630	19110
360	17390	17150	16880	16880	16870	17020	17410

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
800	33870	34080	33970	34630	36430
760	32580	32710	32590	33180	34550
720	30690	30730	30670	31100	32150
680	28720	28710	28690	29000	29710
640	26790	26740	26730	27020	27530
600	25150	25070	25020	25290	25680
560	23560	23440	23360	23590	23850
520	21990	21830	21700	21870	22090
480	20490	20290	20110	20230	20420
440	18960	18740	18510	18590	18730
400	17490	17270	16980	17000	17090
360	16040	15800	15480	15420	15490

These tables include 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
20	374.5	374.5	
18	397.5	393.1	384.4
16	424.4	420.7	412.2
14	453.3	451.7	440.3
12	488.9	484.2	469.7
10	524.5	518.7	503.5
8	562.0	553.8	539.5
6	604.3	588.9	567.4
4	641.4	617.7	589.7
2	671.4	642.9	613.1
0	698.4	666.6	634.4

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)									
	PRESSURE ALTITUDE (1000 FT)									
	0	2	4	6	8	10	12	14	16	18
ENGINE ONLY	0.0	-1.3	-2.2	-2.4	-2.1	-1.7	-1.4	-0.2	0.0	0.0
ENGINE AND WING	-4.7	-6.2	-6.3	-6.6	-5.7	-4.9	-4.0	-3.3	-2.6	-2.0

Performance Dispatch**Text****Chapter PD****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 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 data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Tire Speed, and Obstacle Limit Weights as determined from the following tables. Brake Energy Limit is not shown as it is not limiting for the range of conditions shown in this chapter. When determining a maximum weight for a wet runway, the dry runway limit weight must also be checked and the lower of the two weights used.

Field Limit Weight - Slope and Wind Corrections

These tables for wet and dry runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction 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 condition 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

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct 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

Maximum tire speed limited weights are presented for 235 MPH tires. To determine the tire speed limit weight, enter the table with OAT, move to airport pressure altitude and read the tire speed limit weight. Adjust the tire speed limit weight according to the notes below the table to account for wind.

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 to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Normal takeoff speeds, V1, VR, and V2 are read from either the wet or dry table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR 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 Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle limit weight and the V1 must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 6200 lb for a dry runway or 10700 lb for a wet runway and the V1 associated with the reduced weight by two knots. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 13300 lb for a dry runway or 17700 lb for a wet runway and the V1 associated with the reduced weight by four knots for a dry runway or three knots for a wet runway. If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate stop distance available corrected for wind and slope exceeds approximately 4900 ft for one brake deactivated or 5100 ft for two brakes deactivated. For wet runways, the corrected accelerate stop distance should exceed approximately 6100 ft for one brake deactivated or 6400 ft for two brakes deactivated.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

One Thrust Reverser Inoperative

Wet runway takeoff performance presented for all brakes operating is based on the use of one thrust reverser during deceleration. When operating with a thrust reverser inoperative, the runway/obstacle limited takeoff weight and V1 speed must be reduced to account for the reduced deceleration capability. A simplified method which conservatively accounts for this is to reduce the normal wet runway/obstacle limited weight by 9400 lb and the V1 associated with the reduced weight by three 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 corrected for wind and slope exceeds approximately 6300 ft.

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 at two center of gravity positions: 7.5% MAC (FMC default) for use when no center of gravity is entered on the PERF INIT page, and 30% MAC (typical mid cruise center of gravity) for use when 30% MAC is entered. Crews may interpolate between these values to determine the airplane's capability at other specific center of gravity positions. Note that these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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 fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time 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 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. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time 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

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 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%.

Oxygen Requirements

Flight Crew 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 these requirements is achieved with the minimum dispatch oxygen cylinder pressure. Enter the Crew Oxygen Requirements table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate bottle temperature.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 2.05 liters/person/minute (1.2 psi/person/minute for the single cylinder system), or 13 liters/person/minute (8 psi/person/minute) if 100% oxygen is selected during normal usage.

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 Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited 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 engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table 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, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

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Performance Dispatch

Chapter PD

Table of Contents

Section 60

777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA

Pkg Model IdentificationPD.ModID.60.1

Takeoff..... PD.60.1

Takeoff Field Corrections - Dry RunwayPD.60.1

Takeoff Field & Climb Limit Weights - Dry RunwayPD.60.2

Takeoff Field Corrections - Wet RunwayPD.60.5

Takeoff Field & Climb Limit Weights - Wet RunwayPD.60.6

Takeoff Obstacle Limit Weight.....PD.60.9

Tire Speed Limit.....PD.60.11

Takeoff Speeds - Dry RunwayPD.60.12

Takeoff Speeds - Wet RunwayPD.60.14

Enroute PD.61.1

Long Range Cruise Maximum Operating Altitude.....PD.61.1

Long Range Cruise Trip Fuel and TimePD.61.5

Long Range Cruise Step ClimbPD.61.7

Short Trip Fuel and TimePD.61.8

Holding PlanningPD.61.9

Crew Oxygen Requirements.....PD.61.10

Net Level Off WeightPD.61.11

Landing PD.62.1

Landing Field Limit Weight - Dry RunwayPD.62.1

Landing Field Limit Weight - Wet RunwayPD.62.3

Approach or Landing Climb Limited Weight.....PD.62.4

Go-Around Climb GradientPD.62.5

Quick Turnaround Limit Weight.....PD.62.6

Gear Down..... PD.63.1

Takeoff Climb Limit Weight.....PD.63.1

**Performance Dispatch
Pkg Model Identification****Chapter PD
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
300ER	777-300ER	7350	WY350

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Performance Dispatch
Takeoff

Chapter PD
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	4310	4280	4260	4230	4200	4150	4110	4060	4020
4600	4750	4710	4680	4640	4600	4540	4480	4420	4360
5000	5190	5140	5090	5050	5000	4930	4860	4780	4710
5400	5630	5570	5510	5460	5400	5310	5230	5140	5060
5800	6070	6000	5930	5870	5800	5700	5600	5500	5400
6200	6510	6430	6350	6280	6200	6090	5970	5860	5750
6600	6950	6860	6770	6690	6600	6470	6350	6220	6090
7000	7380	7290	7190	7100	7000	6860	6720	6580	6440
7400	7820	7720	7610	7510	7400	7250	7090	6940	6780
7800	8260	8150	8030	7920	7800	7630	7460	7300	7130
8200	8700	8580	8450	8330	8200	8020	7840	7660	7480
8600	9140	9010	8870	8740	8600	8410	8210	8020	7820
9000	9580	9440	9290	9150	9000	8790	8580	8370	8170
9400	10020	9860	9710	9550	9400	9180	8960	8730	8510
9800	10460	10290	10130	9960	9800	9560	9330	9090	8860
10200	10900	10720	10550	10370	10200	9950	9700	9450	9200
10600	11340	11150	10970	10780	10600	10340	10070	9810	9550
11000	11780	11580	11390	11190	11000	10720	10450	10170	9890
11400	12210	12010	11810	11600	11400	11110	10820	10530	10240
11800	12650	12440	12230	12010	11800	11500	11190	10890	10590

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	4450	4700	4970	5250
4600	3500	3870	4230	4600	4860	5130	5410	5700
5000	3840	4220	4610	5000	5270	5550	5850	6150
5400	4170	4580	4990	5400	5680	5980	6280	6600
5800	4500	4940	5370	5800	6100	6400	6720	7050
6200	4840	5290	5750	6200	6510	6830	7160	7490
6600	5170	5650	6120	6600	6920	7250	7590	7940
7000	5500	6000	6500	7000	7330	7680	8030	8390
7400	5840	6360	6880	7400	7750	8100	8470	8840
7800	6170	6710	7260	7800	8160	8530	8900	9290
8200	6500	7070	7630	8200	8570	8950	9340	9740
8600	6840	7420	8010	8600	8980	9370	9780	10190
9000	7170	7780	8390	9000	9390	9800	10210	10640
9400	7500	8140	8770	9400	9810	10220	10650	11090
9800	7840	8490	9150	9800	10220	10650	11090	11540
10200	8170	8850	9520	10200	10630	11070	11520	11990
10600	8500	9200	9900	10600	11040	11500	11960	12430
11000	8840	9560	10280	11000	11460	11920	12400	12880
11400	9170	9910	10660	11400	11870	12350	12840	13330
11800	9500	10270	11030	11800	12280	12770	13270	13780

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	549.2	495.8	492.5	489.3	486.1	483.0	473.2	461.4	448.3	434.8	421.2
5000	575.4	519.8	516.3	513.0	509.7	506.4	496.3	483.9	470.3	456.2	442.0
5400	600.5	542.7	539.2	535.7	532.3	528.9	518.3	505.5	491.3	476.7	462.0
5800	624.7	564.9	561.2	557.6	554.0	550.5	539.6	526.3	511.7	496.5	481.3
6200	647.9	586.2	582.4	578.6	575.0	571.4	560.1	546.3	531.2	515.6	499.9
6600	670.2	606.6	602.7	598.9	595.1	591.4	579.8	565.6	550.1	534.0	517.8
7000	691.6	626.3	622.3	618.3	614.5	610.7	598.7	584.2	568.2	551.7	535.1
7400	711.9	645.1	640.9	636.9	632.9	629.0	616.8	602.0	585.6	568.7	551.7
7800	731.5	663.2	659.0	654.9	650.8	646.9	634.4	619.2	602.5	585.2	567.8
8200	751.3	681.6	677.3	673.1	668.9	664.9	652.1	636.7	619.6	601.9	584.2
8600	770.2	699.1	694.7	690.4	686.2	682.1	669.1	653.3	635.9	617.9	599.8
9000	787.1	714.7	710.2	705.8	701.5	697.3	684.1	668.0	650.3	631.9	613.5
9400	802.6	728.8	724.3	719.8	715.4	711.2	697.7	681.3	663.2	644.5	625.8
9800	817.8	742.7	738.1	733.6	729.1	724.7	711.0	694.3	676.0	656.9	637.8
10200	832.6	756.3	751.6	747.0	742.4	738.0	724.0	707.1	688.4	669.0	649.6
10600	834.9	769.5	764.7	760.0	755.4	750.9	736.7	719.5	700.5	680.8	661.1
11000	834.9	782.4	777.5	772.8	768.1	763.5	749.1	731.6	712.3	692.3	672.2
CLIMB LIMIT WT (1000 LB)	823.3	823.2	822.9	822.6	822.3	821.9	794.3	763.1	728.8	695.6	662.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	513.5	465.3	462.2	459.2	456.3	447.9	438.5	427.2	414.9	400.0	386.1
5000	538.2	488.0	484.8	481.7	478.6	469.9	460.1	448.3	435.5	420.0	405.5
5400	561.9	509.8	506.4	503.1	500.0	490.9	480.8	468.5	455.2	439.1	424.0
5800	584.7	530.7	527.3	523.9	520.6	511.2	500.7	488.0	474.2	457.5	442.0
6200	606.6	550.9	547.3	543.8	540.4	530.7	519.9	506.8	492.5	475.3	459.3
6600	627.7	570.4	566.7	563.1	559.6	549.6	538.4	524.9	510.3	492.5	476.0
7000	647.9	589.1	585.3	581.6	578.0	567.7	556.3	542.4	527.4	509.2	492.2
7400	667.2	606.9	603.1	599.3	595.6	585.1	573.4	559.2	543.8	525.2	507.8
7800	685.8	624.3	620.3	616.4	612.7	601.9	590.0	575.4	559.7	540.7	522.9
8200	704.7	641.8	637.8	633.8	630.0	619.0	606.8	592.0	575.9	556.5	538.4
8600	722.6	658.6	654.4	650.4	646.5	635.3	622.9	607.7	591.4	571.6	553.1
9000	738.7	673.4	669.2	665.1	661.1	649.7	637.0	621.6	604.9	584.7	565.9
9400	753.2	686.7	682.5	678.3	674.2	662.6	649.7	634.0	617.0	596.5	577.3
9800	767.6	699.9	695.6	691.3	687.2	675.4	662.2	646.2	629.0	608.0	588.5
10200	781.6	712.7	708.3	704.0	699.8	687.8	674.4	658.1	640.6	619.3	599.4
10600	795.2	725.2	720.7	716.3	712.1	699.9	686.2	669.7	651.9	630.2	610.1
11000	808.5	737.4	732.9	728.4	724.0	711.7	697.8	681.1	662.9	641.0	620.4
CLIMB LIMIT WT (1000 LB)	779.2	778.9	778.6	778.4	778.1	756.9	733.8	704.6	673.5	640.1	610.2

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 lb.

Takeoff Field & Climb Limit Weights - Dry Runway**Flaps 15****4000 FT Pressure Altitude**

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	479.2	434.6	431.7	428.8	422.4	414.1	403.9	393.0	380.3	367.0	355.3
5000	502.5	456.0	453.0	450.0	443.3	434.7	424.0	412.7	399.4	385.6	373.4
5400	524.8	476.4	473.3	470.2	463.3	454.4	443.2	431.5	417.7	403.3	390.7
5800	546.3	496.2	493.0	489.8	482.7	473.4	461.8	449.7	435.4	420.5	407.4
6200	567.0	515.3	512.0	508.7	501.3	491.7	479.8	467.3	452.5	437.2	423.6
6600	586.9	533.7	530.3	526.8	519.3	509.4	497.1	484.2	469.1	453.2	439.3
7000	606.1	551.4	547.9	544.4	536.6	526.5	513.9	500.6	485.1	468.8	454.5
7400	624.3	568.4	564.8	561.2	553.2	542.9	530.0	516.4	500.5	483.9	469.2
7800	642.1	584.9	581.2	577.5	569.4	558.8	545.6	531.8	515.5	498.5	483.5
8200	660.0	601.6	597.9	594.1	585.8	575.0	561.5	547.4	530.8	513.4	498.1
8600	677.1	617.6	613.7	609.9	601.4	590.4	576.7	562.3	545.3	527.6	512.1
9000	692.2	631.6	627.7	623.8	615.2	603.9	590.0	575.3	558.0	540.0	524.1
9400	706.0	644.2	640.2	636.3	627.5	616.0	601.8	586.9	569.3	550.9	534.8
9800	719.5	656.6	652.6	648.5	639.6	627.9	613.5	598.2	580.3	561.6	545.2
10200	732.6	668.7	664.6	660.5	651.4	639.5	624.8	609.3	591.1	572.1	555.3
10600	745.4	680.5	676.3	672.1	662.8	650.8	635.8	620.1	601.6	582.3	565.2
11000	758.0	692.0	687.7	683.5	674.1	661.8	646.6	630.6	611.8	592.2	574.9
CLIMB LIMIT WT (1000 LB)	726.9	726.6	726.4	726.1	714.1	696.2	673.1	648.6	619.1	589.4	564.4

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	445.9	403.3	400.3	394.9	386.8	377.0	368.3	358.8	347.6	336.6	326.0
5000	467.8	423.3	420.3	414.6	406.2	396.0	386.9	377.1	365.3	353.9	342.8
5400	488.7	442.6	439.4	433.5	424.8	414.2	404.7	394.5	382.3	370.4	358.9
5800	509.0	461.2	457.9	451.8	442.8	431.8	422.0	411.4	398.8	386.5	374.6
6200	528.4	479.1	475.7	469.4	460.1	448.8	438.6	427.7	414.7	402.0	389.7
6600	547.2	496.4	492.9	486.4	476.9	465.2	454.8	443.5	430.1	417.0	404.4
7000	565.3	513.1	509.6	502.9	493.1	481.1	470.4	458.8	445.0	431.6	418.7
7400	582.6	529.2	525.6	518.7	508.7	496.4	485.5	473.7	459.5	445.8	432.5
7800	599.4	544.8	541.1	534.1	523.8	511.3	500.1	488.0	473.6	459.6	446.0
8200	616.4	560.7	556.9	549.8	539.3	526.5	515.1	502.8	488.0	473.7	459.9
8600	632.7	575.9	572.0	564.7	554.0	541.0	529.3	516.8	501.8	487.2	473.0
9000	647.0	589.1	585.2	577.8	566.9	553.6	541.7	528.9	513.6	498.7	484.3
9400	659.9	601.0	597.0	589.4	578.3	564.8	552.7	539.6	524.1	508.9	494.3
9800	672.6	612.6	608.5	600.8	589.5	575.7	563.4	550.2	534.3	518.9	504.0
10200	684.9	623.9	619.8	611.9	600.4	586.4	573.9	560.4	544.3	528.6	513.4
10600	697.0	635.0	630.7	622.8	611.1	596.8	584.1	570.4	554.0	538.1	522.6
11000	708.7	645.7	641.4	633.3	621.5	607.0	594.1	580.2	563.5	547.3	531.6
CLIMB LIMIT WT (1000 LB)	674.9	674.9	674.6	667.1	651.5	631.2	612.9	592.5	567.3	543.2	520.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 lb.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	409.4	369.4	364.4	357.3	348.5	340.4	331.8	322.0	311.9	302.0	292.0
5000	429.8	388.0	382.9	375.5	366.3	357.8	348.9	338.7	328.1	317.8	307.4
5400	449.2	405.9	400.5	392.8	383.3	374.5	365.2	354.7	343.7	333.0	322.2
5800	468.1	423.2	417.6	409.7	399.8	390.7	381.1	370.1	358.8	347.7	336.5
6200	486.2	439.9	434.2	425.9	415.8	406.3	396.4	385.1	373.4	361.9	350.4
6600	503.7	456.0	450.2	441.7	431.2	421.5	411.3	399.7	387.6	375.8	363.9
7000	520.7	471.7	465.6	456.9	446.2	436.2	425.8	413.8	401.4	389.3	377.1
7400	536.9	486.8	480.6	471.7	460.7	450.5	439.8	427.6	414.9	402.5	390.0
7800	552.7	501.5	495.2	486.1	474.8	464.4	453.4	440.9	427.9	415.3	402.5
8200	568.8	516.5	510.0	500.7	489.3	478.6	467.5	454.7	441.4	428.5	415.5
8600	584.1	530.8	524.2	514.7	503.0	492.2	480.8	467.8	454.2	441.1	427.8
9000	597.5	543.2	536.5	526.8	514.9	503.8	492.2	479.0	465.2	451.8	438.3
9400	609.5	554.2	547.3	537.5	525.4	514.1	502.3	488.8	474.8	461.1	447.3
9800	621.3	564.9	558.0	548.0	535.6	524.2	512.2	498.4	484.1	470.2	456.2
10200	632.7	575.4	568.4	558.2	545.6	534.0	521.7	507.8	493.2	479.1	464.8
10600	643.9	585.7	578.5	568.1	555.3	543.5	531.1	516.9	502.1	487.7	473.2
11000	654.8	595.7	588.4	577.9	564.9	552.9	540.2	525.8	510.8	496.2	481.5
CLIMB LIMIT WT (1000 LB)	620.6	620.5	613.3	599.8	581.8	565.4	547.3	526.4	504.0	482.8	461.8

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 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	4240	4230	4220	4210	4200	4150	4110	4060	4020
4600	4690	4670	4650	4620	4600	4540	4480	4420	4360
5000	5140	5100	5070	5030	5000	4930	4850	4780	4710
5400	5590	5540	5490	5450	5400	5310	5230	5140	5060
5800	6040	5980	5920	5860	5800	5700	5600	5500	5400
6200	6480	6410	6340	6270	6200	6090	5980	5860	5750
6600	6930	6850	6770	6680	6600	6470	6350	6220	6100
7000	7380	7290	7190	7100	7000	6860	6720	6580	6450
7400	7830	7720	7610	7510	7400	7250	7100	6940	6790
7800	8280	8160	8040	7920	7800	7640	7470	7310	7140
8200	8730	8600	8460	8330	8200	8020	7840	7670	7490
8600	9180	9030	8890	8740	8600	8410	8220	8030	7830
9000	9620	9470	9310	9160	9000	8800	8590	8390	8180
9400	10070	9900	9740	9570	9400	9180	8960	8750	8530
9800	10520	10340	10160	9980	9800	9570	9340	9110	8880
10200	10970	10780	10580	10390	10200	9960	9710	9470	9220
10600	11420	11210	11010	10800	10600	10340	10090	9830	9570
11000	11870	11650	11430	11220	11000	10730	10460	10190	9920
11400	12310	12090	11860	11630	11400	11120	10830	10550	10270
11800	12760	12520	12280	12040	11800	11500	11210	10910	10610

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	4470	4740	5040	5340
4600	3380	3790	4190	4600	4880	5170	5480	5800
5000	3720	4150	4570	5000	5290	5600	5920	6260
5400	4050	4500	4950	5400	5700	6020	6360	6720
5800	4390	4860	5330	5800	6110	6450	6800	7180
6200	4720	5220	5710	6200	6520	6870	7250	7640
6600	5060	5570	6090	6600	6940	7300	7690	8100
7000	5400	5930	6470	7000	7350	7730	8130	8560
7400	5730	6290	6840	7400	7760	8150	8570	9020
7800	6070	6640	7220	7800	8170	8580	9010	9480
8200	6400	7000	7600	8200	8580	9000	9450	9940
8600	6740	7360	7980	8600	9000	9430	9900	10400
9000	7070	7710	8360	9000	9410	9850	10340	10860
9400	7410	8070	8740	9400	9820	10280	10780	11320
9800	7740	8430	9110	9800	10230	10710	11220	11780
10200	8080	8790	9490	10200	10640	11130	11660	12240
10600	8410	9140	9870	10600	11060	11560	12110	12700
11000	8750	9500	10250	11000	11470	11980	12550	13160
11400	9080	9860	10630	11400	11880	12410	12990	13620
11800	9420	10210	11010	11800	12290	12830	13430	14080

Takeoff Field & Climb Limit Weights - Wet Runway**Flaps 15****Sea Level Pressure Altitude**

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	626.2	563.5	559.7	555.9	552.2	548.6	537.1	523.2	507.8	492.1	476.6
6200	643.2	578.7	574.8	570.9	567.1	563.4	551.6	537.2	521.5	505.3	489.4
6600	664.8	598.0	593.9	589.9	586.0	582.2	569.9	555.1	538.8	522.1	505.6
7000	685.6	616.7	612.5	608.4	604.3	600.3	587.7	572.4	555.5	538.3	521.2
7400	705.5	634.5	630.1	625.9	621.7	617.6	604.6	588.8	571.5	553.7	536.1
7800	725.1	652.1	647.6	643.2	638.9	634.7	621.4	605.1	587.3	569.0	550.9
8200	745.6	670.6	666.0	661.5	657.1	652.8	639.0	622.4	604.0	585.3	566.7
8600	765.6	688.7	684.0	679.4	674.8	670.4	656.3	639.2	620.4	601.2	582.2
9000	783.6	704.8	700.0	695.3	690.7	686.1	671.7	654.2	634.9	615.2	595.7
9400	800.0	719.4	714.4	709.6	704.9	700.2	685.4	667.5	647.8	627.6	607.7
9800	816.2	733.8	728.7	723.8	718.9	714.1	699.1	680.7	660.6	639.9	619.5
10200	832.7	748.5	743.3	738.2	733.3	728.4	713.0	694.2	673.6	652.5	631.7
10600	834.9	763.2	757.9	752.8	747.7	742.7	727.0	707.8	686.8	665.3	644.0
11000	834.9	777.7	772.3	767.0	761.8	756.8	740.7	721.2	699.7	677.7	656.0
11400	834.9	791.7	786.2	780.9	775.6	770.4	754.1	734.2	712.3	689.9	667.7
11800	834.9	805.5	799.9	794.4	789.1	783.8	767.1	746.9	724.6	701.8	679.2
12200	834.9	818.8	813.1	807.5	802.1	796.7	779.7	759.1	736.5	713.3	690.3
12600	834.9	831.7	825.9	820.2	814.7	809.3	792.0	771.1	748.0	724.5	701.2
CLIMB LIMIT WT (1000 LB)	823.3	823.2	822.9	822.6	822.3	821.9	794.3	763.1	728.8	695.6	662.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	583.5	527.5	524.0	520.4	517.0	507.2	496.3	483.2	469.1	453.9	439.7
6200	599.3	541.7	538.0	534.4	530.9	520.8	509.6	496.1	481.7	466.0	451.4
6600	619.4	559.8	555.9	552.2	548.5	538.1	526.5	512.5	497.6	481.3	466.3
7000	638.7	577.2	573.2	569.4	565.6	554.8	542.8	528.4	513.0	496.2	480.6
7400	657.2	593.8	589.7	585.7	581.9	570.7	558.4	543.6	527.6	510.4	494.3
7800	675.4	610.2	606.0	601.9	597.9	586.5	573.8	558.6	542.2	524.4	508.0
8200	694.5	627.6	623.3	619.1	615.0	603.3	590.2	574.5	557.7	539.5	522.6
8600	713.3	644.6	640.2	635.9	631.7	619.6	606.3	590.2	573.0	554.3	536.9
9000	730.0	659.7	655.2	650.7	646.4	634.1	620.4	603.9	586.3	567.1	549.3
9400	745.1	673.1	668.5	664.0	659.6	647.0	633.0	616.1	598.0	578.4	560.2
9800	760.1	686.5	681.7	677.1	672.6	659.7	645.4	628.1	609.7	589.6	571.0
10200	775.4	700.1	695.3	690.6	686.0	672.8	658.1	640.5	621.6	601.1	582.1
10600	790.7	713.9	708.9	704.1	699.4	685.9	671.0	653.0	633.7	612.8	593.3
11000	805.7	727.3	722.3	717.3	712.5	698.8	683.5	665.2	645.5	624.1	604.3
11400	820.3	740.4	735.3	730.3	725.4	711.4	695.8	677.1	657.0	635.3	615.1
11800	834.6	753.2	748.0	742.9	737.9	723.6	707.8	688.7	668.3	646.2	625.6
12200	834.9	765.6	760.3	755.1	750.0	735.5	719.4	700.0	679.3	656.7	635.8
12600	834.9	777.6	772.2	767.0	761.8	747.1	730.7	711.0	689.9	667.0	645.7
CLIMB LIMIT WT (1000 LB)	779.2	778.9	778.6	778.4	778.1	756.9	733.8	704.6	673.5	640.1	610.2

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Takeoff Field & Climb Limit Weights - Wet Runway**Flaps 15****4000 FT Pressure Altitude**

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	543.5	491.5	488.2	484.9	477.5	468.0	457.2	446.1	433.0	419.3	407.4
6200	558.1	504.7	501.3	497.9	490.3	480.5	469.4	457.9	444.5	430.5	418.2
6600	576.7	521.4	517.9	514.3	506.5	496.4	484.9	473.0	459.1	444.6	431.9
7000	594.7	537.6	533.9	530.3	522.2	511.7	499.9	487.6	473.3	458.3	445.1
7400	611.8	553.0	549.2	545.5	537.2	526.4	514.1	501.5	486.7	471.3	457.8
7800	628.8	568.2	564.4	560.5	552.0	540.9	528.3	515.4	500.1	484.2	470.3
8200	646.7	584.5	580.5	576.6	567.8	556.4	543.5	530.2	514.5	498.2	483.9
8600	664.1	600.4	596.3	592.3	583.3	571.6	558.3	544.7	528.7	511.9	497.3
9000	679.7	614.4	610.2	606.1	596.8	584.9	571.3	557.3	540.9	523.8	508.7
9400	693.6	626.8	622.5	618.3	608.9	596.6	582.7	568.4	551.6	534.1	518.7
9800	707.4	639.1	634.7	630.4	620.7	608.2	594.0	579.3	562.2	544.2	528.5
10200	721.5	651.7	647.2	642.8	632.9	620.1	605.6	590.6	573.1	554.7	538.7
10600	735.7	664.4	659.8	655.3	645.2	632.1	617.3	602.0	584.1	565.4	549.0
11000	749.6	676.8	672.2	667.5	657.3	643.9	628.8	613.2	594.9	575.8	559.1
11400	763.2	689.0	684.2	679.5	669.0	655.4	640.0	624.1	605.5	586.0	568.9
11800	776.4	700.8	696.0	691.2	680.5	666.7	651.0	634.8	615.8	596.0	578.6
12200	789.2	712.3	707.4	702.5	691.7	677.6	661.6	645.2	625.9	605.7	588.0
12600	801.6	723.5	718.5	713.6	702.5	688.2	672.0	655.3	635.6	615.1	597.2
CLIMB LIMIT WT (1000 LB)	726.9	726.6	726.4	726.1	714.1	696.2	673.1	648.6	619.1	589.4	564.4

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	504.6	456.3	453.2	447.5	439.2	429.1	420.1	410.4	398.8	387.5	376.6
6200	518.2	468.5	465.3	459.4	450.9	440.5	431.2	421.3	409.3	397.7	386.6
6600	535.4	484.0	480.7	474.6	465.7	455.0	445.4	435.1	422.7	410.7	399.2
7000	552.0	498.9	495.5	489.2	480.1	469.0	459.1	448.4	435.7	423.3	411.4
7400	567.9	513.2	509.7	503.2	493.8	482.4	472.1	461.2	448.0	435.3	423.0
7800	583.6	527.3	523.7	517.0	507.4	495.6	485.1	473.8	460.3	447.2	434.6
8200	600.2	542.4	538.7	531.9	522.0	509.9	499.1	487.5	473.7	460.2	447.2
8600	616.5	557.3	553.5	546.4	536.3	523.9	512.8	500.9	486.7	472.9	459.6
9000	630.9	570.2	566.3	559.1	548.7	536.0	524.7	512.5	497.9	483.8	470.1
9400	643.7	581.6	577.6	570.3	559.6	546.6	535.0	522.5	507.6	493.1	479.2
9800	656.4	592.8	588.8	581.2	570.4	557.1	545.2	532.4	517.2	502.4	488.1
10200	669.3	604.4	600.3	592.6	581.4	567.9	555.7	542.7	527.1	511.9	497.4
10600	682.4	616.1	611.9	604.0	592.6	578.8	566.4	553.1	537.2	521.7	506.8
11000	695.2	627.6	623.2	615.2	603.6	589.5	576.8	563.2	547.0	531.2	516.0
11400	707.7	638.8	634.4	626.2	614.4	600.0	587.0	573.2	556.7	540.6	525.1
11800	719.9	649.7	645.2	636.9	624.9	610.2	597.0	583.0	566.1	549.7	533.9
12200	731.8	660.3	655.8	647.3	635.1	620.1	606.8	592.4	575.3	558.6	542.6
12600	743.2	670.7	666.0	657.4	645.0	629.8	616.2	601.7	584.3	567.3	551.0
CLIMB LIMIT WT (1000 LB)	674.9	674.9	674.6	667.1	651.5	631.2	612.9	592.5	567.3	543.2	520.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	465.5	420.9	415.7	408.4	399.3	390.9	382.1	372.0	361.6	351.7	341.9
6200	477.9	432.1	426.8	419.2	409.9	401.2	392.2	381.8	371.1	360.9	350.8
6600	493.7	446.2	440.7	432.9	423.3	414.3	404.9	394.2	383.2	372.6	362.1
7000	509.0	460.0	454.3	446.2	436.3	427.0	417.3	406.3	394.9	384.0	373.1
7400	523.5	473.0	467.2	458.9	448.6	439.1	429.1	417.7	406.0	394.8	383.6
7800	537.9	486.0	480.0	471.5	460.9	451.1	440.9	429.2	417.1	405.5	394.1
8200	553.4	500.1	493.9	485.1	474.3	464.2	453.7	441.7	429.3	417.4	405.6
8600	568.5	513.8	507.5	498.5	487.4	477.0	466.2	453.9	441.2	429.0	416.9
9000	581.7	525.7	519.2	510.0	498.6	488.0	477.0	464.3	451.3	438.8	426.5
9400	593.3	536.0	529.4	520.0	508.3	497.5	486.2	473.2	459.9	447.2	434.5
9800	604.9	546.2	539.5	529.8	517.9	506.8	495.2	482.0	468.4	455.3	442.4
10200	616.7	556.8	549.9	540.0	527.8	516.5	504.7	491.1	477.2	463.9	450.6
10600	628.7	567.5	560.4	550.3	537.9	526.3	514.2	500.4	486.2	472.6	459.0
11000	640.4	578.0	570.7	560.4	547.7	535.9	523.6	509.5	495.0	481.1	467.3
11400	651.8	588.2	580.8	570.3	557.4	545.4	532.8	518.5	503.7	489.5	475.4
11800	663.0	598.2	590.7	580.0	566.9	554.6	541.8	527.2	512.1	497.7	483.4
12200	673.8	608.0	600.3	589.5	576.1	563.6	550.6	535.7	520.4	505.8	491.2
12600	684.4	617.5	609.7	598.7	585.1	572.4	559.2	544.1	528.5	513.6	498.8
CLIMB LIMIT WT (1000 LB)	620.6	620.5	613.3	599.8	581.8	565.4	547.3	526.4	504.0	482.8	461.8

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.

With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Takeoff Obstacle Limit Weight**Flaps 15****Sea Level, 30°C & Below, Zero Wind****Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off**

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	651.6	721.7	784.7	831.0					
50	621.4	687.0	741.4	787.8	822.7				
100	588.2	653.4	703.9	746.2	782.2	809.6	830.3		
150	560.4	625.1	674.3	714.9	749.2	778.7	801.4	820.0	834.1
200	536.5	599.6	649.3	689.2	722.7	751.2	776.1	795.5	811.8
250	515.5	576.9	627.2	666.9	700.1	728.3	752.5	773.9	791.0
300	496.6	556.6	606.7	647.0	680.0	708.1	732.4	753.4	772.0
350	479.5	538.5	587.9	628.7	661.8	690.0	714.2	735.4	753.9
400	463.8	522.0	570.6	611.5	645.1	673.3	697.7	718.9	737.7
450	449.3	506.7	554.7	595.4	629.5	657.9	682.4	703.8	722.6
500	436.3	492.6	540.0	580.3	614.7	643.5	668.1	689.7	708.7
550	424.2	479.4	526.3	566.3	600.6	629.9	654.7	676.4	695.6
600	412.6	467.1	513.5	553.1	587.3	616.9	642.0	663.9	683.3
650	401.9	455.5	501.4	540.7	574.8	604.4	629.9	652.0	671.5
700	391.7	444.6	489.9	529.0	562.9	592.5	618.4	640.7	660.3
750	381.9	434.5	479.1	517.9	551.6	581.2	607.1	629.8	649.7
800	372.6	424.9	468.9	507.4	540.9	570.4	596.4	619.3	639.4
850		415.6	459.1	497.3	530.6	560.0	586.1	609.2	629.5
900		406.8	449.9	487.7	520.9	550.2	576.2	599.3	620.0
950		398.4	441.1	478.5	511.6	540.7	566.7	589.9	610.7
1000		390.3	432.8	469.8	502.6	531.7	557.6	580.8	601.6

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)						
	360	440	520	600	680	760	840
30 & Below	0	0	0	0	0	0	0
32	-6.2	-7.6	-9.0	-10.4	-11.7	-13.1	-14.5
34	-12.5	-15.2	-18.0	-20.7	-23.5	-26.2	-29.0
36	-18.7	-22.8	-27.0	-31.1	-35.2	-39.3	-43.5
38	-24.9	-30.4	-36.0	-41.5	-47.0	-52.5	-58.0
40	-31.2	-38.1	-44.9	-51.8	-58.7	-65.6	-72.5
42	-38.9	-47.2	-55.5	-63.8	-72.1	-80.4	-88.7
44	-46.6	-56.4	-66.1	-75.8	-85.6	-95.3	-105.0
46	-54.4	-65.5	-76.7	-87.8	-99.0	-110.1	-121.3
48	-62.1	-74.7	-87.3	-99.8	-112.4	-125.0	-137.6
50	-69.8	-83.8	-97.8	-111.8	-125.8	-139.8	-153.8

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
S.L. & BELOW	0	0	0	0	0	0	0
1000	-15.5	-18.4	-21.3	-24.1	-27.0	-29.9	-32.7
2000	-31.1	-36.8	-42.5	-48.3	-54.0	-59.7	-65.4
3000	-45.4	-53.8	-62.2	-70.5	-78.9	-87.3	-95.7
4000	-59.7	-70.7	-81.8	-92.8	-103.8	-114.9	-125.9
5000	-75.1	-89.0	-102.9	-116.8	-130.7	-144.6	-158.5
6000	-90.6	-107.3	-124.1	-140.8	-157.5	-174.3	-191.0
7000	-105.3	-125.1	-144.8	-164.6	-184.4	-204.1	-223.9
8000	-120.0	-142.8	-165.6	-188.4	-211.2	-234.0	-256.8

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
15 TW	-47.0	-55.0	-63.0	-71.0	-79.0	-87.0	-95.0
10 TW	-31.3	-36.7	-42.0	-47.3	-52.7	-58.0	-63.3
5 TW	-15.7	-18.3	-21.0	-23.7	-26.3	-29.0	-31.7
0	0	0	0	0	0	0	0
10 HW	7.9	7.7	7.4	7.2	7.0	6.7	6.5
20 HW	15.9	15.4	14.9	14.4	13.9	13.4	12.9
30 HW	24.6	23.7	22.7	21.8	20.9	20.0	19.1
40 HW	33.3	31.9	30.6	29.2	27.9	26.6	25.2

With engine bleed for packs off, increase weight by 1900 lb.

With engine and wing anti-ice on, decrease weight by 4400 lb.

Tire Speed Limit

Flaps 15

AIRPORT OAT		TIRE SPEED LIMIT WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
(°C)	(°F)	0	2000	4000	6000	8000
54	129	810.2	746.0	689.8	638.7	591.1
52	126	814.6	750.5	693.7	642.4	594.5
50	122	818.9	754.9	697.6	646.0	597.9
48	118	823.5	761.0	701.7	649.8	601.4
46	115	828.0	767.0	705.7	653.6	604.9
44	111	831.2	772.7	709.8	657.3	608.4
42	108	833.1	777.8	713.9	661.2	612.1
40	104	834.9	783.0	718.0	665.0	615.7
38	100	835.0	787.5	722.6	669.0	619.4
36	97	835.0	792.1	727.2	673.0	623.2
34	93	835.0	796.7	731.8	677.2	627.1
32	90	835.0	801.5	736.8	681.4	631.0
30	86	835.0	806.5	741.6	685.8	635.1
28	82	835.0	811.6	746.7	690.2	639.2
26	79	835.0	816.7	752.0	694.7	643.5
24	75	835.0	822.5	757.5	699.2	647.8
22	72	835.0	828.3	764.0	704.1	652.0
20	68	835.0	834.0	774.2	709.1	656.4
18	64	835.0	835.0	780.2	714.2	661.0
16	61	835.0	835.0	785.9	719.6	665.7
14	57	835.0	835.0	791.6	725.4	670.5
12	54	835.0	835.0	797.4	731.2	675.6
10	50	835.0	835.0	803.2	737.1	680.7
-40	-40	835.0	835.0	835.0	835.0	835.0

Increase tire speed limit weight by 5600 lb per knot headwind.

Decrease tire speed limit weight by 11900 lb per knot tailwind.

Takeoff Speeds - Dry Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
840	175	185	190
800	171	179	186
760	166	175	182
720	162	170	178
680	157	164	174
640	152	159	169
600	146	153	165
560	140	146	160
520	133	140	155
480	125	133	150
440	117	126	145
400	108	119	139
360	98	111	132

Check V1(MCG), Minimum VR.

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	-2	0	2	4	6	8	-2	0	2	4	6	8
70	158	12	14					7	8					-4	-4				
60	140	8	10	12	14			4	6	7	8			-3	-3	-4	-4		
50	122	5	6	8	10	13	16	3	4	5	6	8	9	-2	-2	-3	-3	-4	-5
40	104	1	3	5	7	10	13	1	2	3	5	6	8	-1	-1	-2	-2	-3	-4
30	86	0	0	2	5	8	11	0	0	2	3	5	7	0	0	-1	-2	-2	-3
20	68	0	0	2	4	6	9	0	0	1	2	4	6	0	0	-1	-1	-2	-3
-60	-76	0	0	2	4	6	8	0	0	1	2	4	5	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		
840	-4	-1	0	3	6	-3	-1	0	0	1	3	4	5		
800	-4	-1	0	3	5	-2	-1	0	0	1	3	3	4		
760	-3	-1	0	3	4	-2	-1	0	0	1	2	3	4		
720	-3	-1	0	2	4	-2	-1	0	0	1	2	3	3		
680	-3	-1	0	2	4	-2	-1	0	0	1	2	2	3		
640	-2	-1	0	2	4	-2	-1	0	0	1	2	2	3		
600	-2	-1	0	2	3	-2	-1	0	0	1	2	2	3		
560	-2	0	0	2	3	-2	-1	0	0	1	2	2	3		
520	-2	0	0	2	3	-1	-1	0	0	1	2	3	3		
480	-1	0	0	2	3	-1	-1	0	0	1	2	3	3		
440	-1	0	0	3	4	-1	0	0	0	1	2	3	4		
400	-1	0	0	3	4	-1	0	1	0	1	3	3	4		
360	-1	0	0	3	4	-1	0	1	0	2	3	4	5		

*V1 not to exceed VR

Takeoff Speeds - Dry Runway
Flaps 15
V1(MCG), Minimum VR
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111				
50	122	119	121	116	118	111	113	109	111	106	109	103	106
40	104	126	127	123	124	118	120	113	115	108	111	103	106
30	86	128	130	128	130	123	125	118	120	112	115	106	109
20	68	129	130	129	130	125	126	120	122	116	118	110	113
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114

Takeoff Speeds - Wet Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
840	169	185	190
800	164	179	186
760	158	175	182
720	153	170	178
680	147	164	174
640	141	159	169
600	134	153	165
560	128	146	160
520	121	140	155
480	113	133	150
440	105	126	145
400	97	119	139
360	89	111	132

Check V1(MCG), Minimum VR.

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	-2	0	2	4	6	8	-2	0	2	4	6	8
70	158	14	16					7	8					-4	-4				
60	140	10	11	14	16			4	6	7	8			-3	-3	-4	-4		
50	122	5	7	9	12	14	17	3	4	5	6	8	9	-2	-2	-3	-3	-4	-5
40	104	2	3	6	8	11	14	1	2	3	5	6	8	-1	-1	-2	-2	-3	-4
30	86	0	0	3	5	8	12	0	0	2	3	5	7	0	0	-1	-2	-2	-3
20	68	0	0	2	4	7	10	0	0	1	2	4	6	0	0	-1	-1	-2	-3
-60	-76	0	0	2	4	6	9	0	0	1	2	4	5	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		
840	-6	-3	0	3	6	-3	-2	-1	0	1	2	3	4		
800	-6	-3	0	3	6	-4	-3	-1	0	1	2	3	4		
760	-6	-3	0	3	5	-4	-3	-1	0	1	2	3	4		
720	-5	-3	0	3	5	-4	-3	-2	0	1	2	3	4		
680	-5	-3	0	2	5	-5	-3	-2	0	1	2	3	4		
640	-5	-2	0	2	5	-5	-3	-2	0	1	2	3	4		
600	-5	-2	0	2	5	-5	-3	-1	0	1	2	3	4		
560	-4	-2	0	2	4	-5	-3	-1	0	1	2	3	4		
520	-4	-2	0	3	4	-5	-3	-1	0	1	3	4	5		
480	-3	-1	0	3	4	-5	-3	-1	0	1	3	4	5		
440	-2	-1	0	3	5	-4	-2	-1	0	2	3	4	5		
400	-2	0	0	3	5	-4	-2	0	0	2	4	5	6		
360	-1	1	0	4	5	-4	-2	0	0	2	4	5	7		

*V1 not to exceed VR

Takeoff Speeds - Wet Runway
Flaps 15
V1(MCG), Minimum VR
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111				
50	122	119	121	116	118	111	113	109	111	106	109	103	106
40	104	126	127	123	124	118	120	113	115	108	111	103	106
30	86	128	130	128	130	123	125	118	120	112	115	106	109
20	68	129	130	129	130	125	126	120	122	116	118	110	113
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114

Intentionally
Blank

Performance Dispatch**Enroute****Chapter PD****Section 61****Long Range Cruise Maximum Operating Altitude****Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)****ISA + 10°C and Below**

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	30800	29100	27600
760	28800	2	31300	29700	28200
740	29400	0	31800	30200	28700
720	30000	-1	32300	30700	29100
700	30700	-2	32800	31100	29600
680	31300	-4	33200	31600	30100
660	31900	-5	33700	32100	30600
640	32600	-7	34300	32700	31200
620	33300	-8	34800	33200	31700
600	34000	-10	35300	33800	32300
580	34700	-11	35900	34300	32900
560	35400	-13	36500	34900	33500
540	36200	-15	37100	35600	34100
520	37000	-15	37800	36200	34800
500	37800	-15	38400	36900	35500
480	38600	-15	39100	37600	36200
460	39500	-15	39900	38300	36900
440	40400	-15	40600	39100	37700
420	41400	-15	41400	39900	38600
400	42400	-15	42300	40800	39400
380	43100	-15	43100	41800	40500

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	30800	29100	27600
760	28800	8	31300	29700	28200
740	29400	6	31800	30200	28700
720	30000	5	32300	30700	29100
700	30700	3	32800	31100	29600
680	31300	2	33200	31600	30100
660	31900	1	33700	32100	30600
640	32600	-1	34300	32700	31200
620	33300	-2	34800	33200	31700
600	34000	-4	35300	33800	32300
580	34700	-6	35900	34300	32900
560	35400	-7	36500	34900	33500
540	36200	-9	37100	35600	34100
520	37000	-9	37800	36200	34800
500	37800	-9	38400	36900	35500
480	38600	-9	39100	37600	36200
460	39500	-9	39900	38300	36900
440	40400	-9	40600	39100	37700
420	41400	-9	41400	39900	38600
400	42400	-9	42300	40800	39400
380	43100	-9	43100	41800	40500

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	30800	29100	27600
760	28800	13	31300	29700	28200
740	29400	12	31800	30200	28700
720	30000	11	32300	30700	29100
700	30700	9	32800	31100	29600
680	31300	8	33200	31600	30100
660	31900	6	33700	32100	30600
640	32600	5	34300	32700	31200
620	33300	3	34800	33200	31700
600	34000	2	35300	33800	32300
580	34700	0	35900	34300	32900
560	35400	-2	36500	34900	33500
540	36200	-3	37100	35600	34100
520	37000	-3	37800	36200	34800
500	37800	-3	38400	36900	35500
480	38600	-3	39100	37600	36200
460	39500	-3	39900	38300	36900
440	40400	-3	40600	39100	37700
420	41400	-3	41400	39900	38600
400	42400	-3	42300	40800	39400
380	43100	-3	43100	41800	40500

Long Range Cruise Maximum Operating Altitude**Max Climb Thrust, Mid C.G. (30% MAC)****ISA + 10°C and Below**

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	31800	30200	28600
760	28800	2	32400	30700	29200
740	29400	0	32900	31300	29700
720	30000	-1	33300	31700	30200
700	30700	-2	33800	32200	30700
680	31300	-4	34300	32700	31200
660	31900	-5	34800	33200	31700
640	32600	-7	35300	33700	32200
620	33300	-8	35800	34200	32700
600	34000	-10	36300	34800	33300
580	34700	-11	36900	35300	33900
560	35400	-13	37500	35900	34500
540	36200	-15	38100	36600	35100
520	37000	-15	38800	37200	35800
500	37800	-15	39400	37900	36400
480	38600	-15	40100	38600	37100
460	39500	-15	40900	39300	37900
440	40400	-15	41600	40100	38700
420	41400	-15	42400	40900	39500
400	42400	-15	43100	41700	40300
380	43100	-15	43100	42800	41400

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	31800	30200	28600
760	28800	8	32400	30700	29200
740	29400	6	32900	31300	29700
720	30000	5	33300	31700	30200
700	30700	3	33800	32200	30700
680	31300	2	34300	32700	31200
660	31900	1	34800	33200	31700
640	32600	-1	35300	33700	32200
620	33300	-2	35800	34200	32700
600	34000	-4	36300	34800	33300
580	34700	-6	36900	35300	33900
560	35400	-7	37500	35900	34500
540	36200	-9	38100	36600	35100
520	37000	-9	38800	37200	35800
500	37800	-9	39400	37900	36400
480	38600	-9	40100	38600	37100
460	39500	-9	40900	39300	37900
440	40400	-9	41600	40100	38700
420	41400	-9	42400	40900	39500
400	42400	-9	43100	41700	40300
380	43100	-9	43100	42800	41400

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Mid C.G. (30% MAC)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	31800	30200	28600
760	28800	13	32400	30700	29200
740	29400	12	32900	31300	29700
720	30000	11	33300	31700	30200
700	30700	9	33800	32200	30700
680	31300	8	34300	32700	31200
660	31900	6	34800	33200	31700
640	32600	5	35300	33700	32200
620	33300	3	35800	34200	32700
600	34000	2	36300	34800	33300
580	34700	0	36900	35300	33900
560	35400	-2	37500	35900	34500
540	36200	-3	38100	36600	35100
520	37000	-3	38800	37200	35800
500	37800	-3	39400	37900	36400
480	38600	-3	40100	38600	37100
460	39500	-3	40900	39300	37900
440	40400	-3	41600	40100	38700
420	41400	-3	42400	40900	39500
400	42400	-3	43100	41700	40300
380	43100	-3	43100	42800	41400

*Denotes altitude thrust limited in level flight, 300 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
1058	994	937	886	841	800	766	735	706	679	655
1580	1487	1403	1328	1261	1200	1150	1104	1061	1021	985
2101	1979	1868	1769	1681	1600	1534	1473	1416	1364	1316
2620	2469	2332	2210	2100	2000	1918	1842	1771	1706	1647
3138	2959	2795	2650	2520	2400	2302	2211	2127	2049	1978
3654	3447	3258	3090	2939	2800	2687	2581	2483	2392	2309
4168	3933	3719	3529	3358	3200	3071	2950	2838	2735	2641
4679	4418	4180	3968	3776	3600	3455	3320	3194	3078	2972
5190	4903	4640	4406	4194	4000	3839	3689	3550	3421	3303
5699	5386	5099	4844	4612	4400	4224	4059	3906	3764	3635
6207	5868	5558	5281	5030	4800	4608	4429	4262	4108	3966
6713	6348	6015	5717	5448	5200	4992	4798	4618	4451	4298
7217	6828	6472	6153	5865	5600	5376	5168	4973	4794	4629
7721	7307	6928	6590	6283	6000	5761	5537	5329	5137	4960
8224	7786	7385	7026	6700	6400	6145	5906	5685	5480	5292
8726	8264	7841	7461	7117	6800	6529	6276	6040	5823	5623
9228	8742	8296	7897	7534	7200	6913	6645	6396	6166	5955
9728	9219	8751	8332	7951	7600	7297	7015	6752	6509	6286
10228	9695	9206	8767	8368	8000	7681	7384	7107	6852	6617

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)
800	29.5	2:01	29.0	1:59	28.6	1:56	28.2	1:53	27.7	1:52
1200	43.1	2:57	42.1	2:53	41.4	2:49	40.7	2:45	39.9	2:42
1600	56.8	3:52	55.5	3:47	54.4	3:41	53.3	3:35	52.2	3:32
2000	70.5	4:47	68.8	4:41	67.4	4:33	66.0	4:26	64.5	4:22
2400	84.8	5:41	82.8	5:33	80.9	5:23	79.2	5:16	77.3	5:12
2800	99.1	6:34	96.7	6:25	94.5	6:14	92.3	6:06	90.1	6:02
3200	113.7	7:27	110.9	7:16	108.3	7:04	105.8	6:56	103.2	6:51
3600	128.6	8:19	125.5	8:07	122.4	7:54	119.5	7:45	116.5	7:41
4000	143.6	9:11	140.0	8:58	136.6	8:44	133.2	8:35	129.9	8:31
4400	159.2	10:02	155.1	9:47	151.2	9:33	147.4	9:24	144.0	9:20
4800	174.8	10:53	170.3	10:37	165.9	10:23	161.7	10:13	158.2	10:10
5200	190.8	11:43	185.7	11:26	180.9	11:12	176.3	11:02	172.8	11:00
5600	207.1	12:33	201.5	12:15	196.1	12:01	191.3	11:52	188.1	11:50
6000	223.4	13:22	217.2	13:04	211.4	12:49	206.2	12:41	203.3	12:39
6400	240.3	14:11	233.6	13:53	227.3	13:38	222.2	13:30	220.0	13:29
6800	257.3	15:00	250.0	14:42	243.2	14:27	238.2	14:20	236.6	14:19
7200	274.6	15:48	266.7	15:30	259.6	15:16	254.8	15:09	254.3	15:09
7600	292.3	16:37	283.8	16:19	276.5	16:05	272.1	15:58	273.0	15:59
8000	309.9	17:25	300.9	17:07	293.3	16:54	289.5	16:48	291.8	16:49

Long Range Cruise Trip Fuel and Time

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	600
20	-2.2	-1.1	0.0	1.5	2.8	4.6
40	-4.6	-2.3	0.0	2.6	5.6	10.0
60	-7.1	-3.6	0.0	3.9	9.0	16.5
80	-9.5	-4.9	0.0	5.4	13.1	24.0
100	-12.0	-6.2	0.0	7.4	17.8	32.7
120	-14.5	-7.5	0.0	9.6	23.1	42.4
140	-17.0	-8.8	0.0	12.2	29.2	53.2
160	-19.6	-10.1	0.0	15.1	35.8	65.1
180	-22.2	-11.4	0.0	18.3	43.2	78.1
200	-24.8	-12.7	0.0	21.8	51.1	92.2
220	-27.4	-14.0	0.0	25.7	59.8	107.3
240	-30.0	-15.3	0.0	29.8	69.0	123.6
260	-32.7	-16.6	0.0	34.3	79.0	140.9
280	-35.3	-17.9	0.0	39.1	89.6	159.3
300	-38.0	-19.3	0.0	44.2	100.8	178.8
320	-40.7	-20.6	0.0	49.7	112.7	199.3
340	-43.5	-21.9	0.0	55.4	125.2	221.0
360	-46.2	-23.2	0.0	61.4	138.4	243.7

Based on 310/.84 climb, Long Range Cruise and .84/310/250 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
1040	981	928	881	839	800	765	732	703	675	650
1545	1461	1386	1318	1256	1200	1149	1102	1058	1018	981
2050	1941	1843	1754	1673	1600	1533	1471	1414	1361	1312
2555	2421	2300	2190	2091	2000	1917	1840	1769	1704	1643
3060	2900	2757	2626	2508	2400	2301	2209	2125	2047	1974
3564	3380	3213	3063	2925	2800	2685	2579	2481	2390	2306
4068	3859	3670	3499	3343	3200	3069	2948	2837	2733	2637
4572	4338	4127	3935	3760	3600	3453	3318	3193	3077	2969
5076	4817	4583	4371	4177	4000	3837	3687	3549	3420	3300
5580	5296	5039	4807	4594	4400	4221	4057	3905	3763	3632
6083	5775	5496	5242	5011	4800	4606	4426	4261	4107	3964
6587	6253	5952	5678	5429	5200	4990	4796	4617	4450	4296
7090	6732	6408	6114	5846	5600	5374	5166	4973	4794	4628
7593	7210	6864	6550	6263	6000	5758	5536	5329	5138	4960
8095	7688	7320	6985	6680	6400	6143	5905	5686	5482	5292
8598	8166	7776	7421	7097	6800	6527	6275	6042	5826	5624
9100	8644	8231	7856	7514	7200	6911	6645	6398	6169	5956
9602	9122	8687	8292	7931	7600	7296	7015	6755	6513	6289
10104	9599	9142	8727	8348	8000	7680	7385	7111	6858	6621

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB)											TIME (HRS:MIN)
	LANDING WEIGHT (1000 LB)											
	360	380	400	420	440	460	480	500	520	540	560	
800	23.3	24.0	24.9	25.7	26.8	27.7	28.5	29.3	30.2	31.4	32.3	1:50
1200	33.0	34.1	35.3	36.7	38.4	39.6	40.7	42.0	43.6	45.3	46.5	2:40
1600	42.9	44.4	46.0	48.0	50.1	51.7	53.3	55.1	57.3	59.4	61.0	3:30
2000	53.0	54.9	57.0	59.6	62.1	64.1	66.1	68.6	71.3	73.8	75.8	4:20
2400	63.3	65.6	68.3	71.4	74.3	76.7	79.3	82.4	85.5	88.4	90.8	5:10
2800	73.7	76.6	79.9	83.4	86.7	89.6	92.9	96.5	100.0	103.3	106.3	5:59
3200	84.4	87.9	91.7	95.6	99.3	102.9	106.8	110.8	114.7	118.6	122.1	6:49
3600	95.3	99.5	103.7	108.0	112.4	116.6	121.0	125.3	129.8	134.3	138.4	7:38
4000	106.6	111.2	115.9	120.7	125.7	130.6	135.4	140.2	145.2	150.4	155.1	8:28
4400	118.2	123.2	128.4	133.7	139.5	144.8	150.0	155.4	161.1	166.8	172.1	9:17
4800	129.9	135.4	141.1	147.2	153.5	159.3	165.0	171.0	177.3	183.6	189.3	10:07
5200	141.9	147.9	154.1	161.0	167.8	174.0	180.3	187.0	193.9	200.7	206.9	10:56
5600	154.1	160.6	167.6	175.0	182.3	189.0	196.0	203.4	210.9	218.2	224.9	11:45
6000	166.5	173.6	181.4	189.3	197.1	204.4	212.1	220.1	228.1	236.0	243.4	12:34
6400	179.1	187.0	195.4	203.9	212.2	220.3	228.6	237.2	245.7	254.1	262.3	13:23
6800	192.1	200.8	209.7	218.7	227.7	236.5	245.5	254.5	263.6	272.9	281.6	14:12
7200	205.5	214.9	224.3	233.8	243.6	253.1	262.6	272.3	282.1	291.9	301.3	15:01
7600	219.3	229.2	239.1	249.4	259.9	270.1	280.1	290.4	300.9	311.4	321.4	15:50
8000	233.3	243.7	254.3	265.4	276.6	287.3	298.0	308.9	320.1	331.4	342.0	16:39

Based on 310/.84 climb, LRC and .84/310/250 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
96	81	70	62	55	50	46	42	39	36	34
160	143	129	118	108	100	93	87	82	77	73
224	204	187	173	161	150	141	133	125	119	113
287	264	244	227	213	200	189	178	169	161	154
348	323	301	282	265	250	237	225	214	204	195
410	382	357	336	317	300	285	271	259	247	237
471	440	414	390	369	350	333	317	303	290	279
533	499	470	444	421	400	381	364	348	334	320
595	559	527	499	473	450	429	410	393	376	362
660	620	585	554	525	500	477	456	437	419	403

Trip Fuel and Time Required

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)						TIME (HRS:MIN)
		360	400	440	480	520	560	
50	FUEL (1000 LB)	3.7	3.9	4.2	4.4	4.6	4.8	0:14
	ALT (FT)	11000	11000	9000	7000	7000	5000	
100	FUEL (1000 LB)	5.5	5.8	6.1	6.4	6.7	7.0	0:22
	ALT (FT)	15000	15000	13000	13000	13000	13000	
150	FUEL (1000 LB)	7.2	7.6	8.0	8.4	8.7	9.2	0:30
	ALT (FT)	23000	23000	23000	21000	21000	21000	
200	FUEL (1000 LB)	8.7	9.2	9.6	10.1	10.6	11.1	0:36
	ALT (FT)	29000	27000	27000	27000	25000	25000	
250	FUEL (1000 LB)	10.1	10.7	11.2	11.8	12.4	13.0	0:42
	ALT (FT)	37000	31000	29000	29000	27000	29000	
300	FUEL (1000 LB)	11.3	12.0	12.7	13.4	14.1	14.8	0:48
	ALT (FT)	43000	39000	37000	37000	35000	33000	
350	FUEL (1000 LB)	12.4	13.3	14.1	14.9	15.7	16.5	0:54
	ALT (FT)	43000	41000	39000	37000	35000	35000	
400	FUEL (1000 LB)	13.6	14.5	15.5	16.4	17.3	18.2	0:59
	ALT (FT)	43000	41000	39000	37000	35000	35000	
450	FUEL (1000 LB)	14.8	15.8	16.8	17.9	18.9	19.9	1:06
	ALT (FT)	43000	41000	39000	37000	37000	35000	
500	FUEL (1000 LB)	15.9	17.1	18.2	19.4	20.5	21.6	1:13
	ALT (FT)	43000	41000	39000	37000	37000	35000	

Holding Planning Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
800	21080	20850	20650	21390	22070	22890	24000			
760	20030	19830	19600	19980	20850	21520	22350			
720	18980	18810	18560	18680	19660	20140	20800			
680	17950	17770	17530	17480	18410	18820	19430			
640	16940	16740	16500	16420	16950	17570	18140			
600	15950	15730	15480	15370	15600	16380	16850	17580		
560	15000	14750	14460	14330	14360	15200	15560	16040		
520	14110	13820	13480	13320	13300	13760	14300	14730		
480	13280	12940	12550	12370	12310	12420	13070	13450		
440	12470	12110	11680	11500	11370	11330	11850	12180	12870	
400	11690	11320	10870	10680	10490	10400	10460	10970	11530	
360	11180	10800	10350	10110	9880	9730	9680	9810	10230	10550

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
800	23060	23000	22910	23120	23640
760	21780	21670	21550	21670	22160
720	20580	20460	20320	20370	20800
680	19410	19270	19110	19130	19490
640	18250	18110	17920	17930	18180
600	17120	16950	16730	16710	16860
560	16020	15810	15570	15530	15610
520	14970	14700	14440	14360	14400
480	13970	13660	13340	13220	13210
440	13010	12650	12290	12110	12060
400	12100	11710	11300	11080	10970
360	11450	11070	10600	10350	10210

These tables include 5% additional fuel for holding in a racetrack pattern.

Crew Oxygen Requirements

Required Pressure (PSI) for Two 114/115 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	325	435	545
45	113	320	430	540
40	104	315	420	530
35	95	310	415	520
30	86	305	410	510
25	77	300	400	505
20	68	295	395	495
15	59	290	390	485
10	50	285	380	480
5	41	280	375	470
0	32	275	370	460
-5	23	270	360	455
-10	14	265	355	445

For more extensive than normal crew usage, add 0.6 psi/person/minute.

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	399.4	395.0	382.9
28	430.8	421.2	405.7
26	464.5	451.9	435.2
24	500.6	484.9	467.6
22	538.7	521.7	503.0
20	592.3	577.6	555.9
18	641.7	622.3	598.3
16	695.5	671.7	645.7
14	743.0	715.0	686.1
12	790.9	760.6	730.9
10	833.2	801.9	768.0

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)								
	PRESSURE ALTITUDE (1000 FT)								
	14	16	18	20	22	24	26	28	30
ENGINE ONLY	-1.4	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE AND WING	-5.6	-3.9	-3.2	-2.2	-2.5	-2.6	-2.6	-2.7	-2.6

Intentionally
Blank

Performance Dispatch

Chapter PD

Landing

Section 62

Landing Field Limit Weight - Dry Runway

Flaps 30

Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000			2750	3000	3070	3080	3140	3200
3400	2700	2870	3110	3400	3500	3540	3640	3730
3800	2990	3200	3470	3800	3930	4000	4130	4260
4200	3280	3530	3830	4200	4360	4460	4630	4790
4600	3570	3850	4190	4600	4790	4920	5120	5320
5000	3860	4180	4550	5000	5220	5380	5620	5860
5400	4150	4510	4910	5400	5650	5840	6120	6390
5800	4450	4840	5270	5800	6080	6300	6610	6920
6200	4740	5160	5630	6200	6500	6760	7110	7450
6600	5030	5490	5990	6600	6930	7210	7600	7980
7000	5320	5820	6350	7000	7360	7670	8100	8520
7400	5610	6150	6710	7400	7790	8130	8600	9050
7800	5900	6470	7070	7800	8220	8590	9090	9580
8200	6190	6800	7430	8200	8650	9050	9590	10110
8600	6480	7130	7790	8600	9080	9510	10080	10650
9000	6770	7450	8150	9000	9510	9970	10580	11180
9400	7060	7780	8510	9400	9940	10430	11080	11710
9800	7350	8110	8870	9800	10370	10890	11570	12240
10200	7650	8440	9230	10200	10800	11350	12070	12770
10600	7940	8760	9590	10600	11230	11800	12560	13310

Landing Field Limit Weight - Dry Runway

Flaps 30

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)				
	0	2000	4000	6000	8000
4600	403.3				
5000	451.4	423.9	397.7		
5400	502.1	470.6	440.9	413.4	387.0
5800	553.3	518.9	486.1	454.7	425.8
6200	605.0	567.7	532.0	498.0	465.5
6600	649.4	616.8	578.4	541.7	506.6
7000	670.9	653.4	625.1	585.6	548.0
7400	690.1	672.5	655.1	629.9	589.7
7800	706.4	687.6	669.9	652.2	629.6
8200	723.8	702.2	683.9	666.1	647.6
8600	740.7	718.2	697.1	679.0	661.0
9000	756.7	733.8	711.5	691.4	673.2
9400	779.5	748.8	725.9	703.6	684.6
9800	796.2	764.7	739.8	716.9	695.6
10200	812.3	784.9	753.2	729.9	707.1
10600	827.8	799.9	770.6	742.3	718.9
11000	843.1	814.3	786.5	754.3	730.6
11400		828.3	800.0	770.2	741.8
11800		842.1	813.1	784.9	752.6
12200			825.7	797.1	764.5
12600			838.0	808.9	780.5
13000			850.3	820.3	791.6
13400				831.5	802.2
13800				842.6	812.6
14200				853.7	822.8
14600					832.9

With manual speedbrakes, decrease weight by 47800 lb.

With 1 brake deactivated, decrease weight by 50200 lb.

With 2 brakes deactivated, decrease weight by 102100 lb.

Landing Field Limit Weight - Wet Runway

Flaps 30

Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000				3000	3050	3030	3050	3080
3400			3120	3400	3480	3490	3550	3610
3800	3020	3210	3480	3800	3910	3950	4050	4140
4200	3320	3540	3840	4200	4340	4410	4540	4670
4600	3610	3870	4200	4600	4770	4870	5040	5200
5000	3900	4200	4560	5000	5190	5320	5530	5740
5400	4190	4520	4920	5400	5620	5780	6030	6270
5800	4480	4850	5280	5800	6050	6240	6520	6800
6200	4770	5180	5640	6200	6480	6700	7020	7330
6600	5060	5500	6000	6600	6910	7160	7520	7870
7000	5350	5830	6360	7000	7340	7620	8010	8400
7400	5640	6160	6720	7400	7770	8080	8510	8930
7800	5930	6490	7080	7800	8200	8540	9010	9460
8200	6220	6810	7440	8200	8630	9000	9500	9990
8600	6520	7140	7800	8600	9060	9460	10000	10530
9000	6810	7470	8160	9000	9490	9910	10490	11060
9400	7100	7800	8520	9400	9920	10370	10990	11590
9800	7390	8120	8880	9800	10340	10830	11480	12120
10200	7680	8450	9240	10200	10770	11290	11980	12660
10600	7970	8780	9600	10600	11200	11750	12480	13190

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)				
	0	2000	4000	6000	8000
5400	414.8	389.4			
5800	456.9	428.9	402.4		
6200	501.0	469.6	440.0	412.5	386.2
6600	545.5	511.6	479.1	448.4	419.9
7000	590.3	553.9	519.0	485.7	454.1
7400	634.1	596.5	559.2	523.6	489.6
7800	659.4	638.5	599.7	561.7	525.4
8200	677.6	660.0	637.8	600.1	561.6
8600	693.1	675.5	658.0	635.2	597.9
9000	707.6	688.6	670.8	653.1	630.8
9400	722.7	701.2	683.0	665.2	646.4
9800	737.4	715.1	694.6	676.5	658.5
10200	751.5	728.8	706.7	687.4	669.2
10600	768.6	742.0	719.3	697.9	679.5
11000	786.5	754.8	731.7	709.2	689.2
11400	800.8	771.7	743.6	720.6	698.7
11800	814.7	787.2	755.1	731.8	708.9
12200	828.1	800.2	771.0	742.6	719.2
12600	841.5	812.8	785.0	753.0	729.4
13000	854.8	825.0	796.8	765.4	739.2
13400		837.0	808.3	780.3	748.7
13800		849.1	819.5	791.1	757.9
14200			830.2	801.5	772.2
14600			840.9	811.7	783.2

With manual speedbrakes, decrease weight by 47800 lb.

With 1 brake deactivated, decrease weight by 50200 lb.

With 2 brakes deactivated, decrease weight by 102100 lb.

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Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
(°C)	(°F)	-2000	0	2000	4000	6000	8000
54	129	672.3	628.0				
52	126	690.0	643.1				
50	122	707.8	659.3	605.6			
48	118	725.5	677.8	619.9			
46	115	743.7	696.5	635.4	585.0		
44	111	761.0	714.1	652.5	600.2		
42	108	777.3	732.3	671.6	614.6	563.6	
40	104	793.0	750.7	689.9	629.6	576.5	
38	100	809.0	769.5	707.1	644.2	589.2	523.7
36	97	823.4	785.6	722.9	658.1	600.0	534.2
34	93	834.9	801.0	739.6	671.9	609.6	544.6
32	90	835.0	816.7	753.4	684.7	618.5	554.2
30	86	835.0	830.3	765.2	699.0	627.8	562.5
28	82	835.0	830.6	775.5	709.9	638.0	570.7
26	79	835.0	830.8	787.4	718.4	648.3	578.8
24	75	835.0	831.0	787.5	725.5	659.0	587.6
22	72	835.0	831.2	787.7	732.4	666.4	596.9
20	68	835.0	831.5	787.8	732.6	671.0	604.8
18	64	835.0	831.6	788.0	732.8	675.5	610.3
16	61	835.0	831.8	788.2	732.9	675.6	614.2
14	57	835.0	831.9	788.4	733.1	675.8	617.6
12	54	835.0	832.1	788.5	733.3	675.9	617.8
10	50	835.0	832.1	788.7	733.4	675.9	617.9
8	46	835.0	832.2	788.9	733.6	676.0	617.9
6	43	835.0	832.3	788.9	733.7	676.0	617.8
4	40	835.0	832.4	781.7	706.6	645.9	570.9
2	36	835.0	832.4	781.9	706.7	646.0	570.9
0	32	835.0	832.5	781.9	706.8	646.1	571.0
-40	-40	835.0	832.7	781.9	706.8	646.1	571.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 2900 lb.

With engine and wing anti-ice on, decrease weight by 4800 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 48400 lb.

ENGINE INOP**ADVISORY INFORMATION****Go-Around Climb Gradient****Flaps 20, Gear Up****Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.**

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	6.10	5.13	3.96			
50	6.87	5.86	4.59	3.52	2.51	1.16
46	7.69	6.66	5.32	4.11	3.04	1.64
42	8.44	7.49	6.11	4.83	3.61	2.13
38	9.17	8.30	6.86	5.49	4.19	2.65
34	9.62	9.05	7.54	6.08	4.67	3.14
30	9.64	9.64	8.07	6.61	5.10	3.54
26	9.66	9.65	8.51	7.03	5.59	3.93
22	9.67	9.66	8.52	7.34	5.93	4.36
18	9.69	9.66	8.52	7.34	6.15	4.65
14	9.71	9.67	8.53	7.35	6.15	4.84
10	9.72	9.68	8.54	7.35	6.15	4.84

Weight Adjustment

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)											
	0	1	2	3	4	5	6	7	8	9	10	
800	-3.08	-3.51	-3.94	-4.37	-4.80	-5.22	-5.64	-6.05	-6.46	-6.86	-7.26	
750	-2.74	-3.13	-3.52	-3.90	-4.28	-4.65	-5.03	-5.40	-5.76	-6.12	-6.47	
700	-2.41	-2.74	-3.07	-3.40	-3.72	-4.04	-4.36	-4.68	-4.99	-5.30	-5.60	
650	-2.08	-2.35	-2.61	-2.87	-3.12	-3.38	-3.63	-3.88	-4.13	-4.39	-4.64	
600	-1.51	-1.70	-1.89	-2.08	-2.26	-2.45	-2.63	-2.81	-2.99	-3.18	-3.37	
550	-0.83	-0.93	-1.04	-1.14	-1.24	-1.34	-1.44	-1.54	-1.64	-1.74	-1.85	
500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
450	1.03	1.16	1.28	1.40	1.53	1.65	1.77	1.90	2.03	2.16	2.29	
400	2.38	2.66	2.93	3.21	3.49	3.77	4.06	4.35	4.64	4.95	5.26	

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)											
	0	1	2	3	4	5	6	7	8	9	10	
VREF	-0.22	-0.23	-0.23	-0.23	-0.23	-0.22	-0.22	-0.22	-0.21	-0.21	-0.21	
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
VREF+10	0.08	0.07	0.07	0.07	0.09	0.11	0.12	0.11	0.12	0.10	0.10	
VREF+20	0.17	0.14	0.12	0.13	0.16	0.19	0.19	0.17	0.17	0.14	0.13	
VREF+30	0.14	0.10	0.08	0.08	0.10	0.05	0.03	0.01	-0.01	-0.07	-0.04	

With engine bleed for packs off, increase gradient by 0.1%.**With engine and wing anti-ice on, decrease gradient by 0.1%.****When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease gradient by 0.7%**

Quick Turnaround Limit Weight

Flaps 30 Limit Weight (1000 LB)

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	510.4				
50	122	513.7	494.5			
45	113	517.9	498.5	479.9		
40	104	522.2	502.6	483.7	465.1	
35	95	526.6	506.8	487.7	469.0	450.5
30	86	531.1	511.2	491.8	473.1	454.4
25	77	535.6	515.6	496.1	477.3	458.4
20	68	540.3	520.2	500.4	481.5	462.5
15	59	545.2	524.9	504.9	485.7	466.8
10	50	550.2	529.7	509.6	490.1	471.1
5	41	555.3	534.6	514.3	494.6	475.5
0	32	560.6	539.6	519.2	499.3	480.1
-5	23	566.1	544.8	524.3	504.1	484.6
-10	14	571.7	550.2	529.5	509.1	489.3
-15	5	577.5	555.7	534.7	514.2	494.2
-20	-4	583.4	561.5	540.1	519.5	499.2
-30	-22	595.8	573.4	551.6	530.5	509.8
-40	-40	608.4	586.1	563.8	542.1	521.1
-50	-58	622.0	599.4	576.8	554.5	532.9
-54	-65	627.7	604.9	582.2	559.8	537.7

Increase weight by 4800 lb per 1% uphill slope. Decrease weight by 7600 lb per 1% downhill slope.
Increase weight by 13200 lb per 10 knots headwind. Decrease weight by 69500 lb per 10 knots tailwind.

Decrease weight by 27600 lb when one brake is deactivated. Decrease weight by 56100 lb when two brakes are deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Performance Dispatch
Gear Down

Chapter PD
Section 63

GEAR DOWN

Takeoff Climb Limit Weight
Flaps 15

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	517.8	494.0	458.7	412.7	
52	126	529.7	493.8	471.7	424.7	
50	122	542.4	496.4	473.5	436.5	377.2
48	118	555.5	508.7	473.4	447.8	388.6
46	115	568.6	520.8	475.9	448.8	399.8
44	111	581.5	532.6	486.8	448.6	410.6
42	108	593.6	544.2	497.7	451.1	416.5
40	104	605.9	556.3	508.9	461.3	416.3
38	100	619.5	569.1	520.9	471.9	418.8
36	97	633.2	581.8	532.9	483.2	428.4
34	93	647.1	594.8	545.3	494.8	438.3
32	90	659.4	607.7	557.5	506.1	448.8
30	86	671.1	621.1	569.7	517.9	459.9
28	82	683.0	634.3	582.3	529.5	470.5
26	79	693.7	646.4	593.8	540.9	481.9
24	75	699.0	657.0	604.2	551.5	492.3
22	72	699.2	666.6	614.1	560.7	503.6
20	68	699.4	671.1	622.4	568.3	513.5
18	65	699.6	671.2	630.2	575.3	521.5
16	61	699.7	671.2	634.0	580.4	528.3
14	58	699.8	671.2	633.9	584.6	534.3
10	50	700.0	671.3	633.6	586.4	540.4
-40	-40	696.2	666.9	627.1	579.2	535.1

With engine bleed for packs off, increase weight by 1800 lb.
With engine anti-ice on, decrease weight by 4000 lb.
With engine and wing anti-ice on, decrease weight by 9200 lb.

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	565.0				
52	126	578.9				
50	122	592.7	544.9			
48	118	607.7	558.2			
46	115	623.2	572.8	527.0		
44	111	638.1	588.5	541.2		
42	108	653.6	603.6	554.3	507.6	
40	104	669.5	618.4	567.9	519.1	
38	100	684.8	631.1	580.5	530.6	470.4
36	97	699.4	643.8	591.9	539.9	480.0
34	93	714.0	657.3	601.9	548.5	489.6
32	90	727.3	668.9	612.0	556.3	497.9
30	86	740.1	679.4	622.6	564.9	505.5
28	82	740.3	688.5	632.0	574.0	512.8
26	79	740.5	698.7	639.1	583.5	520.2
24	75	740.7	698.8	644.5	591.9	528.4
22	72	740.9	698.9	650.1	597.5	536.7
20	68	741.1	699.1	650.3	601.0	543.9
18	64	741.3	699.3	650.4	604.6	548.8
16	61	741.5	699.4	650.5	604.7	552.2
14	57	741.6	699.6	650.6	604.8	555.4
12	54	741.7	699.8	650.6	604.8	555.5
10	50	741.8	699.9	650.7	604.8	555.6
-40	-40	742.3	700.4	651.4	605.4	556.0

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

With engine bleed for packs off, increase weight by 3900 lb.

With engine and wing anti-ice on, decrease weight by 3800 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 67500 lb.

GEAR DOWN**Takeoff Obstacle Limit Weight****Flaps 15****Sea Level, 30°C & Below, Zero Wind****Based on engine bleed for packs on, engine and wing anti-ice off**

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	647.4								
50	607.6	666.0							
100	570.3	627.7	668.4						
150	541.1	597.0	638.7	669.6					
200	516.9	571.3	613.6	645.4	670.1				
250	496.0	549.2	591.3	624.2	649.8	670.3			
300	477.4	529.7	571.5	605.0	631.6	652.9	670.4	681.7	681.7
350	460.9	512.3	553.8	587.4	614.8	636.8	655.0	670.2	681.0
400	445.9	496.5	537.7	571.4	599.1	622.0	640.7	656.5	670.0
450	432.4	482.0	522.9	556.6	584.6	607.9	627.4	643.7	657.7
500	419.8	468.6	509.2	542.8	571.0	594.7	614.7	631.6	646.0
550	408.1	456.2	496.5	530.0	558.3	582.3	602.7	620.1	634.9
600	397.2	444.7	484.5	518.1	546.4	570.5	591.3	609.0	624.3
650	387.0	434.0	473.3	506.8	535.1	559.4	580.4	598.4	614.1
700	377.4	423.9	462.8	496.1	524.5	548.9	570.0	588.4	604.3
750		414.4	452.8	486.0	514.4	538.8	560.1	578.7	594.9
800		405.3	443.5	476.3	504.7	529.2	550.6	569.4	585.9
850		396.7	434.6	467.2	495.5	520.1	541.6	560.4	577.1
900		388.5	426.2	458.5	486.7	511.3	532.9	551.9	568.7
950		380.7	418.2	450.1	478.3	502.9	524.5	543.6	560.6
1000		373.3	410.4	442.3	470.2	494.8	516.5	535.7	552.7

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)								
	360	400	440	480	520	560	600	640	680
30 & BELOW	0	0	0	0	0	0	0	0	0
32	-6.3	-7.1	-7.9	-8.8	-9.6	-10.4	-11.3	-12.1	-12.9
34	-12.5	-14.2	-15.9	-17.5	-19.2	-20.9	-22.5	-24.2	-25.8
36	-18.8	-21.3	-23.8	-26.3	-28.8	-31.3	-33.8	-36.3	-38.8
38	-25.1	-28.4	-31.7	-35.1	-38.4	-41.7	-45.0	-48.4	-51.7
40	-31.4	-35.5	-39.7	-43.8	-48.0	-52.1	-56.3	-60.5	-64.6
42	-37.5	-42.5	-47.5	-52.5	-57.6	-62.6	-67.6	-72.7	-77.7
44	-43.5	-49.5	-55.4	-61.3	-67.2	-73.1	-79.0	-84.9	-90.8
46	-49.6	-56.4	-63.2	-70.0	-76.8	-83.6	-90.3	-97.1	-103.9
48	-55.7	-63.4	-71.0	-78.7	-86.4	-94.0	-101.7	-109.3	-117.0
50	-61.8	-70.4	-78.9	-87.4	-96.0	-104.5	-113.0	-121.6	-130.1

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
S.L. & BELOW	0	0	0	0	0	0	0	0	0
1000	-15.3	-16.7	-18.1	-19.5	-20.9	-22.3	-23.7	-25.1	-26.5
2000	-30.7	-33.5	-36.3	-39.1	-41.9	-44.7	-47.5	-50.3	-53.1
3000	-43.7	-48.0	-52.4	-56.7	-61.0	-65.3	-69.6	-73.9	-78.2
4000	-56.8	-62.6	-68.5	-74.3	-80.1	-85.9	-91.7	-97.5	-103.4
5000	-72.4	-79.7	-87.0	-94.3	-101.6	-108.9	-116.3	-123.6	-130.9
6000	-87.9	-96.7	-105.5	-114.3	-123.2	-132.0	-140.8	-149.6	-158.4
7000	-102.1	-112.5	-122.9	-133.3	-143.7	-154.1	-164.5	-174.9	-185.4
8000	-116.3	-128.3	-140.3	-152.3	-164.3	-176.3	-188.3	-200.3	-212.3

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
15 TW	-38.3	-42.0	-45.7	-49.3	-53.0	-56.7	-60.3	-64.0	-67.7
10 TW	-25.6	-28.0	-30.4	-32.9	-35.3	-37.8	-40.2	-42.7	-45.1
5 TW	-12.8	-14.0	-15.2	-16.4	-17.7	-18.9	-20.1	-21.3	-22.6
0	0	0	0	0	0	0	0	0	0
10 HW	8.0	7.6	7.1	6.7	6.3	5.9	5.4	5.0	4.6
20 HW	16.0	15.1	14.3	13.4	12.6	11.7	10.9	10.0	9.1
30 HW	26.0	24.6	23.1	21.7	20.3	18.9	17.4	16.0	14.6
40 HW	36.0	34.0	32.0	30.0	28.0	26.0	24.0	22.0	20.0

With engine bleed for packs off, increase weight by 2100 lb.

With engine anti-ice on, decrease weight by 3600 lb.

With engine and wing anti-ice on, decrease weight by 8700 lb.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18600	16600	14200
760	19100	17200	14800
740	19700	17900	15500
720	20200	18500	16100
700	21000	19400	17100
680	21900	20400	18200
660	22900	21500	19400
640	23900	22500	20600
620	25000	23500	21900
600	25900	24600	23000
580	27000	25700	24200
560	28000	27000	25400
540	29100	28200	26700
520	30100	29500	28000
500	30900	30500	29300
480	31600	31300	30500
460	32400	32200	31500
440	33300	33100	32600
420	34100	33900	33600
400	34900	34800	34600
380	35800	35700	35600
360	36700	36600	36400

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
334	296	264	239	218	200	187	175	165	156	149
500	444	396	358	327	300	281	264	249	235	224
666	591	527	477	436	400	375	352	332	314	299
830	738	659	596	545	500	469	441	416	393	374
993	883	789	714	653	600	563	530	500	473	450
1156	1029	920	833	762	700	657	618	583	552	525
1318	1173	1050	951	870	800	751	707	667	632	601
1479	1318	1179	1069	979	900	845	796	751	712	677
1639	1462	1309	1187	1087	1000	939	884	835	791	753
1799	1605	1438	1305	1196	1100	1033	973	919	871	829
1958	1748	1567	1423	1304	1200	1128	1062	1003	951	905
2116	1890	1696	1540	1412	1300	1222	1151	1087	1030	981
2273	2032	1824	1658	1520	1400	1316	1240	1171	1110	1058
2430	2174	1952	1775	1628	1500	1410	1329	1255	1191	1134
2586	2315	2080	1892	1736	1600	1504	1418	1340	1271	1211
2741	2455	2208	2009	1844	1700	1599	1507	1425	1351	1287
2896	2595	2335	2125	1952	1800	1693	1596	1509	1432	1364
3050	2734	2461	2242	2060	1900	1788	1686	1594	1512	1441
3203	2873	2588	2358	2167	2000	1882	1776	1679	1593	1518

Reference Fuel and Time Required

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	17.3	0:52	16.6	0:50	16.1	0:48	15.8	0:46	15.6	0:45
300	25.3	1:15	24.2	1:12	23.3	1:09	22.5	1:06	22.1	1:03
400	33.4	1:39	31.7	1:34	30.4	1:30	29.2	1:25	28.5	1:21
500	41.4	2:02	39.2	1:56	37.5	1:50	36.0	1:45	35.0	1:40
600	49.7	2:25	47.1	2:18	44.9	2:11	43.0	2:04	41.7	1:58
700	58.1	2:48	54.9	2:39	52.3	2:31	50.0	2:23	48.4	2:16
800	66.4	3:11	62.7	3:01	59.7	2:51	57.0	2:42	55.1	2:34
900	74.8	3:33	70.5	3:22	67.1	3:12	64.0	3:02	61.8	2:52
1000	83.1	3:56	78.4	3:44	74.5	3:32	71.0	3:21	68.5	3:10
1100	91.8	4:18	86.6	4:05	82.2	3:52	78.4	3:39	75.6	3:27
1200	100.6	4:40	94.8	4:25	90.0	4:11	85.7	3:58	82.7	3:45
1300	109.3	5:02	103.0	4:46	97.7	4:31	93.1	4:16	89.7	4:02
1400	118.1	5:24	111.2	5:07	105.4	4:51	100.4	4:35	96.8	4:19
1500	126.8	5:46	119.4	5:28	113.2	5:10	107.8	4:53	103.9	4:37
1600	136.0	6:07	128.0	5:48	121.2	5:29	115.5	5:11	111.4	4:54
1700	145.2	6:28	136.5	6:08	129.3	5:48	123.2	5:29	118.8	5:11
1800	154.3	6:49	145.1	6:28	137.4	6:07	130.9	5:47	126.3	5:28
1900	163.5	7:10	153.7	6:48	145.5	6:26	138.6	6:05	133.8	5:45
2000	172.6	7:32	162.3	7:08	153.6	6:45	146.3	6:23	141.3	6:02

GEAR DOWN**Long Range Cruise Trip Fuel and Time****Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	600
20	-2.4	-1.2	0.0	1.5	3.0	4.6
40	-4.7	-2.4	0.0	2.9	5.9	9.2
60	-7.1	-3.6	0.0	4.4	8.9	13.9
80	-9.5	-4.9	0.0	5.9	12.0	18.8
100	-11.9	-6.1	0.0	7.4	15.2	23.7
120	-14.3	-7.3	0.0	9.0	18.4	28.9
140	-16.7	-8.5	0.0	10.6	21.8	34.1
160	-19.1	-9.7	0.0	12.2	25.1	39.4
180	-21.6	-10.9	0.0	13.8	28.6	44.9

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

GEAR DOWN

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
105	86	73	63	56	50	45	41	38	35	33
174	152	134	120	109	100	92	85	80	75	70
245	217	195	177	163	150	139	130	122	115	108
314	282	256	234	216	200	186	175	164	155	147
384	347	316	290	269	250	234	219	207	196	185
452	411	376	347	322	300	281	264	250	236	224
521	474	436	403	375	350	328	309	292	277	264
590	539	496	459	428	400	376	354	335	318	303
659	603	556	515	480	450	423	399	378	359	342
730	668	616	572	534	500	470	444	421	399	380

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)						TIME (HRS:MIN)
		360	400	440	480	520	560	
50	FUEL (1000 LB)	4.9	5.1	5.4	5.7	6.0	6.4	0:16
	ALT (FT)	11000	11000	11000	11000	11000	9000	
100	FUEL (1000 LB)	8.0	8.5	9.0	9.5	10.0	10.6	0:26
	ALT (FT)	21000	21000	19000	19000	19000	17000	
150	FUEL (1000 LB)	10.8	11.5	12.2	13.0	13.7	14.5	0:35
	ALT (FT)	27000	25000	25000	23000	23000	21000	
200	FUEL (1000 LB)	13.5	14.4	15.3	16.3	17.3	18.3	0:44
	ALT (FT)	33000	29000	27000	27000	25000	23000	
250	FUEL (1000 LB)	16.0	17.2	18.4	19.6	20.9	22.2	0:52
	ALT (FT)	33000	31000	29000	27000	25000	23000	
300	FUEL (1000 LB)	18.6	20.0	21.5	23.0	24.5	26.0	1:01
	ALT (FT)	33000	33000	29000	29000	27000	25000	
350	FUEL (1000 LB)	21.2	22.8	24.5	26.3	28.0	29.8	1:09
	ALT (FT)	33000	33000	31000	29000	27000	25000	
400	FUEL (1000 LB)	23.8	25.7	27.6	29.6	31.6	33.7	1:17
	ALT (FT)	33000	33000	31000	29000	27000	25000	
450	FUEL (1000 LB)	26.5	28.5	30.7	33.0	35.3	37.6	1:26
	ALT (FT)	33000	33000	31000	29000	27000	25000	
500	FUEL (1000 LB)	29.1	31.4	33.8	36.3	38.9	41.5	1:34
	ALT (FT)	33000	33000	31000	29000	27000	25000	

GEAR DOWN

**Holding Planning
Flaps Up**

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
800	34550						
760	33390	33420					
720	31570	31530					
680	29640	29580	29490				
640	27710	27670	27560				
600	26100	26080	25930				
560	24550	24520	24350	24470			
520	23040	22970	22800	22860	23100		
480	21610	21500	21320	21320	21540		
440	20150	20000	19800	19790	19950	20220	
400	18760	18580	18340	18340	18430	18570	19050
360	17350	17150	16890	16860	16880	17000	17360

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
800	33920	34110	34060	34600	36410
760	32630	32740	32680	33150	34530
720	30740	30780	30750	31090	32130
680	28770	28780	28750	28990	29710
640	26830	26830	26770	27030	27540
600	25180	25160	25060	25310	25710
560	23580	23520	23400	23620	23890
520	22000	21900	21750	21910	22150
480	20490	20340	20180	20260	20480
440	18960	18770	18570	18610	18790
400	17490	17280	17030	17010	17140
360	16020	15800	15520	15420	15520

These tables include 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
20	374.5	374.5	
18	397.5	393.1	384.4
16	424.4	420.7	412.2
14	453.3	451.7	440.3
12	488.9	484.2	469.7
10	524.5	518.7	503.5
8	562.0	553.8	539.5
6	604.3	588.9	567.4
4	641.4	617.7	589.7
2	671.4	642.9	613.1
0	698.4	666.6	634.4

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)									
	PRESSURE ALTITUDE (1000 FT)									
	0	2	4	6	8	10	12	14	16	18
ENGINE ONLY	0.0	-1.3	-2.2	-2.4	-2.1	-1.7	-1.4	-0.2	0.0	0.0
ENGINE AND WING	-4.7	-6.2	-6.3	-6.6	-5.7	-4.9	-4.0	-3.3	-2.6	-2.0

Performance Dispatch**Text****Chapter PD****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 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 data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Tire Speed, and Obstacle Limit Weights as determined from the following tables. Brake Energy Limit is not shown as it is not limiting for the range of conditions shown in this chapter. When determining a maximum weight for a wet runway, the dry runway limit weight must also be checked and the lower of the two weights used.

Field Limit Weight - Slope and Wind Corrections

These tables for wet and dry runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction 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 condition 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

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct 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

Maximum tire speed limited weights are presented for 235 MPH tires. To determine the tire speed limit weight, enter the table with OAT, move to airport pressure altitude and read the tire speed limit weight. Adjust the tire speed limit weight according to the notes below the table to account for wind.

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 to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Normal takeoff speeds, V1, VR, and V2 are read from either the wet or dry table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR 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 Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle limit weight and the V1 must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 8400 lb for a dry runway or 5000 lb for a wet runway and the V1 associated with the reduced weight by 2 knots. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 17000 lb for a dry runway or 10400 lb for a wet runway and the V1 associated with the reduced weight by 5 knots for a dry runway or 3 knots for a wet runway. If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate stop distance available corrected for wind and slope exceeds approximately 4900 ft for one brake deactivated or 5100 ft for two brakes deactivated. For wet runways, the corrected accelerate stop distance should exceed approximately 6200 ft for one brake deactivated or 6400 ft for two brakes deactivated.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

One Thrust Reverser Inoperative

Wet runway takeoff performance presented for all brakes operating is based on the use of one thrust reverser during deceleration. When operating with a thrust reverser inoperative, the runway/obstacle limited takeoff weight and V1 speed must be reduced to account for the reduced deceleration capability. A simplified method which conservatively accounts for this is to reduce the normal wet runway/obstacle limited weight by 11800 lb and the V1 associated with the reduced weight by 3 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 corrected for wind and slope exceeds approximately 6300 ft.

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 at two center of gravity positions: 7.5% MAC (FMC default) for use when no center of gravity is entered on the PERF INIT page, and 30% MAC (typical mid cruise center of gravity) for use when 30% MAC is entered. Crews may interpolate between these values to determine the airplane's capability at other specific center of gravity positions. Note that these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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 fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time 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 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. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time 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

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 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%.

Oxygen Requirements

Flight Crew 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 these requirements is achieved with the minimum dispatch oxygen cylinder pressure. Enter the Crew Oxygen Requirements table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate bottle temperature.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 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.

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 Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited 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 engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table 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, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

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Performance Dispatch

Chapter PD

Table of Contents

Section 70

777F GE90-110B1L KG M EASA TALPA

Pkg Model IdentificationPD.ModID.70.1

Takeoff..... PD.70.1

Minimum Weight for FMC Takeoff Speeds Calculation ...PD.70.1

Takeoff Field Corrections - Dry RunwayPD.70.2

Takeoff Field & Climb Limit Weights - Dry RunwayPD.70.3

Takeoff Field Corrections - Wet RunwayPD.70.6

Takeoff Field & Climb Limit Weights - Wet RunwayPD.70.7

Takeoff Obstacle Limit Weight.....PD.70.10

Tire Speed Limit.....PD.70.12

Takeoff Speeds - Dry RunwayPD.70.13

Takeoff Speeds - Wet RunwayPD.70.15

Enroute PD.71.1

Long Range Cruise Maximum Operating Altitude.....PD.71.1

Long Range Cruise Trip Fuel and TimePD.71.3

Long Range Cruise Step Climb Trip Fuel and TimePD.71.5

Short Trip Fuel and TimePD.71.6

Holding PlanningPD.71.7

Crew Oxygen Requirements.....PD.71.8

Net Level Off WeightPD.71.9

Landing PD.72.1

Landing Field Limit Weight - Dry RunwayPD.72.1

Landing Field Limit Weight - Wet RunwayPD.72.2

Approach or Landing Climb Limited Weight.....PD.72.3

Go-Around Climb GradientPD.72.4

Quick Turnaround Limit Weight.....PD.72.5

**Performance Dispatch
Pkg Model Identification****Chapter PD
Section 70****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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
300	777-300	7300	WY300

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Performance Dispatch Takeoff	Chapter PD Section 70
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Minimum Weight for FMC Takeoff Speeds Calculation
Weight Limit (1000 KG)

Flaps 15

Based on engine bleed for packs on and anti-ice off.

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)								
	S.L. & BELOW	1000	2000	3000	4000	5000	6000	7000	8000 & ABOVE
50	165.5	158.6							
45	175.9	169.0	161.5	155.1					
40	186.0	178.7	171.2	164.4	158.0				
35	195.0	187.6	179.8	172.8	166.0	159.6			
30	197.6	193.8	186.9	179.7	172.7	166.1	158.8		
25	197.7	193.8	189.3	184.6	178.4	172.6	164.7	156.1	
20	197.8	193.9	189.4	184.6	179.8	175.1	168.4	160.7	
15	198.0	194.0	189.4	184.6	179.8	175.1	169.4	162.6	155.4
10	198.1	194.0	189.5	184.7	179.8	175.1	169.4	162.6	155.8
0 & BELOW	198.2	194.2	189.6	184.7	179.9	175.1	169.4	162.6	155.8

The FMC may not be able to calculate takeoff speeds for light weight takeoffs at GE90-110B1L thrust rating. For takeoff at weights below the Minimum Weight for FMC Takeoff Speeds Calculation, takeoff speeds may be obtained using available performance software. Use of a lower thrust rating and/or assumed temperature method of thrust reduction may also be necessary.

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	1220	1220	1210	1200	1190	1180	1160	1150
1400	1460	1440	1430	1410	1400	1380	1350	1330	1310
1600	1680	1660	1640	1620	1600	1570	1530	1500	1470
1800	1900	1870	1850	1820	1800	1760	1710	1670	1620
2000	2120	2090	2060	2030	2000	1950	1890	1840	1780
2200	2340	2310	2270	2240	2200	2130	2070	2000	1940
2400	2570	2520	2480	2440	2400	2320	2250	2170	2100
2600	2790	2740	2690	2650	2600	2510	2430	2340	2250
2800	3010	2960	2910	2850	2800	2700	2610	2510	2410
3000	3230	3170	3120	3060	3000	2890	2780	2680	2570
3200	3460	3390	3330	3260	3200	3080	2960	2840	2730
3400	3680	3610	3540	3470	3400	3270	3140	3010	2880
3600	3900	3820	3750	3670	3600	3460	3320	3180	3040
3800	4120	4040	3960	3880	3800	3650	3500	3350	3200
4000	4340	4260	4170	4090	4000	3840	3680	3520	3350
4200	4570	4470	4380	4290	4200	4030	3860	3680	3510
4400	4790	4690	4590	4500	4400	4220	4030	3850	3670
4600	5010	4910	4810	4700	4600	4410	4210	4020	3830
4800	5230	5120	5020	4910	4800	4600	4390	4190	3980
5000	5450	5340	5230	5110	5000	4790	4570	4360	4140

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	890	990	1100	1200	1280	1350	1430	1520
1400	1060	1170	1290	1400	1480	1560	1650	1740
1600	1220	1350	1470	1600	1690	1780	1870	1960
1800	1390	1530	1660	1800	1890	1990	2080	2180
2000	1560	1710	1850	2000	2100	2200	2300	2410
2200	1720	1880	2040	2200	2300	2410	2520	2630
2400	1890	2060	2230	2400	2510	2620	2740	2850
2600	2060	2240	2420	2600	2710	2830	2950	3080
2800	2230	2420	2610	2800	2920	3040	3170	3300
3000	2390	2600	2800	3000	3130	3250	3390	3520
3200	2560	2770	2990	3200	3330	3470	3600	3740
3400	2730	2950	3180	3400	3540	3680	3820	3970
3600	2890	3130	3360	3600	3740	3890	4040	4190
3800	3060	3310	3550	3800	3950	4100	4250	4410
4000	3230	3490	3740	4000	4150	4310	4470	4640
4200	3400	3660	3930	4200	4360	4520	4690	4860
4400	3560	3840	4120	4400	4560	4730	4910	5080
4600	3730	4020	4310	4600	4770	4940	5120	5310
4800	3900	4200	4500	4800	4980	5160	5340	5530
5000	4060	4380	4690	5000	5180	5370	5560	5750

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1700	278.9	253.1	251.5	249.5	248.3	247.5	245.6	240.3	232.4	225.8	218.9
1800	287.9	261.4	259.6	257.6	256.4	255.6	253.6	248.1	240.0	233.2	226.1
2000	304.4	276.6	274.8	272.6	271.3	270.5	268.4	262.7	254.2	247.0	239.5
2200	320.1	290.9	289.0	286.8	285.4	284.6	282.4	276.4	267.5	259.9	252.2
2400	334.7	304.4	302.4	300.1	298.7	297.8	295.5	289.3	280.0	272.2	264.1
2600	347.9	316.7	314.6	312.2	310.8	309.8	307.5	301.0	291.5	283.4	275.1
2800	361.1	329.0	326.9	324.4	322.9	321.9	319.5	312.9	303.1	294.7	286.2
3000	372.0	339.0	336.9	334.3	332.8	331.8	329.3	322.5	312.4	303.9	295.1
3200	378.7	348.5	346.3	343.7	342.2	341.1	338.6	331.6	321.3	312.5	303.5
3400	378.7	357.6	355.4	352.7	351.1	350.1	347.5	340.3	329.8	320.8	311.6
3600	378.7	366.3	364.1	361.3	359.7	358.6	356.0	348.7	337.9	328.7	319.3
3800	378.7	374.6	372.3	369.5	367.8	366.7	364.1	356.6	345.6	336.3	326.6
4000	378.7	378.7	378.7	377.3	375.6	374.5	371.8	364.2	353.0	343.5	333.7
4200	378.7	378.7	378.7	378.7	378.7	378.7	378.7	371.5	360.1	350.4	340.5
4400	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.5	367.0	357.1	347.0
4600	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	373.6	363.6	353.3
4800	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	369.8	359.4
5000	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	375.7	365.2
CLIMB LIMIT WT (1000 KG)	350.8	350.2	350.0	349.7	349.6	349.4	349.1	336.7	319.5	305.3	290.6

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1700	263.7	239.8	238.3	236.4	235.3	234.6	228.7	223.1	215.4	208.7	201.6
1800	272.3	247.6	246.1	244.1	243.0	242.2	236.2	230.4	222.5	215.6	208.3
2000	288.1	262.1	260.5	258.5	257.3	256.5	250.1	244.0	235.7	228.5	220.7
2200	302.9	275.8	274.1	272.0	270.7	269.9	263.2	256.9	248.2	240.6	232.5
2400	316.9	288.7	286.9	284.7	283.4	282.5	275.6	269.0	260.0	252.1	243.7
2600	329.5	300.4	298.6	296.3	295.0	294.1	286.9	280.1	270.8	262.7	254.0
2800	342.2	312.3	310.4	308.0	306.7	305.7	298.4	291.4	281.8	273.4	264.5
3000	352.6	321.9	319.9	317.5	316.1	315.2	307.6	300.4	290.6	282.0	272.8
3200	362.5	331.0	329.0	326.5	325.1	324.1	316.3	309.0	298.9	290.1	280.7
3400	371.9	339.7	337.6	335.1	333.6	332.6	324.7	317.2	306.9	297.9	288.2
3600	378.7	348.0	345.9	343.4	341.8	340.8	332.7	325.0	314.5	305.3	295.5
3800	378.7	355.9	353.8	351.2	349.6	348.6	340.3	332.5	321.7	312.3	302.3
4000	378.7	363.5	361.3	358.6	357.1	356.0	347.6	339.6	328.7	319.1	308.9
4200	378.7	370.8	368.6	365.9	364.3	363.2	354.6	346.5	335.4	325.7	315.3
4400	378.7	377.8	375.6	372.8	371.2	370.1	361.4	353.2	341.8	332.0	321.4
4600	378.7	378.7	378.7	378.7	377.9	376.7	367.9	359.6	348.1	338.1	327.3
4800	378.7	378.7	378.7	378.7	378.7	378.7	374.2	365.7	354.1	343.9	333.1
5000	378.7	378.7	378.7	378.7	378.7	378.7	378.7	371.6	359.8	349.5	338.5
CLIMB LIMIT WT (1000 KG)	335.7	335.5	335.4	335.2	335.1	334.9	322.6	310.6	294.2	280.3	266.6

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 1200 kg and climb limit weight by 2100 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1700	247.9	225.9	224.5	222.7	220.3	218.3	212.3	206.9	199.0	192.7	186.8
1800	256.0	233.3	231.8	230.0	227.6	225.5	219.3	213.8	205.6	199.1	193.0
2000	270.9	247.1	245.5	243.6	241.0	238.8	232.3	226.5	218.0	211.1	204.7
2200	285.0	260.1	258.4	256.5	253.7	251.5	244.6	238.6	229.6	222.4	215.8
2400	298.2	272.3	270.6	268.6	265.7	263.4	256.3	250.0	240.7	233.2	226.3
2600	310.3	283.5	281.8	279.7	276.7	274.3	267.0	260.5	250.9	243.1	236.0
2800	322.4	294.9	293.1	290.9	287.9	285.4	277.8	271.2	261.3	253.3	245.9
3000	332.3	304.0	302.2	299.9	296.9	294.3	286.5	279.7	269.5	261.4	253.8
3200	341.6	312.7	310.8	308.5	305.3	302.7	294.8	287.7	277.3	269.0	261.2
3400	350.6	320.9	319.0	316.7	313.4	310.7	302.6	295.4	284.8	276.2	268.3
3600	359.1	328.9	326.9	324.5	321.2	318.4	310.2	302.8	291.9	283.2	275.1
3800	367.3	336.4	334.4	331.9	328.6	325.8	317.3	309.8	298.7	289.8	281.5
4000	375.0	343.6	341.6	339.1	335.6	332.8	324.2	316.5	305.2	296.2	287.7
4200	378.7	350.6	348.5	345.9	342.5	339.6	330.8	323.0	311.6	302.3	293.8
4400	378.7	357.3	355.2	352.6	349.1	346.1	337.2	329.3	317.6	308.2	299.6
4600	378.7	363.7	361.6	359.0	355.4	352.4	343.3	335.3	323.5	314.0	305.2
4800	378.7	369.9	367.8	365.1	361.5	358.4	349.3	341.2	329.2	319.5	310.6
5000	378.7	375.9	373.7	371.0	367.3	364.2	355.0	346.8	334.6	324.8	315.8
CLIMB LIMIT WT (1000 KG)	317.5	317.3	317.2	317.1	313.2	309.7	297.2	286.7	271.5	259.0	248.1

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1700	232.4	211.8	210.5	207.2	203.8	201.2	195.4	190.5	183.6	178.0	172.6
1800	240.0	218.8	217.4	214.0	210.5	207.9	201.9	196.8	189.7	184.0	178.4
2000	254.2	231.8	230.4	226.8	223.1	220.4	214.0	208.7	201.3	195.2	189.3
2200	267.5	244.1	242.6	238.9	235.0	232.1	225.5	219.9	212.2	205.8	199.7
2400	280.0	255.7	254.2	250.3	246.3	243.3	236.4	230.6	222.5	215.9	209.5
2600	291.5	266.4	264.8	260.8	256.7	253.5	246.5	240.5	232.1	225.3	218.7
2800	303.1	277.3	275.6	271.5	267.2	264.0	256.7	250.6	242.0	235.0	228.2
3000	312.4	286.0	284.2	280.0	275.7	272.4	264.9	258.6	249.7	242.5	235.6
3200	321.3	294.2	292.4	288.1	283.6	280.2	272.6	266.1	257.0	249.7	242.5
3400	329.8	302.0	300.2	295.8	291.2	287.7	279.9	273.3	264.0	256.5	249.2
3600	337.9	309.5	307.7	303.2	298.5	295.0	287.0	280.2	270.7	263.0	255.6
3800	345.6	316.7	314.8	310.2	305.4	301.8	293.6	286.7	277.1	269.2	261.6
4000	353.0	323.5	321.6	316.9	312.1	308.4	300.1	293.0	283.2	275.2	267.5
4200	360.1	330.1	328.2	323.4	318.5	314.7	306.3	299.1	289.1	281.0	273.1
4400	367.0	336.5	334.5	329.7	324.7	320.9	312.3	305.0	294.9	286.6	278.6
4600	373.6	342.7	340.7	335.7	330.7	326.8	318.1	310.7	300.4	292.0	283.9
4800	378.7	348.6	346.6	341.6	336.4	332.5	323.7	316.2	305.8	297.2	289.0
5000	378.7	354.3	352.2	347.2	342.0	338.0	329.0	321.5	310.9	302.3	294.0
CLIMB LIMIT WT (1000 KG)	297.9	297.9	297.8	293.5	287.5	282.8	272.4	263.5	250.7	240.1	230.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.
With engine and wing anti-ice on, decrease field limit weight by 1200 kg and climb limit weight by 2100 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
1700	215.1	194.9	192.4	187.7	184.3	182.2	176.8	171.9	165.5	160.4	155.4
1800	222.2	201.4	198.8	193.9	190.4	188.2	182.8	177.7	171.1	165.8	160.7
2000	235.4	213.5	210.8	205.7	202.0	199.7	193.9	188.6	181.6	176.1	170.7
2200	247.9	225.0	222.1	216.8	212.9	210.5	204.5	198.9	191.6	185.9	180.2
2400	259.7	235.8	232.9	227.3	223.3	220.8	214.5	208.8	201.2	195.2	189.3
2600	270.5	245.9	242.8	237.0	232.9	230.3	223.9	217.9	210.1	203.9	197.8
2800	281.4	256.1	253.0	247.0	242.8	240.2	233.5	227.4	219.3	213.0	206.7
3000	290.2	264.2	261.0	254.9	250.6	247.9	241.0	234.8	226.5	220.0	213.5
3200	298.5	271.9	268.6	262.4	257.9	255.1	248.1	241.7	233.2	226.5	219.9
3400	306.5	279.2	275.9	269.5	265.0	262.1	254.9	248.3	239.6	232.8	226.1
3600	314.1	286.3	282.8	276.3	271.7	268.7	261.4	254.7	245.8	238.8	231.9
3800	321.3	292.9	289.4	282.8	278.1	275.1	267.6	260.7	251.7	244.6	237.5
4000	328.3	299.4	295.8	289.0	284.2	281.1	273.5	266.5	257.3	250.1	242.9
4200	335.0	305.6	301.9	295.0	290.1	287.0	279.3	272.2	262.8	255.4	248.2
4400	341.4	311.6	307.9	300.9	295.9	292.7	284.9	277.7	268.1	260.6	253.3
4600	347.6	317.3	313.6	306.5	301.4	298.2	290.3	282.9	273.3	265.7	258.2
4800	353.6	322.9	319.1	311.9	306.8	303.6	295.5	288.1	278.2	270.6	263.0
5000	359.4	328.3	324.4	317.1	312.0	308.7	300.5	293.0	283.0	275.3	267.6
CLIMB LIMIT WT (1000 KG)	273.7	273.7	270.6	262.7	256.7	253.2	243.8	234.7	222.5	213.2	204.0

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 1200 kg and climb limit weight by 2100 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	1150
1400	1450	1440	1430	1410	1400	1380	1360	1340	1320
1600	1670	1660	1640	1620	1600	1570	1550	1520	1490
1800	1900	1870	1850	1820	1800	1770	1730	1700	1660
2000	2120	2090	2060	2030	2000	1960	1920	1880	1840
2200	2350	2310	2270	2240	2200	2150	2100	2060	2010
2400	2570	2530	2490	2440	2400	2350	2290	2240	2180
2600	2800	2750	2700	2650	2600	2540	2480	2420	2360
2800	3020	2960	2910	2850	2800	2730	2660	2600	2530
3000	3240	3180	3120	3060	3000	2930	2850	2780	2700
3200	3470	3400	3330	3270	3200	3120	3040	2950	2870
3400	3690	3620	3550	3470	3400	3310	3220	3130	3050
3600	3920	3840	3760	3680	3600	3500	3410	3310	3220
3800	4140	4060	3970	3890	3800	3700	3600	3490	3390
4000	4360	4270	4180	4090	4000	3890	3780	3670	3560
4200	4590	4490	4390	4300	4200	4080	3970	3850	3740
4400	4810	4710	4610	4500	4400	4280	4150	4030	3910
4600	5040	4930	4820	4710	4600	4470	4340	4210	4080
4800	5260	5150	5030	4920	4800	4660	4530	4390	4250
5000	5490	5360	5240	5120	5000	4860	4710	4570	4430

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	1280	1370	1450	1550
1400	1020	1150	1270	1400	1490	1580	1670	1770
1600	1190	1330	1460	1600	1690	1790	1890	2000
1800	1360	1500	1650	1800	1900	2010	2110	2230
2000	1520	1680	1840	2000	2110	2220	2330	2460
2200	1690	1860	2030	2200	2310	2430	2560	2680
2400	1860	2040	2220	2400	2520	2640	2780	2910
2600	2030	2220	2410	2600	2730	2860	3000	3140
2800	2190	2400	2600	2800	2930	3070	3220	3370
3000	2360	2570	2790	3000	3140	3280	3440	3590
3200	2530	2750	2980	3200	3340	3500	3660	3820
3400	2700	2930	3170	3400	3550	3710	3880	4050
3600	2860	3110	3350	3600	3760	3920	4100	4280
3800	3030	3290	3540	3800	3960	4140	4320	4510
4000	3200	3470	3730	4000	4170	4350	4540	4730
4200	3370	3640	3920	4200	4380	4560	4760	4960
4400	3530	3820	4110	4400	4580	4780	4980	5190
4600	3700	4000	4300	4600	4790	4990	5200	5420
4800	3870	4180	4490	4800	5000	5200	5420	5640
5000	4040	4360	4680	5000	5200	5410	5640	5870

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	320.5	289.1	287.1	284.7	283.3	282.3	280.0	273.6	264.2	256.3	248.2
2400	331.9	299.3	297.2	294.7	293.2	292.3	289.9	283.2	273.5	265.3	256.9
2600	345.5	311.5	309.4	306.8	305.3	304.2	301.8	294.8	284.6	276.1	267.4
2800	359.8	324.5	322.3	319.5	317.9	316.9	314.3	307.1	296.5	287.7	278.6
3000	371.9	335.3	333.0	330.2	328.5	327.4	324.7	317.3	306.3	297.1	287.7
3200	378.7	345.7	343.3	340.4	338.7	337.6	334.8	327.0	315.7	306.2	296.5
3400	378.7	355.7	353.2	350.2	348.5	347.3	344.4	336.4	324.8	314.9	304.9
3600	378.7	365.3	362.8	359.7	357.9	356.7	353.7	345.5	333.5	323.4	313.0
3800	378.7	374.5	371.9	368.7	366.9	365.6	362.6	354.1	341.8	331.4	320.8
4000	378.7	378.7	378.7	377.4	375.5	374.2	371.1	362.5	349.8	339.2	328.3
4200	378.7	378.7	378.7	378.7	378.7	378.7	378.7	370.5	357.6	346.7	335.6
4400	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.4	365.1	354.0	342.6
4600	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	372.4	361.1	349.5
4800	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	367.9	356.1
5000	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	374.5	362.5
5200	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	368.7
5400	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	374.6
5600	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7
CLIMB LIMIT WT (1000 KG)	350.8	350.2	350.0	349.7	349.6	349.4	349.1	336.7	319.5	305.3	290.6

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	301.7	272.9	271.0	268.8	267.5	266.6	259.5	252.9	243.9	236.3	228.8
2400	312.3	282.5	280.6	278.2	276.9	275.9	268.6	261.7	252.4	244.5	236.7
2600	325.2	294.0	292.0	289.6	288.2	287.2	279.6	272.4	262.7	254.5	246.4
2800	338.6	306.3	304.2	301.7	300.2	299.2	291.3	283.8	273.7	265.2	256.7
3000	349.9	316.4	314.3	311.7	310.1	309.1	300.9	293.1	282.7	273.8	265.1
3200	360.9	326.2	324.0	321.3	319.7	318.6	310.1	302.1	291.2	282.1	273.0
3400	371.4	335.5	333.3	330.5	328.9	327.7	318.9	310.7	299.5	290.1	280.7
3600	378.7	344.6	342.2	339.4	337.7	336.5	327.5	319.0	307.5	297.8	288.1
3800	378.7	353.2	350.8	347.8	346.1	344.9	335.6	326.9	315.1	305.1	295.2
4000	378.7	361.5	359.0	356.0	354.3	353.0	343.5	334.6	322.5	312.3	302.1
4200	378.7	369.5	367.0	364.0	362.1	360.9	351.1	342.0	329.6	319.2	308.8
4400	378.7	377.3	374.8	371.6	369.8	368.5	358.5	349.2	336.6	325.9	315.3
4600	378.7	378.7	378.7	378.7	377.1	375.8	365.7	356.2	343.3	332.4	321.6
4800	378.7	378.7	378.7	378.7	378.7	378.7	372.6	362.9	349.8	338.7	327.7
5000	378.7	378.7	378.7	378.7	378.7	378.7	378.7	369.4	356.1	344.8	333.6
5200	378.7	378.7	378.7	378.7	378.7	378.7	378.7	375.7	362.1	350.7	339.3
5400	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	368.0	356.4	344.9
5600	378.7	378.7	378.7	378.7	378.7	378.7	378.7	378.7	373.6	361.9	350.2
CLIMB LIMIT WT (1000 KG)	335.7	335.5	335.4	335.2	335.1	334.9	322.6	310.6	294.2	280.3	266.6

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 1350 kg and climb limit weight by 2100 kg.

Takeoff Field & Climb Limit Weights - Wet Runway
Flaps 15
4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	282.7	256.1	254.4	252.3	249.4	247.0	239.9	233.9	225.6	218.9	212.7
2400	292.6	265.0	263.3	261.1	258.2	255.7	248.3	242.1	233.5	226.5	220.1
2600	304.6	275.9	274.0	271.8	268.7	266.1	258.4	252.0	243.0	235.7	229.0
2800	317.3	287.4	285.5	283.2	280.0	277.3	269.3	262.6	253.3	245.7	238.7
3000	327.8	296.9	294.9	292.4	289.1	286.4	278.0	271.1	261.4	253.6	246.4
3200	338.0	305.9	303.9	301.4	297.9	295.1	286.5	279.3	269.3	261.2	253.7
3400	347.7	314.7	312.6	310.0	306.4	303.4	294.6	287.2	276.8	268.5	260.8
3600	357.1	323.1	320.9	318.2	314.6	311.5	302.4	294.8	284.2	275.6	267.6
3800	366.1	331.1	328.9	326.1	322.4	319.3	309.9	302.1	291.1	282.3	274.1
4000	374.7	338.9	336.6	333.8	330.0	326.7	317.1	309.1	297.9	288.9	280.5
4200	378.7	346.4	344.1	341.2	337.3	334.0	324.2	315.9	304.5	295.2	286.7
4400	378.7	353.7	351.3	348.4	344.4	341.0	331.0	322.6	310.9	301.5	292.7
4600	378.7	360.8	358.3	355.3	351.3	347.8	337.6	329.0	317.1	307.5	298.6
4800	378.7	367.6	365.1	362.1	357.9	354.4	344.0	335.3	323.1	313.3	304.2
5000	378.7	374.2	371.7	368.5	364.3	360.8	350.2	341.3	329.0	319.0	309.8
5200	378.7	378.7	378.0	374.8	370.5	366.9	356.2	347.2	334.6	324.5	315.1
5400	378.7	378.7	378.7	378.7	376.5	372.8	361.9	352.8	340.1	329.8	320.3
5600	378.7	378.7	378.7	378.7	378.7	378.5	367.5	358.2	345.4	334.9	325.3
CLIMB LIMIT WT (1000 KG)	317.5	317.3	317.2	317.1	313.2	309.7	297.2	286.7	271.5	259.0	248.1

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	264.1	239.3	237.7	233.9	230.3	227.6	221.4	216.2	209.0	203.1	197.3
2400	273.4	247.7	246.0	242.1	238.4	235.5	229.1	223.7	216.2	210.1	204.1
2600	284.5	257.7	256.0	251.9	248.0	245.1	238.4	232.8	225.0	218.6	212.4
2800	296.4	268.6	266.8	262.5	258.5	255.4	248.5	242.7	234.5	227.9	221.5
3000	306.2	277.3	275.5	271.1	266.9	263.7	256.5	250.5	242.0	235.1	228.5
3200	315.6	285.7	283.8	279.2	274.9	271.6	264.2	257.9	249.2	242.1	235.2
3400	324.6	293.8	291.8	287.1	282.7	279.3	271.6	265.1	256.1	248.8	241.6
3600	333.3	301.6	299.6	294.7	290.1	286.6	278.7	272.1	262.8	255.2	247.9
3800	341.7	309.1	307.0	302.0	297.3	293.7	285.6	278.8	269.3	261.5	253.9
4000	349.7	316.3	314.1	309.1	304.2	300.5	292.2	285.2	275.5	267.5	259.8
4200	357.5	323.3	321.1	315.9	310.9	307.2	298.7	291.5	281.6	273.4	265.5
4400	365.0	330.1	327.9	322.5	317.5	313.6	304.9	297.7	287.5	279.1	271.1
4600	372.3	336.7	334.4	329.0	323.8	319.9	311.0	303.6	293.2	284.7	276.5
4800	378.7	343.1	340.8	335.2	330.0	326.0	317.0	309.4	298.8	290.1	281.8
5000	378.7	349.3	346.9	341.3	335.9	331.9	322.7	315.0	304.2	295.4	286.9
5200	378.7	355.2	352.8	347.1	341.7	337.6	328.2	320.4	309.5	300.6	291.9
5400	378.7	361.0	358.5	352.8	347.2	343.1	333.6	325.7	314.6	305.5	296.7
5600	378.7	366.5	364.1	358.2	352.6	348.4	338.8	330.8	319.5	310.3	301.5
CLIMB LIMIT WT (1000 KG)	297.9	297.9	297.8	293.5	287.5	282.8	272.4	263.5	250.7	240.1	230.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.
With engine and wing anti-ice on, decrease field limit weight by 1350 kg and climb limit weight by 2100 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
2240	243.6	220.7	218.0	213.0	209.4	207.1	201.5	196.4	189.5	184.2	179.0
2400	252.2	228.4	225.6	220.4	216.7	214.3	208.5	203.1	196.1	190.5	185.1
2600	262.4	237.7	234.8	229.3	225.4	223.0	216.9	211.4	204.0	198.2	192.6
2800	273.5	247.7	244.7	239.0	235.0	232.5	226.2	220.4	212.7	206.7	200.8
3000	282.4	255.7	252.6	246.7	242.5	239.9	233.4	227.4	219.4	213.2	207.1
3200	291.0	263.3	260.1	254.0	249.7	247.0	240.2	234.0	225.8	219.4	213.1
3400	299.2	270.7	267.4	261.1	256.7	253.8	246.9	240.5	232.0	225.3	218.8
3600	307.2	277.8	274.4	267.9	263.4	260.5	253.3	246.7	237.9	231.1	224.4
3800	314.8	284.7	281.1	274.5	269.8	266.8	259.5	252.7	243.7	236.7	229.8
4000	322.2	291.3	287.7	280.8	276.1	273.0	265.5	258.5	249.3	242.1	235.1
4200	329.3	297.7	294.0	287.0	282.1	279.0	271.3	264.2	254.8	247.4	240.2
4400	336.2	304.0	300.2	293.1	288.1	284.9	277.0	269.7	260.1	252.6	245.2
4600	342.9	310.0	306.2	298.9	293.8	290.6	282.5	275.1	265.3	257.7	250.2
4800	349.4	315.9	312.0	304.6	299.4	296.1	287.9	280.4	270.4	262.6	255.0
5000	355.7	321.7	317.6	310.1	304.9	301.5	293.2	285.5	275.3	267.4	259.6
5200	361.8	327.2	323.1	315.5	310.1	306.7	298.2	290.5	280.2	272.1	264.2
5400	367.6	332.5	328.4	320.7	315.2	311.8	303.2	295.3	284.8	276.7	268.7
5600	373.3	337.7	333.5	325.7	320.2	316.7	308.0	300.0	289.4	281.1	273.0
CLIMB LIMIT WT (1000 KG)	273.7	273.7	270.6	262.7	256.7	253.2	243.8	234.7	222.5	213.2	204.0

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.

With engine bleed for packs off, increase field limit weight by 500 kg and climb limit weight by 1700 kg.

With engine and wing anti-ice on, decrease field limit weight by 1350 kg and climb limit weight by 2100 kg.

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 33°C & Below, Zero Wind

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or Auto

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	294.9	319.3	340.7	356.6	367.3							
20	274.3	297.3	315.6	330.9	344.0	354.2	361.2					
40	253.3	275.8	293.8	308.9	321.8	332.6	341.8	349.3	355.0	359.5	363.5	
60	237.0	258.5	277.5	293.0	305.8	316.6	325.7	333.6	340.5	346.5	351.3	
80		245.1	263.8	279.6	292.7	303.5	312.9	320.9	328.0	334.2	339.6	
100		233.8	252.2	267.8	281.2	292.3	301.8	310.1	317.3	323.7	329.3	
120		224.0	242.0	257.4	270.8	282.3	292.0	300.5	307.9	314.5	320.3	
140		215.2	232.9	248.2	261.4	273.0	283.1	291.7	299.3	306.1	312.1	
160			224.7	239.8	253.0	264.6	274.7	283.7	291.5	298.4	304.6	
180			217.2	232.2	245.3	256.8	267.0	276.1	284.1	291.2	297.5	
200			210.4	225.1	238.1	249.6	259.9	269.0	277.2	284.5	291.0	
220			204.0	218.6	231.5	243.0	253.2	262.4	270.6	278.1	284.7	
240			198.2	212.6	225.4	236.8	247.0	256.2	264.5	272.0	278.8	
260				206.9	219.6	231.0	241.1	250.3	258.7	266.2	273.1	
280				201.6	214.2	225.5	235.6	244.8	253.2	260.8	267.7	
300				196.7	209.1	220.3	230.4	239.6	248.0	255.6	262.5	

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)						
	160	200	240	280	320	360	400
33 & BELOW	0	0	0	0	0	0	0
34	-1.1	-1.3	-1.6	-1.8	-2.1	-2.4	-2.6
36	-4.1	-5.1	-6.1	-7.1	-8.1	-9.2	-10.2
38	-7.1	-8.8	-10.6	-12.4	-14.2	-15.9	-17.7
40	-10.1	-12.6	-15.1	-17.7	-20.2	-22.7	-25.3
42	-13.4	-16.7	-20.1	-23.4	-26.7	-30.0	-33.3
44	-16.8	-20.9	-25.0	-29.1	-33.2	-37.3	-41.4
46	-20.1	-25.0	-29.9	-34.8	-39.6	-44.5	-49.4
48	-23.4	-29.1	-34.8	-40.4	-46.1	-51.8	-57.5
50	-26.8	-33.2	-39.7	-46.1	-52.6	-59.1	-65.5

Pressure Altitude Adjustment

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)						
	160	200	240	280	320	360	400
S.L. & BELOW	0	0	0	0	0	0	0
1000	-6.9	-8.3	-9.7	-11.1	-12.5	-13.9	-15.3
2000	-13.9	-16.7	-19.4	-22.2	-25.0	-27.8	-30.5
3000	-19.9	-24.1	-28.3	-32.5	-36.6	-40.8	-45.0
4000	-26.0	-31.6	-37.1	-42.7	-48.3	-53.9	-59.5
5000	-31.9	-38.8	-45.8	-52.7	-59.7	-66.7	-73.6
6000	-37.8	-46.1	-54.4	-62.8	-71.1	-79.4	-87.8
7000	-44.1	-54.1	-64.1	-74.2	-84.2	-94.2	-104.3
8000	-50.4	-62.1	-73.9	-85.6	-97.3	-109.0	-120.8

Takeoff Obstacle Limit Weight

Flaps 15

Wind Adjustment

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)						
	160	200	240	280	320	360	400
15 TW	-12.0	-18.7	-25.3	-32.0	-31.2	-30.4	-29.6
10 TW	-8.0	-12.4	-16.9	-21.3	-20.8	-20.3	-19.7
5 TW	-4.0	-6.2	-8.4	-10.7	-10.4	-10.1	-9.9
0	0	0	0	0	0	0	0
10 HW	4.5	4.0	3.6	3.2	2.7	2.3	1.8
20 HW	8.9	8.1	7.2	6.3	5.4	4.6	3.7
30 HW	13.7	12.4	11.0	9.6	8.2	6.8	5.5
40 HW	18.5	16.7	14.8	12.9	11.0	9.1	7.2

With engine bleed for packs off, increase weight by 900 kg.

With engine and wing anti-ice on, decrease weight by 2250 kg.

Tire Speed Limit
Flaps 15

AIRPORT OAT		TIRE SPEED LIMIT WEIGHT (1000 KG)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	378.7	359.0	330.4	305.8	283.4
52	126	378.7	361.0	332.4	307.5	285.0
50	122	378.7	363.0	334.5	309.3	286.6
48	118	378.7	365.0	336.6	311.1	288.3
46	115	378.7	367.0	338.7	312.9	289.9
44	111	378.7	369.0	340.9	314.7	291.6
42	108	378.7	371.1	343.4	316.5	293.3
40	104	378.7	373.2	346.1	318.3	295.1
38	100	378.7	375.3	348.8	320.2	296.8
36	97	378.7	377.5	350.8	322.1	298.6
34	93	378.7	378.7	352.9	324.1	300.4
32	90	378.7	378.7	354.7	325.9	302.1
30	86	378.7	378.7	356.6	327.7	303.7
28	82	378.7	378.7	358.5	329.6	305.4
26	79	378.7	378.7	360.5	331.6	307.1
24	75	378.7	378.7	362.5	333.6	308.8
22	72	378.7	378.7	364.7	335.8	310.5
20	68	378.7	378.7	366.9	338.0	312.3
18	64	378.7	378.7	369.1	340.2	314.1
16	61	378.7	378.7	371.4	342.9	316.0
14	57	378.7	378.7	373.7	345.8	317.9
12	54	378.7	378.7	376.0	348.7	319.9
10	50	378.7	378.7	378.3	350.9	322.0
-40	-40	378.7	378.7	378.7	378.7	378.7

Increase tire speed limit weight by 2300 kg per knot headwind.

Decrease tire speed limit weight by 5300 kg per knot tailwind.

Takeoff Speeds - Dry Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	KIAS		
	V1	VR	V2
360	169	176	180
340	164	170	176
320	158	165	171
300	152	158	166
280	146	152	161
260	139	145	156
240	131	138	151
220	122	131	145
200	113	123	139
180	102	115	133
160	91	106	126
140	83	97	119

Check V1(MCG), Minimum VR, Minimum V2, and Minimum Takeoff Weight.

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		-2	0	2	4	6	8		-2	0	2	4	6	8	
70	158	12	14						6	7						-3	-3					
60	140	8	10	12	15				4	5	6	7				-2	-2	-3	-3			
50	122	4	5	8	10	13	17		2	3	4	6	7	8		-1	-1	-2	-2	-3	-4	
40	104	1	2	4	7	10	14		0	1	3	4	5	7		0	-1	-1	-2	-2	-3	
30	86	0	0	1	4	7	11		0	0	1	3	4	6		0	0	0	-1	-1	-2	
20	68	0	0	1	3	5	9		0	0	1	2	3	5		0	0	0	-1	-1	-2	
-60	-76	0	0	1	3	5	7		0	0	1	2	3	4		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		
360	-4	-2	0	3	5	-3	-2	-1	0	1	2	3	3		
340	-4	-2	0	3	5	-3	-2	-1	0	1	2	3	3		
320	-3	-1	0	3	5	-3	-1	0	0	1	2	2	3		
300	-3	-1	0	3	4	-2	-1	0	0	1	2	2	3		
280	-3	-1	0	2	4	-2	-1	0	0	1	2	2	3		
260	-2	-1	0	2	4	-2	-1	0	0	1	2	2	3		
240	-2	-1	0	2	4	-1	-1	0	0	1	2	2	3		
220	-2	0	0	2	4	-1	0	0	0	1	2	2	3		
200	-2	0	0	2	4	-1	0	0	0	1	2	3	3		
180	-1	0	0	3	4	-1	0	1	0	1	2	3	3		
160	-1	0	0	3	4	-1	0	1	0	1	2	3	3		
140	-1	0	0	3	4	-1	0	1	0	1	3	3	4		

*V1 not to exceed VR

Takeoff Speeds - Dry Runway

Flaps 15

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	125	127	121	124	119	122	117	120				
50	122	129	131	125	128	119	122	117	120	115	118	111	114
40	104	136	138	133	135	127	130	122	125	117	120	111	114
30	86	138	140	138	140	133	136	128	130	122	125	115	118
20	68	139	140	138	140	134	137	131	133	126	129	119	123
-60	-76	140	140	139	140	136	137	132	133	127	129	121	124

Minimum V2

Max Takeoff Thrust

PRESSURE ALTITUDE (FT)	-2000	0	2000	4000	6000	8000
SPEED (KIAS)	135	133	131	128	126	123

Takeoff Speeds - Wet Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	KIAS		
	V1	VR	V2
360	161	176	180
340	155	170	176
320	148	165	171
300	141	158	166
280	134	152	161
260	126	145	156
240	119	138	151
220	110	131	145
200	101	123	139
180	91	115	133
160	81	106	126
140	71	97	119

Check V1(MCG), Minimum VR, Minimum V2, and Minimum Takeoff Weight.

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	-2	0	2	4	6	8	-2	0	2	4	6	8
70	158	14	16					6	7					-3	-3				
60	140	9	11	14	16			4	5	6	7			-2	-2	-3	-3		
50	122	5	6	9	11	14	17	2	3	4	6	7	8	-1	-1	-2	-2	-3	-4
40	104	1	2	5	8	10	14	0	1	3	4	5	7	0	-1	-1	-2	-2	-3
30	86	0	0	2	5	7	11	0	0	1	3	4	6	0	0	0	-1	-1	-2
20	68	0	0	1	3	5	9	0	0	1	2	3	5	0	0	0	-1	-1	-2
-60	-76	0	0	1	3	5	8	0	0	1	2	3	4	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		
360	-6	-3	0	3	6		-4	-3	-1	0	1	2	3	4		
340	-6	-3	0	3	6		-4	-3	-1	0	1	2	3	4		
320	-6	-3	0	3	5		-5	-3	-2	0	1	2	3	4		
300	-5	-3	0	3	5		-5	-3	-2	0	1	2	3	4		
280	-5	-2	0	3	5		-5	-3	-2	0	1	2	3	4		
260	-5	-2	0	3	5		-5	-3	-1	0	1	2	3	4		
240	-4	-2	0	3	5		-5	-3	-1	0	1	3	4	5		
220	-4	-1	0	3	5		-4	-3	-1	0	1	3	4	5		
200	-3	-1	0	3	5		-4	-2	-1	0	1	3	4	5		
180	-2	0	0	3	5		-3	-2	0	0	2	3	4	5		
160	-2	0	0	4	5		-3	-1	0	0	2	4	5	6		
140	-1	0	0	4	6		-2	0	0	0	2	4	5	6		

*V1 not to exceed VR

Takeoff Speeds - Wet Runway

Flaps 15

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	125	127	121	124	119	122	117	120				
50	122	129	131	125	128	119	122	117	120	115	118	111	114
40	104	136	138	133	135	127	130	122	125	117	120	111	114
30	86	138	140	138	140	133	136	128	130	122	125	115	118
20	68	139	140	138	140	134	137	131	133	126	129	119	123
-60	-76	140	140	139	140	136	137	132	133	127	129	121	124

Minimum V2

Max Takeoff Thrust

PRESSURE ALTITUDE (FT)	-2000	0	2000	4000	6000	8000
SPEED (KIAS)	135	133	131	128	126	123

Performance Dispatch**Enroute****Chapter PD****Section 71****Long Range Cruise Maximum Operating Altitude****Max Climb Thrust****ISA + 10°C and Below**

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	5	30400	28800	27200
350	27900	4	31000	29400	27800
340	28500	3	31700	30000	28500
330	29200	1	32200	30500	29000
320	29900	0	32700	31000	29500
310	30600	-2	33200	31600	30000
300	31300	-4	33700	32100	30600
290	32000	-5	34300	32700	31200
280	32800	-7	34900	33300	31800
270	33600	-9	35500	33900	32400
260	34400	-11	36100	34500	33100
250	35200	-12	36800	35200	33800
240	36000	-14	37500	35900	34500
230	36900	-15	38200	36600	35200
220	37800	-15	39000	37400	36000
210	38800	-15	39800	38200	36800
200	39800	-15	40600	39000	37700
190	40900	-15	41500	39900	38600
180	42000	-15	42500	40900	39600
170	43100	-15	43100	42100	40800
160	43100	-15	43100	43100	42000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	11	30400	28800	27200
350	27900	10	31000	29400	27800
340	28500	8	31700	30000	28500
330	29200	7	32200	30500	29000
320	29900	5	32700	31000	29500
310	30600	4	33200	31600	30000
300	31300	2	33700	32100	30600
290	32000	0	34300	32700	31200
280	32800	-1	34900	33300	31800
270	33600	-3	35500	33900	32400
260	34400	-5	36100	34500	33100
250	35200	-7	36800	35200	33800
240	36000	-9	37500	35900	34500
230	36900	-9	38200	36600	35200
220	37800	-9	39000	37400	36000
210	38800	-9	39800	38200	36800
200	39800	-9	40600	39000	37700
190	40900	-9	41500	39900	38600
180	42000	-9	42500	40900	39600
170	43100	-9	43100	42100	40800
160	43100	-9	43100	43100	42000

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust
ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	17	30400	28800	27200
350	27900	15	31000	29400	27800
340	28500	14	31700	30000	28500
330	29200	12	32200	30500	29000
320	29900	11	32700	31000	29500
310	30600	9	33200	31600	30000
300	31300	8	33700	32100	30600
290	32000	6	34300	32700	31200
280	32800	4	34900	33300	31800
270	33600	3	35500	33900	32400
260	34400	1	36100	34500	33100
250	35200	-1	36800	35200	33800
240	36000	-3	37500	35900	34500
230	36900	-3	38200	36600	35200
220	37800	-3	39000	37400	36000
210	38800	-3	39800	38200	36800
200	39800	-3	40600	39000	37700
190	40900	-3	41500	39900	38600
180	42000	-3	42500	40900	39600
170	43100	-3	43100	42100	40800
160	43100	-3	43100	43100	42000

**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
665	625	588	556	526	500	479	458	440	423	407
1320	1242	1171	1108	1052	1000	958	919	883	850	820
1973	1857	1752	1660	1576	1500	1438	1381	1327	1278	1233
2623	2471	2333	2211	2101	2000	1918	1842	1771	1706	1647
3271	3083	2913	2761	2625	2500	2398	2304	2216	2135	2061
3915	3693	3491	3311	3149	3000	2879	2766	2661	2564	2475
4556	4301	4068	3860	3672	3500	3359	3228	3106	2993	2890
5195	4906	4643	4407	4195	4000	3840	3690	3551	3422	3304
5831	5510	5216	4954	4717	4500	4320	4152	3995	3851	3719
6465	6112	5788	5500	5240	5000	4800	4613	4440	4280	4133
7096	6712	6360	6046	5762	5500	5280	5075	4885	4709	4547
7726	7311	6931	6591	6283	6000	5761	5537	5329	5137	4961
8354	7909	7501	7136	6805	6500	6240	5998	5773	5565	5375
8981	8506	8070	7680	7326	7000	6720	6460	6217	5993	5788
9607	9102	8639	8224	7847	7500	7201	6921	6661	6421	6201
10233	9698	9208	8768	8368	8000	7681	7382	7105	6849	6614
10858	10294	9777	9312	8890	8500	8161	7844	7549	7277	7028
11483	10890	10345	9856	9411	9000	8641	8305	7993	7705	7441
12108	11486	10914	10399	9932	9500	9121	8766	8437	8133	7854
12732	12081	11482	10943	10453	10000	9601	9228	8881	8561	8267

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)
500	8.6	1:19	8.4	1:18	8.4	1:17	8.3	1:15	8.2	1:14
1000	15.8	2:30	15.5	2:28	15.2	2:24	14.9	2:20	14.6	2:17
1500	23.2	3:40	22.7	3:36	22.2	3:29	21.8	3:23	21.3	3:20
2000	30.7	4:50	29.9	4:43	29.3	4:34	28.6	4:27	27.9	4:23
2500	38.4	5:58	37.4	5:49	36.6	5:38	35.7	5:29	34.9	5:25
3000	46.1	7:06	45.0	6:55	43.9	6:42	42.8	6:32	41.8	6:27
3500	54.2	8:11	52.8	7:58	51.5	7:44	50.2	7:34	49.1	7:29
4000	62.3	9:17	60.6	9:02	59.1	8:47	57.6	8:36	56.4	8:31
4500	70.7	10:21	68.8	10:04	67.0	9:48	65.3	9:38	64.0	9:34
5000	79.1	11:25	76.9	11:07	74.9	10:50	73.1	10:39	71.7	10:36
5500	87.8	12:27	85.4	12:08	83.1	11:51	81.2	11:41	79.9	11:38
6000	96.6	13:29	93.8	13:10	91.3	12:53	89.3	12:42	88.1	12:40
6500	105.7	14:30	102.7	14:11	100.0	13:54	97.9	13:44	97.0	13:43
7000	114.8	15:32	111.5	15:11	108.6	14:55	106.5	14:46	105.8	14:46
7500	124.3	16:32	120.7	16:12	117.8	15:56	115.8	15:48	115.6	15:49
8000	133.8	17:33	130.0	17:13	126.9	16:57	125.1	16:50	125.3	16:52
8500	143.9	18:33	139.8	18:13	136.7	17:58	135.3	17:52		
9000	153.9	19:33	149.7	19:14	146.5	19:00	145.5	18:54		
9500	164.4	20:33	160.1	20:15	157.2	20:01	156.8	19:57		
10000	175.0	21:33	170.5	21:15	167.9	21:03	168.0	21:00		

Long Range Cruise Trip Fuel and Time

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	160	180	200	220	240
20	-2.1	-1.1	0.0	1.2	2.7
30	-3.1	-1.6	0.0	1.9	4.3
40	-4.2	-2.1	0.0	2.7	6.2
50	-5.3	-2.7	0.0	3.6	8.3
60	-6.4	-3.2	0.0	4.7	10.7
70	-7.5	-3.8	0.0	5.9	13.4
80	-8.7	-4.4	0.0	7.2	16.3
90	-9.8	-5.0	0.0	8.6	19.5
100	-11.0	-5.6	0.0	10.2	23.0
110	-12.2	-6.2	0.0	11.9	26.7
120	-13.4	-6.8	0.0	13.7	30.7
130	-14.6	-7.5	0.0	15.7	35.0
140	-15.9	-8.1	0.0	17.8	39.5
150	-17.1	-8.8	0.0	20.0	44.3
160	-18.4	-9.5	0.0	22.3	49.4
170	-19.7	-10.2	0.0	24.8	54.7
180	-21.0	-10.9	0.0	27.3	60.3

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

**Long Range Cruise Step Climb 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
1292	1221	1157	1099	1047	1000	957	917	881	847	816
1923	1820	1728	1645	1569	1500	1437	1379	1325	1276	1229
2554	2420	2299	2190	2091	2000	1917	1840	1770	1704	1643
3185	3020	2871	2735	2612	2500	2397	2302	2214	2133	2057
3816	3619	3442	3281	3134	3000	2877	2764	2659	2562	2472
4446	4218	4012	3826	3656	3500	3357	3225	3104	2991	2886
5077	4817	4583	4371	4177	4000	3837	3687	3548	3420	3300
5707	5416	5154	4916	4699	4500	4317	4149	3993	3849	3715
6336	6015	5724	5461	5220	5000	4798	4611	4438	4278	4129
6966	6613	6295	6006	5742	5500	5278	5073	4883	4707	4544
7595	7212	6865	6550	6263	6000	5758	5535	5329	5137	4959
8224	7810	7435	7095	6784	6500	6238	5997	5774	5566	5373
8853	8408	8005	7640	7306	7000	6719	6459	6219	5996	5788
9481	9006	8575	8184	7827	7500	7199	6921	6664	6426	6204
10110	9603	9145	8729	8348	8000	7679	7384	7110	6855	6619
10738	10201	9715	9273	8870	8500	8160	7846	7555	7285	7034
11366	10798	10284	9817	9391	9000	8640	8308	8001	7715	7449
11993	11395	10854	10362	9912	9500	9121	8771	8446	8145	7865
12621	11992	11423	10906	10433	10000	9601	9233	8892	8575	8280

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)									TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)									
	150	160	170	180	190	200	210	220	230	
1000	11.8	12.2	12.7	13.3	13.8	14.5	14.9	15.5	16.0	2:16
1500	16.9	17.6	18.3	19.1	20.0	20.9	21.6	22.4	23.3	3:18
2000	22.1	23.0	24.1	25.2	26.4	27.5	28.5	29.6	30.9	4:20
2500	27.4	28.6	29.9	31.4	32.9	34.3	35.6	37.1	38.6	5:23
3000	32.9	34.4	36.0	37.8	39.5	41.3	42.9	44.7	46.5	6:25
3500	38.5	40.3	42.3	44.3	46.4	48.4	50.4	52.5	54.6	7:27
4000	44.2	46.3	48.7	51.0	53.4	55.8	58.1	60.5	63.0	8:29
4500	50.1	52.6	55.2	57.9	60.6	63.4	66.0	68.8	71.5	9:31
5000	56.2	59.0	61.9	64.9	68.1	71.2	74.1	77.2	80.3	10:33
5500	62.5	65.6	68.8	72.2	75.7	79.2	82.5	85.9	89.4	11:34
6000	68.9	72.3	75.9	79.7	83.6	87.4	91.0	94.8	98.8	12:36
6500	75.4	79.2	83.2	87.4	91.6	95.8	99.8	104.1	108.5	13:38
7000	82.1	86.3	90.8	95.3	99.9	104.4	108.9	113.6	118.4	14:39
7500	89.0	93.6	98.5	103.4	108.3	113.3	118.2	123.4	128.6	15:40
8000	96.1	101.2	106.4	111.7	117.0	122.5	127.9	133.4	139.0	16:42
8500	103.4	108.9	114.5	120.2	126.1	132.0	137.8	143.8	149.8	17:43
9000	111.0	116.8	122.8	129.0	135.3	141.7	148.0	154.4	160.9	18:44
9500	118.7	124.9	131.4	138.0	144.9	151.7	158.4	165.3	172.2	19:45
10000	126.6	133.3	140.2	147.4	154.7	162.0	169.2	176.5	183.9	20:46

Based on 310/.84 climb, Long Range Cruise and .84/310/250 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	143	129	118	108	100	93	87	82	77	73
225	205	187	173	161	150	141	132	125	118	113
288	264	245	228	213	200	189	178	169	161	153
349	323	301	282	265	250	237	225	214	204	195
410	382	357	336	317	300	285	271	258	247	237
471	440	414	390	369	350	333	317	303	290	279
532	499	470	444	421	400	381	364	348	334	320
595	559	527	499	473	450	429	410	393	376	362
660	621	585	554	526	500	477	456	436	419	402

Trip Fuel and Time

AIR DIST (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		160	180	200	220	240	
50	FUEL (1000 KG)	1.6	1.8	1.9	2.0	2.1	0:14
	ALT (FT)	11000	9000	9000	7000	5000	
100	FUEL (1000 KG)	2.4	2.6	2.7	2.8	3.0	0:23
	ALT (FT)	15000	13000	13000	13000	13000	
150	FUEL (1000 KG)	3.2	3.4	3.5	3.7	3.9	0:30
	ALT (FT)	21000	21000	21000	21000	21000	
200	FUEL (1000 KG)	3.8	4.1	4.3	4.5	4.8	0:37
	ALT (FT)	27000	27000	27000	25000	25000	
250	FUEL (1000 KG)	4.4	4.7	5.0	5.3	5.6	0:43
	ALT (FT)	37000	31000	29000	29000	29000	
300	FUEL (1000 KG)	5.0	5.3	5.6	6.0	6.3	0:48
	ALT (FT)	41000	39000	37000	35000	33000	
350	FUEL (1000 KG)	5.5	5.9	6.2	6.6	7.0	0:54
	ALT (FT)	43000	39000	37000	35000	35000	
400	FUEL (1000 KG)	6.0	6.4	6.9	7.3	7.8	1:00
	ALT (FT)	43000	39000	37000	37000	35000	
450	FUEL (1000 KG)	6.5	7.0	7.5	8.0	8.5	1:06
	ALT (FT)	43000	41000	39000	37000	35000	
500	FUEL (1000 KG)	7.0	7.6	8.1	8.7	9.2	1:13
	ALT (FT)	43000	41000	39000	37000	35000	

Holding Planning
Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
360	9310	9240	9140	9180	9690	10040	10600			
340	8810	8730	8620	8620	9080	9360	9780			
320	8250	8160	8050	8030	8430	8630	8950	9950		
300	7720	7630	7510	7480	7600	7980	8260	8850		
280	7250	7150	7030	6970	7000	7380	7620	8060		
260	6790	6670	6530	6470	6470	6800	6990	7250	8510	
240	6350	6220	6060	5980	5970	6030	6380	6590	7270	
220	5940	5790	5610	5530	5490	5490	5770	5960	6450	7070
200	5590	5430	5230	5140	5070	5040	5150	5350	5660	6020
180	5270	5100	4900	4800	4710	4760	4650	4750	5000	5210
160	5120	4940	4750	4610	4500	4440	4330	4310	4460	4560

Flaps 1

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
360	10290	10260	10210	10300	10530
340	9680	9630	9570	9620	9830
320	9080	9030	8960	8980	9160
300	8510	8450	8370	8380	8520
280	7940	7870	7770	7770	7860
260	7390	7300	7190	7190	7240
240	6860	6740	6630	6600	6620
220	6340	6200	6070	6010	6020
200	5880	5720	5550	5470	5430
180	5480	5300	5110	5020	4960
160	5260	5080	4860	4760	4660

These tables include 5% additional fuel for holding in a racetrack pattern.

Crew Oxygen Requirements

Required Pressure (PSI) for Three 115 Cubic Ft. Cylinders

Table 1 - Minimum Dispatch Pressure Using Normal Oxygen Flow

NUMBER OF CREW USING OXYGEN	TOTAL TIME ON DILUTED OXYGEN (MINUTES)				
	120	180	207	240	300
2	390	520	570	650	770
3	530	720	810	920	1110
4	680	930	1050	1190	1440

For more extensive than normal crew usage, add 0.5 psi/person/minute.

Table 2 - Minimum Dispatch Pressure Using 100% Oxygen Flow

NUMBER OF CREW USING OXYGEN	TOTAL TIME ON 100% OXYGEN (MINUTES)				
	120	180	207	240	300
2	440	590	650	740	880
3	610	830	930	1050	1280
4	770	1070	1210	1370	1670

For more extensive than normal crew usage, add 2.7 psi/person/minute.

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

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.

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
32	166.0	164.5	161.0
30	183.7	181.5	175.5
28	197.9	193.2	185.8
26	213.1	207.2	199.2
24	229.4	222.1	213.9
22	246.8	238.7	230.1
20	271.4	264.3	254.0
18	293.8	284.5	273.3
16	318.2	306.9	294.9
14	339.7	326.4	313.5
12	361.3	347.4	334.2

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALTITUDE (1000 FT)								
	14	16	18	20	22	24	26	28	30
ENGINE ONLY	-0.7	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE AND WING	-2.7	-2.0	-1.6	-1.2	-1.3	-1.4	-1.5	-1.5	-1.5

Intentionally
Blank

Performance Dispatch**Chapter PD****Landing****Section 72****Landing Field Limit Weight - Dry Runway****Flaps 30****Wind Corrected Field Length (M)**

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1400			1280	1400	1450	1520	1580	1640
1600	1300	1360	1460	1600	1670	1750	1820	1900
1800	1440	1520	1640	1800	1880	1980	2070	2170
2000	1580	1680	1820	2000	2090	2210	2310	2430
2200	1720	1840	2000	2200	2310	2430	2550	2690
2400	1860	2010	2180	2400	2520	2660	2800	2950
2600	2010	2170	2360	2600	2730	2890	3040	3210
2800	2150	2330	2540	2800	2940	3120	3290	3470
3000	2290	2490	2720	3000	3160	3350	3530	3740
3200	2430	2650	2900	3200	3370	3580	3770	4000
3400	2570	2810	3080	3400	3580	3800	4020	4260
3600	2710	2980	3260	3600	3790	4030	4260	4520
3800	2860	3140	3440	3800	4010	4260	4500	4780
4000	3000	3300	3620	4000	4220	4490	4750	5050
4200	3140	3460	3800	4200	4430	4720	4990	5310
4400	3280	3620	3980	4400	4650	4950	5230	5570

Field Limit Weight (1000 KG)

WIND CORRECTED FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)						
	0	2000	4000	6000	8000	9000	9800
1400	188.7	176.8	166.1	155.9			
1600	227.3	213.3	200.0	187.5	175.6	169.8	165.4
1800	263.8	249.9	234.4	219.5	205.4	198.8	193.6
2000	293.0	277.5	265.6	252.5	236.4	228.5	222.3
2200	309.3	301.2	292.7	276.4	264.6	258.4	251.4
2400	322.0	313.1	305.0	296.9	287.0	280.4	273.0
2600	334.7	324.6	315.2	307.0	298.7	294.6	290.3
2800	345.8	336.1	325.8	316.1	307.8	303.6	300.3
3000	357.7	346.0	336.3	325.9	316.1	311.8	308.5
3200	369.1	356.7	345.3	335.3	324.9	319.8	316.0
3400	380.0	366.9	354.8	343.8	333.5	328.1	324.0
3600		376.4	363.8	352.1	341.5	336.2	331.8
3800		385.9	372.3	360.1	348.4	343.3	339.3
4000			380.5	367.6	355.9	350.2	345.6
4200			388.7	374.8	362.6	356.9	352.5
4400				381.7	369.0	363.1	358.6

With manual speedbrakes, decrease weight by 21450 kg.

With 1 brake deactivated, decrease weight by 20600 kg.

With 2 brakes deactivated, decrease weight by 41900 kg.

Landing Field Limit Weight - Wet Runway

Flaps 30

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1400				1400	1450	1510	1560	1610
1600			1460	1600	1660	1740	1800	1870
1800	1460	1530	1640	1800	1870	1960	2050	2140
2000	1600	1690	1820	2000	2090	2190	2290	2400
2200	1750	1850	2000	2200	2300	2420	2540	2660
2400	1890	2010	2180	2400	2510	2650	2780	2920
2600	2030	2180	2360	2600	2730	2880	3020	3180
2800	2170	2340	2540	2800	2940	3110	3270	3450
3000	2310	2500	2720	3000	3150	3330	3510	3710
3200	2460	2660	2900	3200	3360	3560	3750	3970
3400	2600	2820	3080	3400	3580	3790	4000	4230
3600	2740	2980	3260	3600	3790	4020	4240	4490
3800	2880	3150	3440	3800	4000	4250	4480	4760
4000	3020	3310	3620	4000	4210	4480	4730	5020
4200	3160	3470	3800	4200	4430	4700	4970	5280
4400	3310	3630	3980	4400	4640	4930	5220	5540

Field Limit Weight (1000 KG)

WIND CORRECTED FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)						
	0	2000	4000	6000	8000	9000	9800
1400	153.4						
1600	187.0	175.2	164.6	154.6			
1800	220.6	206.9	194.1	182.0	170.4	164.8	160.5
2000	253.4	238.7	223.8	209.7	196.3	189.9	185.0
2200	278.4	266.6	253.6	238.1	222.9	215.5	209.7
2400	300.4	291.1	275.9	263.7	250.0	241.6	235.0
2600	313.2	305.1	296.8	285.0	269.5	264.8	260.1
2800	324.2	315.0	306.8	298.7	289.3	284.1	278.1
3000	335.2	325.1	315.7	307.4	299.1	295.0	290.9
3200	344.9	335.1	324.9	315.4	307.0	302.9	299.5
3400	355.0	344.1	334.0	323.8	314.3	310.1	306.7
3600	365.2	353.0	342.5	332.1	321.8	316.8	313.4
3800	374.8	362.1	350.2	340.0	329.4	324.2	320.1
4000	384.2	370.6	358.4	346.6	336.7	331.3	327.1
4200		378.9	366.0	354.2	343.2	338.2	333.8
4400		387.1	373.4	361.1	349.4	344.1	340.2

With manual speedbrakes, decrease weight by 21450 kg.

With 1 brake deactivated, decrease weight by 20600 kg.

With 2 brakes deactivated, decrease weight by 41900 kg.

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	297.3	279.1				
52	126	306.3	287.0				
50	122	315.2	294.5	269.7			
48	118	323.5	303.4	276.9			
46	115	331.8	312.4	284.1	259.6		
44	111	340.4	321.1	291.5	267.7		
42	108	349.8	329.0	299.1	275.0	251.6	
40	104	356.7	337.3	307.2	281.4	257.0	
38	100	363.8	347.0	316.0	287.8	262.8	233.8
36	97	366.6	354.0	323.2	293.4	269.2	238.4
34	93	366.8	360.8	330.4	299.7	274.4	243.0
32	90	367.1	363.3	337.6	306.4	278.7	247.1
30	86	367.3	363.4	344.5	312.9	282.9	250.9
28	82	367.6	363.6	350.2	318.7	287.3	254.6
26	79	367.9	363.7	350.4	322.6	292.2	258.2
24	75	368.1	363.9	350.5	326.0	297.0	263.1
22	72	368.4	364.0	350.5	327.4	300.3	268.1
20	68	368.6	364.1	350.6	327.5	302.5	272.4
18	64	368.9	364.3	350.7	327.6	304.7	275.2
16	61	369.2	364.4	350.8	327.6	304.7	276.9
14	57	369.4	364.5	350.8	327.7	304.8	278.5
12	54	369.6	364.6	350.9	327.8	304.9	278.6
10	50	369.8	364.7	351.0	327.9	304.9	278.7
8	46	369.9	364.8	351.1	327.9	304.9	278.7
6	43	370.0	364.9	349.7	328.0	304.9	272.8
4	40	370.1	365.0	341.5	313.7	286.7	254.9
2	36	370.2	365.1	341.5	313.8	286.8	254.9
0	32	370.3	365.1	341.5	313.8	286.8	255.0
-40	-40	371.0	365.4	341.6	313.8	286.8	255.0

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1250 kg.

With engine anti-ice on, decrease weight by 150 kg.

With engine and wing anti-ice on, decrease weight by 2350 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 24600 kg.

ENGINE INOP

Go-Around Climb Gradient

Flaps 20, Gear Up

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	9.16	7.98	6.54	5.32	4.09	2.49
50	10.10	8.98	7.32	5.99	4.73	3.07
46	11.06	9.95	8.21	6.69	5.39	3.66
42	11.98	10.90	9.09	7.48	6.08	4.27
38	12.83	11.81	9.96	8.25	6.75	4.90
34	13.01	12.64	10.76	8.97	7.32	5.49
30	13.03	12.79	11.43	9.64	7.87	5.98
26	13.06	12.80	11.74	10.19	8.48	6.46
22	13.08	12.81	11.75	10.46	8.89	6.98
18	13.10	12.83	11.75	10.47	9.15	7.33
14	13.13	12.84	11.76	10.47	9.15	7.55
10	13.15	12.85	11.77	10.48	9.16	7.55

Weight Adjustment

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)											
	2	3	4	5	6	7	8	9	10	11	12	13
320	-4.29	-4.77	-5.26	-5.74	-6.13	-6.59	-7.04	-7.50	-7.95	-8.45	-8.92	-9.39
300	-4.02	-4.44	-4.89	-5.32	-5.66	-6.08	-6.49	-6.90	-7.32	-7.77	-8.21	-8.64
280	-3.56	-3.94	-4.33	-4.72	-5.01	-5.38	-5.74	-6.10	-6.47	-6.89	-7.28	-7.67
260	-3.12	-3.43	-3.77	-4.11	-4.34	-4.66	-4.96	-5.26	-5.58	-5.95	-6.29	-6.63
240	-2.44	-2.67	-2.95	-3.23	-3.39	-3.64	-3.88	-4.11	-4.37	-4.68	-4.96	-5.23
220	-1.61	-1.76	-1.97	-2.17	-2.26	-2.43	-2.58	-2.74	-2.93	-3.15	-3.36	-3.52
200	-0.61	-0.66	-0.76	-0.81	-0.85	-0.91	-0.97	-1.03	-1.12	-1.20	-1.25	-1.28
190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
180	0.66	0.75	0.85	0.88	0.94	1.00	1.07	1.17	1.26	1.30	1.33	1.36
160	2.37	2.67	2.86	3.00	3.20	3.44	3.71	3.95	4.13	4.22	4.33	4.44

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)											
	-2	0	2	4	6	8	10	12	14	16	18	
VREF	-0.23	-0.24	-0.25	-0.27	-0.28	-0.27	-0.23	-0.16	-0.07	0.03	0.10	
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
VREF+10	0.17	0.18	0.19	0.20	0.21	0.19	0.15	0.07	-0.03	-0.11	-0.14	
VREF+20	0.38	0.40	0.42	0.43	0.44	0.37	0.23	-0.01	-0.24	-0.42	-0.56	
VREF+30	0.43	0.44	0.44	0.43	0.40	0.28	0.05	-0.28	-0.61	-0.90	-1.12	

With engine bleed for packs off, increase gradient by 0.1%.

With engine and wing anti-ice on, decrease gradient by 0.1%.

When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 1.2%.

Quick Turnaround Limit Weight

Flaps 30 Limit Weight (1000 KG)

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	235.5				
50	122	237.0	228.2			
45	113	239.0	230.0	221.4		
40	104	240.9	231.9	223.2	214.8	
35	95	242.9	233.9	225.1	216.6	208.1
30	86	245.0	235.9	227.0	218.4	209.9
25	77	247.1	237.9	228.9	220.3	211.7
20	68	249.2	240.0	231.0	222.2	213.6
15	59	251.5	242.2	233.0	224.1	215.6
10	50	253.8	244.4	235.2	226.2	217.5
5	41	256.2	246.6	237.4	228.3	219.5
0	32	258.6	248.9	239.6	230.4	221.5
-5	23	261.0	251.3	241.9	232.6	223.6
-10	14	262.9	253.8	244.2	234.9	225.8
-15	5	264.8	256.4	246.7	237.3	228.1
-20	-4	266.8	259.0	249.2	239.7	230.4
-30	-22	270.8	263.5	254.4	244.7	235.3
-40	-40	276.0	267.7	260.0	250.1	240.4
-50	-58	282.2	272.0	264.6	255.7	245.8
-54	-65	284.7	274.4	266.4	258.1	248.0

Increase weight by 2100 kg per 1% uphill slope. Decrease weight by 3450 kg per 1% downhill slope.
Increase weight by 6100 kg per 10 knots headwind. Decrease weight by 29450 kg per 10 knots tailwind.
Decrease weight by 12600 kg when one brake is deactivated. Decrease weight by 24950 kg when two brakes are deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Intentionally
Blank

Performance Dispatch**Chapter PD****Gear Down****Section 73****GEAR DOWN****Takeoff Climb Limit Weight****Flaps 15****Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off**

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	0	2000	4000	6000	8000	9000	9800
54	129	236.9	225.2	209.9	189.5	159.7		
52	126	242.3	226.1	214.7	195.1	166.9		
50	122	248.1	227.3	217.1	200.5	173.2	159.6	
48	118	254.1	232.9	217.0	205.8	178.4	166.2	156.4
46	115	259.9	238.4	218.2	206.1	183.5	171.2	162.0
44	111	264.7	243.7	223.0	206.0	188.5	176.1	166.9
42	108	269.1	249.0	227.9	207.1	191.2	180.9	171.6
40	104	273.8	254.4	233.0	211.6	191.1	183.4	176.3
38	100	280.0	260.2	238.4	216.4	192.3	183.3	177.6
36	97	286.2	264.9	243.9	221.5	196.7	184.5	177.5
34	93	292.5	269.6	249.6	226.7	201.3	188.9	179.5
32	90	298.3	274.8	255.0	231.8	206.2	193.4	183.9
30	86	303.7	280.9	260.5	237.2	211.1	198.2	188.3
28	82	308.6	286.8	265.2	242.4	215.9	203.0	193.1
26	79	308.7	292.3	269.3	247.6	221.0	207.6	197.8
24	75	308.8	296.1	273.6	252.7	225.9	212.5	202.3
22	72	308.9	296.2	278.0	256.7	231.0	217.2	207.1
20	68	309.0	296.2	280.6	260.0	235.5	222.2	211.6
18	64	309.1	296.3	280.7	262.7	239.0	226.4	216.1
16	61	309.2	296.3	280.7	263.7	240.7	229.5	220.1
14	57	309.3	296.4	280.7	263.7	242.0	230.8	222.8
12	54	309.4	296.4	280.7	263.7	242.1	232.0	224.0
10	50	309.5	296.5	280.7	263.7	242.1	232.0	224.8
-40	-40	309.8	296.5	280.9	263.7	242.0	232.0	224.9

With engine bleed for packs off, increase weight by 800 kg.**With engine anti-ice on, decrease weight by 900 kg.****With engine and wing anti-ice on, decrease weight by 2250 kg.**

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	249.4				
52	126	256.6				
50	122	264.0	241.5			
48	118	272.0	247.4			
46	115	278.7	254.0	234.8		
44	111	285.5	260.6	240.6		
42	108	291.8	268.0	246.3	227.7	
40	104	298.7	274.5	252.1	232.7	
38	100	305.4	280.9	257.9	237.6	211.3
36	97	312.2	286.5	263.0	241.7	215.6
34	93	318.6	292.0	268.8	245.7	219.8
32	90	320.7	297.6	273.8	249.3	223.5
30	86	320.8	302.8	278.7	253.2	226.8
28	82	320.9	307.5	283.1	257.2	230.1
26	79	321.1	307.6	286.4	261.7	233.4
24	75	321.2	307.7	288.9	266.2	237.0
22	72	321.3	307.7	289.9	269.2	240.7
20	68	321.4	307.8	290.0	271.0	243.8
18	64	321.5	307.9	290.0	272.8	246.0
16	61	321.6	308.0	290.1	272.8	247.5
14	57	321.8	308.0	290.1	272.9	248.9
12	54	321.9	308.1	290.1	272.9	249.0
10	50	322.0	308.2	290.2	272.9	249.0
-40	-40	322.5	308.5	290.5	273.1	249.2

With engine bleed for packs off, increase weight 1600 kg.

With engine and wing anti-ice on, decrease weight by 2150 kg.

When operating in icing conditions during any part of the flight when forecast landing temperature is below 10°C, decrease weight by 29150 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 33°C & Below, Zero Wind

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or Auto

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	291.3										
20	268.2	287.5									
40	247.9	266.7	281.2	292.1							
60	232.8	251.1	265.7	277.4	286.6	294.1					
80		239.0	253.1	265.0	274.8	282.9	289.5	295.0			
100		227.4	242.3	254.4	264.5	272.9	280.1	286.1	291.2	295.6	298.2
120			232.9	245.0	255.3	264.0	271.5	277.9	283.4	288.1	292.3
140			224.5	236.7	247.0	256.0	263.6	270.3	276.1	281.2	285.6
160			216.9	229.1	239.5	248.6	256.4	263.3	269.3	274.6	279.3
180				222.1	232.6	241.8	249.8	256.8	263.0	268.5	273.3
200				215.7	226.3	235.5	243.6	250.7	257.0	262.7	267.7
220				209.8	220.3	229.6	237.8	245.0	251.4	257.2	262.4
240				204.2	214.8	224.1	232.3	239.6	246.2	252.0	257.3
260				199.1	209.6	218.9	227.2	234.5	241.1	247.1	252.5
280					204.7	214.0	222.3	229.7	236.4	242.4	247.9
300					200.1	209.3	217.7	225.1	231.9	238.0	243.5

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)						
	180	200	220	240	260	280	300
33 & BELOW	0	0	0	0	0	0	0
34	-1.1	-1.2	-1.4	-1.5	-1.7	-1.8	-2.0
36	-4.1	-4.7	-5.2	-5.8	-6.4	-7.0	-7.5
38	-7.1	-8.1	-9.1	-10.1	-11.1	-12.1	-13.1
40	-10.1	-11.6	-13.0	-14.4	-15.9	-17.3	-18.7
42	-13.7	-15.5	-17.4	-19.2	-21.0	-22.8	-24.6
44	-17.3	-19.5	-21.7	-23.9	-26.2	-28.4	-30.6
46	-20.9	-23.5	-26.1	-28.7	-31.3	-33.9	-36.5
48	-24.5	-27.5	-30.5	-33.5	-36.4	-39.4	-42.4
50	-28.1	-31.4	-34.8	-38.2	-41.6	-45.0	-48.4

Pressure Altitude Adjustment

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)						
	180	200	220	240	260	280	300
S.L. & BELOW	0	0	0	0	0	0	0
1000	-7.3	-8.0	-8.7	-9.5	-10.2	-10.9	-11.6
2000	-14.6	-16.0	-17.5	-18.9	-20.4	-21.8	-23.3
3000	-21.0	-23.2	-25.3	-27.5	-29.6	-31.8	-34.0
4000	-27.4	-30.3	-33.2	-36.1	-38.9	-41.8	-44.7
5000	-34.1	-37.7	-41.3	-44.9	-48.5	-52.1	-55.7
6000	-40.7	-45.0	-49.4	-53.7	-58.0	-62.4	-66.7
7000	-47.7	-52.9	-58.1	-63.3	-68.5	-73.7	-78.8
8000	-54.8	-60.8	-66.8	-72.9	-78.9	-85.0	-91.0

GEAR DOWN

Long Range Cruise Altitude Capability
Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	18500	16600	14200
350	19200	17300	14800
340	19700	18000	15500
330	20600	18900	16300
320	21700	20100	17600
310	22800	21300	19000
300	23900	22400	20300
290	25000	23500	21800
280	26000	24600	23000
270	27100	25900	24300
260	28200	27200	25700
250	29400	28600	27100
240	30400	30000	28500
230	31200	30800	29900
220	32000	31700	31000
210	32800	32600	32000
200	33500	33200	32700
190	34000	33900	33400
180	34600	34500	34100
170	35200	35100	34700
160	35800	35700	35300

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
326	291	261	237	217	200	188	177	167	158	150
488	436	391	355	326	300	282	266	251	238	227
649	580	521	473	434	400	376	354	335	318	303
809	724	650	591	543	500	470	443	419	398	380
968	867	779	709	651	600	565	533	504	479	456
1127	1009	908	826	759	700	659	622	589	559	533
1285	1152	1036	944	867	800	754	712	673	639	609
1442	1293	1165	1061	975	900	848	801	758	720	686
1599	1435	1293	1178	1083	1000	943	890	843	800	763
1755	1576	1421	1295	1191	1100	1037	980	928	881	840
1910	1716	1548	1412	1299	1200	1131	1069	1012	962	917
2065	1856	1675	1529	1407	1300	1226	1158	1097	1042	994
2219	1996	1802	1646	1515	1400	1320	1248	1182	1123	1072
2373	2135	1929	1762	1623	1500	1415	1337	1267	1204	1149
2526	2274	2056	1878	1730	1600	1509	1427	1352	1285	1226
2679	2413	2182	1994	1838	1700	1604	1516	1437	1366	1304
2831	2551	2308	2110	1945	1800	1699	1606	1522	1447	1382
2982	2689	2434	2226	2053	1900	1793	1696	1608	1529	1459
3133	2826	2559	2342	2160	2000	1888	1786	1693	1610	1537

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME
	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)	(1000 KG)	(HR:MIN)
200	7.8	0:51	7.4	0:49	7.2	0:47	7.0	0:46	6.9	0:44
300	11.4	1:13	10.8	1:10	10.4	1:07	10.0	1:05	9.7	1:03
400	15.0	1:36	14.2	1:32	13.6	1:28	13.0	1:25	12.6	1:22
500	18.6	1:59	17.6	1:53	16.7	1:48	16.0	1:44	15.4	1:40
600	22.3	2:21	21.1	2:14	20.0	2:08	19.1	2:03	18.4	1:58
700	26.1	2:43	24.6	2:35	23.3	2:28	22.2	2:22	21.3	2:17
800	29.8	3:05	28.1	2:56	26.6	2:48	25.3	2:41	24.2	2:35
900	33.6	3:27	31.6	3:17	29.9	3:08	28.4	3:00	27.2	2:53
1000	37.3	3:49	35.1	3:38	33.2	3:28	31.5	3:20	30.1	3:11
1100	41.3	4:10	38.8	3:59	36.7	3:48	34.7	3:38	33.2	3:29
1200	45.2	4:32	42.4	4:19	40.1	4:07	37.9	3:57	36.2	3:47
1300	49.1	4:53	46.1	4:39	43.5	4:27	41.2	4:15	39.3	4:04
1400	53.0	5:14	49.8	5:00	47.0	4:46	44.4	4:34	42.4	4:22
1500	57.0	5:36	53.4	5:20	50.4	5:05	47.6	4:52	45.5	4:40
1600	61.1	5:56	57.3	5:40	54.0	5:24	51.0	5:11	48.7	4:57
1700	65.2	6:17	61.1	5:59	57.6	5:43	54.4	5:29	51.9	5:15
1800	69.3	6:37	64.9	6:19	61.1	6:02	57.8	5:47	55.2	5:32
1900	73.4	6:58	68.7	6:39	64.7	6:21	61.2	6:05	58.4	5:49
2000	77.5	7:19	72.6	6:58	68.3	6:40	64.6	6:23	61.6	6:07

GEAR DOWN

Long Range Cruise Trip Fuel and Time Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	160	180	200	220	240
5	-0.4	-0.2	0.0	0.3	0.7
10	-0.9	-0.5	0.0	0.6	1.3
15	-1.3	-0.7	0.0	0.9	2.0
20	-1.8	-1.0	0.0	1.3	2.7
25	-2.3	-1.3	0.0	1.6	3.5
30	-2.8	-1.6	0.0	2.0	4.2
35	-3.3	-1.9	0.0	2.3	5.0
40	-3.9	-2.1	0.0	2.7	5.9
45	-4.4	-2.4	0.0	3.1	6.7
50	-4.9	-2.7	0.0	3.5	7.6
55	-5.4	-2.9	0.0	3.9	8.5
60	-6.0	-3.2	0.0	4.4	9.4
65	-6.5	-3.5	0.0	4.8	10.4
70	-7.0	-3.7	0.0	5.2	11.3
75	-7.6	-4.0	0.0	5.7	12.3
80	-8.1	-4.2	0.0	6.2	13.4

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

GEAR DOWN

**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
101	84	72	63	56	50	45	42	38	36	33
171	150	133	120	109	100	92	86	80	75	71
242	215	194	177	162	150	139	130	122	115	109
311	280	255	233	215	200	187	175	165	156	147
380	344	315	290	268	250	234	220	207	196	186
448	408	374	346	321	300	281	265	250	237	225
517	472	434	402	374	350	329	310	293	278	265
586	536	494	458	427	400	376	355	336	319	304
655	600	554	514	480	450	423	400	379	360	343
726	666	615	571	533	500	471	445	421	400	381

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		160	180	200	220	240	
50	FUEL (1000 KG)	2.2	2.3	2.5	2.6	2.7	0:15
	ALT (FT)	13000	11000	11000	11000	11000	
100	FUEL (1000 KG)	3.7	3.9	4.1	4.3	4.5	0:25
	ALT (FT)	23000	21000	21000	19000	19000	
150	FUEL (1000 KG)	5.0	5.2	5.5	5.8	6.2	0:34
	ALT (FT)	29000	27000	25000	25000	23000	
200	FUEL (1000 KG)	6.2	6.5	6.9	7.3	7.8	0:43
	ALT (FT)	31000	29000	29000	27000	25000	
250	FUEL (1000 KG)	7.4	7.8	8.3	8.8	9.4	0:51
	ALT (FT)	33000	31000	29000	27000	25000	
300	FUEL (1000 KG)	8.6	9.1	9.6	10.3	11.0	1:00
	ALT (FT)	33000	31000	31000	29000	27000	
350	FUEL (1000 KG)	9.8	10.3	11.0	11.7	12.6	1:08
	ALT (FT)	33000	33000	31000	29000	27000	
400	FUEL (1000 KG)	11.0	11.6	12.3	13.2	14.2	1:16
	ALT (FT)	33000	33000	31000	29000	27000	
450	FUEL (1000 KG)	12.2	12.9	13.7	14.7	15.8	1:25
	ALT (FT)	33000	33000	31000	29000	27000	
500	FUEL (1000 KG)	13.4	14.2	15.1	16.2	17.5	1:33
	ALT (FT)	33000	33000	31000	29000	27000	

GEAR DOWN

**Holding Planning
Flaps Up**

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
360	15490						
340	14720	14710					
320	13780	13740					
300	12760	12730	12670				
280	11940	11920	11840				
260	11030	11010	10930	10980			
240	10300	10270	10190	10210			
220	9600	9550	9460	9460	9550		
200	9210	9140	9050	9030	9100	9210	
180	8900	8820	8720	8690	8750	8840	9040
160	8630	8540	8430	8390	8430	8510	8690

Flaps 1

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
360	15330	15400	15380	15620	16410
340	14470	14510	14490	14690	15250
320	13540	13550	13540	13670	14090
300	12540	12540	12530	12650	12900
280	11680	11670	11630	11750	11960
260	10760	10730	10680	10790	10930
240	9970	9920	9860	9940	10050
220	9210	9140	9070	9110	9210
200	8700	8610	8520	8540	8620
180	8290	8190	8090	8090	8140
160	7950	7850	7720	7710	7730

These tables include 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

Performance Dispatch
Text

Chapter PD
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 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 data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Tire Speed, and Obstacle Limit Weights as determined from the following tables. Brake Energy Limit is not shown as it is not limiting for the range of conditions shown in this chapter. When determining a maximum weight for a wet runway, the dry runway limit weight must also be checked and the lower of the two weights used.

Regulations require 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. For the 180 degree turnaround case, adjustments are provided for a nominal 60 m runway pavement width. These values may be used when obtaining takeoff weights from the AFM 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
	MINIMUM LINE-UP DISTANCE (M)	NOMINAL LINE-UP DISTANCE (M) (60.0 M RUNWAY)
TORA & TODA	23	51
ASDA	49	77

Minimum Weight for FMC Takeoff Speeds Calculation

The FMC may not be able to calculate takeoff speeds for light weight takeoffs at GE90-110B1L thrust rating. For takeoff at weights below the Minimum Weight for FMC Takeoff Speeds Calculation, takeoff speeds may be obtained using available performance software. Use of a lower thrust rating and/or assumed temperature method of thrust reduction may also be necessary.

Field Limit Weight - Slope and Wind Corrections

These tables for wet and dry runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction 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 condition 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

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct 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

Maximum tire speed limited weights are presented for 235 MPH tires. To determine the tire speed limit weight, enter the table with OAT, move to airport pressure altitude and read the tire speed limit weight. Adjust the tire speed limit weight according to the notes below the table to account for wind.

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 to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. 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.

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 below those shown in the Minimum Weight for FMC Takeoff Speeds Calculation table. In those cases where the required speed increase exceeds the maximum speed increase built into the FMC, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. This typically occurs at high rated thrust, high flaps setting and light weights. To obtain speeds for the takeoff in these situations, the options are to use available performance software, or select a smaller flaps setting, or use reduced takeoff thrust and/or add weight. Selecting derate thrust is the preferred method of reduced takeoff thrust as this will reduce the minimum control speeds.

Normal takeoff speeds, V1, VR, and V2 are read from either the wet or dry table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR 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 Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

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Minimum V2

Minimum takeoff safety speeds (V2) are provided to ensure an adequate margin between the normal operating speed and the in-air minimum control speed is maintained for directional control with high thrust asymmetry during a light weight takeoff.

Data are presented as a function of airport pressure altitude and are valid for all temperatures. To obtain the proper V2 speed for takeoff, first determine the normal takeoff V2 using the takeoff speeds tables provided, adjusted for pressure altitude, temperature, and VR correction (if applicable). Compare this V2 with the minimum V2. If the calculated V2 is less than the minimum V2, set V2 equal to minimum V2 and determine a new VR by adding the difference between calculated V2 and minimum V2 to the original VR obtained from the V1, VR, V2 Adjustments table or Minimum VR table (if applicable).

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle limit weight and the V1 must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 4050 kg for a dry runway or 2550 kg for a wet runway and the V1 associated with the reduced weight by 2 knots. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 8300 kg for a dry runway or 5300 kg for a wet runway and the V1 associated with the reduced weight by 5 knots for a dry runway or 3 knots for a wet runway. If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate stop distance available corrected for wind and slope exceeds approximately 1800 m for one brake deactivated or 1900 m for two brakes deactivated. For wet runways, the corrected accelerate stop distance should exceed approximately 2350 m for one brake deactivated or 2450 m for two brakes deactivated.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

One Thrust Reverser Inoperative

Wet runway takeoff performance presented for all brakes operating is based on the use of one thrust reverser during deceleration. When operating with a thrust reverser inoperative, the runway/obstacle limited takeoff weight and V1 speed must be reduced to account for the reduced deceleration capability. A simplified method which conservatively accounts for this is to reduce the normal wet runway/obstacle limited weight by 5050 kg and the V1 associated with the reduced weight by 3 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 corrected for wind and slope exceeds approximately 2400 m.

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 these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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 fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time 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 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. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time 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

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 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%.

Oxygen Requirements

Flight Crew 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.

For freighter airplanes, regulations also require that sufficient oxygen be provided to the flight crew in case of a main deck cargo fire, which requires cabin depressurization, intermediate level off at 25000 ft altitude, and landing at the nearest suitable airport.

Data are provided to determine the flight crew oxygen dispatch requirements. Table 1 shows the dispatch pressure required for NORMAL regulator setting. Table 2, which can be used if oxygen dispatch requirements are scheduled based on pure oxygen availability, shows the dispatch pressure required for 100% regulator setting.

To determine the flight crew oxygen dispatch requirements, enter the appropriate table with number of crew plus observers using oxygen and total time, which should include maximum diversion time from the intended route to the nearest suitable airport, and read the minimum oxygen system dispatch pressure.

Additional adjustments for more extensive than normal crew usage can be made by adding 0.5 psi/person/minute for NORMAL regulator setting or 2.7 psi/person/minute for 100% regulator setting.

For ambient temperatures above or below 21°C, adjust the required dispatch pressure by the appropriate correction from 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 Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited 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 engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table 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, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

DO NOT USE FOR FLIGHT

777 Flight Crew Operations Manual

Performance Inflight

Table of Contents

Chapter PI

Section TOC

777-200 GE90-76B KG M JAA - - - - -	PI.10.1
777-200ER TRENT892 KG M FAA TALPA - - - - -	PI.20.1
777-200LR GE90-110B1L KG M FAA TO1-10 TO2-20 - - - - -	PI.30.1
777-300 PW4090 LB FT FAA TO1-10 TO2-20 TALPA - - - - -	PI.40.1
777-300ER GE90-115B LB FT FAA TO1-10 TO2-20 TALPA - - - - -	PI.50.1
777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA - - - - -	PI.60.1
777F GE90-110B1L KG M EASA TALPA - - - - -	PI.70.1

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Performance Inflight**Chapter PI****Table of Contents****Section 10****777-200 GE90-76B KG M JAA****Pkg Model Identification PI.ModID.10.1****General PI.10.1**

VREF	PI.10.1
Flap Maneuver Speed	PI.10.2
Slush/Standing Water Takeoff	PI.10.3
Slippery Runway Takeoff	PI.10.5
Minimum Control Speeds	PI.10.7
Go-around %N1	PI.10.8
Max Climb %N1	PI.10.9
Flight With Unreliable Airspeed / Turbulent Air Penetration	PI.10.10

All Engine PI.11.1

Long Range Cruise Maximum Operating Altitude	PI.11.1
Long Range Cruise Control	PI.11.3
Long Range Cruise Enroute Fuel and Time - Low Altitude ..	PI.11.4
Long Range Cruise Enroute Fuel and Time - High Altitude .	PI.11.5
Long Range Cruise Wind-Altitude Trade	PI.11.7
Descent at .84M/310/250	PI.11.7
Holding	PI.11.8

Advisory Information..... PI.12.1

Normal Configuration Landing Distance	PI.12.1
Non-Normal Configuration Landing Distance	PI.12.4
Airspeed Unreliable (Flaps 20)	PI.12.4
ANTISKID (Flaps 25)	PI.12.5
ANTISKID (Flaps 30)	PI.12.6
ENG SHUTDOWN L, R (Flaps 20)	PI.12.7
ENG SHUTDOWN L, R (Flaps 30)	PI.12.8
FLAP / SLAT CONTROL (Flaps 20)	PI.12.9

FLAPS DRIVE (Flaps ≤ 5)	PI.12.10
FLAPS DRIVE (5 < Flaps < 20)	PI.12.11
FLAPS DRIVE (Flaps ≥ 20)	PI.12.12
FLAPS PRIMARY FAIL (Flaps 20)	PI.12.13
FLIGHT CONTROL MODE (Flaps 20)	PI.12.14
FLIGHT CONTROLS (Flaps 20)	PI.12.15
HYD PRESS SYS C (Flaps 20)	PI.12.16
HYD PRESS SYS L (Flaps 25)	PI.12.17
HYD PRESS SYS L (Flaps 30)	PI.12.18
HYD PRESS SYS L+C (Flaps 20)	PI.12.19
HYD PRESS SYS L+R (Flaps 20)	PI.12.20
HYD PRESS SYS R (Flaps 25)	PI.12.21
HYD PRESS SYS R (Flaps 30)	PI.12.22
HYD PRESS SYS R+C (Flaps 20)	PI.12.23
PITCH DOWN AUTHORITY (Flaps 25)	PI.12.24
PITCH DOWN AUTHORITY (Flaps 30)	PI.12.25
PITCH UP AUTHORITY (Flaps ≤ 15)	PI.12.26
PITCH UP AUTHORITY (Flaps ≥ 20)	PI.12.27
PRI FLIGHT COMPUTERS (Flaps 20)	PI.12.28
SLATS DRIVE (Flaps 20)	PI.12.29
SPOILERS (Flaps 25)	PI.12.30
SPOILERS (Flaps 30)	PI.12.31
STABILIZER (Flaps 20)	PI.12.32
Approach or Landing Climb Limited Weight	PI.12.33
Recommended Brake Cooling Schedule	PI.12.34

Engine Inoperative PI.13.1

Initial Max Continuous %N1	PI.13.1
Max Continuous %N1	PI.13.2
Driftdown Speed/Level Off Altitude	PI.13.5
Driftdown/LRC Cruise Range Capability	PI.13.6
Long Range Cruise Altitude Capability	PI.13.7
Long Range Cruise Control	PI.13.8
Long Range Cruise Diversion Fuel and Time	PI.13.9

777 Flight Crew Operations Manual

Holding	PI.13.10
Gear Down Landing Rate of Climb Available	PI.13.11
Gear Down	PI.14.1
Long Range Cruise Altitude Capability	PI.14.1
Long Range Cruise Control	PI.14.2
Long Range Cruise Enroute Fuel and Time	PI.14.3
Descent at VREF30 + 80	PI.14.4
Holding	PI.14.5
Gear Down, Engine Inoperative	PI.15.1
Driftdown Speed/Level Off Altitude	PI.15.1
Long Range Cruise Altitude Capability	PI.15.1
Long Range Cruise Control	PI.15.2
Long Range Cruise Diversion Fuel and Time	PI.15.3
Holding	PI.15.5
Text	PI.16.1
Introduction	PI.16.1
General	PI.16.1
All Engines	PI.16.4
Advisory Information	PI.16.6
Engine Inoperative	PI.16.8
Gear Down	PI.16.11

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**Performance Inflight
Pkg Model Identification****Chapter PI
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
200	777-200	7200	WY200

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Performance Inflight

General

Chapter PI

Section 10

VREF

WEIGHT (1000 KG)	VREF (KIAS)		
	FLAPS		
	30	25	20
250	151	159	164
240	148	156	161
230	145	152	158
220	142	149	154
210	139	145	150
200	135	142	147
190	132	138	143
180	128	134	139
170	124	131	135
160	121	127	131
150	117	123	127
140	113	118	123

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS 0	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

ADVISORY INFORMATION**Slush/Standing Water Takeoff****Maximum Reverse Thrust****Weight Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	-40.2	-44.2	-48.2	-46.7	-50.7	-54.7	-60.5	-64.5	-68.5
300	-36.8	-40.7	-44.7	-42.6	-46.6	-50.5	-54.8	-58.7	-62.7
280	-33.3	-37.3	-41.3	-38.4	-42.4	-46.4	-49.0	-53.0	-57.0
260	-29.8	-33.8	-37.8	-34.2	-38.2	-42.2	-43.3	-47.3	-51.3
240	-26.4	-30.4	-34.4	-30.0	-34.0	-38.0	-37.5	-41.5	-45.5
220	-22.9	-26.9	-30.9	-25.9	-29.8	-33.8	-31.8	-35.8	-39.8
200	-19.5	-23.5	-27.5	-21.7	-25.7	-29.7	-26.1	-30.0	-34.0
180	-16.0	-20.0	-24.0	-17.5	-21.5	-25.5	-20.3	-24.3	-28.3

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2200							162		
2400	159			175			201		
2600	200			217			241	159	
2800	242	156		258	172		281	199	
3000	283	197		299	214			238	156
3200		239	153		255	169		278	196
3400		280	194		296	211			235
3600			236			252			275
3800			277			293			

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
260	-20	-20	-20	-14	-14	-14	-2	-2	-2
240	-22	-22	-22	-17	-17	-17	-6	-6	-6
220	-24	-24	-24	-20	-20	-20	-10	-10	-10
200	-26	-26	-26	-22	-22	-22	-14	-14	-14
180	-27	-27	-27	-24	-24	-24	-18	-18	-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

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	-53.7	-57.9	-62.1	-61.4	-65.6	-69.8	-80.6	-84.7	-88.9
300	-49.4	-53.5	-57.7	-56.0	-60.2	-64.3	-71.7	-75.8	-80.0
280	-45.0	-49.2	-53.4	-50.6	-54.8	-59.0	-63.0	-67.2	-71.3
260	-40.8	-44.9	-49.1	-45.3	-49.5	-53.7	-55.0	-59.1	-63.3
240	-36.6	-40.8	-44.9	-40.2	-44.4	-48.5	-47.6	-51.7	-55.9
220	-32.5	-36.7	-40.9	-35.2	-39.3	-43.5	-40.8	-45.0	-49.1
200	-28.6	-32.7	-36.9	-30.2	-34.4	-38.6	-34.7	-38.8	-43.0
180	-24.7	-28.8	-33.0	-25.5	-29.6	-33.8	-29.1	-33.3	-37.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
3000							147.9		
3200							198.4		
3400							252.7		
3600	145.7			217.1			312.0	163.7	
3800	210.4			285.5				215.2	
4000	281.9			345.2	161.9			270.9	
4200		166.5			240.2			332.0	179.7
4400		231.8			305.0				232.4
4600		308.5				188.8			289.7
4800			186.9			261.9			352.0
5000			254.2			323.8			
5200			338.5						

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 -75 m/+70 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
260	-34	-32	-30	-26	-24	-22	-6	-4	-2
240	-37	-35	-33	-30	-28	-26	-13	-11	-9
220	-40	-38	-36	-35	-33	-31	-20	-18	-16
200	-44	-42	-40	-39	-37	-35	-28	-26	-24
180	-47	-45	-43	-44	-42	-40	-35	-33	-31

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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	0.0	-0.7	-2.0	-13.9	-15.1	-16.4	-33.0	-34.2	-35.5
300	0.0	-1.2	-2.4	-15.4	-16.7	-18.0	-32.6	-33.9	-35.1
280	-0.3	-1.6	-2.9	-17.0	-18.2	-19.5	-32.2	-33.5	-34.7
260	-1.6	-2.9	-4.2	-17.9	-19.2	-20.5	-31.3	-32.6	-33.9
240	-3.1	-4.4	-5.6	-18.1	-19.3	-20.6	-29.8	-31.1	-32.3
220	-3.8	-5.0	-6.3	-17.3	-18.6	-19.9	-27.6	-28.8	-30.1
200	-3.7	-5.0	-6.2	-15.7	-17.0	-18.3	-24.6	-25.9	-27.2
180	-2.9	-4.1	-5.4	-13.3	-14.6	-15.8	-21.1	-22.3	-23.6

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1600	158								
1800	233	156							
2000	307	230	153						
2200		305	228	170					
2400			302	228					
2600				285	201				
2800					258	175			
3000					316	232	181		
3200						289	221		
3400							260	176	
3600							300	216	
3800								255	171
4000								295	210
4200									250
4400									289

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/+20 m for every 5°C above/below 4°C.
Adjust "Medium" field length available by -40 m/+35 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.

V1 Adjustments (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
260	-6	-4	-2	-17	-15	-13	-30	-28	-26
240	-8	-6	-4	-19	-17	-15	-34	-32	-30
220	-9	-7	-5	-22	-20	-18	-38	-36	-34
200	-10	-8	-6	-24	-22	-20	-42	-40	-38
180	-11	-9	-7	-26	-24	-22	-45	-43	-41

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.

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ADVISORY INFORMATION

Slippery Runway Takeoff
No 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	0.0	0.0	-0.7	-25.6	-26.4	-27.1	-48.8	-49.5	-50.2
300	-3.2	-3.9	-4.7	-27.5	-28.2	-28.9	-47.8	-48.5	-49.2
280	-6.3	-7.1	-7.8	-28.5	-29.3	-30.0	-46.0	-46.8	-47.5
260	-8.7	-9.4	-10.1	-28.8	-29.5	-30.2	-43.6	-44.3	-45.1
240	-10.2	-10.9	-11.6	-28.2	-28.9	-29.7	-40.5	-41.2	-41.9
220	-10.8	-11.6	-12.3	-26.9	-27.6	-28.3	-36.6	-37.4	-38.1
200	-10.7	-11.4	-12.2	-24.7	-25.4	-26.1	-32.1	-32.8	-33.5
180	-9.8	-10.5	-11.2	-21.7	-22.5	-23.2	-26.8	-27.5	-28.3
160	-8.0	-8.7	-9.4	-18.0	-18.7	-19.4	-20.8	-21.5	-22.3

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2000	238.5								
2200	333.2	241.5							
2400		335.1	244.5						
2600			337.1						
3000				243.8					
3200				351.8					
3400					295.1				
3600						216.5			
3800						335.8			
4800							285.5		
5400								304.1	
6000									319.9

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/+30 m for every 5°C above/below 4°C.
Adjust “Medium” field length available by -45 m/+40 m for every 5°C above/below 4°C.
Adjust “Poor” field length available by -80 m/+75 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.

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
260	-10	-8	-6	-26	-24	-22	-51	-49	-47
240	-12	-10	-8	-30	-28	-26	-58	-56	-54
220	-15	-13	-11	-34	-32	-30	-65	-63	-61
200	-17	-15	-13	-39	-37	-35	-74	-72	-70
180	-20	-18	-16	-45	-43	-41	-84	-82	-80
160	-22	-20	-18	-50	-48	-46	-95	-93	-91

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.

Minimum Control Speeds

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
60	140	107	103	102	100		
50	122	110	107	103	100	99	97
40	104	115	113	110	105	101	97
30	86	117	117	116	111	107	103
20	68	117	117	116	115	112	107
-60	-76	118	118	117	116	113	110

Go-around %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

REPORTED OAT		TAT	AIRPORT PRESSURE ALTITUDE (FT)											
°F	°C	°C	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
133	56	60	91.5	91.4	91.6	91.8	91.6	91.4	91.1	90.9	90.8	90.5	90.2	90.0
124	51	55	93.2	93.7	93.5	93.4	93.37	93.1	92.7	92.6	92.4	92.1	91.9	91.6
115	46	50	94.3	95.4	95.5	95.6	95.2	94.8	94.3	94.2	94.1	93.8	93.5	93.3
106	41	45	95.4	97.0	97.1	97.2	96.9	96.7	96.3	95.9	95.6	95.3	95.1	94.8
97	36	40	96.0	98.2	98.6	98.7	98.3	98.1	97.8	97.7	97.6	97.1	96.7	96.4
88	31	35	95.2	98.3	99.2	99.7	99.6	99.5	99.2	99.0	98.9	98.6	98.6	98.4
79	26	30	94.4	97.5	98.6	99.6	100.4	100.4	100.4	100.3	100.1	99.9	99.6	99.6
70	21	25	93.6	96.7	97.7	98.8	99.8	100.9	101.2	101.2	101.1	101.0	100.7	100.4
61	16	20	92.8	95.9	96.9	98.0	98.9	100.0	100.7	101.4	101.9	101.8	101.5	101.3
52	11	15	92.0	95.0	96.0	97.1	98.1	99.2	99.9	100.5	101.1	101.7	102.1	102.1
45	7	10	91.2	94.2	95.2	96.3	97.2	98.3	99.0	99.6	100.2	100.9	101.3	101.7
36	2	5	90.4	93.4	94.4	95.4	96.4	97.4	98.1	98.7	99.3	100.0	100.4	100.8
27	-3	0	89.6	92.5	93.5	94.6	95.5	96.5	97.2	97.8	98.5	99.1	99.5	99.9
9	-13	-10	88.0	90.8	91.8	92.8	93.7	94.8	95.4	96.0	96.6	97.2	97.6	98.0
-9	-23	-20	86.3	89.1	90.1	91.0	91.9	92.9	93.6	94.2	94.8	95.4	95.7	96.1
-27	-33	-30	84.6	87.3	88.3	89.2	90.1	91.1	91.7	92.3	92.9	93.5	93.8	94.2
-45	-43	-40	82.8	85.5	86.4	87.4	88.2	89.2	89.8	90.4	91.0	91.5	91.9	92.3
-63	-53	-50	81.0	83.6	84.6	85.5	86.3	87.3	87.9	88.4	89.0	89.5	89.9	90.3

%N1 Adjustments for Engine Bleed

[illegible]

Max Climb %N1**Based on engine bleed for packs on or off and anti-ice off**

TAT		PRESSURE ALTITUDE (FT)/ SPEED (IAS/MACH)									
		0	5000	10000	15000	20000	25000	30000	35000	40000	43000
°C	°F	310(0.47)	310(0.51)	310(0.56)	310(0.61)	310(0.67)	310(0.74)	310(0.81)	(0.84)	(0.84)	(0.84)
60	140	86.5	87.9	89.4	91.3	93.9	96.3	99.7	103.2	103.1	102.5
50	122	88.7	88.8	89.2	89.9	92.5	94.8	98.2	101.6	101.5	100.9
40	104	90.0	90.5	90.7	90.8	91.3	93.3	96.7	100.1	99.9	99.3
30	86	89.1	93.2	92.9	92.8	93.1	93.6	95.2	98.4	98.3	97.7
20	68	87.6	91.6	93.9	94.6	94.8	95.2	96.5	97.2	96.7	96.1
15	59	86.9	90.8	93.1	95.3	95.5	95.9	97.0	97.8	97.0	96.4
10	50	86.1	90.0	92.3	94.5	96.2	96.5	97.6	98.4	97.6	97.1
5	41	85.4	89.2	91.5	93.7	95.8	97.2	98.2	99.0	98.2	97.7
0	32	84.6	88.4	90.7	92.8	94.9	97.0	98.9	99.6	98.9	98.4
-5	23	83.8	87.6	89.8	92.0	94.1	96.1	98.9	100.4	99.6	99.0
-10	14	83.0	86.8	89.0	91.1	93.2	95.2	98.0	101.6	100.5	99.9
-15	5	82.2	86.0	88.1	90.2	92.3	94.3	97.1	101.5	101.4	100.8
-20	-4	81.4	85.1	87.3	89.4	91.4	93.3	96.1	100.5	100.4	99.9
-25	-13	80.6	84.3	86.4	88.5	90.5	92.4	95.2	99.5	99.4	98.9
-30	-22	79.8	83.4	85.5	87.6	89.6	91.5	94.2	98.5	98.4	97.9
-35	-31	79.0	82.6	84.6	86.7	88.6	90.5	93.2	97.5	97.4	96.9
-40	-40	78.2	81.7	83.8	85.8	87.7	89.6	92.3	96.5	96.4	95.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.5	-0.6	-0.8	-0.8	-1.2	-1.4
1 PACK ON - 1 BLEED SOURCE	-0.5	-0.6	-0.8	-0.8	-1.2	-1.4
1 PACK ON - 2 BLEED SOURCES	-0.5	-0.6	-0.8	-0.8	-1.2	-1.4
ENGINE ANTI-ICE ON	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4
ENGINE AND WING ANTI-ICE ON*	-0.5	-0.5	-0.5	-0.9	-1.1	-1.4
ENGINE AND WING ANTI-ICE ON**	-0.6	-0.7	-0.7	-1.4	-1.9	-2.3

*Wing anti-ice on, packs on, or packs off with 2 bleed sources.

**Wing anti-ice on, packs off, 1 bleed source.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT V/S (FT/MIN)	3.5 1300	3.5 600		
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	4.5 2100	4.0 1500	4.0 1000	4.0 600
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	6.5 3100	6.0 2300	6.0 1700	6.0 1200
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	9.5 4200	8.5 3200	8.0 2500	7.5 2000
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	11.5 4700	10.0 3700	9.0 2900	9.0 2300

Cruise

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT %N1	1.7 87.5	2.3 91.4		
35000 (280 KIAS)	PITCH ATT %N1	1.4 84.1	1.9 86.7	2.4 89.8	
30000 (280 KIAS)	PITCH ATT %N1	1.5 79.4	2.1 82.2	2.7 85.5	3.4 89.4
25000 (280 KIAS)	PITCH ATT %N1	1.6 75.3	2.2 77.8	2.9 80.7	3.5 84.4
20000 (270 KIAS)	PITCH ATT %N1	1.8 70.2	2.5 72.9	3.2 75.9	4.0 79.3
15000 (270 KIAS)	PITCH ATT %N1	1.7 65.9	2.5 68.4	3.2 71.3	4.0 74.6

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-1.7 -2900	-0.9 -2700		
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.3 -2200	-0.4 -2000	0.4 -1900	1.0 -1900
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.1 -1800	-0.1 -1600	0.8 -1600	1.6 -1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.4 -1700	-0.3 -1500	0.7 -1400	1.5 -1400
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.4 -1400	-0.3 -1200	0.7 -1200	1.5 -1200

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)			
		160	200	240	280
10000	PITCH ATT	4.0	4.5	5.0	5.0
	%N1	55.1	60.4	65.1	69.6
	KIAS	202	216	230	247
5000	PITCH ATT	4.0	4.5	5.0	5.0
	%N1	52.0	57.0	61.5	65.8
	KIAS	202	216	230	246

Terminal Area (5000 FT)**%N1 for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		160	200	240	280	300
FLAPS UP GEAR UP (VREF30+80)	PITCH ATT	4.5	5.0	5.5	5.5	6.0
	%N1	51.8	57.2	61.9	66.3	68.3
	KIAS	201	215	228	240	246
FLAPS 1 GEAR UP (VREF30+60)	PITCH ATT	6.0	6.5	7.0	7.0	7.5
	%N1	52.2	57.8	62.8	67.3	69.4
	KIAS	181	195	208	220	226
FLAPS 5 GEAR UP (VREF30+40)	PITCH ATT	5.0	5.5	6.0	6.0	6.0
	%N1	53.3	59.2	64.4	68.9	71.0
	KIAS	161	175	188	200	206
FLAPS 15 GEAR UP (VREF30+20)	PITCH ATT	6.0	6.0	6.5	6.5	7.0
	%N1	54.3	60.5	65.9	70.8	72.9
	KIAS	141	155	168	180	186
FLAPS 20 GEAR DOWN (VREF30+20)	PITCH ATT	4.5	4.5	5.0	5.0	5.0
	%N1	60.7	67.1	72.6	77.5	79.6
	KIAS	141	155	168	180	186

Final Approach (1500 FT)**Gear Down, %N1 for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		160	200	240	280	300
FLAPS 20 (VREF20+10)	PITCH ATT	1.0	1.5	1.5	1.5	1.5
	%N1	41.4	46.0	50.2	53.8	55.4
	KIAS	141	157	171	184	190
FLAPS 25 (VREF25+10)	PITCH ATT	0.0	0.5	0.5	0.5	0.5
	%N1	49.8	55.0	59.6	63.8	65.7
	KIAS	137	152	165	178	184
FLAPS 30 (VREF30+10)	PITCH ATT	-0.5	0.0	0.0	0.0	0.0
	%N1	55.0	60.7	65.7	70.1	72.2
	KIAS	131	145	158	170	176

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		160	200	240	280	300
10000	PITCH ATT	16.0	12.5	10.5	9.5	8.5
	V/S (FT/MIN)	3400	2600	2000	1600	1400
	KIAS	141	155	169	181	187
5000	PITCH ATT	18.5	15.0	12.5	10.5	10.0
	V/S (FT/MIN)	3900	3100	2400	1900	1700
	KIAS	141	155	168	180	187
SEA LEVEL	PITCH ATT	20.0	16.0	13.0	11.5	10.5
	V/S (FT/MIN)	4000	3100	2500	2000	1800
	KIAS	141	155	168	180	186

Performance Inflight

All Engine

Chapter PI

Section 11

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
300	30500	-2	33000*	32600	31100
290	31200	-3	34100*	33300	31800
280	32000	-5	35100*	34000	32600
270	32800	-7	35900*	34800	33300
260	33600	-9	36500*	35600	34200
250	34400	-11	37300*	36400	35000
240	35300	-12	38200*	37300	35800
230	36200	-14	39000*	38100	36700
220	37100	-14	39900*	39100	37600
210	38100	-14	40800*	40000	38600
200	39100	-14	41800*	41100	39600
190	40100	-14	42800*	42100	40700
180	41300	-14	43000	43000	41800
170	42500	-14	43000	43000	43000
160	43000	-14	43000	43000	43000
150	43000	-14	43000	43000	43000
140	43000	-14	43000	43000	43000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
300	30500	4	31400*	31400*	31100
290	31200	2	32700*	32700*	31800
280	32000	1	33900*	33900*	32600
270	32800	-1	35100*	34800	33300
260	33600	-3	35900*	35600	34200
250	34400	-5	36500*	36400	35000
240	35300	-7	37400*	37300	35800
230	36200	-9	38300*	38100	36700
220	37100	-9	39200*	39100	37600
210	38100	-9	40000*	40000	38600
200	39100	-9	40900*	40900*	39600
190	40100	-9	41900*	41900*	40700
180	41300	-9	42900*	42900*	41800
170	42500	-9	43000	43000	43000
160	43000	-9	43000	43000	43000
150	43000	-9	43000	43000	43000
140	43000	-9	43000	43000	43000

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
300	30500	10	26100*	26100*	26100*
290	31200	8	27600*	27600*	27600*
280	32000	6	31700*	31700*	31700*
270	32800	5	33400*	33400*	33300
260	33600	3	34900*	34900*	34200
250	34400	1	35800*	35800*	35000
240	35300	-1	36400*	36400*	35800
230	36200	-3	37300*	37300*	36700
220	37100	-3	38200*	38200*	37600
210	38100	-3	39200*	39200*	38600
200	39100	-3	40000*	40000*	39600
190	40100	-3	41000*	41000*	40700
180	41300	-3	42000*	42000*	41800
170	42500	-3	43000	43000	43000
160	43000	-3	43000	43000	43000
150	43000	-3	43000	43000	43000
140	43000	-3	43000	43000	43000

*Denotes altitude thrust limited in level flight, 300 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	43
260	%N1	84.9	86.6	88.2	89.5	90.7	92.4				
	MACH	.760	.787	.814	.837	.844	.842				
	KIAS	319	318	316	313	302	288				
	FF/ENG	3910	3893	3902	3902	3847	3842				
240	%N1	82.8	84.5	86.2	87.8	89.1	90.3	92.5			
	MACH	.737	.763	.790	.817	.839	.844	.841			
	KIAS	309	307	306	304	300	288	275			
	FF/ENG	3598	3573	3565	3582	3582	3525	3547			
220	%N1	80.6	82.3	84.0	85.7	87.3	88.6	90.2	92.9		
	MACH	.711	.737	.763	.791	.819	.840	.843	.841		
	KIAS	297	296	295	294	292	287	276	262		
	FF/ENG	3287	3336	3249	3251	3273	3264	3223	3283		
200	%N1	78.1	79.9	81.6	83.3	85.0	86.6	88.3	90.4	93.1	
	MACH	.680	.708	.735	.762	.791	.818	.840	.843	.841	
	KIAS	284	284	283	282	281	279	274	263	250	
	FF/ENG	3035	3030	2949	2939	2950	2965	2964	2952	3013	
180	%N1	75.6	77.2	79.0	80.7	82.4	84.1	86.1	88.3	90.3	92.9
	MACH	.650	.675	.703	.731	.758	.787	.816	.839	.844	.841
	KIAS	270	270	270	270	268	267	265	261	251	239
	FF/ENG	2732	2714	2709	2641	2632	2645	2671	2699	2683	2731
160	%N1	72.9	74.4	76.0	77.8	79.6	81.3	83.3	85.9	88.0	90.0
	MACH	.620	.643	.666	.695	.724	.751	.780	.810	.835	.844
	KIAS	257	256	255	255	255	254	253	251	248	240
	FF/ENG	2447	2422	2397	2341	2335	2328	2358	2406	2429	2419

Shaded area approximates optimum altitude.

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)						
	140	160	180	200	220	240	260
5	-0.8	-0.5	-0.3	-0.3	0.0	0.2	0.4
10	-1.6	-1.1	-0.7	-0.4	0.0	0.5	1.0
15	-2.5	-1.8	-1.0	-0.5	0.0	0.8	1.6
20	-3.3	-2.4	-1.4	-0.7	0.0	1.1	2.2
25	-4.2	-3.1	-1.8	-0.8	0.0	1.3	2.7
30	-5.1	-3.7	-2.3	-1.0	0.0	1.6	3.2
35	-6.0	-4.4	-2.7	-1.2	0.0	1.8	3.7
40	-6.9	-5.1	-3.2	-1.4	0.0	1.9	4.2
45	-7.9	-5.8	-3.7	-1.7	0.0	2.1	4.6
50	-8.8	-6.6	-4.2	-1.9	0.0	2.2	5.0
55	-9.8	-7.3	-4.7	-2.2	0.0	2.3	5.4
60	-10.8	-8.1	-5.3	-2.5	0.0	2.4	5.7

Long Range Cruise Enroute Fuel and Time - High Altitude

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
526	494	465	441	420	400	383	367	353	340	328
1040	981	928	881	839	800	767	737	709	683	659
1556	1470	1391	1321	1258	1200	1152	1107	1065	1026	991
2075	1960	1855	1762	1677	1600	1536	1476	1420	1369	1322
2595	2451	2320	2203	2097	2000	1920	1845	1776	1712	1653
3117	2944	2785	2644	2517	2400	2304	2215	2131	2055	1984
3641	3437	3251	3086	2937	2800	2688	2584	2487	2397	2315
4167	3933	3719	3528	3357	3200	3072	2952	2841	2739	2645
4695	4430	4187	3972	3778	3600	3455	3321	3196	3080	2975
5226	4928	4657	4416	4199	4000	3839	3689	3550	3421	3304
5759	5429	5128	4861	4620	4400	4223	4058	3904	3762	3632
6294	5931	5600	5306	5042	4800	4606	4425	4258	4103	3960
6832	6435	6073	5752	5464	5200	4989	4793	4610	4442	4288
7373	6940	6547	6199	5886	5600	5372	5159	4962	4780	4614
7915	7447	7022	6646	6309	6000	5755	5526	5314	5119	4940
8459	7956	7498	7094	6731	6400	6138	5893	5666	5457	5265
9006	8466	7975	7542	7155	6800	6520	6259	6017	5794	5590
9556	8979	8454	7992	7578	7200	6903	6625	6368	6131	5914
10109	9493	8934	8442	8002	7600	7285	6991	6718	6467	6237
10665	10010	9416	8893	8426	8000	7667	7356	7068	6803	6560

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	5.1	0:58	4.9	0:57	4.8	0:57	4.7	0:56	4.6	0:57
800	10.6	1:53	10.2	1:51	10.0	1:49	9.8	1:47	9.6	1:47
1200	16.0	2:48	15.5	2:44	15.2	2:41	14.8	2:38	14.6	2:37
1600	21.5	3:44	20.8	3:38	20.4	3:33	19.9	3:28	19.6	3:26
2000	26.9	4:39	26.1	4:31	25.5	4:25	25.0	4:19	24.5	4:16
2400	32.2	5:35	31.3	5:26	30.5	5:18	29.9	5:11	29.3	5:06
2800	37.6	6:32	36.4	6:21	35.4	6:11	34.7	6:03	34.1	5:57
3200	42.8	7:29	41.5	7:17	40.3	7:05	39.5	6:55	38.7	6:48
3600	47.9	8:28	46.5	8:13	45.0	8:00	44.1	7:48	43.3	7:39
4000	53.0	9:26	51.4	9:10	49.7	8:55	48.7	8:41	47.8	8:30
4400	57.9	10:27	56.2	10:08	54.3	9:51	53.1	9:36	52.2	9:23
4800	62.8	11:28	61.0	11:07	58.8	10:47	57.6	10:30	56.5	10:16
5200	67.6	12:29	65.6	12:06	63.2	11:44	61.9	11:26	60.8	11:09
5600	72.3	13:32	70.2	13:06	67.6	12:42	66.2	12:22	65.0	12:03
6000	77.0	14:34	74.8	14:07	72.0	13:40	70.4	13:18	69.1	12:57
6400	81.5	15:39	79.1	15:09	76.1	14:40	74.5	14:15	73.2	13:52
6800	86.0	16:43	83.5	16:11	80.3	15:40	78.5	15:13	77.2	14:48
7200	90.4	17:49	87.8	17:15	84.5	16:41	82.6	16:11	81.2	15:44
7600	94.7	18:56	92.0	18:19	88.5	17:43	86.5	17:11	85.1	16:41
8000	99.0	20:03	96.2	19:23	92.6	18:44	90.5	18:10	89.0	17:38

Long Range Cruise Enroute Fuel and Time - High Altitude Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)						
	140	160	180	200	220	240	260
5	-0.6	-0.4	-0.2	-0.1	0.0	0.4	1.3
10	-1.7	-1.2	-0.7	-0.3	0.0	0.8	2.2
15	-2.9	-2.0	-1.2	-0.6	0.0	1.2	3.0
20	-4.0	-2.9	-1.8	-0.8	0.0	1.6	3.8
25	-5.1	-3.7	-2.3	-1.1	0.0	2.0	4.6
30	-6.2	-4.6	-2.9	-1.3	0.0	2.4	5.4
35	-7.4	-5.4	-3.4	-1.6	0.0	2.7	6.1
40	-8.5	-6.2	-4.0	-1.9	0.0	3.1	6.9
45	-9.7	-7.1	-4.5	-2.1	0.0	3.4	7.6
50	-10.8	-8.0	-5.1	-2.4	0.0	3.7	8.2
55	-12.0	-8.8	-5.7	-2.7	0.0	4.0	8.9
60	-13.2	-9.7	-6.3	-3.0	0.0	4.3	9.5
65	-14.3	-10.6	-6.8	-3.3	0.0	4.6	10.1
70	-15.5	-11.5	-7.4	-3.6	0.0	4.9	10.7
75	-16.7	-12.4	-8.0	-3.9	0.0	5.2	11.3
80	-17.9	-13.3	-8.6	-4.2	0.0	5.5	11.8
85	-19.1	-14.2	-9.2	-4.5	0.0	5.7	12.4
90	-20.3	-15.1	-9.8	-4.8	0.0	6.0	12.9
95	-21.5	-16.0	-10.5	-5.1	0.0	6.2	13.3
100	-22.8	-16.9	-11.1	-5.4	0.0	6.4	13.8

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)						
	260	240	220	200	180	160	140
43				37	8	-1	8
41			37	10	0	4	20
39		33	9	0	2	15	35
37	27	8	0	2	12	29	51
35	6	0	2	11	26	45	68
33	-1	2	11	24	41	61	83
31	3	11	23	39	57	77	98
29	13	24	38	54	72	91	111
27	25	38	53	69	87	105	123
25	40	53	68	84	100	117	133

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 at .84M/310/250

PRESSURE ALTITUDE (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	99	106	113	120	125	130	135	141	147	153
TIME (MINUTES)	20	21	22	23	23	24	24	25	26	27

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
260	%N1	61.0	63.8	67.4	72.2	77.2	82.5	87.4	92.0		
	KIAS	236	237	238	240	262	280	284	283		
	FF/ENG	3600	3590	3480	3420	3520	3620	3720	3940		
240	%N1	58.9	61.5	65.1	70.0	74.5	80.1	85.2	89.8		
	KIAS	229	229	229	229	242	269	272	276		
	FF/ENG	3340	3300	3220	3150	3180	3370	3360	3540		
220	%N1	56.8	59.3	62.9	67.6	71.9	77.3	82.7	87.5	94.7	
	KIAS	223	223	223	223	224	247	260	263	252	
	FF/ENG	3080	3030	2960	2880	2880	2990	3030	3160	3510	
200	%N1	54.6	57.0	60.4	65.1	69.1	74.2	79.9	85.0	91.2	
	KIAS	216	216	216	216	216	225	247	250	252	
	FF/ENG	2840	2770	2710	2630	2610	2640	2720	2800	3040	
180	%N1	52.4	54.6	57.8	62.5	66.3	71.1	76.7	82.0	88.4	92.5
	KIAS	209	209	209	209	209	209	227	236	240	235
	FF/ENG	2600	2530	2470	2380	2360	2350	2430	2470	2640	2810
160	%N1	49.9	52.0	55.1	59.8	63.4	68.0	72.8	78.7	85.4	89.3
	KIAS	202	202	202	202	202	202	202	221	225	227
	FF/ENG	2360	2290	2230	2150	2120	2090	2090	2200	2340	2450
140	%N1	47.2	49.3	52.2	56.8	60.3	64.7	69.4	74.6	81.7	85.9
	KIAS	194	194	194	194	194	194	194	199	209	211
	FF/ENG	2130	2070	2010	1920	1890	1840	1850	1860	2000	2090

Flaps 1

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
260	%N1	62.3	65.1	69.0	74.2	78.7
	KIAS	216	216	216	216	216
	FF/ENG	3780	3760	3680	3630	3660
240	%N1	60.1	62.8	66.6	71.8	76.2
	KIAS	209	209	209	209	209
	FF/ENG	3480	3460	3400	3330	3340
220	%N1	57.7	60.4	64.2	69.2	73.6
	KIAS	203	203	203	203	203
	FF/ENG	3190	3160	3120	3040	3040
200	%N1	55.3	57.8	61.6	66.5	70.7
	KIAS	196	196	196	196	196
	FF/ENG	2910	2870	2830	2760	2750
180	%N1	52.7	55.1	58.7	63.6	67.7
	KIAS	189	189	189	189	189
	FF/ENG	2640	2590	2550	2490	2470
160	%N1	50.1	52.2	55.7	60.5	64.5
	KIAS	182	182	182	182	182
	FF/ENG	2370	2320	2280	2220	2200
140	%N1	47.0	49.2	52.4	57.2	61.1
	KIAS	174	174	174	174	174
	FF/ENG	2110	2070	2010	1960	1940

These tables include 5% additional fuel for holding in a racetrack pattern.

Performance Inflight

Advisory Information

Chapter PI

Section 12

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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1010	30/-5	25	-40/145	10/-10	25/-25	40	15	45
AUTOBRAKE MAX	1355	25/-5	30	-60/200	0/0	35/-35	75	0	0
AUTOBRAKE 4	1675	30/-10	45	-80/280	0/-5	45/-45	90	0	0
AUTOBRAKE 3	2000	35/-10	50	-105/350	10/-10	60/-60	110	0	0
AUTOBRAKE 2	2225	45/-25	65	-115/405	25/-40	65/-65	100	25	25
AUTOBRAKE 1	2370	50/-30	75	-130/455	50/-60	70/-70	105	140	140

Good Reported Braking Action

MAX MANUAL	1390	25/-10	35	-70/245	35/-30	35/-35	60	80	195
AUTOBRAKE MAX	1485	30/-10	40	-70/255	30/-25	35/-35	70	85	200
AUTOBRAKE 4	1680	30/-5	45	-80/290	5/-5	45/-45	90	10	50
AUTOBRAKE 3	2000	35/-10	50	-105/350	10/-10	60/-60	110	0	0
AUTOBRAKE 2	2225	45/-25	65	-115/405	25/-40	65/-65	100	25	25
AUTOBRAKE 1	2370	50/-30	75	-130/455	50/-60	70/-70	105	140	140

Medium Reported Braking Action

MAX MANUAL	1865	40/-25	60	-110/395	80/-70	45/-45	70	235	610
AUTOBRAKE MAX	1880	40/-15	60	-110/405	80/-65	45/-50	80	230	605
AUTOBRAKE 4	1910	40/-15	60	-110/405	80/-60	50/-50	85	235	620
AUTOBRAKE 3	2100	40/-15	60	-115/430	60/-40	60/-60	110	125	465
AUTOBRAKE 2	2275	45/-25	65	-125/455	60/-60	65/-65	100	100	345
AUTOBRAKE 1	2400	50/-30	75	-130/485	75/-70	70/-70	105	185	345

Poor Reported Braking Action

MAX MANUAL	2380	50/-35	80	-155/615	190/-125	65/-65	80	530	1620
AUTOBRAKE MAX	2385	60/-35	80	-155/620	195/-130	65/-65	80	535	1625
AUTOBRAKE 4	2405	60/-35	80	-160/620	190/-130	65/-70	80	535	1640
AUTOBRAKE 3	2440	50/-30	80	-160/625	185/-110	65/-70	105	510	1620
AUTOBRAKE 2	2535	60/-35	80	-165/640	175/-120	70/-70	100	430	1520
AUTOBRAKE 1	2600	60/-35	85	-165/650	180/-120	70/-75	100	465	1455

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 70 m.

For autobrake and manual speedbrakes, increase reference landing distance by 60 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%.

ADVISORY INFORMATION

Normal Configuration Landing Distance Flaps 25

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV NO REV

Dry Runway

MAX MANUAL	1065	30/-10	25	-40/150	10/-10	25/-25	40	25	50
AUTOBRAKE MAX	1450	25/-15	35	-65/205	0/0	35/-35	75	0	0
AUTOBRAKE 4	1805	35/-25	45	-85/295	0/-5	45/-45	100	0	0
AUTOBRAKE 3	2160	40/-30	60	-110/370	10/-15	65/-65	110	0	0
AUTOBRAKE 2	2380	50/-40	70	-120/420	35/-50	70/-70	100	60	60
AUTOBRAKE 1	2520	60/-45	80	-130/465	60/-65	70/-70	105	195	205

Good Reported Braking Action

MAX MANUAL	1465	30/-15	40	-70/255	35/-30	35/-35	60	90	225
AUTOBRAKE MAX	1565	30/-15	40	-75/260	30/-25	35/-40	70	100	235
AUTOBRAKE 4	1805	35/-25	45	-85/300	5/-5	45/-45	100	10	50
AUTOBRAKE 3	2160	40/-30	60	-110/370	10/-15	65/-65	110	0	0
AUTOBRAKE 2	2380	50/-40	70	-120/420	35/-50	70/-70	100	60	60
AUTOBRAKE 1	2520	60/-45	80	-130/465	60/-65	70/-70	105	195	205

Medium Reported Braking Action

MAX MANUAL	1960	40/-35	60	-110/410	85/-70	50/-50	70	265	695
AUTOBRAKE MAX	1980	40/-30	60	-110/410	85/-65	50/-50	80	260	685
AUTOBRAKE 4	2025	40/-30	60	-115/415	75/-50	50/-60	90	245	690
AUTOBRAKE 3	2260	45/-35	65	-120/445	50/-45	65/-65	110	125	495
AUTOBRAKE 2	2430	50/-40	75	-130/470	65/-70	70/-70	100	130	395
AUTOBRAKE 1	2545	60/-45	80	-140/495	85/-80	70/-75	105	240	425

Poor Reported Braking Action

MAX MANUAL	2495	60/-45	85	-160/625	190/-130	65/-70	80	585	1835
AUTOBRAKE MAX	2505	60/-45	85	-160/625	195/-130	65/-70	85	585	1840
AUTOBRAKE 4	2525	60/-45	85	-160/635	190/-130	65/-70	80	590	1850
AUTOBRAKE 3	2595	60/-45	85	-165/640	180/-115	70/-75	105	535	1800
AUTOBRAKE 2	2685	65/-45	85	-165/650	180/-125	70/-75	90	475	1700
AUTOBRAKE 1	2750	65/-50	90	-175/660	185/-125	75/-80	100	535	1645

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 70 m.

For autobrake and manual speedbrakes, increase reference landing distance by 65 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%.

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Dry Runway

MAX MANUAL	1105	35/-15	25	-45/150	10/-10	25/-25	40	30	60
AUTOBRAKE MAX	1520	25/-25	35	-65/215	0/0	35/-35	75	0	0
AUTOBRAKE 4	1905	35/-35	50	-85/300	0/0	50/-50	105	0	0
AUTOBRAKE 3	2300	45/-40	65	-110/380	5/-15	65/-65	115	0	0
AUTOBRAKE 2	2530	50/-50	75	-125/435	30/-50	70/-70	110	60	60
AUTOBRAKE 1	2685	65/-60	85	-140/485	60/-70	75/-75	110	205	205

Good Reported Braking Action

MAX MANUAL	1540	30/-25	40	-75/260	40/-35	35/-40	60	110	255
AUTOBRAKE MAX	1635	30/-30	45	-75/265	35/-25	40/-40	75	110	265
AUTOBRAKE 4	1905	35/-35	50	-90/305	5/-5	50/-50	105	10	60
AUTOBRAKE 3	2300	45/-40	65	-110/380	5/-15	65/-65	115	0	0
AUTOBRAKE 2	2530	50/-50	75	-125/435	30/-50	70/-70	110	60	60
AUTOBRAKE 1	2685	65/-60	85	-140/485	60/-70	75/-75	110	205	205

Medium Reported Braking Action

MAX MANUAL	2075	45/-40	65	-115/420	90/-75	50/-60	75	300	805
AUTOBRAKE MAX	2085	45/-40	65	-115/420	90/-70	50/-60	80	295	795
AUTOBRAKE 4	2135	45/-40	65	-115/425	80/-50	60/-60	100	280	800
AUTOBRAKE 3	2390	45/-45	70	-125/455	50/-45	65/-70	115	145	585
AUTOBRAKE 2	2590	50/-50	80	-140/490	65/-70	75/-75	110	130	455
AUTOBRAKE 1	2710	65/-60	85	-145/510	85/-80	75/-80	110	255	460

Poor Reported Braking Action

MAX MANUAL	2650	65/-60	90	-165/645	205/-140	70/-75	85	665	2140
AUTOBRAKE MAX	2655	65/-60	90	-165/645	205/-145	70/-75	85	665	2145
AUTOBRAKE 4	2675	65/-60	90	-165/650	200/-140	70/-75	90	675	2150
AUTOBRAKE 3	2750	65/-60	90	-175/655	185/-120	75/-80	110	615	2110
AUTOBRAKE 2	2860	65/-60	90	-175/665	185/-130	75/-80	105	530	1990
AUTOBRAKE 1	2920	70/-65	100	-180/685	195/-130	80/-80	105	580	1910

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 75 m.

For autobrake and manual speedbrakes, increase reference landing distance by 65 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%.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1200	25/-15	30	-45/155	15/-15	25/-25	N/A	40	80
AUTOBRAKE MAX	1450	25/-20	35	-60/200	0/0	35/-35	N/A	0	0
AUTOBRAKE 2	2505	50/-50	75	-120/405	10/-30	75/-75	N/A	20	20

Good Reported Braking Action

MAX MANUAL	1650	30/-25	45	-75/255	45/-40	40/-40	N/A	140	345
AUTOBRAKE MAX	1655	30/-30	45	-75/255	40/-35	40/-40	N/A	140	335
AUTOBRAKE 2	2505	50/-50	75	-120/405	10/-30	75/-75	N/A	20	20

Medium Reported Braking Action

MAX MANUAL	2195	45/-40	70	-115/405	100/-80	60/-60	N/A	375	1045
AUTOBRAKE MAX	2190	45/-40	70	-115/405	110/-85	60/-60	N/A	375	1040
AUTOBRAKE 3	2360	45/-40	70	-120/425	65/-35	65/-65	N/A	230	905

Poor Reported Braking Action

MAX MANUAL	2760	65/-60	100	-160/615	215/-145	75/-75	N/A	785	2685
AUTOBRAKE MAX	2765	65/-60	100	-165/615	225/-155	75/-80	N/A	785	2690
AUTOBRAKE 3	2795	65/-55	100	-165/615	210/-130	75/-80	N/A	765	2675

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ANTISKID (Flaps 25)****VREF25**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1705	35/-30	50	-95/355	75/-60	45/-45	60	230	605
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1705	35/-30	50	-95/355	75/-60	45/-45	60	230	605
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2170	50/-40	75	-140/545	165/-115	55/-60	70	510	1595
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2930	75/-60	110	-235/1045	530/-260	75/-85	80	1790	3585
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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1620	35/-20	50	-95/345	70/-60	40/-40	60	205	530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1620	35/-20	50	-95/345	70/-60	40/-40	60	205	530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2070	45/-30	70	-135/535	165/-110	55/-55	70	460	1410
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2805	70/-50	100	-230/1035	515/-255	70/-85	80	1675	3345
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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R (Flaps 20)****VREF20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-15	20	-40/135	15/-10	20/-20	35	0	25
AUTOBRAKE MAX	1320	25/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2240	45/-40	65	-110/385	10/-10	65/-65	125	0	0

Good Reported Braking Action

MAX MANUAL	1400	25/-25	35	-65/235	40/-35	35/-35	55	0	120
AUTOBRAKE MAX	1490	25/-25	40	-70/245	35/-30	35/-40	65	0	125
AUTOBRAKE 2	2240	45/-40	65	-110/385	10/-10	65/-65	125	0	0

Medium Reported Braking Action

MAX MANUAL	1980	40/-40	60	-110/400	105/-80	55/-55	75	0	385
AUTOBRAKE MAX	1985	40/-40	60	-110/400	105/-75	55/-55	85	0	380
AUTOBRAKE 3	2135	45/-40	65	-115/415	80/-50	60/-60	105	0	310

Poor Reported Braking Action

MAX MANUAL	2665	60/-55	90	-170/645	265/-170	75/-75	90	0	990
AUTOBRAKE MAX	2675	65/-60	90	-170/645	270/-175	75/-80	90	0	995
AUTOBRAKE 3	2705	65/-60	90	-170/645	270/-170	75/-80	90	0	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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ENG SHUTDOWN L, R (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-5	20	-35/125	10/-10	20/-20	35	0	20
AUTOBRAKE MAX	1180	20/-5	25	-50/175	0/0	30/-30	65	0	0
AUTOBRAKE 2	1945	40/-15	55	-105/355	10/-10	55/-55	115	0	0

Good Reported Braking Action

MAX MANUAL	1250	20/-10	30	-65/220	35/-30	30/-30	55	0	85
AUTOBRAKE MAX	1340	25/-10	35	-65/230	30/-25	35/-35	65	0	90
AUTOBRAKE 2	1945	40/-15	55	-105/355	10/-10	55/-55	115	0	0

Medium Reported Braking Action

MAX MANUAL	1750	35/-20	50	-100/375	95/-70	45/-45	70	0	280
AUTOBRAKE MAX	1755	35/-15	50	-105/375	90/-65	50/-50	80	0	280
AUTOBRAKE 3	1875	35/-15	55	-105/390	75/-45	50/-50	95	0	235

Poor Reported Braking Action

MAX MANUAL	2335	55/-35	75	-160/605	235/-150	65/-65	85	0	725
AUTOBRAKE MAX	2340	55/-35	75	-160/605	235/-150	65/-70	85	0	725
AUTOBRAKE 3	2370	55/-35	75	-160/610	240/-150	65/-70	85	0	735

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAP / SLAT CONTROL (Flaps 20)****VREF20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-15	20	-40/130	10/-10	20/-20	35	20	50
AUTOBRAKE MAX	1320	25/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2180	45/-45	65	-110/375	30/-45	60/-60	85	60	60

Good Reported Braking Action

MAX MANUAL	1325	25/-20	35	-65/220	30/-30	30/-30	50	90	215
AUTOBRAKE MAX	1415	25/-25	35	-65/230	25/-20	35/-35	65	95	220
AUTOBRAKE 2	2180	45/-45	65	-110/375	30/-45	60/-60	85	60	60

Medium Reported Braking Action

MAX MANUAL	1780	40/-35	55	-100/360	75/-60	45/-45	65	250	670
AUTOBRAKE MAX	1795	40/-35	55	-100/360	75/-55	45/-50	70	245	660
AUTOBRAKE 3	2070	40/-40	60	-110/395	45/-40	55/-60	95	115	470

Poor Reported Braking Action

MAX MANUAL	2270	55/-50	75	-145/555	175/-115	60/-65	75	555	1765
AUTOBRAKE MAX	2275	55/-50	80	-145/555	175/-120	60/-65	75	555	1770
AUTOBRAKE 3	2365	55/-50	75	-145/565	155/-105	65/-65	90	500	1725

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≤ 5)

VREF30 + 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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1170	40/-10	30	-45/150	15/-15	25/-25	40	40	90
AUTOBRAKE MAX	1710	25/-5	45	-65/215	0/0	45/-45	75	0	0
AUTOBRAKE 2	2840	55/-40	95	-130/430	50/-70	85/-85	95	220	220

Good Reported Braking Action

MAX MANUAL	1585	25/-15	45	-70/240	35/-30	40/-40	50	135	325
AUTOBRAKE MAX	1775	30/-10	50	-75/260	15/-10	45/-45	75	85	285
AUTOBRAKE 2	2840	55/-40	95	-130/430	50/-70	85/-85	95	220	220

Medium Reported Braking Action

MAX MANUAL	2165	45/-25	70	-110/390	85/-70	55/-60	65	375	1055
AUTOBRAKE MAX	2195	45/-25	70	-110/390	80/-65	60/-60	75	365	1035
AUTOBRAKE 3	2720	50/-30	85	-130/450	50/-60	75/-80	100	175	675

Poor Reported Braking Action

MAX MANUAL	2780	65/-40	100	-155/600	195/-135	75/-80	80	810	2840
AUTOBRAKE MAX	2790	65/-40	100	-160/600	195/-135	75/-80	80	815	2850
AUTOBRAKE 3	3000	65/-40	105	-165/620	170/-120	85/-85	100	665	2715

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAPS DRIVE (5 < Flaps < 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-5	25	-40/135	15/-10	20/-20	35	25	60
AUTOBRAKE MAX	1430	25/-5	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2420	50/-30	75	-115/395	25/-50	70/-70	100	60	60

Good Reported Braking Action

MAX MANUAL	1430	25/-10	40	-65/230	35/-30	35/-35	50	110	260
AUTOBRAKE MAX	1520	25/-10	40	-70/240	30/-20	40/-40	65	110	270
AUTOBRAKE 2	2420	50/-30	75	-115/395	25/-50	70/-70	100	60	60

Medium Reported Braking Action

MAX MANUAL	1945	40/-25	60	-105/375	85/-70	50/-50	70	305	840
AUTOBRAKE MAX	1965	40/-20	60	-105/380	85/-65	50/-55	70	300	830
AUTOBRAKE 3	2280	45/-20	65	-115/415	40/-40	65/-65	105	135	610

Poor Reported Braking Action

MAX MANUAL	2495	60/-35	90	-150/580	190/-130	65/-70	80	675	2245
AUTOBRAKE MAX	2515	60/-35	90	-150/580	195/-135	65/-70	80	680	2260
AUTOBRAKE 3	2605	60/-30	90	-155/590	170/-110	70/-75	100	625	2220

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≥ 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-15	20	-40/130	10/-10	20/-20	35	25	50
AUTOBRAKE MAX	1320	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2200	45/-45	65	-110/380	25/-45	60/-60	95	50	50

Good Reported Braking Action

MAX MANUAL	1340	25/-20	35	-65/225	35/-30	30/-35	50	95	220
AUTOBRAKE MAX	1420	25/-25	40	-65/230	30/-20	35/-35	65	95	230
AUTOBRAKE 2	2200	45/-45	65	-110/380	25/-45	60/-60	95	50	50

Medium Reported Braking Action

MAX MANUAL	1805	40/-35	55	-100/365	80/-65	45/-50	65	260	700
AUTOBRAKE MAX	1815	40/-35	55	-100/365	80/-60	45/-50	70	255	690
AUTOBRAKE 3	2080	40/-40	60	-110/395	45/-40	55/-60	100	125	510

Poor Reported Braking Action

MAX MANUAL	2305	55/-50	80	-145/560	180/-120	60/-65	75	580	1860
AUTOBRAKE MAX	2310	55/-50	80	-145/560	180/-125	60/-65	75	580	1865
AUTOBRAKE 3	2390	55/-50	80	-150/570	160/-105	65/-70	95	535	1835

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAPS PRIMARY FAIL (Flaps 20)****VREF20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-15	25	-40/145	15/-15	25/-25	45	30	60
AUTOBRAKE MAX	1320	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2245	45/-45	65	-110/385	5/-25	65/-65	115	10	10

Good Reported Braking Action

MAX MANUAL	1475	25/-25	40	-70/240	35/-35	35/-35	60	110	265
AUTOBRAKE MAX	1485	30/-25	40	-70/240	35/-30	35/-35	65	110	265
AUTOBRAKE 2	2245	45/-45	65	-110/385	5/-25	65/-65	115	10	10

Medium Reported Braking Action

MAX MANUAL	1965	40/-40	60	-105/385	90/-70	50/-50	75	305	835
AUTOBRAKE MAX	1955	40/-40	60	-105/380	95/-75	50/-50	75	305	830
AUTOBRAKE 3	2120	40/-35	60	-110/405	55/-35	60/-60	110	175	710

Poor Reported Braking Action

MAX MANUAL	2480	60/-55	85	-155/585	195/-130	65/-70	85	660	2200
AUTOBRAKE MAX	2490	60/-55	85	-155/585	200/-140	65/-70	85	660	2205
AUTOBRAKE 3	2515	60/-50	85	-155/590	190/-120	65/-70	100	645	2195

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLIGHT CONTROL MODE (Flaps 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1105	25/-15	25	-45/145	15/-15	25/-25	45	30	70
AUTOBRAKE MAX	1320	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2260	45/-45	65	-115/385	0/-15	65/-65	125	0	0

Good Reported Braking Action

MAX MANUAL	1520	30/-25	40	-70/245	40/-35	35/-35	65	125	300
AUTOBRAKE MAX	1510	30/-25	40	-70/245	35/-30	40/-40	70	120	290
AUTOBRAKE 2	2260	45/-45	65	-115/385	0/-15	65/-65	125	0	0

Medium Reported Braking Action

MAX MANUAL	2030	45/-40	65	-110/390	95/-75	50/-55	80	340	945
AUTOBRAKE MAX	2020	45/-40	65	-110/390	100/-80	55/-55	85	335	940
AUTOBRAKE 3	2140	45/-35	65	-115/405	70/-35	60/-60	110	245	855

Poor Reported Braking Action

MAX MANUAL	2570	60/-55	90	-155/600	210/-140	65/-70	95	725	2515
AUTOBRAKE MAX	2580	65/-55	90	-155/600	215/-145	70/-70	95	730	2525
AUTOBRAKE 3	2585	65/-55	90	-160/600	215/-130	70/-75	105	725	2520

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLIGHT CONTROLS (Flaps 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1210	20/-5	30	-45/160	20/-20	30/-30	60	50	115
AUTOBRAKE MAX	1430	25/-5	35	-60/195	0/0	35/-35	70	0	15
AUTOBRAKE 2	2470	45/-20	75	-120/405	5/-25	75/-75	125	10	10

Good Reported Braking Action

MAX MANUAL	1685	30/-10	50	-75/260	55/-45	45/-45	80	180	450
AUTOBRAKE MAX	1685	30/-10	50	-75/260	50/-45	45/-45	80	165	430
AUTOBRAKE 2	2470	45/-20	75	-120/405	5/-25	75/-75	125	10	10

Medium Reported Braking Action

MAX MANUAL	2230	50/-25	75	-115/410	115/-90	60/-60	90	440	1280
AUTOBRAKE MAX	2230	50/-25	75	-115/410	120/-95	60/-60	95	440	1280
AUTOBRAKE 3	2340	45/-15	70	-120/425	80/-40	65/-65	115	355	1205

Poor Reported Braking Action

MAX MANUAL	2785	70/-40	105	-165/620	230/-160	75/-80	100	875	3125
AUTOBRAKE MAX	2795	70/-40	105	-165/620	235/-160	75/-80	100	875	3140
AUTOBRAKE 3	2800	70/-35	105	-165/620	235/-140	75/-80	110	870	3130

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS C (Flaps 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-15	25	-40/145	15/-15	25/-25	45	30	60
AUTOBRAKE MAX	1320	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2245	45/-45	65	-110/385	5/-25	65/-65	115	10	10

Good Reported Braking Action

MAX MANUAL	1475	25/-25	40	-70/240	35/-35	35/-35	60	110	265
AUTOBRAKE MAX	1485	30/-25	40	-70/240	35/-30	35/-35	65	110	265
AUTOBRAKE 2	2245	45/-45	65	-110/385	5/-25	65/-65	115	10	10

Medium Reported Braking Action

MAX MANUAL	1965	40/-40	60	-105/385	90/-70	50/-50	75	305	835
AUTOBRAKE MAX	1955	40/-40	60	-105/380	95/-75	50/-50	75	305	830
AUTOBRAKE 3	2120	40/-35	60	-110/405	55/-35	60/-60	110	175	710

Poor Reported Braking Action

MAX MANUAL	2480	60/-55	85	-155/585	195/-130	65/-70	85	660	2200
AUTOBRAKE MAX	2490	60/-55	85	-155/585	200/-140	65/-70	85	660	2205
AUTOBRAKE 3	2515	60/-50	85	-155/590	190/-120	65/-70	100	645	2195

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L (Flaps 25)****VREF25**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-10	20	-40/140	15/-15	20/-20	40	0	30
AUTOBRAKE MAX	1260	20/-15	30	-55/180	0/0	30/-30	65	0	0
AUTOBRAKE 2	2135	40/-30	60	-110/375	0/-10	60/-60	120	0	0

Good Reported Braking Action

MAX MANUAL	1435	25/-20	40	-70/250	45/-40	35/-35	65	0	135
AUTOBRAKE MAX	1495	25/-20	40	-75/255	40/-30	40/-40	70	0	135
AUTOBRAKE 2	2135	40/-30	60	-110/375	0/-10	60/-60	120	0	0

Medium Reported Braking Action

MAX MANUAL	2065	40/-30	65	-120/435	125/-95	55/-60	85	0	455
AUTOBRAKE MAX	2070	40/-30	65	-120/435	130/-100	55/-60	85	0	455
AUTOBRAKE 3	2145	45/-30	65	-120/445	115/-75	60/-60	100	0	455

Poor Reported Braking Action

MAX MANUAL	2875	60/-50	100	-195/765	380/-215	80/-85	100	0	1310
AUTOBRAKE MAX	2885	60/-50	100	-195/765	385/-220	80/-85	100	0	1315
AUTOBRAKE 3	2910	60/-50	100	-195/765	375/-220	85/-85	100	0	1325

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-5	20	-40/135	15/-15	20/-20	40	0	25
AUTOBRAKE MAX	1180	20/-5	25	-50/175	0/0	30/-30	65	0	0
AUTOBRAKE 2	1970	40/-10	55	-105/355	0/-5	55/-55	120	0	0

Good Reported Braking Action

MAX MANUAL	1365	25/-10	35	-70/245	45/-35	35/-35	65	0	120
AUTOBRAKE MAX	1410	25/-10	35	-70/250	35/-30	35/-35	70	0	115
AUTOBRAKE 2	1970	40/-10	55	-105/355	0/-5	55/-55	120	0	0

Medium Reported Braking Action

MAX MANUAL	1965	40/-20	60	-115/430	125/-95	55/-55	85	0	400
AUTOBRAKE MAX	1965	40/-20	60	-115/430	130/-95	55/-55	85	0	405
AUTOBRAKE 3	2020	40/-15	60	-120/435	120/-75	55/-55	95	0	415

Poor Reported Braking Action

MAX MANUAL	2745	60/-35	95	-190/750	375/-210	75/-80	100	0	1180
AUTOBRAKE MAX	2755	60/-35	95	-190/750	380/-215	80/-80	100	0	1185
AUTOBRAKE 3	2775	60/-35	95	-195/755	370/-210	80/-80	105	0	1190

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L+C (Flaps 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1245	30/-5	30	-50/165	20/-20	30/-30	55	0	50
AUTOBRAKE MAX	1430	25/-5	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2480	45/-10	70	-120/405	0/0	75/-75	140	0	0

Good Reported Braking Action

MAX MANUAL	1805	30/-10	50	-85/285	60/-50	45/-50	80	0	215
AUTOBRAKE MAX	1790	30/-10	50	-85/285	60/-45	50/-50	85	0	205
AUTOBRAKE 2	2480	45/-10	70	-120/405	0/0	75/-75	140	0	0

Medium Reported Braking Action

MAX MANUAL	2590	50/-25	85	-140/495	170/-125	75/-75	105	0	710
AUTOBRAKE MAX	2585	50/-25	85	-140/495	175/-135	75/-75	110	0	705
AUTOBRAKE 3	2605	50/-20	85	-140/495	170/-115	75/-75	110	0	715

Poor Reported Braking Action

MAX MANUAL	3580	75/-45	130	-225/845	480/-275	105/-105	125	0	2010
AUTOBRAKE MAX	3590	75/-45	130	-225/850	490/-285	105/-110	125	0	2015
AUTOBRAKE 3	3590	75/-45	135	-225/850	490/-275	105/-110	130	0	2020

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L+R (Flaps 20)

VREF30 + 20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1360	20/-5	35	-60/195	35/-30	35/-35	65	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2180	35/-10	65	-110/375	120/-95	65/-65	100	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3575	60/-20	115	-210/750	450/-280	110/-110	140	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	6120	80/15	215	-445/1775	2080/-875	200/-205	180	0	0
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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R (Flaps 25)****VREF25**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1090	20/-10	25	-45/165	20/-20	25/-25	50	0	45
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1580	30/-20	45	-80/290	60/-50	40/-40	70	0	190
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2240	45/-35	70	-135/500	165/-115	60/-65	85	0	590
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3070	65/-50	110	-220/880	535/-255	85/-90	100	0	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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1035	15/-5	25	-45/160	20/-15	25/-25	45	0	40
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1480	25/-10	40	-80/280	55/-45	40/-40	65	0	160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2090	40/-20	65	-130/485	155/-110	60/-60	85	0	495
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2860	60/-35	100	-210/855	505/-240	80/-85	95	0	1415
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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R+C (Flaps 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1550	25/-5	40	-65/225	40/-35	40/-40	75	0	120
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2235	40/-15	70	-110/385	110/-90	60/-60	100	0	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3130	65/-35	110	-180/655	290/-195	90/-90	120	0	1290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	4220	90/-55	165	-290/1150	1095/-405	120/-130	135	0	3675
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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH DOWN AUTHORITY (Flaps 25)

VREF25

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1070	25/-10	20	-40/145	15/-10	20/-20	45	15	35
AUTOBRAKE MAX	1260	20/-15	30	-55/180	0/0	30/-30	65	0	0
AUTOBRAKE 2	2120	45/-30	60	-110/370	10/-25	60/-60	105	15	15

Good Reported Braking Action

MAX MANUAL	1425	25/-15	35	-65/235	35/-30	35/-35	55	75	175
AUTOBRAKE MAX	1435	25/-15	35	-65/235	35/-30	35/-35	65	75	180
AUTOBRAKE 2	2130	45/-30	60	-110/370	10/-25	60/-60	105	15	15

Medium Reported Braking Action

MAX MANUAL	1860	35/-30	55	-100/370	80/-60	45/-45	70	220	575
AUTOBRAKE MAX	1860	35/-25	55	-100/370	85/-65	45/-50	75	220	575
AUTOBRAKE 3	2015	40/-25	55	-110/390	55/-30	55/-55	110	110	430

Poor Reported Braking Action

MAX MANUAL	2330	50/-40	75	-145/560	170/-115	60/-60	75	495	1555
AUTOBRAKE MAX	2340	50/-40	75	-145/565	180/-120	60/-65	75	500	1560
AUTOBRAKE 3	2365	50/-35	75	-145/565	170/-105	60/-65	95	470	1535

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PITCH DOWN AUTHORITY (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-5	20	-40/140	10/-10	20/-20	45	15	30
AUTOBRAKE MAX	1180	20/0	25	-50/175	5/0	30/-30	65	0	0
AUTOBRAKE 2	1970	40/-15	55	-105/355	0/-15	55/-55	110	0	0

Good Reported Braking Action

MAX MANUAL	1355	20/-10	35	-65/230	30/-30	30/-30	55	65	150
AUTOBRAKE MAX	1365	25/-5	35	-65/230	35/-30	30/-30	65	65	155
AUTOBRAKE 2	1975	40/-15	55	-105/355	5/-15	55/-55	110	5	5

Medium Reported Braking Action

MAX MANUAL	1765	35/-20	50	-100/360	75/-60	45/-45	70	195	505
AUTOBRAKE MAX	1765	35/-15	50	-100/360	80/-65	45/-45	70	195	505
AUTOBRAKE 3	1870	35/-10	50	-105/375	60/-30	50/-50	105	110	400

Poor Reported Braking Action

MAX MANUAL	2215	50/-30	70	-140/555	170/-115	55/-60	75	450	1375
AUTOBRAKE MAX	2225	50/-30	70	-145/555	175/-120	55/-60	75	450	1380
AUTOBRAKE 3	2235	50/-25	70	-145/555	170/-105	60/-60	90	440	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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1145	35/-10	25	-45/145	15/-15	25/-25	40	35	75
AUTOBRAKE MAX	1710	25/-5	45	-65/215	0/0	45/-45	75	0	0
AUTOBRAKE 2	2745	55/-40	90	-125/420	60/-65	80/-80	85	240	265

Good Reported Braking Action

MAX MANUAL	1575	25/-15	45	-70/240	35/-30	40/-40	50	120	280
AUTOBRAKE MAX	1790	30/-10	50	-75/260	20/-15	45/-50	75	80	245
AUTOBRAKE 2	2745	55/-40	90	-125/420	60/-65	80/-80	85	240	265

Medium Reported Braking Action

MAX MANUAL	2135	40/-25	70	-105/385	85/-70	55/-60	60	325	865
AUTOBRAKE MAX	2205	45/-25	70	-110/395	80/-65	60/-60	75	325	870
AUTOBRAKE 3	2650	50/-35	85	-125/445	70/-65	75/-75	85	190	565

Poor Reported Braking Action

MAX MANUAL	2720	60/-40	95	-155/595	190/-130	75/-75	75	690	2220
AUTOBRAKE MAX	2745	60/-40	100	-155/595	190/-130	75/-80	75	685	2225
AUTOBRAKE 3	2935	60/-45	100	-165/615	180/-130	80/-85	85	585	2085

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY (Flaps ≥ 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-5	20	-40/130	10/-10	20/-20	35	25	50
AUTOBRAKE MAX	1430	25/-5	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2315	50/-30	75	-115/385	45/-50	65/-65	85	130	130

Good Reported Braking Action

MAX MANUAL	1375	25/-10	35	-65/225	30/-30	35/-35	45	95	220
AUTOBRAKE MAX	1515	25/-10	40	-70/240	20/-15	40/-40	70	80	215
AUTOBRAKE 2	2315	50/-30	75	-115/385	45/-50	65/-65	85	130	130

Medium Reported Braking Action

MAX MANUAL	1855	40/-20	55	-100/365	75/-60	50/-50	60	260	680
AUTOBRAKE MAX	1895	40/-20	60	-100/370	70/-55	50/-50	70	255	670
AUTOBRAKE 3	2225	40/-25	65	-115/410	55/-50	60/-65	90	125	440

Poor Reported Braking Action

MAX MANUAL	2365	55/-35	80	-145/560	175/-120	65/-65	70	565	1775
AUTOBRAKE MAX	2375	55/-35	80	-145/565	175/-120	65/-65	75	565	1775
AUTOBRAKE 3	2505	55/-35	85	-150/575	160/-110	70/-70	85	470	1690

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PRI FLIGHT COMPUTERS (Flaps 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1105	25/-15	25	-45/145	15/-15	25/-25	45	30	70
AUTOBRAKE MAX	1320	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2260	45/-45	65	-115/385	0/-15	65/-65	125	0	0

Good Reported Braking Action

MAX MANUAL	1520	30/-25	40	-70/245	40/-35	35/-35	65	125	300
AUTOBRAKE MAX	1510	30/-25	40	-70/245	35/-30	40/-40	70	120	290
AUTOBRAKE 2	2260	45/-45	65	-115/385	0/-15	65/-65	125	0	0

Medium Reported Braking Action

MAX MANUAL	2030	45/-40	65	-110/390	95/-75	50/-55	80	340	945
AUTOBRAKE MAX	2020	45/-40	65	-110/390	100/-80	55/-55	85	335	940
AUTOBRAKE 3	2140	45/-35	65	-115/405	70/-35	60/-60	110	245	855

Poor Reported Braking Action

MAX MANUAL	2570	60/-55	90	-155/600	210/-140	65/-70	95	725	2515
AUTOBRAKE MAX	2580	65/-55	90	-155/600	215/-145	70/-70	95	730	2525
AUTOBRAKE 3	2585	65/-55	90	-160/600	215/-130	70/-75	105	725	2520

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SLATS DRIVE (Flaps 20)****VREF30 + 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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1105	30/-5	25	-40/145	15/-15	25/-25	40	30	70
AUTOBRAKE MAX	1565	25/-5	40	-60/205	5/0	40/-40	75	0	0
AUTOBRAKE 2	2550	50/-35	80	-120/405	55/-60	75/-75	85	170	175

Good Reported Braking Action

MAX MANUAL	1545	25/-15	45	-70/240	40/-35	40/-40	55	120	285
AUTOBRAKE MAX	1670	30/-10	45	-75/250	25/-20	45/-45	75	115	290
AUTOBRAKE 2	2550	50/-35	80	-120/405	55/-60	75/-75	85	170	175

Medium Reported Braking Action

MAX MANUAL	2065	40/-25	65	-105/385	90/-70	55/-55	65	315	840
AUTOBRAKE MAX	2095	40/-25	65	-105/390	80/-65	55/-60	75	310	825
AUTOBRAKE 3	2450	45/-30	75	-120/430	65/-55	70/-70	90	160	565

Poor Reported Braking Action

MAX MANUAL	2605	60/-40	90	-155/585	190/-130	70/-75	75	655	2095
AUTOBRAKE MAX	2615	60/-40	90	-155/585	190/-130	70/-75	80	655	2095
AUTOBRAKE 3	2750	60/-40	95	-160/600	175/-125	75/-80	85	555	2000

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.

ADVISORY INFORMATION

**Non-Normal Configuration Landing Distance
SPOILERS (Flaps 25)
VREF25**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-10	20	-40/130	10/-10	20/-20	40	25	50
AUTOBRAKE MAX	1260	20/-15	30	-55/180	0/0	30/-30	65	0	0
AUTOBRAKE 2	2100	45/-35	60	-110/370	15/-40	60/-60	95	30	30

Good Reported Braking Action

MAX MANUAL	1325	25/-20	35	-65/225	35/-30	30/-30	55	95	220
AUTOBRAKE MAX	1385	25/-20	35	-65/230	30/-25	35/-35	65	95	225
AUTOBRAKE 2	2100	45/-35	60	-110/370	15/-40	60/-60	95	30	30

Medium Reported Braking Action

MAX MANUAL	1770	35/-30	55	-100/360	80/-65	45/-45	65	255	690
AUTOBRAKE MAX	1780	40/-30	55	-100/365	80/-65	45/-45	70	250	685
AUTOBRAKE 3	1985	40/-30	55	-110/390	45/-35	55/-55	100	135	550

Poor Reported Braking Action

MAX MANUAL	2250	55/-40	75	-145/560	180/-120	60/-60	75	560	1790
AUTOBRAKE MAX	2255	55/-40	75	-145/560	180/-125	60/-65	75	560	1795
AUTOBRAKE 3	2305	55/-40	75	-145/565	165/-105	60/-65	95	540	1785

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SPOILERS (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	20/-5	20	-35/130	10/-10	20/-20	40	20	45
AUTOBRAKE MAX	1180	20/-5	25	-50/175	0/0	30/-30	65	0	0
AUTOBRAKE 2	1955	40/-20	55	-105/355	5/-30	55/-55	100	10	10

Good Reported Braking Action

MAX MANUAL	1255	20/-10	30	-60/220	35/-30	30/-30	55	80	190
AUTOBRAKE MAX	1315	25/-10	35	-65/225	25/-25	30/-30	60	80	195
AUTOBRAKE 2	1955	40/-20	55	-105/355	5/-30	55/-55	100	10	10

Medium Reported Braking Action

MAX MANUAL	1680	35/-20	50	-95/355	80/-60	45/-45	65	230	600
AUTOBRAKE MAX	1690	35/-20	50	-95/355	80/-60	45/-45	70	225	600
AUTOBRAKE 3	1850	35/-15	50	-105/375	50/-35	50/-50	95	135	510

Poor Reported Braking Action

MAX MANUAL	2140	50/-30	70	-140/550	175/-115	55/-60	75	505	1575
AUTOBRAKE MAX	2150	50/-30	70	-140/550	180/-120	55/-60	75	505	1580
AUTOBRAKE 3	2180	50/-25	70	-145/555	170/-105	60/-60	90	505	1585

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

STABILIZER (Flaps 20)

VREF30 + 20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1030	30/-5	25	-40/135	15/-10	25/-25	35	25	60
AUTOBRAKE MAX	1430	25/-5	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2360	50/-30	75	-115/390	40/-50	65/-65	90	100	100

Good Reported Braking Action

MAX MANUAL	1435	25/-10	40	-65/230	35/-30	35/-35	50	105	255
AUTOBRAKE MAX	1530	25/-10	40	-70/240	30/-20	40/-40	70	110	260
AUTOBRAKE 2	2360	50/-30	75	-115/390	40/-50	65/-65	90	100	100

Medium Reported Braking Action

MAX MANUAL	1925	40/-25	60	-105/375	85/-65	50/-50	65	285	765
AUTOBRAKE MAX	1940	40/-20	60	-105/375	80/-60	50/-55	75	280	755
AUTOBRAKE 3	2250	45/-25	65	-115/410	55/-45	65/-65	95	135	535

Poor Reported Braking Action

MAX MANUAL	2440	55/-35	85	-150/575	185/-125	65/-70	75	610	1965
AUTOBRAKE MAX	2445	55/-35	85	-150/575	185/-125	65/-70	75	615	1965
AUTOBRAKE 3	2555	55/-35	85	-155/585	165/-110	70/-75	95	540	1905

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.

ADVISORY INFORMATION**Approach or Landing Climb Limited Weight****Valid for approach with flaps 20 and landing with flaps 25 or 30**

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
		-2000	0	2000	4000	6000	8000
54	129	216.7	199.0				
52	126	221.7	206.6				
50	122	226.8	214.2	196.2			
48	118	231.9	219.9	202.5			
46	115	237.1	225.9	209.2	189.3		
44	111	242.4	232.0	214.8	195.1		
42	108	248.8	238.1	220.5	200.9	181.7	
40	104	253.9	244.4	226.5	206.1	187.1	
38	100	258.2	252.0	232.5	211.4	192.6	174.1
36	97	261.2	256.2	238.5	216.8	197.3	179.2
34	93	261.4	260.2	245.1	222.4	202.0	184.2
32	90	261.6	262.7	250.5	228.0	207.1	188.5
30	86	261.8	262.9	255.1	233.6	212.3	192.9
28	82	262.0	263.1	257.8	237.9	217.5	197.4
26	79	262.2	263.3	258.0	242.0	223.1	202.2
24	75	262.4	263.4	258.1	246.9	227.4	207.2
22	72	262.6	263.6	258.3	252.0	231.6	212.4
20	68	262.8	263.8	258.4	252.2	235.9	216.4
18	64	263.1	263.9	258.6	252.4	239.9	220.3
16	61	263.3	264.1	258.7	252.5	240.0	224.4
14	57	263.5	264.3	258.9	252.7	240.1	228.0
12	54	263.7	264.5	259.0	252.8	240.2	228.2
10	50	263.9	264.6	259.2	252.9	240.3	228.3
-40	-40	265.1	265.8	260.3	254.0	241.3	228.9

Based on engine bleed for 2 packs on and engine anti-ice on or off and wing anti-ice off.**With packs off, increase allowable weight by 1700 kg.****With engine and wing anti-ice on, decrease allowable weight by 950 kg.****When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 18600 kg.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																							
		80				100				120				140				160				180			
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																							
		0	2	4	0	2	4	0	2	4	0	2	4	0	2	4	0	2	4	0	2	4			
300	0	18.3	19.2	20.2	27.3	28.8	30.5	37.8	40.0	42.4	49.5	52.5	55.8	62.2	66.0	70.2	75.2	79.8	84.8						
	10	18.8	19.7	20.7	28.2	29.7	31.4	39.0	41.3	43.8	51.1	54.2	57.6	64.2	68.2	72.4	77.5	82.3	87.4						
	15	19.2	20.1	21.1	28.7	30.3	32.0	39.7	42.1	44.6	52.0	55.2	58.6	65.3	69.4	73.7	78.8	83.7	88.8						
	20	19.5	20.4	21.5	29.2	30.8	32.5	40.4	42.8	45.3	52.9	56.1	59.6	66.4	70.5	74.9	80.1	85.0	90.2						
	30	19.9	20.9	22.0	29.9	31.6	33.3	41.5	43.9	46.6	54.4	57.7	61.3	68.3	72.5	77.0	82.3	87.3	92.6						
	40	20.1	21.1	22.2	30.3	32.0	33.8	42.2	44.7	47.4	55.4	58.9	62.5	69.7	74.0	78.7	84.1	89.2	94.6						
280	0	17.3	18.2	19.1	25.8	27.2	28.8	35.7	37.7	40.0	46.7	49.5	52.5	58.6	62.2	66.1	70.9	75.3	80.0						
	10	17.8	18.7	19.6	26.6	28.1	29.6	36.8	38.9	41.2	48.2	51.1	54.2	60.5	64.2	68.2	73.2	77.7	82.5						
	15	18.1	19.0	20.0	27.1	28.6	30.2	37.5	39.6	42.0	49.1	52.0	55.2	61.6	65.3	69.4	74.4	79.0	83.9						
	20	18.4	19.3	20.3	27.6	29.1	30.7	38.1	40.3	42.7	49.9	52.9	56.1	62.6	66.4	70.6	75.6	80.3	85.2						
	30	18.9	19.8	20.8	28.3	29.8	31.5	39.1	41.4	43.9	51.3	54.4	57.7	64.4	68.3	72.6	77.8	82.5	87.6						
	40	19.0	20.0	21.0	28.6	30.2	31.9	39.8	42.1	44.6	52.2	55.4	58.9	65.7	69.8	74.1	79.5	84.3	89.5						
260	0	16.4	17.2	18.0	24.4	25.7	27.1	33.5	35.5	37.5	43.8	46.4	49.3	54.9	58.3	62.0	66.5	70.7	75.1						
	10	16.8	17.6	18.5	25.1	26.4	27.9	34.6	36.6	38.7	45.2	47.9	50.8	56.7	60.2	63.9	68.7	72.9	77.5						
	15	17.1	18.0	18.9	25.6	26.9	28.4	35.2	37.3	39.4	46.0	48.8	51.7	57.7	61.3	65.1	69.9	74.2	78.8						
	20	17.4	18.3	19.2	26.0	27.4	28.9	35.8	37.9	40.1	46.8	49.6	52.6	58.7	62.3	66.2	71.0	75.4	80.1						
	30	17.8	18.7	19.6	26.6	28.0	29.6	36.8	38.9	41.2	48.1	51.0	54.1	60.3	64.0	68.0	73.0	77.5	82.3						
	40	18.0	18.8	19.8	26.9	28.4	30.0	37.3	39.5	41.9	49.0	51.9	55.2	61.6	65.4	69.5	74.6	79.2	84.1						
240	0	15.5	16.2	17.0	22.9	24.1	25.4	31.4	33.2	35.1	40.9	43.3	45.9	51.2	54.3	57.7	62.0	65.9	70.0						
	10	15.9	16.6	17.4	23.5	24.8	26.1	32.4	34.2	36.2	42.2	44.7	47.4	52.8	56.1	59.6	64.0	68.0	72.3						
	15	16.2	16.9	17.7	24.0	25.3	26.6	33.0	34.8	36.9	43.0	45.5	48.3	53.8	57.1	60.6	65.1	69.2	73.5						
	20	16.4	17.2	18.0	24.4	25.7	27.0	33.5	35.4	37.5	43.7	46.3	49.1	54.7	58.0	61.6	66.2	70.3	74.7						
	30	16.8	17.6	18.4	25.0	26.3	27.7	34.4	36.3	38.5	44.9	47.5	50.4	56.2	59.7	63.4	68.1	72.3	76.8						
	40	16.9	17.7	18.6	25.3	26.6	28.1	34.9	36.9	39.1	45.7	48.4	51.4	57.3	60.9	64.7	69.6	73.9	78.5						
220	0	14.5	15.2	15.9	21.4	22.5	23.7	29.2	30.9	32.6	37.9	40.2	42.6	47.4	50.3	53.4	57.4	60.9	64.8						
	10	14.9	15.6	16.4	22.0	23.2	24.4	30.1	31.8	33.6	39.1	41.4	43.9	48.9	51.9	55.1	59.2	62.9	66.8						
	15	15.2	15.9	16.7	22.4	23.6	24.8	30.7	32.4	34.2	39.8	42.2	44.7	49.8	52.8	56.1	60.3	64.0	68.0						
	20	15.5	16.2	16.9	22.8	24.0	25.2	31.2	32.9	34.8	40.5	42.9	45.5	50.6	53.7	57.0	61.3	65.1	69.1						
	30	15.8	16.5	17.3	23.3	24.6	25.9	32.0	33.8	35.7	41.6	44.1	46.7	52.1	55.2	58.6	63.0	66.9	71.1						
	40	15.9	16.6	17.4	23.6	24.8	26.2	32.5	34.3	36.3	42.3	44.8	47.6	53.0	56.3	59.8	64.3	68.3	72.6						
200	0	13.6	14.3	14.9	19.9	20.9	22.0	27.1	28.5	30.1	35.0	37.0	39.2	43.5	46.1	48.9	52.6	55.8	59.3						
	10	14.0	14.6	15.3	20.5	21.5	22.6	27.9	29.4	31.1	36.0	38.1	40.4	44.9	47.6	50.5	54.3	57.6	61.2						
	15	14.3	14.9	15.6	20.9	21.9	23.0	28.4	29.9	31.7	36.7	38.8	41.1	45.7	48.5	51.4	55.3	58.7	62.3						
	20	14.5	15.1	15.8	21.2	22.3	23.4	28.9	30.4	32.2	37.3	39.5	41.8	46.5	49.3	52.3	56.2	59.7	63.4						
	30	14.8	15.5	16.2	21.7	22.8	24.0	29.6	31.2	33.0	38.3	40.6	43.0	47.8	50.7	53.8	57.8	61.3	65.2						
	40	14.9	15.6	16.3	21.9	23.1	24.3	30.0	31.7	33.5	38.9	41.2	43.7	48.7	51.6	54.8	58.9	62.6	66.5						
180	0	12.8	13.3	13.9	18.4	19.4	20.3	24.9	26.2	27.6	31.9	33.8	35.7	39.6	41.9	44.4	47.7	50.6	53.7						
	10	13.1	13.7	14.3	19.0	19.9	20.9	25.6	27.0	28.5	32.9	34.8	36.8	40.8	43.2	45.9	49.2	52.2	55.4						
	15	13.3	13.9	14.6	19.3	20.3	21.3	26.1	27.5	29.0	33.5	35.4	37.5	41.6	44.0	46.7	50.1	53.2	56.4						
	20	13.5	14.1	14.8	19.6	20.6	21.7	26.5	27.9	29.5	34.1	36.0	38.1	42.3	44.8	47.5	51.0	54.1	57.4						
	30	13.8	14.4	15.1	20.1	21.1	22.2	27.2	28.6	30.2	35.0	37.0	39.2	43.4	46.0	48.8	52.4	55.6	59.0						
	40	13.9	14.5	15.2	20.3	21.3	22.4	27.5	29.0	30.7	35.5	37.6	39.8	44.2	46.8	49.7	53.4	56.7	60.2						

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****Event Adjusted Brake Energy (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	100
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100
	MAX MAN	5.5	14.9	24.1	33.2	42.3	51.4	60.6	69.9	79.3	88.9
	MAX AUTO	5.5	14.0	22.4	31.0	39.6	48.5	57.6	67.0	76.7	86.9
	AUTOBRAKE 4	5.5	13.5	21.4	29.3	37.3	45.5	54.1	63.1	72.6	82.8
	AUTOBRAKE 3	5.5	12.9	20.3	27.6	35.0	42.5	50.5	58.8	67.8	77.4
	AUTOBRAKE 2	5.4	12.4	19.2	25.9	32.7	39.7	46.9	54.6	62.8	71.7
	AUTOBRAKE 1	5.4	11.9	18.2	24.4	30.6	37.0	43.7	50.8	58.5	66.8

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
EVENT		10	20	30	40	50	60	70	80	90	100
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100
	MAX MAN	4.8	13.6	22.1	30.5	38.8	47.0	55.2	63.4	71.7	80.0
	MAX AUTO	3.0	10.1	17.3	24.5	31.9	39.6	47.5	55.9	64.7	74.0
	AUTOBRAKE 4	2.5	7.9	13.5	19.4	25.6	32.1	39.1	46.6	54.7	63.4
	AUTOBRAKE 3	1.6	5.5	9.7	14.2	19.1	24.5	30.3	36.6	43.4	50.7
	AUTOBRAKE 2	0.9	3.6	6.6	10.0	13.7	17.8	22.4	27.4	32.8	38.7
	AUTOBRAKE 1	0.6	2.7	5.0	7.5	10.3	13.4	16.8	20.7	25.1	30.1

Cooling Time (Minutes)

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
		16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE		1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE
GROUND	REQUIRED		11	18	26	42	55	66	73		
BTMS	UP TO 2.4		2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE

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 for each taxi mile.

For one brake deactivated, increase brake energy by 10 percent.

For two brakes deactivated, increase brake energy by 20 percent.

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 8 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 EICAS may be used 12 to 15 minutes after airplane has come to a complete stop, or inflight with gear retracted, to determine recommended cooling schedule. (Inflight gear extended, the BTMS indications may vary between individual brakes, due to airstream effects, gear tilt, and position of the gear temperature probes.)

Intentionally
Blank

Performance Inflight

Engine Inoperative

Chapter PI

Section 13

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	98.7	98.2	97.7	97.3	97.2	96.8	96.9	96.5	96.1
15	99.3	98.8	98.3	97.8	97.8	97.1	97.2	96.8	96.4
10	99.9	99.4	98.9	98.4	98.4	97.7	97.8	97.4	97.1
5	100.3	100.1	99.5	99.1	99.0	98.3	98.4	98.1	97.7
0	99.4	100.3	100.2	99.7	99.6	99.0	99.1	98.7	98.4
-5	98.5	99.4	100.4	100.6	100.4	99.6	99.8	99.4	99.0
-10	97.6	98.5	99.5	100.7	101.6	100.6	100.7	100.3	99.9
-15	96.6	97.6	98.5	99.7	101.5	101.5	101.6	101.2	100.8
-20	95.7	96.6	97.6	98.7	100.5	100.6	100.6	100.2	99.9
-25	94.8	95.6	96.6	97.7	99.5	99.6	99.6	99.3	98.9
-30	93.8	94.7	95.6	96.8	98.5	98.6	98.6	98.2	97.9
-35	92.8	93.7	94.6	95.8	97.5	97.5	97.6	97.2	96.9
-40	91.8	92.7	93.6	94.7	96.5	96.5	96.5	96.2	95.8

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT				TAT (°C)									
CIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.63	95.1	96.1	97.2	98.2	99.2	100.2	100.8	100.4	99.6	98.9	98.2	98.0
240	0.74	95.1	96.1	97.2	98.2	99.3	100.3	101.0	100.9	100.2	99.3	98.6	98.0
280	0.86	94.0	95.1	96.1	97.1	98.2	99.2	100.2	101.1	100.7	99.7	99.0	98.4
35000 FT PRESS ALT				TAT (°C)									
CIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.60	94.8	95.9	96.9	98.0	99.0	100.0	101.0	101.2	100.4	99.6	98.8	98.5
240	0.71	94.9	95.9	97.0	98.0	99.0	100.0	101.0	101.6	100.9	99.9	99.2	98.7
280	0.82	94.7	95.8	96.8	97.9	98.9	99.9	100.9	101.9	101.3	100.3	99.6	98.9
33000 FT PRESS ALT				TAT (°C)									
CIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.58	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.3	100.6	99.7	98.9	98.1
240	0.68	94.7	95.7	96.8	97.8	98.8	99.8	100.8	101.2	100.8	100.0	99.3	98.6
280	0.79	93.8	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.3	100.4	99.6	98.9
320	0.89	91.4	92.5	93.5	94.5	95.5	96.4	97.4	98.4	99.3	100.2	99.9	99.2
31000 FT PRESS ALT				TAT (°C)									
CIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
200	0.55	95.8	96.8	97.8	98.9	99.9	100.8	101.4	101.1	100.2	99.3	98.5	97.8
240	0.66	95.5	96.5	97.6	98.6	99.6	100.6	101.4	101.2	100.4	99.6	99.0	98.3
280	0.76	94.4	95.4	96.4	97.4	98.4	99.4	100.4	101.3	100.8	99.9	99.3	98.6
320	0.85	92.3	93.3	94.3	95.2	96.2	97.2	98.1	99.1	100.0	100.3	99.5	98.9
29000 FT PRESS ALT				TAT (°C)									
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	0.53	96.7	97.7	98.7	99.7	100.7	101.5	101.6	100.8	99.8	98.9	98.0	98.1
240	0.63	96.2	97.2	98.2	99.2	100.2	101.2	101.5	101.0	100.1	99.4	98.7	98.0
280	0.73	95.1	96.2	97.2	98.2	99.1	100.1	101.1	101.3	100.4	99.7	99.1	98.5
320	0.82	93.1	94.1	95.1	96.1	97.0	98.0	98.9	99.9	100.8	100.0	99.4	98.7
360	0.91	91.0	92.0	93.0	93.9	94.9	95.8	96.7	97.6	98.5	99.4	99.7	99.1
27000 FT PRESS ALT				TAT (°C)									
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	0.51	96.5	97.5	98.6	99.6	100.6	101.5	101.9	101.4	100.4	99.4	98.5	97.5
240	0.60	95.9	96.9	97.9	98.9	99.9	100.9	101.7	101.5	100.7	99.9	99.2	98.4
280	0.70	94.8	95.8	96.8	97.8	98.7	99.7	100.7	101.6	101.0	100.2	99.5	98.9
320	0.79	92.9	93.9	94.9	95.9	96.8	97.8	98.7	99.7	100.6	100.5	99.8	99.2
360	0.88	90.9	91.9	92.9	93.8	94.8	95.7	96.6	97.5	98.4	99.3	100.0	99.9

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESS ALT (1000 FT)					
	37	35	33	31	29	27
ENGINE ANTI-ICE ON	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON (packs on)	-1.0	-1.0	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE ON (packs off)	-1.7	-1.6	-1.5	-1.4	-1.3	-1.2

ENGINE INOP**Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****25000 FT to 18000 FT Pressure Altitudes**

25000 FT PRESS ALT				TAT (°C)										
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
200	0.49	97.5	98.5	99.5	100.5	101.5	102.2	101.9	100.9	99.9	98.9	97.9	97.7	
240	0.58	96.7	97.7	98.7	99.7	100.6	101.6	101.8	101.1	100.3	99.6	98.8	98.0	
280	0.67	95.3	96.3	97.2	98.2	99.2	100.1	101.1	101.3	100.6	100.0	99.3	98.7	
320	0.76	93.6	94.6	95.5	96.5	97.4	98.4	99.3	100.2	100.9	100.2	99.6	99.0	
360	0.85	91.8	92.7	93.7	94.6	95.5	96.5	97.4	98.3	99.2	100.1	99.8	99.2	
24000 FT PRESS ALT				TAT (°C)										
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
200	0.48	97.4	98.4	99.4	100.4	101.4	102.2	102.2	101.2	100.2	99.2	98.2	97.4	
240	0.57	96.4	97.4	98.4	99.4	100.4	101.4	102.0	101.5	100.6	99.9	99.1	98.2	
280	0.66	95.1	96.1	97.1	98.0	99.0	100.0	100.9	101.6	100.9	100.2	99.6	98.9	
320	0.75	93.5	94.4	95.4	96.4	97.3	98.3	99.2	100.1	101.0	100.5	99.8	99.3	
360	0.83	91.7	92.7	93.6	94.6	95.5	96.4	97.3	98.2	99.1	100.0	100.1	99.4	
22000 FT PRESS ALT				TAT (°C)										
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
200	0.46	98.1	99.1	100.1	101.0	102.0	102.4	101.7	100.7	99.7	98.7	97.8	97.7	
240	0.55	97.0	98.0	99.0	100.0	101.0	101.9	101.9	101.2	100.4	99.6	98.8	98.0	
280	0.63	95.8	96.8	97.7	98.7	99.6	100.6	101.5	101.4	100.7	100.1	99.4	98.7	
320	0.72	94.2	95.1	96.1	97.0	98.0	98.9	99.8	100.7	100.9	100.3	99.7	99.1	
360	0.80	92.5	93.5	94.4	95.3	96.3	97.2	98.1	99.0	99.9	100.5	99.9	99.3	
20000 FT PRESS ALT				TAT (°C)										
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
200	0.44	97.7	98.7	99.7	100.7	101.7	102.6	102.3	101.3	100.3	99.3	98.4	97.7	
240	0.53	96.7	97.7	98.7	99.7	100.6	101.6	102.4	101.8	101.0	100.2	99.3	98.6	
280	0.61	95.5	96.5	97.5	98.4	99.4	100.3	101.3	102.0	101.3	100.6	99.9	99.2	
320	0.69	93.9	94.8	95.8	96.7	97.7	98.6	99.5	100.4	101.3	100.8	100.0	99.2	
360	0.77	92.4	93.4	94.3	95.2	96.1	97.0	98.0	98.8	99.7	100.6	100.3	99.6	
18000 FT PRESS ALT				TAT (°C)										
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	0.42	98.3	99.2	100.2	101.2	102.1	102.6	101.6	100.5	99.5	98.6	97.8	97.4	
240	0.51	97.2	98.1	99.1	100.0	101.0	101.9	102.0	101.1	100.2	99.4	98.7	98.0	
280	0.59	95.6	96.5	97.5	98.4	99.3	100.3	101.2	101.2	100.4	99.8	99.2	98.6	
320	0.67	94.1	95.0	95.9	96.9	97.8	98.7	99.6	100.5	100.7	100.1	99.5	98.9	
360	0.75	92.7	93.6	94.5	95.4	96.3	97.2	98.1	99.0	99.9	100.3	99.8	99.2	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESS ALT (1000 FT)				
	25	24	22	20	18
ENGINE ANTI-ICE ON	-0.4	-0.4	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON (packs on)	-0.8	-0.7	-0.7	-0.5	-0.5
ENGINE & WING ANTI-ICE ON (packs off)	-1.1	-1.1	-1.0	-0.7	-0.7

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

16000 FT to 5000 FT Pressure Altitudes

16000 FT PRESS ALT				TAT (°C)										
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	0.41	97.1	98.1	99.0	100.0	100.9	101.9	101.7	100.6	99.6	98.7	97.9	97.1	
240	0.49	96.2	97.1	98.1	99.0	100.0	100.9	101.8	101.2	100.2	99.4	98.6	97.9	
280	0.57	94.7	95.7	96.6	97.6	98.5	99.4	100.3	101.2	100.5	99.8	99.1	98.3	
320	0.64	93.4	94.3	95.2	96.1	97.0	97.9	98.8	99.7	100.6	100.0	99.5	98.8	
360	0.72	92.1	93.0	93.9	94.8	95.7	96.6	97.5	98.3	99.2	100.1	99.8	99.2	
14000 FT PRESS ALT				TAT (°C)										
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
200	0.39	96.7	97.7	98.6	99.6	100.5	101.4	100.5	99.5	98.6	97.8	97.1	96.3	
240	0.47	95.9	96.8	97.8	98.7	99.6	100.5	101.1	100.2	99.4	98.5	97.8	97.0	
280	0.54	94.9	95.8	96.7	97.6	98.5	99.4	100.3	100.7	100.0	99.2	98.3	97.5	
320	0.62	93.8	94.7	95.6	96.5	97.4	98.3	99.2	100.1	100.4	99.7	99.0	98.1	
360	0.69	92.5	93.4	94.3	95.2	96.1	96.9	97.8	98.7	99.5	99.9	99.3	98.6	
12000 FT PRESS ALT				TAT (°C)										
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40	
200	0.38	96.4	97.4	98.3	99.2	100.1	100.6	99.7	98.7	97.9	97.1	96.3	95.5	
240	0.45	95.8	96.7	97.7	98.6	99.5	100.4	100.3	99.4	98.6	97.7	96.8	96.0	
280	0.52	95.0	96.0	96.9	97.8	98.7	99.5	100.4	100.0	99.2	98.5	97.5	96.7	
320	0.60	93.9	94.8	95.7	96.6	97.5	98.4	99.2	100.1	99.7	99.0	98.2	97.3	
360	0.67	92.7	93.6	94.5	95.4	96.3	97.1	98.0	98.8	99.7	99.3	98.6	97.8	
10000 FT PRESS ALT				TAT (°C)										
KIAS	M	-15	10	-5	0	5	10	15	20	25	30	35	40	
200	0.36	95.4	96.3	97.2	98.1	99.0	99.9	99.8	98.9	98.1	97.3	96.5	95.7	
240	0.43	94.8	95.7	96.6	97.5	98.4	99.3	100.1	99.5	98.7	97.9	96.9	96.1	
280	0.51	94.1	95.0	95.9	96.8	97.7	98.6	99.4	100.1	99.3	98.5	97.7	96.8	
320	0.58	93.1	94.0	94.9	95.8	96.7	97.5	98.4	99.3	99.7	99.0	98.2	97.4	
360	0.65	92.0	92.9	93.8	94.6	95.5	96.3	97.2	98.0	98.9	99.2	98.6	97.8	
5000 FT PRESS ALT				TAT (°C)										
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45	
200	0.33	92.4	93.3	94.1	95.0	95.8	96.7	97.5	97.3	96.6	95.8	94.9	94.1	
240	0.40	92.0	92.9	93.7	94.6	95.4	96.3	97.1	97.7	97.0	96.2	95.3	94.5	
280	0.46	91.6	92.4	93.3	94.2	95.0	95.8	96.7	97.5	97.5	96.7	95.9	95.0	
320	0.53	91.0	91.8	92.7	93.5	94.4	95.2	96.0	96.8	97.6	97.2	96.4	95.6	
360	0.59	90.2	91.0	91.9	92.7	93.5	94.4	95.2	96.0	96.8	97.6	96.9	96.1	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESS ALT (1000 FT)				
	16	14	12	10	5
ENGINE ANTI-ICE ON	-0.4	-0.4	-0.4	-0.4	-0.3
ENGINE & WING ANTI-ICE ON (packs on)	-0.5	-0.5	-0.5	-0.5	-0.5
ENGINE & WING ANTI-ICE ON (packs off)	-0.7	-0.7	-0.7	-0.7	-0.7

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
260	252	263	19700	18400	16600
240	232	253	22000	21000	19700
220	213	243	24200	23500	22300
200	194	232	26600	26000	25000
180	174	220	29000	28700	27900
160	155	208	31600	31500	31000

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
134	125	118	111	105	100	95	91	87	83	80
273	255	238	224	211	200	190	181	172	165	158
412	383	358	337	317	300	285	271	258	246	236
550	511	478	449	423	400	379	361	344	329	314
686	639	597	561	529	500	474	451	430	411	393
822	765	716	673	634	600	569	541	516	493	472
958	892	835	784	740	700	664	632	603	576	552
1093	1018	953	896	845	800	759	723	689	659	631
1227	1144	1071	1007	951	900	854	813	776	742	711
1362	1270	1190	1119	1056	1000	950	904	863	825	790
1496	1395	1308	1230	1161	1100	1045	995	949	908	870
1630	1521	1426	1342	1267	1200	1140	1085	1036	991	949
1765	1647	1544	1453	1372	1300	1235	1176	1123	1074	1029
1900	1773	1662	1565	1478	1400	1330	1267	1209	1157	1108
2035	1900	1781	1676	1583	1500	1425	1357	1296	1239	1188
2171	2027	1900	1788	1689	1600	1520	1448	1382	1322	1267
2308	2154	2019	1900	1795	1700	1615	1538	1468	1404	1346
2445	2282	2139	2012	1900	1800	1710	1628	1554	1486	1424

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)						TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)						
	160	180	200	220	240	260	
100	0.9	1.0	1.0	1.1	1.2	1.3	0:15
200	2.1	2.3	2.5	2.7	2.9	3.1	0:32
300	3.4	3.7	4.1	4.4	4.8	5.2	0:49
400	4.7	5.2	5.7	6.2	6.7	7.2	1:05
500	6.0	6.6	7.3	8.0	8.6	9.3	1:21
600	7.2	8.0	8.8	9.6	10.4	11.2	1:37
700	8.4	9.3	10.3	11.3	12.2	13.1	1:53
800	9.6	10.7	11.8	12.9	13.9	15.0	2:09
900	10.8	12.0	13.3	14.5	15.7	16.9	2:24
1000	12.0	13.3	14.7	16.1	17.5	18.8	2:39
1100	13.2	14.7	16.2	17.7	19.2	20.7	2:55
1200	14.4	16.0	17.6	19.3	20.9	22.5	3:10
1300	15.5	17.3	19.1	20.9	22.6	24.4	3:25
1400	16.7	18.6	20.5	22.4	24.3	26.2	3:41
1500	17.8	19.8	21.9	24.0	26.0	28.0	3:57
1600	18.9	21.1	23.3	25.5	27.6	29.8	4:13
1700	20.0	22.3	24.7	27.0	29.3	31.6	4:29
1800	21.1	23.6	26.1	28.5	30.9	33.4	4:45

APU fuel included.

Driftdown at optimum 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
260	15400	13400	10700
240	18500	16300	14400
220	21300	20100	18000
200	23900	22900	21500
180	26600	25800	24600
160	29500	28900	27900
140	32400	32200	31400

With engine anti-ice on, decrease altitude capability by 700 ft.

With engine and wing anti-ice on, decrease altitude capability by 1100 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		10	15	17	19	21	23	25	27
260	%N1	91.5	95.9	97.6					
	MACH	.557	.602	.624					
	KIAS	309	305	304					
	FF/ENG	7544	7611	7718					
240	%N1	89.2	93.5	95.2	97.1				
	MACH	.541	.582	.602	.625				
	KIAS	300	294	293	293				
	FF/ENG	6945	6927	6973	7082				
220	%N1	86.6	90.9	92.6	94.4	96.3			
	MACH	.523	.563	.581	.601	.624			
	KIAS	290	285	283	281	281			
	FF/ENG	6360	6291	6302	6339	6448			
200	%N1	83.9	88.3	89.9	91.7	93.5	95.3	98.2	
	MACH	.504	.544	.561	.578	.598	.621	.653	
	KIAS	279	275	272	270	269	268	272	
	FF/ENG	5797	5700	5677	5683	5711	5811	6096	
180	%N1	81.3	85.3	87.0	88.7	90.4	92.2	94.0	96.6
	MACH	.486	.523	.539	.556	.574	.593	.615	.646
	KIAS	269	263	262	259	257	256	255	257
	FF/ENG	5264	5145	5101	5071	5067	5086	5163	5384
160	%N1	78.6	82.1	83.8	85.5	87.2	88.9	90.6	92.4
	MACH	.468	.499	.515	.532	.549	.566	.585	.607
	KIAS	259	251	250	248	246	244	242	241
	FF/ENG	4777	4580	4553	4511	4470	4457	4468	4522
140	%N1	75.8	79.0	80.4	81.9	83.6	85.4	87.0	88.7
	MACH	.449	.477	.490	.505	.522	.539	.557	.575
	KIAS	248	240	237	235	233	232	230	228
	FF/ENG	4333	4071	4015	3973	3925	3879	3863	3881

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
289	266	245	228	213	200	191	182	174	167	160
581	534	492	457	427	400	381	364	348	333	320
873	802	739	686	641	600	572	545	521	500	480
1166	1071	987	916	855	800	762	726	694	665	639
1460	1340	1235	1145	1069	1000	952	908	867	831	798
1755	1611	1483	1375	1283	1200	1142	1089	1040	996	956
2051	1881	1732	1605	1497	1400	1333	1270	1213	1161	1114
2348	2153	1980	1836	1711	1600	1523	1451	1386	1326	1272
2645	2424	2230	2066	1925	1800	1713	1632	1558	1491	1430
2943	2697	2479	2297	2140	2000	1902	1812	1730	1655	1588

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	3.3	0:40	2.9	0:39	2.6	0:38	2.4	0:36	2.2	0:34
400	7.0	1:18	6.4	1:15	5.9	1:12	5.5	1:09	5.3	1:05
600	10.6	1:56	9.8	1:51	9.1	1:46	8.6	1:42	8.4	1:35
800	14.1	2:34	13.1	2:27	12.3	2:21	11.6	2:15	11.4	2:06
1000	17.7	3:12	16.5	3:04	15.4	2:56	14.7	2:48	14.4	2:37
1200	21.2	3:51	19.8	3:41	18.5	3:31	17.6	3:21	17.3	3:08
1400	24.7	4:30	23.0	4:18	21.6	4:06	20.6	3:55	20.2	3:40
1600	28.1	5:09	26.3	4:56	24.7	4:42	23.5	4:29	23.0	4:12

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)						
	140	160	180	200	220	240	260
5	-0.7	-0.5	-0.2	0.0	0.5	1.0	1.5
10	-1.4	-1.0	-0.5	0.0	1.1	2.2	3.4
15	-2.2	-1.5	-0.8	0.0	1.7	3.4	5.2
20	-2.9	-2.0	-1.0	0.0	2.2	4.5	7.0
25	-3.6	-2.5	-1.3	0.0	2.7	5.6	8.8
30	-4.3	-3.0	-1.6	0.0	3.2	6.7	10.5

MAX CONTINUOUS THRUST

ENGINE INOP**ADVISORY INFORMATION****Gear Down Landing Rate of Climb Available****Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	140	70				
50	180	110	-40			
48	220	150	10			
46	250	190	50	-120		
44	290	240	90	-90		
42	310	280	130	-50	-220	
40	350	320	180	-10	-180	
38	350	350	220	30	-150	-310
36	350	380	250	70	-110	-280
34	360	380	290	110	-70	-250
32	360	380	310	140	-40	-220
30	360	380	320	170	0	-180
20	380	400	330	250	130	-30
10	390	410	340	260	130	0
0	400	420	350	260	140	0
-20	420	440	360	280	150	0
-40	440	460	380	290	150	0

Rate of climb capability shown is valid for 200000 kg, gear down at VREF20 + 5.

Decrease rate of climb 30 ft/min per 5000 kg greater than 200000 kg.

Increase rate of climb 40 ft/min per 5000 kg less than 200000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-340	-420				
50	-300	-380	-520			
48	-270	-340	-490			
46	-240	-300	-450	-620		
44	-210	-270	-410	-590		
42	-180	-230	-370	-550	-720	
40	-150	-190	-340	-520	-690	
38	-140	-170	-300	-480	-660	-820
36	-140	-140	-260	-450	-630	-790
34	-140	-130	-240	-410	-590	-770
32	-140	-130	-210	-380	-560	-740
30	-140	-130	-200	-360	-530	-710
20	-140	-130	-200	-290	-410	-580
10	-130	-130	-200	-290	-420	-550
0	-130	-120	-200	-290	-420	-560
-20	-140	-130	-210	-300	-430	-580
-40	-140	-130	-220	-310	-450	-610

Rate of climb capability shown is valid for 200000 kg, gear down at VREF30 + 5.

Decrease rate of climb 30 ft/min per 5000 kg greater than 200000 kg.

Increase rate of climb 50 ft/min per 5000 kg less than 200000 kg.

Intentionally
Blank

Performance Inflight
Gear Down

Chapter PI
Section 14

GEAR DOWN

Long Range Cruise Altitude Capability
Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
260	17400	15300	12200
240	20900	18400	15600
220	24500	22000	19600
200	27800	26400	23800
180	30900	30500	28900
160	33400	33300	32900
140	36100	36100	36100

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
260	%N1	84.5	89.2	90.9							
	MACH	.453	.492	.508							
	KIAS	251	248	246							
	FF/ENG	5792	5756	5759							
240	%N1	82.1	86.8	88.6	90.4	92.1					
	MACH	.438	.476	.492	.508	.525					
	KIAS	242	240	238	237	235					
	FF/ENG	5337	5288	5273	5275	5290					
220	%N1	79.5	84.1	86.0	87.8	89.6	91.4	93.3			
	MACH	.421	.459	.475	.491	.508	.525	.543			
	KIAS	232	231	230	228	227	225	224			
	FF/ENG	4886	4841	4810	4793	4791	4806	4864			
200	%N1	76.8	81.4	83.1	85.0	86.8	88.6	90.5	92.7		
	MACH	.403	.441	.456	.473	.489	.506	.526	.548		
	KIAS	223	221	220	219	218	217	216	216		
	FF/ENG	4448	4391	4371	4333	4309	4314	4361	4463		
180	%N1	73.8	78.4	80.0	81.8	83.9	85.9	87.9	89.9	92.1	
	MACH	.384	.420	.436	.452	.470	.489	.509	.531	.554	
	KIAS	212	211	210	210	209	209	209	209	209	
	FF/ENG	4011	3934	3926	3975	3941	3878	3931	3984	4071	
160	%N1	70.7	75.6	77.2	79.0	81.1	83.2	85.1	87.1	89.2	91.3
	MACH	.366	.403	.419	.436	.454	.472	.492	.513	.535	.558
	KIAS	202	202	202	202	202	202	202	202	202	202
	FF/ENG	3693	3613	3608	3609	3595	3563	3512	3564	3604	3670
140	%N1	67.8	72.7	74.4	76.1	78.1	80.2	82.2	84.1	86.1	88.2
	MACH	.352	.387	.403	.419	.436	.454	.473	.493	.515	.537
	KIAS	194	194	194	194	194	194	194	194	194	194
	FF/ENG	3358	3267	3255	3251	3245	3228	3206	3208	3194	3226

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
322	287	258	235	216	200	189	178	169	160	153
655	584	522	474	434	400	377	357	338	321	306
992	882	788	714	653	600	566	535	507	482	460
1332	1183	1055	954	872	800	755	713	676	642	612
1675	1485	1323	1195	1091	1000	943	891	844	802	765
2021	1790	1592	1436	1310	1200	1131	1069	1012	962	917
2371	2096	1862	1678	1529	1400	1320	1246	1180	1121	1069
2725	2406	2134	1921	1749	1600	1508	1424	1348	1280	1221
3081	2717	2407	2164	1969	1800	1696	1601	1515	1439	1372
3442	3031	2681	2408	2190	2000	1884	1778	1683	1598	1523
3805	3346	2956	2653	2410	2200	2072	1955	1850	1756	1674
4172	3664	3233	2899	2631	2400	2260	2132	2017	1914	1824
4543	3985	3512	3145	2853	2600	2447	2308	2183	2072	1974
4919	4308	3791	3392	3074	2800	2635	2485	2349	2229	2124
5298	4634	4073	3640	3296	3000	2822	2661	2515	2386	2273
5681	4963	4355	3889	3519	3200	3010	2837	2681	2543	2422
6069	5294	4639	4138	3742	3400	3197	3012	2846	2699	2570
6460	5627	4925	4388	3965	3600	3384	3188	3012	2855	2719
6856	5963	5212	4639	4188	3800	3571	3363	3177	3011	2867
7255	6302	5500	4891	4412	4000	3758	3538	3341	3166	3014

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	6.6	0:46	6.0	0:45	5.2	0:43	4.9	0:42	4.7	0:40
400	13.2	1:36	12.1	1:32	10.7	1:25	10.1	1:22	9.7	1:17
600	19.7	2:25	18.2	2:18	16.3	2:08	15.3	2:01	14.8	1:54
800	26.2	3:15	24.3	3:05	21.9	2:50	20.5	2:41	19.8	2:32
1000	32.7	4:05	30.3	3:51	27.4	3:33	25.7	3:21	24.9	3:09
1200	38.9	4:57	36.1	4:40	32.7	4:17	30.6	4:02	29.5	3:47
1400	45.1	5:49	41.9	5:29	38.0	5:01	35.5	4:43	34.2	4:26
1600	51.3	6:41	47.6	6:18	43.3	5:45	40.4	5:24	38.9	5:04
1800	57.5	7:33	53.4	7:06	48.6	6:29	45.4	6:05	43.6	5:42
2000	63.7	8:26	59.1	7:55	53.9	7:13	50.3	6:46	48.3	6:21
2200	69.3	9:21	64.4	8:47	58.7	7:59	54.8	7:29	52.7	7:01
2400	75.0	10:17	69.7	9:38	63.6	8:46	59.4	8:12	57.0	7:41
2600	80.7	11:12	75.0	10:30	68.4	9:32	64.0	8:55	61.4	8:21
2800	86.3	12:08	80.3	11:22	73.3	10:18	68.6	9:38	65.7	9:01
3000	92.0	13:03	85.6	12:13	78.2	11:05	73.2	10:21	70.1	9:41
3200	97.2	14:03	90.5	13:08	82.7	11:53	77.4	11:07	74.0	10:23
3400	102.3	15:02	95.3	14:03	87.1	12:42	81.7	11:52	78.0	11:05
3600	107.5	16:01	100.2	14:57	91.6	13:31	85.9	12:37	82.0	11:47
3800	112.7	17:00	105.0	15:52	96.1	14:20	90.2	13:22	86.0	12:29
4000	117.8	17:59	109.9	16:47	100.6	15:08	94.4	14:07	90.0	13:10

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
260	%N1	75.2	78	82.5	87.6	92.7			
	KIAS	236	236	236	236	236			
	FF/ENG	5840	5660	5660	5700	5850			
240	%N1	73.2	76.1	80.3	85.4	90.5			
	KIAS	229	229	229	229	229			
	FF/ENG	5440	5300	5260	5280	5360			
220	%N1	71.2	73.9	78.1	83	88	93.2		
	KIAS	223	223	223	223	223	223		
	FF/ENG	5060	4950	4880	4880	4900	5090		
200	%N1	69	71.7	75.8	80.6	85.5	90.5		
	KIAS	216	216	216	216	216	216		
	FF/ENG	4680	4610	4510	4480	4470	4580		
180	%N1	66.7	69.3	73.3	78.2	82.8	87.9	93.4	
	KIAS	209	209	209	209	209	209	209	
	FF/ENG	4320	4260	4150	4090	4150	4130	4340	
160	%N1	64.2	66.8	70.7	75.6	79.9	85.1	90.2	
	KIAS	202	202	202	202	202	202	202	
	FF/ENG	4030	3990	3880	3790	3790	3690	3810	
140	%N1	61.5	64.1	67.8	72.7	77	82.2	87.1	92.9
	KIAS	194	194	194	194	194	194	194	194
	FF/ENG	3660	3630	3530	3430	3410	3370	3370	3570

Flaps 1

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
260	%N1	73.8	76.7	81.2	86.4	91.5
	KIAS	216	216	216	216	216
	FF/ENG	5530	5380	5380	5440	5530
240	%N1	71.6	74.5	78.9	84.0	89.1
	KIAS	209	209	209	209	209
	FF/ENG	5130	5020	4980	5020	5060
220	%N1	69.3	72.1	76.5	81.5	86.6
	KIAS	203	203	203	203	203
	FF/ENG	4730	4670	4600	4600	4600
200	%N1	66.8	69.6	73.9	78.9	83.8
	KIAS	196	196	196	196	196
	FF/ENG	4330	4310	4210	4180	4170
180	%N1	64.2	66.9	71.1	76.2	80.8
	KIAS	189	189	189	189	189
	FF/ENG	4030	4010	3910	3860	3870
160	%N1	61.4	64.1	68.1	73.2	77.7
	KIAS	182	182	182	182	182
	FF/ENG	3650	3630	3530	3470	3480
140	%N1	58.4	61.0	64.9	69.9	74.4
	KIAS	174	174	174	174	174
	FF/ENG	3270	3250	3160	3100	3100

These tables include 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight
Gear Down, Engine INOP

Chapter PI
Section 15

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		VREF + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
220	208	221	4700		
200	190	214	9400	6200	3800
180	172	208	13000	11000	8100
160	154	200	16400	14900	12800

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
200	6400	4100	
180	11700	8200	5900
160	15200	13600	11200
140	18700	17700	15800

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)					
		5	7	9	11	13	15
200	%N1	92.5	94.5	96.5			
	MACH	.358	.371	.385			
	KIAS	216	216	216			
	FF/ENG	8649	8653	8728			
180	%N1	89.6	91.6	93.6	95.6	97.9	
	MACH	.346	.359	.373	.387	.402	
	KIAS	209	209	209	209	209	
	FF/ENG	7860	7852	7900	7957	8109	
160	%N1	86.5	88.5	90.5	92.5	94.5	96.7
	MACH	.334	.346	.359	.373	.388	.403
	KIAS	202	202	202	202	202	202
	FF/ENG	7101	7080	7111	7147	7207	7327
140	%N1	83.1	85.1	87.1	89.1	91.1	93.0
	MACH	.321	.333	.345	.359	.373	.387
	KIAS	194	194	194	194	194	194
	FF/ENG	6375	6348	6356	6373	6409	6461

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
349	305	269	241	219	200	186	174	163	154	146
529	462	406	363	329	300	279	261	244	230	218
710	620	544	486	440	400	372	347	325	306	289
891	777	681	608	550	500	465	433	405	381	361
1074	936	819	730	660	600	557	519	486	457	432
1258	1095	957	853	771	700	650	606	567	533	504
1443	1255	1096	976	881	800	743	692	647	608	575
1629	1415	1235	1099	992	900	836	778	727	683	646
1815	1576	1374	1222	1102	1000	928	864	808	759	717
2003	1737	1515	1346	1213	1100	1021	950	888	834	788
2191	1900	1655	1470	1324	1200	1114	1036	968	909	859
2381	2062	1795	1593	1435	1300	1206	1122	1048	984	930
2571	2226	1936	1717	1546	1400	1298	1207	1127	1058	1000
2763	2390	2077	1841	1658	1500	1391	1293	1207	1133	1070
2955	2554	2219	1966	1769	1600	1483	1379	1287	1207	1140

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	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	6.6	0:54	6.3	0:53	6.1	0:51	5.8	0:51	5.7	0:49
300	10.0	1:21	9.6	1:19	9.3	1:16	9.0	1:15	8.8	1:13
400	13.4	1:47	12.9	1:45	12.6	1:42	12.2	1:39	11.9	1:37
500	16.7	2:15	16.2	2:11	15.7	2:07	15.3	2:04	15.0	2:01
600	20.0	2:42	19.4	2:37	18.9	2:33	18.3	2:29	18.0	2:25
700	23.3	3:09	22.6	3:04	22.0	2:58	21.4	2:54	21.0	2:49
800	26.6	3:36	25.8	3:30	25.1	3:24	24.4	3:19	24.0	3:13
900	29.7	4:04	28.9	3:57	28.1	3:50	27.4	3:44	26.9	3:37
1000	32.9	4:32	32.0	4:24	31.1	4:16	30.3	4:09	29.8	4:02
1100	36.1	5:00	35.0	4:51	34.1	4:43	33.2	4:35	32.6	4:27
1200	39.2	5:28	38.0	5:18	37.1	5:09	36.1	5:00	35.4	4:51
1300	42.2	5:57	41.0	5:46	40.0	5:36	38.9	5:26	38.2	5:16
1400	45.3	6:25	44.0	6:14	42.9	6:02	41.8	5:52	41.0	5:42
1500	48.3	6:54	46.9	6:42	45.7	6:29	44.6	6:18	43.7	6:07
1600	51.3	7:23	49.8	7:09	48.5	6:56	47.3	6:44	46.4	6:32

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Long Range Cruise Diversion Fuel and Time
Fuel Required Adjustment (1000 KG)**

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)					
	140	160	180	200	220	240
5	-0.6	-0.3	0.0	0.5	1.1	1.7
10	-1.2	-0.6	0.0	1.0	2.2	3.5
15	-1.8	-0.9	0.0	1.5	3.3	5.2
20	-2.4	-1.2	0.0	1.9	4.3	6.8
25	-2.9	-1.5	0.0	2.3	5.2	8.3
30	-3.5	-1.8	0.0	2.7	6.1	9.7
35	-4.1	-2.1	0.0	3.1	6.8	11.1
40	-4.7	-2.4	0.0	3.4	7.6	12.3
45	-5.3	-2.7	0.0	3.7	8.2	13.4
50	-5.9	-3.0	0.0	4.0	8.8	14.4
55	-6.4	-3.3	0.0	4.3	9.3	15.3

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
200	%N1	89.0	92.5		
	KIAS	216	216		
	FF/ENG	9240	9080		
180	%N1	86.1	89.6	94.6	
	KIAS	209	209	209	
	FF/ENG	8370	8250	8320	
160	%N1	83.2	86.5	91.5	96.7
	KIAS	202	202	202	202
	FF/ENG	7540	7460	7480	7690
140	%N1	80.1	83.1	88.2	93.0
	KIAS	194	194	194	194
	FF/ENG	6740	6690	6680	6780

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight**Text****Chapter PI****Section 16**

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. 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 Flight Manual, the Flight Manual shall always take precedence.

General**FMC Takeoff Speeds**

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/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 colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush 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 is determined as follows:

- (1) Determine the dry field/obstacle limit weight for the takeoff flap setting.
- (2) 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.
- (3) Adjust field length available for temperature by amount shown on chart.
- (4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Takeoff speed determination:

(1) Determine takeoff speeds V_1 , V_R and V_2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If $V_1(\text{MCG})$ limited, set $V_1 = V_1(\text{MCG})$. If not limited by $V_1(\text{MCG})$ considerations, enter the V_1 Adjustment table with actual brake release weight to determine the V_1 reduction to apply to V_1 speed. If the adjusted V_1 is less than $V_1(\text{MCG})$, set $V_1 = V_1(\text{MCG})$.

Slippery Runway

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. Good reported braking action denotes wet runway conditions or runways covered by compact snow. Similarly, poor braking action denotes runways covered with wet ice. Performance is based on reversers operating and 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.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V_1 less than the minimum V_1 for control on the ground, $V_1(\text{MCG})$. It is therefore necessary to compare the adjusted V_1 to $V_1(\text{MCG})$. To find $V_1(\text{MCG})$, enter the $V_1(\text{MCG})$ table with airport pressure altitude and actual OAT. If the adjusted V_1 is less than $V_1(\text{MCG})$, set V_1 equal to $V_1(\text{MCG})$. If the adjusted V_R is less than $V_1(\text{MCG})$, set V_R equal to $V_1(\text{MCG})$ and determine a new V_2 by adding the difference between the normal V_R and $V_1(\text{MCG})$ to the normal V_2 . No weight adjustment is required provided that the field length available exceeds the minimum field length required shown in the Field and Climb Limit Weight table.

Go-Around %N1

To find Go-Around %N1 based on normal engine bleed for packs on and anti-ice off, enter the Go-Around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for engine bleeds for various conditions.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables 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 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. Note that these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 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, .84 Mach approximates the Long Range Cruise Mach schedule.

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 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 .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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.

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 at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. 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 30 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 for the selected flap setting. Flaps 1 is based on VREF30 + 60 speed schedule. 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

Tables are provided as advisory information for normal configuration landing distances on dry runways and slippery runways with good, medium, and poor reported braking action. All landing distances (reference distances plus adjustments) are 115% of the actual landing distance.

To use these tables, determine the reference landing distance for the selected braking configuration. Then adjust the reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers to obtain the actual landing distance.

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. 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.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is conservative to add the effects of slope and inoperative reversers when using the autobrake system.

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 effects of max manual braking and reverse thrust.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding 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.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy 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 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, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

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 Mach number of .84 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 engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude 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/Cruise 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 correct 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 Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC 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 PENALTY (KG/HR)				
	GROSS WEIGHT (1000 KG)				
	300	260	220	180	140
43				160	140
39			180	160	145
35		200	190	170	140
31	230	220	195	165	140
25	230	220	195	175	155
20	235	230	205	185	165
15	235	235	215	200	185
10	240	240	230	220	200
5	270	270	255	240	220

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 .84/310/250 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 corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required 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 is planned. The tables show gear down rate of climb available for Flaps 20 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. 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 will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

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 20****777-200ER TRENT892 KG M FAA TALPA****Pkg Model Identification PI.ModID.20.1****General PI.20.1**

VREF	PI.20.1
Flap Maneuver Speed	PI.20.2
Slush/Standing Water Takeoff	PI.20.3
Slippery Runway Takeoff	PI.20.6
Minimum Control Speeds	PI.20.10
Go-around EPR	PI.20.11
Max Climb EPR	PI.20.12
Flight With Unreliable Airspeed / Turbulent Air Penetration	PI.20.13

All Engine PI.21.1

Long Range Cruise Maximum Operating Altitude	PI.21.1
Long Range Cruise Control	PI.21.3
Long Range Cruise Enroute Fuel and Time - Low Altitude ..	PI.21.4
Long Range Cruise Enroute Fuel and Time - High Altitude ..	PI.21.5
Long Range Cruise Wind-Altitude Trade	PI.21.7
Descent at .84/310/250 KIAS	PI.21.7
Holding	PI.21.8

Advisory Information..... PI.22.1

Runway Surface Condition Correlation	PI.22.1
Normal Configuration Landing Distance	PI.22.2
Non-Normal Configuration Landing Distance	PI.22.8
Airspeed Unreliable (Flaps 20)	PI.22.8
ANTISKID (Flaps 25)	PI.22.9
ANTISKID (Flaps 30)	PI.22.10
ENG SHUTDOWN L, R (Flaps 20)	PI.22.11
ENG SHUTDOWN L, R (Flaps 30)	PI.22.12

FLAP / SLAT CONTROL (Flaps 20)	PI.22.13
FLAPS DRIVE (Flaps ≤ 5)	PI.22.14
FLAPS DRIVE (5 < Flaps < 20)	PI.22.15
FLAPS DRIVE (Flaps ≥ 20)	PI.22.16
FLAPS PRIMARY FAIL (Flaps 20)	PI.22.17
FLIGHT CONTROL MODE (Flaps 20)	PI.22.18
FLIGHT CONTROLS (Flaps 20)	PI.22.19
HYD PRESS SYS C (Flaps 20)	PI.22.20
HYD PRESS SYS L (Flaps 25)	PI.22.21
HYD PRESS SYS L (Flaps 30)	PI.22.22
HYD PRESS SYS L+C (Flaps 20)	PI.22.23
HYD PRESS SYS L+R (Flaps 20)	PI.22.24
HYD PRESS SYS R (Flaps 25)	PI.22.25
HYD PRESS SYS R (Flaps 30)	PI.22.26
HYD PRESS SYS R+C (Flaps 20)	PI.22.27
PITCH DOWN AUTHORITY (Flaps 25)	PI.22.28
PITCH DOWN AUTHORITY (Flaps 30)	PI.22.29
PITCH UP AUTHORITY (Flaps ≤ 15)	PI.22.30
PITCH UP AUTHORITY (Flaps ≥ 20)	PI.22.31
PRI FLIGHT COMPUTERS (Flaps 20)	PI.22.32
SLATS DRIVE (Flaps 20)	PI.22.33
SPOILERS (Flaps 25)	PI.22.34
SPOILERS (Flaps 30)	PI.22.35
STABILIZER (Flaps 20)	PI.22.36
Approach or Landing Climb Limited Weight	PI.22.37
Recommended Brake Cooling Schedule.	PI.22.38

Engine Inoperative PI.23.1

Initial Max Continuous EPR	PI.23.1
Max Continuous EPR	PI.23.2
Driftdown Speed/Level Off Altitude.	PI.23.5
Driftdown/LRC Cruise Range Capability.	PI.23.6
Long Range Cruise Altitude Capability	PI.23.7
Long Range Cruise Control	PI.23.8

777 Flight Crew Operations Manual

Long Range Cruise Diversion Fuel and Time	PI.23.9
Holding	PI.23.10
Gear Down Landing Rate of Climb Available	PI.23.11
Alternate Mode EEC	PI.24.1
Limit Weight	PI.24.1
Max Takeoff %N1	PI.24.2
Max Climb %N1	PI.24.3
Max Cruise %N1	PI.24.4
Go-Around %N1	PI.24.5
Alternate Mode EEC, Engine Inoperative	PI.25.1
Initial Max Continuous %N1	PI.25.1
Max Continuous %N1	PI.25.2
Gear Down	PI.26.1
220 KIAS Max Climb EPR	PI.26.1
Long Range Cruise Altitude Capability	PI.26.2
Long Range Cruise Control	PI.26.3
Long Range Cruise Enroute Fuel and Time	PI.26.4
Descent at VREF30+80	PI.26.5
Holding	PI.26.6
Gear Down, Engine Inoperative	PI.27.1
Driftdown Speed/Level Off Altitude	PI.27.1
Long Range Cruise Altitude Capability	PI.27.2
Long Range Cruise Control	PI.27.3
Long Range Cruise Diversion Fuel and Time	PI.27.4
Holding	PI.27.6
Text	PI.28.1
Introduction	PI.28.1
General	PI.28.1
All Engines	PI.28.4
Advisory Information	PI.28.6

**Performance Inflight
Pkg Model Identification****Chapter PI
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
200ER	777-200ER	7250	WY250

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Performance Inflight

General

Chapter PI

Section 20

VREF**Flaps 30**

WEIGHT (1000 KG)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
300	164	164	165	165	165	166
280	159	159	159	160	160	161
260	154	154	154	154	155	155
240	148	148	148	148	148	149
220	142	142	142	142	142	142
200	135	135	135	135	135	135
180	128	128	128	128	128	128
160	123	121	121	121	121	121
140	123	121	118	116	114	113

Flaps 25

WEIGHT (1000 KG)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
300	172	172	173	173	173	173
280	167	167	167	167	167	168
260	162	162	162	162	162	162
240	155	155	156	156	156	156
220	149	149	149	149	149	149
200	142	142	142	142	142	142
180	134	134	134	135	135	135
160	127	127	127	127	127	127
140	123	121	118	118	118	118

Flaps 20

WEIGHT (1000 KG)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
300	178	178	179	179	180	181
280	173	173	173	173	174	174
260	167	167	168	168	168	168
240	161	161	161	161	161	162
220	154	154	154	154	154	154
200	147	147	147	147	147	147
180	139	139	139	139	139	139
160	131	131	131	131	131	131
140	123	122	122	123	123	123

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS 0	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

ADVISORY INFORMATION**Slush/Standing Water Takeoff****Maximum Reverse Thrust****Weight Adjustment (1000 KG)**

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.08 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	-32.9	-38.0	-43.0	-38.5	-43.6	-48.7	-50.7	-55.8	-60.9
300	-30.9	-36.0	-41.0	-35.8	-40.8	-45.9	-46.2	-51.3	-56.4
280	-28.6	-33.7	-38.8	-32.8	-37.9	-43.0	-41.7	-46.8	-51.8
260	-26.1	-31.2	-36.3	-29.6	-34.7	-39.8	-37.0	-42.0	-47.1
240	-23.4	-28.5	-33.5	-26.2	-31.3	-36.4	-32.1	-37.2	-42.3
220	-20.4	-25.4	-30.5	-22.6	-27.6	-32.7	-27.2	-32.3	-37.4
200	-17.1	-22.2	-27.3	-18.7	-23.8	-28.9	-22.1	-27.2	-32.3
180	-13.6	-18.6	-23.7	-14.6	-19.7	-24.8	-16.9	-22.0	-27.1
160	-9.8	-14.9	-19.9	-10.3	-15.4	-20.5	-11.6	-16.7	-21.8
140	-5.9	-11.0	-16.1	-5.9	-11.0	-16.1	-6.2	-11.3	-16.4

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1800							109.3		
2000	109.8			123.7			147.5	103.3	
2200	148.5	103.7		162.3	117.5		185.9	141.5	
2400	187.4	142.4		201.6	156.2	111.4	225.4	179.8	135.4
2600	227.7	181.2	136.3	242.3	195.3	150.1	266.0	219.1	173.7
2800	269.7	221.2	175.0	284.4	235.7	189.0	307.9	259.5	212.8
3000	313.5	262.9	214.8	328.3	277.7	229.2	350.8	301.2	253.0
3200	358.6	306.5	256.2	372.5	321.3	270.9		344.0	294.5
3400		351.4	299.4			314.3			337.2
3600			344.3			358.6			

1. Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water adjustment.
2. Adjust field length available by -55 m/+55 m for every 5°C above/below 4°C.
3. Find V1(MCG) limited 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	-18	-14	-10	-13	-9	-5	-5	-1	3
300	-19	-15	-11	-14	-10	-6	-4	0	4
280	-20	-16	-12	-16	-12	-8	-5	-1	3
260	-22	-18	-14	-18	-14	-10	-8	-4	0
240	-24	-20	-16	-20	-16	-12	-11	-7	-3
220	-25	-21	-17	-22	-18	-14	-15	-11	-7
200	-26	-22	-18	-23	-19	-15	-18	-14	-10
180	-26	-22	-18	-24	-20	-16	-20	-16	-12
160	-26	-22	-18	-24	-20	-16	-20	-16	-12
140	-26	-22	-18	-24	-20	-16	-20	-16	-12

1. Obtain V1, VR and V2 for the actual weight.
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 Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	-45.2	-51.2	-57.2	-51.6	-57.6	-63.5	-65.3	-71.3	-77.2
300	-42.0	-48.0	-54.0	-47.3	-53.3	-59.3	-58.7	-64.7	-70.7
280	-38.7	-44.7	-50.7	-43.1	-49.1	-55.1	-52.4	-58.4	-64.4
260	-35.2	-41.2	-47.2	-38.8	-44.8	-50.8	-46.3	-52.3	-58.3
240	-31.6	-37.6	-43.6	-34.5	-40.5	-46.4	-40.5	-46.4	-52.4
220	-27.9	-33.9	-39.9	-30.1	-36.1	-42.1	-34.8	-40.8	-46.8
200	-24.0	-30.0	-36.0	-25.7	-31.7	-37.7	-29.4	-35.4	-41.3
180	-20.0	-26.0	-32.0	-21.3	-27.2	-33.2	-24.2	-30.1	-36.1
160	-15.9	-21.9	-27.9	-16.8	-22.8	-28.8	-19.2	-25.1	-31.1
140	-11.7	-17.7	-23.7	-12.3	-18.3	-24.3	-14.2	-20.2	-26.2

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2600							113.4		
2800							158.1	109.0	
3000				132.3			203.1	153.7	104.6
3200	131.8			180.4	127.6		248.9	198.6	149.3
3400	182.1	126.9		229.4	175.6	122.9	295.6	244.4	194.2
3600	233.3	177.2	122.0	279.7	224.6	170.9	343.2	291.0	239.9
3800	286.0	228.3	172.2	331.4	274.7	219.7		338.5	286.4
4000	339.8	280.7	223.2		326.3	269.8			333.8
4200		334.5	275.5			321.2			
4400			329.2						

1. Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water adjustment.
2. Adjust field length available by -75 m/+70 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
300	-30	-24	-18	-23	-17	-11	-8	-2	0
280	-32	-26	-20	-26	-20	-14	-11	-5	0
260	-34	-28	-22	-29	-23	-17	-15	-9	-3
240	-37	-31	-25	-32	-26	-20	-20	-14	-8
220	-39	-33	-27	-35	-29	-23	-25	-19	-13
200	-41	-35	-29	-38	-32	-26	-30	-24	-18
180	-42	-36	-30	-40	-34	-28	-34	-28	-22
160	-43	-37	-31	-41	-35	-29	-37	-31	-25
140	-44	-38	-32	-42	-36	-30	-39	-33	-27

1. Obtain V1, VR and V2 for the actual weight.
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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	0.0	-1.5	-2.9	-14.9	-16.3	-17.8	-31.3	-32.8	-34.2
300	0.0	-1.5	-2.9	-16.3	-17.7	-19.2	-31.2	-32.7	-34.1
280	-0.4	-1.9	-3.3	-17.1	-18.5	-20.0	-30.6	-32.0	-33.5
260	-1.9	-3.4	-4.8	-17.3	-18.7	-20.2	-29.3	-30.7	-32.2
240	-2.9	-4.4	-5.8	-16.8	-18.3	-19.7	-27.4	-28.8	-30.3
220	-3.4	-4.9	-6.3	-15.7	-17.2	-18.6	-24.9	-26.3	-27.8
200	-3.4	-4.9	-6.3	-14.0	-15.4	-16.9	-21.8	-23.2	-24.7
180	-2.9	-4.4	-5.8	-11.6	-13.1	-14.5	-18.1	-19.5	-21.0
160	-1.9	-3.3	-4.8	-8.6	-10.1	-11.5	-13.8	-15.2	-16.7
140	-0.6	-2.0	-3.5	-5.3	-6.8	-8.2	-9.2	-10.6	-12.1

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1400	104.2								
1600	182.9	135.0							
1800	258.6	212.9	165.8						
2000	330.7	287.1	242.3	146.3	100.0				
2200		358.5	315.2	201.1	154.3	108.0			
2400				257.7	209.3	162.3	114.1		
2600				316.4	266.2	217.5	148.1	104.6	
2800				376.2	325.2	274.7	182.5	138.6	
3000						333.9	218.3	172.7	129.1
3200							256.0	208.1	163.1
3400							295.9	245.2	198.0
3600							338.1	284.5	234.6
3800								326.2	273.3
4000								368.6	314.3

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 -30 m/+30 m for every 5°C above/below 4°C.
Adjust "Medium" field length available by -40 m/+40 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) limited 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 Adjustments (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	-3	-1	1	-12	-10	-8	-24	-22	-20
300	-4	-2	0	-14	-12	-10	-27	-25	-23
280	-6	-4	-2	-16	-14	-12	-30	-28	-26
260	-7	-5	-3	-19	-17	-15	-33	-31	-29
240	-9	-7	-5	-21	-19	-17	-36	-34	-32
220	-10	-8	-6	-23	-21	-19	-39	-37	-35
200	-11	-9	-7	-25	-23	-21	-41	-39	-37
180	-12	-10	-8	-26	-24	-22	-43	-41	-39
160	-13	-11	-9	-27	-25	-23	-44	-42	-40
140	-14	-12	-10	-28	-26	-24	-45	-43	-41

- 1. Obtain V1, VR and V2 for the actual weight.
- 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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
320	-1.4	-2.5	-3.6	-24.7	-25.8	-26.8	-44.3	-45.4	-46.5
300	-4.2	-5.3	-6.4	-25.7	-26.8	-27.9	-42.6	-43.7	-44.8
280	-6.4	-7.4	-8.5	-26.1	-27.2	-28.3	-40.6	-41.7	-42.8
260	-7.9	-9.0	-10.1	-25.9	-27.0	-28.0	-38.4	-39.5	-40.5
240	-8.9	-10.0	-11.0	-24.9	-26.0	-27.1	-35.8	-36.9	-38.0
220	-9.2	-10.3	-11.4	-23.2	-24.3	-25.4	-33.0	-34.1	-35.2
200	-8.9	-10.0	-11.1	-20.9	-22.0	-23.1	-29.8	-30.9	-32.0
180	-8.0	-9.1	-10.2	-17.9	-19.0	-20.1	-26.4	-27.5	-28.6
160	-6.5	-7.6	-8.7	-14.2	-15.3	-16.3	-22.7	-23.8	-24.9
140	-4.8	-5.9	-7.0	-10.2	-11.3	-12.4	-18.9	-20.0	-21.1

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1800	133.8								
2000	263.1	202.4	118.1						
2200	347.5	303.6	253.6						
2400			339.9						
2600				100.3					
2800				218.2	133.5				
3000				307.3	244.4	166.7			
3200					328.1	268.7			
3400						348.8			
3800							119.9		
4000							172.3	111.6	
4200							226.9	164.0	103.3
4400							285.2	218.1	155.7
4600							347.6	275.8	209.3
4800								337.6	266.4
5000									327.7

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 -30 m/+30 m for every 5°C above/below 4°C.
Adjust "Medium" field length available by -50 m/+45 m for every 5°C above/below 4°C.
Adjust "Poor" field length available by -75 m/+70 m for every 5°C above/below 4°C.
3. Find V1(MCG) limited 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
300	-7	-3	0	-21	-17	-13	-41	-37	-33
280	-9	-5	-1	-24	-20	-16	-46	-42	-38
260	-11	-7	-3	-27	-23	-19	-50	-46	-42
240	-13	-9	-5	-31	-27	-23	-55	-51	-47
220	-15	-11	-7	-34	-30	-26	-59	-55	-51
200	-17	-13	-9	-37	-33	-29	-63	-59	-55
180	-19	-15	-11	-41	-37	-33	-67	-63	-59
160	-21	-17	-13	-44	-40	-36	-70	-66	-62
140	-23	-19	-15	-47	-43	-39	-72	-68	-64

1. Obtain V1, VR and V2 for the actual weight.
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.

Minimum Control Speeds

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	113	114	109	111	108	109	106	108				
50	122	115	116	112	114	108	110	106	108	104	106	101	104
40	104	121	122	118	119	114	115	109	110	105	107	101	104
30	86	123	124	122	123	118	119	113	114	108	110	104	106
20	68	123	124	123	123	119	120	115	117	111	113	107	109
-60	-76	124	124	124	124	120	121	116	117	112	113	109	110

Go-around EPR

Based on engine bleed for packs on and anti-ice off

REPORTED OAT		TAT	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F	°C	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
66	150	70	1.269	1.282	1.284	1.287	1.289	1.290	1.290	1.289	1.287	1.284	1.281	1.278
56	133	60	1.316	1.324	1.328	1.332	1.335	1.337	1.339	1.339	1.338	1.336	1.334	1.332
51	124	55	1.347	1.356	1.356	1.355	1.359	1.361	1.363	1.365	1.364	1.362	1.361	1.359
46	115	50	1.380	1.390	1.392	1.392	1.388	1.387	1.388	1.390	1.389	1.388	1.388	1.387
41	106	45	1.406	1.429	1.428	1.428	1.421	1.416	1.416	1.416	1.415	1.414	1.414	1.414
36	97	40	1.431	1.461	1.461	1.460	1.453	1.446	1.445	1.445	1.444	1.443	1.442	1.441
31	88	35	1.443	1.492	1.491	1.491	1.483	1.477	1.475	1.474	1.473	1.473	1.472	1.471
26	79	30	1.443	1.498	1.511	1.518	1.512	1.505	1.506	1.505	1.504	1.504	1.502	1.502
21	70	25	1.443	1.498	1.511	1.521	1.526	1.531	1.527	1.529	1.528	1.527	1.525	1.525
17	62	20	1.443	1.498	1.511	1.521	1.526	1.531	1.535	1.539	1.545	1.546	1.541	1.539
12	53	15	1.443	1.498	1.511	1.521	1.526	1.531	1.535	1.539	1.547	1.555	1.563	1.561
8 & BELOW	46 & BELOW	12 & BELOW	1.443	1.498	1.511	1.521	1.526	1.531	1.535	1.539	1.547	1.555	1.563	1.571

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
PACKS OFF	0.003	0.003	0.003	0.003	0.004	0.004	0.005
1 PACK ON - 2 BLEED SOURCES	-0.003	-0.003	-0.003	-0.003	-0.004	-0.004	-0.005
1 PACK ON - 1 BLEED SOURCE	-0.003	-0.003	-0.003	-0.003	-0.004	-0.004	-0.005
WING ANTI-ICE ON	-0.002	-0.004	-0.004	-0.005	-0.005	-0.006	-0.006

Max Climb EPR

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (IAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	1.132	1.122	1.127	1.146	1.166	1.159	1.152	1.174	1.178	1.170
50	1.168	1.161	1.147	1.146	1.166	1.159	1.152	1.174	1.178	1.170
40	1.209	1.205	1.191	1.184	1.173	1.159	1.152	1.174	1.178	1.170
30	1.217	1.253	1.243	1.237	1.228	1.196	1.157	1.174	1.178	1.170
20	1.217	1.253	1.284	1.298	1.292	1.259	1.228	1.191	1.178	1.170
10	1.217	1.253	1.284	1.329	1.364	1.337	1.307	1.273	1.260	1.257
0	1.217	1.253	1.284	1.329	1.374	1.399	1.402	1.367	1.351	1.348
-10	1.217	1.253	1.284	1.329	1.374	1.399	1.434	1.482	1.468	1.465
-15 & BELOW	1.217	1.253	1.284	1.329	1.374	1.399	1.434	1.506	1.521	1.518

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
ENGINE ONLY	-0.008	-0.010	-0.015	-0.015	-0.006	-0.005	-0.003	-0.003	-0.004	-0.005
ENGINE & WING*	-0.010	-0.012	-0.018	-0.020	-0.012	-0.012	-0.011	-0.014	-0.017	-0.019
ENGINE & WING**	-0.012	-0.014	-0.021	-0.025	-0.018	-0.019	-0.020	-0.024	-0.029	-0.033

***Wing anti-ice on, packs on.**

****Wing anti-ice on, single bleed source and both packs off.**

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb**Flaps Up, Set Max Climb Thrust**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT V/S (FT/MIN)	4.0 1600	3.5 800		
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	4.5 2300	4.5 1600	4.0 1100	4.5 700
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	7.5 3700	7.0 2700	6.5 2100	6.5 1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	10.0 4500	8.5 3400	8.0 2700	8.0 2100
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	12.0 5100	10.5 3900	9.5 3100	9.0 2500

Cruise**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82 M)	PITCH ATT EPR (Alt Mode %N1)	2.0 1.129 (81.1)	2.5 1.249 (85.5)		
35000 (280 KIAS)	PITCH ATT EPR (Alt Mode %N1)	1.5 1.065 (78.9)	2.0 1.118 (81.1)	2.5 1.203 (84.4)	3.0 1.356 (89.3)
30000 (280 KIAS)	PITCH ATT EPR (Alt Mode %N1)	1.5 1.021 (75.4)	2.0 1.059 (77.5)	3.0 1.119 (80.4)	3.5 1.196 (83.8)
25000 (280 KIAS)	PITCH ATT EPR (Alt Mode %N1)	1.5 0.997 (72.1)	2.0 1.024 (74.1)	3.0 1.067 (76.7)	3.5 1.124 (79.8)
20000 (270 KIAS)	PITCH ATT EPR (Alt Mode %N1)	2.0 0.986 (67.6)	2.5 1.008 (70.0)	3.0 1.039 (73.0)	4.0 1.081 (76.0)
15000 (270 KIAS)	PITCH ATT EPR (Alt Mode %N1)	1.5 0.977 (64.0)	2.5 0.994 (66.4)	3.0 1.018 (69.2)	4.0 1.048 (72.5)

Descent**Flaps Up, Set Idle Thrust**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)			
		160	200	240	280
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-1.0 -2500	-0.5 -2400		
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -2200	-0.5 -1900	0.5 -1900	1.0 -1900
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1800	0.0 -1600	0.5 -1600	1.5 -1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -1700	-0.5 -1500	0.5 -1400	1.5 -1400
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -1500	-0.5 -1400	0.5 -1300	1.5 -1300

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)			
		160	200	240	280
10000	PITCH ATT	4.0	4.5	5.0	5.0
	EPR	1.004	1.017	1.029	1.040
	(Alt Mode %N1)	(52.7)	(59.2)	(64.0)	(68.2)
	KLAS	202	216	234	253
5000	PITCH ATT	4.0	4.5	5.0	5.0
	EPR	0.999	1.009	1.019	1.027
	(Alt Mode %N1)	(48.8)	(54.1)	(59.9)	(64.1)
	KLAS	202	216	233	251

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		160	200	240	280	300
FLAPS UP (GEAR UP) (VREF30+80)	PITCH ATT	4.0	5.0	5.5	5.5	6.0
	EPR	0.999	1.011	1.023	1.037	1.044
	(Alt Mode %N1)	(49.1)	(54.4)	(60.3)	(64.5)	(66.5)
	KIAS	203	215	228	240	246
FLAPS 1 (GEAR UP) (VREF30+60)	PITCH ATT	5.5	6.5	7.0	7.0	7.5
	EPR	1.015	1.029	1.045	1.062	1.070
	(Alt Mode %N1)	(50.1)	(56.0)	(61.9)	(66.4)	(68.3)
	KIAS	183	195	208	220	226
FLAPS 5 (GEAR UP) (VREF30+40)	PITCH ATT	4.5	5.5	6.0	6.0	6.0
	EPR	1.028	1.047	1.066	1.085	1.095
	(Alt Mode %N1)	(50.8)	(58.1)	(63.4)	(67.9)	(69.8)
	KIAS	163	175	188	200	206
FLAPS 15 (GEAR UP) (VREF30+20)	PITCH ATT	5.5	6.0	6.5	6.5	7.0
	EPR	1.042	1.064	1.088	1.113	1.124
	(Alt Mode %N1)	(52.3)	(60.0)	(65.6)	(70.1)	(72.0)
	KIAS	143	155	168	180	186
FLAPS 20 (GEAR DOWN) (VREF30+20)	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	EPR	1.071	1.100	1.132	1.167	1.184
	(Alt Mode %N1)	(60.4)	(66.7)	(71.8)	(76.1)	(78.0)
	KIAS	143	155	168	180	186

Final Approach (1500 FT)

Gear Down, Set Thrust for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		160	200	240	280	300
FLAPS 20 (VREF20+10)	PITCH ATT	1.0	1.5	1.5	1.5	1.5
	EPR	1.006	1.010	1.015	1.022	1.025
	(Alt Mode %N1)	(39.0)	(43.2)	(47.2)	(51.0)	(52.6)
	KIAS	141	157	171	184	190
FLAPS 25 (VREF25+10)	PITCH ATT	1.0	1.0	1.0	1.0	1.0
	EPR	1.035	1.046	1.060	1.074	1.082
	(Alt Mode %N1)	(49.0)	(54.2)	(59.7)	(63.7)	(65.7)
	KIAS	137	152	165	178	184
FLAPS 30 (VREF30+10)	PITCH ATT	0.5	1.0	1.0	1.0	1.0
	EPR	1.057	1.072	1.092	1.114	1.126
	(Alt Mode %N1)	(55.2)	(60.8)	(65.7)	(69.9)	(71.8)
	KIAS	133	145	158	170	176

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around**Flaps 20, Gear Up, Set Go-Around Thrust****Normal Mode**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		160	200	240	280	300
10000	PITCH ATT	16.5	13.0	11.0	9.5	9.0
	V/S (FT/MIN)	3600	2800	2200	1700	1500
	KIAS	141	155	169	181	187
5000	PITCH ATT	19.5	15.5	13.0	11.5	10.5
	V/S (FT/MIN)	4200	3400	2700	2200	2000
	KIAS	141	155	168	180	187
SEA LEVEL	PITCH ATT	23.0	18.5	15.5	13.5	12.5
	V/S (FT/MIN)	4900	3900	3200	2700	2400
	KIAS	143	155	168	180	186

Alternate Mode EEC

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		160	200	240	280	300
10000	PITCH ATT	15.5	12.5	10.5	9.0	8.5
	V/S (FT/MIN)	3400	2600	2000	1500	1300
	KIAS	141	155	169	181	187
5000	PITCH ATT	19.0	15.0	12.5	11.0	10.0
	V/S (FT/MIN)	4000	3100	2500	2000	1800
	KIAS	141	155	168	180	187
SEA LEVEL	PITCH ATT	21.5	17.5	14.5	12.5	11.5
	V/S (FT/MIN)	4600	3600	2900	2400	2200
	KIAS	143	155	168	180	186

Intentionally
Blank

Performance Inflight

Chapter PI

All Engine

Section 21

Long Range Cruise Maximum Operating Altitude
Max Climb 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°)
300	30300	-1	33500*	33500*	33500*	33400	31900
290	31100	-3	34300*	34300*	34300*	34100	32700
280	31800	-5	35200*	35200*	35200*	34900	33400
270	32600	-7	36100*	36100*	36100*	35600	34200
260	33400	-8	36800*	36800*	36800*	36400	35000
250	34200	-10	37600*	37600*	37600*	37200	35800
240	35100	-12	38400*	38400*	38400*	38100	36600
230	36000	-14	39300*	39300*	39300*	39000	37500
220	36900	-14	40200*	40200*	40200*	39900	38500
210	37900	-14	41100*	41100*	41100*	40900	39400
200	38900	-14	42100*	42100*	42100*	41900	40400
190	40000	-14	43000	43000	43000	42900	41500
180	41100	-14	43000	43000	43000	43000	42600
170	42300	-14	43000	43000	43000	43000	43000
160	43000	-14	43000	43000	43000	43000	43000
150	43000	-14	43000	43000	43000	43000	43000
140	43000	-14	43000	43000	43000	43000	43000

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°)
300	30300	4	32500*	32500*	32500*	32500*	31900
290	31100	3	33400*	33400*	33400*	33400*	32700
280	31800	1	34300*	34300*	34300*	34300*	33400
270	32600	-1	35200*	35200*	35200*	35200*	34200
260	33400	-3	36100*	36100*	36100*	36100*	35000
250	34200	-5	36900*	36900*	36900*	36900*	35800
240	35100	-7	37700*	37700*	37700*	37700*	36600
230	36000	-9	38600*	38600*	38600*	38600*	37500
220	36900	-9	39500*	39500*	39500*	39500*	38500
210	37900	-9	40400*	40400*	40400*	40400*	39400
200	38900	-9	41400*	41400*	41400*	41400*	40400
190	40000	-9	42400*	42400*	42400*	42400*	41500
180	41100	-9	43000	43000	43000	43000	42600
170	42300	-9	43000	43000	43000	43000	43000
160	43000	-9	43000	43000	43000	43000	43000
150	43000	-9	43000	43000	43000	43000	43000
140	43000	-9	43000	43000	43000	43000	43000

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

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°)
300	30300	10	31100*	31100*	31100*	31100*	31100*
290	31100	8	32100*	32100*	32100*	32100*	32100*
280	31800	7	33100*	33100*	33100*	33100*	33100*
270	32600	5	34100*	34100*	34100*	34100*	34100*
260	33400	3	35100*	35100*	35100*	35100*	35000
250	34200	1	36100*	36100*	36100*	36100*	35800
240	35100	-1	36800*	36800*	36800*	36800*	36600
230	36000	-3	37700*	37700*	37700*	37700*	37500
220	36900	-3	38600*	38600*	38600*	38600*	38500
210	37900	-3	39500*	39500*	39500*	39500*	39400
200	38900	-3	40500*	40500*	40500*	40500*	40400
190	40000	-3	41500*	41500*	41500*	41500*	41500
180	41100	-3	42600*	42600*	42600*	42600*	42600
170	42300	-3	43000	43000	43000	43000	43000
160	43000	-3	43000	43000	43000	43000	43000
150	43000	-3	43000	43000	43000	43000	43000
140	43000	-3	43000	43000	43000	43000	43000

*Denotes altitude thrust limited in level flight, 300 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	43
300	EPR	1.106	1.131	1.168	1.229	1.326					
	MACH	.772	.802	.834	.840	.838					
	KIAS	325	325	325	314	300					
	FF/ENG	4499	4533	4621	4641	4746					
280	EPR	1.083	1.106	1.135	1.182	1.247	1.365				
	MACH	.772	.802	.834	.841	.839	.838				
	KIAS	325	325	325	314	300	287				
	FF/ENG	4289	4321	4375	4343	4305	4482				
260	EPR	1.064	1.085	1.111	1.142	1.193	1.266	1.412			
	MACH	.770	.796	.821	.838	.841	.839	.839			
	KIAS	324	322	319	313	301	287	274			
	FF/ENG	4095	4094	4085	4045	3988	3985	4261			
240	EPR	1.047	1.066	1.088	1.115	1.148	1.201	1.284			
	MACH	.746	.772	.799	.823	.839	.840	.839			
	KIAS	313	312	310	307	300	287	274			
	FF/ENG	3762	3759	3758	3747	3705	3645	3691			
220	EPR	1.033	1.048	1.068	1.090	1.118	1.153	1.209	1.297		
	MACH	.721	.746	.773	.800	.825	.840	.840	.839		
	KIAS	302	300	299	297	294	287	274	261		
	FF/ENG	3437	3429	3427	3425	3413	3372	3337	3416		
200	EPR	1.021	1.033	1.048	1.068	1.090	1.118	1.155	1.212	1.300	
	MACH	.695	.719	.745	.772	.799	.825	.840	.840	.839	
	KIAS	290	289	287	286	284	281	274	262	249	
	FF/ENG	3123	3108	3100	3098	3095	3085	3065	3054	3127	
180	EPR	1.009	1.020	1.032	1.047	1.066	1.089	1.117	1.153	1.208	1.293
	MACH	.667	.690	.714	.740	.768	.796	.822	.839	.840	.839
	KIAS	278	276	275	273	272	270	268	262	250	238
	FF/ENG	2881	2853	2834	2775	2772	2770	2779	2784	2773	2826
160	EPR	1.000	1.008	1.018	1.030	1.044	1.063	1.085	1.114	1.147	1.199
	MACH	.636	.659	.682	.707	.733	.761	.790	.817	.837	.841
	KIAS	264	263	261	260	259	257	256	254	249	239
	FF/ENG	2589	2558	2532	2463	2454	2449	2464	2494	2505	2500

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitude
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
283	262	243	226	213	200	191	182	174	167	161
567	524	485	453	425	400	382	366	351	337	324
851	786	729	680	638	600	573	549	526	505	486
1136	1050	974	908	851	800	764	732	701	673	648
1423	1314	1218	1136	1064	1000	956	914	876	842	810
1711	1580	1463	1364	1277	1200	1147	1097	1052	1010	972
2000	1846	1709	1592	1491	1400	1337	1279	1226	1177	1133
2290	2112	1954	1820	1704	1600	1528	1462	1401	1345	1295
2581	2380	2201	2049	1918	1800	1720	1645	1576	1513	1456
2874	2649	2449	2279	2132	2000	1910	1827	1751	1680	1617

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	3.6	0:39	3.1	0:37	2.6	0:36	2.3	0:35	2.0	0:34
400	7.6	1:14	6.8	1:11	5.9	1:06	5.3	1:04	4.8	1:01
600	11.5	1:50	10.5	1:44	9.1	1:37	8.4	1:33	7.6	1:29
800	15.4	2:26	14.2	2:18	12.4	2:09	11.4	2:03	10.4	1:57
1000	19.4	3:02	17.9	2:53	15.6	2:40	14.4	2:33	13.2	2:26
1200	23.3	3:38	21.5	3:27	18.8	3:12	17.4	3:03	16.0	2:54
1400	27.1	4:15	25.1	4:02	21.9	3:44	20.3	3:33	18.7	3:23
1600	31.0	4:53	28.7	4:37	25.1	4:16	23.2	4:03	21.5	3:51
1800	34.7	5:30	32.2	5:13	28.2	4:48	26.1	4:34	24.2	4:20
2000	38.5	6:08	35.7	5:49	31.2	5:21	29.0	5:04	26.9	4:49

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)							
	160	180	200	220	240	260	280	300
5	-0.3	-0.2	0.0	0.2	0.5	0.7	1.0	1.2
10	-0.7	-0.4	0.0	0.5	1.1	1.6	2.2	2.7
15	-1.1	-0.6	0.0	0.8	1.7	2.5	3.4	4.2
20	-1.6	-0.8	0.0	1.1	2.2	3.4	4.5	5.7
25	-2.0	-1.0	0.0	1.4	2.8	4.2	5.7	7.1
30	-2.5	-1.2	0.0	1.6	3.3	5.0	6.7	8.5
35	-3.0	-1.4	0.0	1.8	3.8	5.7	7.8	9.9
40	-3.4	-1.7	0.0	2.0	4.2	6.5	8.8	11.3

Long Range Cruise Enroute Fuel and Time - High Altitude
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
525	495	467	442	420	400	383	368	353	340	328
1045	985	931	883	840	800	767	737	709	683	659
1566	1477	1396	1324	1259	1200	1152	1107	1065	1026	991
2089	1970	1862	1766	1679	1600	1536	1476	1420	1369	1322
2614	2465	2329	2208	2100	2000	1920	1845	1776	1712	1653
3141	2961	2797	2651	2520	2400	2304	2215	2131	2054	1984
3670	3458	3265	3094	2941	2800	2688	2584	2486	2397	2315
4201	3957	3735	3538	3362	3200	3072	2952	2842	2739	2645
4734	4457	4206	3983	3783	3600	3456	3321	3196	3081	2975
5269	4959	4677	4428	4205	4000	3840	3690	3551	3423	3305
5806	5463	5151	4874	4627	4400	4223	4058	3905	3764	3634
6346	5968	5625	5321	5049	4800	4607	4426	4259	4104	3962
6888	6475	6100	5768	5471	5200	4990	4794	4612	4444	4290
7433	6984	6576	6216	5894	5600	5373	5161	4964	4783	4617
7981	7495	7054	6665	6317	6000	5756	5528	5316	5121	4943
8532	8008	7533	7114	6741	6400	6138	5894	5668	5460	5269
9086	8523	8013	7565	7165	6800	6521	6261	6020	5797	5594
9643	9041	8496	8017	7589	7200	6903	6627	6370	6134	5918
10204	9561	8980	8469	8014	7600	7285	6992	6721	6470	6241
10769	10084	9465	8922	8440	8000	7667	7357	7070	6806	6564

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37 & ABOVE	
	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	4.7	1:01	4.5	0:60	4.4	0:59	4.2	0:58	4.1	0:57
800	10.2	1:56	9.9	1:53	9.6	1:51	9.3	1:49	9.0	1:47
1200	15.6	2:52	15.1	2:48	14.7	2:44	14.3	2:40	13.9	2:38
1600	21.0	3:49	20.3	3:43	19.7	3:37	19.2	3:32	18.7	3:28
2000	26.4	4:45	25.4	4:38	24.7	4:31	24.0	4:24	23.5	4:19
2400	31.6	5:44	30.3	5:35	29.5	5:26	28.7	5:18	28.1	5:10
2800	36.7	6:42	35.3	6:31	34.3	6:21	33.4	6:11	32.6	6:02
3200	41.8	7:41	40.1	7:29	39.0	7:16	38.0	7:05	37.1	6:54
3600	46.7	8:41	44.9	8:27	43.6	8:13	42.4	7:60	41.5	7:47
4000	51.7	9:42	49.6	9:25	48.2	9:09	46.9	8:55	45.8	8:40
4400	56.4	10:44	54.2	10:25	52.7	10:08	51.3	9:51	50.1	9:35
4800	61.2	11:46	58.8	11:25	57.2	11:06	55.6	10:47	54.4	10:29
5200	65.8	12:49	63.3	12:26	61.6	12:05	59.9	11:45	58.5	11:24
5600	70.4	13:53	67.8	13:28	65.8	13:05	64.1	12:43	62.6	12:20
6000	74.9	14:57	72.2	14:30	70.1	14:05	68.2	13:41	66.7	13:16
6400	79.4	16:04	76.4	15:34	74.2	15:07	72.2	14:41	70.6	14:14
6800	83.9	17:11	80.7	16:39	78.3	16:09	76.2	15:40	74.4	15:11
7200	88.3	18:19	84.9	17:44	82.4	17:12	80.1	16:41	78.3	16:10
7600	92.6	19:28	89.0	18:50	86.3	18:16	83.9	17:43	82.0	17:09
8000	96.9	20:38	93.2	19:57	90.3	19:20	87.8	18:45	85.7	18:09

Long Range Cruise Enroute Fuel and Time - High Altitude Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)							
	160	180	200	220	240	260	280	300
10	-1.1	-0.5	0.0	0.6	2.1	6.3	12.7	21.3
20	-2.1	-1.1	0.0	1.1	4.0	9.5	17.3	27.5
30	-3.1	-1.6	0.0	1.7	5.7	12.3	21.4	32.9
40	-4.2	-2.1	0.0	2.4	7.4	14.9	24.9	37.5
50	-5.3	-2.7	0.0	3.1	8.8	17.1	28.0	41.4
60	-6.4	-3.2	0.0	3.8	10.2	19.1	30.5	44.5
70	-7.5	-3.8	0.0	4.5	11.4	20.7	32.6	46.8
80	-8.6	-4.3	0.0	5.1	12.4	22.1	34.1	48.4
90	-9.7	-4.9	0.0	5.6	13.4	23.2	35.1	49.2
100	-10.9	-5.4	0.0	6.1	14.1	24.0	35.7	49.2

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)						
	260	240	220	200	180	160	140
43				43	10	0	7
41			42	12	0	3	19
39		38	12	0	2	14	33
37	32	10	0	1	11	28	49
35	7	0	1	10	24	43	64
33	0	2	10	23	39	58	78
31	3	10	22	37	54	72	91
29	12	23	36	52	68	85	102
27	24	37	51	66	81	97	112
25	38	51	65	79	93	107	121

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 at .84/310/250 KIAS

PRESSURE ALT (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	93	100	107	114	119	124	130	136	142	148
TIME (MINUTES)	19	20	21	22	23	23	24	25	25	26

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
300	EPR	1.023	1.031	1.047	1.059	1.075	1.123	1.198			
	KIAS	260	260	262	277	302	306	311			
	FF/ENG	4350	4320	4190	4230	4440	4530	4710			
280	EPR	1.020	1.027	1.040	1.055	1.067	1.108	1.169	1.356		
	KIAS	251	251	253	261	286	295	299	279		
	FF/ENG	4060	4020	3890	3890	4060	4180	4300	4550		
260	EPR	1.017	1.023	1.034	1.052	1.063	1.092	1.145	1.265		
	KIAS	242	242	243	246	266	283	287	279		
	FF/ENG	3770	3720	3690	3580	3740	3830	3920	4060		
240	EPR	1.014	1.019	1.029	1.045	1.059	1.074	1.124	1.203		
	KIAS	232	233	234	235	247	272	275	279		
	FF/ENG	3560	3510	3460	3350	3380	3490	3560	3710		
220	EPR	1.011	1.015	1.024	1.037	1.055	1.066	1.105	1.167	1.357	
	KIAS	222	223	224	224	230	251	262	266	249	
	FF/ENG	3280	3230	3170	3140	3050	3160	3220	3310	3590	
200	EPR	1.006	1.010	1.018	1.030	1.048	1.061	1.084	1.138	1.249	
	KIAS	215	215	215	215	215	229	249	253	249	
	FF/ENG	3010	2960	2890	2850	2760	2800	2880	2950	3130	
180	EPR	1.002	1.005	1.011	1.020	1.034	1.056	1.113	1.186	1.289	
	KIAS	208	208	208	208	208	209	230	239	242	232
	FF/ENG	2810	2690	2630	2580	2550	2470	2570	2600	2770	2870
160	EPR	0.997	0.999	1.003	1.009	1.021	1.038	1.062	1.088	1.147	1.202
	KIAS	203	203	203	203	203	203	206	224	227	229
	FF/ENG	2570	2510	2390	2330	2290	2270	2220	2320	2440	2560
140	EPR	0.991	0.992	0.994	0.998	1.006	1.017	1.035	1.068	1.115	1.154
	KIAS	203	203	203	203	203	203	203	203	211	213
	FF/ENG	2400	2330	2250	2130	2090	2050	1980	1980	2100	2170

This table includes 5% additional fuel for holding in a racetrack pattern.

Flaps 1

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight

Advisory Information

Chapter PI

Section 22

ADVISORY INFORMATION

Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

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	VREF ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1195	30/-5	25	-40/145	10/-10	25/-25	40	10	30
AUTOBRAKE MAX	1530	25/-5	30	-60/200	0/0	35/-35	75	0	0
AUTOBRAKE 4	1850	30/-10	45	-80/280	0/-5	45/-45	90	0	0
AUTOBRAKE 3	2170	35/-10	50	-105/350	10/-10	60/-60	110	0	0
AUTOBRAKE 2	2405	45/-25	65	-115/410	15/-35	65/-65	110	5	5
AUTOBRAKE 1	2580	50/-30	75	-130/455	45/-65	70/-70	100	105	105

Good Reported Braking Action

MAX MANUAL	1580	25/-10	35	-70/245	35/-30	35/-35	60	65	145
AUTOBRAKE MAX	1670	30/-10	40	-75/260	30/-25	35/-35	70	65	150
AUTOBRAKE 4	1855	30/-10	45	-80/290	10/-5	45/-45	90	5	30
AUTOBRAKE 3	2170	35/-10	50	-105/350	10/-10	60/-60	110	0	0
AUTOBRAKE 2	2405	45/-25	65	-115/410	15/-35	65/-65	110	5	5
AUTOBRAKE 1	2580	50/-30	75	-130/455	45/-65	70/-70	100	105	105

Good To Medium Reported Braking Action

MAX MANUAL	1820	30/-15	45	-90/325	60/-50	40/-40	65	125	295
AUTOBRAKE MAX	1870	35/-15	50	-90/335	55/-40	40/-40	80	120	295
AUTOBRAKE 4	1975	35/-15	50	-95/350	50/-35	50/-50	85	100	245
AUTOBRAKE 3	2220	35/-15	55	-110/390	35/-25	60/-60	110	45	165
AUTOBRAKE 2	2435	45/-25	65	-120/435	35/-45	65/-65	110	30	105
AUTOBRAKE 1	2595	50/-30	75	-135/470	60/-70	70/-70	100	115	160

Medium Reported Braking Action

MAX MANUAL	2060	40/-25	60	-110/405	85/-70	45/-45	75	185	450
AUTOBRAKE MAX	2075	40/-15	60	-110/410	80/-60	45/-45	85	175	445
AUTOBRAKE 4	2095	40/-15	60	-110/410	85/-65	50/-50	80	190	460
AUTOBRAKE 3	2275	40/-15	60	-120/430	60/-35	60/-60	110	90	330
AUTOBRAKE 2	2465	45/-25	65	-125/460	50/-50	65/-65	110	50	205
AUTOBRAKE 1	2610	50/-30	75	-140/490	75/-75	70/-70	100	125	215

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	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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

Medium To Poor Reported Braking Action

MAX MANUAL	2325	45/-30	70	-135/520	145/-100	55/-55	80	290	770
AUTOBRAKE MAX	2335	50/-25	70	-135/520	140/-95	55/-55	85	285	765
AUTOBRAKE 4	2355	50/-25	70	-135/520	145/-100	60/-60	85	295	780
AUTOBRAKE 3	2455	50/-25	70	-140/535	130/-75	60/-60	105	245	710
AUTOBRAKE 2	2600	50/-30	70	-145/555	110/-85	65/-65	110	175	600
AUTOBRAKE 1	2715	55/-30	80	-155/580	125/-100	70/-70	100	225	565

Poor Reported Braking Action

MAX MANUAL	2590	50/-35	80	-160/635	200/-130	65/-65	85	395	1085
AUTOBRAKE MAX	2595	60/-35	80	-160/635	200/-130	65/-65	85	395	1085
AUTOBRAKE 4	2615	60/-35	80	-160/635	200/-140	65/-65	85	405	1100
AUTOBRAKE 3	2635	60/-30	80	-160/640	200/-115	65/-65	100	395	1095
AUTOBRAKE 2	2735	60/-35	80	-165/650	175/-115	70/-70	110	300	990
AUTOBRAKE 1	2820	60/-35	85	-175/665	180/-125	70/-70	100	330	920

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 70 m.

For autobrake and manual speedbrakes, increase reference landing distance by 60 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV NO REV

Dry Runway

MAX MANUAL	1240	30/-10	25	-40/150	10/-10	25/-25	40	15	35
AUTOBRAKE MAX	1625	25/-15	35	-65/205	0/0	35/-35	75	0	0
AUTOBRAKE 4	1975	35/-25	45	-85/295	0/-5	45/-45	100	0	0
AUTOBRAKE 3	2330	40/-30	60	-110/360	10/-10	65/-65	115	0	0
AUTOBRAKE 2	2565	50/-40	70	-120/420	30/-45	70/-70	105	35	35
AUTOBRAKE 1	2725	60/-45	80	-140/470	60/-70	70/-70	100	165	175

Good Reported Braking Action

MAX MANUAL	1645	30/-15	40	-70/255	35/-30	35/-35	60	75	165
AUTOBRAKE MAX	1750	30/-15	40	-75/265	30/-30	40/-40	70	80	180
AUTOBRAKE 4	1980	35/-25	45	-85/300	10/-5	45/-45	100	5	30
AUTOBRAKE 3	2330	40/-30	60	-110/360	10/-10	65/-65	115	0	0
AUTOBRAKE 2	2565	50/-40	70	-120/420	30/-45	70/-70	105	35	35
AUTOBRAKE 1	2725	60/-45	80	-140/470	60/-70	70/-70	100	165	175

Good To Medium Reported Braking Action

MAX MANUAL	1900	35/-25	50	-90/335	60/-50	45/-45	65	140	350
AUTOBRAKE MAX	1960	35/-25	50	-90/340	55/-45	45/-45	80	140	350
AUTOBRAKE 4	2090	35/-25	50	-100/355	50/-30	50/-50	90	105	280
AUTOBRAKE 3	2380	45/-30	60	-115/405	35/-25	65/-65	115	45	175
AUTOBRAKE 2	2595	50/-40	70	-125/450	45/-55	70/-70	105	60	140
AUTOBRAKE 1	2735	60/-45	80	-140/485	70/-75	70/-70	100	180	230

Medium Reported Braking Action

MAX MANUAL	2155	40/-35	60	-110/415	85/-70	50/-50	75	205	530
AUTOBRAKE MAX	2170	40/-30	60	-110/415	80/-65	50/-50	85	200	520
AUTOBRAKE 4	2200	40/-30	60	-115/415	85/-60	50/-50	85	205	535
AUTOBRAKE 3	2430	45/-30	65	-120/450	60/-40	65/-65	115	90	350
AUTOBRAKE 2	2625	50/-40	75	-130/475	65/-65	70/-70	105	80	245
AUTOBRAKE 1	2750	60/-45	80	-145/500	85/-80	75/-75	100	195	290

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 25**

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	2430	50/-40	70	-140/530	145/-100	60/-60	80	330	900
AUTOBRAKE MAX	2440	50/-35	70	-140/530	145/-100	60/-60	85	325	895
AUTOBRAKE 4	2465	50/-35	70	-140/530	145/-100	60/-60	85	330	910
AUTOBRAKE 3	2600	50/-35	75	-145/550	125/-75	65/-65	110	260	805
AUTOBRAKE 2	2755	55/-45	80	-150/570	120/-90	70/-70	105	205	690
AUTOBRAKE 1	2860	60/-50	85	-160/590	140/-105	75/-75	100	295	680

Poor Reported Braking Action

MAX MANUAL	2705	60/-45	80	-165/645	200/-130	65/-65	85	450	1270
AUTOBRAKE MAX	2710	60/-45	85	-165/645	205/-140	70/-70	85	450	1270
AUTOBRAKE 4	2730	60/-45	85	-165/645	200/-140	70/-70	85	455	1280
AUTOBRAKE 3	2770	60/-40	85	-165/650	195/-110	70/-70	110	425	1260
AUTOBRAKE 2	2890	60/-45	85	-175/665	180/-120	75/-75	105	335	1135
AUTOBRAKE 1	2970	65/-50	90	-180/680	190/-130	75/-75	100	395	1075

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 70 m.

For autobrake and manual speedbrakes, increase reference landing distance by 60 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (M)							
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV NO REV

Dry Runway

MAX MANUAL	1285	35/-15	25	-45/150	10/-10	25/-25	40	15	40
AUTOBRAKE MAX	1695	30/-25	35	-65/215	0/0	35/-35	75	0	0
AUTOBRAKE 4	2080	35/-35	50	-85/300	0/-5	50/-50	105	0	0
AUTOBRAKE 3	2465	45/-40	65	-110/380	5/-10	65/-65	120	0	0
AUTOBRAKE 2	2725	50/-50	75	-125/435	25/-45	75/-75	115	35	35
AUTOBRAKE 1	2895	65/-60	85	-145/490	60/-75	75/-75	110	165	175

Good Reported Braking Action

MAX MANUAL	1720	30/-25	40	-75/260	40/-35	35/-40	60	85	195
AUTOBRAKE MAX	1825	30/-30	45	-75/270	35/-30	40/-40	70	85	205
AUTOBRAKE 4	2085	35/-35	50	-90/310	5/-5	50/-50	105	5	35
AUTOBRAKE 3	2465	45/-40	65	-110/380	5/-10	65/-65	120	0	0
AUTOBRAKE 2	2725	50/-50	75	-125/435	25/-45	75/-75	115	35	35
AUTOBRAKE 1	2895	65/-60	85	-145/490	60/-75	75/-75	110	165	175

Good To Medium Reported Braking Action

MAX MANUAL	1995	35/-30	50	-95/340	65/-55	45/-45	65	165	410
AUTOBRAKE MAX	2055	35/-35	55	-95/350	65/-50	50/-50	80	160	410
AUTOBRAKE 4	2200	40/-35	60	-105/370	45/-35	55/-55	100	120	330
AUTOBRAKE 3	2515	45/-40	65	-120/420	30/-25	65/-65	120	50	215
AUTOBRAKE 2	2750	50/-50	80	-130/465	45/-55	75/-75	115	60	160
AUTOBRAKE 1	2910	65/-60	90	-145/505	70/-80	80/-80	110	180	240

Medium Reported Braking Action

MAX MANUAL	2270	45/-40	65	-115/425	90/-75	50/-50	75	240	620
AUTOBRAKE MAX	2280	45/-40	65	-115/425	90/-70	60/-60	85	230	610
AUTOBRAKE 4	2320	45/-40	65	-115/425	85/-65	60/-60	90	235	625
AUTOBRAKE 3	2565	45/-40	70	-125/460	50/-40	65/-70	120	105	425
AUTOBRAKE 2	2780	50/-50	80	-140/490	65/-65	75/-75	115	80	290
AUTOBRAKE 1	2925	65/-60	90	-150/520	85/-85	80/-80	110	195	305

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	2565	55/-50	80	-145/545	150/-110	60/-60	80	380	1060
AUTOBRAKE MAX	2575	55/-50	80	-145/545	155/-105	65/-65	85	375	1060
AUTOBRAKE 4	2600	55/-50	80	-145/545	150/-105	65/-65	90	380	1070
AUTOBRAKE 3	2750	55/-50	80	-150/565	125/-80	70/-70	115	295	955
AUTOBRAKE 2	2920	60/-55	85	-160/585	125/-95	80/-80	115	230	825
AUTOBRAKE 1	3035	65/-60	95	-165/605	140/-115	80/-80	110	310	785

Poor Reported Braking Action

MAX MANUAL	2860	65/-60	90	-175/660	215/-145	70/-70	85	520	1500
AUTOBRAKE MAX	2865	65/-60	90	-175/660	220/-145	70/-70	85	520	1505
AUTOBRAKE 4	2885	65/-60	90	-175/660	215/-145	70/-70	90	525	1520
AUTOBRAKE 3	2935	65/-60	90	-175/665	200/-120	75/-75	110	490	1490
AUTOBRAKE 2	3055	65/-60	90	-180/685	185/-125	80/-80	115	380	1365
AUTOBRAKE 1	3150	70/-65	100	-185/695	195/-145	80/-80	110	425	1265

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 75 m.

For autobrake and manual speedbrakes, increase reference landing distance by 60 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1355	30/-15	30	-45/155	15/-15	25/-25	N/A	30	65
AUTOBRAKE MAX	1600	25/-20	35	-60/200	0/0	35/-35	N/A	0	0
AUTOBRAKE 2	2670	50/-45	75	-120/405	5/-25	75/-75	N/A	10	10

Good Reported Braking Action

MAX MANUAL	1815	30/-25	45	-75/260	45/-40	40/-40	N/A	115	275
AUTOBRAKE MAX	1820	30/-30	45	-75/260	40/-35	40/-45	N/A	115	270
AUTOBRAKE 2	2670	50/-45	75	-120/405	5/-25	75/-75	N/A	10	10

Good To Medium Reported Braking Action

MAX MANUAL	2090	40/-35	60	-95/335	75/-60	50/-50	N/A	215	550
AUTOBRAKE MAX	2090	40/-40	60	-95/335	75/-60	50/-55	N/A	210	545
AUTOBRAKE 2	2700	50/-50	75	-125/435	30/-35	75/-75	N/A	45	250

Medium Reported Braking Action

MAX MANUAL	2365	45/-40	70	-115/410	105/-80	60/-60	N/A	310	825
AUTOBRAKE MAX	2360	45/-45	70	-115/410	110/-85	60/-60	N/A	305	820
AUTOBRAKE 3	2505	45/-40	70	-120/425	75/-35	65/-65	N/A	195	715

Medium To Poor Reported Braking Action

MAX MANUAL	2655	55/-50	85	-140/520	165/-115	70/-70	N/A	470	1380
AUTOBRAKE MAX	2655	55/-55	85	-140/520	175/-125	70/-70	N/A	465	1380
AUTOBRAKE 3	2740	55/-50	85	-145/530	150/-90	70/-70	N/A	405	1325

Poor Reported Braking Action

MAX MANUAL	2945	65/-60	100	-165/625	225/-150	75/-75	N/A	625	1930
AUTOBRAKE MAX	2950	65/-60	100	-165/625	235/-160	75/-75	N/A	625	1935
AUTOBRAKE 3	2970	65/-55	100	-165/630	225/-140	75/-75	N/A	615	1930

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ANTISKID (Flaps 25)****VREF25**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1870	35/-30	50	-95/360	75/-60	45/-45	60	180	460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1870	35/-30	50	-95/360	75/-60	45/-45	60	180	460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	2110	45/-35	60	-120/460	125/-90	50/-50	65	285	785
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2350	50/-40	70	-145/560	175/-115	55/-55	70	390	1105
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	2755	65/-50	90	-200/835	400/-200	65/-65	75	725	2735
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3160	75/-60	110	-250/1110	625/-280	75/-75	80	1055	4365
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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1790	35/-20	50	-95/350	75/-60	40/-40	65	160	390
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1790	35/-20	50	-95/350	75/-60	40/-40	65	160	390
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	2020	40/-25	60	-120/450	125/-90	50/-50	70	255	670
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2250	45/-30	70	-140/550	175/-115	55/-55	70	345	945
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	2650	60/-40	85	-195/825	395/-195	65/-65	75	655	2405
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3045	70/-50	100	-245/1095	615/-275	75/-75	80	965	3860
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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R (Flaps 20)****VREF20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-15	20	-40/135	15/-10	20/-20	35	0	20
AUTOBRAKE MAX	1470	25/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2390	45/-40	65	-110/380	10/-10	65/-65	125	0	0

Good Reported Braking Action

MAX MANUAL	1555	25/-25	35	-70/235	40/-35	35/-35	55	0	95
AUTOBRAKE MAX	1645	25/-25	40	-70/245	35/-30	40/-40	65	0	100
AUTOBRAKE 2	2390	45/-40	65	-110/380	10/-10	65/-65	125	0	0

Good To Medium Reported Braking Action

MAX MANUAL	1850	35/-35	50	-90/320	75/-60	45/-45	65	0	205
AUTOBRAKE MAX	1895	35/-35	50	-90/325	70/-55	50/-50	75	0	205
AUTOBRAKE 2	2430	45/-45	70	-120/410	35/-25	65/-65	125	0	80

Medium Reported Braking Action

MAX MANUAL	2140	40/-40	60	-110/400	105/-85	55/-55	75	0	310
AUTOBRAKE MAX	2145	40/-40	60	-110/400	105/-75	55/-55	85	0	305
AUTOBRAKE 3	2285	45/-40	65	-115/415	80/-50	60/-60	105	0	250

Medium To Poor Reported Braking Action

MAX MANUAL	2490	50/-50	75	-140/525	190/-130	65/-65	85	0	545
AUTOBRAKE MAX	2495	55/-50	75	-140/525	190/-125	65/-65	90	0	540
AUTOBRAKE 3	2580	55/-50	80	-145/535	180/-115	70/-70	100	0	520

Poor Reported Braking Action

MAX MANUAL	2835	60/-55	90	-170/650	270/-170	75/-75	90	0	775
AUTOBRAKE MAX	2840	65/-60	90	-170/650	275/-175	75/-75	90	0	775
AUTOBRAKE 3	2875	65/-60	90	-175/655	275/-175	75/-75	90	0	785

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-5	20	-35/125	10/-10	20/-20	35	0	15
AUTOBRAKE MAX	1330	20/-5	25	-50/175	0/0	30/-30	60	0	0
AUTOBRAKE 2	2090	40/-10	55	-105/355	10/-10	55/-55	115	0	0

Good Reported Braking Action

MAX MANUAL	1405	20/-10	30	-65/225	35/-30	30/-30	55	0	65
AUTOBRAKE MAX	1495	25/-10	35	-65/235	30/-25	35/-35	65	0	70
AUTOBRAKE 2	2090	40/-10	55	-105/355	10/-10	55/-55	115	0	0

Good To Medium Reported Braking Action

MAX MANUAL	1660	30/-15	40	-85/305	65/-55	40/-40	65	0	140
AUTOBRAKE MAX	1705	30/-15	45	-85/310	60/-45	45/-45	75	0	145
AUTOBRAKE 2	2130	40/-15	60	-110/385	35/-20	55/-55	115	0	60

Medium Reported Braking Action

MAX MANUAL	1910	35/-20	50	-105/380	95/-75	45/-45	70	0	215
AUTOBRAKE MAX	1915	35/-15	50	-105/380	90/-65	50/-50	80	0	215
AUTOBRAKE 3	2025	40/-15	55	-110/390	75/-45	50/-50	95	0	180

Medium To Poor Reported Braking Action

MAX MANUAL	2210	45/-30	65	-135/500	170/-115	55/-55	80	0	380
AUTOBRAKE MAX	2215	45/-25	65	-135/500	170/-110	60/-60	85	0	380
AUTOBRAKE 3	2285	50/-25	65	-135/505	160/-100	60/-60	90	0	365

Poor Reported Braking Action

MAX MANUAL	2505	55/-35	75	-160/615	240/-150	65/-65	85	0	540
AUTOBRAKE MAX	2510	55/-35	75	-160/615	245/-155	65/-65	85	0	540
AUTOBRAKE 3	2540	55/-35	75	-160/615	245/-155	65/-65	85	0	545

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAP / SLAT CONTROL (Flaps 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1105	30/-15	20	-40/130	10/-10	20/-20	35	15	35
AUTOBRAKE MAX	1470	25/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2350	45/-45	65	-110/375	25/-45	60/-60	95	40	40

Good Reported Braking Action

MAX MANUAL	1485	25/-20	35	-65/225	30/-30	30/-30	50	70	165
AUTOBRAKE MAX	1575	25/-25	35	-65/235	30/-25	35/-35	60	75	175
AUTOBRAKE 2	2350	45/-45	65	-110/375	25/-45	60/-60	95	40	40

Good To Medium Reported Braking Action

MAX MANUAL	1720	35/-30	45	-85/295	55/-50	40/-40	60	135	340
AUTOBRAKE MAX	1770	35/-30	45	-85/300	55/-40	40/-40	70	135	340
AUTOBRAKE 2	2375	45/-45	70	-115/400	40/-55	65/-65	95	60	140

Medium Reported Braking Action

MAX MANUAL	1950	40/-35	55	-100/365	80/-65	45/-45	65	200	515
AUTOBRAKE MAX	1960	40/-35	55	-100/365	75/-55	45/-45	75	195	505
AUTOBRAKE 3	2220	40/-35	60	-110/400	50/-35	55/-55	100	80	335

Medium To Poor Reported Braking Action

MAX MANUAL	2200	50/-45	65	-125/470	130/-95	55/-55	70	315	875
AUTOBRAKE MAX	2210	50/-45	70	-125/470	130/-90	55/-55	75	315	875
AUTOBRAKE 3	2370	50/-40	70	-130/490	115/-70	60/-60	100	240	780

Poor Reported Braking Action

MAX MANUAL	2450	55/-50	75	-145/570	180/-120	60/-60	75	430	1235
AUTOBRAKE MAX	2455	55/-50	80	-145/570	185/-125	60/-60	75	430	1240
AUTOBRAKE 3	2520	55/-45	75	-150/575	175/-100	65/-65	95	400	1220

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≤ 5)

VREF30 + 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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1325	40/-10	30	-45/155	15/-15	25/-25	40	30	70
AUTOBRAKE MAX	1860	25/-5	45	-65/215	0/0	45/-45	75	0	0
AUTOBRAKE 2	3015	55/-40	95	-130/430	50/-70	85/-85	105	190	190

Good Reported Braking Action

MAX MANUAL	1745	25/-15	45	-70/240	35/-30	40/-40	50	110	270
AUTOBRAKE MAX	1925	30/-10	50	-75/260	15/-10	45/-45	75	75	245
AUTOBRAKE 2	3015	55/-40	95	-130/430	50/-70	85/-85	105	190	190

Good To Medium Reported Braking Action

MAX MANUAL	2040	35/-20	60	-90/320	65/-50	50/-50	60	215	570
AUTOBRAKE MAX	2145	40/-20	60	-95/330	50/-40	55/-55	75	195	550
AUTOBRAKE 2	3040	60/-40	95	-135/455	65/-80	85/-85	105	210	330

Medium Reported Braking Action

MAX MANUAL	2335	45/-25	70	-110/395	90/-70	60/-60	65	315	865
AUTOBRAKE MAX	2365	45/-25	70	-110/395	80/-65	60/-60	75	310	850
AUTOBRAKE 3	2885	50/-30	85	-130/455	50/-60	80/-80	110	120	495

Medium To Poor Reported Braking Action

MAX MANUAL	2645	55/-35	85	-135/505	145/-105	70/-70	75	490	1505
AUTOBRAKE MAX	2670	55/-35	85	-135/505	145/-100	70/-70	80	490	1500
AUTOBRAKE 3	3025	60/-35	95	-150/545	115/-90	85/-85	110	330	1265

Poor Reported Braking Action

MAX MANUAL	2955	65/-40	100	-160/610	200/-135	75/-75	80	665	2140
AUTOBRAKE MAX	2970	65/-40	100	-160/610	205/-135	75/-75	85	670	2150
AUTOBRAKE 3	3160	65/-40	100	-165/630	175/-115	85/-85	105	535	2030

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAPS DRIVE (5 < Flaps < 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1170	30/-5	25	-40/135	15/-10	20/-20	35	20	45
AUTOBRAKE MAX	1580	25/-5	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2565	50/-30	75	-115/395	25/-45	70/-70	105	65	65

Good Reported Braking Action

MAX MANUAL	1580	25/-10	40	-65/230	35/-30	35/-35	50	90	215
AUTOBRAKE MAX	1675	25/-10	40	-70/240	30/-20	40/-40	65	95	225
AUTOBRAKE 2	2565	50/-30	75	-115/395	25/-45	70/-70	105	65	65

Good To Medium Reported Braking Action

MAX MANUAL	1835	35/-20	50	-85/305	60/-50	45/-45	60	175	450
AUTOBRAKE MAX	1890	35/-15	50	-90/310	60/-45	45/-45	70	175	450
AUTOBRAKE 2	2590	50/-30	75	-120/420	40/-55	70/-70	105	85	200

Medium Reported Braking Action

MAX MANUAL	2090	40/-25	60	-105/375	85/-65	50/-50	65	255	680
AUTOBRAKE MAX	2105	40/-20	60	-105/380	85/-65	50/-50	75	250	675
AUTOBRAKE 3	2430	40/-20	65	-115/420	40/-40	65/-65	105	90	455

Medium To Poor Reported Braking Action

MAX MANUAL	2365	50/-30	75	-130/480	140/-100	60/-60	75	400	1170
AUTOBRAKE MAX	2380	50/-30	75	-130/485	140/-100	60/-60	80	400	1175
AUTOBRAKE 3	2585	50/-25	75	-135/510	105/-75	70/-70	100	290	1045

Poor Reported Braking Action

MAX MANUAL	2635	55/-35	85	-150/585	190/-130	65/-65	80	540	1660
AUTOBRAKE MAX	2650	60/-35	85	-155/585	195/-130	65/-65	80	545	1670
AUTOBRAKE 3	2740	55/-30	85	-155/595	170/-110	70/-70	95	490	1630

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≥ 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1115	30/-15	20	-40/130	10/-10	20/-20	35	15	35
AUTOBRAKE MAX	1470	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2365	45/-45	65	-110/380	20/-40	65/-65	100	30	30

Good Reported Braking Action

MAX MANUAL	1495	25/-20	35	-65/225	35/-30	30/-35	50	75	170
AUTOBRAKE MAX	1585	25/-25	40	-65/235	30/-25	35/-35	60	75	180
AUTOBRAKE 2	2365	45/-45	65	-110/380	20/-40	65/-65	100	30	30

Good To Medium Reported Braking Action

MAX MANUAL	1735	35/-30	45	-85/300	60/-50	40/-40	60	145	355
AUTOBRAKE MAX	1785	35/-30	50	-85/305	55/-45	45/-45	70	140	355
AUTOBRAKE 2	2390	45/-45	70	-115/405	40/-50	65/-65	100	50	140

Medium Reported Braking Action

MAX MANUAL	1970	40/-35	55	-100/370	80/-65	45/-45	65	210	540
AUTOBRAKE MAX	1980	40/-35	55	-100/370	80/-60	50/-50	75	200	530
AUTOBRAKE 3	2230	40/-35	60	-110/400	45/-35	55/-60	105	90	370

Medium To Poor Reported Braking Action

MAX MANUAL	2230	50/-45	70	-125/475	135/-95	55/-55	70	330	925
AUTOBRAKE MAX	2235	50/-45	70	-125/475	135/-95	55/-55	75	325	920
AUTOBRAKE 3	2390	50/-45	70	-130/490	110/-70	60/-65	100	260	835

Poor Reported Braking Action

MAX MANUAL	2485	55/-50	80	-150/575	185/-125	60/-60	75	450	1305
AUTOBRAKE MAX	2490	55/-50	80	-150/575	190/-125	60/-60	75	450	1310
AUTOBRAKE 3	2550	55/-50	80	-150/580	175/-105	65/-65	95	425	1295

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS PRIMARY FAIL (Flaps 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1235	25/-15	25	-45/145	15/-15	25/-25	45	20	45
AUTOBRAKE MAX	1470	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2405	45/-45	65	-115/385	0/-20	65/-65	120	5	5

Good Reported Braking Action

MAX MANUAL	1635	25/-25	40	-70/240	40/-35	35/-35	60	90	210
AUTOBRAKE MAX	1650	30/-25	40	-70/245	35/-30	35/-35	70	85	205
AUTOBRAKE 2	2405	45/-45	65	-115/385	0/-20	65/-65	120	5	5

Good To Medium Reported Braking Action

MAX MANUAL	1885	35/-35	50	-90/315	65/-55	45/-45	70	170	430
AUTOBRAKE MAX	1885	35/-35	50	-90/315	65/-55	45/-45	75	165	425
AUTOBRAKE 2	2435	45/-45	65	-120/410	25/-30	65/-65	120	30	175

Medium Reported Braking Action

MAX MANUAL	2130	40/-40	60	-105/390	90/-70	50/-50	75	245	645
AUTOBRAKE MAX	2120	40/-40	60	-105/385	95/-75	50/-50	80	245	640
AUTOBRAKE 3	2265	40/-35	60	-115/405	60/-35	60/-60	110	140	545

Medium To Poor Reported Braking Action

MAX MANUAL	2400	50/-50	75	-130/495	150/-105	60/-60	85	380	1100
AUTOBRAKE MAX	2395	50/-50	75	-130/490	155/-110	60/-60	85	380	1100
AUTOBRAKE 3	2475	50/-45	75	-135/505	130/-80	65/-65	105	325	1050

Poor Reported Braking Action

MAX MANUAL	2665	60/-55	85	-155/595	205/-135	65/-65	90	515	1550
AUTOBRAKE MAX	2665	60/-55	85	-155/595	210/-140	65/-65	90	515	1555
AUTOBRAKE 3	2685	60/-50	85	-155/600	200/-125	70/-70	100	510	1555

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLIGHT CONTROL MODE (Flaps 20)****VREF20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1260	25/-15	25	-45/150	15/-15	25/-25	50	25	50
AUTOBRAKE MAX	1470	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2410	45/-40	65	-115/385	0/-10	65/-65	130	0	0

Good Reported Braking Action

MAX MANUAL	1680	30/-25	40	-70/250	40/-35	35/-35	65	100	235
AUTOBRAKE MAX	1675	30/-25	40	-70/245	35/-30	40/-40	70	95	225
AUTOBRAKE 2	2410	45/-40	65	-115/385	0/-10	65/-65	130	0	0

Good To Medium Reported Braking Action

MAX MANUAL	1940	40/-35	55	-90/325	70/-55	45/-45	75	190	485
AUTOBRAKE MAX	1935	40/-35	55	-90/320	70/-60	50/-50	80	185	475
AUTOBRAKE 2	2445	45/-45	65	-120/410	25/-25	65/-65	130	35	235

Medium Reported Braking Action

MAX MANUAL	2200	45/-40	65	-110/395	95/-75	55/-55	85	275	735
AUTOBRAKE MAX	2190	45/-40	65	-110/395	105/-85	55/-55	85	270	725
AUTOBRAKE 3	2285	45/-40	65	-115/410	75/-35	60/-60	110	200	665

Medium To Poor Reported Braking Action

MAX MANUAL	2480	55/-50	80	-135/505	155/-110	65/-65	90	425	1260
AUTOBRAKE MAX	2475	55/-50	80	-135/505	165/-120	65/-65	90	425	1255
AUTOBRAKE 3	2525	55/-50	80	-140/510	150/-85	65/-65	110	390	1225

Poor Reported Braking Action

MAX MANUAL	2755	65/-55	90	-160/610	215/-145	70/-70	95	575	1780
AUTOBRAKE MAX	2760	65/-55	90	-160/610	225/-150	70/-70	95	575	1785
AUTOBRAKE 3	2765	65/-55	90	-160/610	225/-135	70/-70	105	575	1785

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLIGHT CONTROLS (Flaps 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1370	25/-5	30	-45/160	20/-20	30/-30	60	40	90
AUTOBRAKE MAX	1580	25/-5	35	-60/195	0/0	35/-35	70	0	10
AUTOBRAKE 2	2630	45/-20	70	-120/405	0/-20	75/-75	130	0	0

Good Reported Braking Action

MAX MANUAL	1850	30/-10	50	-75/265	55/-45	45/-45	80	145	360
AUTOBRAKE MAX	1850	30/-10	50	-75/265	50/-45	45/-45	85	135	345
AUTOBRAKE 2	2630	45/-20	70	-120/405	0/-20	75/-75	130	0	0

Good To Medium Reported Braking Action

MAX MANUAL	2130	40/-20	65	-95/345	85/-70	55/-55	90	255	685
AUTOBRAKE MAX	2130	40/-20	65	-95/345	85/-70	55/-55	90	250	680
AUTOBRAKE 2	2670	50/-20	75	-125/430	30/-35	75/-75	130	60	375

Medium Reported Braking Action

MAX MANUAL	2405	50/-25	75	-115/420	115/-90	60/-60	95	365	1010
AUTOBRAKE MAX	2405	50/-25	75	-115/420	120/-95	60/-60	95	365	1010
AUTOBRAKE 3	2505	50/-15	70	-120/430	85/-45	65/-65	115	295	950

Medium To Poor Reported Braking Action

MAX MANUAL	2690	60/-35	90	-145/530	180/-125	70/-70	100	535	1630
AUTOBRAKE MAX	2695	60/-35	90	-145/530	185/-130	70/-70	100	535	1635
AUTOBRAKE 3	2745	60/-25	90	-145/535	165/-95	75/-70	115	500	1605

Poor Reported Braking Action

MAX MANUAL	2975	70/-40	105	-170/635	240/-160	75/-75	100	700	2250
AUTOBRAKE MAX	2985	70/-40	105	-170/635	245/-165	75/-75	100	705	2260
AUTOBRAKE 3	2985	70/-35	105	-170/635	245/-145	80/-75	110	705	2260

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS C (Flaps 20)

VREF20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1235	25/-15	25	-45/145	15/-15	25/-25	45	20	45
AUTOBRAKE MAX	1470	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2405	45/-45	65	-115/385	0/-20	65/-65	120	5	5

Good Reported Braking Action

MAX MANUAL	1635	25/-25	40	-70/240	40/-35	35/-35	60	90	210
AUTOBRAKE MAX	1650	30/-25	40	-70/245	35/-30	35/-35	70	85	205
AUTOBRAKE 2	2405	45/-45	65	-115/385	0/-20	65/-65	120	5	5

Good To Medium Reported Braking Action

MAX MANUAL	1885	35/-35	50	-90/315	65/-55	45/-45	70	170	430
AUTOBRAKE MAX	1885	35/-35	50	-90/315	65/-55	45/-45	75	165	425
AUTOBRAKE 2	2435	45/-45	65	-120/410	25/-30	65/-65	120	30	175

Medium Reported Braking Action

MAX MANUAL	2130	40/-40	60	-105/390	90/-70	50/-50	75	245	645
AUTOBRAKE MAX	2120	40/-40	60	-105/385	95/-75	50/-50	80	245	640
AUTOBRAKE 3	2265	40/-35	60	-115/405	60/-35	60/-60	110	140	545

Medium To Poor Reported Braking Action

MAX MANUAL	2400	50/-50	75	-130/495	150/-105	60/-60	85	380	1100
AUTOBRAKE MAX	2395	50/-50	75	-130/490	155/-110	60/-60	85	380	1100
AUTOBRAKE 3	2475	50/-45	75	-135/505	130/-80	65/-65	105	325	1050

Poor Reported Braking Action

MAX MANUAL	2665	60/-55	85	-155/595	205/-135	65/-65	90	515	1550
AUTOBRAKE MAX	2665	60/-55	85	-155/595	210/-140	65/-65	90	515	1555
AUTOBRAKE 3	2685	60/-50	85	-155/600	200/-125	70/-70	100	510	1555

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L (Flaps 25)****VREF25**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-10	20	-40/140	15/-15	20/-20	40	0	20
AUTOBRAKE MAX	1410	20/-15	30	-55/180	0/0	30/-30	65	0	0
AUTOBRAKE 2	2280	40/-30	60	-110/370	0/-10	60/-60	120	0	0

Good Reported Braking Action

MAX MANUAL	1575	25/-20	40	-70/245	45/-35	35/-35	60	0	100
AUTOBRAKE MAX	1635	25/-20	40	-70/250	35/-30	40/-40	70	0	105
AUTOBRAKE 2	2280	40/-30	60	-110/370	0/-10	60/-60	120	0	0

Good To Medium Reported Braking Action

MAX MANUAL	1880	35/-25	50	-95/335	85/-65	45/-45	75	0	220
AUTOBRAKE MAX	1910	35/-25	50	-95/335	80/-65	50/-50	80	0	225
AUTOBRAKE 2	2335	45/-30	65	-120/410	35/-25	65/-65	120	0	110

Medium Reported Braking Action

MAX MANUAL	2180	40/-30	60	-115/420	120/-90	55/-55	85	0	340
AUTOBRAKE MAX	2180	40/-30	60	-115/420	125/-95	55/-55	85	0	340
AUTOBRAKE 3	2250	45/-30	60	-120/430	110/-65	60/-60	100	0	340

Medium To Poor Reported Braking Action

MAX MANUAL	2550	50/-40	75	-150/565	220/-145	70/-70	95	0	605
AUTOBRAKE MAX	2555	50/-40	75	-150/565	225/-150	70/-70	95	0	605
AUTOBRAKE 3	2605	55/-40	75	-155/570	215/-135	70/-70	100	0	610

Poor Reported Braking Action

MAX MANUAL	2920	60/-50	90	-185/705	320/-195	80/-80	100	0	870
AUTOBRAKE MAX	2930	60/-50	90	-185/705	325/-200	80/-80	100	0	870
AUTOBRAKE 3	2960	65/-50	90	-185/705	320/-200	80/-80	100	0	880

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1090	25/-5	20	-40/135	15/-10	20/-20	40	0	15
AUTOBRAKE MAX	1330	20/-5	25	-50/175	0/0	30/-30	65	0	0
AUTOBRAKE 2	2120	40/-10	55	-105/355	0/-10	55/-55	115	0	0

Good Reported Braking Action

MAX MANUAL	1500	25/-10	35	-70/240	40/-35	35/-35	65	0	85
AUTOBRAKE MAX	1555	25/-10	35	-70/245	35/-30	35/-35	70	0	85
AUTOBRAKE 2	2120	40/-10	55	-105/355	0/-10	55/-55	115	0	0

Good To Medium Reported Braking Action

MAX MANUAL	1790	35/-15	45	-95/330	80/-65	45/-45	75	0	190
AUTOBRAKE MAX	1820	35/-15	45	-95/330	80/-60	45/-45	80	0	190
AUTOBRAKE 2	2175	40/-15	60	-115/395	40/-30	60/-60	115	0	105

Medium Reported Braking Action

MAX MANUAL	2080	40/-20	55	-115/415	115/-90	50/-50	85	0	290
AUTOBRAKE MAX	2080	40/-20	55	-115/415	120/-90	55/-55	85	0	290
AUTOBRAKE 3	2140	40/-20	60	-115/420	115/-75	55/-55	90	0	300

Medium To Poor Reported Braking Action

MAX MANUAL	2440	50/-30	70	-150/555	220/-140	65/-65	95	0	520
AUTOBRAKE MAX	2445	50/-30	70	-150/555	225/-145	65/-65	95	0	525
AUTOBRAKE 3	2490	50/-30	75	-150/560	215/-135	65/-65	95	0	535

Poor Reported Braking Action

MAX MANUAL	2795	60/-35	85	-180/695	320/-190	75/-75	100	0	750
AUTOBRAKE MAX	2805	60/-35	85	-180/695	325/-195	75/-75	100	0	755
AUTOBRAKE 3	2835	60/-35	85	-180/695	315/-195	75/-75	100	0	765

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L+C (Flaps 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-5	30	-50/165	20/-20	30/-30	55	0	35
AUTOBRAKE MAX	1580	25/-5	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2630	45/-10	70	-120/405	0/0	75/-75	140	0	0

Good Reported Braking Action

MAX MANUAL	1945	30/-10	50	-80/280	60/-50	45/-45	80	0	165
AUTOBRAKE MAX	1930	30/-10	50	-80/280	55/-45	50/-50	85	0	160
AUTOBRAKE 2	2630	45/-10	70	-120/405	0/0	75/-75	140	0	0

Good To Medium Reported Braking Action

MAX MANUAL	2320	40/-20	65	-110/380	110/-85	60/-60	95	0	355
AUTOBRAKE MAX	2310	40/-20	65	-110/380	110/-85	60/-60	100	0	350
AUTOBRAKE 2	2705	50/-15	75	-130/445	65/-25	75/-75	140	0	240

Medium Reported Braking Action

MAX MANUAL	2695	50/-25	80	-135/475	160/-120	70/-70	105	0	545
AUTOBRAKE MAX	2685	50/-25	80	-135/475	165/-125	70/-70	110	0	540
AUTOBRAKE 3	2715	55/-25	80	-135/480	160/-105	75/-75	110	0	550

Medium To Poor Reported Braking Action

MAX MANUAL	3150	65/-35	100	-175/630	285/-185	85/-85	115	0	960
AUTOBRAKE MAX	3150	65/-35	100	-175/630	295/-195	85/-85	120	0	960
AUTOBRAKE 3	3165	70/-35	100	-175/635	290/-180	90/-90	120	0	965

Poor Reported Braking Action

MAX MANUAL	3605	75/-45	115	-210/785	410/-250	100/-100	125	0	1375
AUTOBRAKE MAX	3610	80/-45	120	-210/785	420/-260	100/-100	125	0	1380
AUTOBRAKE 3	3615	80/-45	120	-210/785	420/-250	100/-100	130	0	1380

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L+R (Flaps 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BW/ 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1490	20/-5	35	-55/190	30/-25	35/-35	65	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2250	35/-10	60	-105/355	105/-85	60/-60	100	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	2855	50/-20	80	-145/505	230/-160	80/-80	120	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3455	60/-25	95	-185/655	355/-235	100/-100	135	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	4355	80/-35	120	-260/950	905/-415	135/-135	155	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	5255	95/-45	140	-335/1240	1455/-590	165/-165	170	0	0
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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R (Flaps 25)

VREF25

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1235	20/-10	25	-45/160	20/-20	25/-25	50	0	35
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1715	30/-20	45	-80/285	55/-45	40/-40	70	0	145
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	2030	40/-30	55	-105/385	105/-80	50/-50	80	0	290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2345	45/-35	65	-130/480	150/-110	60/-60	85	0	430
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	2720	55/-45	80	-170/640	290/-170	75/-75	95	0	735
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3090	65/-55	95	-205/795	425/-225	85/-85	100	0	1035
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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1180	15/-5	25	-45/155	20/-15	25/-25	45	0	25
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1615	25/-10	40	-75/275	55/-45	40/-40	65	0	115
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	1905	35/-20	50	-100/370	100/-75	50/-50	75	0	235
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2195	40/-25	60	-125/465	145/-105	55/-55	85	0	350
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	2545	50/-30	75	-160/620	275/-160	65/-65	90	0	595
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2890	60/-35	85	-195/775	400/-215	75/-75	95	0	840
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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R+C (Flaps 20)****VREF30 + 20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1690	25/-5	40	-65/220	40/-35	40/-40	75	0	95
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2360	40/-15	65	-110/375	105/-85	60/-60	100	0	345
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	2780	55/-25	85	-140/500	185/-135	75/-75	110	0	645
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3200	65/-35	100	-170/625	265/-185	85/-85	120	0	945
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	3680	80/-45	120	-220/820	515/-270	100/-100	130	0	1555
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	4160	95/-55	140	-265/1015	760/-355	115/-115	135	0	2165
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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH DOWN AUTHORITY (Flaps 25)

VREF25

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1220	25/-10	20	-40/145	15/-10	20/-20	45	10	25
AUTOBRAKE MAX	1410	20/-15	30	-55/180	0/0	30/-30	65	0	0
AUTOBRAKE 2	2280	40/-30	60	-110/370	5/-20	60/-60	115	5	5

Good Reported Braking Action

MAX MANUAL	1580	25/-15	35	-65/235	35/-30	35/-35	55	55	130
AUTOBRAKE MAX	1590	25/-15	35	-65/235	35/-30	35/-35	65	60	135
AUTOBRAKE 2	2285	40/-30	60	-110/370	5/-20	60/-60	115	5	5

Good To Medium Reported Braking Action

MAX MANUAL	1805	30/-25	45	-85/305	60/-50	40/-40	65	115	280
AUTOBRAKE MAX	1805	30/-25	45	-85/305	60/-50	40/-40	70	115	285
AUTOBRAKE 2	2325	45/-35	65	-115/395	30/-30	60/-60	115	30	100

Medium Reported Braking Action

MAX MANUAL	2025	35/-30	55	-100/375	80/-65	45/-45	70	170	430
AUTOBRAKE MAX	2020	35/-30	55	-100/375	85/-65	45/-45	75	170	430
AUTOBRAKE 3	2160	40/-25	55	-110/395	55/-25	55/-55	110	80	305

Medium To Poor Reported Braking Action

MAX MANUAL	2265	45/-35	65	-125/475	130/-95	55/-55	75	275	750
AUTOBRAKE MAX	2265	45/-35	65	-125/475	135/-95	55/-55	80	275	750
AUTOBRAKE 3	2345	45/-35	65	-130/485	120/-70	60/-60	100	225	680

Poor Reported Braking Action

MAX MANUAL	2500	50/-40	75	-150/575	180/-120	60/-60	80	375	1065
AUTOBRAKE MAX	2510	50/-40	75	-150/575	185/-125	60/-60	80	380	1065
AUTOBRAKE 3	2525	50/-40	75	-150/575	180/-110	60/-60	90	365	1055

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH DOWN AUTHORITY (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1170	25/-5	20	-40/140	15/-10	20/-20	45	10	20
AUTOBRAKE MAX	1330	20/-5	25	-50/175	0/0	30/-30	65	0	0
AUTOBRAKE 2	2120	40/-15	55	-105/355	0/-5	55/-55	115	0	0

Good Reported Braking Action

MAX MANUAL	1505	20/-10	35	-65/230	35/-30	30/-30	55	50	110
AUTOBRAKE MAX	1520	25/-10	35	-65/230	35/-30	30/-30	65	50	110
AUTOBRAKE 2	2130	40/-15	55	-105/355	5/-10	55/-55	120	0	0

Good To Medium Reported Braking Action

MAX MANUAL	1720	30/-15	45	-85/300	60/-45	40/-40	65	100	240
AUTOBRAKE MAX	1725	30/-15	45	-85/300	60/-50	40/-40	70	100	240
AUTOBRAKE 2	2165	40/-15	55	-110/380	25/-20	55/-60	120	20	85

Medium Reported Braking Action

MAX MANUAL	1930	35/-20	50	-100/365	80/-60	45/-45	70	150	365
AUTOBRAKE MAX	1925	35/-15	50	-100/365	85/-65	45/-45	75	150	365
AUTOBRAKE 3	2015	35/-10	50	-105/380	55/-25	50/-50	105	80	280

Medium To Poor Reported Braking Action

MAX MANUAL	2160	45/-25	60	-125/465	130/-90	50/-50	75	240	640
AUTOBRAKE MAX	2165	45/-25	60	-125/465	135/-95	55/-55	80	245	640
AUTOBRAKE 3	2210	45/-20	60	-125/475	120/-70	55/-55	95	205	595

Poor Reported Braking Action

MAX MANUAL	2390	50/-30	70	-145/565	175/-120	55/-55	80	330	910
AUTOBRAKE MAX	2400	50/-30	70	-145/565	185/-125	60/-60	80	335	910
AUTOBRAKE 3	2400	50/-25	70	-145/565	185/-115	60/-60	85	330	910

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1300	40/-10	25	-45/150	15/-15	25/-25	40	25	60
AUTOBRAKE MAX	1860	25/-5	45	-65/215	0/0	45/-45	75	0	0
AUTOBRAKE 2	2895	55/-40	90	-125/420	65/-70	80/-80	85	240	260

Good Reported Braking Action

MAX MANUAL	1725	25/-15	45	-70/240	35/-30	40/-40	50	100	235
AUTOBRAKE MAX	1935	30/-10	50	-75/260	20/-15	45/-45	75	65	210
AUTOBRAKE 2	2895	55/-40	90	-125/420	65/-70	80/-80	85	240	260

Good To Medium Reported Braking Action

MAX MANUAL	2005	35/-20	55	-90/315	60/-50	50/-50	60	190	475
AUTOBRAKE MAX	2145	40/-20	60	-95/330	50/-40	55/-55	75	170	470
AUTOBRAKE 2	2920	55/-40	90	-130/445	80/-80	80/-80	85	260	370

Medium Reported Braking Action

MAX MANUAL	2280	40/-25	65	-105/390	85/-70	55/-55	65	275	715
AUTOBRAKE MAX	2355	45/-25	70	-110/395	75/-60	60/-60	75	275	725
AUTOBRAKE 3	2810	50/-35	80	-125/445	65/-65	75/-75	90	140	420

Medium To Poor Reported Braking Action

MAX MANUAL	2570	50/-35	80	-130/495	140/-100	65/-65	70	420	1195
AUTOBRAKE MAX	2620	55/-35	85	-135/500	135/-95	70/-70	80	415	1205
AUTOBRAKE 3	2945	55/-40	90	-145/535	120/-95	80/-80	90	295	980

Poor Reported Braking Action

MAX MANUAL	2855	60/-40	95	-155/595	190/-130	75/-75	75	560	1675
AUTOBRAKE MAX	2885	60/-40	95	-155/600	190/-125	75/-75	80	555	1680
AUTOBRAKE 3	3075	60/-40	100	-165/620	175/-125	80/-80	90	445	1535

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≥ 20)

VREF30 + 20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1145	30/-5	20	-40/135	10/-10	20/-20	35	15	35
AUTOBRAKE MAX	1580	25/-5	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2495	50/-30	75	-115/390	40/-55	65/-65	85	95	95

Good Reported Braking Action

MAX MANUAL	1535	25/-10	35	-65/225	30/-30	35/-35	50	75	170
AUTOBRAKE MAX	1665	25/-5	40	-70/240	25/-15	40/-40	70	75	180
AUTOBRAKE 2	2495	50/-30	75	-115/390	40/-55	65/-65	85	95	95

Good To Medium Reported Braking Action

MAX MANUAL	1780	35/-15	45	-85/300	55/-50	45/-45	55	140	350
AUTOBRAKE MAX	1865	35/-15	50	-85/310	50/-35	45/-45	70	140	350
AUTOBRAKE 2	2520	50/-30	75	-120/415	55/-65	65/-65	85	115	185

Medium Reported Braking Action

MAX MANUAL	2025	40/-20	55	-100/370	80/-65	50/-50	60	205	525
AUTOBRAKE MAX	2065	40/-20	60	-100/375	70/-55	50/-50	70	205	520
AUTOBRAKE 3	2385	40/-20	65	-115/410	50/-45	60/-65	95	80	305

Medium To Poor Reported Braking Action

MAX MANUAL	2285	50/-30	70	-125/475	130/-95	60/-60	65	325	890
AUTOBRAKE MAX	2310	50/-30	70	-125/475	130/-90	60/-60	75	325	890
AUTOBRAKE 3	2530	50/-25	75	-135/500	105/-75	65/-70	95	220	745

Poor Reported Braking Action

MAX MANUAL	2545	55/-35	80	-150/575	180/-120	65/-65	70	440	1255
AUTOBRAKE MAX	2550	55/-35	80	-150/575	185/-120	65/-65	75	440	1255
AUTOBRAKE 3	2670	55/-30	80	-155/585	160/-105	70/-70	95	360	1185

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PRI FLIGHT COMPUTERS (Flaps 20)****VREF20**

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1260	25/-15	25	-45/150	15/-15	25/-25	50	25	50
AUTOBRAKE MAX	1470	20/-20	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2410	45/-40	65	-115/385	0/-10	65/-65	130	0	0

Good Reported Braking Action

MAX MANUAL	1680	30/-25	40	-70/250	40/-35	35/-35	65	100	235
AUTOBRAKE MAX	1675	30/-25	40	-70/245	35/-30	40/-40	70	95	225
AUTOBRAKE 2	2410	45/-40	65	-115/385	0/-10	65/-65	130	0	0

Good To Medium Reported Braking Action

MAX MANUAL	1940	40/-35	55	-90/325	70/-55	45/-45	75	190	485
AUTOBRAKE MAX	1935	40/-35	55	-90/320	70/-60	50/-50	80	185	475
AUTOBRAKE 2	2445	45/-45	65	-120/410	25/-25	65/-65	130	35	235

Medium Reported Braking Action

MAX MANUAL	2200	45/-40	65	-110/395	95/-75	55/-55	85	275	735
AUTOBRAKE MAX	2190	45/-40	65	-110/395	105/-85	55/-55	85	270	725
AUTOBRAKE 3	2285	45/-40	65	-115/410	75/-35	60/-60	110	200	665

Medium To Poor Reported Braking Action

MAX MANUAL	2480	55/-50	80	-135/505	155/-110	65/-65	90	425	1260
AUTOBRAKE MAX	2475	55/-50	80	-135/505	165/-120	65/-65	90	425	1255
AUTOBRAKE 3	2525	55/-50	80	-140/510	150/-85	65/-65	110	390	1225

Poor Reported Braking Action

MAX MANUAL	2755	65/-55	90	-160/610	215/-145	70/-70	95	575	1780
AUTOBRAKE MAX	2760	65/-55	90	-160/610	225/-150	70/-70	95	575	1785
AUTOBRAKE 3	2765	65/-55	90	-160/610	225/-135	70/-70	105	575	1785

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SLATS DRIVE (Flaps 20)

VREF30 + 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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1260	30/-5	25	-40/145	15/-15	25/-25	40	25	50
AUTOBRAKE MAX	1715	25/-5	40	-60/205	0/0	40/-40	75	0	0
AUTOBRAKE 2	2730	50/-35	80	-120/410	50/-60	75/-75	90	135	135

Good Reported Braking Action

MAX MANUAL	1705	25/-15	45	-70/245	40/-35	40/-40	55	95	225
AUTOBRAKE MAX	1825	30/-10	45	-75/255	30/-20	45/-45	70	100	240
AUTOBRAKE 2	2730	50/-35	80	-120/410	50/-60	75/-75	90	135	135

Good To Medium Reported Braking Action

MAX MANUAL	1970	35/-20	55	-90/320	65/-55	50/-50	60	175	445
AUTOBRAKE MAX	2050	40/-20	55	-95/325	55/-45	50/-50	75	175	445
AUTOBRAKE 2	2755	55/-35	85	-125/435	65/-70	75/-75	90	160	255

Medium Reported Braking Action

MAX MANUAL	2235	40/-25	65	-110/390	90/-70	55/-55	65	255	660
AUTOBRAKE MAX	2270	45/-25	65	-110/395	80/-65	55/-55	80	250	650
AUTOBRAKE 3	2615	45/-25	75	-120/435	60/-50	70/-70	100	105	400

Medium To Poor Reported Braking Action

MAX MANUAL	2515	50/-35	80	-135/495	145/-105	65/-65	70	390	1085
AUTOBRAKE MAX	2535	55/-35	80	-135/500	140/-100	65/-65	80	385	1080
AUTOBRAKE 3	2770	55/-30	85	-140/525	120/-85	75/-75	100	270	915

Poor Reported Braking Action

MAX MANUAL	2790	60/-40	90	-155/600	200/-135	70/-70	75	520	1510
AUTOBRAKE MAX	2795	60/-40	90	-155/600	200/-135	70/-70	80	520	1510
AUTOBRAKE 3	2920	60/-35	95	-160/610	180/-115	75/-75	100	430	1430

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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance SPOILERS (Flaps 25) VREF25

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-10	20	-40/135	15/-10	20/-20	40	15	35
AUTOBRAKE MAX	1410	20/-15	30	-55/180	0/0	30/-30	65	0	0
AUTOBRAKE 2	2260	40/-35	60	-110/370	15/-30	60/-60	100	15	15

Good Reported Braking Action

MAX MANUAL	1480	25/-20	35	-65/225	35/-30	30/-30	55	75	170
AUTOBRAKE MAX	1550	25/-20	35	-65/235	30/-25	35/-35	65	75	175
AUTOBRAKE 2	2260	40/-35	60	-110/370	15/-30	60/-60	100	15	15

Good To Medium Reported Braking Action

MAX MANUAL	1710	35/-25	45	-85/295	60/-50	40/-40	65	140	350
AUTOBRAKE MAX	1745	35/-25	45	-85/300	60/-45	40/-40	70	140	350
AUTOBRAKE 2	2290	45/-35	65	-115/395	30/-40	60/-60	100	40	135

Medium Reported Braking Action

MAX MANUAL	1940	40/-30	55	-100/365	80/-65	45/-45	70	205	525
AUTOBRAKE MAX	1940	40/-30	55	-100/365	85/-65	45/-45	70	200	520
AUTOBRAKE 3	2130	40/-25	55	-110/390	50/-35	55/-55	100	95	405

Medium To Poor Reported Braking Action

MAX MANUAL	2185	50/-35	65	-125/470	135/-95	55/-55	75	320	885
AUTOBRAKE MAX	2190	50/-35	65	-125/470	140/-95	55/-55	75	315	885
AUTOBRAKE 3	2300	50/-35	65	-130/485	115/-75	60/-60	95	260	830

Poor Reported Braking Action

MAX MANUAL	2430	55/-40	75	-145/570	185/-125	60/-60	80	430	1245
AUTOBRAKE MAX	2435	55/-40	75	-145/570	190/-125	60/-60	80	430	1245
AUTOBRAKE 3	2470	55/-40	75	-150/575	180/-115	60/-60	90	425	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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SPOILERS (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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1065	20/-5	20	-35/130	10/-10	20/-20	40	15	30
AUTOBRAKE MAX	1330	20/-5	25	-50/175	0/0	30/-30	65	0	0
AUTOBRAKE 2	2110	40/-15	55	-105/355	5/-20	55/-55	105	0	0

Good Reported Braking Action

MAX MANUAL	1415	20/-10	35	-60/220	35/-30	30/-30	55	60	145
AUTOBRAKE MAX	1475	25/-10	35	-65/230	30/-25	30/-30	65	65	145
AUTOBRAKE 2	2110	40/-15	55	-105/355	5/-20	55/-55	105	0	0

Good To Medium Reported Braking Action

MAX MANUAL	1635	30/-15	45	-80/290	60/-50	40/-40	65	120	295
AUTOBRAKE MAX	1665	30/-15	45	-85/295	60/-45	40/-40	70	120	295
AUTOBRAKE 2	2135	40/-20	55	-110/380	25/-30	55/-55	105	25	115

Medium Reported Braking Action

MAX MANUAL	1850	35/-20	50	-100/360	80/-65	45/-45	70	175	445
AUTOBRAKE MAX	1855	35/-20	50	-100/360	85/-60	45/-45	70	175	445
AUTOBRAKE 3	1995	35/-15	50	-105/380	55/-35	50/-50	95	100	370

Medium To Poor Reported Braking Action

MAX MANUAL	2090	45/-25	60	-125/460	135/-95	50/-50	75	280	755
AUTOBRAKE MAX	2095	45/-25	60	-125/465	140/-95	55/-55	75	280	755
AUTOBRAKE 3	2175	45/-25	65	-125/475	120/-80	55/-55	90	245	725

Poor Reported Braking Action

MAX MANUAL	2325	50/-30	70	-145/560	185/-120	55/-55	80	380	1060
AUTOBRAKE MAX	2330	50/-30	70	-145/565	190/-125	60/-60	80	380	1065
AUTOBRAKE 3	2355	50/-30	75	-145/565	185/-120	60/-60	85	385	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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

STABILIZER (Flaps 20)

VREF30 + 20

	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	200000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 200000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-5	25	-40/140	15/-10	25/-25	40	20	45
AUTOBRAKE MAX	1580	25/-5	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2535	50/-30	75	-115/395	35/-50	70/-70	90	65	65

Good Reported Braking Action

MAX MANUAL	1595	25/-10	40	-65/235	35/-30	35/-35	55	85	200
AUTOBRAKE MAX	1695	25/-10	40	-70/245	30/-25	40/-40	65	90	210
AUTOBRAKE 2	2535	50/-30	75	-115/395	35/-50	70/-70	90	65	65

Good To Medium Reported Braking Action

MAX MANUAL	1845	35/-20	50	-85/310	60/-50	45/-45	60	160	400
AUTOBRAKE MAX	1905	35/-15	50	-90/315	55/-45	45/-45	70	160	400
AUTOBRAKE 2	2560	50/-30	75	-120/420	50/-60	70/-70	90	90	180

Medium Reported Braking Action

MAX MANUAL	2095	40/-25	60	-105/380	85/-70	50/-50	65	230	595
AUTOBRAKE MAX	2110	40/-20	60	-105/380	80/-60	50/-50	75	225	585
AUTOBRAKE 3	2405	45/-20	65	-115/415	50/-40	65/-65	100	90	380

Medium To Poor Reported Braking Action

MAX MANUAL	2360	50/-30	75	-130/485	140/-100	60/-60	70	355	995
AUTOBRAKE MAX	2370	50/-30	75	-130/485	140/-95	60/-60	75	355	995
AUTOBRAKE 3	2560	50/-25	75	-135/505	115/-75	70/-70	100	260	870

Poor Reported Braking Action

MAX MANUAL	2620	55/-35	85	-150/585	190/-130	65/-65	75	480	1395
AUTOBRAKE MAX	2630	55/-35	85	-150/585	195/-130	65/-65	75	480	1400
AUTOBRAKE 3	2710	55/-30	85	-155/595	180/-110	70/-70	100	430	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 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	258.6	243.7				
52	126	264.6	249.6				
50	122	270.9	255.3	236.3			
48	118	277.2	261.0	242.0			
46	115	283.6	266.6	247.5	227.9		
44	111	289.9	272.9	253.0	232.3		
42	108	294.5	279.4	258.3	236.5	219.7	
40	104	298.9	285.7	263.4	240.9	223.4	
38	100	303.1	290.9	268.8	244.9	226.8	209.6
36	97	307.2	296.1	273.9	249.0	230.3	212.9
34	93	311.2	300.9	278.2	253.1	233.7	216.1
32	90	311.3	305.3	282.4	256.9	237.2	219.3
30	86	311.3	309.7	286.6	260.6	240.8	222.4
28	82	311.4	309.7	290.4	264.4	244.5	225.8
26	79	311.4	309.7	294.1	267.9	248.0	229.2
24	75	311.5	309.8	294.9	271.1	251.4	232.5
22	72	311.6	309.8	294.9	274.2	253.5	234.1
20	68	311.6	309.9	294.9	274.8	254.5	235.5
18	64	311.6	309.9	295.0	274.9	255.6	237.2
16	61	311.6	310.0	295.1	274.9	256.1	239.0
14	57	311.7	310.0	295.1	275.0	256.1	240.5
12	54	311.7	310.1	295.2	275.0	256.2	240.6
10	50	311.8	310.2	295.2	275.1	256.2	240.7
-40	-40	312.9	311.5	296.6	276.3	257.3	241.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 900 kg.

With engine and wing anti-ice on, decrease weight by 1450 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature is below 10°C, decrease weight by 20800 kg.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																																			
		80						100						120						140						160						180					
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																																			
		0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8												
300	0	17.3	19.1	21.2	26.1	29.1	32.6	36.4	40.8	46.0	47.9	53.9	61.0	60.4	68.1	77.1	73.2	82.4	93.0																		
	10	17.9	19.7	21.8	27.0	30.0	33.7	37.6	42.1	47.5	49.5	55.7	63.0	62.4	70.4	79.6	75.6	85.0	95.8																		
	15	18.2	20.0	22.2	27.4	30.5	34.2	38.2	42.9	48.3	50.3	56.7	64.1	63.5	71.5	80.8	76.8	86.3	97.2																		
	20	18.4	20.3	22.5	27.9	31.0	34.8	38.9	43.6	49.1	51.2	57.6	65.1	64.5	72.7	82.1	78.0	87.6	98.5																		
	30	18.8	20.8	23.1	28.6	31.8	35.7	39.9	44.7	50.5	52.6	59.2	66.9	66.3	74.7	84.3	80.2	90.0	101.1																		
280	40	19.1	21.0	23.4	29.0	32.4	36.3	40.6	45.6	51.5	53.7	60.5	68.4	67.8	76.4	86.3	82.0	92.0	103.3																		
	0	16.4	18.0	20.0	24.7	27.4	30.7	34.3	38.4	43.2	45.1	50.7	57.3	56.9	64.1	72.6	69.0	77.8	87.9																		
	10	16.9	18.6	20.6	25.5	28.3	31.7	35.4	39.7	44.7	46.6	52.4	59.3	58.8	66.3	74.9	71.3	80.3	90.6																		
	15	17.2	18.9	20.9	25.9	28.8	32.2	36.0	40.4	45.5	47.4	53.3	60.3	59.8	67.4	76.2	72.5	81.6	92.0																		
	20	17.4	19.2	21.3	26.3	29.3	32.8	36.6	41.0	46.2	48.2	54.2	61.2	60.7	68.5	77.3	73.6	82.8	93.3																		
260	30	17.8	19.6	21.8	27.0	30.0	33.6	37.6	42.1	47.5	49.5	55.7	63.0	62.5	70.4	79.5	75.7	85.1	95.8																		
	40	18.0	19.8	22.0	27.4	30.5	34.2	38.3	42.9	48.4	50.5	56.9	64.4	63.8	72.0	81.3	77.4	87.0	97.9																		
	0	15.5	17.0	18.8	23.2	25.8	28.8	32.2	36.0	40.5	42.3	47.5	53.7	53.3	60.0	67.9	64.7	73.0	82.6																		
	10	15.9	17.5	19.4	24.0	26.6	29.7	33.3	37.2	41.9	43.7	49.1	55.5	55.0	62.0	70.2	66.9	75.4	85.1																		
	15	16.2	17.8	19.7	24.4	27.0	30.2	33.8	37.8	42.6	44.4	49.9	56.4	56.0	63.1	71.3	68.0	76.6	86.5																		
240	20	16.5	18.1	20.0	24.8	27.5	30.7	34.4	38.5	43.3	45.2	50.8	57.3	56.9	64.1	72.5	69.1	77.8	87.8																		
	30	16.8	18.5	20.4	25.4	28.2	31.5	35.3	39.5	44.5	46.4	52.2	58.9	58.5	65.9	74.5	71.0	79.9	90.1																		
	40	17.0	18.7	20.7	25.7	28.6	32.0	35.9	40.2	45.3	47.3	53.3	60.2	59.8	67.4	76.2	72.6	81.8	92.2																		
	0	14.6	15.9	17.6	21.8	24.1	26.9	30.1	33.6	37.8	39.4	44.2	49.9	49.6	55.8	63.2	60.3	68.0	76.9																		
	10	15.0	16.4	18.1	22.5	24.9	27.8	31.1	34.7	39.0	40.7	45.7	51.6	51.2	57.7	65.3	62.3	70.2	79.4																		
220	15	15.2	16.7	18.4	22.8	25.3	28.3	31.6	35.3	39.7	41.4	46.5	52.5	52.1	58.7	66.3	63.3	71.4	80.7																		
	20	15.5	16.9	18.7	23.2	25.7	28.7	32.1	35.9	40.3	42.1	47.3	53.3	53.0	59.7	67.4	64.4	72.5	81.9																		
	30	15.8	17.3	19.2	23.7	26.3	29.4	32.9	36.8	41.4	43.2	48.6	54.8	54.4	61.3	69.3	66.2	74.6	84.2																		
	40	15.9	17.5	19.4	24.1	26.7	29.9	33.5	37.5	42.2	44.1	49.6	56.0	55.6	62.7	70.9	67.7	76.3	86.1																		
	200	0	13.6	14.9	16.4	20.3	22.4	25.0	28.0	31.2	35.0	36.5	40.9	46.1	45.8	51.6	58.3	55.7	62.8	71.1																	
10		14.1	15.4	16.9	20.9	23.2	25.8	28.9	32.2	36.1	37.7	42.3	47.7	47.3	53.3	60.2	57.6	64.9	73.4																		
15		14.3	15.6	17.2	21.3	23.5	26.2	29.4	32.7	36.7	38.4	43.0	48.5	48.2	54.2	61.2	58.5	66.0	74.6																		
20		14.5	15.9	17.5	21.6	23.9	26.7	29.8	33.3	37.3	39.0	43.7	49.3	49.0	55.1	62.2	59.5	67.0	75.8																		
30		14.8	16.2	17.9	22.1	24.5	27.3	30.6	34.1	38.3	40.0	44.9	50.6	50.3	56.6	64.0	61.2	68.9	77.9																		
180	40	14.9	16.3	18.1	22.4	24.8	27.7	31.1	34.7	39.0	40.8	45.8	51.7	51.3	57.9	65.4	62.5	70.5	79.7																		
	0	12.7	13.9	15.3	18.8	20.8	23.1	25.8	28.7	32.2	33.6	37.5	42.3	42.0	47.2	53.3	51.0	57.4	65.0																		
	10	13.1	14.3	15.7	19.4	21.4	23.8	26.6	29.6	33.2	34.7	38.8	43.7	43.4	48.8	55.1	52.7	59.4	67.1																		
	15	13.3	14.5	16.0	19.7	21.8	24.2	27.1	30.1	33.8	35.2	39.5	44.4	44.1	49.6	56.0	53.6	60.4	68.2																		
	20	13.5	14.8	16.3	20.0	22.1	24.6	27.5	30.6	34.3	35.8	40.1	45.2	44.9	50.4	56.9	54.5	61.3	69.3																		
	30	13.8	15.1	16.6	20.5	22.6	25.2	28.2	31.4	35.2	36.8	41.2	46.4	46.1	51.8	58.5	56.0	63.1	71.3																		
	40	13.9	15.2	16.8	20.8	22.9	25.6	28.6	31.9	35.8	37.4	42.0	47.3	47.0	52.9	59.8	57.2	64.5	72.9																		
	0	11.8	12.9	14.1	17.4	19.1	21.2	23.6	26.2	29.3	30.6	34.1	38.4	38.1	42.7	48.2	46.1	51.9	58.6																		
	10	12.2	13.3	14.6	17.9	19.7	21.9	24.4	27.1	30.3	31.6	35.3	39.6	39.3	44.1	49.8	47.6	53.6	60.6																		
	15	12.4	13.5	14.8	18.2	20.0	22.2	24.8	27.5	30.8	32.1	35.9	40.3	40.0	44.9	50.7	48.5	54.5	61.6																		
	20	12.6	13.7	15.0	18.5	20.3	22.6	25.2	28.0	31.3	32.6	36.4	41.0	40.7	45.6	51.5	49.2	55.4	62.6																		
	30	12.8	14.0	15.3	18.9	20.8	23.1	25.8	28.7	32.1	33.5	37.4	42.1	41.8	46.9	52.9	50.6	57.0	64.4																		
	40	12.9	14.1	15.5	19.1	21.1	23.4	26.2	29.1	32.6	34.0	38.1	42.9	42.6	47.8	54.0	51.7	58.2	65.8																		

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 Event Adjusted Brake Energy (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
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90
	MAX MAN	6.3	15.6	24.9	34.0	43.2	52.3	61.6	70.9	80.4
	MAX AUTO	6.1	14.4	22.8	31.3	40.0	49.0	58.2	67.7	77.6
	AUTOBRAKE 4	5.9	13.6	21.2	29.1	37.1	45.5	54.2	63.3	73.0
	AUTOBRAKE 3	5.6	12.7	19.7	26.9	34.2	41.9	49.8	58.3	67.3
	AUTOBRAKE 2	5.3	11.8	18.2	24.8	31.5	38.4	45.6	53.3	61.5
	AUTOBRAKE 1	5.2	11.0	16.8	22.8	28.9	35.2	41.9	48.9	56.4

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90
	MAX MAN	5.8	14.7	23.4	32.0	40.4	48.8	57.2	65.6	74.2
	MAX AUTO	4.3	11.6	18.9	26.4	34.1	42.0	50.2	58.9	68.0
	AUTOBRAKE 4	3.6	9.2	15.0	21.1	27.5	34.4	41.7	49.6	58.2
	AUTOBRAKE 3	2.5	6.6	11.1	15.9	21.0	26.7	32.8	39.5	46.8
	AUTOBRAKE 2	1.4	4.4	7.6	11.3	15.3	19.7	24.5	29.8	35.6
	AUTOBRAKE 1	1.0	3.0	5.3	7.8	10.6	13.9	17.5	21.7	26.4

Cooling Time (Minutes)

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
		16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
INFLIGHT	NO SPECIAL	PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE
GEAR DOWN											
GROUND			11	18	26	42	55	66	73		
BTMS	UP TO 2.4		2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE

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 for each taxi mile.

For one brake deactivated, increase brake energy by 10 percent.

For two brakes deactivated, increase brake energy by 20 percent.

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 8 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 EICAS 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. (When inflight with gear extended, the BTMS indications may vary between individual brakes, due to airstream effects.)

Intentionally
Blank

Performance Inflight
Engine Inoperative

Chapter PI
Section 23

ENGINE INOP

Initial Max Continuous EPR
Based on .84M, engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20 & ABOVE	1.243	1.234	1.226	1.211	1.192	1.183	1.181	1.175	1.170
15	1.284	1.275	1.263	1.250	1.232	1.222	1.220	1.216	1.212
10	1.327	1.319	1.307	1.288	1.273	1.264	1.262	1.259	1.257
5	1.364	1.366	1.354	1.337	1.314	1.306	1.304	1.302	1.300
0	1.364	1.402	1.406	1.388	1.368	1.355	1.354	1.351	1.349
-5	1.364	1.402	1.439	1.444	1.424	1.412	1.411	1.408	1.406
-10	1.364	1.402	1.439	1.473	1.482	1.471	1.469	1.467	1.465
-15	1.364	1.402	1.439	1.473	1.506	1.523	1.523	1.521	1.518
-20 & BELOW	1.364	1.402	1.439	1.473	1.506	1.523	1.523	1.521	1.518

ENGINE INOP

Max Continuous EPR

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT												TAT (°C)	
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.63	1.531	1.531	1.531	1.531	1.531	1.489	1.436	1.385	1.341	1.302	1.263	1.233
240	0.74	1.534	1.534	1.534	1.534	1.534	1.534	1.517	1.455	1.402	1.349	1.308	1.268
280	0.86	1.506	1.506	1.506	1.506	1.506	1.506	1.506	1.506	1.469	1.413	1.356	1.304
35000 FT PRESS ALT												TAT (°C)	
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.60	1.517	1.517	1.517	1.517	1.517	1.486	1.433	1.385	1.341	1.304	1.267	1.234
240	0.71	1.514	1.514	1.514	1.514	1.514	1.514	1.502	1.444	1.394	1.344	1.305	1.266
280	0.82	1.519	1.519	1.519	1.519	1.519	1.519	1.519	1.519	1.476	1.417	1.362	1.311
33000 FT PRESS ALT												TAT (°C)	
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
200	0.58	1.499	1.499	1.499	1.499	1.499	1.499	1.447	1.401	1.358	1.323	1.290	1.257
240	0.68	1.491	1.491	1.491	1.491	1.491	1.491	1.491	1.452	1.402	1.355	1.314	1.278
280	0.79	1.489	1.489	1.489	1.489	1.489	1.489	1.489	1.489	1.472	1.414	1.363	1.314
320	0.89	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.389	1.338
31000 FT PRESS ALT												TAT (°C)	
KLAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
200	0.55	1.480	1.480	1.480	1.480	1.480	1.461	1.414	1.372	1.332	1.303	1.274	1.245
240	0.66	1.471	1.471	1.471	1.471	1.471	1.471	1.461	1.410	1.365	1.322	1.291	1.260
280	0.76	1.459	1.459	1.459	1.459	1.459	1.459	1.459	1.459	1.415	1.366	1.321	1.281
320	0.85	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.406	1.353	1.306
29000 FT PRESS ALT												TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	0.53	1.493	1.493	1.493	1.493	1.493	1.454	1.411	1.369	1.334	1.302	1.270	1.252
240	0.63	1.475	1.475	1.475	1.475	1.475	1.475	1.441	1.395	1.352	1.315	1.286	1.255
280	0.73	1.446	1.446	1.446	1.446	1.446	1.446	1.446	1.426	1.378	1.334	1.293	1.259
320	0.82	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.413	1.362	1.317
360	0.91	1.351	1.351	1.351	1.351	1.351	1.351	1.351	1.351	1.351	1.351	1.330	1.284

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	37	35	33	31	29
ENGINE ONLY	-0.004	-0.003	-0.003	-0.003	-0.003
ENGINE & WING*	-0.015	-0.014	-0.013	-0.012	-0.012
ENGINE & WING**	-0.026	-0.024	-0.022	-0.021	-0.020

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ENGINE INOP**Max Continuous EPR****Based on engine bleed for packs on or off and anti-ice off****27000 FT to 20000 Pressure Altitudes**

27000 FT PRESS ALT			TAT (°C)										
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	0.51	1.507	1.507	1.507	1.507	1.507	1.499	1.452	1.409	1.368	1.336	1.302	1.268
240	0.60	1.488	1.488	1.488	1.488	1.488	1.488	1.483	1.434	1.391	1.349	1.317	1.286
280	0.70	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.443	1.398	1.355	1.314	1.279
320	0.79	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.368	1.323	1.282
360	0.88	1.330	1.330	1.330	1.330	1.330	1.330	1.330	1.330	1.330	1.330	1.325	1.281
25000 FT PRESS ALT			TAT (°C)										
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	0.49	1.521	1.521	1.521	1.521	1.521	1.496	1.450	1.407	1.369	1.337	1.303	1.278
240	0.58	1.502	1.502	1.502	1.502	1.502	1.502	1.477	1.431	1.389	1.350	1.316	1.282
280	0.67	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.430	1.384	1.344	1.305	1.273
320	0.76	1.386	1.386	1.386	1.386	1.386	1.386	1.386	1.386	1.380	1.335	1.296	1.257
360	0.85	1.319	1.319	1.319	1.319	1.319	1.319	1.319	1.319	1.319	1.319	1.288	1.249
24000 FT PRESS ALT			TAT (°C)										
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	0.48	1.523	1.523	1.523	1.523	1.523	1.512	1.465	1.420	1.379	1.346	1.312	1.278
240	0.57	1.502	1.502	1.502	1.502	1.502	1.502	1.490	1.443	1.399	1.357	1.324	1.289
280	0.66	1.455	1.455	1.455	1.455	1.455	1.455	1.455	1.447	1.400	1.358	1.316	1.283
320	0.75	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.350	1.309	1.269
360	0.83	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.324	1.300	1.259
22000 FT PRESS ALT			TAT (°C)										
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
200	0.46	1.523	1.523	1.523	1.523	1.523	1.496	1.449	1.404	1.364	1.330	1.295	1.271
240	0.55	1.505	1.505	1.505	1.505	1.505	1.505	1.473	1.426	1.380	1.341	1.307	1.273
280	0.63	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.433	1.387	1.342	1.302	1.269
320	0.72	1.407	1.407	1.407	1.407	1.407	1.407	1.407	1.407	1.385	1.340	1.297	1.255
360	0.80	1.336	1.336	1.336	1.336	1.336	1.336	1.336	1.336	1.336	1.329	1.287	1.246
20000 FT PRESS ALT			TAT (°C)										
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
200	0.44	1.519	1.519	1.519	1.519	1.519	1.519	1.477	1.429	1.383	1.346	1.311	1.275
240	0.53	1.512	1.512	1.512	1.512	1.512	1.512	1.509	1.461	1.413	1.366	1.329	1.294
280	0.61	1.469	1.469	1.469	1.469	1.469	1.469	1.469	1.465	1.417	1.368	1.321	1.287
320	0.69	1.422	1.422	1.422	1.422	1.422	1.422	1.422	1.422	1.422	1.376	1.329	1.283
360	0.77	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.317	1.274

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	27	25	24	22	20
ENGINE ONLY	-0.004	-0.005	-0.006	-0.007	-0.006
ENGINE & WING*	-0.012	-0.012	-0.012	-0.013	-0.012
ENGINE & WING**	-0.019	-0.019	-0.019	-0.019	-0.018

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ENGINE INOP

Max Continuous EPR

Based on engine bleed for packs on or off and anti-ice off
18000 FT to 5000 FT Pressure Altitudes

18000 FT PRESS ALT													TAT (°C)	
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	0.42	1.511	1.511	1.511	1.511	1.511	1.500	1.455	1.411	1.369	1.337	1.305	1.275	
240	0.51	1.515	1.515	1.515	1.515	1.515	1.515	1.495	1.449	1.403	1.362	1.328	1.293	
280	0.59	1.472	1.472	1.472	1.472	1.472	1.472	1.472	1.447	1.400	1.354	1.313	1.282	
320	0.67	1.424	1.424	1.424	1.424	1.424	1.424	1.424	1.424	1.402	1.356	1.311	1.269	
360	0.75	1.362	1.362	1.362	1.362	1.362	1.362	1.362	1.362	1.362	1.349	1.305	1.262	
16000 FT PRESS ALT													TAT (°C)	
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	0.41	1.504	1.504	1.504	1.504	1.504	1.504	1.479	1.438	1.396	1.360	1.332	1.304	
240	0.49	1.511	1.511	1.511	1.511	1.511	1.511	1.511	1.477	1.432	1.389	1.354	1.322	
280	0.57	1.474	1.474	1.474	1.474	1.474	1.474	1.474	1.474	1.432	1.387	1.344	1.310	
320	0.64	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.427	1.384	1.340	1.296	
360	0.72	1.372	1.372	1.372	1.372	1.372	1.372	1.372	1.372	1.372	1.372	1.337	1.294	
14000 FT PRESS ALT													TAT (°C)	
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
200	0.39	1.488	1.488	1.488	1.488	1.488	1.488	1.452	1.413	1.373	1.343	1.315	1.288	
240	0.47	1.491	1.491	1.491	1.491	1.491	1.491	1.484	1.444	1.402	1.361	1.330	1.298	
280	0.54	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.449	1.407	1.365	1.324	1.293	
320	0.62	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.400	1.357	1.315	1.275	
360	0.69	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.368	1.354	1.313	1.272
12000 FT PRESS ALT													TAT (°C)	
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40	
200	0.38	1.475	1.475	1.475	1.475	1.475	1.468	1.431	1.393	1.355	1.329	1.302	1.276	
240	0.45	1.473	1.473	1.473	1.473	1.473	1.473	1.453	1.415	1.375	1.339	1.308	1.277	
280	0.52	1.452	1.452	1.452	1.452	1.452	1.452	1.452	1.424	1.385	1.344	1.308	1.275	
320	0.60	1.407	1.407	1.407	1.407	1.407	1.407	1.407	1.407	1.373	1.333	1.292	1.257	
360	0.67	1.359	1.359	1.359	1.359	1.359	1.359	1.359	1.359	1.359	1.359	1.327	1.288	1.248
10000 FT PRESS ALT													TAT (°C)	
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40	
200	0.36	1.462	1.462	1.462	1.462	1.462	1.462	1.444	1.408	1.371	1.338	1.311	1.284	
240	0.43	1.452	1.452	1.452	1.452	1.452	1.452	1.452	1.421	1.383	1.345	1.313	1.283	
280	0.51	1.438	1.438	1.438	1.438	1.438	1.438	1.438	1.433	1.397	1.358	1.318	1.286	
320	0.58	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.382	1.344	1.305	1.265	
360	0.65	1.344	1.344	1.344	1.344	1.344	1.344	1.344	1.344	1.344	1.332	1.295	1.258	
5000 FT PRESS ALT													TAT (°C)	
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45	
200	0.33	1.422	1.422	1.422	1.422	1.422	1.422	1.422	1.399	1.367	1.334	1.306	1.282	
240	0.40	1.400	1.400	1.400	1.400	1.400	1.400	1.400	1.394	1.361	1.328	1.295	1.269	
280	0.46	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.365	1.330	1.295	1.263	
320	0.53	1.349	1.349	1.349	1.349	1.349	1.349	1.349	1.349	1.349	1.349	1.323	1.288	1.253
360	0.59	1.303	1.303	1.303	1.303	1.303	1.303	1.303	1.303	1.303	1.303	1.303	1.270	1.237

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	18	16	14	12	10	5
ENGINE ONLY	-0.010	-0.013	-0.015	-0.015	-0.015	-0.010
ENGINE & WING*	-0.015	-0.018	-0.019	-0.019	-0.018	-0.012
ENGINE & WING**	-0.021	-0.024	-0.024	-0.023	-0.022	-0.014

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
300	290	282	17500	16100	14600
280	271	273	19400	18000	16600
260	252	264	21300	20000	18600
240	232	253	23300	22100	20700
220	213	243	25400	24200	22900
200	194	231	27400	26200	25100
180	174	219	29500	28300	27200
160	154	206	32200	30600	29500

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
136	127	119	112	106	100	95	90	86	82	79
272	254	238	224	211	200	190	181	173	165	158
407	380	356	335	317	300	285	271	259	248	238
541	505	474	447	422	400	380	362	346	331	317
675	631	592	558	527	500	475	453	433	414	397
808	755	709	669	633	600	571	544	520	498	477
940	880	827	780	738	700	666	635	607	581	558
1072	1004	944	890	843	800	761	726	694	665	638
1204	1128	1061	1001	948	900	857	817	782	749	719
1335	1251	1177	1112	1053	1000	952	909	869	833	799
1467	1375	1294	1222	1158	1100	1048	1000	957	917	880
1598	1499	1411	1333	1263	1200	1143	1091	1044	1001	961
1729	1622	1527	1443	1368	1300	1239	1183	1132	1085	1042
1860	1746	1644	1554	1473	1400	1334	1274	1219	1169	1122
1992	1869	1761	1664	1578	1500	1429	1365	1306	1253	1203
2123	1993	1878	1775	1683	1600	1525	1456	1394	1336	1284
2255	2117	1995	1886	1788	1700	1620	1548	1481	1420	1364
2388	2241	2112	1997	1893	1800	1716	1639	1568	1504	1445

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)								TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)								
	160	180	200	220	240	260	280	300	
100	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4	0:16
200	2.5	2.6	2.8	2.9	3.1	3.2	3.3	3.4	0:32
300	3.8	4.1	4.4	4.7	5.0	5.2	5.5	5.7	0:47
400	5.1	5.6	6.0	6.5	6.9	7.4	7.8	8.2	1:03
500	6.4	7.0	7.6	8.2	8.9	9.4	10.0	10.6	1:18
600	7.7	8.4	9.1	9.9	10.7	11.4	12.1	12.9	1:33
700	8.9	9.8	10.6	11.5	12.5	13.3	14.2	15.1	1:47
800	10.1	11.1	12.1	13.1	14.2	15.2	16.3	17.3	2:02
900	11.3	12.5	13.6	14.7	16.0	17.2	18.3	19.5	2:16
1000	12.5	13.8	15.1	16.4	17.7	19.1	20.4	21.6	2:31
1100	13.6	15.1	16.5	18.0	19.5	20.9	22.4	23.8	2:45
1200	14.8	16.4	18.0	19.5	21.2	22.8	24.4	25.9	2:59
1300	16.0	17.7	19.4	21.1	22.9	24.7	26.4	28.1	3:14
1400	17.1	19.0	20.8	22.7	24.6	26.5	28.4	30.2	3:28
1500	18.3	20.3	22.3	24.2	26.3	28.3	30.3	32.3	3:42
1600	19.4	21.6	23.7	25.8	28.0	30.1	32.3	34.4	3:57
1700	20.6	22.8	25.1	27.3	29.7	32.0	34.2	36.5	4:11
1800	21.7	24.1	26.5	28.8	31.3	33.7	36.2	38.5	4:26

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
300	15000	12700	10300
290	15700	13600	11200
280	16300	14400	12000
270	17000	15300	13000
260	18100	16500	14600
250	19200	17600	15800
240	20300	18800	17000
230	21400	20000	18200
220	22500	21100	19400
210	23600	22300	20700
200	24800	23500	22000
190	26000	24800	23400
180	27300	26000	24800
170	28600	27300	26100
160	30000	28600	27400

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		10	15	17	19	21	23	25	27
300	EPR	1.259	1.366						
	MACH	.585	.641						
	KIAS	325	325						
	FF/ENG	8919	9092						
280	EPR	1.236	1.333	1.383					
	MACH	.585	.641	.665					
	KIAS	325	325	325					
	FF/ENG	8548	8681	8780					
260	EPR	1.213	1.297	1.341	1.398				
	MACH	.577	.627	.651	.680				
	KIAS	321	318	318	320				
	FF/ENG	8069	8080	8152	8331				
240	EPR	1.188	1.260	1.298	1.344	1.402			
	MACH	.558	.606	.627	.652	.681			
	KIAS	310	307	306	306	308			
	FF/ENG	7412	7389	7412	7482	7658			
220	EPR	1.164	1.226	1.258	1.297	1.343	1.402		
	MACH	.538	.585	.605	.626	.651	.681		
	KIAS	298	296	294	294	294	296		
	FF/ENG	6764	6736	6728	6748	6810	6972		
200	EPR	1.141	1.195	1.223	1.254	1.293	1.339	1.398	
	MACH	.516	.562	.581	.601	.623	.648	.677	
	KIAS	286	284	283	282	281	281	282	
	FF/ENG	6126	6094	6085	6077	6089	6140	6273	
180	EPR	1.119	1.166	1.189	1.217	1.247	1.284	1.330	1.386
	MACH	.492	.537	.556	.576	.596	.617	.642	.671
	KIAS	272	271	270	269	268	267	267	268
	FF/ENG	5490	5462	5451	5443	5434	5438	5475	5573
160	EPR	1.098	1.139	1.158	1.181	1.207	1.237	1.272	1.316
	MACH	.466	.510	.529	.548	.568	.588	.609	.633
	KIAS	258	257	256	256	255	254	253	252
	FF/ENG	4862	4838	4827	4817	4809	4800	4796	4817

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
287	264	244	227	213	200	191	182	174	167	160
576	530	489	455	426	400	381	364	348	334	321
865	796	735	684	640	600	572	546	522	501	482
1156	1064	982	913	853	800	763	729	698	669	643
1448	1332	1229	1142	1067	1000	953	910	871	835	803
1742	1602	1477	1372	1281	1200	1144	1092	1045	1002	963
2036	1871	1725	1602	1495	1400	1335	1274	1219	1168	1122
2332	2141	1973	1831	1709	1600	1525	1456	1392	1334	1282
2629	2414	2223	2062	1924	1800	1715	1637	1565	1500	1441

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	3.4	0:40	3.0	0:38	2.6	0:37	2.4	0:36	2.1	0:34
400	7.1	1:17	6.5	1:13	6.0	1:10	5.5	1:07	5.2	1:03
600	10.9	1:54	10.0	1:48	9.3	1:43	8.7	1:38	8.2	1:33
800	14.5	2:31	13.5	2:24	12.6	2:17	11.8	2:10	11.2	2:02
1000	18.2	3:09	16.9	2:59	15.8	2:51	14.9	2:42	14.2	2:32
1200	21.8	3:47	20.3	3:35	19.1	3:25	17.9	3:14	17.1	3:02
1400	25.3	4:26	23.7	4:12	22.2	3:59	20.9	3:47	20.0	3:33
1600	28.8	5:05	27.0	4:48	25.4	4:33	23.9	4:19	22.9	4:03
1800	32.3	5:44	30.3	5:25	28.5	5:08	26.9	4:52	25.7	4:34

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)							
	160	180	200	220	240	260	280	300
2	-0.1	-0.1	0.0	0.1	0.3	0.4	0.6	0.7
4	-0.4	-0.2	0.0	0.4	0.7	1.1	1.5	1.9
6	-0.6	-0.3	0.0	0.6	1.2	1.8	2.4	3.1
8	-0.9	-0.4	0.0	0.8	1.6	2.5	3.4	4.3
10	-1.1	-0.5	0.0	1.0	2.1	3.2	4.3	5.4
12	-1.3	-0.7	0.0	1.2	2.5	3.8	5.2	6.6
14	-1.6	-0.8	0.0	1.4	2.9	4.5	6.1	7.7
16	-1.8	-0.9	0.0	1.6	3.3	5.1	6.9	8.8
18	-2.0	-1.0	0.0	1.8	3.7	5.7	7.8	10.0
20	-2.3	-1.1	0.0	2.0	4.1	6.3	8.6	11.1
22	-2.5	-1.2	0.0	2.2	4.5	6.9	9.5	12.1
24	-2.8	-1.4	0.0	2.4	4.9	7.5	10.3	13.2
26	-3.0	-1.5	0.0	2.5	5.2	8.1	11.1	14.3
28	-3.2	-1.6	0.0	2.7	5.6	8.7	11.9	15.4
30	-3.5	-1.7	0.0	2.9	5.9	9.2	12.7	16.4
32	-3.7	-1.8	0.0	3.0	6.2	9.7	13.5	17.4
34	-3.9	-2.0	0.0	3.1	6.6	10.3	14.2	18.5

ENGINE INOP

MAX CONTINUOUS THRUST

Holding Flaps up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
300	EPR	1.163	1.200	1.271	1.363		
	KIAS	260	260	262	277		
	FF/ENG	8080	8090	8160	8510		
280	EPR	1.147	1.179	1.242	1.327	1.460	
	KIAS	251	251	253	261	286	
	FF/ENG	7480	7480	7530	7730	8420	
260	EPR	1.131	1.159	1.215	1.294	1.401	
	KIAS	242	242	243	246	266	
	FF/ENG	6890	6900	6910	7010	7430	
240	EPR	1.116	1.141	1.189	1.259	1.352	
	KIAS	232	233	234	235	247	
	FF/ENG	6310	6310	6320	6370	6620	
220	EPR	1.102	1.124	1.165	1.225	1.310	1.437
	KIAS	222	223	224	224	230	251
	FF/ENG	5750	5740	5740	5760	5880	6350
200	EPR	1.088	1.106	1.142	1.193	1.269	1.370
	KIAS	215	215	215	215	215	229
	FF/ENG	5230	5190	5190	5180	5230	5480
180	EPR	1.075	1.090	1.119	1.161	1.225	1.316
	KIAS	208	208	208	208	208	209
	FF/ENG	4840	4680	4650	4650	4670	4750
160	EPR	1.061	1.074	1.097	1.133	1.183	1.259
	KIAS	203	203	203	203	203	203
	FF/ENG	4360	4310	4160	4160	4160	4180
140	EPR	1.047	1.058	1.076	1.105	1.146	1.208
	KIAS	203	203	203	203	203	203
	FF/ENG	3960	3910	3760	3740	3780	3750

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

**Gear Down Landing Rate of Climb Available
Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	550	460				
50	600	510	380			
48	650	550	420			
46	690	600	470	310		
44	720	650	510	340		
42	760	690	550	370	230	
40	790	730	580	400	260	
38	820	760	610	440	290	150
36	840	800	650	470	320	180
34	840	830	680	500	350	200
32	850	850	710	530	380	230
30	850	850	730	550	410	260
20	870	870	760	620	480	340
10	890	890	770	630	490	360
0	900	900	790	650	500	370
-20	940	940	820	670	520	390
-40	990	990	860	710	550	400

Rate of climb capability shown is valid for 200000 kg, gear down at VREF20 + 5.
Decrease rate of climb 40 ft/min per 5000 kg greater than 200000 kg.
Increase rate of climb 60 ft/min per 5000 kg less than 200000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	50	-50				
50	90	-10	-140			
48	130	30	-100			
46	170	80	-60	-220		
44	200	120	-20	-190		
42	230	160	20	-160	-290	
40	260	190	50	-130	-270	
38	290	230	80	-100	-240	-380
36	310	260	110	-70	-220	-360
34	310	290	130	-40	-190	-340
32	320	310	160	-20	-170	-310
30	320	310	180	10	-140	-290
20	320	320	200	60	-80	-220
10	330	330	210	70	-80	-210
0	340	330	210	70	-80	-210
-20	360	350	220	70	-80	-210
-40	380	370	240	80	-80	-220

Rate of climb capability shown is valid for 200000 kg, gear down at VREF30 + 5.
Decrease rate of climb 40 ft/min per 5000 kg greater than 200000 kg.
Increase rate of climb 60 ft/min per 5000 kg less than 200000 kg.

Intentionally
Blank

Performance Inflight
Alternate Mode EEC

Chapter PI
Section 24

ALTERNATE MODE EEC

Limit Weight

PERFORMANCE LIMIT	ALTERNATE MODE EEC LIMIT WEIGHT (1000 KG)									
	PRIMARY MODE PERFORMANCE LIMIT WEIGHT (1000 KG)									
	140	160	180	200	220	240	260	280	300	320
FIELD	134.5	153.0	171.5	190.0	208.5	227.0	245.5	264.0	282.5	301.0
CLIMB	127.9	146.2	164.5	182.8	201.1	219.4	237.6	255.9	274.2	292.5
OBSTACLE	130.0	148.1	166.2	184.3	202.4	220.5	238.6	256.7	274.8	292.9
NET LEVEL OFF WEIGHT	130.0	148.4	166.9	185.3	203.8	222.2	240.7	259.1	277.5	296.0
APPROACH OR LANDING CLIMB	127.2	145.6	164.1	182.5	200.9	219.4	237.8	256.2	274.6	293.1

Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
V1	+1
VR	0
V2	0

ALTERNATE MODE EEC

Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	8400	
55	131	92.4	92.7	92.9	93.1	93.3	93.4	93.4	93.4	93.3	93.2	93.1	
50	122	93.4	93.9	93.9	93.9	93.9	94.0	94.1	94.1	94.0	94.0	93.9	
45	113	94.4	95.0	95.0	95.0	94.8	94.7	94.7	94.7	94.7	94.6	94.6	
40	104	94.9	96.3	96.1	96.1	95.7	95.4	95.3	95.3	95.3	95.3	95.2	
35	95	95.4	96.9	97.0	96.9	96.5	96.1	96.1	96.0	96.0	96.0	96.0	
30	86	94.9	98.0	97.8	97.8	97.4	97.0	96.9	96.9	96.8	96.8	96.7	
25	77	94.1	97.4	97.8	98.2	97.9	97.6	97.8	97.7	97.6	97.6	97.6	
20	68	93.3	96.6	97.0	97.4	97.6	97.8	97.7	97.8	97.9	97.8	97.8	
15	59	92.5	95.7	96.1	96.6	96.8	96.9	97.2	97.4	97.8	98.0	97.9	
10	50	91.7	94.9	95.3	95.7	95.9	96.1	96.3	96.5	96.9	97.3	97.5	
5	41	90.9	94.0	94.4	94.9	95.1	95.2	95.5	95.7	96.1	96.5	96.6	
0	32	90.1	93.2	93.6	94.0	94.2	94.4	94.6	94.8	95.2	95.6	95.8	
-10	14	88.4	91.5	91.9	92.3	92.5	92.6	92.9	93.1	93.5	93.8	94.0	
-20	-4	86.7	89.7	90.1	90.5	90.7	90.9	91.1	91.3	91.7	92.0	92.2	
-30	-22	85.0	87.9	88.3	88.7	88.9	89.0	89.3	89.5	89.8	90.2	90.3	
-40	-40	83.2	86.1	86.5	86.9	87.0	87.2	87.4	87.6	88.0	88.3	88.5	
-50	-58	81.4	84.2	84.6	85.0	85.1	85.3	85.5	85.7	86.1	86.4	86.5	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
PACKS OFF	0.1	0.2	0.2	0.2	0.2	0.2
WING ANTI-ICE ON	-0.1	-0.2	-0.2	-0.3	-0.3	-0.3

ALTERNATE MODE EEC

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT) / SPEED (KIAS OR MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	40000	43000
	310	310	310	310	310	310	310	.84	.84	.84
60	83.9	84.6	86.7	89.4	92.2	93.4	94.5	96.1	96.3	96.0
50	85.4	86.2	86.7	88.1	90.8	92.0	93.1	94.7	94.9	94.5
40	86.8	87.5	88.0	88.9	89.8	90.6	91.6	93.2	93.4	93.1
30	85.9	88.8	89.4	90.2	91.0	90.8	90.5	91.7	91.9	91.6
20	84.5	87.3	89.8	91.3	92.1	91.8	91.9	90.9	90.3	90.0
15	83.7	86.6	89.1	91.7	92.6	92.5	92.3	91.5	91.1	90.9
10	83.0	85.8	88.3	90.9	93.2	93.1	92.9	92.1	91.7	91.5
5	82.3	85.1	87.5	90.1	92.8	93.9	93.6	92.5	92.2	92.1
0	81.5	84.3	86.7	89.3	92.0	93.9	94.5	93.3	92.8	92.7
-5	80.8	83.5	85.9	88.5	91.1	93.0	94.6	94.3	93.8	93.7
-10	80.0	82.7	85.1	87.7	90.3	92.1	93.7	95.4	94.9	94.8
-15	79.3	81.9	84.3	86.8	89.4	91.2	92.9	95.4	96.0	95.9
-20	78.5	81.1	83.5	86.0	88.5	90.4	91.9	94.5	95.0	94.9
-25	77.7	80.3	82.7	85.1	87.7	89.5	91.0	93.5	94.1	94.0
-30	76.9	79.5	81.8	84.3	86.8	88.5	90.1	92.6	93.1	93.0
-35	76.1	78.7	81.0	83.4	85.9	87.6	89.2	91.6	92.2	92.1
-40	75.3	77.9	80.1	82.5	85.0	86.7	88.2	90.7	91.2	91.1

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)									
	0	5000	10000	15000	20000	25000	30000	35000	40000	43000
ENGINE ANTI-ICE ON	-0.4	-0.5	-0.7	-0.6	-0.3	-0.2	-0.1	-0.1	-0.1	-0.2
ENGINE & WING ANTI-ICE ON	-0.5	-0.6	-0.8	-0.8	-0.5	-0.5	-0.4	-0.5	-0.6	-0.7

ALTERNATE MODE EEC

Max Cruise %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)									
	25000	27000	29000	31000	33000	35000	37000	39000	41000	43000
25	89.6	89.4	89.5	89.9	89.2	89.3	89.6	89.5	89.3	89.1
20	90.1	90.0	90.1	90.4	89.9	89.2	88.9	88.8	88.6	88.4
15	90.7	90.5	90.6	90.9	90.5	89.9	89.5	89.5	89.3	89.2
10	91.1	91.0	91.1	91.4	90.9	90.4	90.1	90.1	90.0	89.9
5	91.7	91.5	91.6	91.9	91.4	90.8	90.6	90.5	90.5	90.4
0	91.5	91.9	92.2	92.5	92.0	91.4	91.1	91.0	91.0	90.9
-5	90.7	91.1	91.8	92.6	92.7	92.1	91.8	91.7	91.7	91.6
-10	89.8	90.2	91.0	91.7	92.6	92.9	92.6	92.5	92.5	92.4
-15	89.0	89.4	90.1	90.8	91.7	92.7	93.2	93.1	93.1	93.0
-20	88.1	88.5	89.2	89.9	90.8	91.8	92.2	92.2	92.2	92.1
-25	87.2	87.6	88.3	89.0	89.9	90.9	91.3	91.3	91.3	91.2
-30	86.3	86.7	87.5	88.1	89.0	89.9	90.4	90.4	90.3	90.3
-35	85.4	85.8	86.5	87.2	88.1	89.0	89.5	89.4	89.4	89.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)				
	25000	30000	35000	40000	43000
ENGINE ANTI-ICE ON	-0.1	-0.1	-0.1	-0.1	-0.1
ENGINE & WING ANTI-ICE ON	-0.4	-0.4	-0.5	-0.5	-0.6

ALTERNATE MODE EEC

Go-Around %N1

Based on engine bleed for packs on, engine anti-ice on or off, wing anti-ice off

AIRPORT OAT		TAT (°C)	PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
51	124	55	93.4	93.9	93.9	93.8	94.0	94.2	94.3	94.3	94.3	94.2	94.1	94.1
46	115	50	94.4	95.0	95.1	95.1	94.9	94.8	94.9	95.0	94.9	94.9	94.9	94.8
41	106	45	95.1	96.2	96.1	96.1	95.8	95.6	95.6	95.6	95.5	95.5	95.5	95.5
36	97	40	95.5	97.0	97.0	96.9	96.6	96.2	96.2	96.2	96.1	96.1	96.0	96.0
31	88	35	95.3	97.7	97.7	97.7	97.3	97.0	96.9	96.9	96.8	96.8	96.8	96.7
26	79	30	94.6	97.3	98.0	98.4	98.0	97.7	97.7	97.6	97.6	97.6	97.5	97.5
21	70	25	93.8	96.5	97.2	97.8	98.1	98.3	98.1	98.2	98.2	98.1	98.0	98.0
17	62	20	93.0	95.7	96.4	97.0	97.2	97.5	97.8	98.0	98.3	98.3	98.1	97.9
12	53	15	92.2	94.9	95.5	96.1	96.4	96.7	96.9	97.1	97.6	98.0	98.3	98.3
7	45	10	91.4	94.0	94.7	95.3	95.6	95.9	96.1	96.3	96.7	97.1	97.5	97.9
2	36	5	90.6	93.2	93.9	94.4	94.7	95.0	95.2	95.4	95.9	96.3	96.6	97.0
-3	27	0	89.8	92.4	93.0	93.6	93.9	94.1	94.4	94.6	95.0	95.4	95.8	96.1
-13	9	-10	88.1	90.7	91.3	91.9	92.1	92.4	92.6	92.8	93.3	93.6	94.0	94.3
-23	-9	-20	86.4	88.9	89.5	90.1	90.4	90.6	90.8	91.0	91.5	91.8	92.2	92.5
-33	-27	-30	84.7	87.1	87.8	88.3	88.6	88.8	89.0	89.2	89.6	90.0	90.3	90.7
-43	-45	-40	82.9	85.3	85.9	86.5	86.7	87.0	87.2	87.4	87.8	88.1	88.5	88.8
-53	-63	-50	81.1	83.5	84.1	84.6	84.8	85.1	85.3	85.5	85.9	86.2	86.5	86.9

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
PACKS OFF	0.1	0.1	0.2	0.2	0.2	0.2	0.2
1 PACK ON	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
WING ANTI-ICE ON	-0.1	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3

Intentionally
Blank

Performance Inflight

Alternate Mode EEC, Engine INOP

Chapter PI

Section 25

ALTERNATE MODE EEC

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	92.7	92.4	92.1	91.6	90.9	90.5	90.5	90.2	90.0
15	93.2	92.9	92.5	92.1	91.5	91.2	91.1	91.0	90.9
10	93.7	93.5	93.1	92.5	92.1	91.8	91.7	91.6	91.5
5	94.1	94.1	93.7	93.2	92.5	92.3	92.2	92.1	92.1
0	93.2	94.4	94.6	94.0	93.3	92.9	92.9	92.8	92.8
-5	92.4	93.6	94.8	94.9	94.3	93.9	93.9	93.8	93.7
-10	91.5	92.7	93.9	95.1	95.4	95.0	95.0	94.9	94.8
-15	90.6	91.8	93.0	94.2	95.4	96.0	96.0	95.9	95.9
-20	89.7	90.9	92.1	93.3	94.5	95.1	95.1	95.0	94.9
-25	88.9	90.0	91.2	92.3	93.6	94.1	94.1	94.1	94.0
-30	88.0	89.1	90.3	91.4	92.6	93.2	93.2	93.1	93.0
-35	87.0	88.2	89.3	90.5	91.6	92.2	92.2	92.1	92.1
-40	86.1	87.2	88.4	89.5	90.7	91.3	91.2	91.2	91.1

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
ENGINE ONLY	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2
ENGINE & WING*	-0.4	-0.4	-0.4	-0.4	-0.5	-0.5	-0.6	-0.6	-0.7
ENGINE & WING**	-0.6	-0.6	-0.7	-0.8	-0.9	-0.9	-1.0	-1.1	-1.2

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ALTERNATE MODE EEC

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

320 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	93.6	94.2	94.1	93.7	93.4	92.7	92.1	91.6	91.2	91.1	90.9	91.0	91.0	90.5	90.8	91.9
25	92.9	95.0	95.0	94.6	94.3	93.5	92.9	92.2	91.7	91.6	91.6	91.7	91.7	91.3	91.5	92.3
20	92.1	94.6	95.6	95.6	95.3	94.5	93.8	93.0	92.3	92.1	92.0	92.2	92.2	91.8	92.0	92.7
15	91.3	93.8	94.8	95.5	96.3	95.6	94.9	93.8	93.0	92.7	92.6	92.7	92.7	92.3	92.5	93.2
10	90.5	93.0	94.0	94.7	95.5	95.7	96.0	94.8	93.7	93.3	93.2	93.3	93.2	92.9	93.0	93.8
5	89.7	92.2	93.1	93.9	94.6	94.9	95.1	94.8	94.5	94.1	94.0	94.0	93.8	93.5	93.7	94.6
0	88.9	91.3	92.3	93.0	93.8	94.0	94.3	93.9	93.6	93.5	94.1	94.8	94.6	94.3	94.5	95.4
-5	88.1	90.5	91.4	92.2	92.9	93.1	93.4	93.1	92.8	92.7	93.2	93.9	94.4	94.7	95.5	95.9
-10	87.2	89.6	90.6	91.3	92.0	92.3	92.5	92.2	91.9	91.8	92.3	93.0	93.5	93.8	94.6	95.0
-15	86.4	88.8	89.7	90.4	91.2	91.4	91.7	91.3	91.0	90.9	91.4	92.2	92.6	92.9	93.7	94.1
-20	85.6	87.9	88.8	89.6	90.3	90.5	90.8	90.4	90.1	90.0	90.6	91.3	91.7	92.0	92.8	93.2
-25	84.7	87.1	88.0	88.7	89.4	89.6	89.9	89.5	89.2	89.1	89.7	90.4	90.8	91.1	91.9	92.2
-30	83.9	86.2	87.1	87.8	88.5	88.7	89.0	88.6	88.3	88.2	88.7	89.4	89.9	90.2	91.0	91.3
-35	83.0	85.3	86.2	86.9	87.6	87.8	88.0	87.7	87.4	87.3	87.8	88.5	89.0	89.2	90.0	90.4
-40	82.1	84.4	85.3	85.9	86.6	86.8	87.1	86.8	86.5	86.4	86.9	87.6	88.0	88.3	89.1	89.4

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	-0.4	-0.6	-0.6	-0.6	-0.6	-0.4	-0.3	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1
ENGINE & WING*	-0.5	-0.8	-0.8	-0.8	-0.8	-0.6	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5	-0.4
ENGINE & WING**	-0.6	-0.9	-1.0	-1.0	-1.0	-0.9	-0.8	-0.8	-0.7	-0.7	-0.7	-0.7	-0.7	-0.8	-0.8	-0.8

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ALTERNATE MODE EEC

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

280 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	93.2	93.6	93.4	92.9	92.6	91.8	91.1	90.7	90.3	90.1	89.9	90.0	90.4	91.1	91.8	91.8
25	93.2	94.5	94.3	93.8	93.2	92.3	91.7	91.4	91.1	90.8	90.1	89.6	89.6	90.3	91.1	91.0
20	92.4	95.4	95.3	94.8	94.3	93.2	92.2	91.9	91.5	91.4	90.8	90.3	90.2	90.4	90.5	90.6
15	91.7	94.8	95.8	95.9	95.5	94.3	93.3	92.6	92.0	91.8	91.2	90.9	90.8	91.0	91.2	91.3
10	90.9	94.0	94.9	95.8	96.6	95.6	94.6	93.6	92.8	92.5	91.8	91.3	91.3	91.6	91.8	91.9
5	90.0	93.1	94.1	94.9	95.7	95.8	95.8	94.8	93.7	93.3	92.5	92.0	91.9	92.1	92.3	92.3
0	89.2	92.3	93.3	94.1	94.8	95.0	95.2	95.2	94.9	94.3	93.4	92.9	92.7	92.9	93.1	93.0
-5	88.4	91.4	92.4	93.2	94.0	94.1	94.3	94.4	94.4	94.3	94.4	93.9	93.7	93.9	94.1	94.0
-10	87.6	90.6	91.5	92.3	93.1	93.2	93.4	93.5	93.5	93.4	93.5	93.8	94.5	95.0	95.2	95.0
-15	86.8	89.7	90.7	91.5	92.2	92.3	92.5	92.6	92.6	92.5	92.6	92.9	93.6	94.7	95.8	95.5
-20	85.9	88.8	89.8	90.6	91.3	91.4	91.6	91.7	91.7	91.6	91.7	92.0	92.7	93.8	94.9	94.5
-25	85.1	88.0	88.9	89.7	90.4	90.5	90.7	90.8	90.8	90.7	90.8	91.1	91.8	92.8	93.9	93.6
-30	84.2	87.1	88.0	88.8	89.5	89.6	89.8	89.9	89.9	89.8	89.9	90.2	90.8	91.9	93.0	92.6
-35	83.3	86.2	87.1	87.8	88.6	88.7	88.8	88.9	88.9	88.9	89.0	89.3	89.9	91.0	92.0	91.7
-40	82.4	85.3	86.2	86.9	87.6	87.7	87.9	88.0	88.0	87.9	88.0	88.3	89.0	90.0	91.0	90.7

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	0.4	-0.7	-0.7	-0.7	-0.6	-0.4	-0.3	-0.3	-0.3	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1
ENGINE & WING*	-0.5	-0.8	-0.9	-0.9	-0.8	-0.7	-0.5	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.5	-0.5
ENGINE & WING**	-0.6	-1.0	-1.0	-1.1	-1.1	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.7	-0.9	-1.0

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ALTERNATE MODE EEC

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

240 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	92.1	91.9	91.9	91.8	91.8	90.7	89.4	89.4	90.0	90.4	90.5	90.3	90.3	90.6	91.1	91.6
25	92.8	92.9	92.8	92.4	92.4	91.5	90.4	89.8	89.5	89.6	89.7	89.6	89.6	89.8	90.3	90.8
20	92.3	93.8	93.7	93.4	93.1	92.2	91.2	90.6	90.3	90.1	89.4	88.8	88.8	89.0	89.6	90.0
15	91.5	94.4	94.7	94.5	94.3	93.2	91.9	91.3	90.9	90.8	90.0	89.2	88.5	88.3	88.8	89.3
10	90.7	93.6	94.9	95.6	95.6	94.5	93.1	92.1	91.5	91.4	90.4	89.6	89.1	88.8	88.7	89.1
5	89.9	92.7	94.0	95.1	96.4	95.9	94.6	93.3	92.4	92.1	90.9	89.9	89.5	89.4	89.4	89.8
0	89.1	91.9	93.2	94.3	95.5	96.0	95.9	94.6	93.5	93.1	91.7	90.5	89.8	89.9	90.0	90.4
-5	88.3	91.1	92.3	93.4	94.6	95.1	95.2	95.1	94.7	94.3	92.7	91.4	90.6	90.6	90.6	91.1
-10	87.4	90.2	91.4	92.5	93.7	94.2	94.3	94.3	94.4	94.5	93.9	92.5	91.5	91.6	91.6	92.3
-15	86.6	89.4	90.6	91.7	92.8	93.3	93.4	93.4	93.5	93.6	93.3	93.0	92.8	92.8	92.8	93.4
-20	85.8	88.5	89.7	90.8	91.9	92.4	92.5	92.4	92.6	92.7	92.4	92.1	92.3	93.5	94.1	94.8
-25	84.9	87.6	88.8	89.9	91.0	91.5	91.6	91.5	91.6	91.8	91.4	91.2	91.4	92.5	93.7	94.6
-30	84.1	86.7	87.9	89.0	90.1	90.5	90.6	90.6	90.7	90.8	90.5	90.3	90.5	91.6	92.7	93.6
-35	83.2	85.8	87.0	88.0	89.2	89.6	89.7	89.7	89.8	89.9	89.6	89.4	89.5	90.6	91.7	92.7
-40	82.3	84.9	86.1	87.1	88.2	88.7	88.8	88.7	88.8	89.0	88.6	88.4	88.6	89.7	90.8	91.7

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	-0.4	-0.7	-0.7	-0.7	-0.6	-0.5	-0.3	-0.3	-0.3	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1
ENGINE & WING*	-0.5	-0.8	-0.9	-0.9	-0.8	-0.7	-0.5	-0.6	-0.6	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.6
ENGINE & WING**	-0.6	-1.0	-1.0	-1.2	-1.1	-1.0	-0.8	-0.9	-0.9	-0.8	-0.8	-0.8	-0.9	-0.9	-0.9	-1.0

*Wing anti-ice on, packs on.
**Wing anti-ice on, packs off.

ALTERNATE MODE EEC

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

200 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	91.6	90.6	90.3	89.8	89.4	88.2	87.9	88.7	89.3	89.6	89.3	89.2	89.3	89.7	89.9	90.4
25	92.4	91.4	90.9	90.4	90.1	89.1	87.8	87.9	88.6	88.9	88.6	88.5	88.6	89.0	89.1	89.7
20	92.7	92.3	91.8	91.1	90.7	89.9	88.9	88.4	87.9	88.1	87.8	87.7	87.9	88.2	88.4	88.9
15	91.9	93.2	92.7	92.1	91.5	90.5	89.8	89.3	88.8	88.6	87.3	87.0	87.1	87.5	87.6	88.2
10	91.1	93.2	93.6	93.0	92.5	91.6	90.6	90.0	89.5	89.3	88.2	87.1	86.3	86.7	86.8	87.4
5	90.3	92.4	93.2	93.9	93.6	92.7	91.8	90.9	90.1	89.9	88.8	87.8	86.9	86.6	86.1	86.6
0	89.4	91.6	92.3	93.0	93.9	94.0	93.2	92.1	91.1	90.6	89.3	88.3	87.4	87.3	86.8	87.1
-5	88.6	90.7	91.5	92.2	93.1	93.6	94.3	93.5	92.3	91.7	90.2	88.9	87.8	87.8	87.5	87.8
-10	87.8	89.9	90.6	91.3	92.2	92.8	93.4	93.8	93.6	93.0	91.3	89.8	88.5	88.3	88.0	88.4
-15	87.0	89.0	89.7	90.4	91.3	91.9	92.5	92.9	93.2	93.3	92.6	90.8	89.4	89.2	88.9	89.3
-20	86.1	88.1	88.9	89.6	90.4	91.0	91.6	92.0	92.3	92.4	92.1	91.7	90.6	90.3	90.0	90.5
-25	85.3	87.3	88.0	88.7	89.5	90.1	90.7	91.1	91.4	91.5	91.1	90.8	90.5	91.6	91.3	91.8
-30	84.4	86.4	87.1	87.8	88.6	89.2	89.8	90.2	90.4	90.5	90.2	89.9	89.6	90.7	91.7	92.6
-35	83.5	85.5	86.2	86.9	87.7	88.3	88.8	89.2	89.5	89.6	89.3	89.0	88.7	89.7	90.7	91.6
-40	82.6	84.6	85.3	86.0	86.8	87.3	87.9	88.3	88.6	88.7	88.3	88.0	87.8	88.8	89.8	90.6

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	-0.4	-0.7	-0.7	-0.7	-0.6	-0.5	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1
ENGINE & WING*	-0.5	-0.8	-0.9	-0.9	-0.9	-0.7	-0.5	-0.6	-0.5	-0.5	-0.6	-0.5	-0.5	-0.5	-0.6	-0.6
ENGINE & WING**	-0.6	-1.0	-1.1	-1.1	-1.1	-1.0	-0.8	-0.9	-0.9	-0.8	-0.9	-0.9	-0.9	-1.0	-1.0	-1.0

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

Intentionally
Blank

Performance Inflight**Gear Down****Chapter PI****Section 26****GEAR DOWN****220 KIAS Max Climb EPR**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	1.187	1.185	1.206	1.210	1.216	1.222	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
50	1.204	1.199	1.206	1.210	1.216	1.222	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
45	1.223	1.219	1.206	1.210	1.216	1.222	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
40	1.243	1.239	1.229	1.218	1.216	1.222	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
35	1.264	1.262	1.253	1.243	1.233	1.223	1.232	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
30	1.280	1.286	1.276	1.268	1.259	1.250	1.243	1.244	1.254	1.262	1.260	1.251	1.246	1.235	1.225
25	1.280	1.311	1.303	1.293	1.284	1.276	1.271	1.267	1.259	1.262	1.260	1.251	1.246	1.235	1.225
20	1.280	1.323	1.331	1.321	1.312	1.304	1.299	1.296	1.290	1.280	1.260	1.251	1.246	1.235	1.225
15	1.280	1.323	1.360	1.350	1.342	1.334	1.329	1.326	1.321	1.313	1.293	1.264	1.246	1.235	1.225
10	1.280	1.323	1.366	1.377	1.373	1.366	1.362	1.359	1.352	1.345	1.325	1.295	1.270	1.246	1.225
5	1.280	1.323	1.366	1.377	1.391	1.399	1.396	1.394	1.389	1.380	1.359	1.326	1.298	1.276	1.256
0	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.431	1.426	1.419	1.397	1.359	1.325	1.306	1.292
-5	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.452	1.468	1.461	1.439	1.401	1.363	1.337	1.327
-10	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.452	1.474	1.495	1.484	1.444	1.406	1.381	1.369
-15	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.452	1.474	1.495	1.501	1.491	1.454	1.427	1.417
-20	1.280	1.323	1.366	1.377	1.391	1.406	1.428	1.452	1.474	1.495	1.501	1.491	1.480	1.480	1.469

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
ENGINE ONLY	-0.008	-0.010	-0.015	-0.014	-0.006	-0.005	-0.003	-0.003
ENGINE AND WING*	-0.010	-0.012	-0.018	-0.019	-0.012	-0.012	-0.011	-0.013
ENGINE AND WING**	-0.012	-0.014	-0.021	-0.024	-0.018	-0.019	-0.020	-0.023

*Wing anti-ice on, packs on.

**Wing anti-ice on, single bleed source and both packs off.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
300	13000	10400	7300
280	16200	13700	11000
260	19500	17200	14600
240	22500	20500	18200
220	25300	23600	21700
200	27300	26100	25000
180	29400	28200	27100
160	32100	30500	29300
140	35700	34000	32300

GEAR DOWN**Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
300	EPR	1.240									
	MACH	.488									
	KIAS	270									
	FF/ENG	7412									
280	EPR	1.216	1.292	1.334							
	MACH	.474	.518	.538							
	KIAS	262	261	261							
	FF/ENG	6899	6901	6969							
260	EPR	1.192	1.261	1.295	1.338						
	MACH	.458	.501	.519	.540						
	KIAS	253	252	252	252						
	FF/ENG	6367	6344	6363	6431						
240	EPR	1.169	1.231	1.261	1.296	1.340	1.395				
	MACH	.441	.484	.501	.520	.541	.563				
	KIAS	244	243	243	242	242	242				
	FF/ENG	5839	5818	5811	5829	5893	5962				
220	EPR	1.147	1.202	1.229	1.259	1.295	1.339	1.394			
	MACH	.422	.465	.482	.500	.519	.541	.563			
	KIAS	233	234	233	233	232	232	232			
	FF/ENG	5304	5300	5291	5283	5299	5356	5419			
200	EPR	1.127	1.174	1.197	1.224	1.255	1.290	1.334	1.389		
	MACH	.402	.445	.462	.480	.498	.517	.538	.561		
	KIAS	222	223	223	223	222	222	222	222		
	FF/ENG	4772	4784	4779	4771	4763	4773	4820	4879		
180	EPR	1.110	1.147	1.167	1.190	1.218	1.247	1.281	1.324	1.378	
	MACH	.387	.422	.439	.457	.475	.493	.512	.534	.557	
	KIAS	213	212	212	212	212	211	211	211	211	
	FF/ENG	4327	4262	4268	4264	4257	4249	4252	4286	4341	
160	EPR	1.094	1.125	1.141	1.160	1.185	1.211	1.240	1.275	1.317	1.369
	MACH	.372	.403	.419	.436	.454	.472	.492	.513	.535	.558
	KIAS	205	202	202	202	202	202	202	202	202	202
	FF/ENG	3925	3818	3812	3805	3799	3797	3802	3815	3845	3887
140	EPR	1.079	1.106	1.120	1.136	1.157	1.180	1.205	1.233	1.267	1.308
	MACH	.352	.387	.403	.419	.436	.454	.473	.493	.515	.537
	KIAS	194	194	194	194	194	194	194	194	194	194
	FF/ENG	3474	3496	3491	3486	3475	3468	3407	3409	3419	3444

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	189	179	170	161	154
656	584	523	474	435	400	378	357	339	323	308
991	882	788	714	653	600	567	536	509	484	462
1329	1181	1053	953	871	800	755	714	677	644	615
1670	1482	1320	1193	1090	1000	943	892	845	804	767
2014	1785	1589	1434	1309	1200	1132	1070	1014	964	919
2362	2091	1859	1676	1528	1400	1320	1248	1182	1123	1071
2715	2400	2130	1919	1748	1600	1508	1425	1349	1282	1223
3073	2711	2403	2163	1968	1800	1696	1602	1517	1441	1373
3434	3026	2678	2407	2189	2000	1884	1779	1684	1599	1524
3799	3343	2954	2652	2410	2200	2072	1955	1850	1756	1674
4169	3662	3232	2898	2631	2400	2259	2132	2016	1914	1824
4542	3984	3511	3145	2853	2600	2447	2308	2183	2071	1974
4921	4309	3792	3393	3075	2800	2635	2485	2349	2229	2123
5303	4637	4074	3641	3297	3000	2822	2661	2515	2386	2272
5689	4968	4358	3890	3519	3200	3010	2837	2681	2542	2421
6081	5301	4643	4140	3742	3400	3197	3012	2846	2698	2569
6477	5638	4930	4391	3966	3600	3384	3188	3011	2854	2717
6877	5977	5220	4643	4190	3800	3571	3363	3176	3010	2865
7283	6320	5510	4896	4414	4000	3758	3538	3340	3165	3012

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	6.7	0:49	6.1	0:47	5.3	0:44	4.8	0:42	4.4	0:40
400	13.9	1:37	12.9	1:31	11.5	1:24	10.7	1:20	10.1	1:16
600	21.0	2:25	19.5	2:17	17.5	2:06	16.4	1:59	15.6	1:53
800	27.9	3:15	26.0	3:04	23.4	2:48	22.0	2:39	20.9	2:30
1000	34.7	4:04	32.4	3:51	29.3	3:30	27.5	3:19	26.2	3:07
1200	41.3	4:55	38.6	4:40	35.0	4:14	32.9	3:59	31.3	3:45
1400	47.8	5:46	44.7	5:28	40.6	4:58	38.2	4:40	36.3	4:23
1600	54.2	6:38	50.8	6:17	46.2	5:42	43.4	5:22	41.3	5:02
1800	60.5	7:31	56.7	7:07	51.7	6:27	48.5	6:03	46.1	5:41
2000	66.7	8:24	62.6	7:57	57.2	7:12	53.6	6:45	51.0	6:20
2200	72.9	9:19	68.3	8:48	62.4	7:58	58.5	7:28	55.6	7:00
2400	79.0	10:14	74.0	9:39	67.7	8:44	63.4	8:11	60.2	7:39
2600	85.1	11:10	79.5	10:31	72.8	9:31	68.2	8:54	64.8	8:20
2800	91.0	12:07	85.0	11:24	77.8	10:18	73.0	9:38	69.2	9:01
3000	96.9	13:04	90.4	12:17	82.8	11:06	77.7	10:22	73.6	9:41
3200	102.5	14:03	95.7	13:12	87.6	11:54	82.3	11:07	77.9	10:23
3400	108.1	15:02	101.0	14:06	92.4	12:43	86.8	11:53	82.2	11:05
3600	113.6	16:02	106.2	15:02	97.1	13:33	91.3	12:38	86.4	11:47
3800	119.0	17:04	111.3	15:58	101.7	14:23	95.6	13:24	90.5	12:30
4000	124.4	18:05	116.4	16:54	106.3	15:13	100.0	14:11	94.7	13:13

GEAR DOWN**Long Range Cruise Enroute Fuel and Time****Fuel Required Adjustment (1000 KG)**

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)							
	160	180	200	220	240	260	280	300
10	-1.4	-0.7	0.0	0.8	2.0	3.5	5.4	7.6
20	-2.1	-1.1	0.0	1.6	3.7	6.3	9.4	13.1
30	-2.9	-1.5	0.0	2.3	5.3	8.9	13.2	18.1
40	-3.7	-1.9	0.0	3.0	6.8	11.4	16.6	22.7
50	-4.6	-2.4	0.0	3.7	8.2	13.6	19.8	26.8
60	-5.4	-2.8	0.0	4.3	9.5	15.6	22.6	30.5
70	-6.3	-3.3	0.0	4.9	10.7	17.5	25.1	33.7
80	-7.2	-3.7	0.0	5.5	11.8	19.1	27.4	36.5
90	-8.1	-4.2	0.0	6.0	12.8	20.6	29.3	38.8
100	-9.1	-4.7	0.0	6.4	13.7	21.9	30.9	40.7
110	-10.1	-5.1	0.0	6.9	14.5	22.9	32.1	42.1
120	-11.1	-5.6	0.0	7.3	15.2	23.8	33.1	43.1
130	-12.1	-6.1	0.0	7.6	15.8	24.5	33.8	43.6

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30+80

PRESSURE ALT (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	41	45	49	53	57	61	65	69	73	78
TIME (MINUTES)	12	12	13	14	15	16	16	17	18	18

GEAR DOWN

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
300	EPR	1.138	1.167	1.227	1.313			
	KIAS	244	244	244	244			
	FF/ENG	7090	7090	7110	7210			
280	EPR	1.123	1.150	1.203	1.278			
	KIAS	239	239	239	239			
	FF/ENG	6610	6620	6620	6670			
260	EPR	1.110	1.134	1.179	1.247	1.345		
	KIAS	234	234	234	234	234		
	FF/ENG	6160	6150	6150	6180	6300		
240	EPR	1.097	1.119	1.158	1.217	1.302		
	KIAS	228	228	228	228	228		
	FF/ENG	5720	5690	5690	5690	5750		
220	EPR	1.086	1.104	1.140	1.190	1.263	1.376	
	KIAS	222	222	222	222	222	222	
	FF/ENG	5290	5260	5240	5230	5250	5390	
200	EPR	1.076	1.092	1.123	1.166	1.230	1.322	
	KIAS	215	215	215	215	215	215	
	FF/ENG	5000	4840	4810	4790	4800	4860	
180	EPR	1.067	1.081	1.106	1.144	1.199	1.277	1.402
	KIAS	208	208	208	208	208	208	208
	FF/ENG	4600	4440	4390	4380	4370	4390	4510
160	EPR	1.059	1.071	1.093	1.126	1.173	1.242	1.345
	KIAS	203	203	203	203	203	203	203
	FF/ENG	4270	4220	4060	4040	4030	4030	4100
140	EPR	1.053	1.064	1.084	1.114	1.157	1.219	1.310
	KIAS	203	203	203	203	203	203	203
	FF/ENG	4110	4060	3900	3870	3910	3830	3870

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

**Holding
Flaps 1**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
300	EPR	1.140	1.168	1.225	1.307	
	KIAS	224	224	224	224	
	FF/ENG	6760	6760	6760	6820	
280	EPR	1.126	1.153	1.202	1.276	1.384
	KIAS	219	219	219	219	219
	FF/ENG	6320	6310	6300	6330	6470
260	EPR	1.113	1.137	1.181	1.247	1.342
	KIAS	214	214	214	214	214
	FF/ENG	5890	5870	5860	5880	5960
240	EPR	1.101	1.122	1.161	1.218	1.301
	KIAS	208	208	208	208	208
	FF/ENG	5460	5430	5420	5410	5450
220	EPR	1.090	1.107	1.143	1.191	1.264
	KIAS	202	202	202	202	202
	FF/ENG	5030	4990	4970	4960	4980
200	EPR	1.080	1.095	1.125	1.167	1.229
	KIAS	195	195	195	195	195
	FF/ENG	4730	4570	4530	4530	4530
180	EPR	1.069	1.083	1.107	1.144	1.196
	KIAS	188	188	188	188	188
	FF/ENG	4310	4270	4110	4100	4090
160	EPR	1.059	1.072	1.093	1.125	1.169
	KIAS	183	183	183	183	183
	FF/ENG	3960	3920	3770	3800	3790
140	EPR	1.053	1.064	1.083	1.111	1.151
	KIAS	183	183	183	183	183
	FF/ENG	3770	3720	3640	3600	3580

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight
Gear Down, Engine INOP

Chapter PI
Section 27

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude
100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		VREF + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
260	246	233	2200		
240	228	227	5600	3300	400
220	210	221	8500	6600	4200
200	191	214	11300	9700	7500
180	172	208	14100	12500	10700
160	153	200	16800	15400	13700
140	134	192	19500	18100	16500

GEAR DOWN

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
240	3500		
220	6900	4800	1700
200	10100	8100	5800
180	13000	11300	9300
160	15900	14400	12500
140	18700	17200	15700

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
240	EPR	1.394						
	MACH	.379						
	KIAS	229						
	FF/ENG	10859						
230	EPR	1.372	1.420					
	MACH	.374	.388					
	KIAS	226	226					
	FF/ENG	10399	10514					
220	EPR	1.350	1.395					
	MACH	.369	.382					
	KIAS	223	223					
	FF/ENG	9949	10039					
210	EPR	1.330	1.371	1.420				
	MACH	.363	.377	.391				
	KIAS	220	220	220				
	FF/ENG	9514	9582	9688				
200	EPR	1.310	1.348	1.393	1.447			
	MACH	.358	.371	.385	.400			
	KIAS	216	216	216	216			
	FF/ENG	9096	9139	9222	9351			
190	EPR	1.291	1.326	1.367	1.417	1.478		
	MACH	.352	.365	.379	.393	.408		
	KIAS	213	213	213	213	213		
	FF/ENG	8689	8712	8774	8870	9037		
180	EPR	1.273	1.305	1.343	1.388	1.442		
	MACH	.346	.359	.373	.387	.402		
	KIAS	209	209	209	209	209		
	FF/ENG	8291	8303	8340	8414	8529		
170	EPR	1.255	1.285	1.320	1.361	1.409	1.470	
	MACH	.340	.353	.366	.380	.395	.410	
	KIAS	206	206	206	206	206	206	
	FF/ENG	7892	7901	7919	7971	8055	8200	
160	EPR	1.238	1.266	1.298	1.335	1.379	1.432	1.500
	MACH	.334	.346	.359	.373	.388	.403	.419
	KIAS	202	202	202	202	202	202	202
	FF/ENG	7496	7504	7513	7541	7605	7701	7882
150	EPR	1.221	1.247	1.276	1.310	1.350	1.397	1.456
	MACH	.327	.340	.353	.366	.380	.395	.411
	KIAS	198	198	198	198	198	198	198
	FF/ENG	7109	7109	7116	7129	7168	7238	7355
140	EPR	1.205	1.228	1.256	1.287	1.323	1.365	1.416
	MACH	.321	.333	.345	.359	.373	.387	.403
	KIAS	194	194	194	194	194	194	194
	FF/ENG	6729	6721	6725	6732	6750	6799	6877

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
170	150	132	119	109	100	93	88	83	78	75
349	305	269	241	219	200	187	175	164	154	146
529	462	406	363	329	300	279	260	244	230	218
710	620	544	486	440	400	372	347	325	306	290
892	778	681	608	550	500	465	433	406	381	361
1075	936	819	730	660	600	558	520	487	458	433
1259	1096	958	853	771	700	651	606	567	533	504
1444	1256	1097	976	882	800	743	692	647	608	575
1630	1416	1236	1100	992	900	836	778	727	683	646
1817	1577	1375	1223	1103	1000	928	864	808	759	717

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	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)
100	3.3	0:28	3.1	0:27	2.9	0:27	2.7	0:26	2.6	0:26
200	6.9	0:54	6.6	0:53	6.4	0:52	6.1	0:50	5.9	0:49
300	10.5	1:21	10.1	1:19	9.8	1:17	9.5	1:15	9.2	1:13
400	14.1	1:48	13.6	1:45	13.2	1:42	12.8	1:39	12.5	1:36
500	17.6	2:15	17.0	2:11	16.5	2:07	16.1	2:04	15.7	2:00
600	21.1	2:42	20.4	2:37	19.8	2:33	19.3	2:29	18.9	2:24
700	24.6	3:09	23.8	3:04	23.1	2:59	22.5	2:54	22.0	2:49
800	28.0	3:37	27.1	3:31	26.3	3:25	25.6	3:19	25.1	3:13
900	31.3	4:05	30.4	3:58	29.5	3:51	28.8	3:44	28.1	3:37
1000	34.7	4:33	33.6	4:25	32.7	4:17	31.8	4:09	31.2	4:02

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)					
	140	160	180	200	220	240
4	-0.4	-0.2	0.0	0.3	0.8	1.3
6	-0.7	-0.3	0.0	0.5	1.2	2.0
8	-0.9	-0.5	0.0	0.7	1.6	2.7
10	-1.2	-0.6	0.0	0.9	2.0	3.3
12	-1.4	-0.7	0.0	1.0	2.4	4.0
14	-1.7	-0.8	0.0	1.2	2.7	4.6
16	-1.9	-1.0	0.0	1.4	3.1	5.2
18	-2.1	-1.1	0.0	1.5	3.5	5.8
20	-2.4	-1.2	0.0	1.7	3.8	6.4
22	-2.6	-1.3	0.0	1.8	4.1	7.0
24	-2.9	-1.4	0.0	2.0	4.5	7.5
26	-3.1	-1.6	0.0	2.1	4.8	8.0
28	-3.3	-1.7	0.0	2.3	5.1	8.5
30	-3.6	-1.8	0.0	2.4	5.4	9.0
32	-3.8	-1.9	0.0	2.6	5.7	9.5
34	-4.1	-2.0	0.0	2.7	6.0	10.0
36	-4.3	-2.2	0.0	2.8	6.2	10.4

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
240	EPR	1.319	1.390		
	KIAS	228	228		
	FF/ENG	11170	11310		
220	EPR	1.285	1.347		
	KIAS	222	222		
	FF/ENG	10300	10360		
200	EPR	1.253	1.307	1.414	
	KIAS	215	215	215	
	FF/ENG	9440	9470	9650	
180	EPR	1.223	1.270	1.360	
	KIAS	208	208	208	
	FF/ENG	8620	8620	8700	
160	EPR	1.199	1.240	1.319	1.437
	KIAS	203	203	203	203
	FF/ENG	7950	7940	7970	8170
140	EPR	1.185	1.222	1.295	1.401
	KIAS	203	203	203	203
	FF/ENG	7590	7570	7590	7720

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight

Text

Chapter PI

Section 28

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. 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 Flight Manual, the Flight Manual shall always take precedence.

General

FMC Takeoff Speeds

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/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 colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush 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 is determined as follows:

- (1) Determine the dry field/obstacle limit weight for the takeoff flap setting.
- (2) 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.
- (3) Adjust field length available for temperature by amount shown on chart.
- (4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Takeoff speed determination:

(1) Determine takeoff speeds V_1 , V_R and V_2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If $V_1(\text{MCG})$ limited, set $V_1 = V_1(\text{MCG})$. If not limited by $V_1(\text{MCG})$ considerations, enter the V_1 Adjustment table with actual brake release weight to determine the V_1 reduction to apply to V_1 speed. If the adjusted V_1 is less than $V_1(\text{MCG})$, set $V_1 = V_1(\text{MCG})$.

Slippery Runway

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. Good reported braking action denotes wet runway conditions or runways covered by compact snow. Similarly, poor braking action denotes runways covered with wet ice. Performance is based on reversers operating and 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.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V_1 less than minimum V_1 for control on the ground, $V_1(\text{MCG})$, and V_R less than minimum V_R , $(1.05) \text{ VMCA}$. It is therefore necessary to compare the adjusted V_1 and V_R to $V_1(\text{MCG})$ and Minimum V_R respectively. To find $V_1(\text{MCG})$ and Minimum V_R , enter the $V_1(\text{MCG})$, Minimum V_R table with the airport pressure altitude and actual OAT. If the adjusted V_1 is less than $V_1(\text{MCG})$, set V_1 equal to $V_1(\text{MCG})$. If the adjusted V_R is less than Min V_R , set V_R equal to Min V_R and determine a new V_2 by adding the difference between the normal V_R and Min V_R to the normal V_2 . No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around EPR

To find Go-Around EPR based on normal engine bleed for packs on and anti-ice off, enter the Go-Around EPR table with airport pressure altitude and reported OAT or TAT and read EPR. EPR adjustments are shown for engine bleeds for various conditions.

Max Climb EPR

This table shows Max Climb EPR for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read EPR. EPR adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body attitude and average EPR 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables 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 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. Note that these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Control

These tables provide target EPR, 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, .84 Mach approximates the Long Range Cruise Mach schedule.

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 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 .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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.

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 at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. 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 30 at the outer marker.

Holding

Target EPR, 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 for the selected flap setting. Flaps 1 is based on VREF30+60 speed schedule. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read EPR, IAS and fuel flow per engine.

Advisory Information

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

The table "Approach or Landing Climb Limited Weight" presents the data which are the more limiting of Approach Climb Limit Weight and Landing Climb Limit Weight.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding 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.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy 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 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, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

Engine Inoperative

Initial Max Continuous EPR

The Initial Max Continuous EPR setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target EPR setting at the start of driftdown. Once driftdown is established, the Max Continuous EPR table should be used to determine EPR for the given conditions.

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Max Continuous EPR

Power setting is based on one engine operating with one bleed source for pack(s) operating and all anti-ice bleeds off. Enter the table for appropriate pressure altitude with IAS or Mach and TAT to read Max Continuous EPR. Apply the anti-ice corrections below the table as required.

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/Cruise 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 correct 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 Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target EPR, 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 PENALTY (KG/HR)				
	GROSS WEIGHT (1000 KG)				
	300	260	220	180	140
43				160	140
39			180	160	145
35		200	190	170	140
31	230	220	195	165	140
25	230	220	195	175	155
20	235	230	205	185	165
15	235	235	215	200	185
10	240	240	230	220	200
5	270	270	255	240	220

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 .84/310/250 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 corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required 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 is planned. The tables show gear down rate of climb available for Flaps 20 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

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in the ALTERNATE mode is to reduce the PRIMARY mode (normal) performance limited weights. The Limit Weight table provides takeoff field, climb, obstacle, net level off and approach or landing climb weights. To determine limit weights for operations with the EEC in the ALTERNATE mode, enter the table with the limit weights for PRIMARY mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. The ALTERNATE Mode EEC Approach or Landing Climb limit must be compared to the Landing Field Length limit and the more limiting of the two must be used as the landing limit weight. 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 Adjustments Table. The adjusted V1 should not exceed the adjusted VR.

NOTE: The FMC does incorporate ALTERNATE Mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule with anti-ice off. Enter the table with pressure altitude and TAT to read Max Climb %N1. Apply bleed adjustments as required.

Max Cruise %N1

Maximum Cruise %N1 is presented for .84M, which approximates Long Range Cruise speed. Enter the table with pressure altitude and TAT to read Max Cruise %N1. Appropriate bleed adjustments are shown.

Go-Around %N1

Go-Around power setting for ALTERNATE MODE EEC operation is presented for normal engine bleed for packs on. Go-Around %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Alternate Mode EEC, Engine Inoperative

Initial Max Continuous %N1

Initial Max Continuous %N1 settings for use following an engine failure are presented. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Appropriate bleed adjustments are shown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Max Continuous %N1 settings are presented as a function of pressure altitude and TAT for engine inoperative speeds of 320, 280, 240, and 200 KIAS. Power settings may be interpolated for intermediate airspeeds. Apply bleed adjustments as required.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

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Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

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 30****777-200LR GE90-110B1L KG M FAA TO1-10 TO2-20****Pkg Model Identification PI.ModID.30.1****General PI.30.1**

VREF	PI.30.1
Flap Maneuver Speed	PI.30.2
Slush/Standing Water Takeoff	PI.30.3
Slippery Runway Takeoff	PI.30.7
TO1 Slush/Standing Water Takeoff	PI.30.11
TO1 Slippery Runway Takeoff	PI.30.15
TO2 Slush/Standing Water Takeoff	PI.30.19
TO2 Slippery Runway Takeoff	PI.30.23
Minimum Control Speeds	PI.30.27
Go-around %N1	PI.30.28
Max Climb %N1	PI.30.29
Flight With Unreliable Airspeed / Turbulent Air Penetration	PI.30.30

All Engine PI.31.1

Long Range Cruise Maximum Operating Altitude	PI.31.1
Long Range Cruise Control	PI.31.3
Long Range Cruise Enroute Fuel and Time - Low Altitude ..	PI.31.4
Long Range Cruise Enroute Fuel and Time - High Altitude ..	PI.31.5
Long Range Cruise Wind-Altitude Trade	PI.31.7
Descent at .84M/310/250	PI.31.7
Holding	PI.31.8

Advisory Information..... PI.32.1

Normal Configuration Landing Distance	PI.32.1
Non-Normal Configuration Landing Distance	PI.32.4
Airspeed Unreliable (Flaps 20)	PI.32.4
ANTISKID (Flaps 25)	PI.32.5

ANTISKID (Flaps 30)	PI.32.6
ENG SHUTDOWN L, R (Flaps 20)	PI.32.7
ENG SHUTDOWN L, R (Flaps 30)	PI.32.8
FLAP / SLAT CONTROL (Flaps 20)	PI.32.9
FLAPS DRIVE (Flaps ≤ 5)	PI.32.10
FLAPS DRIVE (5 < Flaps < 20)	PI.32.11
FLAPS DRIVE (Flaps ≥ 20)	PI.32.12
FLAPS PRIMARY FAIL (Flaps 20)	PI.32.13
FLIGHT CONTROL MODE (Flaps 20)	PI.32.14
FLIGHT CONTROLS (Flaps 20)	PI.32.15
HYD PRESS SYS C (Flaps 20)	PI.32.16
HYD PRESS SYS L (Flaps 25)	PI.32.17
HYD PRESS SYS L (Flaps 30)	PI.32.18
HYD PRESS SYS L+C (Flaps 20)	PI.32.19
HYD PRESS SYS L+R (Flaps 20)	PI.32.20
HYD PRESS SYS R (Flaps 25)	PI.32.21
HYD PRESS SYS R (Flaps 30)	PI.32.22
HYD PRESS SYS R+C (Flaps 20)	PI.32.23
PITCH DOWN AUTHORITY (Flaps 25)	PI.32.24
PITCH DOWN AUTHORITY (Flaps 30)	PI.32.25
PITCH UP AUTHORITY (Flaps ≤ 15)	PI.32.26
PITCH UP AUTHORITY (Flaps ≥ 20)	PI.32.27
PRI FLIGHT COMPUTERS (Flaps 20)	PI.32.28
SLATS DRIVE (Flaps 20)	PI.32.29
SPOILERS (Flaps 25)	PI.32.30
SPOILERS (Flaps 30)	PI.32.31
STABILIZER (Flaps 20)	PI.32.32
Approach or Landing Climb Limited Weight	PI.32.33
Recommended Brake Cooling Schedule	PI.32.35

Engine Inoperative PI.33.1

Initial Max Continuous %N1	PI.33.1
Max Continuous %N1	PI.33.2
Driftdown Speed/Level Off Altitude	PI.33.5

777 Flight Crew Operations Manual

Driftdown/LRC Cruise Range Capability	PI.33.6
Long Range Cruise Altitude Capability	PI.33.7
Long Range Cruise Control	PI.33.8
Long Range Cruise Diversion Fuel and Time	PI.33.9
Holding.....	PI.33.10
Gear Down Landing Rate of Climb Available	PI.33.11
Alternate Mode EEC	PI.34.1
Alternate Mode EEC Max Takeoff %N1	PI.34.1
Gear Down	PI.35.1
220 KIAS Max Climb %N1	PI.35.1
Long Range Cruise Altitude Capability	PI.35.2
Long Range Cruise Control	PI.35.3
Long Range Cruise Enroute Fuel and Time	PI.35.4
Descent at VREF30 + 80	PI.35.5
Holding.....	PI.35.6
Gear Down, Engine Inoperative	PI.36.1
Driftdown Speed/Level Off Altitude	PI.36.1
Long Range Cruise Altitude Capability	PI.36.1
Long Range Cruise Control	PI.36.2
Long Range Cruise Diversion Fuel and Time	PI.36.3
Holding.....	PI.36.4
Text	PI.37.1
Introduction	PI.37.1
General	PI.37.1
All Engines.....	PI.37.4
Advisory Information	PI.37.6
Engine Inoperative	PI.37.8
Alternate Mode EEC	PI.37.11
Gear Down	PI.37.11

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Performance Inflight
Pkg Model Identification**Chapter PI**
Section 30**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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
200LR	777-200LR	7260	WY260

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Performance Inflight

General

Chapter PI

Section 30

VREF**Flaps 30**

WEIGHT (1000 KG)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360	184	184	184	184	184	184
340	180	180	180	180	180	180
320	173	173	173	173	173	173
300	164	164	164	164	164	165
280	158	158	158	158	158	158
260	149	149	149	150	150	150
240	143	144	144	144	144	144
220	137	137	138	138	138	138
200	137	134	131	131	131	131
180	137	134	130	126	124	124
160	137	134	130	126	121	117

Flaps 25

WEIGHT (1000 KG)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360	183	183	183	183	183	183
340	180	180	180	180	181	181
320	175	175	175	175	175	176
300	169	170	170	170	170	170
280	164	164	164	164	164	164
260	158	158	158	158	158	158
240	152	152	152	152	152	152
220	145	145	146	146	146	146
200	139	139	139	139	139	139
180	137	134	131	131	131	132
160	137	134	130	126	124	124

Flaps 20

WEIGHT (1000 KG)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360	193	193	193	193	194	195
340	190	190	190	191	191	192
320	185	185	185	185	185	186
300	179	179	179	179	180	180
280	173	173	173	173	174	174
260	167	167	167	167	167	167
240	160	160	161	161	161	161
220	154	154	154	154	154	154
200	147	147	147	147	147	147
180	139	139	139	139	139	139
160	137	134	131	131	131	131

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS 0	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

ADVISORY INFORMATION**Slush/Standing Water Takeoff****Maximum Reverse Thrust****Weight Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-36.7	-41.6	-46.5	-43.6	-48.5	-53.4	-55.0	-59.9	-64.8
340	-34.6	-39.5	-44.4	-40.8	-45.7	-50.6	-51.0	-55.9	-60.8
320	-32.3	-37.2	-42.1	-37.8	-42.7	-47.6	-46.8	-51.7	-56.6
300	-29.7	-34.6	-39.5	-34.5	-39.4	-44.3	-42.4	-47.3	-52.2
280	-26.8	-31.7	-36.6	-31.0	-35.9	-40.8	-37.8	-42.7	-47.6
260	-23.7	-28.6	-33.5	-27.3	-32.2	-37.1	-32.9	-37.8	-42.7
240	-20.4	-25.3	-30.2	-23.3	-28.2	-33.1	-27.9	-32.8	-37.7
220	-16.9	-21.7	-26.6	-19.1	-24.0	-28.9	-22.6	-27.5	-32.4
200	-13.0	-17.9	-22.8	-14.7	-19.6	-24.5	-17.1	-22.0	-26.9
180	-9.0	-13.9	-18.8	-10.0	-14.9	-19.8	-11.4	-16.3	-21.2
160	-4.9	-9.7	-14.6	-5.3	-10.2	-15.1	-5.6	-10.5	-15.4

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2200				134.1			155.7		
2400	155.7			168.7			190.4		
2600	190.1			203.4	137.9		225.3	159.5	
2800	224.7	159.5		238.4	172.5		260.5	194.2	128.6
3000	259.8	193.9	128.9	273.8	207.2	141.7	296.0	229.2	163.3
3200	295.3	228.6	163.3	309.5	242.3	176.3	331.8	264.4	198.0
3400	331.3	263.7	197.7	345.7	277.7	211.1	367.9	299.9	233.0
3600	367.8	299.3	232.4	382.2	313.5	246.1		335.8	268.3
3800		335.3	267.6		349.7	281.6		371.9	303.9
4000		371.8	303.2			317.4			339.7
4200			339.3			353.7			375.9
4400			375.8						

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 -65 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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-26	-24	-22	-22	-20	-18	-14	-12	-10
340	-28	-26	-24	-23	-21	-19	-15	-13	-11
320	-29	-27	-25	-25	-23	-21	-16	-14	-12
300	-30	-28	-26	-26	-24	-22	-18	-16	-14
280	-31	-29	-27	-27	-25	-23	-20	-18	-16
260	-31	-29	-27	-28	-26	-24	-21	-19	-17
240	-31	-29	-27	-29	-27	-25	-23	-21	-19
220	-31	-29	-27	-29	-27	-25	-24	-22	-20
200	-31	-29	-27	-29	-27	-25	-25	-23	-21
180	-30	-28	-26	-28	-26	-24	-25	-23	-21
160	-29	-27	-25	-28	-26	-24	-25	-23	-21

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 Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-49.8	-54.9	-60.0	-57.7	-62.8	-67.9	-70.5	-75.6	-80.7
340	-46.7	-51.8	-56.8	-53.7	-58.8	-63.9	-64.9	-70.0	-75.1
320	-43.4	-48.4	-53.5	-49.6	-54.7	-59.8	-59.3	-64.3	-69.4
300	-39.9	-45.0	-50.0	-45.3	-50.4	-55.5	-53.6	-58.7	-63.8
280	-36.2	-41.3	-46.4	-40.9	-46.0	-51.1	-47.9	-53.0	-58.1
260	-32.4	-37.5	-42.6	-36.4	-41.4	-46.5	-42.2	-47.2	-52.3
240	-28.4	-33.5	-38.6	-31.7	-36.7	-41.8	-36.4	-41.5	-46.6
220	-24.3	-29.4	-34.4	-26.8	-31.9	-37.0	-30.6	-35.7	-40.8
200	-20.0	-25.0	-30.1	-21.8	-26.9	-32.0	-24.8	-29.9	-35.0
180	-15.5	-20.6	-25.7	-16.7	-21.8	-26.9	-19.0	-24.1	-29.1
160	-11.0	-16.0	-21.1	-11.5	-16.6	-21.7	-13.1	-18.2	-23.3

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
3200							128.5		
3400							177.1		
3600							223.7	125.0	
3800				165.6			266.2	173.6	
4000	132.1			221.2			305.4	220.5	121.5
4200	198.7			268.3	161.3		341.9	263.3	170.1
4400	253.1	127.2		309.7	217.5		376.6	302.6	217.3
4600	298.2	194.2		347.0	265.1	157.1		339.4	260.3
4800	337.4	249.6	122.4	382.0	306.8	213.7		374.2	299.9
5000	372.9	295.1	189.6		344.4	261.9			336.8
5200		334.7	246.0		379.5	304.0			371.7
5400		370.4	292.1			341.8			
5600			332.0			377.0			
5800			367.8						

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 -100 m/+95 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-42	-38	-34	-36	-32	-28	-23	-19	-15
340	-44	-40	-36	-38	-34	-30	-25	-21	-17
320	-45	-41	-37	-40	-36	-32	-27	-23	-19
300	-46	-42	-38	-41	-37	-33	-29	-25	-21
280	-47	-43	-39	-43	-39	-35	-32	-28	-24
260	-47	-43	-39	-44	-40	-36	-35	-31	-27
240	-48	-44	-40	-45	-41	-37	-37	-33	-29
220	-48	-44	-40	-45	-41	-37	-40	-36	-32
200	-48	-44	-40	-46	-42	-38	-41	-37	-33
180	-48	-44	-40	-46	-42	-38	-42	-38	-34
160	-48	-44	-40	-46	-42	-38	-43	-39	-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****Maximum 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	0.0	-1.5	-2.9	-21.4	-22.9	-24.3	-38.0	-39.5	-40.9
340	-1.6	-3.1	-4.5	-21.4	-22.8	-24.3	-36.4	-37.9	-39.3
320	-4.0	-5.5	-6.9	-21.3	-22.7	-24.2	-34.9	-36.3	-37.8
300	-5.4	-6.8	-8.3	-21.0	-22.5	-23.9	-33.3	-34.8	-36.2
280	-5.8	-7.3	-8.7	-20.5	-21.9	-23.4	-31.6	-33.1	-34.5
260	-5.8	-7.2	-8.7	-19.2	-20.7	-22.1	-29.1	-30.6	-32.0
240	-5.2	-6.7	-8.1	-17.2	-18.7	-20.1	-25.9	-27.3	-28.8
220	-4.2	-5.7	-7.2	-14.5	-15.9	-17.4	-21.9	-23.3	-24.8
200	-2.8	-4.2	-5.7	-11.0	-12.4	-13.9	-17.1	-18.5	-20.0
180	-0.8	-2.3	-3.7	-6.7	-8.2	-9.7	-11.5	-12.9	-14.4
160	0.0	-0.2	-1.6	-2.2	-3.7	-5.1	-5.6	-7.0	-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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1600	143.2								
1800	210.7	144.9							
2000	277.9	212.3	146.5	121.3					
2200	344.9	279.5	213.9	169.0					
2400	411.7	346.5	281.1	217.0	152.7				
2600		413.3	348.1	266.5	200.4	136.4	140.9		
2800				317.9	249.4	184.0	172.2		
3000				371.1	300.1	232.4	203.7	140.5	
3200					352.7	282.5	236.1	171.8	
3400						334.5	269.6	203.3	140.2
3600						388.1	304.3	235.7	171.4
3800							340.2	269.2	202.9
4000							377.5	303.8	235.3
4200								339.8	268.8
4400								377.0	303.4
4600									339.4
4800									376.6

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 -50 m/+45 m for every 5°C above/below 4°C.
Adjust "Poor" field length available by -65 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
Maximum Reverse Thrust
V1 Adjustments (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-6	-4	-2	-18	-16	-14	-33	-31	-29
340	-9	-7	-5	-21	-19	-17	-36	-34	-32
320	-10	-8	-6	-23	-21	-19	-39	-37	-35
300	-12	-10	-8	-25	-23	-21	-41	-39	-37
280	-13	-11	-9	-27	-25	-23	-42	-40	-38
260	-14	-12	-10	-28	-26	-24	-44	-42	-40
240	-14	-12	-10	-29	-27	-25	-45	-43	-41
220	-15	-13	-11	-30	-28	-26	-45	-43	-41
200	-15	-13	-11	-30	-28	-26	-46	-44	-42
180	-16	-14	-12	-30	-28	-26	-46	-44	-42
160	-16	-14	-12	-30	-28	-26	-46	-44	-42

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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-6.0	-7.1	-8.2	-33.7	-34.8	-35.9	-54.8	-55.9	-56.9
340	-8.4	-9.5	-10.6	-32.9	-34.0	-35.1	-51.6	-52.7	-53.8
320	-10.2	-11.3	-12.4	-32.1	-33.2	-34.3	-48.9	-50.0	-51.0
300	-11.4	-12.5	-13.6	-31.5	-32.6	-33.6	-46.5	-47.6	-48.7
280	-12.0	-13.1	-14.1	-30.6	-31.7	-32.8	-44.2	-45.3	-46.3
260	-11.9	-13.0	-14.1	-28.8	-29.9	-31.0	-41.1	-42.2	-43.3
240	-11.1	-12.2	-13.3	-26.1	-27.2	-28.3	-37.3	-38.4	-39.5
220	-9.7	-10.8	-11.9	-22.5	-23.5	-24.6	-32.8	-33.9	-35.0
200	-7.6	-8.7	-9.8	-17.9	-19.0	-20.1	-27.5	-28.6	-29.7
180	-4.9	-6.0	-7.1	-12.4	-13.5	-14.6	-21.4	-22.5	-23.6
160	-1.9	-3.0	-4.1	-6.5	-7.6	-8.7	-15.1	-16.2	-17.3

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2000	160.9								
2200	267.5	171.1							
2400	351.0	275.4	181.3						
2600		357.5	283.1						
2800			364.0						
3200				221.8					
3400				316.2	183.1				
3600				385.4	293.6	138.0			
3800					366.8	268.7			
4000						348.1			
4800							121.1		
5000							195.4		
5200							267.3	143.0	
5400							335.7	216.9	
5600								287.7	164.8
5800								355.3	238.1
6000									307.9

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 -40 m/+35 m for every 5°C above/below 4°C.
Adjust "Medium" field length available by -60 m/+55 m for every 5°C above/below 4°C.
Adjust "Poor" field length available by -95 m/+90 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-10	-6	-2	-27	-23	-19	-54	-50	-46
340	-12	-8	-4	-31	-27	-23	-58	-54	-50
320	-14	-10	-6	-34	-30	-26	-62	-58	-54
300	-16	-12	-8	-37	-33	-29	-65	-61	-57
280	-18	-14	-10	-39	-35	-31	-68	-64	-60
260	-19	-15	-11	-41	-37	-33	-71	-67	-63
240	-21	-17	-13	-43	-39	-35	-73	-69	-65
220	-22	-18	-14	-45	-41	-37	-75	-71	-67
200	-23	-19	-15	-48	-44	-40	-77	-73	-69
180	-24	-20	-16	-50	-46	-42	-77	-73	-69
160	-25	-21	-17	-52	-48	-44	-78	-74	-70

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**TO1 Slush/Standing Water Takeoff****10% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 KG)**

TO1 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-35.0	-39.9	-44.8	-42.0	-46.9	-51.8	-53.6	-58.5	-63.4
340	-33.2	-38.1	-43.0	-39.5	-44.4	-49.3	-50.1	-55.0	-59.9
320	-31.5	-36.4	-41.3	-37.2	-42.1	-46.9	-46.6	-51.5	-56.4
300	-29.4	-34.3	-39.2	-34.5	-39.4	-44.3	-42.8	-47.7	-52.6
280	-27.1	-32.0	-36.9	-31.5	-36.4	-41.3	-38.7	-43.6	-48.5
260	-24.4	-29.3	-34.2	-28.3	-33.2	-38.1	-34.4	-39.3	-44.2
240	-21.5	-26.4	-31.3	-24.7	-29.6	-34.5	-29.8	-34.7	-39.6
220	-18.3	-23.2	-28.1	-20.9	-25.8	-30.7	-24.8	-29.7	-34.6
200	-14.8	-19.7	-24.6	-16.7	-21.6	-26.5	-19.6	-24.5	-29.4
180	-11.0	-15.9	-20.8	-12.3	-17.2	-22.1	-14.2	-19.1	-24.0
160	-6.9	-11.7	-16.6	-7.6	-12.5	-17.4	-8.4	-13.3	-18.2

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2000				123.0			144.4		
2200	146.8			159.7			181.3		
2400	183.4			196.6	127.0		218.5	148.5	
2600	220.5	150.8		234.2	163.7		256.3	185.4	
2800	258.5	187.4		272.4	200.7	131.0	294.7	222.6	152.6
3000	297.3	224.7	154.8	311.5	238.4	167.8	333.8	260.5	189.4
3200	336.9	262.7	191.5	351.3	276.7	204.8	373.5	299.0	226.8
3400	377.4	301.6	228.8		315.8	242.5		338.1	264.7
3600		341.3	266.9		355.7	281.0		377.9	303.2
3800		381.8	305.9			320.2			342.5
4000			345.8			360.1			382.3
4200			386.3						

1. Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -65 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 slush/standing water limited weight is lesser of weights from 1 and 3.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-24	-22	-20	-20	-18	-16	-11	-9	-7
340	-26	-24	-22	-21	-19	-17	-12	-10	-8
320	-28	-26	-24	-23	-21	-19	-13	-11	-9
300	-29	-27	-25	-25	-23	-21	-15	-13	-11
280	-30	-28	-26	-26	-24	-22	-17	-15	-13
260	-30	-28	-26	-27	-25	-23	-19	-17	-15
240	-30	-28	-26	-27	-25	-23	-21	-19	-17
220	-30	-28	-26	-27	-25	-23	-22	-20	-18
200	-29	-27	-25	-27	-25	-23	-23	-21	-19
180	-28	-26	-24	-27	-25	-23	-23	-21	-19
160	-28	-26	-24	-26	-24	-22	-23	-21	-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**TO1 Slush/Standing Water Takeoff****10% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 KG)**

TO1 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-48.6	-53.7	-58.8	-56.8	-61.9	-67.0	-70.5	-75.6	-80.7
340	-45.8	-50.8	-55.9	-53.1	-58.2	-63.3	-65.2	-70.3	-75.3
320	-42.9	-48.0	-53.0	-49.5	-54.6	-59.6	-59.9	-65.0	-70.1
300	-39.8	-44.9	-50.0	-45.6	-50.7	-55.8	-54.6	-59.6	-64.7
280	-36.6	-41.6	-46.7	-41.6	-46.7	-51.8	-49.2	-54.2	-59.3
260	-33.1	-38.2	-43.3	-37.4	-42.5	-47.5	-43.7	-48.8	-53.9
240	-29.4	-34.5	-39.6	-33.0	-38.1	-43.1	-38.2	-43.3	-48.3
220	-25.5	-30.6	-35.7	-28.4	-33.5	-38.6	-32.6	-37.7	-42.7
200	-21.5	-26.5	-31.6	-23.6	-28.7	-33.8	-26.9	-32.0	-37.1
180	-17.2	-22.2	-27.3	-18.7	-23.8	-28.8	-21.2	-26.3	-31.4
160	-12.7	-17.7	-22.8	-13.5	-18.6	-23.7	-15.4	-20.4	-25.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
3000							139.9		
3200							194.3		
3400				135.9			245.1	136.0	
3600				202.7			291.9	190.4	
3800	187.8			260.6	131.0		335.8	241.6	132.1
4000	254.6			310.8	198.1		377.7	288.7	186.6
4200	308.8	182.1		356.1	256.8	126.2		332.7	238.0
4400	355.8	250.3			307.4	193.5		374.7	285.4
4600		305.1	176.3		353.0	252.8			329.6
4800		352.6	246.0			304.0			371.7
5000			301.5			349.9			
5200			349.3						

1. Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -100 m/+95 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

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-39	-35	-31	-32	-28	-24	-17	-13	-9
340	-41	-37	-33	-34	-30	-26	-19	-15	-11
320	-42	-38	-34	-36	-32	-28	-21	-17	-13
300	-44	-40	-36	-38	-34	-30	-24	-20	-16
280	-44	-40	-36	-39	-35	-31	-27	-23	-19
260	-45	-41	-37	-41	-37	-33	-31	-27	-23
240	-45	-41	-37	-42	-38	-34	-33	-29	-25
220	-45	-41	-37	-42	-38	-34	-36	-32	-28
200	-45	-41	-37	-43	-39	-35	-38	-34	-30
180	-45	-41	-37	-43	-39	-35	-39	-35	-31
160	-46	-42	-38	-44	-40	-36	-40	-36	-32

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**TO1 Slippery Runway Takeoff****10% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustments (1000 KG)**

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	0.0	-1.5	-2.9	-19.0	-20.5	-21.9	-35.7	-37.1	-38.6
340	0.0	-1.5	-2.9	-19.1	-20.6	-22.0	-34.4	-35.8	-37.3
320	-1.5	-2.9	-4.4	-19.4	-20.9	-22.3	-33.2	-34.7	-36.1
300	-3.9	-5.3	-6.8	-19.5	-21.0	-22.4	-32.0	-33.5	-35.0
280	-5.1	-6.6	-8.0	-19.5	-21.0	-22.4	-30.9	-32.4	-33.8
260	-5.5	-6.9	-8.4	-19.1	-20.5	-22.0	-29.4	-30.8	-32.3
240	-5.4	-6.8	-8.3	-17.8	-19.3	-20.7	-27.0	-28.4	-29.9
220	-4.7	-6.2	-7.6	-15.7	-17.2	-18.6	-23.7	-25.2	-26.6
200	-3.6	-5.1	-6.5	-12.8	-14.3	-15.7	-19.6	-21.0	-22.5
180	-2.0	-3.4	-4.9	-9.1	-10.6	-12.1	-14.6	-16.0	-17.5
160	0.0	-1.4	-2.8	-4.7	-6.2	-7.6	-8.8	-10.3	-11.7

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1600	172.9								
1800	243.8	174.6							
2000	314.4	245.5	176.3	147.3					
2200	384.9	316.1	247.2	197.6	130.1				
2400		386.6	317.8	249.2	180.3		130.1		
2600			388.3	302.8	231.3	163.2	163.1		
2800				358.6	284.3	213.7	196.3	129.7	
3000					339.3	265.9	230.4	162.7	
3200					396.1	320.2	265.7	195.9	129.3
3400						376.6	302.3	230.0	162.3
3600							340.5	265.2	195.5
3800							380.0	301.9	229.5
4000								340.0	264.8
4200								379.6	301.4
4400									339.5
4600									379.1

1. Enter Weight Adjustment table with reported braking action and TO1 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 -50 m/+45 m for every 5°C above/below 4°C. Adjust "Poor" field length available by -65 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

TO1 Slippery Runway Takeoff

10% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustments (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-7	-5	-3	-18	-16	-14	-31	-29	-27
340	-9	-7	-5	-20	-18	-16	-34	-32	-30
320	-11	-9	-7	-22	-20	-18	-36	-34	-32
300	-12	-10	-8	-24	-22	-20	-38	-36	-34
280	-13	-11	-9	-26	-24	-22	-40	-38	-36
260	-14	-12	-10	-27	-25	-23	-41	-39	-37
240	-14	-12	-10	-27	-25	-23	-42	-40	-38
220	-15	-13	-11	-28	-26	-24	-43	-41	-39
200	-15	-13	-11	-28	-26	-24	-43	-41	-39
180	-16	-14	-12	-29	-27	-25	-43	-41	-39
160	-16	-14	-12	-29	-27	-25	-44	-42	-40

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**TO1 Slippery Runway Takeoff****10% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 KG)**

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-2.5	-3.5	-4.6	-31.1	-32.2	-33.3	-52.9	-54.0	-55.1
340	-5.1	-6.2	-7.3	-30.5	-31.6	-32.7	-50.0	-51.1	-52.2
320	-7.6	-8.7	-9.8	-30.0	-31.1	-32.2	-47.4	-48.5	-49.6
300	-9.5	-10.6	-11.7	-29.7	-30.7	-31.8	-45.1	-46.2	-47.3
280	-10.7	-11.8	-12.9	-29.3	-30.4	-31.5	-43.3	-44.4	-45.4
260	-11.3	-12.4	-13.5	-28.6	-29.7	-30.8	-41.2	-42.3	-43.4
240	-11.1	-12.2	-13.3	-26.8	-27.9	-29.0	-38.4	-39.4	-40.5
220	-10.3	-11.4	-12.4	-24.0	-25.1	-26.2	-34.6	-35.7	-36.8
200	-8.7	-9.8	-10.9	-20.2	-21.3	-22.4	-30.0	-31.1	-32.2
180	-6.4	-7.5	-8.6	-15.4	-16.5	-17.6	-24.6	-25.7	-26.8
160	-3.5	-4.6	-5.7	-9.6	-10.7	-11.8	-18.3	-19.4	-20.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2000	232.8								
2200	329.7	242.2	130.8						
2400		337.0	251.3						
2600			344.3						
3000				230.6					
3200				328.5	190.7				
3400					305.1	141.9			
3600					382.1	279.1			
3800						361.8			
4600							183.2		
4800							262.8	125.4	
5000							338.3	207.1	
5200								285.4	149.5
5400								359.8	230.5
5600									307.7
5800									381.2

1. Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -40 m/+35 m for every 5°C above/below 4°C.
Adjust "Medium" field length available by -60 m/+55 m for every 5°C above/below 4°C.
Adjust "Poor" field length available by -95 m/+90 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

TO1 Slippery Runway Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-10	-6	-2	-26	-22	-18	-50	-46	-42
340	-12	-8	-4	-29	-25	-21	-54	-50	-46
320	-14	-10	-6	-31	-27	-23	-57	-53	-49
300	-16	-12	-8	-34	-30	-26	-61	-57	-53
280	-17	-13	-9	-36	-32	-28	-64	-60	-56
260	-18	-14	-10	-38	-34	-30	-66	-62	-58
240	-20	-16	-12	-40	-36	-32	-68	-64	-60
220	-21	-17	-13	-42	-38	-34	-70	-66	-62
200	-22	-18	-14	-44	-40	-36	-71	-67	-63
180	-23	-19	-15	-46	-42	-38	-72	-68	-64
160	-24	-20	-16	-48	-44	-40	-73	-69	-65

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**TO2 Slush/Standing Water Takeoff****20% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 KG)**

TO2 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-33.8	-38.7	-43.6	-40.8	-45.7	-50.6	-52.6	-57.5	-62.4
340	-31.8	-36.7	-41.6	-38.1	-43.0	-47.9	-48.9	-53.8	-58.7
320	-30.0	-34.9	-39.8	-35.9	-40.8	-45.7	-45.6	-50.5	-55.4
300	-28.6	-33.5	-38.4	-33.8	-38.7	-43.6	-42.5	-47.4	-52.3
280	-26.8	-31.7	-36.6	-31.5	-36.4	-41.3	-39.1	-44.0	-48.9
260	-24.7	-29.6	-34.5	-28.7	-33.6	-38.5	-35.3	-40.2	-45.1
240	-22.2	-27.1	-32.0	-25.7	-30.6	-35.5	-31.2	-36.1	-41.0
220	-19.4	-24.3	-29.2	-22.2	-27.1	-32.0	-26.7	-31.6	-36.5
200	-16.2	-21.1	-26.0	-18.4	-23.3	-28.2	-21.8	-26.7	-31.6
180	-12.6	-17.5	-22.4	-14.3	-19.2	-24.1	-16.7	-21.6	-26.5
160	-8.7	-13.6	-18.5	-9.8	-14.6	-19.5	-11.1	-16.0	-20.9

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1800							131.5		
2000	137.0			149.8			171.4		
2200	176.6			189.8			211.6	135.9	
2400	217.0	141.3		230.6	154.2		252.7	175.8	
2600	258.5	181.0		272.5	194.2		294.7	216.1	140.3
2800	301.3	221.5	145.7	315.5	235.2	158.6	337.8	257.3	180.2
3000	345.3	263.2	185.4	359.7	277.2	198.7	381.9	299.4	220.6
3200	390.5	306.1	226.0		320.3	239.7		342.6	261.9
3400		350.3	267.8		364.6	281.8		386.8	304.1
3600			310.9			325.1			347.4
3800			355.2			369.6			391.7

1. Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -65 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 slush/standing water limited weight is lesser of weights from 1 and 3.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-21	-19	-17	-16	-14	-12	-6	-4	-2
340	-23	-21	-19	-18	-16	-14	-7	-5	-3
320	-25	-23	-21	-20	-18	-16	-9	-7	-5
300	-26	-24	-22	-21	-19	-17	-11	-9	-7
280	-27	-25	-23	-23	-21	-19	-13	-11	-9
260	-27	-25	-23	-24	-22	-20	-15	-13	-11
240	-27	-25	-23	-24	-22	-20	-17	-15	-13
220	-27	-25	-23	-24	-22	-20	-18	-16	-14
200	-26	-24	-22	-24	-22	-20	-19	-17	-15
180	-26	-24	-22	-24	-22	-20	-19	-17	-15
160	-25	-23	-21	-23	-21	-19	-19	-17	-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**TO2 Slush/Standing Water Takeoff****20% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 KG)**

TO2 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-48.0	-53.1	-58.1	-56.4	-61.5	-66.6	-70.9	-76.0	-81.1
340	-45.0	-50.1	-55.1	-52.7	-57.7	-62.8	-65.6	-70.7	-75.8
320	-42.2	-47.2	-52.3	-49.1	-54.1	-59.2	-60.4	-65.5	-70.6
300	-39.5	-44.5	-49.6	-45.6	-50.7	-55.7	-55.3	-60.4	-65.5
280	-36.5	-41.6	-46.7	-41.9	-47.0	-52.0	-50.1	-55.2	-60.3
260	-33.4	-38.5	-43.6	-38.0	-43.1	-48.1	-44.9	-50.0	-55.0
240	-30.0	-35.1	-40.2	-33.9	-38.9	-44.0	-39.5	-44.6	-49.7
220	-26.4	-31.5	-36.5	-29.5	-34.6	-39.7	-34.1	-39.2	-44.3
200	-22.5	-27.6	-32.7	-25.0	-30.0	-35.1	-28.6	-33.7	-38.7
180	-18.4	-23.5	-28.6	-20.2	-25.3	-30.4	-23.0	-28.1	-33.1
160	-14.0	-19.1	-24.2	-15.2	-20.2	-25.3	-17.2	-22.3	-27.4

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2800							153.7		
3000							217.1		
3200				178.3			275.0	149.0	
3400	174.6			251.6			328.7	212.7	
3600	257.5			313.2	172.5		379.7	271.0	144.4
3800	322.4	167.6		368.2	246.8			324.9	208.2
4000	379.1	252.3			309.0	166.6		376.1	266.9
4200		318.1	160.7		364.3	242.0			321.2
4400		375.1	247.1			304.8			372.4
4600			313.8			360.5			
4800			371.1						

1. Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -100 m/+95 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

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-34	-30	-26	-25	-21	-17	-7	-3	0
340	-36	-32	-28	-28	-24	-20	-10	-6	-2
320	-38	-34	-30	-30	-26	-22	-13	-9	-5
300	-39	-35	-31	-32	-28	-24	-16	-12	-8
280	-40	-36	-32	-34	-30	-26	-20	-16	-12
260	-41	-37	-33	-36	-32	-28	-24	-20	-16
240	-41	-37	-33	-37	-33	-29	-27	-23	-19
220	-41	-37	-33	-38	-34	-30	-30	-26	-22
200	-41	-37	-33	-39	-35	-31	-32	-28	-24
180	-41	-37	-33	-39	-35	-31	-34	-30	-26
160	-41	-37	-33	-39	-35	-31	-34	-30	-26

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**TO2 Slippery Runway Takeoff****20% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustments (1000 KG)**

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	0.0	-1.5	-2.9	-17.6	-19.1	-20.5	-34.9	-36.3	-37.8
340	0.0	-1.5	-2.9	-17.6	-19.1	-20.6	-33.3	-34.7	-36.2
320	0.0	-1.5	-2.9	-17.8	-19.2	-20.7	-32.0	-33.4	-34.9
300	-1.5	-2.9	-4.4	-18.1	-19.5	-21.0	-30.9	-32.4	-33.8
280	-3.8	-5.2	-6.7	-18.3	-19.7	-21.2	-29.9	-31.3	-32.8
260	-4.9	-6.3	-7.8	-18.3	-19.7	-21.2	-28.8	-30.3	-31.7
240	-5.2	-6.6	-8.1	-17.7	-19.2	-20.6	-27.2	-28.6	-30.1
220	-4.9	-6.4	-7.8	-16.3	-17.7	-19.2	-24.6	-26.0	-27.5
200	-4.1	-5.6	-7.1	-14.0	-15.4	-16.9	-21.1	-22.5	-24.0
180	-2.8	-4.3	-5.7	-10.8	-12.2	-13.7	-16.7	-18.1	-19.6
160	-1.0	-2.4	-3.9	-6.7	-8.2	-9.6	-11.3	-12.7	-14.2

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1400	130.8								
1600	205.8	132.6							
1800	280.6	207.6	134.4	123.3					
2000	355.4	282.4	209.3	176.5					
2200		357.2	284.2	230.5	158.3				
2400			359.0	286.8	211.8	140.1	153.4		
2600				345.5	267.3	193.3	188.6		
2800					325.1	248.1	224.6	153.0	
3000					385.4	305.1	262.1	188.2	
3200						364.6	301.2	224.2	152.5
3400							342.0	261.7	187.7
3600							384.4	300.7	223.8
3800								341.5	261.2
4000								383.9	300.2
4200									341.0
4400									383.4

1. Enter Weight Adjustment table with reported braking action and TO2 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 -50 m/+45 m for every 5°C above/below 4°C. Adjust "Poor" field length available by -65 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

TO2 Slippery Runway Takeoff

20% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustments (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-7	-5	-3	-16	-14	-12	-28	-26	-24
340	-9	-7	-5	-19	-17	-15	-31	-29	-27
320	-10	-8	-6	-20	-18	-16	-33	-31	-29
300	-11	-9	-7	-22	-20	-18	-35	-33	-31
280	-12	-10	-8	-23	-21	-19	-37	-35	-33
260	-13	-11	-9	-24	-22	-20	-38	-36	-34
240	-13	-11	-9	-25	-23	-21	-39	-37	-35
220	-14	-12	-10	-25	-23	-21	-39	-37	-35
200	-14	-12	-10	-26	-24	-22	-40	-38	-36
180	-14	-12	-10	-26	-24	-22	-40	-38	-36
160	-15	-13	-11	-26	-24	-22	-40	-38	-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**TO2 Slippery Runway Takeoff****20% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 KG)**

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	0.0	-0.4	-1.5	-29.9	-30.9	-32.0	-52.6	-53.7	-54.8
340	-2.0	-3.0	-4.1	-29.0	-30.1	-31.2	-49.6	-50.7	-51.8
320	-4.6	-5.7	-6.8	-28.4	-29.5	-30.6	-46.8	-47.8	-48.9
300	-7.1	-8.2	-9.3	-28.0	-29.1	-30.2	-44.2	-45.3	-46.4
280	-9.0	-10.1	-11.2	-27.7	-28.8	-29.9	-42.1	-43.2	-44.3
260	-10.2	-11.3	-12.4	-27.4	-28.5	-29.6	-40.3	-41.4	-42.5
240	-10.6	-11.7	-12.8	-26.6	-27.7	-28.7	-38.2	-39.3	-40.4
220	-10.3	-11.4	-12.5	-24.6	-25.7	-26.7	-35.2	-36.3	-37.4
200	-9.2	-10.3	-11.4	-21.5	-22.6	-23.7	-31.3	-32.3	-33.4
180	-7.4	-8.5	-9.6	-17.3	-18.4	-19.5	-26.4	-27.5	-28.6
160	-4.8	-5.9	-7.0	-12.0	-13.1	-14.2	-20.5	-21.6	-22.7

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1800	185.5								
2000	302.0	197.2							
2200	394.2	310.5	208.5						
2400			318.9						
2800				238.7					
3000				341.3	196.9				
3200					316.7	144.0			
3400					399.1	289.6			
3600						376.8			
4200							164.7		
4400							253.5		
4600							337.5	191.3	
4800								278.7	127.5
5000								361.3	217.6
5200									303.5
5400									385.1

1. Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -40 m/+35 m for every 5°C above/below 4°C. Adjust "Medium" field length available by -60 m/+55 m for every 5°C above/below 4°C. Adjust "Poor" field length available by -95 m/+90 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

TO2 Slippery Runway Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-9	-5	-1	-23	-19	-15	-45	-41	-37
340	-11	-7	-3	-26	-22	-18	-49	-45	-41
320	-13	-9	-5	-28	-24	-20	-52	-48	-44
300	-14	-10	-6	-30	-26	-22	-55	-51	-47
280	-16	-12	-8	-32	-28	-24	-58	-54	-50
260	-17	-13	-9	-34	-30	-26	-60	-56	-52
240	-18	-14	-10	-36	-32	-28	-62	-58	-54
220	-18	-14	-10	-38	-34	-30	-64	-60	-56
200	-19	-15	-11	-39	-35	-31	-65	-61	-57
180	-20	-16	-12	-41	-37	-33	-66	-62	-58
160	-21	-17	-13	-43	-39	-35	-66	-62	-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.

Minimum Control Speeds

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
60	140	125	121	119	117		
50	122	128	125	119	117	115	110
40	104	136	133	127	122	116	110
30	86	138	137	133	127	122	115
20	68	138	138	134	130	126	119
-60	-76	140	139	135	131	127	121

TO1 V1(MCG)

10% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
60	140	118	115	112	111		
50	122	122	118	113	111	109	105
40	104	129	126	120	115	110	105
30	86	130	130	126	120	115	109
20	68	130	130	127	123	119	113
-60	-76	132	132	128	124	120	115

TO2 V1(MCG)

20% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
60	140	112	108	106	104		
50	122	115	112	106	104	103	99
40	104	121	119	113	108	104	99
30	86	122	122	118	113	108	102
20	68	123	122	119	116	112	106
-60	-76	125	124	121	117	113	108

Go-around %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

REPORTED OAT		TAT	AIRPORT PRESSURE ALTITUDE (1000 FT)												
°C	°F	°C	-2	-1	0	1	2	3	4	5	6	7	8	9	10
66	150	70	93.2	93.3	93.6	93.4	93.3	93.3	93.3	93.4	93.3	92.6	91.5	90.5	89.6
56	133	60	95.9	96.1	96.4	96.2	96.1	96.1	96.1	96.2	96.1	95.4	94.3	93.4	92.5
51	124	55	97.2	97.6	97.9	97.7	97.5	97.5	97.5	97.5	97.4	96.7	95.7	94.7	93.9
46	115	50	98.5	98.9	99.3	99.2	98.9	98.8	98.8	98.8	98.7	98.0	97.0	96.1	95.2
41	106	45	99.6	100.1	100.6	100.5	100.2	100.2	100.1	100.2	100.0	99.3	98.3	97.3	96.5
36	97	40	100.4	101.6	102.4	102.3	101.9	101.8	101.7	101.7	101.3	100.5	99.5	98.6	97.8
31	88	35	99.6	101.2	103.2	104.4	103.9	103.7	103.6	103.5	102.7	101.7	100.6	99.7	98.9
26	79	30	98.8	100.4	102.3	103.8	105.1	105.9	105.9	106.1	105.0	103.4	101.9	100.8	100.0
21	70	25	97.9	99.5	101.5	102.9	104.2	105.2	106.3	107.2	106.8	105.7	104.0	102.3	101.3
16	61	20	97.1	98.7	100.6	102.0	103.3	104.3	105.4	106.5	106.8	106.3	105.2	104.2	103.3
11	53	15	96.3	97.9	99.8	101.2	102.4	103.4	104.5	105.6	105.9	105.5	104.9	104.4	104.0
7	44	10	95.4	97.0	98.9	100.3	101.5	102.5	103.6	104.6	105.0	104.6	104.0	103.5	103.4
2	35	5	94.6	96.1	98.0	99.4	100.6	101.6	102.7	103.7	104.1	103.7	103.1	102.5	102.5
-3	26	0	93.7	95.3	97.1	98.5	99.7	100.7	101.7	102.8	103.1	102.7	102.1	101.6	101.6
-13	8	-10	92.0	93.5	95.3	96.7	97.9	98.8	99.8	100.9	101.2	100.8	100.3	99.7	99.7
-23	-10	-20	90.2	91.7	93.5	94.8	96.0	96.9	97.9	98.9	99.3	98.9	98.3	97.8	97.8
-33	-27	-30	88.4	89.9	91.7	92.9	94.1	95.0	96.0	97.0	97.3	96.9	96.4	95.9	95.8
-43	-45	-40	86.6	88.0	89.7	91.0	92.1	93.0	94.0	95.0	95.3	94.9	94.4	93.9	93.9
-53	-63	-50	84.7	86.1	87.8	89.0	90.1	91.0	91.9	92.9	93.2	92.9	92.3	91.8	91.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)												
	-2	-1	0	1	2	3	4	5	6	7	8	9	10
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
1 PACK ON	-0.2	-0.2	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Max Climb %N1**Based on engine bleed for packs on or off and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	.84	.84	.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

*Packs on or packs off with 2 bleed sources.

**Packs off with 1 bleed source.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT V/S (FT/MIN)	5.0 2500	4.5 1500			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	6.5 3700	5.5 2600	5.5 1800	5.0 1300	4.5 900
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	9.5 5000	8.5 3600	8.0 2700	7.5 2000	7.5 1400
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	14.0 6700	11.5 4900	10.0 3700	9.5 2900	9.5 2200
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	17.5 7800	14.5 5700	12.5 4400	11.5 3500	11.0 2800

Cruise

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT %N1	2.0 78.6	3.0 83.2			
35000 (.82M)	PITCH ATT %N1	1.5 76.5	2.0 78.9	3.0 82.8	3.5 88.0	
30000 (280 KIAS)	PITCH ATT %N1	1.5 72.6	2.5 74.7	3.0 78.1	3.5 82.4	3.5 87.3
25000 (280 KIAS)	PITCH ATT %N1	1.5 68.6	2.5 70.7	3.5 73.8	4.0 77.7	4.0 82.3
20000 (270 KIAS)	PITCH ATT %N1	2.0 63.4	2.5 65.8	3.5 69.0	4.5 72.8	5.5 77.4
15000 (270 KIAS)	PITCH ATT %N1	1.5 59.6	2.5 61.8	3.5 65.0	4.5 68.2	5.5 72.5

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-1.5 -2900	0.0 -2600			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -2500	-0.5 -2000	0.5 -1900	1.0 -1900	0.5 -2400
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1900	0.5 -1600	1.5 -1500	2.5 -1400	3.0 -1400
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -1700	0.0 -1400	1.0 -1300	2.0 -1300	3.0 -1300
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-2.0 -1500	-0.5 -1300	1.0 -1200	2.0 -1200	3.0 -1200

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		150	200	250	300	350
10000	PITCH ATT	3.0	4.5	5.5	6.0	6.0
	%N1	50.2	54.4	59.1	63.9	68.2
	KIAS	216	216	226	244	262
5000	PITCH ATT	3.0	4.5	5.5	6.0	6.0
	%N1	46.6	50.9	55.4	59.7	64.2
	KIAS	216	216	226	244	262

Terminal Area (5000 FT)**%N1 for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		150	200	250	300	350
FLAPS UP GEAR UP (VREF30+80)	PITCH ATT	3.5	5.0	6.0	6.0	6.5
	%N1	46.7	51.3	56.1	60.7	65.0
	KIAS	217	217	226	244	262
FLAPS 1 GEAR UP (VREF30+60)	PITCH ATT	5.0	6.5	7.5	8.0	8.0
	%N1	47.5	52.4	57.6	62.6	66.8
	KIAS	197	197	206	224	242
FLAPS 5 GEAR UP (VREF30+40)	PITCH ATT	3.5	5.5	6.5	6.5	6.5
	%N1	47.9	52.9	58.4	63.4	67.7
	KIAS	177	177	186	204	222
FLAPS 15 GEAR UP (VREF30+20)	PITCH ATT	3.5	6.5	7.5	7.5	7.0
	%N1	48.0	54.1	60.5	65.3	69.8
	KIAS	157	157	166	184	202
FLAPS 20 GEAR DOWN (VREF30+20)	PITCH ATT	2.0	4.5	6.0	5.5	5.5
	%N1	55.2	60.2	66.1	71.7	76.6
	KIAS	157	157	166	184	202

Final Approach (1500 FT)**Gear Down, %N1 for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		150	200	250	300	350
FLAPS 20 (VREF20+10)	PITCH ATT	0.0	1.5	2.0	2.0	2.5
	%N1	36.9	40.5	44.9	49.0	52.2
	KIAS	147	157	174	189	201
FLAPS 25 (VREF25+10)	PITCH ATT	0.5	1.5	1.5	1.5	2.0
	%N1	51.8	50.0	54.5	58.9	62.8
	KIAS	147	149	165	180	191
FLAPS 30 (VREF30+10)	PITCH ATT	-0.5	0.5	1.0	1.0	1.0
	%N1	57.2	56.3	60.1	65.3	70.9
	KIAS	147	147	156	174	192

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		150	200	250	300	350
10000	PITCH ATT	22.0	17.0	14.0	11.5	9.5
	V/S (FT/MIN)	4900	3600	2800	2200	1700
	KIAS	136	151	167	185	203
5000	PITCH ATT	25.5	21.0	17.0	14.0	11.5
	V/S (FT/MIN)	6400	4500	3600	2900	2400
	KIAS	148	151	167	184	202
SEA LEVEL	PITCH ATT	28.0	23.0	19.0	15.5	13.0
	V/S (FT/MIN)	7200	5100	4000	3300	2800
	KIAS	157	157	166	184	202

Performance Inflight

All Engine

Chapter PI

Section 31

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30(39°)	1.40(44°)	1.50(48°)
360	27300	5	30400	28800	27200
350	27900	4	31000	29400	27800
340	28500	3	31700	30000	28500
330	29200	1	32200	30500	29000
320	29900	0	32700	31000	29500
310	30600	-2	33200	31600	30000
300	31300	-4	33700	32100	30600
290	32000	-5	34300	32700	31200
280	32800	-7	34900	33300	31800
270	33600	-9	35500	33900	32400
260	34400	-11	36100	34500	33100
250	35200	-12	36800	35200	33800
240	36000	-14	37500	35900	34500
230	36900	-15	38200	36600	35200
220	37800	-15	39000	37400	36000
210	38800	-15	39800	38200	36800
200	39800	-15	40600	39000	37700
190	40900	-15	41500	39900	38600
180	42000	-15	42500	40900	39600
170	43100	-15	43100	42100	40800
160	43100	-15	43100	43100	42000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	11	30400	28800	27200
350	27900	10	31000	29400	27800
340	28500	8	31700	30000	28500
330	29200	7	32200	30500	29000
320	29900	5	32700	31000	29500
310	30600	4	33200	31600	30000
300	31300	2	33700	32100	30600
290	32000	0	34300	32700	31200
280	32800	-1	34900	33300	31800
270	33600	-3	35500	33900	32400
260	34400	-5	36100	34500	33100
250	35200	-7	36800	35200	33800
240	36000	-9	37500	35900	34500
230	36900	-9	38200	36600	35200
220	37800	-9	39000	37400	36000
210	38800	-9	39800	38200	36800
200	39800	-9	40600	39000	37700
190	40900	-9	41500	39900	38600
180	42000	-9	42500	40900	39600
170	43100	-9	43100	42100	40800
160	43100	-9	43100	43100	42000

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust
ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	17	30400	28800	27200
350	27900	15	31000	29400	27800
340	28500	14	31700	30000	28500
330	29200	12	32200	30500	29000
320	29900	11	32700	31000	29500
310	30600	9	33200	31600	30000
300	31300	8	33700	32100	30600
290	32000	6	34300	32700	31200
280	32800	4	34900	33300	31800
270	33600	3	35500	33900	32400
260	34400	1	36100	34500	33100
250	35200	-1	36800	35200	33800
240	36000	-3	37500	35900	34500
230	36900	-3	38200	36600	35200
220	37800	-3	39000	37400	36000
210	38800	-3	39800	38200	36800
200	39800	-3	40600	39000	37700
190	40900	-3	41500	39900	38600
180	42000	-3	42500	40900	39600
170	43100	-3	43100	42100	40800
160	43100	-3	43100	43100	42000

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		25	27	29	31	33	35	37	39	41	43
360	%N1	84.0	86.0	87.6	90.1						
	MACH	.819	.840	.837	.830						
	KIAS	346	342	326	310						
	FF/ENG	5139	5211	5162	5303						
340	%N1	83.0	84.7	86.1	88.1						
	MACH	.819	.839	.840	.835						
	KIAS	346	341	328	312						
	FF/ENG	4943	4959	4875	4910						
320	%N1	81.9	83.1	84.6	86.0	88.3					
	MACH	.818	.833	.840	.839	.833					
	KIAS	346	339	327	313	297					
	FF/ENG	4735	4662	4585	4523	4633					
300	%N1	80.2	81.8	82.9	84.5	86.1					
	MACH	.800	.823	.836	.840	.837					
	KIAS	337	334	326	314	299					
	FF/ENG	4416	4391	4316	4248	4232					
280	%N1	78.4	80.1	81.6	82.9	84.4	86.2				
	MACH	.775	.806	.827	.838	.840	.836				
	KIAS	326	326	322	313	300	285				
	FF/ENG	4088	4112	4069	4004	3948	3972				
260	%N1	76.6	78.3	80.0	81.3	82.8	84.2	86.6			
	MACH	.746	.780	.810	.830	.839	.839	.834			
	KIAS	313	315	315	309	300	287	272			
	FF/ENG	3751	3796	3803	3758	3703	3653	3726			
240	%N1	74.7	76.3	78.0	79.7	81.0	82.5	84.3			
	MACH	.720	.749	.783	.813	.831	.839	.839			
	KIAS	302	302	303	303	297	287	274			
	FF/ENG	3448	3464	3501	3503	3460	3406	3378			
220	%N1	73.1	74.2	75.8	77.6	79.3	80.6	82.5	84.7		
	MACH	.701	.721	.750	.785	.815	.832	.840	.838		
	KIAS	293	289	289	291	290	284	274	261		
	FF/ENG	3203	3158	3175	3207	3211	3165	3130	3132		
200	%N1	71.1	72.5	73.6	75.2	77.0	78.8	80.4	82.7	84.9	
	MACH	.680	.700	.719	.748	.784	.814	.832	.840	.838	
	KIAS	284	280	277	276	278	277	271	262	249	
	FF/ENG	2958	2915	2872	2886	2917	2918	2888	2878	2879	
180	%N1	68.6	70.2	71.7	72.8	74.4	76.2	78.4	80.4	82.7	84.8
	MACH	.648	.675	.697	.715	.744	.780	.812	.831	.839	.839
	KIAS	270	270	267	263	263	264	264	259	250	238
	FF/ENG	2673	2665	2631	2592	2599	2622	2636	2634	2624	2609
160	%N1	65.8	67.4	69.1	70.7	71.9	73.3	75.5	78.1	80.2	82.5
	MACH	.612	.639	.667	.691	.710	.735	.772	.806	.828	.838
	KIAS	254	254	255	253	250	248	249	250	246	238
	FF/ENG	2392	2386	2375	2356	2321	2308	2335	2372	2379	2356

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitude
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
282	261	242	226	213	200	191	182	174	167	160
559	519	482	451	424	400	382	366	351	337	325
837	777	723	677	637	600	574	550	528	508	489
1115	1035	964	902	849	800	766	734	705	678	653
1395	1295	1206	1129	1061	1000	957	918	881	848	817
1675	1555	1447	1354	1273	1200	1149	1101	1057	1017	980
1956	1815	1689	1581	1486	1400	1340	1285	1234	1187	1144
2237	2075	1931	1807	1698	1600	1532	1469	1410	1356	1307
2520	2338	2174	2034	1911	1800	1723	1652	1586	1525	1470
2803	2599	2417	2260	2124	2000	1915	1835	1762	1695	1633

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	3.8	0:38	3.3	0:37	2.8	0:35	2.5	0:35	2.2	0:34
400	7.9	1:11	7.2	1:09	6.3	1:04	5.7	1:02	5.3	1:00
600	11.9	1:45	11.0	1:40	9.8	1:33	9.0	1:30	8.4	1:26
800	15.9	2:19	14.8	2:13	13.2	2:02	12.2	1:58	11.5	1:52
1000	19.9	2:53	18.6	2:45	16.6	2:31	15.4	2:26	14.5	2:19
1200	23.8	3:27	22.3	3:17	20.0	3:01	18.6	2:54	17.5	2:45
1400	27.8	4:02	26.0	3:50	23.4	3:31	21.8	3:23	20.5	3:12
1600	31.6	4:37	29.7	4:23	26.8	4:01	24.9	3:51	23.5	3:39
1800	35.5	5:12	33.3	4:56	30.1	4:31	28.1	4:19	26.5	4:06
2000	39.3	5:47	36.9	5:30	33.4	5:01	31.2	4:48	29.4	4:33

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	150	200	250	300	350
5	-0.7	-0.4	0.0	0.4	1.1
10	-1.6	-0.8	0.0	1.1	2.5
15	-2.5	-1.3	0.0	1.7	3.9
20	-3.3	-1.7	0.0	2.3	5.2
25	-4.1	-2.2	0.0	2.9	6.5
30	-4.9	-2.6	0.0	3.6	7.8
35	-5.7	-3.1	0.0	4.2	9.0
40	-6.4	-3.5	0.0	4.8	10.2

Long Range Cruise Enroute Fuel and Time - High Altitude
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
649	613	580	551	524	500	479	459	441	424	409
1286	1217	1154	1098	1047	1000	959	921	886	853	823
1926	1824	1730	1646	1570	1500	1439	1383	1330	1282	1237
2569	2432	2307	2195	2094	2000	1920	1845	1775	1710	1651
3215	3043	2886	2745	2617	2500	2400	2306	2219	2139	2065
3864	3656	3466	3296	3142	3000	2880	2768	2664	2568	2479
4516	4271	4047	3847	3666	3500	3360	3229	3108	2996	2893
5170	4888	4630	4400	4192	4000	3840	3691	3552	3424	3306
5826	5506	5214	4953	4717	4500	4320	4152	3996	3852	3719
6485	6126	5798	5506	5242	5000	4800	4613	4440	4279	4132
7146	6748	6384	6061	5768	5500	5280	5074	4883	4706	4545
7809	7371	6972	6616	6295	6000	5759	5534	5326	5133	4956
8474	7996	7559	7171	6821	6500	6238	5994	5768	5558	5367
9144	8624	8149	7728	7348	7000	6717	6454	6209	5983	5776
9818	9255	8741	8286	7876	7500	7196	6912	6649	6406	6184
10496	9889	9335	8845	8404	8000	7674	7371	7089	6829	6591
11179	10526	9932	9406	8933	8500	8153	7829	7528	7251	6997
11866	11167	10530	9968	9462	9000	8631	8286	7966	7671	7401
12559	11811	11131	10531	9993	9500	9108	8742	8403	8090	7804
13256	12459	11735	11096	10523	10000	9585	9198	8839	8508	8206

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)
500	6.9	1:10	6.7	1:10	6.5	1:10	6.4	1:10	6.4	1:11
1000	14.3	2:17	13.8	2:13	13.5	2:12	13.2	2:12	13.2	2:13
1500	21.6	3:23	21.0	3:17	20.4	3:15	20.1	3:14	20.0	3:15
2000	29.0	4:29	28.2	4:21	27.4	4:17	26.9	4:17	26.8	4:18
2500	36.0	5:37	35.1	5:27	34.2	5:21	33.5	5:19	33.2	5:20
3000	43.1	6:46	42.0	6:33	40.9	6:25	40.0	6:22	39.7	6:22
3500	49.9	7:56	48.6	7:41	47.4	7:30	46.3	7:25	45.8	7:25
4000	56.7	9:06	55.2	8:49	53.8	8:35	52.7	8:29	52.0	8:27
4500	63.2	10:18	61.6	9:59	60.1	9:42	58.7	9:34	57.9	9:31
5000	69.7	11:30	68.0	11:09	66.3	10:50	64.8	10:38	63.9	10:34
5500	76.0	12:44	74.1	12:21	72.3	11:59	70.7	11:45	69.6	11:38
6000	82.3	13:57	80.2	13:32	78.3	13:09	76.5	12:52	75.3	12:42
6500	88.4	15:13	86.1	14:46	84.1	14:21	82.1	14:01	80.7	13:48
7000	94.5	16:28	92.0	15:59	89.8	15:32	87.8	15:10	86.2	14:54
7500	100.4	17:46	97.7	17:14	95.4	16:46	93.2	16:21	91.5	16:02
8000	106.2	19:05	103.4	18:30	100.9	17:59	98.6	17:32	96.8	17:10
8500	112.0	20:26	109.0	19:47	106.3	19:14	103.8	18:45	101.9	18:20
9000	117.7	21:48	114.5	21:05	111.7	20:29	109.0	19:58	106.9	19:30
9500	123.3	23:12	119.9	22:26	116.9	21:46	114.1	21:13	111.8	20:43
10000	129.0	24:37	125.3	23:47	122.0	23:03	119.1	22:28	116.7	21:55

Long Range Cruise Enroute Fuel and Time - High Altitude Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	150	200	250	300	350
10	-2.3	-1.2	0.0	3.2	13.1
20	-4.4	-2.4	0.0	5.4	18.3
30	-6.5	-3.6	0.0	7.4	23.1
40	-8.6	-4.8	0.0	9.3	27.5
50	-10.8	-5.9	0.0	11.1	31.4
60	-13.0	-7.0	0.0	12.7	35.0
70	-15.2	-8.1	0.0	14.2	38.1
80	-17.5	-9.2	0.0	15.6	40.9
90	-19.8	-10.3	0.0	16.8	43.2
100	-22.1	-11.3	0.0	18.0	45.1
110	-24.4	-12.3	0.0	19.0	46.6
120	-26.8	-13.3	0.0	19.8	47.7
130	-29.2	-14.3	0.0	20.6	48.4

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)										
	360	340	320	300	280	260	240	220	200	180	160
43							120	55	17	1	3
41						105	50	17	2	1	12
39					87	43	15	2	1	10	25
37			119	68	33	11	1	1	9	22	40
35		89	50	24	8	1	1	9	21	36	54
33	64	35	15	4	0	2	9	21	35	50	67
31	22	9	2	0	4	11	21	34	49	64	79
29	4	0	1	5	13	23	35	48	62	76	89
27	0	3	8	16	25	36	48	61	74	86	97
25	5	11	19	28	38	50	61	73	84	94	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 at .84M/310/250

PRESSURE ALTITUDE (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	96	103	110	117	123	128	133	139	145	150
TIME (MINUTES)	20	21	22	23	24	24	25	26	26	27

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
360	%N1	62.0	64.9	69.0	73.3	78.3	83.1	88.2			
	KIAS	264	264	265	269	308	312	310			
	FF/ENG	4660	4620	4570	4590	4840	5020	5300			
340	%N1	60.5	63.4	67.5	71.7	76.7	81.6	86.4			
	KIAS	260	260	260	260	299	302	307			
	FF/ENG	4410	4360	4310	4310	4540	4680	4890			
320	%N1	58.8	61.5	65.7	69.8	74.9	79.6	84.4	91.3		
	KIAS	253	253	253	253	289	293	297	278		
	FF/ENG	4130	4080	4030	4020	4210	4320	4480	4980		
300	%N1	57.2	59.7	63.9	67.9	72.6	77.6	82.3	88.0		
	KIAS	244	244	244	244	259	283	287	278		
	FF/ENG	3860	3810	3760	3740	3800	3990	4130	4430		
280	%N1	55.6	58.0	62.1	66.1	70.7	75.7	80.5	85.6		
	KIAS	238	238	238	238	238	272	276	278		
	FF/ENG	3630	3570	3510	3480	3500	3690	3810	4030		
260	%N1	53.9	56.3	60.1	64.3	68.6	73.7	78.5	83.5	93.7	
	KIAS	229	229	229	229	229	262	265	269	247	
	FF/ENG	3390	3330	3270	3230	3240	3400	3500	3630	4260	
240	%N1	52.2	54.5	58.2	62.3	66.5	71.1	76.2	81.2	88.6	
	KIAS	223	223	223	223	223	228	254	258	247	
	FF/ENG	3180	3110	3030	2990	2990	3010	3190	3290	3640	
220	%N1	50.4	52.7	56.2	60.1	64.3	68.7	73.9	78.9	85.6	92.1
	KIAS	217	217	217	217	217	217	242	246	247	231
	FF/ENG	2970	2890	2800	2760	2740	2740	2890	2980	3220	3530
200	%N1	48.4	50.9	54.4	58.0	62.2	66.3	71.3	76.3	82.8	87.4
	KIAS	217	217	217	217	217	217	226	233	237	231
	FF/ENG	2790	2710	2610	2570	2530	2520	2570	2670	2830	3010
180	%N1	46.6	49.1	52.7	56.2	60.1	64.3	68.7	73.4	79.9	84.1
	KIAS	217	217	217	217	217	217	217	220	223	226
	FF/ENG	2630	2550	2450	2400	2360	2380	2320	2370	2500	2610
160	%N1	45.1	47.4	51.0	54.5	58.2	62.3	66.5	71.0	77.1	81.1
	KIAS	217	217	217	217	217	217	217	217	217	217
	FF/ENG	2560	2470	2370	2300	2250	2220	2170	2160	2230	2280

This table includes 5% additional fuel for holding in a racetrack pattern.

**Holding
Flaps 1**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
360	%N1	64.8	67.6	72.3	76.7	81.7
	KIAS	244	244	244	244	244
	FF/ENG	5150	5130	5110	5150	5270
340	%N1	63.2	66.0	70.3	74.9	79.9
	KIAS	240	240	240	240	240
	FF/ENG	4840	4810	4790	4810	4920
320	%N1	61.5	64.4	68.5	73.1	78.0
	KIAS	233	233	233	233	233
	FF/ENG	4540	4510	4480	4490	4580
300	%N1	59.7	62.6	66.6	71.3	76.1
	KIAS	224	224	224	224	224
	FF/ENG	4250	4220	4190	4190	4260
280	%N1	57.9	60.6	64.7	69.1	74.0
	KIAS	218	218	218	218	218
	FF/ENG	3970	3930	3890	3880	3930
260	%N1	56.1	58.6	62.8	66.9	71.8
	KIAS	209	209	209	209	209
	FF/ENG	3700	3650	3600	3600	3620
240	%N1	54.2	56.6	60.6	64.6	69.4
	KIAS	203	203	203	203	203
	FF/ENG	3430	3370	3310	3300	3310
220	%N1	52.1	54.5	58.2	62.3	66.7
	KIAS	197	197	197	197	197
	FF/ENG	3170	3100	3030	3010	3010
200	%N1	50.1	52.3	55.9	59.8	64.0
	KIAS	197	197	197	197	197
	FF/ENG	2940	2860	2770	2730	2720
180	%N1	47.9	50.3	53.8	57.4	61.6
	KIAS	197	197	197	197	197
	FF/ENG	2740	2650	2550	2510	2480
160	%N1	45.9	48.4	51.8	55.2	59.2
	KIAS	197	197	197	197	197
	FF/ENG	2630	2540	2430	2380	2330

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight Advisory Information

Chapter PI Section 32

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1%	TEMP ADJ PER 10°C	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	220000 KG LANDING WT	PER 5000 KG ABOVE/ BELOW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	910	+25/0	20	-35/+125	+10/-10	+20/-20	35	20	40
AUTOBRAKE MAX	1215	+25/0	25	-50/+180	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1575	+35/0	40	-75/+255	0/0	+40/-40	90	0	0
AUTOBRAKE 3	1855	+45/-10	45	-90/+315	0/-10	+50/-50	100	0	0
AUTOBRAKE 2	2045	+50/-20	60	-105/+365	+25/-45	+55/-55	80	65	65
AUTOBRAKE 1	2205	+55/-25	70	-120/+420	+65/-70	+60/-60	80	250	305

Good Reported Braking Action

MAX MANUAL	1270	+25/-5	30	-60/+220	+30/-25	+30/-30	50	80	195
AUTOBRAKE MAX	1320	+25/-5	35	-65/+225	+30/-20	+30/-30	60	85	205
AUTOBRAKE 4	1580	+35/0	40	-75/+260	+10/-5	+40/-40	90	5	35
AUTOBRAKE 3	1855	+45/-10	45	-90/+315	+5/-10	+50/-50	100	0	0
AUTOBRAKE 2	2045	+50/-20	60	-105/+365	+25/-45	+55/-55	80	65	65
AUTOBRAKE 1	2205	+55/-25	70	-120/+420	+65/-70	+60/-60	80	250	305

Medium Reported Braking Action

MAX MANUAL	1695	+40/-15	50	-95/+350	+75/-60	+45/-45	60	215	575
AUTOBRAKE MAX	1695	+40/-15	50	-95/+350	+75/-60	+45/-45	65	210	570
AUTOBRAKE 4	1755	+40/-5	50	-100/+360	+60/-35	+50/-50	90	195	565
AUTOBRAKE 3	1955	+45/-10	50	-105/+385	+40/-35	+55/-55	100	85	390
AUTOBRAKE 2	2095	+50/-20	60	-115/+405	+55/-65	+60/-60	80	115	310
AUTOBRAKE 1	2210	+55/-25	70	-125/+435	+90/-70	+60/-65	80	275	415

Poor Reported Braking Action

MAX MANUAL	2145	+50/-25	70	-140/+540	+165/-110	+60/-60	70	445	1380
AUTOBRAKE MAX	2150	+55/-25	70	-140/+540	+170/-115	+60/-60	70	445	1385
AUTOBRAKE 4	2150	+55/-20	70	-140/+540	+170/-110	+60/-60	75	445	1385
AUTOBRAKE 3	2220	+55/-20	70	-140/+545	+140/-90	+65/-65	100	395	1340
AUTOBRAKE 2	2320	+55/-25	75	-145/+560	+145/-115	+65/-65	80	345	1265
AUTOBRAKE 1	2380	+60/-30	80	-150/+570	+170/-120	+70/-70	80	440	1220

Reference distance is for sea level, standard day, no wind or slope, VREF30, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 65 m.

For autobrake and manual speedbrakes, increase reference landing distance by 50 m.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 25**

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1%	TEMP ADJ PER 10°C	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	220000 KG LANDING WT	PER 5000 KG ABOVE/ BELOW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Dry Runway

MAX MANUAL	940	+20/-5	20	-35/+130	+10/-10	+20/-20	35	20	45
AUTOBRAKE MAX	1285	+20/-5	30	-55/+185	0/0	+30/-30	65	0	0
AUTOBRAKE 4	1670	+30/-10	45	-80/+265	0/0	+45/-45	95	0	0
AUTOBRAKE 3	1975	+35/-15	55	-95/+330	0/-15	+55/-55	100	5	5
AUTOBRAKE 2	2165	+40/-25	70	-110/+375	+30/-50	+60/-60	85	90	90
AUTOBRAKE 1	2330	+50/-30	80	-125/+435	+75/-75	+65/-65	80	295	365

Good Reported Braking Action

MAX MANUAL	1325	+20/-10	35	-65/+225	+30/-30	+35/-35	50	90	215
AUTOBRAKE MAX	1380	+25/-10	35	-65/+230	+30/-20	+35/-35	65	95	225
AUTOBRAKE 4	1680	+30/-10	45	-80/+270	+10/-5	+45/-45	95	5	35
AUTOBRAKE 3	1975	+35/-15	55	-95/+330	+5/-15	+55/-55	100	5	5
AUTOBRAKE 2	2165	+40/-25	70	-110/+375	+30/-50	+60/-60	85	90	90
AUTOBRAKE 1	2330	+50/-30	80	-125/+435	+75/-75	+65/-65	80	295	365

Medium Reported Braking Action

MAX MANUAL	1775	+35/-20	55	-100/+360	+75/-60	+50/-50	60	235	635
AUTOBRAKE MAX	1775	+35/-20	55	-100/+360	+80/-60	+50/-50	65	235	630
AUTOBRAKE 4	1855	+35/-10	55	-100/+370	+55/-35	+50/-50	95	195	610
AUTOBRAKE 3	2075	+35/-20	60	-110/+395	+40/-40	+60/-60	100	90	410
AUTOBRAKE 2	2220	+40/-25	70	-120/+420	+65/-70	+65/-65	85	145	350
AUTOBRAKE 1	2340	+50/-30	80	-125/+445	+95/-80	+65/-65	80	315	480

Poor Reported Braking Action

MAX MANUAL	2250	+45/-30	80	-145/+550	+170/-115	+65/-65	70	485	1535
AUTOBRAKE MAX	2255	+50/-30	80	-145/+550	+175/-120	+65/-65	70	490	1535
AUTOBRAKE 4	2255	+50/-30	80	-145/+550	+175/-110	+65/-65	80	490	1535
AUTOBRAKE 3	2350	+45/-25	80	-145/+560	+145/-95	+70/-70	100	415	1470
AUTOBRAKE 2	2445	+50/-35	85	-150/+575	+155/-120	+70/-70	80	390	1395
AUTOBRAKE 1	2510	+55/-35	90	-155/+585	+175/-125	+75/-75	80	490	1360

Reference distance is for sea level, standard day, no wind or slope, VREF25, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 65 m.

For autobrake and manual speedbrakes, increase reference landing distance by 55 m.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WEIGHT ADJ	ALT ADJ	WIND ADJ PER 10 KTS	SLOPE ADJ PER 1%	TEMP ADJ PER 10°C	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	220000 KG LANDING WT	PER 5000 KG ABOVE/ BELOW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD/ TAIL WIND	DOWN / UP HILL	ABOVE/ BELOW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	+25/-10	25	-40/+135	+10/-10	+20/-20	35	25	55
AUTOBRAKE MAX	1390	+20/-15	35	-60/+195	0/0	+35/-35	70	0	0
AUTOBRAKE 4	1820	+30/-20	50	-80/+280	0/0	+50/-50	100	0	0
AUTOBRAKE 3	2160	+40/-30	65	-100/+345	+5/-15	+60/-60	105	5	5
AUTOBRAKE 2	2370	+45/-40	75	-115/+395	+35/-55	+70/-70	90	105	105
AUTOBRAKE 1	2560	+55/-45	90	-135/+455	+80/-85	+75/-75	90	345	420

Good Reported Braking Action

MAX MANUAL	1430	+25/-20	40	-65/+230	+35/-30	+35/-35	50	105	250
AUTOBRAKE MAX	1485	+25/-20	40	-70/+240	+30/-20	+40/-40	65	105	265
AUTOBRAKE 4	1825	+30/-20	50	-85/+285	+10/0	+50/-50	100	10	40
AUTOBRAKE 3	2160	+40/-30	65	-100/+345	+5/-15	+60/-60	105	5	5
AUTOBRAKE 2	2370	+45/-40	75	-115/+395	+35/-55	+70/-70	90	105	105
AUTOBRAKE 1	2560	+55/-45	90	-135/+455	+80/-85	+75/-75	90	345	420

Medium Reported Braking Action

MAX MANUAL	1925	+35/-30	65	-105/+375	+85/-65	+55/-55	65	275	750
AUTOBRAKE MAX	1925	+40/-30	65	-105/+375	+85/-65	+55/-55	70	270	745
AUTOBRAKE 4	2010	+40/-25	65	-105/+385	+60/-40	+55/-60	100	225	710
AUTOBRAKE 3	2260	+40/-35	70	-115/+415	+45/-45	+65/-65	105	100	490
AUTOBRAKE 2	2425	+50/-40	80	-125/+440	+65/-75	+70/-70	90	160	410
AUTOBRAKE 1	2565	+55/-45	95	-135/+470	+100/-90	+75/-75	90	370	550

Poor Reported Braking Action

MAX MANUAL	2450	+55/-45	90	-150/+570	+185/-125	+70/-70	75	565	1815
AUTOBRAKE MAX	2455	+55/-45	90	-150/+570	+190/-130	+70/-70	75	565	1815
AUTOBRAKE 4	2455	+55/-40	90	-150/+570	+190/-120	+70/-70	80	565	1815
AUTOBRAKE 3	2550	+55/-40	90	-155/+580	+160/-100	+75/-75	105	480	1740
AUTOBRAKE 2	2665	+55/-45	95	-160/+595	+165/-125	+80/-80	90	445	1650
AUTOBRAKE 1	2745	+60/-50	100	-165/+610	+190/-140	+80/-80	85	565	1600

Reference distance is for sea level, standard day, no wind or slope, VREF20, 2 engine reverse thrust, and auto speedbrakes.

For Max Manual braking and manual speedbrakes, increase reference landing distance by 70 m.

For autobrake and manual speedbrakes, increase reference landing distance by 55 m.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (305 meters of air distance).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 20)

VREF20

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1255	30/-15	30	-45/155	15/-15	30/-30	N/A	40	90
AUTOBRAKE MAX	1525	20/-15	40	-60/205	0/0	40/-40	N/A	0	0
AUTOBRAKE 2	2690	50/-45	85	-125/425	30/-45	80/-80	N/A	70	70

Good Reported Braking Action

MAX MANUAL	1755	30/-25	50	-75/265	45/-40	45/-45	N/A	155	385
AUTOBRAKE MAX	1740	30/-20	50	-75/265	45/-40	45/-45	N/A	150	380
AUTOBRAKE 2	2690	50/-45	85	-125/425	30/-45	80/-80	N/A	70	70

Medium Reported Braking Action

MAX MANUAL	2315	45/-35	80	-115/415	105/-85	65/-65	N/A	380	1090
AUTOBRAKE MAX	2300	45/-35	80	-115/410	110/-90	65/-65	N/A	380	1080
AUTOBRAKE 3	2550	45/-35	75	-125/440	60/-50	75/-75	N/A	165	855

Poor Reported Braking Action

MAX MANUAL	2885	60/-50	110	-165/620	220/-150	85/-85	N/A	745	2535
AUTOBRAKE MAX	2885	60/-50	110	-165/620	225/-155	85/-85	N/A	745	2535
AUTOBRAKE 3	2945	60/-50	105	-170/625	205/-135	90/-90	N/A	685	2475

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ANTISKID (Flaps 25)****VREF25**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1775	35/-20	55	-100/360	75/-60	50/-50	60	235	635
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1775	35/-20	55	-100/360	75/-60	50/-50	60	235	635
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2250	45/-30	80	-145/550	170/-115	65/-65	70	485	1535
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3005	70/-50	115	-235/1010	900/-260	90/-90	80	1335	2675
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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	40/-15	50	-95/350	75/-60	45/-45	60	215	575
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1695	40/-15	50	-95/350	75/-60	45/-45	60	215	575
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2145	50/-25	70	-140/540	165/-110	60/-60	70	445	1380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2865	75/-40	105	-230/990	865/-250	85/-85	75	1240	2480
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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R (Flaps 20)****VREF20**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-10	25	-40/135	15/-10	25/-25	35	0	30
AUTOBRAKE MAX	1390	20/-15	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2470	45/-35	75	-120/405	5/-25	75/-75	125	0	0

Good Reported Braking Action

MAX MANUAL	1495	25/-20	40	-70/245	40/-35	40/-40	55	0	140
AUTOBRAKE MAX	1560	25/-20	45	-70/250	40/-35	40/-40	65	0	150
AUTOBRAKE 2	2470	45/-35	75	-120/405	5/-25	75/-75	125	0	0

Medium Reported Braking Action

MAX MANUAL	2115	40/-35	65	-115/410	110/-85	60/-60	75	0	430
AUTOBRAKE MAX	2110	40/-35	70	-115/410	115/-80	60/-60	85	0	430
AUTOBRAKE 3	2315	45/-30	70	-120/435	70/-50	70/-70	115	0	320

Poor Reported Braking Action

MAX MANUAL	2835	60/-50	100	-175/655	275/-180	85/-85	95	0	1060
AUTOBRAKE MAX	2835	60/-50	100	-175/655	275/-180	85/-85	95	0	1060
AUTOBRAKE 3	2865	60/-50	100	-175/660	265/-165	85/-85	105	0	1070

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ENG SHUTDOWN L, R (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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/0	20	-35/125	10/-10	20/-20	35	0	20
AUTOBRAKE MAX	1215	25/0	25	-50/180	0/0	30/-30	60	0	0
AUTOBRAKE 2	2100	50/-10	55	-110/370	10/-20	60/-60	110	0	0

Good Reported Braking Action

MAX MANUAL	1315	25/-5	30	-65/230	35/-30	35/-35	55	0	105
AUTOBRAKE MAX	1375	30/-5	35	-65/235	35/-30	35/-35	60	0	115
AUTOBRAKE 2	2100	50/-10	55	-110/370	10/-20	60/-60	110	0	0

Medium Reported Braking Action

MAX MANUAL	1830	40/-15	50	-105/380	95/-75	50/-50	70	0	325
AUTOBRAKE MAX	1835	45/-10	55	-105/380	95/-70	50/-50	80	0	320
AUTOBRAKE 3	1995	45/-5	55	-110/400	65/-50	55/-55	100	0	250

Poor Reported Braking Action

MAX MANUAL	2430	60/-25	80	-160/610	235/-150	70/-70	85	0	790
AUTOBRAKE MAX	2435	60/-25	80	-160/610	240/-155	70/-70	85	0	790
AUTOBRAKE 3	2465	60/-20	80	-160/615	230/-145	75/-75	90	0	800

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAP / SLAT CONTROL (Flaps 20)****VREF20**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-10	25	-40/135	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1390	20/-15	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2375	45/-40	75	-115/395	35/-55	70/-70	90	105	105

Good Reported Braking Action

MAX MANUAL	1430	25/-20	40	-65/230	35/-30	35/-35	50	105	250
AUTOBRAKE MAX	1485	25/-20	40	-70/240	30/-20	40/-40	65	105	265
AUTOBRAKE 2	2375	45/-40	75	-115/395	35/-55	70/-70	90	105	105

Medium Reported Braking Action

MAX MANUAL	1925	35/-30	60	-105/375	85/-65	55/-55	65	275	750
AUTOBRAKE MAX	1925	35/-30	65	-105/375	85/-65	55/-55	70	270	745
AUTOBRAKE 3	2260	40/-35	70	-115/415	45/-45	65/-65	105	100	490

Poor Reported Braking Action

MAX MANUAL	2450	55/-45	90	-150/570	185/-125	70/-70	75	565	1815
AUTOBRAKE MAX	2455	55/-45	90	-150/570	190/-130	70/-70	75	565	1815
AUTOBRAKE 3	2550	55/-40	90	-155/580	160/-100	75/-75	105	480	1740

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≤ 5)

VREF30 + 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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1150	45/-5	25	-40/140	15/-10	25/-25	35	35	75
AUTOBRAKE MAX	1755	30/0	40	-65/220	0/0	45/-50	80	0	0
AUTOBRAKE 2	2945	65/-35	100	-130/440	60/-70	85/-85	100	295	295

Good Reported Braking Action

MAX MANUAL	1670	30/-10	45	-70/245	40/-35	45/-45	50	145	360
AUTOBRAKE MAX	1825	30/0	45	-75/260	15/-10	50/-50	80	75	300
AUTOBRAKE 2	2945	65/-35	100	-130/440	60/-70	85/-85	100	295	295

Medium Reported Braking Action

MAX MANUAL	2280	45/-20	75	-110/400	90/-75	65/-65	65	385	1120
AUTOBRAKE MAX	2270	50/-20	75	-110/400	95/-70	65/-65	75	380	1105
AUTOBRAKE 3	2825	55/-25	85	-130/460	65/-60	85/-85	110	170	675

Poor Reported Braking Action

MAX MANUAL	2910	65/-35	105	-160/605	200/-140	85/-85	80	790	2800
AUTOBRAKE MAX	2910	65/-35	110	-160/605	205/-140	85/-85	80	790	2800
AUTOBRAKE 3	3115	70/-35	110	-170/625	180/-120	95/-95	105	610	2620

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAPS DRIVE (5 < Flaps < 20)****VREF30 + 20**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1045	35/-5	20	-40/135	15/-10	25/-25	35	30	65
AUTOBRAKE MAX	1470	25/0	35	-60/200	0/0	40/-40	70	0	0
AUTOBRAKE 2	2515	55/-25	75	-120/405	35/-50	75/-75	100	125	125

Good Reported Braking Action

MAX MANUAL	1500	30/-10	40	-70/235	35/-30	40/-40	55	115	290
AUTOBRAKE MAX	1555	30/0	40	-70/240	30/-15	40/-40	70	115	295
AUTOBRAKE 2	2515	55/-25	75	-120/405	35/-50	75/-75	100	125	125

Medium Reported Braking Action

MAX MANUAL	2030	45/-20	65	-105/380	85/-70	55/-55	70	315	890
AUTOBRAKE MAX	2025	45/-15	65	-105/380	90/-70	55/-55	70	310	880
AUTOBRAKE 3	2390	50/-15	65	-120/425	45/-45	70/-70	110	110	590

Poor Reported Braking Action

MAX MANUAL	2585	60/-30	90	-155/585	190/-130	75/-75	80	645	2190
AUTOBRAKE MAX	2590	60/-30	90	-155/585	195/-135	75/-75	80	650	2190
AUTOBRAKE 3	2690	65/-25	90	-160/595	175/-105	80/-80	105	550	2095

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≥ 20)

VREF20

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/-10	25	-40/135	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1390	20/-15	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2375	45/-40	75	-115/395	35/-55	70/-70	90	105	105

Good Reported Braking Action

MAX MANUAL	1430	25/-20	40	-65/230	35/-30	35/-35	50	105	250
AUTOBRAKE MAX	1485	25/-20	40	-70/240	30/-20	40/-40	65	105	265
AUTOBRAKE 2	2375	45/-40	75	-115/395	35/-55	70/-70	90	105	105

Medium Reported Braking Action

MAX MANUAL	1925	35/-30	60	-105/375	85/-65	55/-55	65	275	750
AUTOBRAKE MAX	1925	35/-30	65	-105/375	85/-65	55/-55	70	270	745
AUTOBRAKE 3	2260	40/-35	70	-115/415	45/-45	65/-65	105	100	490

Poor Reported Braking Action

MAX MANUAL	2450	55/-45	90	-150/570	185/-125	70/-70	75	565	1815
AUTOBRAKE MAX	2455	55/-45	90	-150/570	190/-130	70/-70	75	565	1815
AUTOBRAKE 3	2550	55/-40	90	-155/580	160/-100	75/-75	105	480	1740

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAPS PRIMARY FAIL (Flaps 20)****VREF20**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1145	25/-10	25	-45/150	15/-15	25/-25	45	30	70
AUTOBRAKE MAX	1390	20/-15	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2435	45/-40	75	-120/400	20/-35	70/-70	115	40	40

Good Reported Braking Action

MAX MANUAL	1595	25/-20	45	-70/250	40/-35	40/-40	65	125	315
AUTOBRAKE MAX	1580	25/-20	45	-70/250	40/-35	40/-40	70	125	310
AUTOBRAKE 2	2435	45/-40	75	-120/400	20/-35	70/-70	115	40	40

Medium Reported Braking Action

MAX MANUAL	2110	40/-35	70	-110/395	95/-75	60/-60	80	325	915
AUTOBRAKE MAX	2095	40/-35	70	-110/395	100/-80	60/-60	80	320	905
AUTOBRAKE 3	2305	40/-30	70	-120/420	55/-40	65/-65	115	145	725

Poor Reported Braking Action

MAX MANUAL	2645	55/-45	95	-160/595	205/-140	75/-75	90	650	2180
AUTOBRAKE MAX	2645	60/-45	100	-160/595	210/-145	75/-75	90	650	2180
AUTOBRAKE 3	2685	55/-45	95	-160/600	195/-125	80/-80	105	610	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 305 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLIGHT CONTROL MODE (Flaps 20)

VREF20

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1160	25/-10	25	-45/150	15/-15	25/-25	50	35	75
AUTOBRAKE MAX	1390	20/-15	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2455	45/-40	75	-120/405	15/-35	70/-70	120	25	25

Good Reported Braking Action

MAX MANUAL	1625	25/-20	45	-75/255	45/-35	40/-40	65	135	335
AUTOBRAKE MAX	1600	25/-20	45	-75/250	40/-35	40/-40	70	130	325
AUTOBRAKE 2	2455	45/-40	75	-120/405	15/-35	70/-70	120	25	25

Medium Reported Braking Action

MAX MANUAL	2150	40/-35	70	-110/400	100/-80	60/-60	80	345	985
AUTOBRAKE MAX	2135	40/-35	70	-110/400	105/-85	60/-60	80	340	975
AUTOBRAKE 3	2310	40/-30	70	-120/420	60/-40	65/-70	120	180	815

Poor Reported Braking Action

MAX MANUAL	2705	60/-50	100	-160/605	210/-145	80/-80	90	695	2370
AUTOBRAKE MAX	2700	60/-50	100	-160/605	220/-150	80/-80	90	695	2370
AUTOBRAKE 3	2730	60/-45	100	-160/605	205/-130	80/-80	105	665	2340

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLIGHT CONTROLS (Flaps 20)****VREF30 + 20**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1245	25/0	30	-45/155	20/-20	30/-30	60	55	120
AUTOBRAKE MAX	1470	25/0	35	-60/200	0/0	40/-40	70	0	10
AUTOBRAKE 2	2615	55/-20	75	-125/415	15/-35	75/-75	125	30	30

Good Reported Braking Action

MAX MANUAL	1760	35/-5	50	-80/265	55/-45	45/-45	80	190	485
AUTOBRAKE MAX	1745	35/-5	50	-80/265	55/-50	45/-45	80	185	475
AUTOBRAKE 2	2615	55/-20	75	-125/415	15/-35	75/-75	125	30	30

Medium Reported Braking Action

MAX MANUAL	2320	50/-20	75	-120/420	115/-90	65/-65	90	445	1320
AUTOBRAKE MAX	2320	50/-20	75	-120/420	120/-95	65/-65	95	445	1320
AUTOBRAKE 3	2460	50/-10	70	-125/435	80/-50	70/-70	120	305	1180

Poor Reported Braking Action

MAX MANUAL	2890	70/-30	105	-170/625	235/-160	85/-85	100	840	2990
AUTOBRAKE MAX	2895	70/-35	110	-170/625	240/-165	85/-85	100	840	3000
AUTOBRAKE 3	2920	70/-30	105	-170/625	230/-145	85/-85	115	820	2975

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS C (Flaps 20)

VREF20

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1145	25/-10	25	-45/150	15/-15	25/-25	45	30	70
AUTOBRAKE MAX	1390	20/-15	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2435	45/-40	75	-120/400	20/-35	70/-70	115	40	40

Good Reported Braking Action

MAX MANUAL	1595	25/-20	45	-70/250	40/-35	40/-40	65	125	315
AUTOBRAKE MAX	1580	25/-20	45	-70/250	40/-35	40/-40	70	125	310
AUTOBRAKE 2	2435	45/-40	75	-120/400	20/-35	70/-70	115	40	40

Medium Reported Braking Action

MAX MANUAL	2110	40/-35	70	-110/395	95/-75	60/-60	80	325	915
AUTOBRAKE MAX	2095	40/-35	70	-110/395	100/-80	60/-60	80	320	905
AUTOBRAKE 3	2305	40/-30	70	-120/420	55/-40	65/-65	115	145	725

Poor Reported Braking Action

MAX MANUAL	2645	55/-45	95	-160/595	205/-140	75/-75	90	650	2180
AUTOBRAKE MAX	2645	60/-45	100	-160/595	210/-145	75/-75	90	650	2180
AUTOBRAKE 3	2685	55/-45	95	-160/600	195/-125	80/-80	105	610	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 305 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L (Flaps 25)****VREF25**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	20/-5	25	-40/140	15/-15	25/-25	40	0	30
AUTOBRAKE MAX	1285	20/-5	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2260	40/-15	65	-115/385	0/0	65/-65	135	0	0

Good Reported Braking Action

MAX MANUAL	1500	25/-10	40	-75/255	45/-40	40/-40	65	0	155
AUTOBRAKE MAX	1530	25/-10	45	-75/255	40/-35	40/-40	70	0	160
AUTOBRAKE 2	2260	40/-15	65	-115/385	0/0	65/-65	135	0	0

Medium Reported Braking Action

MAX MANUAL	2140	40/-20	70	-120/435	125/-95	60/-60	85	0	485
AUTOBRAKE MAX	2140	40/-20	70	-120/435	130/-100	60/-60	85	0	485
AUTOBRAKE 3	2200	40/-15	70	-125/445	110/-60	65/-65	115	0	475

Poor Reported Braking Action

MAX MANUAL	2925	60/-35	105	-190/735	345/-205	90/-90	100	0	1270
AUTOBRAKE MAX	2935	60/-35	105	-190/735	350/-210	90/-90	100	0	1275
AUTOBRAKE 3	2935	60/-35	105	-190/735	350/-205	90/-90	105	0	1275

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	975	25/0	20	-40/135	15/-15	20/-20	40	0	30
AUTOBRAKE MAX	1215	25/0	25	-50/180	0/0	30/-30	65	0	0
AUTOBRAKE 2	2115	50/0	55	-110/370	0/0	60/-60	130	0	0

Good Reported Braking Action

MAX MANUAL	1440	30/-5	35	-70/250	45/-40	35/-35	65	0	140
AUTOBRAKE MAX	1460	30/-5	35	-70/250	40/-35	40/-40	70	0	145
AUTOBRAKE 2	2115	50/0	55	-110/370	0/0	60/-60	130	0	0

Medium Reported Braking Action

MAX MANUAL	2050	45/-15	60	-120/425	125/-95	55/-60	85	0	445
AUTOBRAKE MAX	2050	45/-15	60	-120/425	125/-95	60/-60	85	0	445
AUTOBRAKE 3	2085	50/-5	60	-120/430	115/-65	60/-60	105	0	450

Poor Reported Braking Action

MAX MANUAL	2795	65/-25	95	-185/720	335/-200	85/-85	100	0	1170
AUTOBRAKE MAX	2805	65/-25	95	-185/720	340/-205	85/-85	100	0	1175
AUTOBRAKE 3	2805	65/-25	95	-185/720	340/-200	85/-85	100	0	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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L+C (Flaps 20)****VREF30 + 20**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1310	30/0	30	-50/165	20/-20	30/-30	60	0	55
AUTOBRAKE MAX	1470	25/0	35	-60/200	0/0	40/-40	70	0	0
AUTOBRAKE 2	2645	55/0	70	-125/420	0/0	80/-80	145	0	0

Good Reported Braking Action

MAX MANUAL	1925	35/-5	50	-85/295	65/-55	50/-50	85	0	250
AUTOBRAKE MAX	1880	40/-5	50	-85/290	70/-55	50/-50	90	0	240
AUTOBRAKE 2	2645	55/0	70	-125/420	0/0	80/-80	145	0	0

Medium Reported Braking Action

MAX MANUAL	2705	60/-15	85	-140/495	170/-130	80/-80	110	0	750
AUTOBRAKE MAX	2685	60/-15	85	-140/490	175/-135	80/-80	110	0	745
AUTOBRAKE 3	2690	60/-10	85	-140/490	175/-110	80/-80	115	0	745

Poor Reported Braking Action

MAX MANUAL	3630	85/-35	130	-220/810	430/-260	110/-110	125	0	1885
AUTOBRAKE MAX	3625	85/-35	130	-215/810	445/-270	110/-110	125	0	1885
AUTOBRAKE 3	3625	85/-35	130	-215/810	445/-270	110/-110	125	0	1885

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L+R (Flaps 20)

VREF30 + 20

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/0	35	-60/195	35/-30	35/-35	65	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2325	45/0	60	-110/385	125/-100	70/-70	110	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3725	70/-10	110	-205/725	435/-280	115/-115	150	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	5995	100/-20	185	-395/1490	2465/-760	195/-195	185	0	0
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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R (Flaps 25)****VREF25**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1115	15/-5	25	-45/160	20/-20	25/-25	50	0	50
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1645	25/-15	45	-85/290	60/-50	45/-45	70	0	210
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2305	45/-25	75	-135/495	160/-115	65/-65	85	0	610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3095	60/-40	115	-210/825	450/-240	95/-95	100	0	1530
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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R (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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1065	20/0	25	-45/155	20/-15	25/-25	45	0	45
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1555	30/-5	40	-80/285	55/-45	40/-40	65	0	185
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2165	50/-15	65	-130/480	150/-110	60/-60	85	0	530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2890	65/-30	100	-205/800	420/-225	85/-85	95	0	1320
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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R+C (Flaps 20)****VREF30 + 20**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1610	30/0	40	-65/225	40/-35	40/-40	75	0	130
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2340	50/-10	70	-115/390	110/-90	65/-65	100	0	480
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3205	70/-25	110	-180/640	275/-190	95/-95	120	0	1275
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	4195	100/-45	160	-270/1055	810/-370	130/-130	135	0	3040
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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH DOWN AUTHORITY (Flaps 25)

VREF25

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1095	25/-5	25	-40/145	15/-10	25/-25	45	15	35
AUTOBRAKE MAX	1285	20/-5	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2220	40/-25	65	-110/380	15/-35	65/-65	100	40	40

Good Reported Braking Action

MAX MANUAL	1490	20/-10	40	-70/240	35/-30	35/-35	55	80	190
AUTOBRAKE MAX	1475	20/-10	40	-70/240	40/-35	35/-35	60	75	185
AUTOBRAKE 2	2220	40/-20	65	-110/380	25/-35	65/-65	105	40	40

Medium Reported Braking Action

MAX MANUAL	1940	35/-20	60	-105/375	80/-65	50/-50	70	220	595
AUTOBRAKE MAX	1935	35/-20	60	-105/375	85/-70	50/-50	70	215	590
AUTOBRAKE 3	2135	35/-15	60	-115/405	60/-40	60/-60	110	85	405

Poor Reported Braking Action

MAX MANUAL	2420	50/-30	80	-150/565	175/-120	65/-65	75	470	1485
AUTOBRAKE MAX	2430	50/-30	80	-150/565	180/-125	70/-70	75	470	1480
AUTOBRAKE 3	2485	45/-25	80	-150/575	165/-110	70/-70	95	415	1425

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PITCH DOWN AUTHORITY (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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	25/0	20	-40/140	15/-10	20/-20	45	15	30
AUTOBRAKE MAX	1215	25/5	25	-50/180	5/0	30/-30	65	0	0
AUTOBRAKE 2	2090	45/-15	55	-110/370	10/-30	60/-60	100	20	20

Good Reported Braking Action

MAX MANUAL	1425	25/-5	35	-65/235	35/-30	35/-35	55	70	170
AUTOBRAKE MAX	1415	25/-5	35	-65/235	35/-30	35/-35	60	70	165
AUTOBRAKE 2	2090	45/-10	55	-110/370	15/-30	60/-60	100	20	20

Medium Reported Braking Action

MAX MANUAL	1850	40/-15	50	-100/370	75/-60	45/-50	70	200	535
AUTOBRAKE MAX	1845	40/-10	50	-100/365	80/-65	50/-50	70	195	530
AUTOBRAKE 3	2010	40/-5	50	-110/390	60/-40	55/-55	110	85	380

Poor Reported Braking Action

MAX MANUAL	2305	50/-25	70	-145/555	170/-115	65/-65	75	425	1335
AUTOBRAKE MAX	2310	50/-25	75	-145/555	175/-120	65/-65	75	425	1330
AUTOBRAKE 3	2350	50/-20	70	-145/560	165/-100	65/-65	95	390	1300

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1190	40/-5	25	-45/145	15/-15	30/-30	35	35	80
AUTOBRAKE MAX	1755	30/0	40	-65/220	0/0	45/-50	80	0	0
AUTOBRAKE 2	2875	60/-35	95	-130/430	70/-75	85/-85	85	320	345

Good Reported Braking Action

MAX MANUAL	1700	30/-10	45	-75/250	40/-35	45/-45	55	140	350
AUTOBRAKE MAX	1840	30/0	50	-75/265	20/-15	50/-50	80	90	310
AUTOBRAKE 2	2875	60/-35	95	-130/430	70/-75	85/-85	85	320	345

Medium Reported Braking Action

MAX MANUAL	2280	45/-20	75	-110/400	90/-75	65/-65	65	360	1005
AUTOBRAKE MAX	2290	50/-20	75	-110/400	90/-70	65/-65	75	360	1010
AUTOBRAKE 3	2795	55/-30	85	-130/455	70/-75	80/-80	90	205	635

Poor Reported Braking Action

MAX MANUAL	2870	65/-35	105	-160/600	200/-140	85/-85	75	710	2350
AUTOBRAKE MAX	2870	65/-35	105	-160/600	200/-140	85/-85	75	710	2350
AUTOBRAKE 3	3085	70/-35	105	-165/625	175/-135	90/-90	90	575	2195

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY (Flaps ≥ 20)****VREF30 + 20**

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-5	25	-40/135	15/-10	25/-25	35	25	60
AUTOBRAKE MAX	1470	25/0	35	-60/200	0/0	40/-40	70	0	0
AUTOBRAKE 2	2475	55/-25	75	-120/400	45/-60	70/-70	85	160	160

Good Reported Braking Action

MAX MANUAL	1500	30/-10	40	-70/235	35/-30	40/-40	55	110	270
AUTOBRAKE MAX	1565	30/0	40	-70/245	30/-15	40/-40	70	110	280
AUTOBRAKE 2	2475	55/-25	75	-120/400	45/-60	70/-70	85	160	160

Medium Reported Braking Action

MAX MANUAL	2005	45/-20	60	-105/380	85/-70	55/-55	65	285	785
AUTOBRAKE MAX	2005	45/-15	60	-105/380	90/-65	55/-55	70	285	780
AUTOBRAKE 3	2380	50/-20	70	-120/425	55/-55	70/-70	100	120	500

Poor Reported Braking Action

MAX MANUAL	2535	60/-30	90	-150/575	185/-130	75/-75	75	580	1850
AUTOBRAKE MAX	2540	60/-30	90	-150/575	190/-130	75/-75	75	580	1855
AUTOBRAKE 3	2670	60/-30	90	-155/590	160/-110	80/-80	100	475	1760

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PRI FLIGHT COMPUTERS (Flaps 20)

VREF20

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1160	25/-10	25	-45/150	15/-15	25/-25	50	35	75
AUTOBRAKE MAX	1390	20/-15	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2455	45/-40	75	-120/405	15/-35	70/-70	120	25	25

Good Reported Braking Action

MAX MANUAL	1625	25/-20	45	-75/255	45/-35	40/-40	65	135	335
AUTOBRAKE MAX	1600	25/-20	45	-75/250	40/-35	40/-40	70	130	325
AUTOBRAKE 2	2455	45/-40	75	-120/405	15/-35	70/-70	120	25	25

Medium Reported Braking Action

MAX MANUAL	2150	40/-35	70	-110/400	100/-80	60/-60	80	345	985
AUTOBRAKE MAX	2135	40/-35	70	-110/400	105/-85	60/-60	80	340	975
AUTOBRAKE 3	2310	40/-30	70	-120/420	60/-40	65/-70	120	180	815

Poor Reported Braking Action

MAX MANUAL	2705	60/-50	100	-160/605	210/-145	80/-80	90	695	2370
AUTOBRAKE MAX	2700	60/-50	100	-160/605	220/-150	80/-80	90	695	2370
AUTOBRAKE 3	2730	60/-45	100	-160/605	205/-130	80/-80	105	665	2340

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SLATS DRIVE (Flaps 20)****VREF30 + 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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	35/-5	25	-40/145	15/-15	25/-25	40	30	75
AUTOBRAKE MAX	1610	30/0	40	-65/210	0/0	40/-45	75	0	0
AUTOBRAKE 2	2675	55/-30	85	-125/415	60/-70	80/-80	85	230	235

Good Reported Braking Action

MAX MANUAL	1615	30/-10	45	-70/245	40/-35	40/-40	55	125	310
AUTOBRAKE MAX	1705	30/0	45	-75/255	25/-15	45/-45	75	110	305
AUTOBRAKE 2	2675	55/-30	85	-125/415	60/-70	80/-80	85	230	235

Medium Reported Braking Action

MAX MANUAL	2155	45/-20	70	-110/390	90/-75	60/-60	65	320	870
AUTOBRAKE MAX	2160	45/-20	70	-110/390	90/-70	60/-60	75	320	870
AUTOBRAKE 3	2595	55/-25	75	-125/440	65/-70	75/-75	90	155	555

Poor Reported Braking Action

MAX MANUAL	2710	65/-35	95	-155/590	195/-135	80/-80	75	630	2020
AUTOBRAKE MAX	2715	65/-35	95	-155/590	195/-135	80/-80	75	630	2020
AUTOBRAKE 3	2890	65/-35	95	-165/610	170/-130	85/-85	90	510	1905

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SPOILERS (Flaps 25)

VREF25

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	975	20/-5	20	-40/130	10/-10	20/-20	40	25	55
AUTOBRAKE MAX	1285	20/-5	30	-55/185	0/0	30/-30	65	0	0
AUTOBRAKE 2	2200	40/-25	70	-110/380	25/-40	65/-65	100	60	60

Good Reported Braking Action

MAX MANUAL	1375	20/-10	40	-65/230	35/-30	35/-35	55	100	245
AUTOBRAKE MAX	1410	25/-10	40	-65/235	30/-25	35/-35	60	105	255
AUTOBRAKE 2	2200	40/-25	70	-110/380	25/-40	65/-65	100	60	60

Medium Reported Braking Action

MAX MANUAL	1840	35/-20	60	-100/370	85/-65	50/-50	65	260	720
AUTOBRAKE MAX	1840	35/-20	60	-100/370	85/-70	50/-50	70	260	715
AUTOBRAKE 3	2085	35/-20	60	-110/400	40/-35	60/-60	105	105	530

Poor Reported Braking Action

MAX MANUAL	2325	50/-30	85	-145/560	180/-125	65/-65	75	535	1720
AUTOBRAKE MAX	2335	50/-30	85	-145/560	185/-125	65/-65	75	535	1725
AUTOBRAKE 3	2380	50/-25	80	-150/570	170/-95	70/-70	105	490	1680

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.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SPOILERS (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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	940	20/0	20	-35/130	10/-10	20/-20	40	20	50
AUTOBRAKE MAX	1215	20/0	25	-50/180	0/0	30/-30	65	0	0
AUTOBRAKE 2	2070	45/-15	60	-105/365	20/-35	60/-60	95	40	40

Good Reported Braking Action

MAX MANUAL	1320	25/-5	35	-65/225	35/-30	30/-30	55	90	220
AUTOBRAKE MAX	1345	25/-5	35	-65/225	30/-25	35/-35	60	95	230
AUTOBRAKE 2	2070	45/-15	60	-105/365	20/-35	60/-60	95	40	40

Medium Reported Braking Action

MAX MANUAL	1755	40/-15	50	-100/360	80/-65	45/-45	65	235	645
AUTOBRAKE MAX	1755	40/-15	50	-100/360	80/-65	45/-45	65	235	645
AUTOBRAKE 3	1960	40/-10	50	-105/385	40/-30	55/-55	105	100	495

Poor Reported Braking Action

MAX MANUAL	2215	55/-25	75	-145/550	175/-120	60/-65	75	485	1545
AUTOBRAKE MAX	2220	55/-25	75	-145/550	180/-120	65/-65	75	485	1550
AUTOBRAKE 3	2255	55/-20	70	-145/555	165/-90	65/-65	100	455	1520

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.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

STABILIZER (Flaps 20)

VREF30 + 20

	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	220000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 220000 KG	PER 1000 FT ABOVE SEA LEVEL	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	30/-5	25	-40/135	15/-10	25/-25	35	25	60
AUTOBRAKE MAX	1470	25/0	35	-60/200	0/0	40/-40	70	0	0
AUTOBRAKE 2	2475	55/-25	75	-120/400	45/-60	70/-70	85	160	160

Good Reported Braking Action

MAX MANUAL	1500	30/-10	40	-70/235	35/-30	40/-40	55	110	270
AUTOBRAKE MAX	1565	30/0	40	-70/245	30/-15	40/-40	70	110	280
AUTOBRAKE 2	2475	55/-25	75	-120/400	45/-60	70/-70	85	160	160

Medium Reported Braking Action

MAX MANUAL	2005	45/-20	60	-105/380	85/-70	55/-55	65	285	785
AUTOBRAKE MAX	2005	45/-15	60	-105/380	90/-65	55/-55	70	285	780
AUTOBRAKE 3	2380	50/-20	70	-120/425	55/-55	70/-70	100	120	500

Poor Reported Braking Action

MAX MANUAL	2535	60/-30	90	-150/575	185/-130	75/-75	75	580	1850
AUTOBRAKE MAX	2540	60/-30	90	-150/575	190/-130	75/-75	75	580	1855
AUTOBRAKE 3	2670	60/-30	90	-155/590	160/-110	80/-80	100	475	1760

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.

ADVISORY INFORMATION**Approach or Landing Climb Limited Weight****Valid for approach with flaps 20 and landing with flaps 30**

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	297.3	279.1				
52	126	306.3	287.0				
50	122	315.2	294.5	269.7			
48	118	323.5	303.4	276.9			
46	115	331.8	312.4	284.1	259.6		
44	111	340.4	321.1	291.5	267.7		
42	108	352.1	329.0	299.1	275.0	251.6	
40	104	359.1	337.3	307.2	281.4	257.0	
38	100	366.2	349.6	316.0	287.8	262.8	233.8
36	97	369.0	356.4	323.2	293.4	269.2	238.4
34	93	369.3	363.2	330.4	299.7	274.4	243.0
32	90	369.5	365.7	338.2	306.4	278.7	247.1
30	86	369.8	365.9	346.1	312.9	282.9	250.9
28	82	370.1	366.0	352.5	318.7	287.3	254.6
26	79	370.3	366.1	352.7	322.6	292.2	258.2
24	75	370.6	366.3	352.8	326.0	297.0	263.1
22	72	370.8	366.4	352.9	327.4	300.3	268.1
20	68	371.1	366.5	352.9	327.5	302.5	272.4
18	64	371.3	366.7	353.0	327.6	304.7	275.2
16	61	371.6	366.8	353.1	327.6	304.7	276.9
14	57	371.8	366.9	353.2	327.7	304.8	278.5
12	54	372.0	367.0	353.3	327.8	304.9	278.6
10	50	372.2	367.2	353.3	327.9	304.9	278.7
8	46	372.3	367.3	353.4	327.9	304.9	278.7
6	43	372.5	367.4	350.4	328.0	304.9	272.8
4	40	372.6	367.4	341.5	313.7	286.7	254.9
2	36	372.7	367.5	341.6	313.8	286.8	254.9
0	32	372.8	367.5	341.6	313.8	286.8	255.0
-40	-40	373.4	367.8	341.6	313.8	286.8	255.0

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1250 kg.

With engine anti-ice on, decrease weight by 150 kg.

With engine and wing anti-ice on, decrease weight by 2350 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 26950 kg.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	302.7	284.5				
52	126	310.0	292.5				
50	122	317.6	300.2	275.6			
48	118	325.1	307.8	282.4			
46	115	332.9	315.3	289.8	267.1		
44	111	340.7	322.9	297.4	273.6		
42	108	351.0	330.3	304.4	280.1	258.9	
40	104	357.8	337.9	311.1	286.7	264.5	
38	100	365.0	348.4	318.5	293.4	269.9	241.1
36	97	367.8	355.1	325.0	299.2	275.1	245.9
34	93	368.0	361.9	331.6	305.0	279.9	250.6
32	90	368.3	364.3	338.6	310.6	284.3	254.9
30	86	368.5	364.5	345.5	315.9	288.7	259.0
28	82	368.8	364.6	351.2	320.8	293.2	262.9
26	79	369.1	364.8	351.4	324.4	298.1	266.5
24	75	369.3	364.9	351.5	327.7	302.6	270.7
22	72	369.6	365.0	351.6	329.0	305.5	274.7
20	68	369.8	365.2	351.6	329.1	307.3	278.2
18	64	370.1	365.3	351.7	329.1	309.0	281.0
16	61	370.3	365.4	351.8	329.2	309.1	282.8
14	57	370.5	365.5	351.9	329.3	309.1	284.4
12	54	370.7	365.7	351.9	329.3	309.2	284.5
10	50	370.9	365.8	352.0	329.4	309.2	284.5
8	46	371.1	365.9	352.1	329.5	309.3	284.6
6	43	371.2	366.0	352.1	329.5	309.3	284.5
4	40	371.3	366.0	352.2	329.6	309.3	278.4
2	36	371.4	366.1	352.2	329.6	309.4	278.4
0	32	371.5	366.1	352.3	329.7	309.4	278.4
-40	-40	372.1	366.4	352.4	329.8	309.5	278.5

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1400 kg.

With engine anti-ice on, decrease weight by 100 kg.

With engine and wing anti-ice on, decrease weight by 2300 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 24500 kg.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT 1000 KG	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8
360	0	23.3	25.7	28.3	33.8	37.7	41.9	46.1	51.6	57.8	59.8	67.3	75.6	74.5	84.0	94.5	89.8	101.1	113.6
	10	23.9	26.4	29.2	34.8	38.8	43.2	47.5	53.2	59.6	61.7	69.4	78.0	76.9	86.6	97.4	92.6	104.1	116.9
	15	24.4	26.9	29.7	35.5	39.5	44.0	48.4	54.2	60.7	62.8	70.6	79.4	78.3	88.1	99.1	94.2	105.9	118.8
	20	24.8	27.4	30.2	36.1	40.2	44.8	49.2	55.2	61.8	63.9	71.9	80.8	79.6	89.6	100.8	95.8	107.6	120.6
	30	25.5	28.1	31.0	37.1	41.3	46.1	50.6	56.7	63.6	65.8	74.0	83.1	81.9	92.2	103.6	98.5	110.6	123.9
340	40	25.7	28.4	31.4	37.7	42.0	46.8	51.5	57.8	64.8	67.1	75.5	84.9	83.7	94.2	105.8	100.7	113.0	126.4
	0	22.2	24.5	27.0	32.3	35.9	39.9	43.9	49.1	55.0	56.9	64.0	71.9	71.0	79.9	90.0	85.6	96.4	108.4
	10	22.9	25.2	27.8	33.2	37.0	41.1	45.2	50.6	56.7	58.7	66.0	74.2	73.2	82.4	92.8	88.3	99.3	111.6
	15	23.3	25.7	28.3	33.9	37.7	41.9	46.1	51.6	57.7	59.8	67.2	75.5	74.5	83.9	94.4	89.8	101.0	113.4
	20	23.7	26.2	28.8	34.5	38.4	42.7	46.9	52.5	58.8	60.8	68.4	76.8	75.8	85.4	96.0	91.3	102.7	115.3
320	30	24.3	26.8	29.6	35.4	39.4	43.9	48.2	54.0	60.5	62.6	70.3	79.0	78.0	87.8	98.7	94.0	105.6	118.4
	40	24.6	27.1	30.0	35.9	40.0	44.6	49.0	55.0	61.6	63.8	71.8	80.7	79.7	89.7	100.8	96.0	107.9	120.9
	0	21.2	23.4	25.7	30.7	34.2	37.9	41.7	46.6	52.2	54.0	60.7	68.1	67.3	75.8	85.3	81.3	91.5	103.0
	10	21.8	24.0	26.5	31.6	35.2	39.1	43.0	48.1	53.8	55.7	62.6	70.3	69.5	78.2	88.0	83.8	94.4	106.1
	15	22.2	24.5	27.0	32.2	35.8	39.8	43.8	49.0	54.8	56.7	63.7	71.5	70.7	79.6	89.5	85.3	96.0	107.9
300	20	22.6	24.9	27.5	32.8	36.5	40.5	44.6	49.8	55.7	57.7	64.8	72.8	72.0	81.0	91.1	86.8	97.6	109.7
	30	23.2	25.6	28.2	33.7	37.5	41.6	45.8	51.2	57.3	59.4	66.7	74.9	74.0	83.3	93.7	89.3	100.4	112.7
	40	23.4	25.8	28.5	34.2	38.0	42.3	46.6	52.2	58.4	60.5	68.0	76.5	75.6	85.1	95.7	91.2	102.6	115.1
	0	20.2	22.2	24.5	29.2	32.4	36.0	39.5	44.1	49.3	51.1	57.3	64.3	63.7	71.6	80.6	76.8	86.6	97.5
	10	20.8	22.9	25.1	30.0	33.4	37.0	40.7	45.5	50.8	52.7	59.1	66.4	65.7	73.9	83.1	79.3	89.3	100.4
260	15	21.2	23.3	25.6	30.6	34.0	37.7	41.5	46.3	51.8	53.6	60.2	67.6	66.8	75.2	84.6	80.7	90.8	102.1
	20	21.6	23.7	26.1	31.2	34.6	38.4	42.2	47.2	52.7	54.6	61.3	68.8	68.0	76.5	86.1	82.1	92.4	103.8
	30	22.1	24.3	26.8	32.0	35.5	39.4	43.4	48.5	54.2	56.1	63.0	70.7	70.0	78.8	88.5	84.4	95.0	106.7
	40	22.3	24.6	27.1	32.4	36.0	40.1	44.1	49.3	55.2	57.2	64.3	72.2	71.4	80.4	90.5	86.3	97.1	109.0
	0	18.2	20.0	21.9	26.1	28.9	32.0	35.1	39.1	43.6	45.2	50.6	56.6	56.1	63.1	70.9	67.7	76.2	85.8
220	10	18.7	20.6	22.5	26.9	29.7	32.9	36.2	40.3	44.9	46.5	52.1	58.4	57.9	65.1	73.1	69.8	78.6	88.5
	15	19.1	20.9	23.0	27.4	30.3	33.6	36.8	41.1	45.8	47.4	53.1	59.5	58.9	66.2	74.4	71.1	80.0	90.0
	20	19.4	21.3	23.4	27.9	30.9	34.2	37.5	41.8	46.6	48.3	54.1	60.6	60.0	67.4	75.7	72.4	81.4	91.6
	30	19.9	21.9	24.0	28.6	31.7	35.1	38.5	43.0	47.9	49.6	55.6	62.3	61.7	69.4	77.9	74.4	83.8	94.2
	40	20.1	22.1	24.2	28.9	32.1	35.6	39.1	43.7	48.7	50.5	56.6	63.5	62.9	70.8	79.6	76.0	85.6	96.2
180	0	16.3	17.8	19.5	23.1	25.4	28.1	30.7	34.1	37.9	39.2	43.7	48.9	48.4	54.2	60.8	58.2	65.4	73.5
	10	16.7	18.3	20.0	23.7	26.2	28.9	31.6	35.1	39.0	40.3	45.1	50.4	49.9	55.9	62.7	60.0	67.4	75.8
	15	17.1	18.7	20.4	24.2	26.7	29.4	32.2	35.8	39.8	41.1	45.9	51.3	50.8	57.0	63.9	61.1	68.7	77.2
	20	17.4	19.0	20.8	24.6	27.1	30.0	32.8	36.4	40.5	41.8	46.7	52.2	51.7	58.0	65.0	62.2	69.9	78.5
	30	17.8	19.5	21.3	25.2	27.8	30.7	33.7	37.4	41.6	43.0	48.1	53.7	53.2	59.6	66.9	63.9	71.9	80.8
	40	17.9	19.6	21.5	25.5	28.2	31.1	34.1	38.0	42.3	43.7	48.9	54.7	54.1	60.8	68.2	65.2	73.4	82.5
	0	14.4	15.7	17.1	20.0	22.0	24.2	26.3	29.1	32.2	33.1	36.8	41.0	40.4	45.2	50.5	48.2	54.0	60.6
	10	14.8	16.1	17.6	20.6	22.6	24.9	27.0	29.9	33.1	34.1	37.9	42.2	41.6	46.5	52.0	49.7	55.7	62.5
	15	15.1	16.4	17.9	21.0	23.0	25.3	27.5	30.5	33.7	34.7	38.6	43.0	42.4	47.4	53.0	50.6	56.7	63.6
	20	15.4	16.7	18.2	21.3	23.5	25.8	28.0	31.0	34.4	35.3	39.3	43.8	43.2	48.3	53.9	51.5	57.8	64.8
	30	15.7	17.1	18.7	21.9	24.1	26.5	28.8	31.8	35.3	36.3	40.4	45.0	44.4	49.6	55.5	53.0	59.4	66.6
	40	15.8	17.2	18.8	22.1	24.3	26.8	29.1	32.3	35.8	36.8	41.0	45.7	45.1	50.5	56.5	53.9	60.5	68.0

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****Event Adjusted Brake Energy (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	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	3.6	13.6	23.5	33.2	42.8	52.3	61.8	71.4	81.0	90.6	100.5	110.4
	MAX AUTO	3.5	12.5	21.4	30.2	39.0	47.8	56.8	66.0	75.5	85.5	95.9	106.8
	AUTOBRAKE 4	3.2	11.7	20.0	28.0	36.0	44.0	52.2	60.6	69.4	78.7	88.6	99.2
	AUTOBRAKE 3	2.7	11.0	18.8	26.3	33.7	41.0	48.4	56.1	64.2	72.8	82.0	92.2
	AUTOBRAKE 2	2.3	10.2	17.5	24.5	31.2	37.9	44.6	51.5	58.9	66.7	75.2	84.6
	AUTOBRAKE 1	1.9	9.0	15.6	21.8	27.8	33.8	39.8	45.9	52.4	59.4	66.9	75.1

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	3.4	12.0	21.2	30.6	39.7	48.6	57.4	65.9	74.4	82.8	91.3	99.7
	MAX AUTO	2.0	8.8	15.9	23.2	30.5	38.0	45.7	53.7	62.1	71.0	80.6	90.9
	AUTOBRAKE 4	1.3	5.6	10.9	16.6	22.5	28.3	34.3	40.7	47.5	54.9	63.0	72.0
	AUTOBRAKE 3	0.8	3.1	7.0	11.6	16.2	20.9	25.8	30.9	36.6	42.7	49.6	57.3
	AUTOBRAKE 2	0.0	2.3	5.0	7.8	10.8	14.0	17.4	21.2	25.6	30.4	36.0	42.4
	AUTOBRAKE 1	0.0	1.6	3.3	5.2	7.2	9.4	11.8	14.4	17.4	20.8	24.7	29.2

Cooling Time (Minutes)

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
		16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
GEAR DOWN INFLIGHT	NO SPECIAL PROCEDURE	1	2	3	4	6	7	7		CAUTION	FUSE PLUG MELT ZONE
GROUND	REQUIRED	11	18	26	42	55	66	73			
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3		

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 for each taxi mile.

For one brake deactivated, increase brake energy by 10 percent.

For two brakes deactivated, increase brake energy by 20 percent.

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 8 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 EICAS 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.

(When inflight with gear extended, the BTMS indications may vary between individual brakes, due to airstream effects.)

Performance Inflight

Engine Inoperative

Chapter PI

Section 33

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	98.3	97.9	97.6
-5	98.4	99.9	101.2	101.3	100.5	100.2	99.7	99.3	98.8
-10	97.4	99.0	100.3	101.6	101.3	101.3	100.7	100.3	100.0
-15	96.5	98.1	99.3	100.6	101.0	102.0	101.1	100.8	100.5
-20	95.6	97.1	98.3	99.6	100.1	101.0	100.1	99.8	99.5
-25	94.6	96.1	97.4	98.6	99.1	100.0	99.1	98.8	98.5
-30	93.7	95.2	96.4	97.6	98.1	99.0	98.1	97.8	97.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	97.1	96.8	96.5
-40	91.7	93.2	94.4	95.6	96.0	96.9	96.1	95.8	95.5

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT					TAT (°C)									
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	
280	0.86	94.3	95.4	96.4	97.4	98.4	99.5	100.5	101.4	101.2	100.2	98.9	97.7	
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1	
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3	
35000 FT PRESS ALT					TAT (°C)									
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1	
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2	
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1	
33000 FT PRESS ALT					TAT (°C)									
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8	
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7	
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5	
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4	
31000 FT PRESS ALT					TAT (°C)									
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4	
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	102.0	100.6	99.1	98.0	
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9	
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1	
29000 FT PRESS ALT					TAT (°C)									
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8	
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1	
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0	
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2	
27000 FT PRESS ALT					TAT (°C)									
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1	
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1	
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1	
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.1	
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.5	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	37	35	33	31	29	27
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/I ON - PACKS OFF	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

ENGINE INOP**Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****25000 FT to 18000 FT Pressure Altitudes**

25000 FT PRESS ALT				TAT (°C)										
CIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1	
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6	
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7	
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9	
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9	
24000 FT PRESS ALT				TAT (°C)										
CIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4	
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8	
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9	
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2	
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6	
22000 FT PRESS ALT				TAT (°C)										
CIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3	
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5	
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6	
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1	
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8	
20000 FT PRESS ALT				TAT (°C)										
CIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1	
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1	
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3	
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2	
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3	
18000 FT PRESS ALT				TAT (°C)										
CIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100	100.9	101.8	102.0	100.6	99.4	
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6	
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8	
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2	
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

16000 FT to 5000 FT Pressure Altitudes

16000 FT PRESS ALT			TAT (°C)										
KLAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4
14000 FT PRESS ALT			TAT (°C)										
KLAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4
240	0.47	97.3	98.2	99.2	100.1	101.0	102.0	102.7	102.5	100.6	99.0	97.8	96.7
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6
12000 FT PRESS ALT			TAT (°C)										
KLAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8
10000 FT PRESS ALT			TAT (°C)										
KLAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6
5000 FT PRESS ALT			TAT (°C)										
KLAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	16	14	12	10	5
ENGINE A/I ON	-0.3	-0.2	-0.4	-0.5	-0.5
WING A/I ON - PACKS ON	-0.4	-0.5	-0.6	-0.7	-0.8
WING A/I ON - PACKS OFF	-0.6	-0.7	-0.8	-0.9	-1.1

ENGINE INOP
MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	350	301	18000	16900	15700
340	331	293	19500	18400	17300
320	312	285	20900	20200	19100
300	291	276	22400	21500	20600
280	272	266	24200	23200	22000
260	252	257	26200	25300	24000
240	233	248	28500	27700	26300
220	214	238	30500	30000	28900
200	195	227	32300	32000	31300
180	175	215	34300	34100	33800
160	155	203	36500	36400	36200

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
134	125	118	111	105	100	95	90	86	82	79
268	251	236	222	210	200	190	181	173	166	159
402	376	354	333	316	300	285	272	260	249	239
535	501	471	445	421	400	380	363	347	332	319
668	626	588	555	526	500	476	454	434	416	399
800	750	706	666	631	600	571	545	521	499	479
932	874	823	777	736	700	666	636	608	583	560
1064	998	940	888	841	800	762	727	696	667	640
1196	1122	1057	998	946	900	857	818	783	751	721
1327	1246	1173	1109	1051	1000	952	910	870	835	801
1459	1369	1290	1220	1156	1100	1048	1001	958	918	882
1590	1493	1407	1330	1262	1200	1143	1092	1045	1002	963
1722	1617	1524	1441	1367	1300	1239	1183	1133	1086	1043
1854	1741	1641	1552	1472	1400	1334	1275	1220	1170	1124
1986	1865	1758	1662	1577	1500	1430	1366	1307	1254	1205
2118	1989	1875	1773	1682	1600	1525	1457	1395	1338	1285
2250	2113	1992	1884	1787	1700	1620	1548	1482	1421	1365
2383	2238	2109	1995	1892	1800	1716	1639	1569	1505	1446

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)											TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)											
	160	180	200	220	240	260	280	300	320	340	360	
100	1.0	1.1	1.2	1.4	1.4	1.6	1.7	1.7	1.8	1.9	2.0	0:15
200	2.3	2.5	2.8	3.0	3.2	3.4	3.6	3.8	4.1	4.3	4.5	0:31
300	3.6	3.9	4.4	4.8	5.1	5.4	5.8	6.1	6.5	6.9	7.2	0:46
400	4.9	5.4	6.0	6.6	7.0	7.5	7.9	8.4	8.9	9.5	10.0	1:01
500	6.2	6.8	7.5	8.2	8.8	9.4	10.0	10.6	11.2	11.9	12.6	1:16
600	7.4	8.1	9.0	9.8	10.6	11.3	12.0	12.7	13.4	14.3	15.2	1:30
700	8.6	9.4	10.4	11.4	12.3	13.1	13.9	14.8	15.6	16.6	17.7	1:45
800	9.7	10.7	11.9	13.0	14.0	14.9	15.9	16.8	17.8	19.0	20.2	1:59
900	10.9	12.0	13.3	14.5	15.6	16.8	17.8	18.9	20.0	21.3	22.7	2:14
1000	12.1	13.3	14.7	16.1	17.3	18.5	19.7	20.9	22.1	23.6	25.2	2:28
1100	13.2	14.6	16.1	17.6	19.0	20.3	21.6	22.9	24.3	25.9	27.6	2:43
1200	14.4	15.9	17.5	19.1	20.6	22.1	23.5	24.9	26.4	28.1	30.0	2:57
1300	15.5	17.2	18.9	20.6	22.3	23.8	25.4	26.9	28.5	30.4	32.4	3:11
1400	16.6	18.4	20.3	22.1	23.9	25.6	27.2	28.9	30.6	32.6	34.8	3:26
1500	17.7	19.6	21.7	23.6	25.5	27.3	29.1	30.9	32.7	34.8	37.2	3:40
1600	18.8	20.9	23.0	25.1	27.1	29.0	30.9	32.8	34.8	37.0	39.5	3:55
1700	19.9	22.1	24.4	26.6	28.7	30.7	32.8	34.8	36.8	39.2	41.9	4:10
1800	21.0	23.3	25.7	28.0	30.2	32.4	34.6	36.7	38.9	41.4	44.2	4:24

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
360	15600	14200	12700
350	16000	14700	13200
340	16900	15200	13700
330	17800	16300	14600
320	18800	17300	15600
310	19800	18300	16600
300	20500	19300	17700
290	21100	20200	18700
280	21800	20800	19800
270	22700	21500	20600
260	23600	22300	21200
250	24600	23400	21900
240	25800	24600	23100
230	27100	25900	24300
220	28500	27300	25600
210	29900	28600	27100
200	30900	30000	28500
190	31900	31200	30100
180	32900	32500	31400
170	34000	33700	32800
160	35200	35100	34300

With engine anti-ice on, no altitude capability adjustment is required.
With engine and wing anti-ice on, decrease altitude capability by 300 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
360	%N1	90.9	96.3								
	MACH	.602	.664								
	KIAS	334	337								
	FF/ENG	10070	10778								
340	%N1	89.9	94.9	97.6							
	MACH	.602	.664	.683							
	KIAS	334	337	335							
	FF/ENG	9696	10338	10505							
320	%N1	88.7	92.9	94.8	97.7						
	MACH	.602	.653	.670	.689						
	KIAS	334	332	328	325						
	FF/ENG	9267	9589	9644	9735						
300	%N1	86.8	91.0	92.7	94.7	97.9					
	MACH	.592	.638	.657	.674	.694					
	KIAS	329	324	321	317	315					
	FF/ENG	8693	8874	8919	8944	9073					
280	%N1	85.0	89.2	90.8	92.6	94.8	98.3				
	MACH	.574	.622	.641	.660	.677	.700				
	KIAS	319	315	313	310	306	305				
	FF/ENG	8068	8218	8264	8284	8332	8544				
260	%N1	82.9	87.2	88.8	90.5	92.3	94.7	98.4			
	MACH	.557	.605	.623	.643	.662	.679	.704			
	KIAS	309	306	304	302	299	295	294			
	FF/ENG	7484	7593	7619	7642	7676	7747	8011			
240	%N1	80.8	84.8	86.8	88.3	90.0	91.8	94.5	98.3		
	MACH	.540	.585	.605	.624	.644	.663	.681	.707		
	KIAS	299	296	295	293	291	288	284	283		
	FF/ENG	6926	6949	7005	7013	7041	7088	7163	7427		
220	%N1	78.6	82.5	84.2	86.1	87.7	89.4	91.2	93.8	97.8	
	MACH	.522	.564	.584	.604	.623	.644	.663	.681	.708	
	KIAS	289	285	284	283	281	279	276	272	272	
	FF/ENG	6372	6314	6372	6413	6419	6456	6501	6563	6820	
200	%N1	76.2	79.9	81.7	83.4	85.3	86.9	88.6	90.4	93.0	96.9
	MACH	.503	.543	.561	.581	.601	.621	.642	.661	.680	.706
	KIAS	278	274	272	271	270	268	267	264	260	260
	FF/ENG	5827	5717	5752	5795	5829	5836	5870	5906	5957	6195
180	%N1	73.8	77.2	78.9	80.7	82.3	84.2	85.8	87.5	89.3	91.9
	MACH	.484	.521	.538	.556	.575	.596	.616	.638	.658	.677
	KIAS	268	263	261	259	258	257	256	254	251	248
	FF/ENG	5301	5135	5167	5198	5215	5244	5254	5279	5309	5352
160	%N1	71.0	74.3	76.0	77.6	79.3	81.0	82.7	84.5	86.1	88.0
	MACH	.464	.498	.514	.530	.548	.567	.589	.609	.631	.652
	KIAS	257	251	249	247	246	244	243	242	240	238
	FF/ENG	4797	4574	4596	4632	4637	4636	4658	4673	4689	4716

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
284	263	244	227	213	200	190	181	173	166	159
565	523	485	453	425	400	381	364	348	334	321
847	784	728	680	638	600	572	546	522	501	482
1129	1045	970	906	850	800	763	729	698	669	643
1413	1308	1214	1133	1063	1000	954	911	872	836	804
1697	1570	1457	1361	1276	1200	1145	1094	1047	1004	965
1982	1834	1701	1588	1489	1400	1336	1276	1221	1171	1125
2268	2097	1945	1815	1702	1600	1526	1458	1395	1338	1286
2554	2362	2190	2043	1915	1800	1717	1640	1569	1505	1446
2842	2626	2434	2270	2128	2000	1908	1822	1743	1671	1606

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	3.8	0:39	3.3	0:38	3.0	0:36	2.7	0:36	2.5	0:35
400	8.0	1:13	7.3	1:10	6.8	1:08	6.4	1:05	6.1	1:03
600	12.1	1:48	11.2	1:44	10.6	1:39	10.0	1:35	9.7	1:32
800	16.2	2:23	15.1	2:17	14.3	2:11	13.6	2:06	13.2	2:01
1000	20.2	2:59	18.9	2:50	18.0	2:43	17.1	2:36	16.7	2:30
1200	24.2	3:34	22.7	3:24	21.7	3:15	20.7	3:06	20.2	2:59
1400	28.2	4:10	26.5	3:58	25.3	3:47	24.1	3:37	23.6	3:29
1600	32.1	4:46	30.2	4:33	28.9	4:19	27.6	4:08	26.9	3:58
1800	36.0	5:22	33.8	5:07	32.4	4:52	31.0	4:39	30.2	4:28
2000	39.8	5:59	37.5	5:42	36.0	5:25	34.4	5:10	33.5	4:58

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)										
	150	170	190	210	230	250	270	290	310	330	350
5	-1.0	-0.8	-0.6	-0.4	-0.2	0.0	0.3	0.7	1.1	1.7	2.4
10	-2.1	-1.7	-1.3	-0.9	-0.4	0.0	0.7	1.5	2.5	3.7	5.0
15	-3.3	-2.6	-2.0	-1.3	-0.7	0.0	1.0	2.3	3.8	5.6	7.6
20	-4.4	-3.5	-2.7	-1.8	-0.9	0.0	1.4	3.1	5.1	7.4	9.9
25	-5.5	-4.4	-3.4	-2.2	-1.1	0.0	1.8	3.9	6.3	9.1	12.2
30	-6.7	-5.4	-4.0	-2.7	-1.3	0.0	2.1	4.6	7.5	10.7	14.3
35	-7.8	-6.3	-4.7	-3.2	-1.6	0.0	2.5	5.3	8.6	12.2	16.2
40	-8.9	-7.2	-5.4	-3.6	-1.8	0.0	2.8	6.0	9.7	13.7	18.1

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
360	%N1	80.5	83.9	88.6	93.4			
	KIAS	264	264	265	269			
	FF/ENG	9070	9130	9370	9670			
340	%N1	78.7	81.9	86.7	91.4	100.4		
	KIAS	260	260	260	260	299		
	FF/ENG	8520	8560	8730	8950	10320		
320	%N1	76.7	79.7	84.6	89.2	96.4		
	KIAS	253	253	253	253	289		
	FF/ENG	7930	7940	8050	8210	9240		
300	%N1	74.7	77.7	82.3	87.1	92.4		
	KIAS	244	244	244	244	259		
	FF/ENG	7380	7360	7430	7550	8120		
280	%N1	72.8	75.7	80.1	85.0	90.1		
	KIAS	238	238	238	238	238		
	FF/ENG	6880	6850	6880	6950	7350		
260	%N1	70.7	73.6	77.8	82.8	87.8	95.1	
	KIAS	229	229	229	229	229	262	
	FF/ENG	6380	6340	6330	6380	6690	7470	
240	%N1	68.5	71.5	75.6	80.3	85.4	90.5	
	KIAS	223	223	223	223	223	228	
	FF/ENG	5910	5870	5820	5850	6110	6420	
220	%N1	66.2	69.1	73.2	77.7	82.8	87.7	96.7
	KIAS	217	217	217	217	217	217	242
	FF/ENG	5440	5400	5330	5350	5530	5760	6550
200	%N1	64.1	66.7	71.0	75.3	80.1	85.0	91.2
	KIAS	217	217	217	217	217	217	226
	FF/ENG	5010	4970	4910	4900	5040	5200	5550
180	%N1	62.0	64.6	68.6	72.9	77.6	82.5	87.2
	KIAS	217	217	217	217	217	217	217
	FF/ENG	4630	4580	4520	4500	4630	4730	4880
160	%N1	59.9	62.6	66.3	70.7	75.2	80.0	84.7
	KIAS	217	217	217	217	217	217	217
	FF/ENG	4300	4240	4160	4140	4250	4340	4450

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

**Gear Down Landing Rate of Climb Available
Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	460	370				
50	510	420	260			
48	560	470	310			
46	600	510	360	210		
44	650	560	400	260		
42	690	610	450	300	150	
40	720	660	490	340	190	
38	730	700	540	380	220	20
36	730	720	580	410	250	50
34	730	730	610	450	280	80
32	740	730	650	490	310	100
30	740	730	650	520	350	130
20	760	750	660	550	420	240
10	780	770	620	440	300	150
0	800	780	610	410	210	-30
-20	830	810	630	430	220	-30
-40	870	850	650	440	220	-30

Rate of climb capability shown is valid for 220000 kg, gear down at VREF20 + 5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 220000 kg.

Increase rate of climb 50 ft/min per 5000 kg less than 220000 kg.

Flaps 25

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	140	50				
50	190	100	-60			
48	230	140	-10			
46	280	190	30	-110		
44	320	230	70	-70		
42	360	280	120	-30	-170	
40	400	320	160	10	-140	
38	400	360	200	40	-110	-310
36	400	390	230	80	-90	-280
34	400	390	270	110	-60	-260
32	410	390	300	140	-30	-240
30	410	400	310	170	0	-210
20	420	410	320	200	80	-110
10	440	420	300	200	-110	-280
0	450	420	250	60	-140	-380
-20	470	440	260	60	-150	-390
-40	490	460	270	60	-150	-410

Rate of climb capability shown is valid for 220000 kg, gear down at VREF25 + 5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 220000 kg.

Increase rate of climb 50 ft/min per 5000 kg less than 220000 kg.

Performance Inflight

Alternate Mode EEC

Chapter PI

Section 34

ALTERNATE MODE EEC

Alternate Mode EEC Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	8400
55	131	95.7	96.0	96.2	96.1	96.0	96.1	96.1	96.1	96.1	95.5	94.6	94.2
50	122	97.1	97.5	98.0	97.6	97.3	97.4	97.5	97.5	97.4	96.8	95.9	95.6
45	113	98.5	98.9	99.4	99.1	98.8	98.7	98.8	98.8	98.7	98.2	97.3	96.9
40	104	99.6	100.2	100.9	100.4	100.2	100.0	99.9	100.0	99.9	99.4	98.6	98.2
35	95	99.3	100.8	102.8	102.3	101.8	101.4	101.2	101.3	101.0	100.4	99.6	99.3
30	86	98.5	99.9	102.7	104.0	104.0	103.8	103.4	103.4	102.6	101.5	100.7	100.3
25	77	97.7	99.1	101.8	103.1	104.4	105.5	105.8	106.3	105.3	103.8	102.4	101.8
20	68	96.9	98.3	101.0	102.3	103.5	104.6	105.8	106.8	106.8	105.9	104.8	104.3
15	59	96.0	97.4	100.1	101.4	102.6	103.7	104.9	105.9	106.4	106.1	105.6	105.3
10	50	95.2	96.6	99.2	100.5	101.7	102.8	103.9	105.0	105.5	105.2	104.9	104.8
5	41	94.4	95.7	98.4	99.6	100.8	101.9	103.0	104.1	104.5	104.2	104.0	103.8
0	32	93.5	94.9	97.5	98.7	99.9	101.0	102.1	103.1	103.6	103.3	103.0	102.9
-10	14	91.8	93.1	95.7	96.9	98.1	99.1	100.2	101.2	101.7	101.4	101.1	101.0
-20	-4	90.0	91.3	93.8	95.0	96.2	97.2	98.3	99.3	99.7	99.4	99.2	99.0
-30	-22	88.2	89.5	92.0	93.1	94.3	95.3	96.3	97.3	97.7	97.5	97.2	97.1
-40	-40	86.4	87.6	90.1	91.2	92.3	93.3	94.3	95.3	95.7	95.4	95.2	95.1
-50	-58	84.5	85.7	88.1	89.2	90.3	91.3	92.3	93.2	93.6	93.4	93.1	93.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)											
	-2	-1	0	1	2	3	4	5	6	7	8	8.4
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Intentionally
Blank

Performance Inflight

Gear Down

Chapter PI

Section 35

GEAR DOWN

220 KIAS Max Climb %N1

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	91.4	91.1	92.1	91.3	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.4	91.4	92.1	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	89.7	90.7	91.4	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	89.7	89.9	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.3	92.2	92.1	90.6	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.2	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.2	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

Anti-ice Adjustment

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

* Packs on or off with 2 bleed sources.

** Packs off with 1 bleed source.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	18500	16600	14200
350	19200	17300	14800
340	19700	18000	15500
330	20600	18900	16300
320	21700	20100	17600
310	22800	21300	19000
300	23900	22400	20300
290	25000	23500	21800
280	26000	24600	23000
270	27100	25900	24300
260	28200	27200	25700
250	29400	28600	27100
240	30400	30000	28500
230	31200	30800	29900
220	32000	31700	31000
210	32800	32600	32000
200	33500	33200	32700
190	34000	33900	33400
180	34600	34500	34100
170	35200	35100	34700
160	35800	35700	35300

GEAR DOWN**Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
360	%N1	84.4	88.7	90.7	93.0						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	7524	7653	7775	7993						
340	%N1	83.5	87.8	89.7	91.8						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	7296	7405	7486	7646						
320	%N1	82.6	86.7	88.3	90.0	92.1					
	MACH	.488	.534	.550	.568	.588					
	KIAS	270	269	267	265	264					
	FF/ENG	7058	7105	7101	7142	7267					
300	%N1	81.2	84.9	86.6	88.2	89.9	92.1				
	MACH	.481	.520	.537	.554	.572	.594				
	KIAS	266	262	260	258	257	256				
	FF/ENG	6725	6632	6624	6623	6679	6806				
280	%N1	79.3	83.1	84.9	86.4	87.9	89.7	92.3			
	MACH	.468	.507	.523	.540	.557	.576	.598			
	KIAS	259	255	253	252	250	248	248			
	FF/ENG	6283	6189	6167	6168	6164	6230	6361			
260	%N1	77.2	81.1	82.9	84.6	86.0	87.6	89.4	92.3	96.7	
	MACH	.453	.492	.508	.525	.542	.559	.579	.602	.628	
	KIAS	251	248	246	244	243	241	239	239	239	
	FF/ENG	5831	5754	5724	5709	5711	5706	5778	5910	6239	
240	%N1	75.0	79.0	80.8	82.4	84.1	85.5	87.1	89.0	92.0	
	MACH	.438	.476	.492	.508	.525	.543	.561	.581	.605	
	KIAS	242	240	238	237	235	233	231	230	230	
	FF/ENG	5377	5317	5292	5266	5254	5253	5252	5320	5450	
220	%N1	72.6	76.7	78.4	80.2	81.7	83.4	84.9	86.4	88.4	91.5
	MACH	.421	.459	.475	.491	.508	.525	.543	.561	.582	.606
	KIAS	232	231	230	228	227	225	224	222	221	220
	FF/ENG	4925	4872	4859	4836	4811	4800	4799	4799	4859	4983
200	%N1	69.9	74.1	75.8	77.5	79.3	80.9	82.7	84.4	86.3	88.5
	MACH	.403	.441	.456	.473	.489	.506	.526	.548	.571	.596
	KIAS	223	221	220	219	218	217	217	216	217	217
	FF/ENG	4476	4425	4418	4408	4384	4360	4387	4432	4481	4565
180	%N1	67.8	72.2	74.1	75.9	77.9	79.8	81.5	83.3	85.1	87.0
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	4152	4138	4141	4159	4170	4182	4208	4249	4283	4335
160	%N1	66.8	71.3	73.1	74.9	76.9	78.7	80.5	82.4	84.1	85.9
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	4013	3995	3994	4006	4019	4031	4053	4088	4125	4159

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
310	280	254	233	216	200	189	179	170	162	155
622	562	510	467	431	400	378	358	340	324	311
936	845	766	702	648	600	567	538	511	487	466
1253	1131	1024	937	864	800	757	718	682	650	621
1573	1418	1283	1173	1081	1000	946	897	852	812	776
1896	1706	1542	1409	1298	1200	1135	1076	1022	973	930
2222	1997	1803	1646	1515	1400	1324	1254	1191	1134	1084
2552	2291	2066	1884	1733	1600	1513	1433	1361	1296	1238
2883	2586	2329	2122	1951	1800	1702	1612	1530	1457	1392
3215	2881	2593	2361	2169	2000	1890	1790	1699	1618	1545
3547	3177	2857	2600	2387	2200	2079	1968	1868	1778	1699
3880	3472	3120	2838	2604	2400	2268	2147	2038	1940	1853
4213	3768	3384	3076	2822	2600	2457	2326	2207	2101	2007
4545	4063	3648	3315	3040	2800	2646	2505	2377	2262	2161
4878	4359	3912	3554	3258	3000	2835	2683	2546	2424	2315
5211	4655	4176	3792	3476	3200	3023	2862	2716	2585	2468
5544	4951	4440	4031	3694	3400	3212	3041	2885	2746	2622
5876	5246	4703	4269	3912	3600	3401	3220	3055	2907	2776
6209	5541	4967	4507	4130	3800	3590	3398	3224	3068	2930
6542	5837	5230	4746	4348	4000	3778	3576	3393	3229	3084

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	7.4	0:46	6.7	0:44	5.8	0:42	5.3	0:41	5.0	0:39
400	15.0	1:29	13.9	1:25	12.4	1:20	11.6	1:17	11.1	1:13
600	22.6	2:13	21.1	2:06	19.0	1:58	17.9	1:53	17.2	1:48
800	30.0	2:57	28.0	2:48	25.4	2:37	24.0	2:30	23.0	2:23
1000	37.3	3:42	34.9	3:30	31.8	3:15	30.1	3:07	28.9	2:57
1200	44.4	4:28	41.6	4:14	38.0	3:55	35.9	3:44	34.5	3:33
1400	51.5	5:14	48.3	4:57	44.1	4:35	41.8	4:22	40.1	4:09
1600	58.3	6:01	54.7	5:41	50.1	5:15	47.5	5:00	45.6	4:45
1800	65.1	6:49	61.2	6:26	56.1	5:56	53.1	5:38	51.0	5:21
2000	71.7	7:37	67.5	7:11	61.9	6:37	58.7	6:17	56.3	5:57
2200	78.3	8:25	73.7	7:56	67.7	7:18	64.2	6:55	61.6	6:33
2400	84.8	9:13	79.9	8:41	73.4	7:59	69.6	7:34	66.8	7:09
2600	91.3	10:00	86.0	9:26	79.1	8:40	75.0	8:12	72.0	7:45
2800	97.6	10:48	92.0	10:11	84.6	9:21	80.3	8:51	77.1	8:21
3000	104.0	11:36	98.0	10:56	90.2	10:02	85.6	9:29	82.1	8:57
3200	110.2	12:24	103.9	11:41	95.7	10:43	90.8	10:08	87.1	9:33
3400	116.5	13:12	109.8	12:27	101.1	11:24	96.0	10:46	92.1	10:09
3600	122.6	14:00	115.6	13:12	106.5	12:05	101.1	11:25	97.0	10:45
3800	128.7	14:48	121.4	13:57	111.9	12:46	106.2	12:03	101.9	11:21
4000	134.8	15:36	127.2	14:42	117.2	13:27	111.3	12:42	106.8	11:57

GEAR DOWN**Long Range Cruise Enroute Fuel and Time****Fuel Required Adjustment (1000 KG)**

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)										
	150	170	190	210	230	250	270	290	310	330	350
10	-1.8	-1.6	-1.3	-0.9	-0.4	0.0	0.8	1.8	2.9	4.1	5.5
20	-3.6	-3.2	-2.6	-1.8	-0.9	0.0	1.6	3.4	5.5	7.9	10.5
30	-5.3	-4.7	-3.8	-2.7	-1.4	0.0	2.2	4.9	7.9	11.3	15.1
40	-6.8	-6.0	-5.0	-3.5	-1.8	0.0	2.9	6.2	10.1	14.4	19.2
50	-8.3	-7.3	-6.0	-4.2	-2.2	0.0	3.4	7.4	12.0	17.1	22.9
60	-9.5	-8.4	-6.9	-4.9	-2.5	0.0	3.9	8.4	13.7	19.6	26.1
70	-10.7	-9.5	-7.8	-5.5	-2.8	0.0	4.3	9.3	15.1	21.6	28.9
80	-11.7	-10.4	-8.5	-6.1	-3.1	0.0	4.6	10.1	16.3	23.4	31.2
90	-12.6	-11.2	-9.2	-6.5	-3.4	0.0	4.9	10.7	17.3	24.8	33.1
100	-13.4	-11.9	-9.8	-7.0	-3.7	0.0	5.1	11.1	18.0	25.9	34.6
110	-14.1	-12.5	-10.3	-7.3	-3.9	0.0	5.2	11.4	18.5	26.6	35.6
120	-14.6	-12.9	-10.7	-7.6	-4.0	0.0	5.3	11.6	18.8	27.0	36.1
130	-15.0	-13.3	-11.0	-7.9	-4.2	0.0	5.3	11.6	18.8	27.0	36.2
140	-15.2	-13.5	-11.2	-8.1	-4.3	0.0	5.2	11.5	18.6	26.7	35.8

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30 + 80

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	35	40	44	48	52	57	61	65	69	74
TIME (MINUTES)	11	12	13	14	15	15	16	17	18	18

GEAR DOWN

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
360	%N1	76.1						
	KIAS	264						
	FF/ENG	7750						
340	%N1	74.6	77.7					
	KIAS	260	260					
	FF/ENG	7360	7350					
320	%N1	72.8	75.8					
	KIAS	253	253					
	FF/ENG	6890	6870					
300	%N1	70.6	73.7	78.1				
	KIAS	244	244	244				
	FF/ENG	6380	6370	6340				
280	%N1	68.8	72.0	76.3				
	KIAS	238	238	238				
	FF/ENG	5970	5960	5920				
260	%N1	66.7	69.7	74.1	78.6			
	KIAS	229	229	229	229			
	FF/ENG	5520	5510	5470	5490			
240	%N1	64.9	67.7	72.2	76.7			
	KIAS	223	223	223	223			
	FF/ENG	5150	5130	5100	5100			
220	%N1	63.1	65.8	70.1	74.6	79.4		
	KIAS	217	217	217	217	217		
	FF/ENG	4800	4770	4730	4730	4770		
200	%N1	61.9	64.7	68.8	73.3	78.0	82.7	
	KIAS	217	217	217	217	217	217	
	FF/ENG	4610	4570	4520	4520	4550	4610	
180	%N1	61.0	63.8	67.8	72.2	76.9	81.5	86.0
	KIAS	217	217	217	217	217	217	217
	FF/ENG	4450	4410	4360	4350	4370	4420	4520
160	%N1	60.1	62.9	66.8	71.3	75.9	80.5	84.9
	KIAS	217	217	217	217	217	217	217
	FF/ENG	4320	4270	4210	4190	4210	4260	4350

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

**Holding
Flaps 1**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
360	%N1	75.9	79.0	83.8	88.3	94.3
	KIAS	244	244	244	244	244
	FF/ENG	7660	7700	7690	7810	8200
340	%N1	74.3	77.4	82.1	86.8	91.8
	KIAS	240	240	240	240	240
	FF/ENG	7240	7260	7250	7350	7630
320	%N1	72.5	75.5	80.0	84.9	89.7
	KIAS	233	233	233	233	233
	FF/ENG	6770	6780	6770	6830	7040
300	%N1	70.3	73.4	77.8	82.9	87.6
	KIAS	224	224	224	224	224
	FF/ENG	6270	6270	6270	6320	6450
280	%N1	68.3	71.5	75.8	80.6	85.6
	KIAS	218	218	218	218	218
	FF/ENG	5840	5840	5820	5870	5980
260	%N1	66.0	69.1	73.5	78.1	83.3
	KIAS	209	209	209	209	209
	FF/ENG	5380	5370	5340	5400	5460
240	%N1	64.1	66.9	71.4	75.9	81.0
	KIAS	203	203	203	203	203
	FF/ENG	4980	4960	4930	4970	5020
220	%N1	62.0	64.7	69.0	73.6	78.4
	KIAS	197	197	197	197	197
	FF/ENG	4600	4570	4530	4550	4610
200	%N1	60.5	63.2	67.3	71.8	76.5
	KIAS	197	197	197	197	197
	FF/ENG	4350	4310	4260	4270	4310
180	%N1	59.1	61.8	65.8	70.3	74.9
	KIAS	197	197	197	197	197
	FF/ENG	4140	4100	4040	4050	4070
160	%N1	57.9	60.7	64.6	69.0	73.5
	KIAS	197	197	197	197	197
	FF/ENG	3970	3920	3860	3860	3860

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight

Gear Down, Engine INOP

Chapter PI

Section 36

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
320	307	254	5600	4400	2200
300	288	246	7700	6800	5300
280	269	238	9800	9100	8100
260	250	230	12100	11400	10300
240	230	223	14000	13500	12400
220	210	217	15900	15400	14400
200	191	216	17300	16700	15700
180	172	216	18500	18100	16900
160	153	216	19700	19400	18200

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
340	1800		
330	3300	1000	
320	4500	2700	
310	5700	4400	1900
300	6800	5700	3800
290	7800	7000	5300
280	8800	8100	6700
270	9800	9100	8100
260	11100	10400	9300
250	12100	11400	10300
240	13100	12500	11300
230	14000	13600	12400
220	15100	14600	13600
210	15900	15400	14400
200	16700	16100	15100
190	17400	16700	15800
180	18000	17500	16400
170	18700	18200	16900
160	19300	18900	17700

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
300	%N1	94.3	96.8						
	MACH	.403	.418						
	KIAS	244	244						
	FF/ENG	12328	12507						
280	%N1	92.3	94.1	96.8					
	MACH	.393	.407	.422					
	KIAS	238	238	238					
	FF/ENG	11514	11566	11807					
260	%N1	90.5	91.6	93.6	96.4				
	MACH	.385	.393	.408	.423				
	KIAS	233	229	229	229				
	FF/ENG	10870	10626	10714	10945				
240	%N1	88.9	89.8	91.3	93.4	96.5			
	MACH	.379	.385	.397	.412	.428			
	KIAS	229	225	223	223	223			
	FF/ENG	10228	9966	9915	10023	10245			
220	%N1	86.6	88.0	89.1	90.9	93.1	96.4		
	MACH	.368	.377	.387	.401	.417	.433		
	KIAS	223	220	217	217	217	217		
	FF/ENG	9452	9309	9167	9222	9323	9542		
200	%N1	84.2	86.0	87.8	89.5	91.4	94.0	98.1	
	MACH	.358	.371	.385	.400	.415	.431	.448	
	KIAS	217	217	217	217	217	217	217	
	FF/ENG	8693	8698	8718	8773	8844	8956	9300	
180	%N1	82.9	84.7	86.7	88.4	90.2	92.3	95.5	100.2
	MACH	.358	.371	.385	.400	.415	.431	.448	.466
	KIAS	217	217	217	217	217	217	217	217
	FF/ENG	8330	8328	8342	8399	8458	8533	8740	9239
160	%N1	81.7	83.6	85.4	87.3	89.0	90.9	93.5	97.7
	MACH	.358	.371	.385	.400	.415	.431	.448	.466
	KIAS	217	217	217	217	217	217	217	217
	FF/ENG	8019	8011	8010	8058	8115	8168	8310	8670

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
165	145	129	118	108	100	95	90	84	78	73
332	295	263	238	218	200	187	175	165	155	147
500	444	396	358	327	300	280	262	246	233	221
669	593	528	477	436	400	374	350	329	310	294
837	742	661	597	545	500	467	437	410	387	367
1007	893	795	718	655	600	560	524	492	464	440
1177	1043	928	838	764	700	653	611	574	541	513
1347	1193	1061	958	873	800	746	698	655	618	586
1519	1344	1195	1078	983	900	839	785	737	695	659
1691	1496	1329	1198	1092	1000	933	873	819	772	731

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	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)
100	4.0	0:27	3.8	0:26	3.5	0:26	3.4	0:25	3.3	0:25
200	8.2	0:51	7.8	0:50	7.5	0:49	7.3	0:48	7.2	0:47
300	12.3	1:15	11.8	1:14	11.4	1:12	11.1	1:10	11.1	1:09
400	16.4	1:40	15.8	1:38	15.3	1:36	14.9	1:33	14.9	1:30
500	20.5	2:04	19.7	2:02	19.1	1:59	18.7	1:56	18.7	1:53
600	24.5	2:29	23.6	2:27	22.9	2:23	22.5	2:19	22.4	2:15
700	28.5	2:53	27.5	2:51	26.7	2:46	26.1	2:42	26.0	2:37
800	32.5	3:18	31.3	3:16	30.4	3:10	29.8	3:05	29.6	2:59
900	36.4	3:43	35.1	3:40	34.1	3:34	33.4	3:28	33.2	3:22
1000	40.3	4:08	38.8	4:05	37.8	3:58	37.0	3:51	36.7	3:44

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	150	200	250	300	350
5	-0.8	-0.5	0.0	1.6	2.6
10	-1.8	-1.1	0.0	3.0	5.6
15	-2.8	-1.6	0.0	4.4	8.6
20	-3.7	-2.2	0.0	5.6	11.6
25	-4.5	-2.7	0.0	6.8	14.4
30	-5.4	-3.2	0.0	7.8	17.3
35	-6.2	-3.7	0.0	8.7	20.0
40	-7.0	-4.2	0.0	9.5	22.7
45	-7.7	-4.7	0.0	10.2	25.3

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
340	%N1	95.5			
	KIAS	260			
	FF/ENG	14970			
320	%N1	93.4	97.2		
	KIAS	253	253		
	FF/ENG	13980	14120		
300	%N1	91.1	94.3		
	KIAS	244	244		
	FF/ENG	12970	12940		
280	%N1	89.3	92.3	98.8	
	KIAS	238	238	238	
	FF/ENG	12100	12090	12660	
260	%N1	86.8	90.0	94.8	
	KIAS	229	229	229	
	FF/ENG	11100	11180	11340	
240	%N1	84.6	88.0	92.2	
	KIAS	223	223	223	
	FF/ENG	10310	10380	10460	
220	%N1	82.3	85.7	90.0	96.4
	KIAS	217	217	217	217
	FF/ENG	9540	9590	9650	10020
200	%N1	80.8	84.2	88.6	94.0
	KIAS	217	217	217	217
	FF/ENG	9080	9130	9180	9400
180	%N1	79.6	82.9	87.5	92.3
	KIAS	217	217	217	217
	FF/ENG	8700	8750	8780	8960
160	%N1	78.6	81.7	86.4	90.9
	KIAS	217	217	217	217
	FF/ENG	8380	8420	8430	8580

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight**Text****Chapter PI****Section 37**

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. 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 Flight Manual, the Flight Manual shall always take precedence.

General**FMC Takeoff Speeds**

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. 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.

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 below those shown in the Minimum Weight for FMC Takeoff Speeds Calculation table. In those cases where the required speed increase exceeds the maximum speed increase built into the FMC, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. This typically occurs at high rated thrust, high flaps setting and light weights. To obtain speeds for the takeoff in these situations, the options are to use available performance software, or select a smaller flap setting, or use reduced takeoff thrust and/or add weight. Selecting derate thrust is the preferred method of reduced takeoff thrust as this will reduce the minimum control speeds.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/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 colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush 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 is determined as follows:

- (1) Determine the dry field/obstacle limit weight for the takeoff flap setting.
- (2) 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.
- (3) Adjust field length available for temperature by amount shown on chart.
- (4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Takeoff speed determination:

(1) Determine takeoff speeds V_1 , V_R and V_2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If $V_1(\text{MCG})$ limited, set $V_1 = V_1(\text{MCG})$. If not limited by $V_1(\text{MCG})$ considerations, enter the V_1 Adjustment table with actual brake release weight to determine the V_1 reduction to apply to V_1 speed. If the adjusted V_1 is less than $V_1(\text{MCG})$, set $V_1 = V_1(\text{MCG})$.

Slippery Runway

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. Good reported braking action denotes wet runway conditions or runways covered by compact snow. Similarly, poor braking action denotes runways covered with wet ice. Performance is based on reversers operating and 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.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V_1 less than the minimum V_1 for control on the ground, $V_1(\text{MCG})$. It is therefore necessary to compare the adjusted V_1 to $V_1(\text{MCG})$. To find $V_1(\text{MCG})$, enter the $V_1(\text{MCG})$ table with airport pressure altitude and actual OAT. If the adjusted V_1 is less than $V_1(\text{MCG})$, set V_1 equal to $V_1(\text{MCG})$. If the adjusted V_R is less than $V_1(\text{MCG})$, set V_R equal to $V_1(\text{MCG})$ and determine a new V_2 by adding the difference between the normal V_R and $V_1(\text{MCG})$ to the normal V_2 . No weight adjustment is required provided that the field length available exceeds the minimum field length required shown in the Field and Climb Limit Weight table.

Go-Around %N1

To find Go-Around %N1 based on normal engine bleed for packs on and anti-ice off, enter the Go-Around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for engine bleeds for various conditions.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables 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 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. Note that these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 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, .84 Mach approximates the Long Range Cruise Mach schedule.

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 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 .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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.

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 at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. 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 30 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 for the selected flap setting. Flaps 1 is based on VREF30 + 60 speed schedule. 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

Tables are provided as advisory information for normal configuration landing distance on dry runways and slippery runways with good, medium, and poor reported braking action. These values are actual landing distances and do not include the 1.67 regulatory factor. Therefore, they cannot be used to determine the dispatch required landing field length.

To use these tables, determine the reference landing distance for the selected braking configuration. Then adjust the reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers to obtain the actual landing distance.

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. 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.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is conservative to add the effects of slope and inoperative reversers when using the autobrake system.

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 effects of max manual braking and reverse thrust.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

The table "Approach or Landing Climb Limited Weight" presents the data which are the more limiting of Approach Climb Limit Weight and Landing Climb Limit Weight.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding 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.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy 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 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, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

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 Mach number of .84 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 engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude 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/Cruise 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 correct 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 Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC 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 PENALTY (KG/HR)				
	GROSS WEIGHT (1000 KG)				
	300	260	220	180	140
43				160	140
39			180	160	145
35		200	190	170	140
31	230	220	195	165	140
25	230	220	195	175	155
20	235	230	205	185	165
15	235	235	215	200	185
10	240	240	230	220	200
5	270	270	255	240	220

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 .84/310/250 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 corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required 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 is planned. The tables show gear down rate of climb available for Flaps 20, Flaps 25 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

For most conditions, no takeoff speed adjustments or other performance adjustments other than takeoff power setting adjustments are required for operation of EEC in the ALTERNATE mode. For pressure altitudes between -2000 feet and -1000 feet and temperatures greater than ISA + 15°C, a thrust reduction occurs with EEC in the ALTERNATE mode. Performance software must be used to account for appropriate takeoff performance in this environmental region.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. 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 will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

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 40****777-300 PW4090 LB FT FAA TO1-10 TO2-20 TALPA****Pkg Model Identification PI.ModID.40.1****General PI.40.1**

VREF	PI.40.1
Flap Maneuver Speed	PI.40.2
Slush/Standing Water Takeoff	PI.40.3
Slippery Runway Takeoff	PI.40.5
TO1 Slush/Standing Water Takeoff	PI.40.8
TO1 Slippery Runway Takeoff	PI.40.10
TO2 Slush/Standing Water Takeoff	PI.40.14
TO2 Slippery Runway Takeoff	PI.40.16
Minimum Control Speeds	PI.40.20
Go-around EPR	PI.40.21
Max Climb EPR	PI.40.22
Flight With Unreliable Airspeed / Turbulent Air Penetration	PI.40.23

All Engine PI.41.1

Long Range Cruise Maximum Operating Altitude	PI.41.1
Long Range Cruise Control	PI.41.3
Long Range Cruise Enroute Fuel and Time - Low Altitude ..	PI.41.4
Long Range Cruise Enroute Fuel and Time - High Altitude ..	PI.41.6
Long Range Cruise Wind-Altitude Trade	PI.41.8
Descent at .84/310/250	PI.41.8
Holding	PI.41.9

Advisory Information..... PI.42.1

Runway Surface Condition Correlation	PI.42.1
Normal Configuration Landing Distance	PI.42.2
Non-Normal Configuration Landing Distance	PI.42.8
Airspeed Unreliable (Flaps 20)	PI.42.8

ANTISKID (Flaps 25)	PI.42.9
ANTISKID (Flaps 30)	PI.42.10
ENG SHUTDOWN L, R (Flaps 20)	PI.42.11
ENG SHUTDOWN L, R (Flaps 30)	PI.42.12
FLAP / SLAT CONTROL (Flaps 20)	PI.42.13
FLAPS DRIVE (Flaps ≤ 5)	PI.42.14
FLAPS DRIVE ($5 < \text{Flaps} < 20$)	PI.42.15
FLAPS DRIVE (Flaps ≥ 20)	PI.42.16
FLAPS PRIMARY FAIL (Flaps 20)	PI.42.17
FLIGHT CONTROL MODE (Flaps 20)	PI.42.18
FLIGHT CONTROLS (Flaps 20)	PI.42.19
HYD PRESS SYS C (Flaps 20)	PI.42.20
HYD PRESS SYS L (Flaps 25)	PI.42.21
HYD PRESS SYS L (Flaps 30)	PI.42.22
HYD PRESS SYS L+C (Flaps 20)	PI.42.23
HYD PRESS SYS L+R (Flaps 20)	PI.42.24
HYD PRESS SYS R (Flaps 25)	PI.42.25
HYD PRESS SYS R (Flaps 30)	PI.42.26
HYD PRESS SYS R+C (Flaps 20)	PI.42.27
PITCH DOWN AUTHORITY (Flaps 25)	PI.42.28
PITCH DOWN AUTHORITY (Flaps 30)	PI.42.29
PITCH UP AUTHORITY (Flaps ≤ 15)	PI.42.30
PITCH UP AUTHORITY (Flaps ≥ 20)	PI.42.31
PRI FLIGHT COMPUTERS (Flaps 20)	PI.42.32
SLATS DRIVE (Flaps 20)	PI.42.33
SPOILERS (Flaps 25)	PI.42.34
SPOILERS (Flaps 30)	PI.42.35
STABILIZER (Flaps 20)	PI.42.36
Approach or Landing Climb Limited Weight	PI.42.37
Recommended Brake Cooling Schedule.	PI.42.38

Engine Inoperative PI.43.1

Initial Max Continuous EPR PI.43.1

Max Continuous EPR PI.43.2

777 Flight Crew Operations Manual

Driftdown Speed/Level Off Altitude	PI.43.6
Driftdown/LRC Cruise Range Capability	PI.43.7
Long Range Cruise Altitude Capability	PI.43.8
Long Range Cruise Control	PI.43.9
Long Range Cruise Diversion Fuel and Time	PI.43.10
Holding	PI.43.12
Gear Down Landing Rate of Climb Available	PI.43.13
 Alternate Mode EEC	 PI.44.1
Limit Weight	PI.44.1
Max Takeoff %N1	PI.44.2
Max Climb %N1	PI.44.3
Max Cruise %N1	PI.44.4
Go-Around %N1	PI.44.5
 Alternate Mode EEC, Engine Inoperative	 PI.45.1
Initial Max Continuous %N1	PI.45.1
Max Continuous %N1	PI.45.2
 Gear Down	 PI.46.1
220 KIAS Max Climb EPR	PI.46.1
Long Range Cruise Altitude Capability	PI.46.2
Long Range Cruise Control	PI.46.3
Long Range Cruise Enroute Fuel and Time	PI.46.4
Descent at VREF30+80	PI.46.5
Holding	PI.46.6
 Gear Down, Engine Inoperative	 PI.47.1
Driftdown Speed/Level Off Altitude	PI.47.1
Long Range Cruise Altitude Capability	PI.47.2
Long Range Cruise Control	PI.47.3
Long Range Cruise Diversion Fuel and Time	PI.47.4
Holding	PI.47.5

**Performance Inflight
Pkg Model Identification****Chapter PI
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
777F	777F	7270	WY270

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Performance Inflight

Chapter PI

General

Section 40

VREF

WEIGHT (1000 LB)	VREF (KIAS)		
	FLAPS		
	30	25	20
660	169	174	183
640	165	172	181
620	163	169	178
600	160	167	175
580	157	164	172
560	155	161	169
540	152	158	166
520	149	155	163
500	146	152	160
480	143	149	157
460	140	146	154
440	137	143	150
420	133	139	147
400	130	136	143
380	126	132	139
360	123	128	135
340	119	124	131

777 Flight Crew Operations Manual

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS 0	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-73.7	-84.1	-94.5	-85.8	-96.2	-106.6	-112.4	-122.8	-133.2
660	-72.0	-82.4	-92.8	-83.4	-93.8	-104.2	-108.1	-118.5	-128.9
620	-69.1	-79.5	-89.9	-79.6	-90.0	-100.4	-102.3	-112.7	-123.1
580	-65.1	-75.5	-85.9	-74.5	-84.9	-95.3	-94.8	-105.2	-115.6
540	-59.8	-70.2	-80.6	-68.1	-78.5	-88.9	-85.9	-96.3	-106.7
500	-53.4	-63.8	-74.2	-60.4	-70.8	-81.2	-75.4	-85.8	-96.2
460	-45.7	-56.1	-66.5	-51.4	-61.8	-72.2	-63.3	-73.7	-84.1
420	-36.9	-47.3	-57.7	-41.0	-51.4	-61.8	-49.7	-60.1	-70.5
380	-26.9	-37.3	-47.7	-29.3	-39.7	-50.1	-34.5	-44.9	-55.3

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800				320.3			315.4		
6200							389.7	364.4	339.7
6600	359.2	332.9	306.7	399.0	372.3	346.0	469.8	442.1	415.3
7000	440.8	412.7	385.4	482.6	454.0	426.0	559.0	527.9	498.1
7400	529.9	499.1	469.3	572.8	541.7	511.6	661.0	625.0	590.9
7800	628.9	594.4	561.3	671.3	637.2	604.3	777.0	737.8	698.6
8200	740.6	702.2	664.4	777.2	741.7	706.1			
8600			778.5						

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 -125ft/+125ft 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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-17	-13	-9	-12	-8	-4	-2	2	6
620	-19	-15	-11	-13	-9	-5	-3	1	5
580	-21	-17	-13	-15	-11	-7	-4	0	4
540	-23	-19	-15	-18	-14	-10	-7	-3	1
500	-25	-21	-17	-20	-16	-12	-10	-6	-2
460	-27	-23	-19	-23	-19	-15	-13	-9	-5
420	-28	-24	-20	-24	-20	-16	-16	-12	-8
380	-28	-24	-20	-25	-21	-17	-19	-15	-11
340	-28	-24	-20	-26	-22	-18	-21	-17	-13

1. Obtain V1, VR and V2 for the actual weight.
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 Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-103.0	-115.0	-127.0	-121.9	-133.9	-145.9	-154.2	-166.2	-178.2
660	-97.5	-109.5	-121.5	-114.7	-126.7	-138.7	-143.6	-155.6	-167.6
620	-91.4	-103.4	-115.4	-106.8	-118.8	-130.8	-132.2	-144.2	-156.2
580	-84.5	-96.5	-108.5	-98.2	-110.2	-122.2	-120.1	-132.1	-144.1
540	-77.0	-89.0	-101.0	-88.8	-100.8	-112.8	-107.2	-119.2	-131.2
500	-68.9	-80.9	-92.9	-78.6	-90.6	-102.6	-93.5	-105.5	-117.5
460	-60.0	-72.0	-84.0	-67.6	-79.6	-91.6	-79.1	-91.1	-103.1
420	-50.5	-62.5	-74.5	-55.9	-67.9	-79.9	-64.0	-76.0	-88.0
380	-40.3	-52.3	-64.3	-43.5	-55.5	-67.5	-48.1	-60.1	-72.1
340	-29.4	-41.4	-53.4	-30.3	-42.3	-54.3	-31.4	-43.4	-55.4

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
8200							268.7		
8600							377.1	268.7	
9000							492.1	377.1	268.7
9400				334.6			619.2	492.1	377.1
9800				476.5	334.6		761.0	619.2	492.1
10200	369.2			647.8	476.5	334.6		761.0	619.2
10600	624.9	369.2			647.8	476.5			761.0
11000		624.9	369.2						
11400			624.9						

1. Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water adjustment.
2. Adjust field length available by -190 ft/+180 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limited 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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-30	-24	-18	-21	-15	-9	-7	-1	0
620	-33	-27	-21	-24	-18	-12	-9	-3	0
580	-36	-30	-24	-27	-21	-15	-12	-6	0
540	-39	-33	-27	-31	-25	-19	-15	-9	-3
500	-42	-36	-30	-35	-29	-23	-20	-14	-8
460	-45	-39	-33	-39	-33	-27	-25	-19	-13
420	-47	-41	-35	-43	-37	-31	-31	-25	-19
380	-49	-43	-37	-45	-39	-33	-36	-30	-24
340	-51	-45	-39	-47	-41	-35	-43	-37	-31

1. Obtain V1, VR and V2 for the actual weight.
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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	-4.0	-8.0	-31.1	-35.1	-39.1	-67.5	-71.5	-75.5
660	0.0	-4.0	-8.0	-35.8	-39.8	-43.8	-68.9	-72.9	-76.9
620	-1.9	-5.9	-9.9	-38.8	-42.8	-46.8	-68.8	-72.8	-76.8
580	-5.8	-9.8	-13.8	-40.3	-44.3	-48.3	-67.1	-71.1	-75.1
540	-8.4	-12.4	-16.4	-40.0	-44.0	-48.0	-63.9	-67.9	-71.9
500	-9.6	-13.6	-17.6	-38.2	-42.2	-46.2	-59.1	-63.1	-67.1
460	-9.3	-13.3	-17.3	-34.7	-38.7	-42.7	-52.8	-56.8	-60.8
420	-7.6	-11.6	-15.6	-29.6	-33.6	-37.6	-45.0	-49.0	-53.0
380	-4.6	-8.6	-12.6	-22.9	-26.9	-30.9	-35.7	-39.7	-43.7

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4600	424.1	304.8							
5000	590.2	494.7	386.0						
5400	730.2	648.4	559.5						
5800			703.3						
6200				397.2					
6600				517.4	397.2				
7000				642.2	517.4	397.2			
7400				771.0	642.2	517.4			
7800					771.0	642.2	321.8		
8200						771.0	383.8		
8600							449.5	340.2	
9000							520.4	403.0	
9400							598.0	470.1	358.7
9800							684.8	542.9	422.6
10200							778.6	623.0	491.3
10600								712.9	566.1
11000									648.8
11400									741.0

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 -70ft/+70ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -100ft/+100ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -135ft/+135ft 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 Adjustments (KIAS)**

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-3	-1	1	-12	-10	-8	-25	-23	-21
620	-4	-2	0	-15	-13	-11	-28	-26	-24
580	-6	-4	-2	-17	-15	-13	-31	-29	-27
540	-8	-6	-4	-20	-18	-16	-35	-33	-31
500	-9	-7	-5	-22	-20	-18	-38	-36	-34
460	-10	-8	-6	-25	-23	-21	-41	-39	-37
420	-11	-9	-7	-26	-24	-22	-44	-42	-40
380	-12	-10	-8	-28	-26	-24	-46	-44	-42
340	-12	-10	-8	-29	-27	-25	-48	-46	-44

1. Obtain V1, VR and V2 for the actual weight.
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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-7.4	-11.4	-15.4	-57.1	-61.1	-65.1	-100.6	-104.6	-108.6
660	-12.9	-16.9	-20.9	-60.0	-64.0	-68.0	-97.9	-101.9	-105.9
620	-17.1	-21.1	-25.1	-61.3	-65.3	-69.3	-94.4	-98.4	-102.4
580	-20.3	-24.3	-28.3	-61.2	-65.2	-69.2	-89.9	-93.9	-97.9
540	-22.2	-26.2	-30.2	-59.5	-63.5	-67.5	-84.5	-88.5	-92.5
500	-23.1	-27.1	-31.1	-56.2	-60.2	-64.2	-78.1	-82.1	-86.1
460	-22.7	-26.7	-30.7	-51.4	-55.4	-59.4	-70.9	-74.9	-78.9
420	-21.2	-25.2	-29.2	-45.1	-49.1	-53.1	-62.8	-66.8	-70.8
380	-18.6	-22.6	-26.6	-37.3	-41.3	-45.3	-53.7	-57.7	-61.7
340	-14.8	-18.8	-22.8	-28.0	-32.0	-36.0	-43.8	-47.8	-51.8

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800	686.4	601.9	452.4						
6200			722.1						
8600				716.0	531.6				
9000					772.9	632.7			
12600							409.4		
13000							621.4	275.1	
13400								496.1	
13800								701.9	364.9
14200									580.3

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 -130 ft/+120 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -200 ft/+190 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limited weight for adjusted field length and pressure altitude.
4. Max allowable slippery runway limited weight is lesser of weights from 1 and 3.

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-6	0	0	-19	-13	-7	-40	-34	-28
620	-8	-2	0	-23	-17	-11	-45	-39	-33
580	-10	-4	0	-26	-20	-14	-50	-44	-38
540	-12	-6	0	-30	-24	-18	-56	-50	-44
500	-15	-9	-3	-34	-28	-22	-61	-55	-49
460	-17	-11	-5	-38	-32	-26	-66	-60	-54
420	-19	-13	-7	-42	-36	-30	-72	-66	-60
380	-21	-15	-9	-46	-40	-34	-77	-71	-65
340	-24	-18	-12	-50	-44	-38	-81	-75	-69

1. Obtain V1, VR and V2 for the actual weight.
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.

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ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

TO1 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-63.3	-72.0	-80.6	-74.6	-83.3	-91.9	-99.8	-108.4	-116.8
660	-62.1	-70.7	-79.0	-72.6	-80.9	-89.1	-95.0	-103.3	-111.5
620	-59.5	-67.8	-76.0	-69.0	-77.2	-85.5	-89.6	-97.9	-106.1
580	-56.0	-64.2	-72.5	-64.6	-73.0	-81.5	-83.9	-92.5	-101.1
540	-53.2	-61.7	-70.3	-61.1	-69.7	-78.8	-78.9	-88.1	-97.4
500	-50.5	-59.8	-69.1	-57.9	-67.2	-76.4	-73.6	-83.2	-93.0
460	-46.6	-56.3	-66.1	-52.9	-62.6	-72.3	-66.2	-76.0	-85.7
420	-40.1	-49.8	-59.6	-44.8	-54.6	-64.3	-55.0	-64.7	-74.4
380	-30.8	-40.6	-50.3	-34.0	-43.7	-53.5	-40.8	-50.5	-60.2

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400				333.2			314.4		
5800				402.4			402.4	305.6	
6200	384.0			424.5	324.1		496.6	393.4	
6600	478.2	374.9		520.6	415.2	315.0	601.0	486.8	384.5
7000	580.1	468.4	365.9	623.0	510.7	406.0	721.1	590.0	477.1
7400	693.4	569.5	458.8	733.5	612.4	500.9		708.4	579.1
7800		681.4	559.0		722.3	601.9			695.8
8200			669.6			711.1			

1. Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -125ft/+125ft 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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-13	-9	-4	-8	-3	1	3	7	12
620	-15	-11	-7	-9	-5	-1	2	6	11
580	-17	-13	-9	-11	-7	-3	0	5	9
540	-20	-15	-11	-14	-10	-5	-2	2	6
500	-22	-18	-14	-17	-13	-8	-6	-1	3
460	-24	-20	-16	-20	-16	-12	-9	-5	-1
420	-26	-22	-17	-22	-18	-14	-13	-9	-4
380	-27	-23	-18	-24	-19	-15	-17	-12	-8
340	-27	-23	-19	-24	-20	-16	-20	-16	-11

1. Obtain V1, VR and V2 for the actual weight.
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

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

No Reverse Thrust

Weight Adjustment (1000 LB)

TO1 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-102.5	-114.5	-126.5	-121.9	-133.9	-145.9	-155.8	-167.8	-179.8
660	-96.9	-108.9	-120.9	-114.6	-126.6	-138.6	-145.0	-157.0	-169.0
620	-91.0	-103.0	-115.0	-107.0	-119.0	-131.0	-133.8	-145.8	-157.8
580	-84.5	-96.5	-108.5	-98.7	-110.7	-122.7	-121.9	-133.9	-145.9
540	-77.2	-89.2	-101.2	-89.5	-101.5	-113.5	-109.3	-121.3	-133.3
500	-69.3	-81.3	-93.3	-79.6	-91.6	-103.6	-95.9	-107.9	-119.9
460	-60.6	-72.6	-84.6	-69.0	-81.0	-93.0	-81.8	-93.8	-105.8
420	-51.3	-63.3	-75.3	-57.5	-69.5	-81.5	-66.8	-78.8	-90.8
380	-41.3	-53.3	-65.3	-45.3	-57.3	-69.3	-51.1	-63.1	-75.1
340	-30.7	-42.7	-54.7	-32.4	-44.4	-56.4	-34.8	-46.8	-58.8

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7800							345.5		
8200							477.7	345.5	
8600				346.6			631.3	477.7	345.5
9000				531.0	346.6			631.3	477.7
9400	551.9				531.0	346.6			631.3
9800		551.9				531.0			
10200			551.9						

1. Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water adjustment.
2. Adjust field length available by -190 ft/+180 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.

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-24	-18	-12	-15	-9	-3	-1	0	0
620	-27	-21	-15	-18	-12	-6	-3	0	0
580	-30	-24	-18	-21	-15	-9	-6	0	0
540	-33	-27	-21	-25	-19	-13	-9	-3	0
500	-36	-30	-24	-29	-23	-17	-14	-8	-2
460	-39	-33	-27	-33	-27	-21	-19	-13	-7
420	-41	-35	-29	-37	-31	-25	-25	-19	-13
380	-43	-37	-31	-39	-33	-27	-31	-25	-19
340	-45	-39	-33	-41	-35	-29	-37	-31	-25

1. Obtain V1, VR and V2 for the actual weight.
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

TO1 Slippery Runway Takeoff

10% Thrust Reduction

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	-3.7	-7.5	-23.9	-27.6	-31.4	-61.3	-65.1	-68.8
660	0.0	-3.7	-7.5	-29.1	-32.9	-36.6	-63.3	-67.0	-70.8
620	0.0	-3.7	-7.5	-33.7	-37.5	-41.2	-64.6	-68.3	-72.1
580	-2.3	-6.0	-9.8	-36.6	-40.4	-44.1	-64.3	-68.0	-71.8
540	-6.0	-9.8	-13.5	-37.8	-41.5	-45.3	-62.4	-66.1	-69.9
500	-8.3	-12.0	-15.8	-37.2	-40.9	-44.7	-58.8	-62.5	-66.3
460	-9.0	-12.7	-16.5	-34.9	-38.6	-42.4	-53.6	-57.3	-61.1
420	-8.2	-12.0	-15.7	-30.8	-34.6	-38.3	-46.8	-50.5	-54.2
380	-6.0	-9.7	-13.5	-25.0	-28.8	-32.5	-38.3	-42.0	-45.8

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4200	361.3								
4600	550.9	443.0	317.4						
5000	705.0	615.7	516.5						
5400		762.4	676.1						
5800				390.6					
6200				518.3	390.6				
6600				651.0	518.3	390.6			
7000					651.0	518.3			
7400						651.0	333.4		
7800							399.6		
8200							470.4	353.0	
8600							547.4	420.3	307.3
9000							632.6	492.8	372.7
9400							728.4	572.0	441.4
9800								660.1	515.8
10200								758.1	597.4
10600									688.9

1. Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -70ft/+70ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -100ft/+100ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -135ft/+135ft 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

TO1 Slippery Runway Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-4	-2	0	-11	-10	-8	-22	-20	-18
620	-5	-3	-2	-13	-11	-10	-25	-23	-21
580	-6	-4	-3	-15	-14	-12	-28	-26	-24
540	-7	-6	-4	-17	-16	-14	-31	-29	-27
500	-9	-7	-6	-20	-18	-17	-34	-33	-31
460	-10	-9	-7	-22	-21	-19	-38	-36	-34
420	-12	-10	-8	-25	-23	-21	-41	-39	-37
380	-13	-11	-9	-26	-24	-23	-43	-41	-39
340	-13	-11	-10	-27	-25	-24	-45	-43	-41

1. Obtain V1, VR and V2 for the actual weight.
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.

777 Flight Crew Operations Manual

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction

No Reverse Thrust

Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-1.1	-5.1	-9.1	-50.9	-54.9	-58.9	-98.0	-102.0	-106.0
660	-7.0	-11.0	-15.0	-54.2	-58.2	-62.2	-95.4	-99.4	-103.4
620	-12.4	-16.4	-20.4	-56.8	-60.8	-64.8	-92.3	-96.3	-100.3
580	-16.5	-20.5	-24.5	-57.8	-61.8	-65.8	-88.2	-92.2	-96.2
540	-19.4	-23.4	-27.4	-57.1	-61.1	-65.1	-83.3	-87.3	-91.3
500	-21.0	-25.0	-29.0	-54.9	-58.9	-62.9	-77.4	-81.4	-85.4
460	-21.5	-25.5	-29.5	-51.0	-55.0	-59.0	-70.5	-74.5	-78.5
420	-20.6	-24.6	-28.6	-45.5	-49.5	-53.5	-62.7	-66.7	-70.7
380	-18.5	-22.5	-26.5	-38.3	-42.3	-46.3	-53.9	-57.9	-61.9
340	-15.2	-19.2	-23.2	-29.6	-33.6	-37.6	-44.3	-48.3	-52.3

V1(MCG) Limit Weight (1000 LB)[illegible]

1. Enter Weight Adjustment table with reported braking action and TO1 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 -130 ft/+120 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -200 ft/+190 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limited 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

TO1 Slippery Runway Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-5	0	0	-16	-10	-4	-34	-28	-22
620	-7	-1	0	-19	-13	-7	-39	-33	-27
580	-9	-3	0	-23	-17	-11	-44	-38	-32
540	-11	-5	0	-26	-20	-14	-49	-43	-37
500	-13	-7	-1	-29	-23	-17	-54	-48	-42
460	-15	-9	-3	-33	-27	-21	-59	-53	-47
420	-17	-11	-5	-37	-31	-25	-64	-58	-52
380	-18	-12	-6	-40	-34	-28	-69	-63	-57
340	-20	-14	-8	-44	-38	-32	-74	-68	-62

1. Obtain V1, VR and V2 for the actual weight.
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

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

TO2 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-53.0	-59.8	-66.7	-63.5	-70.4	-77.2	-87.2	-94.1	-101.0
660	-51.7	-58.6	-65.5	-61.5	-68.4	-75.3	-83.5	-90.4	-97.2
620	-50.5	-57.4	-64.2	-59.6	-66.5	-73.3	-79.8	-86.7	-93.4
580	-49.3	-55.8	-61.9	-57.1	-63.2	-69.3	-73.5	-79.6	-85.7
540	-44.0	-50.0	-56.1	-50.7	-56.8	-62.8	-65.4	-71.5	-78.2
500	-40.3	-47.1	-53.8	-46.9	-53.6	-60.3	-61.0	-68.5	-76.7
460	-41.5	-49.6	-57.7	-47.9	-56.0	-64.3	-61.6	-70.5	-79.6
420	-40.6	-49.6	-58.7	-46.1	-55.1	-64.2	-57.8	-66.8	-75.9
380	-34.3	-43.4	-52.4	-38.2	-47.3	-56.3	-46.5	-55.6	-64.6

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5000							312.9		
5400	311.7			351.0			420.3	301.9	
5800	417.0	300.9		458.3	340.3		532.6	409.5	
6200	525.7	406.4		568.6	447.5	329.4	656.1	521.0	398.7
6600	642.1	514.6	395.8	684.3	557.4	436.7		643.0	509.5
7000	767.5	630.0	503.5		672.4	546.2		778.2	630.1
7400		755.0	618.0			660.6			764.8
7800			742.5			779.0			

1. Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -125ft/+125ft 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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-8	-3	2	-2	3	8	11	15	20
620	-10	-5	-1	-4	1	6	9	14	19
580	-13	-8	-3	-6	-1	4	7	12	17
540	-15	-10	-6	-9	-4	1	5	10	14
500	-18	-13	-8	-12	-7	-2	1	6	11
460	-20	-15	-11	-16	-11	-6	-3	1	6
420	-23	-18	-13	-19	-14	-9	-8	-4	1
380	-24	-19	-14	-20	-15	-10	-12	-7	-2
340	-24	-19	-14	-21	-16	-11	-15	-10	-5

1. Obtain V1, VR and V2 for the actual weight.
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

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

No Reverse Thrust

Weight Adjustment (1000 LB)

TO2 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-98.7	-110.7	-122.7	-118.4	-130.4	-142.4	-153.8	-165.8	-177.8
660	-93.5	-105.5	-117.5	-111.6	-123.6	-135.6	-143.5	-155.5	-167.5
620	-88.2	-100.2	-112.2	-104.7	-116.7	-128.7	-133.2	-145.2	-157.2
580	-82.9	-94.9	-106.9	-97.8	-109.8	-121.8	-122.8	-134.8	-146.8
540	-76.9	-88.9	-100.9	-90.0	-102.0	-114.0	-111.6	-123.6	-135.6
500	-70.1	-82.1	-94.1	-81.4	-93.4	-105.4	-99.5	-111.5	-123.5
460	-62.5	-74.5	-86.5	-71.8	-83.8	-95.8	-86.5	-98.5	-110.5
420	-54.1	-66.1	-78.1	-61.4	-73.4	-85.4	-72.5	-84.5	-96.5
380	-44.9	-56.9	-68.9	-50.0	-62.0	-74.0	-57.7	-69.7	-81.7
340	-34.8	-46.8	-58.8	-37.7	-49.7	-61.7	-42.0	-54.0	-66.0

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7000							310.7		
7400							468.9	310.7	
7800				376.4			661.7	468.9	310.7
8200	336.9			632.5	376.4			661.7	468.9
8600	740.6	336.9			632.5	376.4			661.7
9000		740.6	336.9			632.5			
9400			740.6						

1. Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water adjustment.
2. Adjust field length available by -190 ft/+180 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.

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-15	-9	-3	-5	0	0	0	0	0
620	-19	-13	-7	-8	-2	0	0	0	0
580	-22	-16	-10	-13	-7	-1	0	0	0
540	-26	-20	-14	-17	-11	-5	0	0	0
500	-30	-24	-18	-22	-16	-10	-4	0	0
460	-33	-27	-21	-27	-21	-15	-10	-4	0
420	-36	-30	-24	-31	-25	-19	-16	-10	-4
380	-38	-32	-26	-34	-28	-22	-23	-17	-11
340	-40	-34	-28	-36	-30	-24	-31	-25	-19

1. Obtain V1, VR and V2 for the actual weight.
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

TO2 Slippery Runway Takeoff

20% Thrust Reduction

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	-3.4	-6.8	-15.1	-18.5	-21.8	-52.9	-56.3	-59.6
660	0.0	-3.4	-6.8	-20.3	-23.7	-27.1	-54.8	-58.2	-61.6
620	0.0	-3.4	-6.8	-25.6	-29.0	-32.4	-57.0	-60.4	-63.8
580	0.0	-3.4	-6.8	-30.6	-34.0	-37.4	-58.9	-62.3	-65.8
540	-2.3	-5.8	-9.2	-33.7	-37.2	-40.6	-59.0	-62.5	-66.0
500	-6.0	-9.4	-12.9	-34.9	-38.4	-41.9	-57.3	-60.8	-64.3
460	-8.0	-11.5	-14.9	-34.3	-37.8	-41.3	-53.8	-57.3	-60.9
420	-8.3	-11.9	-15.4	-31.7	-35.2	-38.7	-48.5	-52.0	-55.6
380	-7.1	-10.7	-14.2	-27.2	-30.8	-34.3	-41.4	-44.9	-48.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4200	503.1	377.3							
4600	676.7	576.8	463.5						
5000		738.7	644.6						
5400				384.7					
5800				521.3	371.3				
6200				663.2	507.5	358.0			
6600					648.8	493.7			
7000						634.4	347.4		
7400						779.7	418.2		
7800							494.7	368.1	
8200							578.3	440.5	319.7
8600							671.8	518.9	389.3
9000							774.8	605.2	463.3
9400								702.5	543.8
9800									633.0
10200									733.5

1. Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -70ft/+70ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -100ft/+100ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -135ft/+135ft 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

TO2 Slippery Runway Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-4	-3	-2	-10	-9	-7	-19	-17	-16
620	-5	-4	-2	-12	-10	-9	-21	-20	-18
580	-6	-5	-3	-13	-12	-11	-24	-22	-21
540	-7	-6	-4	-15	-14	-12	-27	-25	-23
500	-8	-7	-5	-17	-16	-14	-29	-28	-26
460	-9	-8	-7	-19	-18	-16	-33	-31	-29
420	-11	-10	-9	-22	-21	-19	-36	-35	-33
380	-12	-11	-9	-23	-22	-20	-38	-37	-35
340	-12	-11	-9	-24	-22	-21	-39	-38	-36

1. Obtain V1, VR and V2 for the actual weight.
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

TO2 Slippery Runway Takeoff
20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	0.0	-2.1	-43.0	-47.0	-51.0	-93.5	-97.5	-101.5
660	0.0	-4.0	-8.0	-46.4	-50.4	-54.4	-91.1	-95.1	-99.1
620	-5.9	-9.9	-13.9	-49.8	-53.8	-57.8	-88.5	-92.5	-96.5
580	-11.3	-15.3	-19.3	-52.5	-56.5	-60.5	-85.5	-89.5	-93.5
540	-15.4	-19.4	-23.4	-53.5	-57.5	-61.5	-81.5	-85.5	-89.5
500	-18.2	-22.2	-26.2	-52.7	-56.7	-60.7	-76.5	-80.5	-84.5
460	-19.7	-23.7	-27.7	-50.2	-54.2	-58.2	-70.4	-74.4	-78.4
420	-19.8	-23.8	-27.8	-45.9	-49.9	-53.9	-63.4	-67.4	-71.4
380	-18.5	-22.5	-26.5	-39.9	-43.9	-47.9	-55.2	-59.2	-63.2
340	-16.0	-20.0	-24.0	-32.1	-36.1	-40.1	-46.1	-50.1	-54.1

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5000	668.1	554.0							
5400			711.3						
7400				708.9					
7800					775.3	604.2			
11000							495.5		
11400							730.9	344.1	
11800								592.0	
12200									445.9
12600									685.2

1. Enter Weight Adjustment table with reported braking action and TO2 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 -130 ft/+120 ft for every 5°C above/below 4°C.
Adjust “Poor” field length available by -200 ft/+190 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limited 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

TO2 Slippery Runway Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-6	0	0	-15	-9	-3	-30	-24	-18
620	-8	-2	0	-17	-11	-5	-34	-28	-22
580	-9	-3	0	-20	-14	-8	-38	-32	-26
540	-10	-4	0	-23	-17	-11	-42	-36	-30
500	-12	-6	0	-26	-20	-14	-47	-41	-35
460	-14	-8	-2	-29	-23	-17	-52	-46	-40
420	-15	-9	-3	-32	-26	-20	-56	-50	-44
380	-17	-11	-5	-35	-29	-23	-61	-55	-49
340	-18	-12	-6	-38	-32	-26	-65	-59	-53

1. Obtain V1, VR and V2 for the actual weight.
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.

Minimum Control Speeds

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)					
		0		4000		8000	
°C	°F	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR
60	140	97	103	95	100		
50	122	100	105	95	100	91	97
40	104	106	111	98	103	91	97
30	86	110	115	102	107	94	99
20	68	110	115	103	108	95	100
-60	-76	111	115	104	109	97	102

TO1 V1(MCG), Minimum VR

10% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)					
		0		4000		8000	
°C	°F	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR
60	140	93	98	90	95		
50	122	95	101	90	95	87	92
40	104	100	105	93	98	87	92
30	86	104	109	97	102	89	95
20	68	105	109	98	103	90	96
-60	-76	106	110	99	104	92	97

TO2 V1(MCG), Minimum VR

20% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)					
		0		4000		8000	
°C	°F	V1(MCG)	MinVR	V1(MCG)	MinVR	V1(MCG)	MinVR
60	140	89	94	86	91		
50	122	91	96	86	91	82	88
40	104	95	100	88	94	82	88
30	86	99	104	91	97	85	90
20	68	99	104	93	98	86	91
-60	-76	100	104	94	99	88	93

Go-around EPR

Based on engine bleed for packs on and anti-ice off

REPORTED OAT		TAT	AIRPORT PRESSURE ALTITUDE (FT)										
°C	°F	°C	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
56	133	60	1.276	1.274	1.275	1.276	1.278	1.279	1.281	1.293	1.284	1.286	1.289
51	124	55	1.309	1.306	1.306	1.303	1.305	1.308	1.310	1.313	1.315	1.318	1.322
46	115	50	1.346	1.345	1.344	1.341	1.341	1.339	1.340	1.343	1.345	1.350	1.355
41	106	45	1.387	1.387	1.387	1.385	1.383	1.382	1.381	1.380	1.377	1.382	1.388
36	97	40	1.401	1.433	1.430	1.430	1.429	1.426	1.430	1.427	1.427	1.426	1.421
31	88	35	1.401	1.472	1.471	1.470	1.468	1.470	1.469	1.467	1.467	1.468	1.454
26	79	30	1.401	1.481	1.494	1.500	1.495	1.496	1.493	1.492	1.490	1.481	1.472
21	70	25	1.401	1.481	1.494	1.507	1.514	1.512	1.510	1.508	1.506	1.499	1.492
16	61	20	1.401	1.481	1.494	1.507	1.517	1.527	1.526	1.524	1.522	1.515	1.507
11	52	15	1.401	1.481	1.494	1.507	1.517	1.527	1.533	1.539	1.538	1.531	1.524
7	45	10	1.401	1.481	1.494	1.507	1.517	1.527	1.533	1.539	1.545	1.546	1.541
2 & BELOW	36 & BELOW	5 & BELOW	1.401	1.481	1.494	1.507	1.517	1.527	1.533	1.539	1.545	1.546	1.546

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	10000
PACKS OFF	0.013	0.013	0.014	0.016	0.017	0.018	0.020
2 PACK ON - 2 BLEED SOURCES	0	0	0	0	0	0	0
2 PACK ON - 1 BLEED SOURCES	-0.013	-0.014	-0.015	-0.016	-0.016	-0.018	-0.020
1 PACK ON - 2 BLEED SOURCE	-0.013	-0.014	-0.015	-0.016	-0.016	-0.018	-0.020
1 PACK ON - 1 BLEED SOURCE	-0.013	-0.014	-0.015	-0.016	-0.016	-0.018	-0.020
WING ANTI-ICE ON	0.006	0.006	0.008	0.008	0.008	0.009	0.010

Max Climb EPR

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (IAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	1.148	1.134	1.141	1.151	1.154	1.104	1.100	1.171	1.186	1.201
50	1.186	1.171	1.158	1.151	1.154	1.104	1.100	1.171	1.186	1.201
40	1.210	1.212	1.198	1.186	1.161	1.104	1.100	1.171	1.186	1.201
30	1.210	1.234	1.252	1.241	1.209	1.153	1.113	1.171	1.186	1.201
20	1.210	1.234	1.264	1.301	1.277	1.248	1.223	1.193	1.186	1.201
10	1.210	1.234	1.264	1.301	1.330	1.382	1.338	1.294	1.281	1.289
0	1.210	1.234	1.264	1.301	1.330	1.410	1.441	1.401	1.384	1.384
-10	1.210	1.234	1.264	1.301	1.330	1.410	1.458	1.487	1.474	1.472
-15 & BELOW	1.210	1.234	1.264	1.301	1.330	1.410	1.458	1.503	1.505	1.504

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	40	43
ENGINE ONLY	-0.016	-0.015	-0.017	-0.019	-0.019	-0.021
ENGINE & WING*	-0.022	-0.025	-0.030	-0.034	-0.038	-0.042
ENGINE & WING**	-0.029	-0.035	-0.043	-0.048	-0.056	-0.063

*Wing anti-ice on, packs on.

**Wing anti-ice on, single bleed source and both packs off.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		400	500	600	700
40000 (.82M)	PITCH ATT V/S (FT/MIN)	3.5 800			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	4.0 1800	4.0 1200	4.0 700	
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	6.5 2900	6.0 2100	6.0 1500	6.5 1000
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	9.0 3900	8.0 2900	8.0 2200	8.0 1700
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	11.5 4700	10.5 3600	9.5 2800	9.5 2300

Cruise

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		400	500	600	700
40000 (.82M)	PITCH ATT EPR (Alt Mode %N1)	2.5 1.211 (83.6)			
35000 (280 KIAS)	PITCH ATT EPR (Alt Mode %N1)	1.5 1.092 (79.8)	2.0 1.18 (83.1)	3.0 1.370 (89.7)	
30000 (280 KIAS)	PITCH ATT EPR (Alt Mode %N1)	2.0 1.027 (76.3)	2.5 1.082 (79.0)	3.0 1.168 (82.8)	4.0 1.336 (89.2)
25000 (280 KIAS)	PITCH ATT EPR (Alt Mode %N1)	2.0 0.988 (72.5)	2.5 1.024 (75.2)	3.5 1.084 (78.6)	4.0 1.162 (82.4)
20000 (270 KIAS)	PITCH ATT EPR (Alt Mode %N1)	2.0 0.973 (68.0)	3.0 1.001 (70.6)	4.0 1.042 (74.5)	5.0 1.101 (78.5)
15000 (270 KIAS)	PITCH ATT EPR (Alt Mode %N1)	2.0 0.969 (64.9)	3.0 0.988 (67.3)	4.0 1.018 (70.2)	5.0 1.057 (74.1)

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		400	500	600	700
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-0.5 -2500			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -2100	0.0 -1900	1.0 -1900	
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-0.5 -1700	0.5 -1600	1.5 -1600	2.0 -1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1600	0.0 -1500	1.0 -1400	2.0 -1400
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -1600	-0.5 -1400	1.0 -1400	2.0 -1400

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		400	500	600	700
10000	PITCH ATT	4.5	5.0	5.0	4.5
	EPR	1.002	1.012	1.019	1.028
	(Alt Mode %N1)	(55.8)	(61.5)	(66.3)	(70.0)
	KLAS	210	227	249	271
5000	PITCH ATT	4.0	4.5	5.0	5.0
	EPR	0.998	1.006	1.010	1.016
	(Alt Mode %N1)	(51.5)	(57.2)	(62.2)	(66.3)
	KLAS	210	226	248	268

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)			
		400	500	600	700
FLAPS UP (GEAR UP) (VREF30+80)	PITCH ATT	4.5	5.0	5.5	5.5
	EPR	0.997	1.007	1.020	1.034
	(Alt Mode %N1)	(51.3)	(57.2)	(62.2)	(66.7)
	KLAS	210	226	239	254
FLAPS 1 (GEAR UP) (VREF30+60)	PITCH ATT	6.0	6.5	7.0	7.0
	EPR	1.012	1.024	1.040	1.060
	(Alt Mode %N1)	(51.9)	(58.0)	(63.5)	(68.2)
	KLAS	190	206	219	234
FLAPS 5 (GEAR UP) (VREF30+40)	PITCH ATT	5.0	5.5	6.0	6.0
	EPR	1.027	1.043	1.063	1.084
	(Alt Mode %N1)	(53.1)	(59.5)	(65.0)	(69.5)
	KLAS	170	186	199	214
FLAPS 15 (GEAR UP) (VREF30+20)	PITCH ATT	6.0	6.0	6.5	6.5
	EPR	1.043	1.062	1.088	1.112
	(Alt Mode %N1)	(55.0)	(61.4)	(66.9)	(71.3)
	KLAS	150	166	179	194
FLAPS 20 (GEAR DOWN) (VREF30+20)	PITCH ATT	4.5	5.0	5.5	5.5
	EPR	1.070	1.101	1.136	1.174
	(Alt Mode %N1)	(61.4)	(67.9)	(73.1)	(77.6)
	KLAS	150	166	179	194

Final Approach (1500 FT)

Gear Down, Set Thrust for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)			
		400	500	600	700
FLAPS 20 (VREF20+10)	PITCH ATT	1.0	1.5	1.5	1.5
	EPR	1.002	1.007	1.012	1.017
	(Alt Mode %N1)	41.0	45.6	49.6	53.1
	KLAS	153	170	184	198
FLAPS 25 (VREF25+10)	PITCH ATT	1.0	1.0	1.0	1.5
	EPR	1.031	1.043	1.055	1.071
	(Alt Mode %N1)	50.2	55.8	60.7	64.7
	KLAS	145	162	176	189
FLAPS 30 (VREF30+10)	PITCH ATT	0.5	0.5	0.5	0.5
	EPR	1.050	1.066	1.085	1.108
	(Alt Mode %N1)	55.3	60.9	65.7	70.1
	KLAS	140	156	169	184

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

Normal Mode

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		400	500	600	700
10000	PITCH ATT	14.0	11.0	9.5	7.5
	V/S (FT/MIN)	3000	2300	1700	1300
	KIAS	150	166	180	197
5000	PITCH ATT	17.0	13.5	11.5	9.5
	V/S (FT/MIN)	3700	2900	2300	1800
	KIAS	150	166	180	195
SEA LEVEL	PITCH ATT	20.0	16.0	13.0	11.0
	V/S (FT/MIN)	4300	3400	2700	2200
	KIAS	150	166	179	194

Alternate Mode EEC

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		350	450	550	650
10000	PITCH ATT	13.5	10.5	9.0	7.5
	V/S (FT/MIN)	2900	2100	1600	1200
	KIAS	150	166	180	197
5000	PITCH ATT	16.5	13.0	11.0	9.0
	V/S (FT/MIN)	3600	2800	2200	1700
	KIAS	150	166	180	195
SEA LEVEL	PITCH ATT	19.0	15.0	12.5	10.5
	V/S (FT/MIN)	4100	3200	2600	2100
	KIAS	150	166	179	194

Intentionally
Blank

Performance Inflight
All Engine

Chapter PI
Section 41

Long Range Cruise Maximum Operating Altitude
Max Climb 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°)
660	29500	0	32800*	32800*	32800*	32800*	32200
640	30100	-1	33600*	33600*	33600*	33600*	32900
620	30800	-3	34300*	34300*	34300*	34300*	33500
600	31500	-4	35100*	35100*	35100*	35100*	34200
580	32300	-6	35800*	35800*	35800*	35800*	35000
560	33000	-8	36300*	36300*	36300*	36300*	35700
540	33800	-9	37000*	37000*	37000*	37000*	36400
520	34600	-11	37800*	37800*	37800*	37800*	37200
500	35400	-13	38600*	38600*	38600*	38600*	38000
480	36300	-14	39400*	39400*	39400*	39400*	38900
460	37200	-14	40200*	40200*	40200*	40200*	39800
440	38100	-14	41100*	41100*	41100*	41100*	40700
420	39100	-14	42000*	42000*	42000*	42000*	41700
400	40100	-14	43000*	43000*	43000*	43000*	42700
380	41100	-14	43100	43100	43100	43100	43100
360	42300	-14	43100	43100	43100	43100	43100
340	43100	-14	43100	43100	43100	43100	43100

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°)
660	29500	6	31800*	31800*	31800*	31800*	31800*
640	30100	5	32600*	32600*	32600*	32600*	32600*
620	30800	3	33400*	33400*	33400*	33400*	33400*
600	31500	1	34300*	34300*	34300*	34300*	34200
580	32300	0	35100*	35100*	35100*	35100*	35000
560	33000	-2	35800*	35800*	35800*	35800*	35700
540	33800	-4	36400*	36400*	36400*	36400*	36400
520	34600	-5	37200*	37200*	37200*	37200*	37200
500	35400	-7	38000*	38000*	38000*	38000*	38000
480	36300	-9	38800*	38800*	38800*	38800*	38800*
460	37200	-9	39600*	39600*	39600*	39600*	39600*
440	38100	-9	40500*	40500*	40500*	40500*	40500*
420	39100	-9	41400*	41400*	41400*	41400*	41400*
400	40100	-9	42300*	42300*	42300*	42300*	42300*
380	41100	-9	43100	43100	43100	43100	43100
360	42300	-9	43100	43100	43100	43100	43100
340	43100	-9	43100	43100	43100	43100	43100

*Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust
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°)
660	29500	12	30300*	30300*	30300*	30300*	30300*
640	30100	10	31200*	31200*	31200*	31200*	31200*
620	30800	9	32100*	32100*	32100*	32100*	32100*
600	31500	7	33000*	33000*	33000*	33000*	33000*
580	32300	6	34000*	34000*	34000*	34000*	34000*
560	33000	4	34900*	34900*	34900*	34900*	34900*
540	33800	2	35600*	35600*	35600*	35600*	35600*
520	34600	0	36200*	36200*	36200*	36200*	36200*
500	35400	-2	37000*	37000*	37000*	37000*	37000*
480	36300	-3	37800*	37800*	37800*	37800*	37800*
460	37200	-3	38700*	38700*	38700*	38700*	38700*
440	38100	-3	39500*	39500*	39500*	39500*	39500*
420	39100	-3	40400*	40400*	40400*	40400*	40400*
400	40100	-3	41300*	41300*	41300*	41300*	41300*
380	41100	-3	42300*	42300*	42300*	42300*	42300*
360	42300	-3	43100	43100	43100	43100	43100
340	43100	-3	43100	43100	43100	43100	43100

*Denotes altitude thrust limited in level flight, 300 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	43
660	EPR	1.090	1.125	1.172	1.250	1.370					
	MACH	.772	.802	.834	.841	.839					
	KIAS	325	325	325	314	300					
	FF/ENG	9724	9828	10065	10189	10650					
620	EPR	1.069	1.100	1.140	1.199	1.286					
	MACH	.772	.802	.834	.841	.841					
	KIAS	325	325	325	314	301					
	FF/ENG	9343	9405	9586	9535	9619					
580	EPR	1.052	1.079	1.111	1.157	1.224	1.325				
	MACH	.772	.802	.828	.838	.841	.840				
	KIAS	325	325	322	313	301	287				
	FF/ENG	9022	9054	9067	8966	8903	9099				
540	EPR	1.036	1.061	1.088	1.123	1.174	1.249	1.367			
	MACH	.754	.785	.813	.831	.839	.841	.839			
	KIAS	317	317	316	310	300	288	274			
	FF/ENG	8469	8495	8493	8410	8316	8291	8668			
500	EPR	1.021	1.041	1.067	1.095	1.134	1.189	1.273	1.408		
	MACH	.726	.758	.789	.816	.833	.840	.841	.838		
	KIAS	304	305	306	304	297	287	275	261		
	FF/ENG	7809	7842	7861	7848	7760	7673	7734	8277		
460	EPR	1.006	1.024	1.045	1.072	1.101	1.143	1.204	1.294		
	MACH	.699	.728	.760	.792	.818	.834	.840	.841		
	KIAS	292	292	294	294	292	285	274	262		
	FF/ENG	7189	7184	7218	7225	7205	7121	7087	7227		
420	EPR	.994	1.007	1.026	1.047	1.074	1.105	1.150	1.216	1.307	
	MACH	.672	.698	.727	.760	.792	.819	.835	.840	.841	
	KIAS	280	280	280	281	282	279	272	262	250	
	FF/ENG	6616	6566	6564	6590	6589	6571	6533	6548	6696	
380	EPR	.985	.994	1.007	1.026	1.047	1.073	1.108	1.155	1.219	1.310
	MACH	.645	.669	.695	.724	.757	.791	.818	.834	.840	.841
	KIAS	268	267	266	267	268	268	266	260	250	239
	FF/ENG	6060	5995	5947	5941	5960	5969	5979	5987	6000	6133
340	EPR	.977	.984	.993	1.006	1.023	1.044	1.072	1.108	1.153	1.216
	MACH	.615	.639	.663	.689	.718	.751	.785	.815	.832	.840
	KIAS	255	254	253	253	253	254	254	253	247	239
	FF/ENG	5608	5553	5380	5332	5314	5332	5371	5422	5433	5443

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitude
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
283	262	243	226	213	200	191	182	174	167	161
423	392	364	340	319	300	286	274	262	252	243
564	522	485	453	425	400	382	366	351	337	325
705	653	606	566	531	500	478	457	439	422	407
846	783	727	680	638	600	574	549	527	507	489
987	914	849	793	744	700	670	642	616	592	570
1128	1044	970	906	850	800	766	734	704	677	652
1271	1176	1092	1020	957	900	861	825	792	762	734
1413	1308	1214	1133	1063	1000	957	917	880	846	816
1555	1439	1335	1247	1170	1100	1053	1009	968	931	898
1698	1571	1458	1361	1276	1200	1148	1101	1056	1016	979
1841	1703	1580	1475	1383	1300	1244	1192	1145	1101	1061
1984	1835	1702	1589	1489	1400	1340	1284	1233	1185	1142
2128	1968	1825	1703	1596	1500	1436	1376	1321	1270	1224
2272	2100	1948	1817	1703	1600	1532	1468	1409	1355	1305
2417	2234	2070	1931	1809	1700	1627	1559	1497	1439	1387
2562	2367	2193	2045	1916	1800	1723	1651	1584	1524	1468
2707	2500	2316	2159	2023	1900	1818	1742	1672	1608	1549
2852	2634	2439	2274	2129	2000	1914	1834	1760	1692	1630

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	8.9	0:39	7.6	0:37	6.2	0:35	5.4	0:34	4.8	0:33
300	13.6	0:56	12.0	0:53	10.0	0:50	9.0	0:48	8.2	0:46
400	18.4	1:13	16.3	1:10	13.9	1:05	12.7	1:02	11.6	1:00
500	23.1	1:30	20.7	1:26	17.7	1:20	16.2	1:17	15.0	1:13
600	27.8	1:48	25.1	1:42	21.6	1:35	19.8	1:31	18.3	1:26
700	32.5	2:05	29.5	1:59	25.4	1:50	23.4	1:45	21.7	1:39
800	37.2	2:23	33.9	2:15	29.2	2:05	26.9	1:59	25.0	1:53
900	41.9	2:41	38.2	2:32	33.0	2:20	30.4	2:13	28.3	2:06
1000	46.6	2:58	42.5	2:48	36.7	2:36	34.0	2:28	31.7	2:19
1100	51.2	3:16	46.8	3:05	40.6	2:51	37.5	2:42	34.9	2:33
1200	55.9	3:34	51.1	3:22	44.4	3:06	41.0	2:57	38.2	2:46
1300	60.5	3:52	55.4	3:39	48.2	3:21	44.4	3:11	41.5	3:00
1400	65.1	4:11	59.7	3:56	52.0	3:37	47.9	3:26	44.8	3:13
1500	69.7	4:29	63.9	4:13	55.7	3:52	51.4	3:40	48.0	3:27
1600	74.3	4:47	68.1	4:30	59.5	4:08	54.8	3:55	51.2	3:41
1700	78.8	5:06	72.3	4:47	63.2	4:23	58.2	4:10	54.5	3:55
1800	83.3	5:24	76.5	5:04	66.9	4:39	61.7	4:24	57.7	4:08
1900	87.8	5:43	80.7	5:22	70.6	4:55	65.1	4:39	60.9	4:22
2000	92.3	6:02	84.9	5:39	74.3	5:10	68.5	4:54	64.0	4:36

Long Range Cruise Enroute Fuel and Time - Low Altitude
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	300	350	400	450	500	550	600	650
10	-1.3	-1.1	-0.6	-0.3	0.0	0.4	0.8	1.3
20	-3.4	-2.4	-1.5	-0.8	0.0	1.0	2.0	3.1
30	-5.5	-3.8	-2.4	-1.2	0.0	1.5	3.2	4.9
40	-7.6	-5.3	-3.3	-1.6	0.0	2.1	4.3	6.7
50	-9.6	-6.8	-4.2	-2.1	0.0	2.7	5.5	8.5
60	-11.8	-8.3	-5.2	-2.6	0.0	3.3	6.7	10.2
70	-13.9	-9.9	-6.2	-3.0	0.0	3.9	7.8	11.9
80	-16.1	-11.5	-7.3	-3.5	0.0	4.4	9.0	13.6
90	-18.3	-13.1	-8.4	-4.0	0.0	5.0	10.2	15.3
100	-20.4	-14.8	-9.5	-4.5	0.0	5.6	11.3	17.0

Long Range Cruise Enroute Fuel and Time - High Altitude
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
521	492	465	441	419	400	383	367	352	339	327
1032	976	925	879	838	800	767	736	708	682	658
1545	1462	1386	1318	1257	1200	1151	1106	1064	1025	990
2059	1949	1848	1758	1676	1600	1535	1475	1419	1368	1321
2576	2438	2311	2198	2095	2000	1920	1844	1775	1711	1652
3095	2928	2775	2638	2514	2400	2304	2214	2131	2054	1983
3616	3419	3239	3079	2934	2800	2688	2583	2486	2397	2315
4139	3912	3705	3520	3353	3200	3072	2953	2842	2739	2645
4664	4407	4172	3963	3774	3600	3456	3322	3197	3082	2976
5192	4904	4640	4406	4194	4000	3840	3691	3552	3424	3306
5721	5401	5109	4849	4615	4400	4224	4059	3906	3765	3636
6253	5901	5579	5294	5036	4800	4607	4428	4261	4107	3965
6787	6402	6051	5739	5458	5200	4991	4796	4615	4448	4295
7324	6905	6523	6185	5880	5600	5375	5164	4969	4789	4623
7863	7410	6997	6631	6302	6000	5758	5532	5322	5128	4951
8405	7917	7472	7078	6724	6400	6141	5899	5674	5467	5277
8950	8426	7949	7526	7147	6800	6523	6266	6026	5805	5603
9497	8936	8426	7975	7571	7200	6906	6632	6378	6143	5929
10048	9449	8905	8425	7994	7600	7289	6998	6729	6480	6253
10601	9964	9385	8875	8418	8000	7671	7364	7079	6817	6577

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	11.9	0:57	11.5	0:56	11.1	0:56	11.0	0:57	11.1	0:58
800	24.7	1:51	23.9	1:48	23.2	1:47	22.8	1:47	22.8	1:47
1200	37.5	2:44	36.3	2:40	35.3	2:37	34.7	2:37	34.6	2:37
1600	50.3	3:38	48.7	3:32	47.4	3:28	46.5	3:27	46.3	3:27
2000	63.0	4:32	61.1	4:24	59.5	4:18	58.4	4:17	58.1	4:17
2400	75.3	5:27	73.0	5:17	71.1	5:10	69.7	5:07	69.2	5:07
2800	87.6	6:23	85.0	6:11	82.7	6:02	81.0	5:58	80.4	5:56
3200	99.6	7:19	96.7	7:05	94.1	6:54	92.1	6:49	91.2	6:47
3600	111.4	8:17	108.2	8:00	105.2	7:48	102.9	7:40	101.9	7:37
4000	123.2	9:14	119.7	8:56	116.3	8:41	113.8	8:32	112.5	8:28
4400	134.6	10:14	130.7	9:53	127.1	9:36	124.2	9:25	122.6	9:19
4800	146.0	11:13	141.7	10:50	137.8	10:31	134.6	10:18	132.8	10:10
5200	157.2	12:13	152.5	11:49	148.3	11:27	144.9	11:12	142.8	11:02
5600	168.3	13:15	163.1	12:48	158.6	12:24	154.9	12:06	152.5	11:55
6000	179.3	14:16	173.7	13:47	168.9	13:21	164.9	13:01	162.3	12:47
6400	190.1	15:20	184.1	14:49	178.8	14:20	174.5	13:58	171.6	13:41
6800	200.8	16:24	194.4	15:50	188.7	15:19	184.2	14:55	181.0	14:35
7200	211.4	17:29	204.6	16:52	198.5	16:19	193.6	15:52	190.2	15:31
7600	221.7	18:35	214.7	17:56	208.2	17:20	202.9	16:51	199.2	16:27
8000	232.0	19:41	224.7	18:59	218.0	18:21	212.1	17:50	208.2	17:23

Long Range Cruise Enroute Fuel and Time - High Altitude Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	300	350	400	450	500	550	600	650
10	-1.9	-1.9	-1.4	-0.7	0.0	1.9	5.8	11.7
20	-3.8	-3.3	-2.5	-1.2	0.0	2.9	8.2	15.9
30	-5.8	-4.8	-3.5	-1.7	0.0	3.8	10.5	20.0
40	-7.8	-6.2	-4.4	-2.2	0.0	4.7	12.7	23.8
50	-9.9	-7.7	-5.4	-2.7	0.0	5.6	14.8	27.5
60	-11.9	-9.2	-6.3	-3.2	0.0	6.5	16.9	31.1
70	-14.1	-10.8	-7.3	-3.8	0.0	7.3	18.8	34.4
80	-16.2	-12.3	-8.3	-4.3	0.0	8.2	20.7	37.6
90	-18.4	-13.9	-9.3	-4.8	0.0	9.0	22.5	40.6
100	-20.6	-15.5	-10.3	-5.3	0.0	9.7	24.2	43.5
110	-22.9	-17.1	-11.4	-5.9	0.0	10.5	25.9	46.1
120	-25.2	-18.7	-12.4	-6.4	0.0	11.2	27.4	48.6
130	-27.5	-20.4	-13.5	-6.9	0.0	11.9	28.9	50.9
140	-29.8	-22.1	-14.5	-7.5	0.0	12.6	30.3	53.1
150	-32.2	-23.8	-15.6	-8.0	0.0	13.2	31.6	55.0
160	-34.6	-25.5	-16.7	-8.6	0.0	13.9	32.8	56.8
170	-37.1	-27.3	-17.8	-9.1	0.0	14.5	33.9	58.4
180	-39.6	-29.1	-19.0	-9.7	0.0	15.1	35.0	59.8
190	-42.1	-30.9	-20.1	-10.2	0.0	15.6	36.0	61.1
200	-44.7	-32.7	-21.3	-10.8	0.0	16.2	36.9	62.2
210	-47.3	-34.5	-22.4	-11.3	0.0	16.7	37.7	63.1
220	-49.9	-36.4	-23.6	-11.9	0.0	17.2	38.4	63.8
230	-52.6	-38.3	-24.8	-12.4	0.0	17.6	39.1	64.3
240	-55.2	-40.2	-26.0	-13.0	0.0	18.1	39.6	64.7

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)								
	660	620	580	540	500	460	420	380	340
43							44	10	0
41						42	11	0	3
39				80	36	10	0	2	14
37			64	28	8	0	2	12	29
35		47	20	5	0	2	12	26	44
33	33	13	2	0	3	12	25	42	59
31	7	0	0	5	13	26	40	56	73
29	0	1	7	15	27	40	55	70	85
27	3	9	18	29	41	55	69	82	96
25	12	21	32	43	56	68	81	93	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 at .84/310/250

PRESSURE ALT (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	97	104	111	119	125	130	135	141	147	152
TIME (MINUTES)	19	20	21	22	23	23	24	25	26	26

Holding Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
660	EPR	1.009	1.013	1.025	1.033	1.041	1.100	1.204			
	KIAS	259	260	261	277	302	306	310			
	FF/ENG	9660	9510	9380	9290	9550	9750	10250			
620	EPR	1.007	1.011	1.021	1.033	1.034	1.082	1.169			
	KIAS	251	252	253	262	287	296	300			
	FF/ENG	9060	8960	8820	8660	8830	9080	9430			
580	EPR	1.006	1.010	1.017	1.032	1.034	1.066	1.139	1.321		
	KIAS	243	244	245	248	269	285	289	279		
	FF/ENG	8610	8540	8390	8190	8100	8430	8670	9270		
540	EPR	1.005	1.008	1.014	1.027	1.034	1.049	1.113	1.241		
	KIAS	234	235	236	237	252	275	278	279		
	FF/ENG	8050	7950	7850	7630	7560	7790	7960	8400		
500	EPR	1.003	1.006	1.012	1.022	1.034	1.039	1.090	1.188		
	KIAS	226	226	227	228	235	259	267	271		
	FF/ENG	7500	7370	7300	7090	6930	7090	7290	7600		
460	EPR	1.000	1.003	1.008	1.016	1.032	1.039	1.068	1.147	1.350	
	KIAS	220	220	220	220	220	238	255	259	249	
	FF/ENG	6970	6830	6750	6560	6380	6400	6660	6850	7580	
420	EPR	.996	.999	1.004	1.010	1.021	1.037	1.047	1.112	1.248	
	KIAS	213	213	213	213	213	220	243	246	249	
	FF/ENG	6430	6310	6180	6040	5900	5880	6020	6150	6670	
380	EPR	.993	.996	1.000	1.005	1.012	1.031	1.041	1.081	1.182	1.302
	KIAS	206	206	206	206	206	206	221	233	237	232
	FF/ENG	5900	5790	5660	5530	5420	5310	5420	5510	5850	6220
340	EPR	.991	.993	.996	1.000	1.005	1.019	1.039	1.054	1.130	1.211
	KIAS	199	199	199	199	199	199	199	219	223	225
	FF/ENG	5400	5280	5160	5020	4960	4800	4770	4930	5110	5380

This table includes 5% additional fuel for holding in a racetrack pattern.

777 Flight Crew Operations Manual

Holding Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
660	EPR	1.038	1.050	1.071	1.108	1.164
	KIAS	229	229	229	229	229
	FF/ENG	10050	9940	9850	9600	9690
620	EPR	1.034	1.044	1.063	1.094	1.143
	KIAS	222	222	222	222	222
	FF/ENG	9420	9320	9250	9000	8990
580	EPR	1.028	1.037	1.054	1.079	1.121
	KIAS	217	217	217	217	217
	FF/ENG	8950	8840	8740	8520	8290
540	EPR	1.023	1.030	1.045	1.065	1.099
	KIAS	212	212	212	212	212
	FF/ENG	8360	8230	8140	7930	7790
500	EPR	1.019	1.025	1.037	1.054	1.079
	KIAS	206	206	206	206	206
	FF/ENG	7760	7630	7540	7360	7220
460	EPR	1.014	1.020	1.030	1.044	1.062
	KIAS	200	200	200	200	200
	FF/ENG	7160	7050	6940	6790	6660
420	EPR	1.009	1.015	1.024	1.035	1.047
	KIAS	193	193	193	193	193
	FF/ENG	6570	6470	6360	6230	6120
380	EPR	1.005	1.010	1.018	1.027	1.035
	KIAS	186	186	186	186	186
	FF/ENG	5990	5890	5790	5670	5590
340	EPR	1.001	1.005	1.012	1.020	1.025
	KIAS	179	179	179	179	179
	FF/ENG	5420	5320	5240	5140	5080

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight
Advisory Information

Chapter PI
Section 42

ADVISORY INFORMATION

Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

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	VREF ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4400	90/-50	90	-150/530	60/-50	80/-80	140	80	180
AUTOBRAKE MAX	5640	70/-70	130	-210/710	10/0	130/-130	260	0	0
AUTOBRAKE 4	6900	90/-90	170	-290/1000	10/-20	170/-170	330	0	0
AUTOBRAKE 3	8180	120/-120	220	-370/1240	30/-60	220/-220	390	0	0
AUTOBRAKE 2	9000	140/-140	250	-430/1440	100/-150	240/-240	360	140	140
AUTOBRAKE 1	9630	160/-160	290	-470/1610	180/-230	260/-260	360	520	590

Good Reported Braking Action

MAX MANUAL	5760	80/-80	140	-240/870	140/-120	130/-130	210	280	620
AUTOBRAKE MAX	6120	80/-80	150	-250/910	120/-90	140/-140	250	290	640
AUTOBRAKE 4	6920	90/-90	170	-300/1020	30/-30	170/-170	330	20	100
AUTOBRAKE 3	8180	120/-120	220	-370/1240	30/-60	220/-220	390	0	0
AUTOBRAKE 2	9000	140/-140	250	-430/1440	100/-150	240/-240	360	140	140
AUTOBRAKE 1	9630	160/-160	290	-470/1610	180/-230	260/-260	360	520	590

Good To Medium Reported Braking Action

MAX MANUAL	6690	100/-100	180	-320/1150	240/-190	160/-160	230	510	1210
AUTOBRAKE MAX	6910	100/-100	180	-320/1170	220/-160	170/-170	280	500	1200
AUTOBRAKE 4	7370	100/-100	200	-350/1230	180/-130	180/-180	320	360	940
AUTOBRAKE 3	8370	120/-120	220	-400/1390	130/-100	220/-220	390	180	600
AUTOBRAKE 2	9110	140/-140	260	-440/1540	170/-180	250/-240	360	230	510
AUTOBRAKE 1	9680	160/-160	290	-480/1670	240/-250	270/-260	360	560	780

Medium Reported Braking Action

MAX MANUAL	7620	120/-120	220	-390/1430	330/-260	200/-180	250	740	1790
AUTOBRAKE MAX	7690	130/-120	220	-390/1430	320/-230	200/-200	300	710	1760
AUTOBRAKE 4	7810	120/-120	220	-390/1440	320/-220	200/-200	310	700	1780
AUTOBRAKE 3	8560	130/-130	230	-430/1530	230/-150	230/-230	390	370	1200
AUTOBRAKE 2	9210	140/-150	260	-460/1630	240/-220	250/-240	360	320	870
AUTOBRAKE 1	9730	160/-160	290	-490/1730	300/-280	280/-260	360	610	980

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	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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

Medium To Poor Reported Braking Action

MAX MANUAL	8660	140/-140	260	-490/1830	560/-390	230/-220	280	1140	2970
AUTOBRAKE MAX	8710	150/-140	260	-490/1830	560/-370	230/-220	300	1140	2960
AUTOBRAKE 4	8790	140/-140	260	-490/1840	550/-370	230/-220	300	1140	2980
AUTOBRAKE 3	9260	150/-140	270	-510/1890	480/-300	250/-250	390	900	2630
AUTOBRAKE 2	9750	160/-160	290	-530/1970	480/-350	260/-260	360	790	2300
AUTOBRAKE 1	10140	170/-170	310	-560/2030	510/-390	280/-280	350	1010	2280

Poor Reported Braking Action

MAX MANUAL	9690	170/-160	310	-590/2230	780/-520	260/-250	300	1550	4150
AUTOBRAKE MAX	9720	170/-160	310	-590/2230	790/-520	260/-250	300	1560	4160
AUTOBRAKE 4	9780	170/-160	310	-590/2240	780/-530	260/-250	300	1580	4190
AUTOBRAKE 3	9960	170/-160	310	-590/2250	740/-450	280/-260	380	1440	4070
AUTOBRAKE 2	10280	170/-170	320	-600/2300	720/-480	280/-280	360	1270	3730
AUTOBRAKE 1	10560	180/-180	330	-620/2330	720/-490	290/-290	350	1400	3580

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 230 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.

Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)							
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV NO REV

Dry Runway

MAX MANUAL	4600	90/-60	90	-160/550	60/-60	90/-90	150	100	220
AUTOBRAKE MAX	5930	80/-80	130	-220/740	10/0	140/-140	260	0	0
AUTOBRAKE 4	7330	100/-100	180	-310/1040	10/-20	180/-180	350	0	0
AUTOBRAKE 3	8690	130/-130	230	-380/1290	50/-80	230/-230	380	0	0
AUTOBRAKE 2	9510	150/-160	280	-440/1480	140/-180	260/-260	360	250	250
AUTOBRAKE 1	10110	170/-170	310	-480/1660	220/-250	290/-280	360	690	820

Good Reported Braking Action

MAX MANUAL	5970	80/-80	150	-250/890	140/-120	140/-140	200	310	720
AUTOBRAKE MAX	6380	80/-80	160	-260/920	120/-80	150/-150	260	320	750
AUTOBRAKE 4	7350	100/-100	180	-310/1060	30/-30	180/-180	350	20	100
AUTOBRAKE 3	8690	130/-130	230	-380/1290	50/-80	230/-230	380	0	0
AUTOBRAKE 2	9510	150/-160	280	-440/1480	140/-180	260/-260	360	250	250
AUTOBRAKE 1	10110	170/-170	310	-480/1660	220/-250	290/-280	360	690	820

Good To Medium Reported Braking Action

MAX MANUAL	6940	100/-100	190	-330/1170	240/-190	170/-170	220	580	1400
AUTOBRAKE MAX	7190	100/-100	200	-330/1180	220/-160	180/-180	280	570	1390
AUTOBRAKE 4	7760	120/-120	210	-360/1270	170/-120	200/-200	340	380	1050
AUTOBRAKE 3	8880	130/-130	240	-410/1430	130/-130	240/-240	380	180	650
AUTOBRAKE 2	9610	150/-160	280	-450/1580	200/-210	260/-260	360	350	650
AUTOBRAKE 1	10160	170/-170	320	-490/1710	270/-280	290/-280	360	740	1020

Medium Reported Braking Action

MAX MANUAL	7910	130/-130	230	-400/1450	330/-260	210/-200	250	840	2080
AUTOBRAKE MAX	8000	130/-130	230	-400/1450	320/-240	210/-210	300	820	2040
AUTOBRAKE 4	8180	130/-130	230	-400/1470	300/-210	220/-210	330	740	2000
AUTOBRAKE 3	9070	140/-140	250	-440/1580	220/-170	240/-240	380	370	1300
AUTOBRAKE 2	9720	150/-160	290	-470/1670	260/-240	260/-260	360	440	1050
AUTOBRAKE 1	10210	170/-170	320	-510/1760	320/-310	290/-280	360	780	1230

ADVISORY INFORMATION

Normal Configuration Landing Distance Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	8980	150/-150	280	-490/1850	560/-390	240/-230	280	1290	3440
AUTOBRAKE MAX	9040	150/-150	280	-490/1850	560/-390	240/-240	300	1280	3420
AUTOBRAKE 4	9150	150/-150	280	-490/1870	550/-370	250/-240	320	1250	3420
AUTOBRAKE 3	9750	160/-160	290	-520/1930	470/-320	260/-260	370	950	2960
AUTOBRAKE 2	10230	170/-170	320	-540/2000	500/-370	280/-280	360	940	2660
AUTOBRAKE 1	10620	180/-180	340	-570/2060	530/-410	290/-290	360	1180	2680

Poor Reported Braking Action

MAX MANUAL	10040	170/-170	320	-590/2250	780/-520	280/-260	300	1750	4800
AUTOBRAKE MAX	10070	170/-170	330	-590/2250	790/-530	280/-260	300	1750	4810
AUTOBRAKE 4	10130	170/-170	330	-590/2270	790/-530	280/-260	300	1760	4840
AUTOBRAKE 3	10420	170/-170	330	-600/2290	720/-470	290/-280	370	1530	4610
AUTOBRAKE 2	10740	180/-180	350	-610/2330	740/-490	300/-290	360	1440	4270
AUTOBRAKE 1	11030	200/-200	360	-630/2370	740/-510	300/-300	360	1590	4130

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 240 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 210 ft.

Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	9710	170/-160	310	-520/1930	610/-430	260/-250	300	1510	4080
AUTOBRAKE MAX	9750	170/-160	320	-520/1930	610/-420	260/-250	320	1500	4060
AUTOBRAKE 4	9900	170/-170	320	-520/1940	590/-400	260/-260	330	1450	4060
AUTOBRAKE 3	10550	170/-170	320	-550/2010	510/-350	290/-290	400	1110	3540
AUTOBRAKE 2	11100	190/-180	350	-570/2090	530/-400	310/-300	390	1060	3160
AUTOBRAKE 1	11530	200/-200	380	-590/2160	570/-430	330/-320	390	1360	3120

Poor Reported Braking Action

MAX MANUAL	10880	200/-180	370	-620/2350	850/-560	300/-290	320	2040	5700
AUTOBRAKE MAX	10890	200/-180	370	-620/2350	860/-580	300/-290	320	2050	5720
AUTOBRAKE 4	10970	200/-200	370	-620/2350	850/-580	300/-290	320	2060	5750
AUTOBRAKE 3	11280	200/-200	370	-630/2380	780/-510	310/-310	390	1790	5510
AUTOBRAKE 2	11650	210/-200	380	-640/2430	790/-530	320/-310	380	1640	5120
AUTOBRAKE 1	11960	210/-210	400	-660/2470	790/-540	330/-320	380	1830	4880

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 250 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 220 ft.

Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 20)

VREF20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4940	110/-60	110	-160/550	70/-60	110/-110	N/A	140	300
AUTOBRAKE MAX	5980	70/-80	140	-210/700	0/0	140/-140	N/A	0	0
AUTOBRAKE 2	10200	150/-170	300	-430/1460	40/-130	300/-290	N/A	70	70

Good Reported Braking Action

MAX MANUAL	6720	90/-100	180	-270/910	180/-150	170/-160	N/A	490	1140
AUTOBRAKE MAX	6770	90/-100	190	-270/920	160/-140	170/-170	N/A	480	1130
AUTOBRAKE 2	10200	150/-170	300	-430/1460	40/-130	300/-290	N/A	70	70

Good To Medium Reported Braking Action

MAX MANUAL	7810	120/-120	230	-340/1180	300/-240	210/-200	N/A	860	2170
AUTOBRAKE MAX	7830	120/-130	240	-340/1190	300/-250	210/-210	N/A	860	2160
AUTOBRAKE 2	10300	160/-170	310	-450/1550	130/-170	300/-290	N/A	220	940

Medium Reported Braking Action

MAX MANUAL	8890	140/-140	280	-410/1450	410/-330	240/-230	N/A	1230	3190
AUTOBRAKE MAX	8880	150/-150	290	-410/1450	440/-350	240/-240	N/A	1230	3190
AUTOBRAKE 3	9570	140/-150	280	-430/1520	280/-150	270/-260	N/A	710	2680

Medium To Poor Reported Braking Action

MAX MANUAL	10050	170/-170	340	-510/1840	660/-470	280/-270	N/A	1840	5210
AUTOBRAKE MAX	10060	180/-180	350	-510/1840	690/-490	280/-280	N/A	1850	5230
AUTOBRAKE 3	10470	170/-170	340	-520/1880	580/-350	300/-290	N/A	1550	4950

Poor Reported Braking Action

MAX MANUAL	11200	200/-200	400	-600/2220	900/-600	320/-300	N/A	2450	7230
AUTOBRAKE MAX	11240	210/-200	400	-600/2230	930/-630	320/-310	N/A	2460	7260
AUTOBRAKE 3	11360	200/-190	400	-600/2240	870/-540	330/-310	N/A	2390	7220

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (Flaps 25)

VREF25

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	6880	110/-110	200	-350/1260	290/-230	180/-170	220	730	1810
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6880	110/-110	200	-350/1260	290/-230	180/-170	220	730	1810
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7810	130/-130	240	-430/1610	490/-340	210/-200	240	1130	2990
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8730	150/-150	280	-510/1960	680/-450	240/-230	260	1520	4170
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10300	190/-190	350	-700/2920	1540/-770	280/-270	280	2730	9500
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11860	230/-220	410	-890/3880	2390/-1080	320/-310	290	3930	14830
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	6630	100/-100	190	-340/1240	290/-230	170/-160	220	640	1560
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6630	100/-100	190	-340/1240	290/-230	170/-160	220	640	1560
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7530	130/-120	230	-430/1590	490/-340	200/-190	240	1000	2590
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8430	150/-140	270	-510/1940	680/-450	230/-220	260	1350	3610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9960	190/-180	330	-700/2900	1520/-760	270/-260	280	2480	8380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11490	220/-210	390	-880/3850	2350/-1070	310/-300	290	3600	13140
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ENG SHUTDOWN L, R (Flaps 20)

VREF20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4340	100/-60	90	-150/520	60/-50	90/-90	140	0	120
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9220	140/-150	260	-410/1380	40/-60	260/-260	440	0	0

Good Reported Braking Action

MAX MANUAL	5810	80/-80	150	-240/850	160/-130	140/-140	200	0	400
AUTOBRAKE MAX	6180	80/-90	160	-260/880	140/-120	150/-150	230	0	420
AUTOBRAKE 2	9220	140/-150	260	-410/1380	40/-60	260/-260	440	0	0

Good To Medium Reported Braking Action

MAX MANUAL	6980	110/-110	200	-320/1140	290/-230	180/-180	240	0	810
AUTOBRAKE MAX	7180	110/-110	200	-330/1160	270/-210	190/-190	270	0	810
AUTOBRAKE 2	9370	150/-150	270	-430/1480	150/-110	270/-270	440	0	290

Medium Reported Braking Action

MAX MANUAL	8140	130/-130	240	-400/1430	420/-330	220/-220	270	0	1220
AUTOBRAKE MAX	8180	130/-130	240	-400/1440	400/-290	230/-220	310	0	1190
AUTOBRAKE 3	8800	140/-140	250	-420/1500	330/-200	250/-240	380	0	900

Medium To Poor Reported Braking Action

MAX MANUAL	9530	160/-160	300	-520/1880	750/-510	270/-270	300	0	2080
AUTOBRAKE MAX	9550	160/-160	300	-520/1880	750/-500	280/-270	320	0	2070
AUTOBRAKE 3	9920	170/-170	310	-530/1920	710/-430	290/-280	370	0	1940

Poor Reported Braking Action

MAX MANUAL	10910	190/-190	360	-630/2320	1070/-690	320/-310	330	0	2940
AUTOBRAKE MAX	10920	190/-190	360	-630/2320	1090/-700	320/-310	330	0	2940
AUTOBRAKE 3	11030	190/-190	360	-630/2330	1090/-660	320/-310	350	0	2980

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ENG SHUTDOWN L, R (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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	3880	80/-50	80	-140/470	50/-50	80/-80	130	0	80
AUTOBRAKE MAX	4900	60/-60	110	-180/620	10/0	110/-110	220	0	0
AUTOBRAKE 2	7940	120/-120	220	-370/1260	30/-50	220/-220	390	0	0

Good Reported Braking Action

MAX MANUAL	5190	70/-70	130	-230/790	140/-120	120/-120	190	0	290
AUTOBRAKE MAX	5530	70/-70	130	-240/830	120/-100	130/-130	220	0	300
AUTOBRAKE 2	7940	120/-120	220	-370/1260	30/-50	220/-220	390	0	0

Good To Medium Reported Braking Action

MAX MANUAL	6170	90/-90	170	-300/1070	260/-200	160/-160	220	0	580
AUTOBRAKE MAX	6370	90/-90	170	-310/1090	240/-180	160/-160	260	0	580
AUTOBRAKE 2	8080	130/-130	230	-390/1360	130/-100	230/-230	390	0	210

Medium Reported Braking Action

MAX MANUAL	7140	110/-110	200	-370/1340	370/-280	190/-190	250	0	870
AUTOBRAKE MAX	7200	110/-110	200	-370/1350	350/-250	190/-190	290	0	850
AUTOBRAKE 3	7660	120/-120	210	-390/1390	300/-190	210/-210	340	0	660

Medium To Poor Reported Braking Action

MAX MANUAL	8310	140/-140	250	-480/1760	660/-440	230/-230	280	0	1470
AUTOBRAKE MAX	8350	140/-140	250	-480/1760	650/-430	230/-230	300	0	1460
AUTOBRAKE 3	8630	150/-140	260	-490/1790	630/-390	240/-240	330	0	1380

Poor Reported Braking Action

MAX MANUAL	9480	160/-160	300	-580/2170	940/-590	270/-260	300	0	2070
AUTOBRAKE MAX	9500	160/-160	300	-580/2170	950/-600	270/-260	300	0	2070
AUTOBRAKE 3	9600	170/-160	300	-580/2180	960/-580	270/-270	310	0	2100

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAP / SLAT CONTROL (Flaps 20)

VREF20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4250	90/-50	90	-150/510	50/-50	90/-90	130	110	230
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	8910	140/-150	270	-400/1340	140/-180	250/-250	320	300	300

Good Reported Braking Action

MAX MANUAL	5490	70/-80	140	-230/790	130/-110	130/-130	180	310	710
AUTOBRAKE MAX	5890	80/-80	150	-240/830	90/-70	140/-140	240	290	710
AUTOBRAKE 2	8910	140/-150	270	-400/1340	140/-180	250/-250	320	300	300

Good To Medium Reported Braking Action

MAX MANUAL	6410	100/-100	180	-300/1040	220/-180	160/-160	210	570	1380
AUTOBRAKE MAX	6650	100/-100	190	-300/1070	190/-150	170/-170	250	550	1350
AUTOBRAKE 2	9000	150/-150	270	-420/1430	200/-210	250/-250	320	380	680

Medium Reported Braking Action

MAX MANUAL	7330	120/-120	220	-360/1290	310/-250	190/-190	230	820	2040
AUTOBRAKE MAX	7410	120/-120	220	-360/1300	290/-220	200/-190	260	800	1990
AUTOBRAKE 3	8480	130/-130	240	-400/1420	200/-170	230/-230	330	360	1250

Medium To Poor Reported Braking Action

MAX MANUAL	8330	150/-140	270	-450/1660	520/-370	230/-220	250	1260	3380
AUTOBRAKE MAX	8370	150/-140	270	-450/1660	510/-350	230/-220	270	1250	3350
AUTOBRAKE 3	9090	150/-150	280	-470/1740	430/-300	250/-250	330	910	2870

Poor Reported Braking Action

MAX MANUAL	9320	170/-160	310	-530/2020	720/-480	260/-250	270	1700	4710
AUTOBRAKE MAX	9330	170/-160	310	-530/2020	730/-480	260/-250	270	1700	4710
AUTOBRAKE 3	9700	170/-160	310	-540/2050	660/-430	270/-260	330	1450	4490

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≤ 5)

VREF30 + 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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	5150	140/-80	130	-180/640	70/-70	120/-120	160	210	470
AUTOBRAKE MAX	6770	90/-80	160	-230/770	10/0	170/-170	270	10	40
AUTOBRAKE 2	11180	170/-190	370	-460/1520	190/-250	330/-320	360	700	700

Good Reported Braking Action

MAX MANUAL	6350	80/-80	170	-250/850	140/-120	160/-150	180	460	1080
AUTOBRAKE MAX	7040	80/-90	180	-260/910	70/-50	180/-180	260	280	890
AUTOBRAKE 2	11180	170/-190	370	-460/1520	190/-250	330/-320	360	700	700

Good To Medium Reported Braking Action

MAX MANUAL	7500	110/-110	230	-320/1120	250/-200	200/-190	210	850	2170
AUTOBRAKE MAX	7880	110/-110	230	-330/1150	200/-150	210/-210	270	750	2040
AUTOBRAKE 2	11270	170/-190	370	-480/1610	240/-280	330/-320	360	780	1210

Medium Reported Braking Action

MAX MANUAL	8640	130/-130	280	-390/1390	350/-280	240/-230	240	1240	3260
AUTOBRAKE MAX	8710	130/-130	280	-390/1390	320/-250	240/-230	270	1210	3180
AUTOBRAKE 3	10650	150/-160	320	-460/1590	210/-220	300/-300	370	510	1840

Medium To Poor Reported Braking Action

MAX MANUAL	9870	160/-160	340	-490/1770	580/-410	280/-270	270	1910	5570
AUTOBRAKE MAX	9900	160/-160	340	-490/1770	560/-400	280/-270	290	1890	5520
AUTOBRAKE 3	11240	170/-180	360	-530/1910	460/-350	320/-320	370	1290	4610

Poor Reported Braking Action

MAX MANUAL	11100	190/-190	400	-580/2150	800/-540	320/-300	290	2580	7870
AUTOBRAKE MAX	11090	190/-190	400	-580/2150	800/-540	320/-300	300	2570	7860
AUTOBRAKE 3	11820	190/-190	400	-600/2220	710/-480	340/-330	360	2060	7370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (5 < Flaps < 20)

VREF30 + 20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4470	100/-60	100	-150/530	60/-50	90/-90	140	140	310
AUTOBRAKE MAX	5780	70/-70	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9510	150/-160	290	-410/1390	130/-190	270/-270	350	340	340

Good Reported Braking Action

MAX MANUAL	5760	80/-80	150	-230/810	130/-120	140/-140	180	390	910
AUTOBRAKE MAX	6120	80/-80	160	-240/850	90/-70	150/-150	240	350	890
AUTOBRAKE 2	9510	150/-160	290	-410/1390	130/-190	270/-270	350	340	340

Good To Medium Reported Braking Action

MAX MANUAL	6740	100/-100	200	-300/1070	230/-190	170/-170	210	710	1800
AUTOBRAKE MAX	6930	100/-100	200	-310/1090	210/-160	180/-180	250	670	1760
AUTOBRAKE 2	9600	150/-160	300	-430/1480	180/-220	270/-270	350	420	830

Medium Reported Braking Action

MAX MANUAL	7720	120/-120	240	-370/1320	330/-260	200/-200	240	1030	2690
AUTOBRAKE MAX	7740	120/-120	240	-370/1330	320/-240	210/-200	260	990	2630
AUTOBRAKE 3	9030	130/-140	250	-420/1470	170/-170	250/-240	360	400	1700

Medium To Poor Reported Braking Action

MAX MANUAL	8770	150/-150	290	-460/1690	540/-380	240/-230	260	1570	4490
AUTOBRAKE MAX	8780	150/-150	290	-460/1700	540/-380	240/-230	280	1550	4460
AUTOBRAKE 3	9640	150/-160	300	-490/1790	420/-310	270/-260	350	1120	3880

Poor Reported Braking Action

MAX MANUAL	9820	170/-170	340	-540/2060	740/-500	270/-260	280	2110	6290
AUTOBRAKE MAX	9820	170/-170	340	-540/2060	750/-510	270/-260	290	2110	6290
AUTOBRAKE 3	10250	170/-170	340	-560/2100	660/-450	290/-280	340	1830	6050

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≥ 20)

VREF20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4260	90/-50	90	-150/510	50/-50	90/-90	140	110	230
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9000	140/-150	270	-400/1350	130/-170	250/-250	330	240	240

Good Reported Braking Action

MAX MANUAL	5550	80/-80	140	-230/800	130/-110	130/-130	180	320	740
AUTOBRAKE MAX	5910	80/-80	150	-240/830	100/-70	140/-140	240	320	750
AUTOBRAKE 2	9000	140/-150	270	-400/1350	130/-170	250/-250	330	240	240

Good To Medium Reported Braking Action

MAX MANUAL	6490	100/-100	180	-300/1060	230/-190	160/-160	210	590	1440
AUTOBRAKE MAX	6700	100/-100	190	-300/1070	210/-150	170/-170	260	580	1420
AUTOBRAKE 2	9090	150/-150	270	-420/1440	190/-200	260/-250	330	330	650

Medium Reported Braking Action

MAX MANUAL	7420	120/-120	220	-360/1310	320/-260	190/-190	230	860	2140
AUTOBRAKE MAX	7480	120/-120	230	-360/1310	310/-230	200/-190	270	830	2090
AUTOBRAKE 3	8540	130/-130	240	-400/1430	200/-160	230/-230	350	370	1360

Medium To Poor Reported Braking Action

MAX MANUAL	8440	150/-140	270	-450/1680	530/-380	230/-220	260	1320	3550
AUTOBRAKE MAX	8480	150/-140	280	-450/1680	530/-370	230/-220	280	1310	3530
AUTOBRAKE 3	9180	150/-150	280	-480/1750	440/-300	250/-250	350	970	3080

Poor Reported Braking Action

MAX MANUAL	9460	170/-160	320	-540/2040	740/-490	260/-250	280	1770	4960
AUTOBRAKE MAX	9470	170/-160	320	-540/2040	750/-500	260/-250	280	1780	4970
AUTOBRAKE 3	9810	170/-170	320	-550/2070	680/-440	270/-270	340	1560	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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS PRIMARY FAIL (Flaps 20)

VREF20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4520	100/-50	100	-150/510	60/-50	90/-90	140	110	230
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9250	140/-150	270	-410/1380	30/-120	260/-260	400	60	60

Good Reported Braking Action

MAX MANUAL	6070	80/-90	160	-250/860	150/-130	140/-140	220	380	890
AUTOBRAKE MAX	6150	90/-90	160	-250/860	140/-120	150/-150	240	380	890
AUTOBRAKE 2	9250	140/-150	270	-410/1380	30/-120	260/-260	400	60	60

Good To Medium Reported Braking Action

MAX MANUAL	7050	110/-110	210	-320/1120	260/-210	180/-170	250	690	1720
AUTOBRAKE MAX	7080	110/-110	210	-320/1120	260/-210	180/-180	260	690	1720
AUTOBRAKE 2	9350	150/-160	270	-430/1470	110/-150	260/-260	400	180	680

Medium Reported Braking Action

MAX MANUAL	8020	130/-130	250	-390/1380	360/-290	210/-200	270	1000	2550
AUTOBRAKE MAX	8000	130/-130	250	-380/1370	380/-300	210/-210	280	990	2540
AUTOBRAKE 3	8690	130/-130	250	-410/1450	240/-130	240/-230	390	530	2040

Medium To Poor Reported Braking Action

MAX MANUAL	9080	160/-160	300	-480/1750	590/-420	250/-240	300	1520	4210
AUTOBRAKE MAX	9090	160/-160	300	-480/1750	610/-430	250/-240	300	1520	4220
AUTOBRAKE 3	9500	160/-160	300	-490/1790	510/-320	270/-260	380	1260	3950

Poor Reported Braking Action

MAX MANUAL	10130	180/-180	350	-570/2120	810/-540	280/-270	320	2040	5870
AUTOBRAKE MAX	10170	190/-180	350	-570/2120	840/-560	280/-270	320	2040	5900
AUTOBRAKE 3	10300	180/-180	350	-570/2130	780/-500	290/-280	370	1980	5860

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLIGHT CONTROL MODE (Flaps 20)

VREF20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4600	100/-50	100	-150/520	60/-50	100/-90	170	120	250
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10

Good Reported Braking Action

MAX MANUAL	6250	90/-90	170	-250/880	160/-140	150/-150	230	420	990
AUTOBRAKE MAX	6260	90/-90	170	-260/880	150/-130	150/-150	250	410	970
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10

Good To Medium Reported Braking Action

MAX MANUAL	7280	120/-110	220	-330/1150	280/-230	190/-180	270	770	1940
AUTOBRAKE MAX	7270	120/-120	220	-330/1150	280/-230	190/-190	280	760	1920
AUTOBRAKE 2	9420	140/-160	270	-430/1470	100/-110	270/-270	440	150	870

Medium Reported Braking Action

MAX MANUAL	8300	140/-130	260	-400/1410	390/-310	220/-210	300	1110	2890
AUTOBRAKE MAX	8280	140/-140	260	-400/1410	410/-330	220/-220	300	1110	2870
AUTOBRAKE 3	8770	140/-130	250	-410/1460	280/-140	240/-240	400	740	2540

Medium To Poor Reported Braking Action

MAX MANUAL	9410	170/-160	320	-490/1790	630/-450	260/-250	320	1690	4810
AUTOBRAKE MAX	9420	170/-170	320	-490/1790	660/-470	260/-250	320	1700	4820
AUTOBRAKE 3	9680	170/-160	310	-500/1820	580/-340	270/-270	390	1510	4650

Poor Reported Braking Action

MAX MANUAL	10520	190/-190	370	-580/2170	870/-580	290/-280	340	2270	6730
AUTOBRAKE MAX	10550	200/-190	370	-580/2170	900/-600	300/-280	340	2280	6760
AUTOBRAKE 3	10590	200/-180	370	-580/2180	880/-540	300/-290	380	2270	6760

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLIGHT CONTROLS (Flaps 20)

VREF30 + 20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4930	80/-60	120	-170/560	80/-70	110/-110	210	180	400
AUTOBRAKE MAX	5780	70/-70	130	-210/690	0/0	140/-140	240	0	40
AUTOBRAKE 2	9850	140/-160	280	-430/1430	10/-90	280/-280	450	20	20

Good Reported Braking Action

MAX MANUAL	6770	100/-100	190	-270/930	210/-180	170/-170	280	590	1440
AUTOBRAKE MAX	6760	100/-100	190	-270/930	200/-160	170/-170	290	550	1370
AUTOBRAKE 2	9850	140/-160	280	-430/1430	10/-90	280/-280	450	20	20

Good To Medium Reported Braking Action

MAX MANUAL	7860	130/-130	250	-350/1210	340/-270	210/-210	310	1010	2630
AUTOBRAKE MAX	7850	130/-130	250	-350/1210	340/-270	210/-210	320	990	2590
AUTOBRAKE 2	9980	150/-160	290	-450/1520	110/-130	290/-290	450	250	1390

Medium Reported Braking Action

MAX MANUAL	8950	150/-150	300	-420/1480	460/-360	250/-240	340	1420	3810
AUTOBRAKE MAX	8930	150/-150	300	-420/1480	470/-370	250/-240	340	1420	3800
AUTOBRAKE 3	9310	140/-140	280	-430/1510	330/-160	260/-260	420	1160	3580

Medium To Poor Reported Braking Action

MAX MANUAL	10080	180/-180	360	-520/1860	710/-510	290/-280	360	2070	6050
AUTOBRAKE MAX	10080	180/-180	360	-520/1870	730/-520	290/-280	360	2070	6050
AUTOBRAKE 3	10270	180/-170	350	-520/1880	660/-370	300/-290	410	1940	5940

Poor Reported Braking Action

MAX MANUAL	11210	210/-200	410	-610/2240	960/-650	320/-310	370	2710	8280
AUTOBRAKE MAX	11230	210/-200	410	-610/2250	980/-660	330/-310	370	2710	8300
AUTOBRAKE 3	11230	210/-190	410	-610/2250	980/-580	330/-310	400	2710	8290

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS C (Flaps 20)

VREF20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4520	100/-50	100	-150/510	60/-50	90/-90	140	110	230
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9250	140/-150	270	-410/1380	30/-120	260/-260	400	60	60

Good Reported Braking Action

MAX MANUAL	6070	80/-90	160	-250/860	150/-130	140/-140	220	380	890
AUTOBRAKE MAX	6150	90/-90	160	-250/860	140/-120	150/-150	240	380	890
AUTOBRAKE 2	9250	140/-150	270	-410/1380	30/-120	260/-260	400	60	60

Good To Medium Reported Braking Action

MAX MANUAL	7050	110/-110	210	-320/1120	260/-210	180/-170	250	690	1720
AUTOBRAKE MAX	7080	110/-110	210	-320/1120	260/-210	180/-180	260	690	1720
AUTOBRAKE 2	9350	150/-160	270	-430/1470	110/-150	260/-260	400	180	680

Medium Reported Braking Action

MAX MANUAL	8020	130/-130	250	-390/1380	360/-290	210/-200	270	1000	2550
AUTOBRAKE MAX	8000	130/-130	250	-380/1370	380/-300	210/-210	280	990	2540
AUTOBRAKE 3	8690	130/-130	250	-410/1450	240/-130	240/-230	390	530	2040

Medium To Poor Reported Braking Action

MAX MANUAL	9080	160/-160	300	-480/1750	590/-420	250/-240	300	1520	4210
AUTOBRAKE MAX	9090	160/-160	300	-480/1750	610/-430	250/-240	300	1520	4220
AUTOBRAKE 3	9500	160/-160	300	-490/1790	510/-320	270/-260	380	1260	3950

Poor Reported Braking Action

MAX MANUAL	10130	180/-180	350	-570/2120	810/-540	280/-270	320	2040	5870
AUTOBRAKE MAX	10170	190/-180	350	-570/2120	840/-560	280/-270	320	2040	5900
AUTOBRAKE 3	10300	180/-180	350	-570/2130	780/-500	290/-280	370	1980	5860

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (Flaps 25)

VREF25

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4140	90/-50	90	-150/490	60/-50	90/-90	140	0	110
AUTOBRAKE MAX	5160	70/-70	110	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8570	130/-130	240	-390/1320	10/-40	240/-240	430	0	0

Good Reported Braking Action

MAX MANUAL	5770	80/-80	150	-250/860	170/-140	140/-140	220	0	430
AUTOBRAKE MAX	6000	80/-80	150	-260/880	140/-120	150/-150	250	0	430
AUTOBRAKE 2	8570	130/-130	240	-390/1320	10/-40	240/-240	430	0	0

Good To Medium Reported Braking Action

MAX MANUAL	6930	100/-110	200	-330/1170	320/-250	180/-180	260	0	870
AUTOBRAKE MAX	7050	110/-110	200	-340/1180	310/-240	190/-190	280	0	870
AUTOBRAKE 2	8770	130/-140	250	-420/1450	150/-100	250/-250	430	0	390

Medium Reported Braking Action

MAX MANUAL	8090	120/-130	250	-410/1480	460/-350	220/-220	290	0	1300
AUTOBRAKE MAX	8100	130/-130	250	-410/1480	470/-360	220/-220	300	0	1300
AUTOBRAKE 3	8440	130/-130	250	-420/1510	400/-250	230/-230	360	0	1220

Medium To Poor Reported Braking Action

MAX MANUAL	9520	160/-160	320	-540/1970	850/-550	270/-270	320	0	2260
AUTOBRAKE MAX	9540	160/-160	320	-540/1970	860/-560	270/-270	330	0	2260
AUTOBRAKE 3	9770	160/-160	320	-540/1990	820/-510	280/-270	360	0	2240

Poor Reported Braking Action

MAX MANUAL	10950	190/-180	380	-660/2460	1240/-750	320/-310	350	0	3210
AUTOBRAKE MAX	10980	190/-180	380	-660/2460	1250/-760	320/-310	350	0	3220
AUTOBRAKE 3	11090	190/-190	380	-660/2470	1230/-770	320/-310	350	0	3250

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	3960	90/-40	80	-140/480	50/-50	80/-80	150	0	90
AUTOBRAKE MAX	4900	60/-60	110	-180/620	10/0	110/-110	220	0	0
AUTOBRAKE 2	8040	120/-120	220	-370/1270	10/-30	220/-220	410	0	0

Good Reported Braking Action

MAX MANUAL	5550	80/-80	140	-240/850	160/-140	130/-130	220	0	370
AUTOBRAKE MAX	5760	80/-80	150	-250/870	140/-120	140/-140	250	0	370
AUTOBRAKE 2	8040	120/-120	220	-370/1270	10/-30	220/-220	410	0	0

Good To Medium Reported Braking Action

MAX MANUAL	6670	100/-100	190	-330/1160	310/-250	170/-170	260	0	760
AUTOBRAKE MAX	6780	100/-100	200	-330/1170	310/-240	180/-180	280	0	760
AUTOBRAKE 2	8250	130/-130	230	-400/1400	160/-100	230/-230	410	0	380

Medium Reported Braking Action

MAX MANUAL	7790	120/-120	230	-410/1460	460/-350	210/-210	290	0	1140
AUTOBRAKE MAX	7790	120/-120	240	-410/1460	470/-360	210/-210	300	0	1140
AUTOBRAKE 3	8050	120/-120	240	-410/1480	430/-260	220/-220	350	0	1140

Medium To Poor Reported Braking Action

MAX MANUAL	9180	150/-150	300	-530/1950	850/-550	260/-260	320	0	1980
AUTOBRAKE MAX	9200	150/-150	300	-530/1950	860/-560	260/-260	330	0	1990
AUTOBRAKE 3	9380	150/-150	300	-530/1970	830/-510	270/-260	350	0	2000

Poor Reported Braking Action

MAX MANUAL	10570	180/-180	360	-650/2440	1230/-740	300/-300	350	0	2820
AUTOBRAKE MAX	10600	180/-180	360	-650/2440	1250/-750	310/-300	350	0	2830
AUTOBRAKE 3	10700	180/-180	360	-650/2450	1220/-760	310/-300	350	0	2860

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L+C (Flaps 20)

VREF30 + 20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	5010	110/-60	110	-170/570	80/-70	110/-110	200	0	160
AUTOBRAKE MAX	5780	70/-70	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9870	140/-150	280	-430/1430	0/0	280/-280	500	0	0

Good Reported Braking Action

MAX MANUAL	7110	90/-100	190	-290/990	230/-190	180/-180	290	0	660
AUTOBRAKE MAX	7100	90/-100	200	-290/990	210/-180	190/-180	310	0	640
AUTOBRAKE 2	9870	140/-150	280	-430/1430	0/0	280/-280	500	0	0

Good To Medium Reported Braking Action

MAX MANUAL	8570	120/-130	260	-390/1330	430/-330	230/-230	340	0	1340
AUTOBRAKE MAX	8560	120/-130	260	-390/1330	430/-340	240/-230	350	0	1330
AUTOBRAKE 2	10150	150/-160	300	-460/1570	250/-100	290/-290	500	0	850

Medium Reported Braking Action

MAX MANUAL	10030	150/-160	320	-480/1670	620/-470	280/-280	380	0	2010
AUTOBRAKE MAX	10010	150/-160	320	-480/1670	650/-490	290/-280	380	0	2010
AUTOBRAKE 3	10120	160/-160	330	-480/1680	630/-400	290/-280	400	0	2040

Medium To Poor Reported Braking Action

MAX MANUAL	11800	190/-200	410	-620/2210	1110/-720	340/-340	420	0	3480
AUTOBRAKE MAX	11820	190/-200	410	-620/2210	1150/-750	350/-340	420	0	3490
AUTOBRAKE 3	11880	200/-200	420	-620/2220	1130/-690	350/-340	430	0	3510

Poor Reported Braking Action

MAX MANUAL	13570	230/-230	490	-750/2750	1600/-970	400/-390	450	0	4950
AUTOBRAKE MAX	13620	230/-230	500	-750/2750	1640/-1010	410/-400	450	0	4970
AUTOBRAKE 3	13640	230/-230	500	-750/2760	1630/-980	410/-400	460	0	4980

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L+R (Flaps 20)

VREF30 + 20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	5800	70/-70	140	-220/740	140/-130	140/-140	240	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8920	120/-120	260	-400/1370	480/-380	250/-250	370	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	11340	160/-160	350	-560/1940	1040/-700	340/-340	440	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	13750	190/-200	440	-720/2510	1600/-1020	420/-420	500	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	17270	240/-240	600	-1000/3590	4200/-1750	540/-540	560	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	20790	290/-280	760	-1270/4670	6800/-2480	660/-660	610	0	0
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R (Flaps 25)

VREF25

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4710	60/-60	110	-180/620	90/-80	100/-100	180	0	200
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6630	90/-100	180	-310/1080	250/-210	170/-170	250	0	690
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7880	120/-130	240	-410/1450	460/-350	220/-210	280	0	1290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	9130	150/-150	290	-500/1820	670/-480	260/-250	310	0	1880
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10600	180/-180	360	-640/2410	1290/-720	310/-300	340	0	3070
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	12060	210/-200	430	-770/2990	1910/-960	350/-340	360	0	4260
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R (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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4520	50/-50	100	-180/600	80/-80	100/-100	170	0	160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6300	90/-90	170	-300/1050	240/-200	160/-160	240	0	570
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7460	120/-120	220	-390/1410	440/-330	200/-200	270	0	1060
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8620	140/-140	270	-480/1770	640/-450	240/-230	300	0	1540
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9990	170/-170	330	-620/2350	1230/-680	290/-280	320	0	2520
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11350	200/-190	390	-750/2920	1820/-910	330/-320	340	0	3490
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R+C (Flaps 20)

VREF30 + 20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	6150	70/-80	150	-230/780	150/-130	150/-150	260	0	390
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8710	120/-130	260	-390/1320	410/-330	240/-230	350	0	1300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	10350	160/-170	340	-510/1760	730/-530	300/-290	390	0	2370
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	11980	190/-200	410	-620/2190	1040/-720	350/-340	430	0	3440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	13860	240/-240	510	-780/2880	1970/-1050	410/-400	460	0	5570
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	15730	280/-270	600	-940/3560	2900/-1380	470/-460	490	0	7690
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH DOWN AUTHORITY (Flaps 25)

VREF25

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4510	90/-50	90	-160/530	60/-50	90/-90	160	70	160
AUTOBRAKE MAX	5160	70/-70	110	-190/640	20/0	120/-120	240	0	0
AUTOBRAKE 2	8500	130/-140	240	-390/1310	50/-100	230/-230	370	100	100

Good Reported Braking Action

MAX MANUAL	5710	70/-70	140	-230/820	130/-110	130/-130	200	250	560
AUTOBRAKE MAX	5780	70/-80	140	-240/820	130/-120	130/-130	220	260	580
AUTOBRAKE 2	8520	130/-140	240	-390/1310	60/-110	230/-230	370	100	100

Good To Medium Reported Braking Action

MAX MANUAL	6560	90/-90	180	-300/1060	220/-180	160/-160	220	470	1130
AUTOBRAKE MAX	6600	90/-100	180	-300/1070	230/-190	160/-160	240	480	1150
AUTOBRAKE 2	8640	130/-140	250	-410/1400	140/-150	240/-240	370	180	450

Medium Reported Braking Action

MAX MANUAL	7400	110/-110	210	-360/1300	300/-240	180/-180	240	690	1700
AUTOBRAKE MAX	7410	110/-110	210	-360/1310	320/-250	190/-180	260	690	1710
AUTOBRAKE 3	8060	120/-120	220	-390/1390	200/-100	210/-210	390	320	1130

Medium To Poor Reported Braking Action

MAX MANUAL	8330	130/-130	250	-450/1660	500/-350	210/-210	260	1080	2860
AUTOBRAKE MAX	8360	140/-130	260	-450/1660	520/-370	220/-210	270	1080	2880
AUTOBRAKE 3	8750	140/-140	260	-460/1710	440/-260	230/-230	370	830	2520

Poor Reported Braking Action

MAX MANUAL	9250	150/-150	290	-530/2010	690/-460	240/-230	280	1470	4020
AUTOBRAKE MAX	9300	160/-150	300	-530/2010	720/-480	250/-240	280	1470	4040
AUTOBRAKE 3	9430	150/-150	290	-530/2030	670/-420	250/-250	340	1340	3910

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance PITCH DOWN AUTHORITY (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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4310	80/-50	80	-150/510	50/-50	80/-80	150	60	130
AUTOBRAKE MAX	4900	70/-60	110	-180/620	20/0	110/-110	240	0	0
AUTOBRAKE 2	8030	120/-130	220	-370/1270	20/-70	220/-220	370	30	30

Good Reported Braking Action

MAX MANUAL	5490	70/-70	130	-230/800	130/-110	120/-120	200	210	480
AUTOBRAKE MAX	5560	70/-70	130	-230/810	130/-120	130/-120	220	220	500
AUTOBRAKE 2	8050	120/-130	220	-370/1270	30/-90	220/-220	380	30	30

Good To Medium Reported Braking Action

MAX MANUAL	6300	90/-90	170	-300/1050	220/-180	150/-150	220	410	970
AUTOBRAKE MAX	6340	90/-90	170	-300/1050	230/-180	160/-150	240	420	990
AUTOBRAKE 2	8170	130/-130	230	-390/1360	110/-120	220/-220	380	120	360

Medium Reported Braking Action

MAX MANUAL	7110	110/-100	200	-360/1290	300/-240	170/-170	240	600	1460
AUTOBRAKE MAX	7120	110/-110	200	-360/1290	320/-240	180/-170	260	610	1470
AUTOBRAKE 3	7600	110/-110	210	-380/1350	210/-100	200/-200	380	320	1040

Medium To Poor Reported Braking Action

MAX MANUAL	8010	130/-120	240	-440/1640	500/-350	200/-200	260	950	2470
AUTOBRAKE MAX	8040	130/-130	240	-440/1640	520/-360	210/-200	270	960	2480
AUTOBRAKE 3	8310	130/-130	250	-450/1680	450/-260	220/-220	360	790	2240

Poor Reported Braking Action

MAX MANUAL	8910	150/-140	270	-520/1990	690/-460	230/-230	270	1300	3470
AUTOBRAKE MAX	8950	150/-150	280	-520/1990	710/-480	240/-230	280	1310	3490
AUTOBRAKE 3	9010	150/-140	280	-520/2000	690/-420	240/-230	330	1250	3430

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	5030	130/-70	120	-170/590	70/-60	110/-110	150	180	400
AUTOBRAKE MAX	6770	80/-80	160	-230/760	10/0	170/-170	270	0	20
AUTOBRAKE 2	10630	160/-180	350	-440/1470	230/-250	310/-300	310	900	1080

Good Reported Braking Action

MAX MANUAL	6260	80/-80	170	-240/840	140/-120	160/-150	170	420	980
AUTOBRAKE MAX	7070	80/-90	180	-270/910	80/-60	180/-180	270	250	770
AUTOBRAKE 2	10630	160/-180	350	-440/1470	230/-250	310/-300	310	900	1080

Good To Medium Reported Braking Action

MAX MANUAL	7320	110/-110	220	-310/1100	240/-200	200/-190	200	750	1880
AUTOBRAKE MAX	7840	110/-110	230	-330/1150	190/-150	210/-210	270	670	1770
AUTOBRAKE 2	10720	170/-180	350	-460/1560	280/-280	310/-310	310	980	1480

Medium Reported Braking Action

MAX MANUAL	8370	130/-130	260	-380/1360	330/-270	230/-220	220	1080	2780
AUTOBRAKE MAX	8600	130/-130	270	-390/1380	300/-240	230/-230	260	1080	2770
AUTOBRAKE 3	10250	150/-160	310	-440/1550	270/-240	290/-280	310	680	1680

Medium To Poor Reported Braking Action

MAX MANUAL	9490	160/-160	320	-470/1730	540/-390	270/-250	240	1630	4540
AUTOBRAKE MAX	9620	160/-160	320	-480/1740	520/-370	270/-260	270	1610	4510
AUTOBRAKE 3	10800	170/-180	350	-510/1860	490/-360	310/-300	310	1270	3710

Poor Reported Braking Action

MAX MANUAL	10600	180/-180	370	-560/2100	740/-500	300/-280	260	2170	6290
AUTOBRAKE MAX	10640	180/-180	370	-560/2100	740/-490	300/-290	280	2140	6250
AUTOBRAKE 3	11340	180/-190	390	-580/2160	710/-480	320/-310	310	1850	5740

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≥ 20)

VREF30 + 20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4410	100/-60	100	-150/530	60/-50	90/-90	140	120	260
AUTOBRAKE MAX	5780	70/-70	130	-210/690	10/0	140/-140	250	0	0
AUTOBRAKE 2	9230	140/-150	280	-410/1370	160/-190	260/-260	310	460	470

Good Reported Braking Action

MAX MANUAL	5590	70/-70	140	-230/800	120/-110	130/-130	170	310	700
AUTOBRAKE MAX	6130	80/-80	150	-240/850	80/-60	150/-150	240	230	650
AUTOBRAKE 2	9230	140/-150	280	-410/1370	160/-190	260/-260	310	460	470

Good To Medium Reported Braking Action

MAX MANUAL	6530	90/-90	180	-300/1050	220/-180	170/-160	200	570	1370
AUTOBRAKE MAX	6890	100/-100	190	-300/1080	180/-140	180/-180	250	520	1330
AUTOBRAKE 2	9320	140/-150	290	-430/1450	220/-220	260/-260	310	540	810

Medium Reported Braking Action

MAX MANUAL	7470	110/-110	220	-360/1300	310/-250	200/-190	220	820	2030
AUTOBRAKE MAX	7640	120/-120	230	-360/1310	280/-220	200/-200	260	810	2000
AUTOBRAKE 3	8840	130/-140	250	-410/1450	220/-190	240/-240	320	380	1180

Medium To Poor Reported Braking Action

MAX MANUAL	8490	140/-140	270	-450/1670	510/-370	230/-220	240	1260	3350
AUTOBRAKE MAX	8590	140/-140	280	-450/1670	500/-350	230/-230	270	1250	3340
AUTOBRAKE 3	9430	150/-150	290	-480/1760	440/-320	260/-260	320	890	2760

Poor Reported Braking Action

MAX MANUAL	9510	160/-160	320	-530/2030	710/-480	260/-250	260	1700	4670
AUTOBRAKE MAX	9530	160/-160	320	-530/2030	720/-470	260/-250	270	1690	4670
AUTOBRAKE 3	10020	170/-160	330	-550/2070	660/-440	280/-270	310	1390	4340

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PRI FLIGHT COMPUTERS (Flaps 20)

VREF20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4600	100/-50	100	-150/520	60/-50	100/-90	170	120	250
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10

Good Reported Braking Action

MAX MANUAL	6250	90/-90	170	-250/880	160/-140	150/-150	230	420	990
AUTOBRAKE MAX	6260	90/-90	170	-260/880	150/-130	150/-150	250	410	970
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10

Good To Medium Reported Braking Action

MAX MANUAL	7280	120/-110	220	-330/1150	280/-230	190/-180	270	770	1940
AUTOBRAKE MAX	7270	120/-120	220	-330/1150	280/-230	190/-190	280	760	1920
AUTOBRAKE 2	9420	140/-160	270	-430/1470	100/-110	270/-270	440	150	870

Medium Reported Braking Action

MAX MANUAL	8300	140/-130	260	-400/1410	390/-310	220/-210	300	1110	2890
AUTOBRAKE MAX	8280	140/-140	260	-400/1410	410/-330	220/-220	300	1110	2870
AUTOBRAKE 3	8770	140/-130	250	-410/1460	280/-140	240/-240	400	740	2540

Medium To Poor Reported Braking Action

MAX MANUAL	9410	170/-160	320	-490/1790	630/-450	260/-250	320	1690	4810
AUTOBRAKE MAX	9420	170/-170	320	-490/1790	660/-470	260/-250	320	1700	4820
AUTOBRAKE 3	9680	170/-160	310	-500/1820	580/-340	270/-270	390	1510	4650

Poor Reported Braking Action

MAX MANUAL	10520	190/-190	370	-580/2170	870/-580	290/-280	340	2270	6730
AUTOBRAKE MAX	10550	200/-190	370	-580/2170	900/-600	300/-280	340	2280	6760
AUTOBRAKE 3	10590	200/-180	370	-580/2180	880/-540	300/-290	380	2270	6760

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SLATS DRIVE (Flaps 20)

VREF30 + 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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4700	110/-60	110	-160/540	60/-60	100/-100	140	130	290
AUTOBRAKE MAX	6260	70/-80	150	-220/720	10/0	150/-150	260	0	0
AUTOBRAKE 2	10090	150/-160	310	-430/1440	190/-220	290/-290	320	570	600

Good Reported Braking Action

MAX MANUAL	6200	80/-80	170	-250/850	150/-130	150/-150	190	390	910
AUTOBRAKE MAX	6690	80/-90	170	-260/890	100/-80	170/-170	260	340	890
AUTOBRAKE 2	10090	150/-160	310	-430/1440	190/-220	290/-290	320	570	600

Good To Medium Reported Braking Action

MAX MANUAL	7230	110/-110	220	-320/1110	250/-210	190/-190	220	700	1710
AUTOBRAKE MAX	7540	110/-110	220	-330/1140	210/-170	200/-200	270	660	1680
AUTOBRAKE 2	10180	160/-170	320	-450/1520	250/-250	300/-290	320	660	1030

Medium Reported Braking Action

MAX MANUAL	8250	130/-130	260	-380/1370	350/-280	220/-220	240	1000	2500
AUTOBRAKE MAX	8390	130/-130	260	-390/1380	320/-250	230/-220	280	980	2460
AUTOBRAKE 3	9660	140/-150	290	-430/1520	260/-210	270/-270	330	500	1540

Medium To Poor Reported Braking Action

MAX MANUAL	9340	160/-160	310	-470/1740	570/-410	260/-250	260	1500	4040
AUTOBRAKE MAX	9420	160/-160	310	-480/1750	560/-390	270/-250	290	1490	4020
AUTOBRAKE 3	10300	160/-170	330	-510/1840	500/-350	290/-290	330	1090	3380

Poor Reported Braking Action

MAX MANUAL	10420	180/-180	360	-560/2110	780/-530	290/-280	280	1990	5570
AUTOBRAKE MAX	10440	180/-180	360	-560/2110	790/-520	300/-280	290	1990	5570
AUTOBRAKE 3	10930	180/-180	370	-580/2160	730/-490	310/-300	320	1670	5220

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SPOILERS (Flaps 25)

VREF25

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4030	90/-50	80	-140/470	50/-50	80/-80	130	90	200
AUTOBRAKE MAX	5160	60/-70	110	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8410	130/-140	240	-380/1300	90/-140	230/-230	340	130	130

Good Reported Braking Action

MAX MANUAL	5380	70/-70	140	-230/790	130/-110	130/-120	190	310	720
AUTOBRAKE MAX	5640	80/-80	140	-230/820	110/-90	130/-130	220	320	730
AUTOBRAKE 2	8410	130/-140	240	-380/1300	90/-140	230/-230	340	130	130

Good To Medium Reported Braking Action

MAX MANUAL	6260	90/-90	180	-300/1040	230/-180	160/-150	220	570	1390
AUTOBRAKE MAX	6400	100/-100	180	-300/1060	220/-170	160/-160	240	560	1380
AUTOBRAKE 2	8510	130/-140	250	-400/1390	150/-170	240/-230	340	220	570

Medium Reported Braking Action

MAX MANUAL	7140	110/-110	210	-360/1290	320/-250	180/-180	240	820	2050
AUTOBRAKE MAX	7160	110/-110	220	-360/1290	320/-240	190/-180	260	790	2030
AUTOBRAKE 3	7960	120/-120	220	-390/1380	210/-140	210/-210	350	400	1480

Medium To Poor Reported Braking Action

MAX MANUAL	8090	140/-130	260	-450/1650	530/-370	220/-210	260	1250	3370
AUTOBRAKE MAX	8110	140/-140	260	-450/1650	530/-370	220/-210	270	1240	3370
AUTOBRAKE 3	8620	140/-140	260	-460/1710	450/-290	230/-230	340	990	3060

Poor Reported Braking Action

MAX MANUAL	9040	160/-150	300	-530/2000	730/-480	250/-240	280	1680	4690
AUTOBRAKE MAX	9060	160/-160	300	-530/2010	740/-490	250/-240	280	1680	4700
AUTOBRAKE 3	9270	160/-150	300	-530/2030	690/-430	250/-250	330	1580	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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance SPOILERS (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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	80/-40	80	-130/460	50/-40	70/-70	130	70	160
AUTOBRAKE MAX	4900	60/-60	110	-180/620	10/0	110/-110	220	0	0
AUTOBRAKE 2	7950	120/-130	220	-370/1260	60/-120	220/-220	340	60	60

Good Reported Braking Action

MAX MANUAL	5190	70/-70	130	-220/780	130/-110	120/-120	190	270	620
AUTOBRAKE MAX	5430	70/-70	140	-230/800	110/-90	130/-120	220	270	630
AUTOBRAKE 2	7950	120/-130	220	-370/1260	60/-120	220/-220	340	60	60

Good To Medium Reported Braking Action

MAX MANUAL	6030	90/-90	170	-290/1030	230/-180	150/-150	220	500	1200
AUTOBRAKE MAX	6160	90/-90	170	-290/1040	220/-170	160/-150	240	490	1190
AUTOBRAKE 2	8040	130/-130	230	-390/1350	130/-150	220/-220	340	160	470

Medium Reported Braking Action

MAX MANUAL	6870	110/-110	200	-350/1270	320/-250	180/-170	240	720	1770
AUTOBRAKE MAX	6890	110/-110	200	-350/1270	320/-240	180/-170	260	710	1750
AUTOBRAKE 3	7520	120/-110	210	-370/1340	220/-130	200/-200	350	400	1360

Medium To Poor Reported Braking Action

MAX MANUAL	7800	140/-130	240	-440/1630	520/-370	210/-200	260	1110	2910
AUTOBRAKE MAX	7820	140/-130	250	-440/1630	530/-370	210/-200	270	1110	2910
AUTOBRAKE 3	8200	140/-130	250	-450/1670	470/-280	220/-220	340	930	2710

Poor Reported Braking Action

MAX MANUAL	8730	160/-150	280	-520/1980	720/-480	240/-230	280	1490	4050
AUTOBRAKE MAX	8750	160/-150	290	-520/1990	730/-490	240/-230	280	1500	4060
AUTOBRAKE 3	8880	160/-150	290	-520/2000	710/-430	240/-240	330	1460	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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

STABILIZER (Flaps 20)

VREF30 + 20

	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	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4420	100/-50	100	-150/520	60/-50	90/-90	140	120	250
AUTOBRAKE MAX	5780	70/-70	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9390	140/-150	290	-410/1380	150/-190	270/-260	330	360	360

Good Reported Braking Action

MAX MANUAL	5810	80/-80	150	-240/820	140/-120	140/-140	190	350	810
AUTOBRAKE MAX	6190	80/-80	160	-250/860	110/-80	150/-150	240	340	820
AUTOBRAKE 2	9390	140/-150	290	-410/1380	150/-190	270/-260	330	360	360

Good To Medium Reported Braking Action

MAX MANUAL	6780	100/-100	200	-310/1080	240/-200	180/-170	220	630	1550
AUTOBRAKE MAX	7010	100/-100	200	-310/1100	220/-160	180/-180	260	620	1530
AUTOBRAKE 2	9480	150/-160	290	-430/1470	210/-220	270/-270	330	450	780

Medium Reported Braking Action

MAX MANUAL	7740	120/-120	240	-370/1330	330/-270	210/-200	240	910	2290
AUTOBRAKE MAX	7820	120/-120	240	-370/1340	320/-240	210/-200	270	890	2240
AUTOBRAKE 3	8950	130/-140	260	-410/1460	220/-180	250/-240	340	410	1430

Medium To Poor Reported Braking Action

MAX MANUAL	8780	150/-150	290	-460/1700	540/-390	240/-230	260	1380	3740
AUTOBRAKE MAX	8830	150/-150	290	-460/1710	550/-380	250/-230	280	1380	3720
AUTOBRAKE 3	9590	150/-160	300	-490/1780	460/-320	270/-260	340	1000	3190

Poor Reported Braking Action

MAX MANUAL	9820	170/-170	330	-550/2070	750/-510	270/-260	280	1850	5190
AUTOBRAKE MAX	9830	170/-170	340	-550/2070	770/-510	280/-260	280	1860	5190
AUTOBRAKE 3	10220	170/-170	340	-560/2100	700/-460	290/-280	330	1590	4950

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	129	509.5			
52	126	524.1	504.0		
50	122	539.1	519.0	497.5	
48	118	555.3	533.9	512.5	493.3
46	115	571.0	549.5	526.9	506.8
44	111	586.0	564.3	541.8	520.4
42	108	600.7	578.4	555.9	533.9
40	104	614.6	591.8	569.1	546.8
38	100	628.0	604.4	581.5	559.3
36	97	640.3	616.1	592.9	570.6
34	93	651.1	627.0	603.2	581.0
32	90	660.2	636.1	612.5	588.7
30	86	668.7	644.0	619.6	596.1
28	82	668.8	651.9	625.1	601.9
26	79	668.9	652.0	630.4	606.1
24	75	669.0	652.2	633.1	610.0
22	72	669.2	652.3	633.3	612.9
20	68	669.3	652.4	633.4	615.3
18	64	669.4	652.5	633.5	615.4
16	61	669.5	652.6	633.6	615.5
14	57	669.6	652.8	633.7	615.6
12	54	669.8	652.9	633.8	615.7
10 & BELOW	50 & BELOW	669.9	653.0	634.0	615.9

Based on engine bleed for 2 packs on and engine anti-ice off and wing anti-ice off.

With engine bleed for packs off, increase weight by 4800 lb.

With engine anti-ice on, decrease weight by 1100 lb.

With engine and wing anti-ice on, decrease weight by 4800 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 43300 lb.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																							
		80				100				120				140				160				180			
WEIGHT (1000 LB)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																							
		0	2	4	0	2	4	0	2	4	0	2	4	0	2	4	0	2	4	0	2	4			
680	0	19.3	20.2	21.0	28.6	30.1	31.5	39.3	41.5	43.7	51.2	54.2	57.3	64.1	67.9	71.8	77.0	81.7	86.3						
	10	19.8	20.7	21.6	29.4	31.0	32.5	40.5	42.8	45.0	52.8	55.9	59.1	66.1	70.1	74.1	79.4	84.1	88.9						
	15	20.2	21.1	22.0	30.0	31.6	33.1	41.2	43.6	45.9	53.8	56.9	60.2	67.3	71.3	75.4	80.7	85.5	90.3						
	20	20.6	21.5	22.4	30.5	32.1	33.6	41.9	44.3	46.7	54.7	57.9	61.2	68.4	72.5	76.6	82.0	86.8	91.7						
	30	21.0	22.0	22.9	31.3	32.9	34.5	43.1	45.5	47.9	56.2	59.5	62.8	70.2	74.4	78.7	84.2	89.2	94.1						
40	21.2	22.1	23.1	31.6	33.3	34.9	43.7	46.2	48.7	57.2	60.6	64.0	71.6	75.9	80.2	85.9	91.0	96.0							
640	0	18.5	19.3	20.1	27.3	28.7	30.0	37.4	39.5	41.6	48.7	51.6	54.4	60.9	64.6	68.3	73.4	77.8	82.3						
	10	19.0	19.8	20.6	28.1	29.5	30.9	38.6	40.7	42.8	50.2	53.2	56.1	62.8	66.6	70.4	75.6	80.2	84.7						
	15	19.3	20.2	21.0	28.6	30.1	31.5	39.3	41.5	43.6	51.1	54.2	57.1	63.9	67.8	71.6	76.9	81.5	86.1						
	20	19.6	20.5	21.4	29.1	30.6	32.0	39.9	42.2	44.4	52.0	55.1	58.1	65.0	68.9	72.8	78.2	82.8	87.5						
	30	20.1	21.0	21.8	29.8	31.3	32.8	41.0	43.3	45.6	53.4	56.6	59.7	66.8	70.8	74.8	80.3	85.1	89.8						
40	20.2	21.1	22.0	30.1	31.7	33.2	41.6	43.9	46.3	54.4	57.6	60.8	68.1	72.2	76.3	81.9	86.8	91.6							
600	0	17.6	18.4	19.1	26.0	27.3	28.5	35.5	37.5	39.4	46.2	48.8	51.5	57.7	61.2	64.7	69.6	73.8	78.0						
	10	18.1	18.9	19.6	26.7	28.0	29.4	36.6	38.6	40.6	47.6	50.4	53.1	59.5	63.1	66.7	71.8	76.1	80.4						
	15	18.4	19.2	20.0	27.2	28.5	29.9	37.3	39.3	41.4	48.5	51.3	54.1	60.6	64.2	67.9	73.0	77.4	81.8						
	20	18.7	19.5	20.3	27.7	29.0	30.4	37.9	40.0	42.1	49.3	52.2	55.0	61.6	65.3	69.0	74.2	78.6	83.1						
	30	19.2	20.0	20.8	28.3	29.8	31.2	38.9	41.0	43.2	50.6	53.6	56.5	63.3	67.1	70.9	76.2	80.8	85.3						
40	19.2	20.1	20.9	28.6	30.1	31.5	39.4	41.6	43.8	51.5	54.5	57.6	64.5	68.4	72.3	77.8	82.4	87.1							
560	0	16.8	17.5	18.2	24.6	25.8	27.0	33.6	35.4	37.2	43.6	46.1	48.6	54.4	57.7	60.9	65.7	69.7	73.7						
	10	17.2	17.9	18.7	25.3	26.6	27.8	34.6	36.5	38.4	44.9	47.5	50.1	56.1	59.5	62.8	67.7	71.8	75.9						
	15	17.5	18.3	19.0	25.8	27.1	28.3	35.3	37.2	39.1	45.8	48.4	51.0	57.1	60.6	63.9	68.9	73.1	77.2						
	20	17.8	18.6	19.3	26.3	27.5	28.8	35.9	37.8	39.7	46.6	49.2	51.9	58.1	61.6	65.0	70.1	74.3	78.5						
	30	18.2	19.0	19.8	26.9	28.2	29.5	36.8	38.8	40.8	47.8	50.6	53.3	59.7	63.3	66.8	72.0	76.3	80.6						
40	18.3	19.1	19.9	27.1	28.5	29.8	37.3	39.3	41.4	48.6	51.4	54.2	60.8	64.5	68.1	73.4	77.8	82.3							
520	0	15.9	16.6	17.2	23.3	24.4	25.5	31.7	33.4	35.1	41.0	43.3	45.6	51.1	54.1	57.1	61.7	65.4	69.1						
	10	16.4	17.0	17.7	24.0	25.1	26.3	32.6	34.4	36.1	42.3	44.7	47.1	52.7	55.8	58.9	63.6	67.4	71.3						
	15	16.7	17.3	18.0	24.4	25.6	26.8	33.2	35.0	36.8	43.1	45.5	47.9	53.7	56.8	60.0	64.7	68.6	72.5						
	20	17.0	17.6	18.3	24.8	26.0	27.2	33.8	35.6	37.4	43.8	46.3	48.7	54.6	57.8	61.0	65.8	69.8	73.7						
	30	17.3	18.0	18.7	25.4	26.6	27.9	34.7	36.5	38.4	44.9	47.5	50.1	56.1	59.4	62.7	67.6	71.7	75.7						
40	17.4	18.1	18.8	25.6	26.9	28.2	35.1	37.0	38.9	45.6	48.3	50.9	57.1	60.5	63.9	68.9	73.1	77.2							
480	0	15.1	15.7	16.3	22.0	23.0	24.0	29.8	31.3	32.9	38.4	40.5	42.6	47.7	50.5	53.3	57.5	61.0	64.4						
	10	15.5	16.1	16.7	22.6	23.7	24.7	30.6	32.2	33.8	39.5	41.7	44.0	49.2	52.1	54.9	59.3	62.9	66.4						
	15	15.8	16.4	17.0	23.0	24.1	25.2	31.2	32.8	34.5	40.3	42.5	44.8	50.1	53.0	55.9	60.4	64.0	67.6						
	20	16.1	16.7	17.3	23.4	24.5	25.6	31.8	33.4	35.1	41.0	43.2	45.5	50.9	53.9	56.9	61.4	65.1	68.7						
	30	16.4	17.1	17.7	24.0	25.1	26.2	32.5	34.2	36.0	42.0	44.4	46.7	52.3	55.4	58.4	63.1	66.9	70.6						
40	16.5	17.1	17.8	24.2	25.3	26.5	32.9	34.7	36.4	42.7	45.1	47.5	53.2	56.4	59.5	64.3	68.2	72.0							
440	0	14.3	14.9	15.4	20.7	21.6	22.5	27.8	29.2	30.6	35.7	37.7	39.6	44.2	46.8	49.3	53.2	56.4	59.6						
	10	14.7	15.2	15.8	21.2	22.2	23.2	28.6	30.1	31.6	36.8	38.8	40.8	45.6	48.2	50.9	54.9	58.2	61.4						
	15	15.0	15.5	16.1	21.6	22.6	23.6	29.2	30.7	32.2	37.5	39.5	41.6	46.4	49.1	51.8	55.9	59.2	62.5						
	20	15.2	15.8	16.4	22.0	23.0	24.0	29.7	31.2	32.7	38.1	40.2	42.3	47.2	49.9	52.7	56.8	60.2	63.6						
	30	15.5	16.1	16.7	22.5	23.5	24.6	30.4	32.0	33.5	39.1	41.2	43.4	48.5	51.3	54.1	58.4	61.9	65.3						
40	15.6	16.2	16.8	22.7	23.7	24.8	30.7	32.3	33.9	39.6	41.9	44.1	49.3	52.2	55.1	59.5	63.0	66.6							

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.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Event Adjusted Brake Energy (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	100
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100
	MAX MAN	5.1	14.1	23.1	32.1	41.2	50.3	59.5	68.8	78.3	87.9
	MAX AUTO	5.1	13.1	21.2	29.6	38.1	46.9	56.0	65.5	75.3	85.6
	AUTOBRAKE 4	4.9	12.4	19.9	27.5	35.4	43.5	52.1	61.1	70.6	80.8
	AUTOBRAKE 3	4.6	11.6	18.5	25.5	32.7	40.1	47.9	56.2	65.0	74.5
	AUTOBRAKE 2	4.3	10.8	17.2	23.6	30.1	36.9	43.9	51.4	59.4	68.0
	AUTOBRAKE 1	4.2	10.1	15.9	21.8	27.7	33.8	40.3	47.1	54.5	62.4

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
EVENT		10	20	30	40	50	60	70	80	90	100
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100
	MAX MAN	4.4	13.0	21.4	29.7	37.9	46.1	54.3	62.6	71.1	79.7
	MAX AUTO	2.4	9.4	16.4	23.5	30.9	38.6	46.6	55.0	64.0	73.5
	AUTOBRAKE 4	1.9	7.2	12.7	18.4	24.5	31.0	37.9	45.5	53.6	62.5
	AUTOBRAKE 3	1.1	4.9	9.0	13.4	18.2	23.4	29.0	35.2	42.0	49.3
	AUTOBRAKE 2	0.3	3.1	6.1	9.4	13.0	16.9	21.3	26.1	31.4	37.2
	AUTOBRAKE 1	0.1	2.3	4.6	7.1	9.8	12.7	16.1	19.9	24.2	29.2

Cooling Time (Minutes)

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
		16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
GEAR DOWN	NO SPECIAL	PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE
INFLIGHT											
GROUND			11	18	26	42	55	66	73		
BTMS	UP TO 2.4		2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE

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 for each taxi mile.

For one brake deactivated, increase brake energy by 10 percent.

For two brakes deactivated, increase brake energy by 20 percent.

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 8 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 EICAS may be used 12 to 15 minutes after airplane has come to a complete stop, or inflight with gear retracted, to determine recommended cooling schedule. (Inflight gear extended, the BTMS indications may vary between individual brakes, due to airstream effects, gear tilt, and position of the gear temperature probes.)

Intentionally
Blank

Performance Inflight
Engine Inoperative

Chapter PI
Section 43

ENGINE INOP

Initial Max Continuous EPR

Based on .84M, engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	1.260	1.236	1.217	1.204	1.193	1.176	1.182	1.192	1.203
15	1.320	1.295	1.272	1.256	1.244	1.224	1.229	1.237	1.245
10	1.376	1.351	1.328	1.311	1.295	1.275	1.280	1.285	1.290
5	1.378	1.404	1.382	1.365	1.352	1.329	1.333	1.335	1.337
0	1.378	1.420	1.431	1.415	1.402	1.381	1.385	1.385	1.384
-5	1.378	1.420	1.460	1.460	1.488	1.429	1.433	1.431	1.430
-10	1.378	1.420	1.460	1.482	1.488	1.472	1.475	1.473	1.472
-15	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-20	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-25	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-30	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-35	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-40	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504

ENGINE INOP

Max Continuous EPR

37000 FT to 31000 FT Pressure Altitudes

37000 FT PRESS ALT			TAT (°C)										
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150	0.48	1.480	1.480	1.480	1.477	1.464	1.445	1.421	1.392	1.359	1.326	1.324	1.324
200	0.63	1.495	1.495	1.495	1.495	1.495	1.480	1.453	1.419	1.379	1.336	1.292	1.258
250	0.77	1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.499	1.460	1.416	1.367	1.316
300	0.91	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.434	1.393	1.346
35000 FT PRESS ALT			TAT (°C)										
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150	0.46	1.479	1.479	1.479	1.479	1.464	1.445	1.421	1.392	1.362	1.332	1.323	1.323
200	0.60	1.484	1.484	1.484	1.484	1.484	1.473	1.451	1.421	1.385	1.350	1.315	1.283
250	0.74	1.528	1.528	1.528	1.528	1.528	1.528	1.528	1.498	1.459	1.413	1.360	1.303
300	0.87	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.448	1.404	1.355
33000 FT PRESS ALT			TAT (°C)										
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150	0.44	1.486	1.486	1.486	1.486	1.480	1.460	1.435	1.407	1.375	1.345	1.317	1.317
200	0.58	1.493	1.493	1.493	1.493	1.493	1.493	1.471	1.444	1.409	1.372	1.336	1.299
250	0.71	1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.516	1.478	1.430	1.370	1.301
300	0.84	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.460	1.415	1.365
330	0.91	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.426	1.383
31000 FT PRESS ALT			TAT (°C)										
KLAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
150	0.42	1.492	1.492	1.492	1.492	1.478	1.453	1.425	1.393	1.362	1.333	1.315	1.315
200	0.55	1.506	1.506	1.506	1.506	1.506	1.497	1.470	1.438	1.400	1.361	1.322	1.284
250	0.68	1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.498	1.454	1.395	1.326	1.262
300	0.81	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.477	1.435	1.386	1.334
333	0.88	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.385	1.335

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	31	33	35	37
ENGINE ONLY	-0.018	-0.017	-0.016	-0.017
ENGINE & WING *	-0.033	-0.032	-0.032	-0.034
ENGINE & WING **	-0.048	-0.047	-0.048	-0.051

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ENGINE INOP

Max Continuous EPR

29000 FT to 24000 FT Pressure Altitudes

29000 FT PRESS ALT		TAT (°C)											
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
150	0.40	1.504	1.504	1.504	1.504	1.488	1.459	1.429	1.394	1.363	1.334	1.326	1.326
200	0.53	1.509	1.509	1.509	1.509	1.509	1.497	1.464	1.427	1.388	1.350	1.313	1.293
250	0.65	1.504	1.504	1.504	1.504	1.504	1.504	1.504	1.457	1.405	1.350	1.294	1.251
300	0.78	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.450	1.397	1.340	1.281
330	0.85	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.406	1.354	1.298
27000 FT PRESS ALT		TAT (°C)											
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
150	0.38	1.523	1.523	1.523	1.523	1.523	1.505	1.473	1.440	1.404	1.372	1.343	1.343
200	0.51	1.512	1.512	1.512	1.512	1.512	1.512	1.496	1.458	1.416	1.376	1.341	1.306
250	0.63	1.479	1.479	1.479	1.479	1.479	1.479	1.479	1.474	1.423	1.372	1.325	1.285
300	0.75	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.417	1.350	1.288
330	0.81	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.370	1.311
25000 FT PRESS ALT		TAT (°C)											
KLAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
150	0.37	1.540	1.540	1.540	1.540	1.540	1.522	1.488	1.451	1.415	1.380	1.360	1.360
200	0.49	1.511	1.511	1.511	1.511	1.511	1.511	1.490	1.447	1.404	1.366	1.332	1.307
250	0.60	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.451	1.400	1.354	1.315	1.282
300	0.72	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.371	1.302	1.248
330	0.78	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.327	1.260
24000 FT PRESS ALT		TAT (°C)											
KLAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
150	0.36	1.536	1.536	1.536	1.536	1.536	1.530	1.494	1.459	1.421	1.387	1.355	1.355
200	0.48	1.507	1.507	1.507	1.507	1.507	1.507	1.497	1.455	1.412	1.372	1.339	1.307
250	0.59	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.453	1.408	1.363	1.324	1.289
300	0.70	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.424	1.381	1.310	1.257
333	0.77	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.378	1.336	1.270

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	24	25	27	29
ENGINE ONLY	-0.022	-0.023	-0.021	-0.020
ENGINE & WING*	-0.037	-0.038	-0.036	-0.035
ENGINE & WING**	-0.051	-0.053	-0.051	-0.050

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ENGINE INOP

Max Continuous EPR
22000 FT to 16000 FT Pressure Altitudes

22000 FT PRESS ALT				TAT (°C)									
KLAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
150	0.35	1.529	1.529	1.529	1.529	1.529	1.511	1.474	1.399	1.399	1.367	1.346	1.346
200	0.46	1.500	1.500	1.500	1.500	1.500	1.496	1.470	1.428	1.389	1.353	1.322	1.301
250	0.57	1.466	1.466	1.466	1.466	1.466	1.466	1.455	1.423	1.380	1.339	1.302	1.270
300	0.68	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.424	1.387	1.325	1.273	1.234
330	0.74	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.386	1.347	1.283	1.228
20000 FT PRESS ALT				TAT (°C)									
KLAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
150	0.33	1.523	1.523	1.523	1.523	1.523	1.523	1.493	1.453	1.412	1.378	1.347	1.336
200	0.44	1.492	1.492	1.492	1.492	1.492	1.492	1.484	1.444	1.404	1.365	1.334	1.305
250	0.55	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.435	1.395	1.355	1.317	1.285
300	0.65	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.393	1.338	1.291	1.250
330	0.71	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.351	1.291	1.238
18000 FT PRESS ALT				TAT (°C)									
KLAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
150	0.32	1.496	1.496	1.496	1.496	1.496	1.494	1.455	1.415	1.380	1.351	1.322	1.321
200	0.42	1.474	1.474	1.474	1.474	1.474	1.471	1.452	1.409	1.369	1.336	1.309	1.283
250	0.53	1.498	1.498	1.498	1.498	1.498	1.498	1.485	1.429	1.373	1.325	1.288	1.260
300	0.63	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.398	1.337	1.285	1.238
330	0.69	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.415	1.352	1.293	1.240
16000 FT PRESS ALT				TAT (°C)									
KLAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
150	0.31	1.473	1.473	1.473	1.473	1.473	1.472	1.456	1.418	1.383	1.353	1.326	1.306
200	0.41	1.454	1.454	1.454	1.454	1.454	1.454	1.442	1.412	1.375	1.342	1.314	1.288
250	0.51	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.465	1.408	1.354	1.309	1.273
300	0.60	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.436	1.375	1.318	1.271
330	0.66	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.381	1.321	1.267

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	16	18	20	22
ENGINE ONLY	-0.011	-0.014	-0.018	-0.020
ENGINE & WING*	-0.022	-0.026	-0.031	-0.034
ENGINE & WING**	-0.033	-0.038	-0.044	-0.047

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ENGINE INOP

Max Continuous EPR

14000 FT to 5000 FT Pressure Altitudes

14000 FT PRESS ALT			TAT (°C)										
KLAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
150	0.29	1.446	1.446	1.446	1.446	1.446	1.443	1.417	1.381	1.351	1.325	1.301	1.290
200	0.39	1.437	1.437	1.437	1.437	1.437	1.437	1.407	1.372	1.341	1.315	1.291	1.267
250	0.49	1.490	1.490	1.490	1.490	1.490	1.490	1.490	1.435	1.379	1.329	1.286	1.252
300	0.58	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.410	1.350	1.300	1.256
330	0.64	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.416	1.354	1.298	1.250

12000 FT PRESS ALT			TAT (°C)										
KLAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
150	0.28	1.444	1.444	1.444	1.444	1.444	1.431	1.415	1.388	1.351	1.317	1.285	1.278
200	0.38	1.433	1.433	1.433	1.433	1.433	1.430	1.415	1.397	1.367	1.325	1.285	1.247
250	0.47	1.478	1.478	1.478	1.478	1.478	1.478	1.462	1.416	1.371	1.329	1.289	1.252
300	0.56	1.471	1.471	1.471	1.471	1.471	1.471	1.471	1.453	1.393	1.338	1.293	1.254
330	0.62	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.403	1.344	1.294	1.251

10000 FT PRESS ALT			TAT (°C)										
KLAS	M	-15	-10	5	0	5	10	15	20	25	30	35	40
150	0.27	1.425	1.425	1.425	1.425	1.425	1.422	1.403	1.384	1.355	1.320	1.299	1.280
200	0.36	1.401	1.401	1.401	1.401	1.401	1.401	1.394	1.380	1.358	1.323	1.291	1.270
250	0.45	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.387	1.353	1.318	1.282	1.252
300	0.54	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.372	1.323	1.282	1.254
330	0.59	1.383	1.383	1.383	1.383	1.383	1.383	1.383	1.383	1.382	1.327	1.285	1.246

5000 FT PRESS ALT			TAT (°C)										
KLAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
150	0.25	1.385	1.385	1.385	1.385	1.385	1.385	1.377	1.348	1.323	1.302	1.281	1.260
200	0.33	1.367	1.367	1.367	1.367	1.367	1.367	1.367	1.353	1.336	1.316	1.291	1.265
250	0.41	1.341	1.341	1.341	1.341	1.341	1.341	1.341	1.341	1.326	1.311	1.287	1.253
300	0.49	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.327	1.289	1.254	1.221
330	0.54	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.289	1.252	1.218

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	5	10	12	14
ENGINE ONLY	-0.015	-0.015	-0.013	-0.010
ENGINE & WING*	-0.023	-0.025	-0.023	-0.020
ENGINE & WING**	-0.031	-0.035	-0.033	-0.030

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	638	281	16200	14700	13100
620	600	273	17700	16300	14700
580	562	264	19000	18000	16400
540	522	255	20400	19600	18300
500	483	246	22300	21700	20500
460	444	236	24300	24100	22900
420	406	226	26400	26200	25300
380	367	215	28700	28300	27500
340	329	204	31200	30600	29900

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
134	125	118	111	105	100	95	91	87	83	80
274	255	239	224	211	200	190	181	172	165	158
413	384	359	337	317	300	284	270	258	246	236
551	512	479	449	423	400	379	360	343	328	314
688	640	598	561	529	500	474	451	429	410	393
825	768	717	674	635	600	569	541	516	492	471
961	895	836	785	740	700	664	631	602	575	550
1097	1021	955	897	846	800	759	722	688	658	629
1233	1148	1074	1009	951	900	854	812	775	740	709
1368	1274	1192	1121	1057	1000	949	903	861	823	788
1503	1401	1311	1232	1162	1100	1044	993	947	906	867
1639	1527	1430	1344	1268	1200	1139	1084	1034	988	947
1774	1654	1548	1456	1373	1300	1234	1174	1120	1071	1026
1910	1781	1667	1567	1479	1400	1329	1265	1207	1153	1105
2047	1908	1786	1679	1585	1500	1424	1355	1293	1236	1184
2184	2035	1906	1792	1690	1600	1519	1445	1379	1318	1263
2321	2163	2025	1904	1796	1700	1614	1536	1465	1400	1341
2460	2292	2145	2016	1902	1800	1708	1626	1550	1482	1419

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)									TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)									
	340	380	420	460	500	540	580	620	660	
100	2.1	2.3	2.5	2.8	3.0	3.2	3.2	3.4	3.6	0:15
200	4.9	5.4	5.8	6.3	6.8	7.2	7.5	8.0	8.6	0:32
300	8.0	8.8	9.5	10.3	11.1	11.9	12.5	13.4	14.2	0:49
400	11.2	12.3	13.4	14.5	15.6	16.7	17.7	18.9	20.1	1:06
500	14.2	15.7	17.1	18.5	20.0	21.4	22.6	24.2	25.8	1:22
600	17.2	19.0	20.7	22.4	24.1	25.9	27.4	29.3	31.2	1:38
700	20.2	22.2	24.2	26.2	28.3	30.4	32.2	34.4	36.5	1:54
800	23.1	25.4	27.7	30.0	32.4	34.8	36.9	39.4	41.8	2:10
900	26.0	28.6	31.2	33.8	36.4	39.1	41.6	44.4	47.1	2:26
1000	28.8	31.7	34.6	37.5	40.5	43.4	46.2	49.4	52.3	2:41
1100	31.6	34.8	38.0	41.2	44.4	47.7	50.8	54.2	57.5	2:57
1200	34.4	37.9	41.4	44.8	48.4	51.9	55.3	59.1	62.6	3:13
1300	37.1	40.9	44.7	48.4	52.2	56.1	59.8	63.8	67.7	3:29
1400	39.8	43.9	47.9	52.0	56.1	60.2	64.2	68.6	72.7	3:44
1500	42.5	46.9	51.2	55.5	59.9	64.3	68.6	73.3	77.6	4:00
1600	45.1	49.8	54.4	59.0	63.7	68.4	73.0	77.9	82.5	4:17
1700	47.8	52.7	57.6	62.5	67.4	72.4	77.3	82.5	87.4	4:33
1800	50.3	55.5	60.7	65.9	71.1	76.4	81.5	87.0	92.2	4:50

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	13	15	17	19	21	23	25	27	29
660	EPR	1.263	1.355								
	MACH	.577	.615								
	KIAS	321	323								
	FF/ENG	20270	21145								
620	EPR	1.235	1.302	1.379							
	MACH	.567	.591	.622							
	KIAS	315	310	315							
	FF/ENG	19027	19136	20113							
580	EPR	1.209	1.263	1.315	1.404						
	MACH	.555	.575	.595	.628						
	KIAS	308	302	301	306						
	FF/ENG	17754	17668	17936	19053						
540	EPR	1.185	1.233	1.270	1.327	1.426					
	MACH	.541	.564	.577	.599	.633					
	KIAS	300	296	292	292	297					
	FF/ENG	16495	16470	16382	16765	17916					
500	EPR	1.164	1.204	1.236	1.274	1.336					
	MACH	.526	.549	.564	.578	.601					
	KIAS	292	288	285	281	281					
	FF/ENG	15293	15222	15189	15142	15546					
460	EPR	1.145	1.179	1.205	1.235	1.274	1.342				
	MACH	.512	.532	.548	.564	.577	.601				
	KIAS	284	279	277	274	270	270				
	FF/ENG	14164	14013	13947	13934	13868	14271				
420	EPR	1.127	1.157	1.178	1.201	1.233	1.273	1.342	1.448		
	MACH	.497	.516	.530	.546	.563	.576	.599	.634		
	KIAS	275	270	267	265	263	259	258	263		
	FF/ENG	13077	12883	12744	12662	12641	12582	12936	13947		
380	EPR	1.110	1.136	1.154	1.172	1.198	1.231	1.274	1.333	1.440	
	MACH	.482	.499	.513	.527	.543	.559	.574	.594	.630	
	KIAS	267	261	258	255	253	251	247	246	250	
	FF/ENG	12119	11793	11631	11445	11375	11331	11311	11574	12465	
340	EPR	1.092	1.116	1.131	1.146	1.168	1.193	1.227	1.267	1.321	1.419
	MACH	.461	.483	.495	.508	.522	.537	.554	.570	.587	.620
	KIAS	255	253	249	246	243	240	238	235	233	236
	FF/ENG	11113	10789	10555	10335	10202	10115	10047	10033	10187	10906

MAX CONTINUOUS THRUST

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
288	265	245	228	213	200	190	181	173	165	158
573	528	489	455	426	400	380	362	346	331	318
860	793	734	683	639	600	571	544	519	497	477
1147	1057	978	911	852	800	761	725	692	662	635
1435	1323	1224	1139	1066	1000	951	906	865	828	794
1724	1589	1469	1367	1279	1200	1141	1086	1037	992	952
2014	1856	1716	1596	1493	1400	1331	1268	1210	1157	1109
2305	2123	1962	1825	1706	1600	1521	1448	1381	1321	1266
2596	2391	2208	2054	1920	1800	1710	1628	1552	1484	1423

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		18		22	
	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	8.6	0:40	7.5	0:39	6.8	0:38	6.5	0:36
300	13.1	0:58	11.9	0:56	11.0	0:54	10.9	0:51
400	17.7	1:16	16.2	1:13	15.2	1:11	15.2	1:06
500	22.3	1:34	20.6	1:31	19.4	1:28	19.4	1:22
600	26.8	1:52	24.9	1:48	23.5	1:44	23.6	1:37
700	31.3	2:10	29.2	2:05	27.6	2:01	27.8	1:53
800	35.8	2:29	33.4	2:23	31.7	2:18	31.9	2:08
900	40.2	2:47	37.7	2:41	35.7	2:35	35.9	2:24
1000	44.6	3:05	41.9	2:58	39.8	2:52	40.0	2:40
1100	49.0	3:24	46.1	3:16	43.8	3:09	43.9	2:56
1200	53.4	3:42	50.2	3:34	47.8	3:26	47.9	3:12
1300	57.8	4:01	54.4	3:52	51.7	3:43	51.8	3:28
1400	62.1	4:19	58.5	4:09	55.7	4:00	55.7	3:44
1500	66.4	4:38	62.6	4:27	59.6	4:17	59.5	4:01
1600	70.7	4:57	66.7	4:45	63.5	4:34	63.3	4:17
1700	75.0	5:16	70.7	5:03	67.3	4:52	67.0	4:33
1800	79.2	5:35	74.8	5:22	71.2	5:09	70.8	4:50

ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	300	350	400	450	500	550	600	650
5	-0.7	-0.6	-0.4	-0.2	0.0	0.5	0.8	1.2
10	-1.7	-1.4	-1.0	-0.5	0.0	1.3	2.3	3.1
15	-2.8	-2.2	-1.5	-0.8	0.0	2.1	3.7	5.1
20	-3.8	-3.0	-2.1	-1.1	0.0	2.8	5.2	7.0
25	-4.9	-3.8	-2.6	-1.3	0.0	3.6	6.6	9.0
30	-5.9	-4.6	-3.1	-1.6	0.0	4.3	8.0	10.9
35	-6.9	-5.3	-3.6	-1.9	0.0	5.1	9.3	12.9
40	-7.9	-6.1	-4.2	-2.1	0.0	5.8	10.7	14.8
45	-9.0	-6.9	-4.7	-2.4	0.0	6.5	12.0	16.7
50	-10.0	-7.6	-5.2	-2.7	0.0	7.1	13.4	18.7
55	-11.0	-8.4	-5.7	-2.9	0.0	7.8	14.7	20.6
60	-12.0	-9.1	-6.2	-3.2	0.0	8.5	16.0	22.5
65	-13.0	-9.9	-6.6	-3.4	0.0	9.1	17.2	24.4
70	-14.0	-10.6	-7.1	-3.7	0.0	9.7	18.5	26.4
75	-15.0	-11.3	-7.6	-3.9	0.0	10.3	19.7	28.3
80	-16.0	-12.0	-8.0	-4.2	0.0	10.9	20.9	30.2

APU fuel included

MAX CONTINUOUS THRUST

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
660	EPR	1.150	1.186	1.256	1.382		
	KIAS	259	260	261	277		
	FF/ENG	17910	17770	18030	19530		
620	EPR	1.136	1.168	1.231	1.333		
	KIAS	251	252	253	262		
	FF/ENG	16750	16610	16750	17560		
580	EPR	1.122	1.152	1.208	1.294		
	KIAS	243	244	245	248		
	FF/ENG	15690	15450	15560	15900		
540	EPR	1.109	1.136	1.186	1.261	1.400	
	KIAS	234	235	236	237	252	
	FF/ENG	14630	14330	14410	14510	16030	
500	EPR	1.097	1.120	1.165	1.229	1.334	
	KIAS	226	226	227	228	235	
	FF/ENG	13600	13270	13270	13280	14050	
460	EPR	1.085	1.105	1.144	1.199	1.283	1.470
	KIAS	220	220	220	220	220	238
	FF/ENG	12610	12350	12200	12140	12400	14260
420	EPR	1.073	1.090	1.124	1.171	1.241	1.371
	KIAS	213	213	213	213	213	220
	FF/ENG	11610	11430	11230	11090	11140	12000
380	EPR	1.061	1.076	1.105	1.145	1.201	1.303
	KIAS	206	206	206	206	206	206
	FF/ENG	10630	10450	10290	10050	10030	10340
340	EPR	1.051	1.063	1.087	1.121	1.164	1.252
	KIAS	199	199	199	199	199	199
	FF/ENG	9660	9480	9370	9050	9000	9150

ENGINE INOP

ADVISORY INFORMATION

**Gear Down Landing Rate of Climb Available
Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	290	160				
50	340	210	70			
48	400	260	120			
46	450	310	170	30		
44	500	360	220	80		
42	550	410	270	130	-20	
40	600	460	310	170	20	
38	620	510	360	210	60	-100
36	620	550	400	250	100	-60
34	620	590	430	280	130	-20
32	620	620	460	320	160	-10
30	630	650	490	340	180	0
20	640	660	550	410	240	60
10	650	680	560	430	280	100
0	670	690	570	440	290	120
-20	700	720	600	460	300	130
-40	730	750	620	480	320	130

Rate of climb capability shown is valid for 450000 lb, gear down at VREF20 + 5.
Decrease rate of climb 40 ft/min per 10000 lb greater than 450000 lb.
Increase rate of climb 50 ft/min per 10000 lb less than 450000 lb.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-200	-330				
50	-150	-290	-420			
48	-100	-240	-380			
46	-50	-190	-330	-470		
44	-10	-150	-290	-430		
42	40	-110	-250	-390	-540	
40	80	-60	-210	-350	-500	
38	90	-20	-170	-320	-460	-620
36	90	20	-130	-280	-430	-590
34	90	50	-100	-250	-400	-560
32	90	80	-70	-220	-380	-550
30	90	110	-50	-200	-360	-540
20	100	110	-10	-150	-320	-500
10	100	110	-10	-140	-290	-460
0	110	110	-10	-140	-290	-460
-20	110	120	-10	-140	-300	-470
-40	120	130	0	-150	-310	-490

Rate of climb capability shown is valid for 450000 lb, gear down at VREF30 + 5.
Decrease rate of climb 40 ft/min per 10000 lb greater than 450000 lb.
Increase rate of climb 50 ft/min per 10000 lb less than 450000 lb.

Intentionally
Blank

Performance Inflight
Alternate Mode EEC

Chapter PI
Section 44

ALTERNATE MODE EEC

Limit Weight

PERFORMANCE LIMIT	ALTERNATE MODE EEC LIMIT WEIGHT (1000 LB)							
	PRIMARY MODE PERFORMANCE LIMIT WEIGHT (1000 LB)							
	350	400	450	500	550	600	650	700
FIELD CLIMB	322.5 301.5	368.5 344.5	416.5 387.0	462.0 431.0	508.5 474.5	555.5 517.5	584.5 562.0	653.0 605.0
OBSTACLE NET LEVEL OFF WEIGHT APPROACH OR LANDING CLIMB	312.0	356.0 333.5	398.5 378.0 404.5	441.0 423.5 454.5	485.5 469.0 503.5	528.0 514.0 553.0	572.0 559.0 603.0	615.0 604.5 655.0

Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
V1	+2
VR	+1
V2	0

ALTERNATE MODE EEC

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	85.1	85.5	87.4	89.5	90.9	89.6	90.6	93.8	94.5	95.1
50	86.3	86.6	87.1	88.1	89.6	88.3	89.3	92.4	93.0	93.6
40	86.6	87.6	88.0	88.6	88.5	86.9	87.9	91.0	91.6	92.2
30	85.2	87.5	89.4	89.9	89.4	87.8	87.0	89.5	90.1	90.7
20	83.7	86.0	88.6	91.4	91.0	90.4	89.9	88.8	88.6	89.2
15	83.0	85.3	87.8	90.7	92.2	92.0	91.3	90.0	89.6	90.0
10	82.3	84.5	87.1	89.9	91.7	94.0	92.7	91.1	90.6	90.9
5	81.6	83.8	86.3	89.1	90.8	94.3	93.8	92.3	91.7	91.8
0	80.8	83.0	85.5	88.3	90.0	93.5	95.0	93.3	92.7	92.6
-5	80.1	82.3	84.7	87.5	89.2	92.6	94.8	94.4	93.7	93.6
-10	79.3	81.5	83.9	86.6	88.4	91.8	93.9	95.2	94.6	94.5
-15	78.6	80.7	83.1	85.8	87.5	90.9	93.0	94.9	95.0	95.0
-20	77.8	79.9	82.3	85.0	86.7	90.0	92.1	94.0	94.1	94.0
-25	77.0	79.1	81.5	84.1	85.8	89.1	91.2	93.1	93.2	93.1
-30	76.3	78.3	80.7	83.3	84.9	88.2	90.3	92.1	92.2	92.2
-35	75.5	77.5	79.8	82.4	84.1	87.3	89.3	91.2	91.3	91.2
-40	74.7	76.7	79.0	81.5	83.2	86.4	88.4	90.2	90.3	90.2

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
ENGINE ANTI-ICE ON	-1.0	-0.9	-0.8	-0.4	-0.7	-0.8	-0.8	-0.7	-0.8	-0.9
ENGINE & WING ANTI-ICE ON	-1.4	-1.3	-1.3	-1.0	-1.3	-1.4	-1.5	-1.3	-1.6	-1.7

ALTERNATE MODE EEC

Max Cruise %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)									
	25000	27000	29000	31000	33000	35000	37000	39000	41000	43000
25	87.0	86.7	86.9	86.7	86.3	86.9	87.1	87.3	87.6	87.9
20	88.2	88.0	88.1	87.6	87.3	86.9	86.3	86.5	86.9	87.2
15	89.4	89.3	89.3	88.6	88.1	87.7	87.1	87.3	87.5	87.7
10	91.0	90.4	90.2	89.6	89.1	88.6	87.9	88.1	88.3	88.4
5	91.1	91.6	91.1	90.5	90.0	89.6	88.8	89.0	89.0	89.1
0	90.3	91.1	91.8	91.3	90.7	90.3	89.7	89.8	89.8	89.8
-5	89.5	90.3	91.0	91.4	91.4	91.0	90.4	90.5	90.4	90.4
-10	88.6	89.4	90.1	90.5	91.3	91.5	90.9	91.0	91.0	90.9
-15	87.8	88.6	89.2	89.7	90.4	91.2	91.3	91.4	91.3	91.3
-20	86.9	87.7	88.4	88.8	89.5	90.3	90.4	90.5	90.4	90.4
-25	86.1	86.8	87.5	87.9	88.6	89.4	89.5	89.6	89.5	89.5
-30	85.2	85.9	86.6	87.0	87.7	88.5	88.6	88.7	88.6	88.6
-35	84.3	85.1	85.7	86.1	86.8	87.6	87.7	87.7	87.7	87.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)									
	25000	27000	29000	31000	33000	35000	37000	39000	41000	43000
ENGINE ANTI-ICE ON	-0.7	-0.6	-0.6	-0.6	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6
ENGINE & WING ANTI-ICE ON	-1.1	-1.1	-1.0	-1.0	-1.0	-1.0	-1.0	-1.1	-1.2	-1.3

ALTERNATE MODE EEC

Go-Around %N1

Based on engine bleed for packs on, engine anti-ice on or off, wing anti-ice off

AIRPORT OAT		TAT (°C)	PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
51	124	55	90.4	90.2	90.2	90.0	90.2	90.3	90.5	90.7	90.8	91.0	91.3	91.4
46	115	50	92.1	92.1	92.0	91.8	91.8	91.7	91.7	91.9	92.1	92.4	92.7	92.9
41	106	45	94.0	94.0	94.0	93.9	93.8	93.7	93.7	93.6	93.4	93.7	94.1	94.4
36	97	40	94.7	96.2	96.0	96.0	95.9	95.7	96.0	95.8	95.8	95.7	95.4	95.7
31	88	35	94.6	97.8	97.7	97.7	97.5	97.7	97.6	97.5	97.5	97.0	96.7	96.4
26	79	30	94.1	98.1	98.6	98.7	98.4	98.5	98.3	98.2	98.1	97.5	97.0	96.6
21	70	25	93.4	98.0	98.5	98.8	98.9	98.7	98.5	98.4	98.2	97.8	97.4	96.9
16	61	20	92.6	97.3	98.1	98.8	98.8	98.9	98.8	98.6	98.5	98.0	97.5	97.1
11	52	15	91.8	96.4	97.3	98.1	98.7	98.9	98.9	98.9	98.7	98.2	97.8	97.3
7	45	10	91.0	95.6	96.4	97.3	97.9	98.6	98.8	98.8	98.8	98.5	98.0	97.5
2	36	5	90.2	94.7	95.6	96.4	97.1	97.7	98.1	98.5	98.8	98.4	98.1	97.7
-3	27	0	89.4	93.9	94.7	95.5	96.2	96.9	97.2	97.6	98.0	98.0	98.0	97.7
-13	9	-10	87.7	92.1	93.0	93.8	94.4	95.1	95.4	95.8	96.2	96.2	96.3	96.3
-23	-9	-20	86.0	90.4	91.2	92.0	92.6	93.3	93.6	94.0	94.4	94.4	94.4	94.5
-33	-27	-30	84.3	88.6	89.4	90.1	90.8	91.4	91.7	92.1	92.5	92.5	92.5	92.6
-43	-45	-40	82.6	86.7	87.5	88.3	88.9	89.5	89.8	90.2	90.6	90.6	90.6	90.7
-53	-63	-50	80.8	84.9	85.6	86.4	86.9	87.6	87.9	88.2	88.6	88.6	88.7	88.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	9000
PACKS OFF	0.8	0.8	0.9	1.0	1.0	1.1	1.1
WING ANTI-ICE ON	-0.4	-0.4	-0.5	-0.5	-0.5	-0.6	-0.6

Intentionally
Blank

Performance Inflight
Alternate Mode EEC, Engine INOP

Chapter PI
Section 45

ALTERNATE MODE EEC

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	91.4	90.5	89.8	89.3	88.9	88.2	88.4	88.8	89.2
15	92.9	91.9	91.1	90.5	90.0	89.3	89.5	89.8	90.1
10	94.1	93.2	92.3	91.7	91.1	90.4	90.6	90.8	90.9
5	93.3	94.2	93.4	92.8	92.3	91.5	91.7	91.7	91.8
0	92.4	94.1	94.6	93.9	93.3	92.5	92.7	92.7	92.7
-5	91.6	93.2	94.9	94.9	94.4	93.6	93.7	93.7	93.6
-10	90.7	92.3	94.0	95.0	95.2	94.5	94.7	94.6	94.5
-15	89.9	91.5	93.1	94.0	95.0	95.0	95.1	95.0	95.0
-20	89.0	90.6	92.2	93.1	94.0	94.1	94.1	94.1	94.0
-25	88.1	89.7	91.3	92.2	93.1	93.2	93.2	93.2	93.1
-30	87.2	88.8	90.4	91.3	92.2	92.2	92.3	92.2	92.2
-35	86.3	87.8	89.5	90.3	91.2	91.3	91.3	91.3	91.2
-40	85.4	86.9	88.5	89.4	90.2	90.3	90.3	90.3	90.3

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
ENGINE ONLY	-0.7	-0.9	-0.8	-0.7	-0.6	-0.6	-0.6	-0.7	-0.7
ENGINE & WING*	-1.2	-1.4	-1.4	-1.2	-1.2	-1.2	-1.2	-1.4	-1.4
ENGINE & WING**	-1.7	-1.9	-1.9	-1.8	-1.7	-1.8	-1.9	-2.1	-2.2

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ALTERNATE MODE EEC

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

320 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	92.3	93.5	94.8	93.0	91.7	90.6	89.3									
25	91.5	95.2	96.6	94.7	93.3	92.3	90.2	90.0	89.5	89.1						
20	90.8	95.0	98.1	96.6	95.0	93.9	91.6	91.4	91.0	90.7	90.6	90.2				
15	90.0	94.2	97.3	96.9	96.8	95.7	93.1	93.1	92.8	92.5	92.2	91.7	91.3	91.3	91.6	92.0
10	89.2	93.4	96.5	96.0	96.0	96.1	94.8	94.2	94.2	94.4	93.6	93.0	92.5	92.2	92.5	92.9
5	88.4	92.6	95.6	95.2	95.1	95.3	93.9	94.0	93.8	93.7	94.7	94.1	93.5	93.1	93.4	93.7
0	87.6	91.7	94.7	94.3	94.2	94.4	93.1	93.2	93.0	92.8	93.8	94.6	94.6	93.9	94.3	94.6
-5	86.8	90.9	93.9	93.5	93.4	93.6	92.2	92.3	92.1	92.0	92.9	93.7	94.5	94.4	94.9	95.1
-10	86.0	90.0	93.0	92.6	92.5	92.7	91.4	91.5	91.3	91.1	92.1	92.8	93.6	93.5	94.1	94.2
-15	85.2	89.2	92.1	91.7	91.6	91.8	90.5	90.6	90.4	90.2	91.2	91.9	92.7	92.6	93.2	93.3
-20	84.3	88.3	91.2	90.8	90.7	90.9	89.6	89.7	89.5	89.4	90.3	91.0	91.8	91.7	92.3	92.4
-25	83.5	87.4	90.3	89.9	89.8	90.0	88.7	88.8	88.6	88.5	89.4	90.1	90.9	90.8	91.4	91.4
-30	82.7	86.6	89.4	89.0	88.9	89.1	87.8	87.9	87.7	87.6	88.5	89.2	89.9	89.9	90.5	90.5
-35	81.8	85.7	88.5	88.1	88.0	88.2	86.9	87.0	86.8	86.7	87.6	88.3	89.0	88.9	89.5	89.6
-40	80.9	84.8	87.5	87.1	87.1	87.2	86.0	86.1	85.9	85.7	86.7	87.4	88.1	88.0	88.6	88.6

280 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	91.2	91.9	93.0	91.3	90.5	89.7	89.8									
25	91.3	93.6	94.7	92.9	91.9	90.9	90.6	90.0	89.6	89.3						
20	90.5	95.5	96.8	94.9	93.5	92.4	91.6	90.9	90.3	90.0	89.2	88.4				
15	89.7	95.0	98.2	97.0	95.5	94.2	92.6	92.0	91.4	91.2	90.5	89.7	89.7	90.4	90.0	89.5
10	88.9	94.2	97.3	97.2	97.3	96.1	93.5	93.3	92.7	92.5	92.1	91.6	91.4	91.6	91.2	90.5
5	88.1	93.4	96.5	96.3	96.4	96.7	95.1	94.3	94.7	94.6	93.7	93.2	92.9	92.8	92.3	91.6
0	87.3	92.5	95.6	95.4	95.6	95.8	94.4	94.4	94.6	94.9	96.2	94.9	94.3	93.9	93.3	92.6
-5	86.5	91.7	94.7	94.5	94.7	94.9	93.6	93.6	93.8	94.0	95.8	96.4	95.5	94.9	94.4	93.6
-10	85.7	90.8	93.8	93.7	93.8	94.1	92.7	92.7	92.9	93.2	94.9	95.5	96.0	95.7	95.3	94.5
-15	84.9	90.0	92.9	92.8	92.9	93.2	91.8	91.8	92.0	92.3	94.0	94.6	95.1	95.2	95.4	94.6
-20	84.1	89.1	92.0	91.9	92.0	92.2	90.9	90.9	91.2	91.4	93.1	93.7	94.2	94.3	94.5	93.6
-25	83.3	88.2	91.1	91.0	91.1	91.3	90.0	90.0	90.2	90.5	92.2	92.8	93.2	93.3	93.6	92.7
-30	82.4	87.3	90.2	90.0	90.2	90.4	89.1	89.1	89.3	89.5	91.3	91.8	92.3	92.4	92.6	91.8
-35	81.6	86.4	89.3	89.1	89.2	89.5	88.2	88.2	88.4	88.6	90.3	90.9	91.3	91.4	91.7	90.8
-40	80.7	85.5	88.3	88.2	88.3	88.5	87.2	87.2	87.5	87.7	89.4	89.9	90.4	90.5	90.7	89.9

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.6	-0.7	-0.8	-0.8	-0.7	-0.9	-0.8	-0.7	-0.6	-0.6
ENGINE & WING*	-0.9	-0.9	-0.9	-0.8	-0.8	-0.9	-1.1	-1.2	-1.3	-1.3	-1.2	-1.4	-1.4	-1.2	-1.2	-1.2
ENGINE & WING**	-1.2	-1.2	-1.2	-1.2	-1.2	-1.4	-1.5	-1.7	-1.9	-1.9	-1.7	-1.9	-1.9	-1.8	-1.7	-1.8

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

ALTERNATE MODE EEC

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

240 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	90.5	90.6	91.4	89.3	89.1	89.0	89.1									
25	90.5	91.6	92.8	90.6	90.2	89.8	90.0	89.6	89.3	89.4						
20	89.8	92.4	94.1	92.1	91.5	90.7	90.8	90.5	90.2	90.1	89.2	88.0				
15	89.1	92.9	95.3	94.0	93.3	92.2	91.8	91.4	91.0	90.9	90.2	88.8	87.1	86.0	86.5	88.0
10	88.3	92.1	95.5	95.9	95.2	94.0	92.9	92.5	92.0	91.8	91.0	89.9	88.6	87.5	86.9	88.2
5	87.5	91.3	94.6	95.5	96.5	95.9	94.1	93.7	93.2	93.0	92.0	91.1	90.1	89.2	88.8	89.7
0	86.7	90.4	93.8	94.6	95.6	96.2	94.7	94.4	94.5	94.3	93.1	92.3	91.8	90.9	90.5	91.0
-5	85.9	89.6	92.9	93.7	94.7	95.3	93.9	94.2	94.3	94.4	94.2	93.5	93.4	92.5	91.8	92.1
-10	85.1	88.8	92.1	92.9	93.8	94.4	93.0	93.4	93.5	93.6	94.1	94.5	94.4	93.8	93.2	93.3
-15	84.3	87.9	91.2	92.0	92.9	93.5	92.1	92.5	92.6	92.7	93.2	94.2	95.0	94.7	94.1	94.1
-20	83.5	87.1	90.3	91.1	92.0	92.6	91.2	91.6	91.7	91.8	92.3	93.2	94.4	94.8	94.7	94.7
-25	82.7	86.2	89.4	90.2	91.1	91.7	90.3	90.7	90.8	90.9	91.3	92.3	93.4	93.8	94.0	94.1
-30	81.8	85.3	88.5	89.3	90.2	90.8	89.4	89.7	89.9	89.9	90.4	91.4	92.5	92.9	93.0	93.1
-35	81.0	84.4	87.6	88.3	89.3	89.8	88.5	88.8	89.0	89.0	89.5	90.4	91.5	91.9	92.1	92.2
-40	80.1	83.6	86.6	87.4	88.3	88.9	87.6	87.9	88.0	88.1	88.5	89.5	90.6	91.0	91.1	91.2

200 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	89.8	89.6	89.9	88.2	88.3	88.3	89.4									
25	90.1	90.8	91.6	88.9	89.1	89.1	89.2	89.3	89.9	90.2						
20	90.1	91.4	92.6	89.6	89.9	89.9	90.0	89.6	89.2	89.4	89.5	89.5				
15	89.4	91.4	92.8	90.6	91.0	90.9	90.9	90.5	90.1	89.9	89.0	88.7	88.7	89.2	89.7	88.8
10	88.6	91.0	92.8	91.7	92.2	92.2	92.2	91.6	91.0	90.8	89.9	89.0	88.0	88.4	88.9	88.0
5	87.8	90.2	92.1	92.5	93.0	93.7	93.4	92.8	92.2	91.9	90.8	89.9	89.0	88.4	88.1	87.2
0	87.0	89.4	91.3	91.7	92.8	93.8	94.7	94.1	93.5	93.2	91.9	90.9	90.0	89.2	88.7	88.0
-5	86.2	88.6	90.4	90.8	91.9	93.1	94.2	94.5	94.7	94.5	93.1	91.9	90.9	90.0	89.4	89.1
-10	85.4	87.7	89.6	90.0	91.1	92.3	93.3	93.9	94.3	94.6	94.1	92.8	91.8	90.8	90.1	90.0
-15	84.6	86.9	88.7	89.1	90.2	91.4	92.4	93.0	93.5	93.7	93.9	93.4	92.4	91.5	90.7	90.8
-20	83.8	86.0	87.9	88.2	89.3	90.5	91.5	92.1	92.6	92.8	93.0	93.0	92.7	91.7	91.1	91.4
-25	82.9	85.2	87.0	87.4	88.4	89.6	90.6	91.1	91.6	91.9	92.1	92.1	92.2	91.8	91.1	91.6
-30	82.1	84.3	86.1	86.5	87.5	88.7	89.7	90.2	90.7	91.0	91.2	91.2	91.2	90.8	90.7	91.3
-35	81.2	83.5	85.2	85.6	86.6	87.8	88.8	89.3	89.8	90.0	90.2	90.2	90.3	89.9	89.7	90.4
-40	80.4	82.6	84.3	84.7	85.7	86.8	87.8	88.3	88.8	89.1	89.3	89.3	89.3	89.0	88.8	89.4

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.6	-0.7	-0.8	-0.8	-0.7	-0.9	-0.8	-0.7	-0.6	-0.6
ENGINE & WING*	-0.9	-0.9	-0.9	-0.8	-0.8	-0.9	-1.1	-1.2	-1.3	-1.3	-1.2	-1.4	-1.4	-1.2	-1.2	-1.2
ENGINE & WING**	-1.2	-1.2	-1.2	-1.2	-1.2	-1.4	-1.5	-1.7	-1.9	-1.9	-1.7	-1.9	-1.9	-1.8	-1.7	-1.8

*Wing anti-ice on, packs on.

**Wing anti-ice on, packs off.

Intentionally
Blank

Performance Inflight

Gear Down

Chapter PI

Section 46

GEAR DOWN

220 KIAS Max Climb EPR

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	0	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35
55	1.204	1.203	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
50	1.221	1.215	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
45	1.239	1.232	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
40	1.258	1.250	1.242	1.239	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
35	1.271	1.270	1.260	1.260	1.257	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
30	1.271	1.293	1.284	1.283	1.282	1.278	1.273	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
25	1.271	1.303	1.311	1.309	1.307	1.304	1.301	1.299	1.284	1.281	1.282	1.274	1.265	1.252	1.238	1.219
20	1.271	1.303	1.339	1.337	1.335	1.334	1.331	1.329	1.316	1.300	1.291	1.274	1.265	1.252	1.238	1.219
15	1.271	1.303	1.343	1.361	1.367	1.368	1.365	1.363	1.348	1.333	1.325	1.299	1.271	1.252	1.238	1.219
10	1.271	1.303	1.343	1.361	1.385	1.404	1.403	1.402	1.386	1.369	1.360	1.334	1.308	1.277	1.243	1.219
5	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.444	1.429	1.410	1.400	1.372	1.345	1.317	1.288	1.253
0	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.471	1.455	1.447	1.413	1.385	1.359	1.332	1.306
-5	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.456	1.426	1.402	1.380	1.359
-10	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.464	1.441	1.426	1.407
-15	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.495	1.475	1.463	1.450
-20	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.495	1.499	1.493	1.484

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
ENGINE ONLY	-.016	-.015	-.015	-.009	-.017	-.023	-.019	-.016
ENGINE AND WING*	-.022	-.023	-.025	-.020	-.030	-.038	-.034	-.032
ENGINE AND WING**	-.029	-.031	-.035	-.030	-.043	-.053	-.048	-.048

*Wing anti-ice on, dual bleed source and packs on or off.

**Wing anti-ice on, single bleed source and both packs off.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	14400	14300	12000
640	15800	15700	13600
620	17100	17000	15100
600	18400	18300	16500
580	19700	19600	17900
560	20800	20700	19300
540	21900	21800	20500
520	23000	22900	21700
500	24200	24100	22800
480	25300	25200	24000
460	26300	26100	25100
440	27300	27100	26200
420	28300	28000	27200
400	29400	29100	28300
380	30600	30100	29400
360	31500	31200	30600
340	32200	31900	31500

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)										
		10	13	15	17	19	21	23	25	27	29	31
660	EPR	1.204	1.253	1.291								
	MACH	.479	.499	.511								
	KIAS	265	261	258								
	FF/ENG	15529	15395	15416								
620	EPR	1.186	1.228	1.261	1.301							
	MACH	.469	.489	.501	.514							
	KIAS	259	256	252	249							
	FF/ENG	14589	14433	14371	14499							
580	EPR	1.167	1.205	1.234	1.266	1.312						
	MACH	.457	.478	.491	.504	.517						
	KIAS	253	250	247	244	241						
	FF/ENG	13649	13497	13400	13407	13541						
540	EPR	1.150	1.183	1.208	1.236	1.272	1.322					
	MACH	.444	.465	.479	.492	.505	.519					
	KIAS	245	243	241	238	235	232					
	FF/ENG	12713	12572	12457	12394	12420	12552					
500	EPR	1.132	1.162	1.184	1.208	1.239	1.277	1.336				
	MACH	.430	.452	.466	.480	.493	.507	.527				
	KIAS	238	236	234	232	229	226	226				
	FF/ENG	11769	11644	11535	11422	11399	11426	11779				
460	EPR	1.115	1.141	1.160	1.182	1.209	1.241	1.285	1.347			
	MACH	.415	.436	.451	.465	.480	.493	.513	.534			
	KIAS	229	228	226	225	223	220	220	220			
	FF/ENG	10894	10707	10614	10495	10443	10413	10634	10992			
420	EPR	1.099	1.121	1.138	1.157	1.178	1.208	1.246	1.291	1.357		
	MACH	.398	.420	.434	.449	.464	.478	.498	.519	.540		
	KIAS	220	219	218	217	215	213	213	213	213		
	FF/ENG	10010	9791	9683	9581	9527	9501	9605	9792	10171		
380	EPR	1.083	1.103	1.117	1.132	1.149	1.177	1.212	1.247	1.294	1.361	
	MACH	.381	.402	.416	.431	.446	.463	.482	.502	.523	.546	
	KIAS	210	209	209	208	207	206	206	206	206	206	
	FF/ENG	9133	8911	8771	8660	8625	8650	8724	8803	8956	9326	
340	EPR	1.070	1.086	1.098	1.110	1.121	1.147	1.180	1.209	1.245	1.293	1.360
	MACH	.362	.382	.397	.412	.429	.446	.465	.484	.505	.527	.549
	KIAS	199	199	199	199	199	199	199	199	199	199	199
	FF/ENG	8341	8164	8039	7946	7798	7838	7883	7931	7997	8134	8478

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
315	285	258	236	217	200	190	180	171	162	154
634	570	515	471	433	400	378	359	340	324	309
955	858	774	706	650	600	567	537	509	485	463
1280	1149	1035	943	867	800	756	715	679	646	617
1609	1441	1297	1180	1084	1000	944	894	848	807	771
1940	1736	1560	1419	1302	1200	1133	1072	1017	968	924
2276	2034	1825	1658	1520	1400	1322	1251	1186	1128	1077
2615	2334	2091	1898	1739	1600	1510	1429	1354	1288	1229
2959	2636	2359	2139	1958	1800	1699	1606	1523	1448	1382
3307	2942	2629	2381	2177	2000	1887	1784	1691	1607	1534
3660	3251	2901	2623	2397	2200	2075	1961	1859	1767	1685
4017	3563	3174	2867	2617	2400	2263	2139	2026	1925	1837
4378	3877	3449	3112	2838	2600	2451	2316	2193	2084	1987
4743	4194	3725	3357	3059	2800	2639	2493	2360	2242	2138
5112	4514	4003	3603	3280	3000	2827	2669	2527	2400	2288
5485	4835	4282	3850	3502	3200	3014	2845	2693	2557	2437
5862	5160	4563	4098	3724	3400	3202	3021	2858	2714	2587
6245	5488	4845	4346	3946	3600	3389	3197	3024	2870	2735
6632	5819	5129	4596	4169	3800	3577	3373	3190	3027	2884
7023	6152	5415	4846	4392	4000	3764	3549	3356	3183	3032

Reference Fuel and Time Required at Check Point

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	17.0	0:45	15.5	0:44	13.7	0:42	13.4	0:40
400	33.1	1:31	30.5	1:27	27.5	1:23	26.8	1:19
600	49.2	2:18	45.5	2:11	41.2	2:03	40.2	1:57
800	65.3	3:04	60.5	2:55	55.0	2:44	53.6	2:35
1000	81.4	3:50	75.5	3:38	68.7	3:24	67.0	3:13
1200	96.8	4:39	89.7	4:24	81.8	4:06	79.6	3:53
1400	112.2	5:27	104.0	5:09	94.9	4:48	92.2	4:32
1600	127.2	6:16	117.9	5:55	107.7	5:30	104.5	5:12
1800	142.0	7:07	131.6	6:43	120.1	6:13	116.4	5:52
2000	156.7	7:57	145.2	7:30	132.6	6:56	128.4	6:32
2200	170.9	8:50	158.4	8:19	144.5	7:40	139.8	7:13
2400	185.1	9:43	171.6	9:08	156.4	8:24	151.2	7:55
2600	198.9	10:37	184.5	9:58	168.1	9:09	162.3	8:36
2800	212.5	11:32	197.3	10:49	179.6	9:54	173.2	9:19
3000	226.0	12:27	210.0	11:40	191.1	10:40	184.0	10:01
3200	238.9	13:23	222.1	12:32	202.2	11:27	194.4	10:44
3400	251.8	14:20	234.3	13:25	213.3	12:13	204.8	11:28
3600	264.5	15:18	246.2	14:18	224.2	13:01	214.9	12:12
3800	276.8	16:17	257.9	15:12	234.9	13:49	224.8	12:56
4000	289.2	17:16	269.6	16:06	245.5	14:37	234.7	13:41

GEAR DOWN

Long Range Cruise Enroute Fuel and Time Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)									
	300	350	400	450	500	550	600	650	700	
20	-3.7	-2.9	-2.0	-1.1	0.0	2.6	5.2	8.0	10.9	
40	-7.8	-5.9	-4.0	-2.0	0.0	5.4	11.1	17.1	23.5	
60	-11.9	-8.9	-5.9	-3.0	0.0	8.0	16.5	25.6	35.2	
80	-16.1	-12.0	-7.9	-4.0	0.0	10.4	21.5	33.4	46.1	
100	-20.2	-15.0	-9.9	-5.0	0.0	12.6	26.2	40.7	56.1	
120	-24.4	-18.1	-12.0	-6.1	0.0	14.6	30.4	47.2	65.2	
140	-28.5	-21.2	-14.0	-7.1	0.0	16.5	34.2	53.2	73.5	
160	-32.7	-24.3	-16.1	-8.1	0.0	18.1	37.6	58.6	81.0	
180	-36.9	-27.4	-18.1	-9.1	0.0	19.5	40.6	63.3	87.6	
200	-41.0	-30.6	-20.2	-10.2	0.0	20.7	43.2	67.4	93.4	
220	-45.2	-33.7	-22.3	-11.2	0.0	21.8	45.4	70.9	98.3	
240	-49.4	-36.9	-24.5	-12.3	0.0	22.6	47.2	73.8	102.3	
260	-53.6	-40.1	-26.6	-13.3	0.0	23.2	48.6	76.0	105.5	
280	-57.9	-43.3	-28.8	-14.4	0.0	23.7	49.5	77.6	107.9	
300	-62.1	-46.5	-31.0	-15.5	0.0	23.9	50.1	78.6	109.4	

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30+80

PRESSURE ALT (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	54	58	63	67	71	75	79	84	88	92
TIME (MINUTES)	13	14	15	16	16	17	17	18	19	19

GEAR DOWN

**Holding
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
660	EPR	1.111	1.139	1.194	1.281			
	KIAS	249	249	249	249			
	FF/ENG	15280	15000	15140	15520			
620	EPR	1.100	1.125	1.174	1.250			
	KIAS	242	242	242	242			
	FF/ENG	14400	14090	14160	14360			
580	EPR	1.090	1.113	1.157	1.223	1.339		
	KIAS	237	237	237	237	237		
	FF/ENG	13620	13290	13290	13370	14160		
540	EPR	1.081	1.101	1.140	1.199	1.292		
	KIAS	232	232	232	232	232		
	FF/ENG	12860	12580	12460	12470	12970		
500	EPR	1.072	1.090	1.125	1.175	1.255		
	KIAS	226	226	226	226	226		
	FF/ENG	12060	11860	11680	11600	11850		
460	EPR	1.063	1.079	1.110	1.154	1.222	1.347	
	KIAS	220	220	220	220	220	220	
	FF/ENG	11250	11110	10910	10750	10850	11540	
420	EPR	1.054	1.068	1.095	1.134	1.191	1.291	
	KIAS	213	213	213	213	213	213	
	FF/ENG	10450	10300	10150	9880	9920	10280	
380	EPR	1.047	1.059	1.081	1.115	1.161	1.247	1.408
	KIAS	206	206	206	206	206	206	206
	FF/ENG	9660	9490	9380	9080	9050	9240	10040
340	EPR	1.040	1.050	1.069	1.098	1.133	1.209	1.323
	KIAS	199	199	199	199	199	199	199
	FF/ENG	9020	8860	8720	8440	8210	8330	8700

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

**Holding
Flaps 1**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
660	EPR	1.115	1.143	1.198	1.284	
	KIAS	229	229	229	229	
	FF/ENG	14670	14390	14570	14830	
620	EPR	1.103	1.129	1.177	1.252	
	KIAS	222	222	222	222	
	FF/ENG	13770	13480	13560	13700	
580	EPR	1.093	1.115	1.159	1.223	1.332
	KIAS	217	217	217	217	217
	FF/ENG	12930	12690	12630	12720	13310
540	EPR	1.083	1.103	1.142	1.197	1.285
	KIAS	212	212	212	212	212
	FF/ENG	12130	11960	11820	11820	12130
500	EPR	1.073	1.091	1.125	1.174	1.247
	KIAS	206	206	206	206	206
	FF/ENG	11300	11160	11010	10920	11050
460	EPR	1.064	1.079	1.109	1.152	1.211
	KIAS	200	200	200	200	200
	FF/ENG	10490	10340	10230	10020	10080
420	EPR	1.054	1.068	1.094	1.131	1.177
	KIAS	193	193	193	193	193
	FF/ENG	9680	9520	9440	9150	9170
380	EPR	1.047	1.058	1.080	1.111	1.146
	KIAS	186	186	186	186	186
	FF/ENG	9010	8870	8750	8490	8310
340	EPR	1.039	1.049	1.067	1.093	1.115
	KIAS	179	179	179	179	179
	FF/ENG	8200	8080	7950	7730	7610

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight
Gear Down, Engine INOP

Chapter PI
Section 47

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		VREF30 + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
500	476	224	4100	2800	
460	438	218	6700	5900	5000
420	401	211	9300	8700	7900
380	364	204	12400	11900	11100
340	326	197	14900	14000	13200

GEAR DOWN
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
500			
480	2100		
460	4000	2400	
440	5800	4800	3200
420	7500	6700	5800
400	9200	8500	7700
380	11200	10300	9500
360	12700	12200	11500
340	13900	13200	12600

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)					
		5	7	9	11	13	15
480	EPR						
	MACH						
	KIAS						
	FF/ENG						
440	EPR	1.312	1.361				
	MACH	.366	.379				
	KIAS	221	221				
	FF/ENG	20938	21487				
400	EPR	1.263	1.302	1.351	1.409		
	MACH	.349	.362	.375	.389		
	KIAS	211	211	211	210		
	FF/ENG	18577	18792	19254	19826		
360	EPR	1.227	1.257	1.294	1.342	1.403	
	MACH	.335	.347	.360	.374	.389	
	KIAS	202	203	203	203	203	
	FF/ENG	16667	16770	16958	17332	17890	
340	EPR	1.212	1.239	1.271	1.313	1.366	1.439
	MACH	.329	.341	.354	.367	.382	.397
	KIAS	199	199	199	199	199	199
	FF/ENG	15842	15909	16058	16265	16688	17379

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
500	EPR	1.286			
	KIAS	226			
	FF/ENG	23810			
460	EPR	1.255	1.320		
	KIAS	220	220		
	FF/ENG	22000	22290		
420	EPR	1.227	1.278		
	KIAS	213	213		
	FF/ENG	20230	20240		
380	EPR	1.200	1.243	1.345	
	KIAS	206	206	206	
	FF/ENG	18490	18390	19110	
340	EPR	1.175	1.212	1.291	1.439
	KIAS	199	199	199	199
	FF/ENG	16750	16630	16950	18250

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight

Text

Chapter PI

Section 48

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. 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 Flight Manual, the Flight Manual shall always take precedence.

General

FMC Takeoff Speeds

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/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 colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush 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 is determined as follows:

- (1) Determine the dry field/obstacle limit weight for the takeoff flap setting.
- (2) 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.
- (3) Adjust field length available for temperature by amount shown on chart.
- (4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Takeoff speed determination:

(1) Determine takeoff speeds V_1 , V_R and V_2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If $V_1(\text{MCG})$ limited, set $V_1 = V_1(\text{MCG})$. If not limited by $V_1(\text{MCG})$ considerations, enter the V_1 Adjustment table with actual brake release weight to determine the V_1 reduction to apply to V_1 speed. If the adjusted V_1 is less than $V_1(\text{MCG})$, set $V_1 = V_1(\text{MCG})$.

Slippery Runway

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. Good reported braking action denotes wet runway conditions or runways covered by compact snow. Similarly, poor braking action denotes runways covered with wet ice. Performance is based on reversers operating and 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.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V_1 less than minimum V_1 for control on the ground, $V_1(\text{MCG})$, and V_R less than minimum V_R , $(1.05) \text{ VMCA}$. It is therefore necessary to compare the adjusted V_1 and V_R to $V_1(\text{MCG})$ and Minimum V_R respectively. To find $V_1(\text{MCG})$ and Minimum V_R , enter the $V_1(\text{MCG})$, Minimum V_R table with the airport pressure altitude and actual OAT. If the adjusted V_1 is less than $V_1(\text{MCG})$, set V_1 equal to $V_1(\text{MCG})$. If the adjusted V_R is less than Min V_R , set V_R equal to Min V_R and determine a new V_2 by adding the difference between the normal V_R and Min V_R to the normal V_2 . No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around EPR

To find Go-Around EPR based on normal engine bleed for packs on and anti-ice off, enter the Go-Around EPR table with airport pressure altitude and reported OAT or TAT and read EPR. EPR adjustments are shown for engine bleeds for various conditions.

Max Climb EPR

This table shows Max Climb EPR for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read EPR. EPR adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body attitude and average EPR 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables 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 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. Note that these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Control

These tables provide target EPR, 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, .84 Mach approximates the Long Range Cruise Mach schedule.

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 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 .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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.

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 at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. 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 30 at the outer marker.

Holding

Target EPR, 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 for the selected flap setting. Flaps 1 is based on VREF30+60 speed schedule. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read EPR, IAS and fuel flow per engine.

Advisory Information

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding 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.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy 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 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, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

Engine Inoperative

Initial Max Continuous EPR

The Initial Max Continuous EPR setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target EPR setting at the start of driftdown. Once driftdown is established, the Max Continuous EPR table should be used to determine EPR for the given conditions.

Max Continuous EPR

Power setting is based on one engine operating with one bleed source for pack(s) operating and all anti-ice bleeds off. Enter the table for appropriate pressure altitude with IAS or Mach and TAT to read Max Continuous EPR. Apply the anti-ice corrections below the table as required.

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/Cruise 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 correct 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 Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target EPR, 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 PENALTY (LB/HR)				
	GROSS WEIGHT (1000 LB)				
	700	600	500	400	300
43				360	310
39			420	360	310
35		470	420	380	300
31	520	500	450	370	310
25	510	490	440	380	340
20	520	520	460	410	360
15	520	520	480	440	400
10	540	520	510	490	440
5	590	590	570	530	480

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 .84/310/250 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 corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required 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 is planned. The tables show gear down rate of climb available for Flaps 20 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

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in the ALTERNATE mode is to reduce the PRIMARY mode (normal) performance limited weights. The Limit Weight table provides takeoff field, climb, obstacle, net level off and approach or landing climb weights. To determine limit weights for operations with the EEC in the ALTERNATE mode, enter the table with the limit weights for PRIMARY mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. The ALTERNATE Mode EEC Approach or Landing Climb limit must be compared to the Landing Field Length limit and the more limiting of the two must be used as the landing limit weight. 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 Adjustments Table. The adjusted V1 should not exceed the adjusted VR.

NOTE: The FMC does incorporate ALTERNATE Mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule with anti-ice off. Enter the table with pressure altitude and TAT to read Max Climb %N1. Apply bleed adjustments as required.

Max Cruise %N1

Maximum Cruise %N1 is presented for .84M, which approximates Long Range Cruise speed. Enter the table with pressure altitude and TAT to read Max Cruise %N1. Appropriate bleed adjustments are shown.

Go-Around %N1

Go-Around power setting for ALTERNATE MODE EEC operation is presented for normal engine bleed for packs on. Go-Around %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Alternate Mode EEC, Engine Inoperative

Initial Max Continuous %N1

Initial Max Continuous %N1 settings for use following an engine failure are presented. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Appropriate bleed adjustments are shown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Max Continuous %N1 settings are presented as a function of pressure altitude and TAT for engine inoperative speeds of 320, 280, 240, and 200 KIAS. Power settings may be interpolated for intermediate airspeeds. Apply bleed adjustments as required.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

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Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

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****777-300ER GE90-115B LB FT FAA TO1-10 TO2-20 TALPA****Pkg Model Identification PI.ModID.50.1****General PI.50.1**

VREF	PI.50.1
Flap Maneuver Speed	PI.50.2
Slush/Standing Water Takeoff	PI.50.3
Slippery Runway Takeoff	PI.50.7
TO1 Slush/Standing Water Takeoff	PI.50.11
TO1 Slippery Runway Takeoff	PI.50.15
TO2 Slush/Standing Water Takeoff	PI.50.19
TO2 Slippery Runway Takeoff	PI.50.23
Minimum Control Speeds	PI.50.27
Go-Around %N1	PI.50.28
Max Climb %N1	PI.50.29
Flight With Unreliable Airspeed / Turbulent Air Penetration	PI.50.30

All Engine PI.51.1

Long Range Cruise Maximum Operating Altitude	PI.51.1
Long Range Cruise Control	PI.51.5
Long Range Cruise Enroute Fuel and Time - Low Altitudes ..	PI.51.6
Long Range Cruise Enroute Fuel and Time - High Altitudes ..	PI.51.7
Long Range Cruise Wind-Altitude Trade	PI.51.9
Descent at .84M/310/250	PI.51.9
Holding	PI.51.10

Advisory Information..... PI.52.1

Runway Surface Condition Correlation	PI.52.1
Normal Configuration Landing Distance	PI.52.2
Non-Normal Configuration Landing Distance	PI.52.8
Airspeed Unreliable (Flaps 20)	PI.52.8

ANTISKID (Flaps 25)	PI.52.9
ANTISKID (Flaps 30)	PI.52.10
ENG SHUTDOWN L, R (Flaps 20)	PI.52.11
ENG SHUTDOWN L, R (Flaps 30)	PI.52.12
FLAP / SLAT CONTROL (Flaps 20)	PI.52.13
FLAPS DRIVE (Flaps ≤ 5)	PI.52.14
FLAPS DRIVE ($5 < \text{Flaps} < 20$)	PI.52.15
FLAPS DRIVE (Flaps ≥ 20)	PI.52.16
FLAPS PRIMARY FAIL (Flaps 20)	PI.52.17
FLIGHT CONTROL MODE (Flaps 20)	PI.52.18
FLIGHT CONTROLS (Flaps 20)	PI.52.19
HYD PRESS SYS C (Flaps 20)	PI.52.20
HYD PRESS SYS L (Flaps 25)	PI.52.21
HYD PRESS SYS L (Flaps 30)	PI.52.22
HYD PRESS SYS L+C (Flaps 20)	PI.52.23
HYD PRESS SYS L+R (Flaps 20)	PI.52.24
HYD PRESS SYS R (Flaps 25)	PI.52.25
HYD PRESS SYS R (Flaps 30)	PI.52.26
HYD PRESS SYS R+C (Flaps 20)	PI.52.27
PITCH DOWN AUTHORITY (Flaps 25)	PI.52.28
PITCH DOWN AUTHORITY (Flaps 30)	PI.52.29
PITCH UP AUTHORITY (Flaps ≤ 15)	PI.52.30
PITCH UP AUTHORITY (Flaps ≥ 20)	PI.52.31
PRI FLIGHT COMPUTERS (Flaps 20)	PI.52.32
SLATS DRIVE (Flaps 20)	PI.52.33
SPOILERS (Flaps 25)	PI.52.34
SPOILERS (Flaps 30)	PI.52.35
STABILIZER (Flaps 20)	PI.52.36
Approach or Landing Climb Limited Weight	PI.52.37
Recommended Brake Cooling Schedule.	PI.52.39

Engine Inoperative PI.53.1

Initial Max Continuous %N1 PI.53.1

Max Continuous %N1 PI.53.2

777 Flight Crew Operations Manual

Driftdown Speed/Level Off Altitude	PI.53.5
Driftdown/LRC Cruise Range Capability	PI.53.6
Long Range Cruise Altitude Capability	PI.53.7
Long Range Cruise Control	PI.53.8
Long Range Cruise Diversion Fuel and Time	PI.53.9
Holding	PI.53.10
Gear Down Landing Rate of Climb Available	PI.53.11
Alternate Mode EEC	PI.54.1
Alternate Mode EEC Max Takeoff %N1	PI.54.1
Gear Down	PI.55.1
220 KIAS Max Climb %N1	PI.55.1
Long Range Cruise Altitude Capability	PI.55.2
Long Range Cruise Control	PI.55.3
Long Range Cruise Enroute Fuel and Time	PI.55.4
Descent at VREF30+80	PI.55.5
Holding	PI.55.6
Gear Down, Engine Inoperative	PI.56.1
Driftdown Speed/Level Off Altitude	PI.56.1
Long Range Cruise Altitude Capability	PI.56.2
Long Range Cruise Control	PI.56.3
Long Range Cruise Diversion Fuel and Time	PI.56.4
Holding	PI.56.6
Text	PI.57.1
Introduction	PI.57.1
General	PI.57.1
All Engines	PI.57.4
Advisory Information	PI.57.6
Engine Inoperative	PI.57.9
Alternate Mode EEC	PI.57.12
Gear Down	PI.57.12

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**Performance Inflight
Pkg Model Identification****Chapter PI
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
300ER	777-300ER	7350	WY350

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Performance Inflight
General

Chapter PI
Section 50

VREF

WEIGHT (1000 LB)	VREF (KIAS)		
	FLAPS		
	30	25	20
800	185	187	200
750	180	183	196
700	173	177	189
650	162	171	183
600	156	164	176
550	149	157	168
500	142	150	161
450	135	142	152
400	127	134	144
350	118	125	134

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

ADVISORY INFORMATION**Slush/Standing Water Takeoff****Maximum Reverse Thrust****Weight Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-83.3	-94.5	-105.7	-98.7	-109.9	-121.1	-124.4	-135.6	-146.8
800	-80.4	-91.6	-102.8	-94.8	-106.0	-117.2	-118.5	-129.7	-140.9
760	-77.3	-88.5	-99.7	-90.6	-101.8	-113.0	-112.4	-123.6	-134.8
720	-73.5	-84.7	-95.9	-85.8	-97.0	-108.2	-105.5	-116.7	-127.9
680	-69.1	-80.3	-91.5	-80.2	-91.4	-102.6	-97.9	-109.1	-120.3
640	-63.9	-75.1	-86.3	-73.8	-85.0	-96.2	-89.5	-100.7	-111.9
600	-58.1	-69.3	-80.5	-66.8	-78.0	-89.2	-80.3	-91.5	-102.7
560	-51.6	-62.8	-74.0	-59.0	-70.2	-81.4	-70.3	-81.5	-92.7
520	-44.5	-55.7	-66.9	-50.5	-61.7	-72.9	-59.6	-70.8	-82.0
480	-36.6	-47.8	-59.0	-41.3	-52.5	-63.7	-48.1	-59.3	-70.5
440	-28.1	-39.3	-50.5	-31.4	-42.6	-53.8	-35.8	-47.0	-58.2
400	-19.1	-30.3	-41.5	-20.9	-32.1	-43.3	-22.9	-34.1	-45.3
360	-10.1	-21.3	-32.5	-10.4	-21.6	-32.8	-10.1	-21.3	-32.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7000	343.3			371.4			419.6		
7400	396.8			425.4			475.2	370.4	
7800	450.6	348.7		480.7	376.8		532.2	425.1	
8200	506.2	402.1		537.5	430.9		590.6	480.8	375.9
8600	563.6	456.1	354.0	596.2	486.3	382.2	650.7	537.9	430.7
9000	623.2	511.8	407.5	656.9	543.3	436.4	712.6	596.6	486.5
9400	685.1	569.5	461.6	719.8	602.2	491.9	776.3	656.8	543.7
9800	749.7	629.2	517.5	785.2	663.1	549.1		718.9	602.5
10200	817.0	691.4	575.4		726.2	608.2		782.9	662.9
10600		756.3	635.3		791.9	669.3			725.2
11000		823.8	697.8			732.7			789.4
11400			763.0			798.6			

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 -180 ft/+170 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-25	-23	-21	-21	-19	-17	-14	-12	-10
760	-27	-25	-23	-23	-21	-19	-15	-13	-11
720	-29	-27	-25	-25	-23	-21	-16	-14	-12
680	-30	-28	-26	-26	-24	-22	-18	-16	-14
640	-31	-29	-27	-27	-25	-23	-19	-17	-15
600	-31	-29	-27	-28	-26	-24	-20	-18	-16
560	-31	-29	-27	-28	-26	-24	-22	-20	-18
520	-31	-29	-27	-28	-26	-24	-23	-21	-19
480	-30	-28	-26	-28	-26	-24	-23	-21	-19
440	-29	-27	-25	-28	-26	-24	-24	-22	-20
400	-29	-27	-25	-27	-25	-23	-24	-22	-20
360	-28	-26	-24	-26	-24	-22	-24	-22	-20

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 Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-115.4	-127.8	-140.2	-134.1	-146.5	-158.9	-164.7	-177.1	-189.5
800	-110.3	-122.7	-135.1	-127.5	-139.9	-152.3	-155.2	-167.6	-180.0
760	-105.1	-117.5	-129.9	-120.8	-133.2	-145.6	-145.5	-157.9	-170.3
720	-99.3	-111.7	-124.1	-113.4	-125.8	-138.2	-135.4	-147.8	-160.2
680	-92.9	-105.3	-117.7	-105.5	-117.9	-130.3	-124.7	-137.1	-149.5
640	-85.9	-98.3	-110.7	-97.0	-109.4	-121.8	-113.5	-125.9	-138.3
600	-78.3	-90.7	-103.1	-88.0	-100.4	-112.8	-101.8	-114.2	-126.6
560	-70.1	-82.5	-94.9	-78.3	-90.7	-103.1	-89.6	-102.0	-114.4
520	-61.3	-73.7	-86.1	-68.1	-80.5	-92.9	-76.9	-89.3	-101.7
480	-51.9	-64.3	-76.7	-57.3	-69.7	-82.1	-63.7	-76.1	-88.5
440	-42.0	-54.4	-66.8	-45.9	-58.3	-70.7	-49.9	-62.3	-74.7
400	-31.6	-44.0	-56.4	-34.1	-46.5	-58.9	-35.8	-48.2	-60.6
360	-21.2	-33.6	-46.0	-22.2	-34.6	-47.0	-21.7	-34.1	-46.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
10200							429.6		
10600							495.1		
11000				363.8			562.5	449.1	339.8
11400				431.9	316.1		632.0	515.1	403.9
11800	363.6			502.3	384.2		703.7	583.1	468.7
12200	434.3	314.3		575.7	452.7	336.6	778.0	653.3	535.3
12600	508.2	384.8		652.8	523.9	404.6		725.7	603.9
13000	586.7	456.1	335.4	734.1	598.5	473.8		800.8	674.8
13400	670.7	531.2	405.9	820.0	676.7	545.9			748.0
13800	761.9	611.3	478.2		759.4	621.5			823.6
14200	859.2	697.2	554.7		846.1	701.0			
14600		790.9	636.4			785.2			
15000			724.4						

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 -280 ft/+270 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-41	-37	-33	-35	-31	-27	-23	-19	-15
760	-43	-39	-35	-37	-33	-29	-25	-21	-17
720	-45	-41	-37	-39	-35	-31	-27	-23	-19
680	-46	-42	-38	-41	-37	-33	-29	-25	-21
640	-47	-43	-39	-42	-38	-34	-32	-28	-24
600	-47	-43	-39	-43	-39	-35	-34	-30	-26
560	-47	-43	-39	-44	-40	-36	-36	-32	-28
520	-47	-43	-39	-44	-40	-36	-37	-33	-29
480	-47	-43	-39	-44	-40	-36	-39	-35	-31
440	-46	-42	-38	-44	-40	-36	-40	-36	-32
400	-46	-42	-38	-44	-40	-36	-40	-36	-32
360	-45	-41	-37	-44	-40	-36	-41	-37	-33

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	-3.2	-6.4	-45.4	-48.6	-51.8	-85.6	-88.8	-92.0
800	0.0	-3.2	-6.4	-46.4	-49.6	-52.8	-83.4	-86.6	-89.8
760	-2.4	-5.6	-8.8	-47.3	-50.5	-53.7	-81.1	-84.3	-87.5
720	-7.6	-10.8	-14.0	-47.7	-50.9	-54.1	-78.5	-81.7	-84.9
680	-11.3	-14.5	-17.7	-47.6	-50.8	-54.0	-75.7	-78.9	-82.1
640	-13.2	-16.4	-19.6	-47.0	-50.2	-53.4	-72.5	-75.7	-78.9
600	-13.9	-17.1	-20.3	-45.2	-48.4	-51.6	-68.3	-71.5	-74.7
560	-13.6	-16.8	-20.0	-42.2	-45.4	-48.6	-62.7	-65.9	-69.1
520	-12.4	-15.6	-18.8	-37.9	-41.1	-44.3	-55.7	-58.9	-62.1
480	-10.3	-13.5	-16.7	-32.1	-35.3	-38.5	-47.3	-50.5	-53.7
440	-7.2	-10.4	-13.6	-25.1	-28.3	-31.5	-37.5	-40.7	-43.9
400	-3.2	-6.4	-9.6	-16.8	-20.0	-23.2	-26.3	-29.5	-32.7
360	0.0	-1.4	-4.6	-7.1	-10.3	-13.5	-13.7	-16.9	-20.1

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5000	396.3								
5400	513.2	396.3							
5800	629.1	513.2	396.3						
6200	744.1	629.1	513.2	317.2					
6600	858.4	744.1	629.1	391.6					
7000		858.4	744.1	468.4	361.7				
7400			858.4	548.5	437.4	332.1			
7800				632.2	516.0	406.8			
8200				720.2	598.3	484.2	369.2		
8600				812.9	684.4	564.9	414.9		
9000					775.2	649.4	462.2	360.3	
9400						738.3	511.2	405.7	
9800						831.7	562.3	452.6	351.4
10200							615.7	501.3	396.4
10600							671.7	551.9	443.0
11000							730.6	604.8	491.4
11400							793.3	660.2	541.6
11800								718.6	594.0
12200								780.4	648.9
12600									706.6
13000									767.8

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 -90 ft/+90 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -190 ft/+180 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-7	-5	-3	-18	-16	-14	-32	-30	-28
760	-9	-7	-5	-21	-19	-17	-35	-33	-31
720	-10	-8	-6	-23	-21	-19	-37	-35	-33
680	-11	-9	-7	-24	-22	-20	-39	-37	-35
640	-12	-10	-8	-25	-23	-21	-40	-38	-36
600	-13	-11	-9	-26	-24	-22	-41	-39	-37
560	-13	-11	-9	-26	-24	-22	-41	-39	-37
520	-13	-11	-9	-27	-25	-23	-42	-40	-38
480	-14	-12	-10	-27	-25	-23	-42	-40	-38
440	-14	-12	-10	-27	-25	-23	-42	-40	-38
400	-14	-12	-10	-28	-26	-24	-42	-40	-38
360	-15	-13	-11	-29	-27	-25	-41	-39	-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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-6.4	-6.4	-6.4	-74.5	-74.5	-74.5	-126.1	-126.1	-126.1
800	-11.5	-11.5	-11.5	-73.4	-73.4	-73.4	-120.9	-120.9	-120.9
760	-16.3	-16.3	-16.3	-72.4	-72.4	-72.4	-115.8	-115.8	-115.8
720	-20.5	-20.5	-20.5	-71.5	-71.5	-71.5	-111.2	-111.2	-111.2
680	-23.8	-23.8	-23.8	-70.8	-70.8	-70.8	-107.0	-107.0	-107.0
640	-26.4	-26.4	-26.4	-70.2	-70.2	-70.2	-103.2	-103.2	-103.2
600	-27.7	-27.7	-27.7	-68.3	-68.3	-68.3	-98.4	-98.4	-98.4
560	-27.6	-27.6	-27.6	-64.5	-64.5	-64.5	-92.0	-92.0	-92.0
520	-26.1	-26.1	-26.1	-58.9	-58.9	-58.9	-83.7	-83.7	-83.7
480	-23.2	-23.2	-23.2	-51.3	-51.3	-51.3	-73.8	-73.8	-73.8
440	-18.9	-18.9	-18.9	-42.0	-42.0	-42.0	-62.3	-62.3	-62.3
400	-13.2	-13.2	-13.2	-30.7	-30.7	-30.7	-49.0	-49.0	-49.0
360	-6.0	-6.0	-6.0	-17.5	-17.5	-17.5	-33.9	-33.9	-33.9

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
6200	502.7	311.8							
6600	678.3	541.9	365.2						
7000	820.6	708.7	578.6						
7400		847.7	737.9						
7800			874.7						
9400				405.5					
9800				613.9	380.0				
10200				775.2	595.7	353.1			
10600					760.3	577.1			
11000					905.4	745.3			
11400						890.9			
...									
15400							324.8		
15800							570.0	294.2	
16200							738.4	550.3	
16600							879.7	723.4	529.9
17000								865.7	708.0
17400									851.7

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 -100 ft/+90 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -270 ft/+270 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-10	-6	-2	-27	-23	-19	-52	-48	-44
760	-12	-8	-4	-30	-26	-22	-55	-51	-47
720	-14	-10	-6	-32	-28	-24	-58	-54	-50
680	-15	-11	-7	-35	-31	-27	-61	-57	-53
640	-17	-13	-9	-36	-32	-28	-64	-60	-56
600	-18	-14	-10	-38	-34	-30	-67	-63	-59
560	-18	-14	-10	-40	-36	-32	-69	-65	-61
520	-19	-15	-11	-41	-37	-33	-70	-66	-62
480	-20	-16	-12	-43	-39	-35	-71	-67	-63
440	-21	-17	-13	-44	-40	-36	-71	-67	-63
400	-22	-18	-14	-46	-42	-38	-71	-67	-63
360	-23	-19	-15	-48	-44	-40	-71	-67	-63

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**TO1 Slush/Standing Water Takeoff****10% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 LB)**

TO1 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-78.3	-89.5	-100.7	-93.6	-104.8	-116.0	-119.3	-130.5	-141.7
800	-75.4	-86.6	-97.8	-89.7	-100.9	-112.1	-113.6	-124.8	-136.0
760	-72.7	-83.9	-95.1	-86.1	-97.3	-108.5	-108.3	-119.5	-130.7
720	-70.3	-81.5	-92.7	-82.7	-93.9	-105.1	-103.1	-114.3	-125.5
680	-67.3	-78.5	-89.7	-78.7	-89.9	-101.1	-97.2	-108.4	-119.6
640	-63.5	-74.7	-85.9	-73.8	-85.0	-96.2	-90.3	-101.5	-112.7
600	-58.8	-70.0	-81.2	-68.0	-79.2	-90.4	-82.6	-93.8	-105.0
560	-53.4	-64.6	-75.8	-61.4	-72.6	-83.8	-73.8	-85.0	-96.2
520	-47.2	-58.4	-69.6	-53.9	-65.1	-76.3	-64.2	-75.4	-86.6
480	-40.2	-51.4	-62.6	-45.6	-56.8	-68.0	-53.7	-64.9	-76.1
440	-32.4	-43.6	-54.8	-36.5	-47.7	-58.9	-42.2	-53.4	-64.6
400	-23.8	-35.0	-46.2	-26.5	-37.7	-48.9	-29.9	-41.1	-52.3
360	-14.8	-26.0	-37.2	-16.0	-27.2	-38.4	-17.0	-28.2	-39.4

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800							313.5		
6200	298.1			325.6			373.3		
6600	356.6			384.7			433.3	319.5	
7000	415.2	303.9		444.3	331.5		494.7	379.3	
7400	475.2	362.4		505.8	390.7		558.0	439.3	325.5
7800	537.5	421.1	309.7	569.5	450.4	337.4	623.5	501.0	385.3
8200	602.5	481.3	368.3	635.8	512.1	396.6	691.1	564.5	445.4
8600	670.4	543.9	427.0	704.9	576.1	456.5	761.3	630.1	507.2
9000	741.8	609.1	487.5	777.2	642.6	518.3	833.8	698.0	570.9
9400	816.8	677.4	550.3	851.9	712.0	582.6	906.6	768.5	636.8
9800	892.7	749.1	615.8		784.7	649.4		841.0	704.9
10200		824.4	684.4		859.4	719.1		913.9	775.7
10600		900.3	756.5			792.2			848.3
11000			832.0			866.9			
11400			907.9						

1. Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -180 ft/+170 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

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-22	-20	-18	-17	-15	-13	-9	-7	-5
760	-24	-22	-20	-20	-18	-16	-11	-9	-7
720	-26	-24	-22	-21	-19	-17	-12	-10	-8
680	-27	-25	-23	-23	-21	-19	-14	-12	-10
640	-28	-26	-24	-24	-22	-20	-15	-13	-11
600	-28	-26	-24	-25	-23	-21	-17	-15	-13
560	-28	-26	-24	-25	-23	-21	-18	-16	-14
520	-28	-26	-24	-25	-23	-21	-19	-17	-15
480	-27	-25	-23	-25	-23	-21	-20	-18	-16
440	-26	-24	-22	-24	-22	-20	-20	-18	-16
400	-26	-24	-22	-24	-22	-20	-20	-18	-16
360	-25	-23	-21	-23	-21	-19	-20	-18	-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**TO1 Slush/Standing Water Takeoff****10% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 LB)**

TO1 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-111.3	-123.7	-136.1	-130.5	-142.9	-155.3	-162.7	-175.1	-187.5
800	-106.4	-118.8	-131.2	-124.1	-136.5	-148.9	-153.4	-165.8	-178.2
760	-101.6	-114.0	-126.4	-117.8	-130.2	-142.6	-144.3	-156.7	-169.1
720	-96.9	-109.3	-121.7	-111.7	-124.1	-136.5	-135.3	-147.7	-160.1
680	-91.7	-104.1	-116.5	-105.0	-117.4	-129.8	-125.8	-138.2	-150.6
640	-85.8	-98.2	-110.6	-97.7	-110.1	-122.5	-115.7	-128.1	-140.5
600	-79.3	-91.7	-104.1	-89.7	-102.1	-114.5	-105.0	-117.4	-129.8
560	-72.0	-84.4	-96.8	-80.9	-93.3	-105.7	-93.7	-106.1	-118.5
520	-64.1	-76.5	-88.9	-71.5	-83.9	-96.3	-81.8	-94.2	-106.6
480	-55.4	-67.8	-80.2	-61.5	-73.9	-86.3	-69.2	-81.6	-94.0
440	-46.1	-58.5	-70.9	-50.7	-63.1	-75.5	-56.1	-68.5	-80.9
400	-36.1	-48.5	-60.9	-39.3	-51.7	-64.1	-42.4	-54.8	-67.2
360	-25.7	-38.1	-50.5	-27.5	-39.9	-52.3	-28.3	-40.7	-53.1

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
8600							302.3		
9000							375.7		
9400							450.3	324.3	
9800				329.4			528.3	397.8	
10200				410.6			610.1	473.2	346.3
10600	356.7			495.2	353.6		696.5	552.3	420.2
11000	443.9	296.6		585.8	435.3	297.2	788.1	635.4	496.6
11400	537.9	382.5		683.6	521.6	377.9	883.3	723.3	576.8
11800	641.5	471.2	322.2	790.5	614.2	460.6		816.4	661.3
12200	757.9	567.8	408.4	903.3	714.6	548.6		912.1	750.7
12600	886.3	674.7	499.2		824.0	643.4			844.9
13000		795.8	598.6			746.4			
13400			709.4			857.8			
13800			834.4						

1. Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -280 ft/+270 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

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-36	-32	-28	-29	-25	-21	-16	-12	-8
760	-39	-35	-31	-32	-28	-24	-18	-14	-10
720	-41	-37	-33	-34	-30	-26	-20	-16	-12
680	-42	-38	-34	-36	-32	-28	-23	-19	-15
640	-43	-39	-35	-37	-33	-29	-25	-21	-17
600	-43	-39	-35	-39	-35	-31	-28	-24	-20
560	-43	-39	-35	-39	-35	-31	-30	-26	-22
520	-43	-39	-35	-40	-36	-32	-32	-28	-24
480	-43	-39	-35	-40	-36	-32	-34	-30	-26
440	-42	-38	-34	-40	-36	-32	-35	-31	-27
400	-41	-37	-33	-39	-35	-31	-35	-31	-27
360	-41	-37	-33	-39	-35	-31	-36	-32	-28

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**TO1 Slippery Runway Takeoff****10% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 LB)**

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	-3.2	-6.4	-39.0	-42.2	-45.4	-79.4	-82.6	-85.8
800	0.0	-3.2	-6.4	-40.0	-43.2	-46.4	-77.2	-80.4	-83.6
760	0.0	-3.2	-6.4	-41.1	-44.3	-47.5	-75.3	-78.5	-81.7
720	-0.9	-4.1	-7.3	-42.4	-45.6	-48.8	-73.8	-77.0	-80.2
680	-6.4	-9.6	-12.8	-43.4	-46.6	-49.8	-72.0	-75.2	-78.4
640	-10.3	-13.5	-16.7	-43.8	-47.0	-50.2	-69.9	-73.1	-76.3
600	-12.3	-15.5	-18.7	-43.6	-46.8	-50.0	-67.4	-70.6	-73.8
560	-13.0	-16.2	-19.4	-42.1	-45.3	-48.5	-63.6	-66.8	-70.0
520	-12.7	-15.9	-19.1	-39.2	-42.4	-45.6	-58.2	-61.4	-64.6
480	-11.4	-14.6	-17.8	-34.8	-38.0	-41.2	-51.3	-54.5	-57.7
440	-9.1	-12.3	-15.5	-29.0	-32.2	-35.4	-42.9	-46.1	-49.3
400	-5.7	-8.9	-12.1	-21.7	-24.9	-28.1	-32.8	-36.0	-39.2
360	-1.3	-4.5	-7.7	-12.9	-16.1	-19.3	-21.1	-24.3	-27.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4600	364.9								
5000	488.8	364.9							
5400	611.7	488.8	364.9						
5800	733.7	611.7	488.8	310.5					
6200	855.0	733.7	611.7	389.4					
6600		855.0	733.7	470.9	357.7				
7000			855.0	556.1	437.9	326.3	284.0		
7400				645.6	521.6	405.4	331.5		
7800				740.0	609.2	487.6	379.1		
8200				839.5	701.6	573.7	428.1	322.0	
8600					799.4	664.1	479.0	369.5	
9000					899.6	759.6	532.1	418.1	312.5
9400						859.5	587.5	468.6	360.0
9800							645.8	521.3	408.3
10200							707.4	576.2	458.4
10600							772.8	633.9	510.6
11000							841.4	694.8	565.0
11400							910.2	759.4	622.2
11800								827.7	682.3
12200								896.5	746.1
12600									813.9
13000									882.7

1. Enter Weight Adjustment table with reported braking action and TO1 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 -130 ft/+120 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -190 ft/+180 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

TO1 Slippery Runway Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-6	-4	-2	-16	-14	-12	-29	-27	-25
760	-8	-6	-4	-19	-17	-15	-32	-30	-28
720	-9	-7	-5	-20	-18	-16	-34	-32	-30
680	-10	-8	-6	-22	-20	-18	-35	-33	-31
640	-11	-9	-7	-23	-21	-19	-37	-35	-33
600	-11	-9	-7	-23	-21	-19	-37	-35	-33
560	-12	-10	-8	-24	-22	-20	-38	-36	-34
520	-12	-10	-8	-24	-22	-20	-38	-36	-34
480	-12	-10	-8	-24	-22	-20	-38	-36	-34
440	-12	-10	-8	-25	-23	-21	-38	-36	-34
400	-13	-11	-9	-25	-23	-21	-38	-36	-34
360	-13	-11	-9	-26	-24	-22	-38	-36	-34

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**TO1 Slippery Runway Takeoff****10% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 LB)**

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	0.0	0.0	-68.2	-68.2	-68.2	-120.4	-120.4	-120.4
800	-3.6	-3.6	-3.6	-67.1	-67.1	-67.1	-115.5	-115.5	-115.5
760	-8.7	-8.7	-8.7	-66.3	-66.3	-66.3	-110.9	-110.9	-110.9
720	-13.7	-13.7	-13.7	-65.8	-65.8	-65.8	-106.5	-106.5	-106.5
680	-18.2	-18.2	-18.2	-65.5	-65.5	-65.5	-102.6	-102.6	-102.6
640	-21.8	-21.8	-21.8	-65.3	-65.3	-65.3	-99.2	-99.2	-99.2
600	-24.5	-24.5	-24.5	-65.2	-65.2	-65.2	-96.2	-96.2	-96.2
560	-25.9	-25.9	-25.9	-63.7	-63.7	-63.7	-91.9	-91.9	-91.9
520	-25.8	-25.8	-25.8	-60.1	-60.1	-60.1	-85.7	-85.7	-85.7
480	-24.2	-24.2	-24.2	-54.4	-54.4	-54.4	-77.7	-77.7	-77.7
440	-21.1	-21.1	-21.1	-46.7	-46.7	-46.7	-67.7	-67.7	-67.7
400	-16.4	-16.4	-16.4	-36.9	-36.9	-36.9	-55.8	-55.8	-55.8
360	-10.2	-10.2	-10.2	-24.9	-24.9	-24.9	-41.8	-41.8	-41.8

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800	519.6	314.6							
6200	705.4	561.1	372.9						
6600	857.4	737.4	600.0						
7000		887.0	768.3						
7400			916.7						
8600				341.7					
9000				588.1	311.8				
9400				769.2	567.4	282.0			
9800					752.8	546.0			
10200					912.9	736.0			
10600						896.9			
...									
14200							401.0		
14600							637.8	369.0	
15000							808.0	618.2	335.0
15400								792.4	597.9
15800									776.8

1. Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -100 ft/+90 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -270 ft/+270 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

TO1 Slippery Runway Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-9	-5	-1	-24	-20	-16	-47	-43	-39
760	-11	-7	-3	-26	-22	-18	-50	-46	-42
720	-12	-8	-4	-29	-25	-21	-53	-49	-45
680	-14	-10	-6	-31	-27	-23	-56	-52	-48
640	-15	-11	-7	-32	-28	-24	-58	-54	-50
600	-16	-12	-8	-34	-30	-26	-61	-57	-53
560	-16	-12	-8	-35	-31	-27	-63	-59	-55
520	-17	-13	-9	-37	-33	-29	-64	-60	-56
480	-18	-14	-10	-38	-34	-30	-65	-61	-57
440	-18	-14	-10	-40	-36	-32	-65	-61	-57
400	-19	-15	-11	-41	-37	-33	-65	-61	-57
360	-20	-16	-12	-43	-39	-35	-65	-61	-57

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**TO2 Slush/Standing Water Takeoff****20% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 LB)**

TO2 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-74.8	-86.0	-97.2	-90.1	-101.3	-112.5	-116.1	-127.3	-138.5
800	-71.8	-83.0	-94.2	-86.1	-97.3	-108.5	-110.2	-121.4	-132.6
760	-68.9	-80.1	-91.3	-82.2	-93.4	-104.6	-104.5	-115.7	-126.9
720	-66.2	-77.4	-88.6	-78.6	-89.8	-101.0	-99.3	-110.5	-121.7
680	-64.0	-75.2	-86.4	-75.6	-86.8	-98.0	-94.6	-105.8	-117.0
640	-61.6	-72.8	-84.0	-72.2	-83.4	-94.6	-89.5	-100.7	-111.9
600	-58.3	-69.5	-80.7	-67.9	-79.1	-90.3	-83.2	-94.4	-105.6
560	-54.1	-65.3	-76.5	-62.5	-73.7	-84.9	-76.0	-87.2	-98.4
520	-48.9	-60.1	-71.3	-56.2	-67.4	-78.6	-67.5	-78.7	-89.9
480	-42.8	-54.0	-65.2	-48.8	-60.0	-71.2	-58.1	-69.3	-80.5
440	-35.8	-47.0	-58.2	-40.6	-51.8	-63.0	-47.6	-58.8	-70.0
400	-27.9	-39.1	-50.3	-31.3	-42.5	-53.7	-36.0	-47.2	-58.4
360	-19.2	-30.4	-41.6	-21.1	-32.3	-43.5	-23.5	-34.7	-45.9

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400							315.6		
5800	306.4			334.0			381.9		
6200	371.3			399.6			448.5	322.3	
6600	436.5	312.9		466.1	340.6		517.2	388.5	
7000	504.0	377.8		535.2	406.2	281.7	588.3	455.3	328.9
7400	574.5	443.1	319.4	607.3	472.9	347.1	662.0	524.2	395.1
7800	648.6	510.9	384.3	682.7	542.3	412.7	738.8	595.5	462.1
8200	726.6	581.7	449.7	761.9	614.7	479.7	818.6	669.6	531.2
8600	809.2	656.1	517.8	844.5	690.5	549.4	899.3	746.6	602.8
9000	893.4	734.7	589.0		770.0	622.1		826.7	677.1
9400		817.6	663.8		852.7	698.2		907.4	754.5
9800		901.8	742.8			778.2			834.7
10200			826.0			861.0			915.5
10600			910.2						

1. Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -180 ft/+170 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

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-19	-17	-15	-14	-12	-10	-5	-3	-1
760	-21	-19	-17	-16	-14	-12	-6	-4	-2
720	-23	-21	-19	-18	-16	-14	-8	-6	-4
680	-24	-22	-20	-20	-18	-16	-10	-8	-6
640	-25	-23	-21	-21	-19	-17	-11	-9	-7
600	-26	-24	-22	-22	-20	-18	-13	-11	-9
560	-25	-23	-21	-22	-20	-18	-14	-12	-10
520	-25	-23	-21	-22	-20	-18	-15	-13	-11
480	-24	-22	-20	-22	-20	-18	-16	-14	-12
440	-23	-21	-19	-21	-19	-17	-17	-15	-13
400	-23	-21	-19	-21	-19	-17	-17	-15	-13
360	-22	-20	-18	-20	-18	-16	-17	-15	-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**TO2 Slush/Standing Water Takeoff****20% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 LB)**

TO2 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-109.4	-121.8	-134.2	-129.3	-141.7	-154.1	-163.0	-175.4	-187.8
800	-104.3	-116.7	-129.1	-122.7	-135.1	-147.5	-153.5	-165.9	-178.3
760	-99.3	-111.7	-124.1	-116.2	-128.6	-141.0	-144.3	-156.7	-169.1
720	-94.5	-106.9	-119.3	-109.9	-122.3	-134.7	-135.2	-147.6	-160.0
680	-89.9	-102.3	-114.7	-103.8	-116.2	-128.6	-126.2	-138.6	-151.0
640	-85.0	-97.4	-109.8	-97.5	-109.9	-122.3	-117.0	-129.4	-141.8
600	-79.3	-91.7	-104.1	-90.3	-102.7	-115.1	-107.1	-119.5	-131.9
560	-72.8	-85.2	-97.6	-82.4	-94.8	-107.2	-96.5	-108.9	-121.3
520	-65.6	-78.0	-90.4	-73.7	-86.1	-98.5	-85.2	-97.6	-110.0
480	-57.6	-70.0	-82.4	-64.3	-76.7	-89.1	-73.3	-85.7	-98.1
440	-48.9	-61.3	-73.7	-54.1	-66.5	-78.9	-60.7	-73.1	-85.5
400	-39.4	-51.8	-64.2	-43.2	-55.6	-68.0	-47.4	-59.8	-72.2
360	-29.1	-41.5	-53.9	-31.6	-44.0	-56.4	-33.5	-45.9	-58.3

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7800							295.8		
8200							383.1		
8600							473.0	322.0	
9000				370.5			569.3	409.6	
9400	333.9			472.2	302.1		673.2	501.3	348.2
9800	441.8			583.6	400.5		786.0	599.7	436.6
10200	561.3	365.8		707.9	504.5	331.3	905.9	706.0	530.1
10600	699.2	476.0	291.8	848.1	619.3	430.6		821.4	630.6
11000	862.5	600.4	397.7		748.3	537.4			739.4
11400		745.9	511.6		892.3	656.4			857.4
11800		913.7	641.6			790.6			
12200			794.8						

1. Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -280 ft/+270 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

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-31	-27	-23	-23	-19	-15	-7	-3	0
760	-34	-30	-26	-26	-22	-18	-10	-6	-2
720	-36	-32	-28	-29	-25	-21	-12	-8	-4
680	-37	-33	-29	-31	-27	-23	-15	-11	-7
640	-38	-34	-30	-32	-28	-24	-18	-14	-10
600	-39	-35	-31	-34	-30	-26	-21	-17	-13
560	-39	-35	-31	-34	-30	-26	-24	-20	-16
520	-39	-35	-31	-35	-31	-27	-26	-22	-18
480	-38	-34	-30	-35	-31	-27	-28	-24	-20
440	-38	-34	-30	-35	-31	-27	-29	-25	-21
400	-37	-33	-29	-35	-31	-27	-30	-26	-22
360	-36	-32	-28	-34	-30	-26	-31	-27	-23

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**TO2 Slippery Runway Takeoff****20% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 LB)**

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	-3.2	-6.4	-34.0	-37.2	-40.4	-75.3	-78.5	-81.7
800	0.0	-3.2	-6.4	-35.0	-38.2	-41.4	-73.1	-76.3	-79.5
760	0.0	-3.2	-6.4	-36.0	-39.2	-42.4	-70.9	-74.1	-77.3
720	0.0	-3.2	-6.4	-37.0	-40.2	-43.4	-69.1	-72.3	-75.5
680	0.0	-3.2	-6.4	-38.6	-41.8	-45.0	-67.9	-71.1	-74.3
640	-5.6	-8.8	-12.0	-39.9	-43.1	-46.3	-66.6	-69.8	-73.0
600	-9.6	-12.8	-16.0	-40.6	-43.8	-47.0	-64.9	-68.1	-71.3
560	-11.5	-14.7	-17.9	-40.6	-43.8	-47.0	-62.8	-66.0	-69.2
520	-12.2	-15.4	-18.6	-39.2	-42.4	-45.6	-59.1	-62.3	-65.5
480	-11.8	-15.0	-18.2	-36.3	-39.5	-42.7	-53.8	-57.0	-60.2
440	-10.3	-13.5	-16.7	-31.7	-34.9	-38.1	-46.7	-49.9	-53.1
400	-7.7	-10.9	-14.1	-25.5	-28.7	-31.9	-37.9	-41.1	-44.3
360	-4.0	-7.2	-10.4	-17.8	-21.0	-24.2	-27.4	-30.6	-33.8

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4200	324.0								
4600	455.9	324.0							
5000	586.8	455.9	324.0						
5400	716.7	586.8	455.9	299.5					
5800	845.8	716.7	586.8	383.3					
6200		845.8	716.7	470.0	349.7				
6600			845.8	560.9	434.9	316.2	286.7		
7000				656.8	524.0	400.4	337.3		
7400				758.6	617.9	487.8	388.3		
7800				865.4	717.1	579.7	441.1	327.2	
8200					822.5	676.7	496.2	378.0	
8600						779.7	553.9	430.4	317.0
9000						886.8	614.6	485.0	367.7
9400							678.8	542.1	419.7
9800							747.2	602.2	473.8
10200							820.2	665.6	530.5
10600							894.1	733.1	589.9
11000								805.4	652.6
11400								879.3	719.3
11800									790.6
12200									864.5

1. Enter Weight Adjustment table with reported braking action and TO2 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 -130 ft/+120 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -190 ft/+180 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

TO2 Slippery Runway Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-6	-4	-2	-15	-13	-11	-27	-25	-23
760	-7	-5	-3	-17	-15	-13	-29	-27	-25
720	-9	-7	-5	-19	-17	-15	-31	-29	-27
680	-9	-7	-5	-20	-18	-16	-32	-30	-28
640	-10	-8	-6	-21	-19	-17	-33	-31	-29
600	-10	-8	-6	-21	-19	-17	-34	-32	-30
560	-11	-9	-7	-22	-20	-18	-35	-33	-31
520	-11	-9	-7	-22	-20	-18	-35	-33	-31
480	-11	-9	-7	-22	-20	-18	-35	-33	-31
440	-11	-9	-7	-23	-21	-19	-35	-33	-31
400	-12	-10	-8	-23	-21	-19	-35	-33	-31
360	-12	-10	-8	-23	-21	-19	-35	-33	-31

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**TO2 Slippery Runway Takeoff****20% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 LB)**

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	0.0	0.0	-64.0	-64.0	-64.0	-117.7	-117.7	-117.7
800	0.0	0.0	0.0	-63.0	-63.0	-63.0	-112.5	-112.5	-112.5
760	-1.6	-1.6	-1.6	-61.9	-61.9	-61.9	-107.6	-107.6	-107.6
720	-6.7	-6.7	-6.7	-61.0	-61.0	-61.0	-103.1	-103.1	-103.1
680	-11.8	-11.8	-11.8	-60.7	-60.7	-60.7	-99.0	-99.0	-99.0
640	-16.4	-16.4	-16.4	-60.6	-60.6	-60.6	-95.4	-95.4	-95.4
600	-20.2	-20.2	-20.2	-60.7	-60.7	-60.7	-92.4	-92.4	-92.4
560	-23.0	-23.0	-23.0	-60.9	-60.9	-60.9	-89.7	-89.7	-89.7
520	-24.4	-24.4	-24.4	-59.4	-59.4	-59.4	-85.6	-85.6	-85.6
480	-24.1	-24.1	-24.1	-55.6	-55.6	-55.6	-79.4	-79.4	-79.4
440	-22.2	-22.2	-22.2	-49.6	-49.6	-49.6	-71.1	-71.1	-71.1
400	-18.6	-18.6	-18.6	-41.4	-41.4	-41.4	-60.7	-60.7	-60.7
360	-13.5	-13.5	-13.5	-30.9	-30.9	-30.9	-48.1	-48.1	-48.1

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400	522.5	295.8							
5800	723.4	567.7	359.8						
6200	888.7	757.9	610.0						
6600			790.9						
8200				528.9					
8600				740.6	503.8				
9000				918.2	721.8	477.7			
9400					900.6	702.6			
9800						882.9			
...									
13000							416.2		
13400							669.3	381.7	
13800							852.7	648.5	344.2
14200								835.2	627.0
14600									817.8

1. Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -100 ft/+90 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -270 ft/+270 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

TO2 Slippery Runway Takeoff
20% Thrust Reduction
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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-8	-4	0	-21	-17	-13	-42	-38	-34
760	-10	-6	-2	-23	-19	-15	-44	-40	-36
720	-11	-7	-3	-26	-22	-18	-47	-43	-39
680	-12	-8	-4	-27	-23	-19	-50	-46	-42
640	-13	-9	-5	-29	-25	-21	-52	-48	-44
600	-14	-10	-6	-30	-26	-22	-55	-51	-47
560	-15	-11	-7	-32	-28	-24	-56	-52	-48
520	-15	-11	-7	-33	-29	-25	-58	-54	-50
480	-16	-12	-8	-34	-30	-26	-58	-54	-50
440	-16	-12	-8	-35	-31	-27	-58	-54	-50
400	-17	-13	-9	-37	-33	-29	-58	-54	-50
360	-18	-14	-10	-38	-34	-30	-58	-54	-50

- 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.

Minimum Control Speeds**V1(MCG), Minimum VR****Max Takeoff Thrust**

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111				
50	122	119	121	116	118	111	113	109	111	106	109	103	106
40	104	126	127	123	124	118	120	113	115	108	111	103	106
30	86	128	130	128	130	123	125	118	120	112	115	106	109
20	68	129	130	129	130	125	126	120	122	116	118	110	113
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114

TO1 V1(MCG), Minimum VR**10% Thrust Reduction**

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	111	112	107	110	105	107	103	106				
50	122	113	115	110	112	105	108	103	106	101	104	98	101
40	104	119	121	117	119	112	114	107	110	103	105	98	101
30	86	122	123	121	123	116	118	112	114	107	109	101	104
20	68	122	124	121	123	118	119	114	116	110	112	104	107
-60	-76	124	124	123	123	119	120	115	116	111	112	106	108

TO2 V1(MCG), Minimum VR**20% Thrust Reduction**

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	105	107	102	104	100	102	98	101						
50	122	107	109	105	107	100	103	98	101	96	99	93	96	89	92
40	104	113	115	111	113	106	108	102	104	97	100	93	96	89	92
30	86	115	117	115	117	110	112	106	108	101	104	96	99	91	94
20	68	115	117	115	117	112	114	108	110	104	106	99	102	94	97
-60	-76	117	117	116	117	113	114	109	111	105	107	101	103	97	99

Go-Around %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

REPORTED OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (1000 FT)													
°C	°F		-2	-1	0	1	2	3	4	5	6	7	8	9	10	
66	150	70	92.7	92.7	92.9	92.9	92.6	92.2	91.6	91.0	89.9	88.6	87.1	85.5	84.5	
56	133	60	96.5	96.6	96.7	96.3	96.0	95.5	94.9	94.3	93.3	92.0	90.5	89.0	88.0	
51	124	55	97.8	98.0	98.3	98.1	97.9	97.4	96.6	96.0	94.9	93.6	92.2	90.7	89.7	
46	115	50	99.1	99.3	99.6	99.4	99.3	99.1	98.8	98.2	97.0	95.3	93.8	92.3	91.3	
41	106	45	100.2	100.7	101.1	101.0	100.9	100.5	100.1	99.9	99.7	98.8	96.7	94.2	92.9	
36	97	40	101.5	102.4	103.2	103.2	102.8	102.2	101.7	101.3	100.8	100.0	99.3	98.6	96.7	
31	88	35	101.2	103.9	105.8	105.4	105.1	104.4	103.6	102.9	102.0	101.1	100.2	99.4	98.7	
26	79	30	100.4	103.1	105.9	106.8	107.3	106.6	105.9	105.2	104.1	102.7	101.5	100.5	99.8	
21	70	25	99.5	102.2	105.0	105.9	106.5	107.0	107.4	107.0	106.1	105.0	103.6	102.2	101.1	
16	61	20	98.7	101.4	104.1	105.0	105.6	106.1	106.5	107.0	106.8	106.3	104.9	103.9	103.2	
11	53	15	97.9	100.5	103.2	104.1	104.7	105.2	105.6	106.1	105.9	105.5	104.9	104.4	103.9	
7	44	10	97.0	99.6	102.3	103.2	103.8	104.3	104.7	105.1	105.0	104.6	104.0	103.5	103.4	
2	35	5	96.1	98.7	101.4	102.3	102.9	103.4	103.8	104.2	104.1	103.7	103.1	102.6	102.5	
-3	26	0	95.3	97.8	100.5	101.4	102.0	102.4	102.8	103.3	103.1	102.7	102.2	101.7	101.6	
-13	8	-10	93.5	96.0	98.6	99.5	100.1	100.5	100.9	101.4	101.2	100.8	100.3	99.8	99.7	
-23	-10	-20	91.7	94.2	96.7	97.6	98.2	98.6	99.0	99.4	99.3	98.9	98.3	97.9	97.8	
-33	-27	-30	89.9	92.3	94.8	95.6	96.2	96.6	97.0	97.4	97.3	96.9	96.4	95.9	95.8	
-43	-45	-40	88.0	90.4	92.8	93.6	94.2	94.6	95.0	95.4	95.3	94.9	94.4	93.9	93.9	
-53	-63	-50	86.1	88.4	90.8	91.6	92.2	92.6	93.0	93.3	93.2	92.9	92.3	91.9	91.6	

%N1 Adjustments for Engine Bleed

[illegible]

Max Climb %N1**Based on engine bleed for packs on or off and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	97.4	97.0
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	96.5	96.1
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	95.6	95.2
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	94.7	94.3
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	93.8	93.4
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	92.9	92.4
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	91.9	91.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	91.0	90.6
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	90.0	89.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

*Packs on or off with 2 bleed sources.

**Packs off with 1 bleed source.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	PITCH ATT V/S (FT/MIN)	4.0 1400	4.0 600			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	5.5 2800	5.0 2100	5.0 1500	4.5 1100	4.0 800
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	8.5 4100	7.5 3100	7.5 2400	7.5 1800	7.0 1200
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	11.5 5400	10.5 4100	9.5 3300	9.5 2600	9.0 2100
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	15.0 6300	13.0 4900	12.0 3900	11.5 3200	11.0 2600

Cruise

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	PITCH ATT %N1	2.5 82.9	3.0 88.1			
35000 (280 KIAS)	PITCH ATT %N1	1.5 79.0	2.5 81.8	3.0 85.5	3.5 92.0	
30000 (280 KIAS)	PITCH ATT %N1	2.0 74.6	2.5 77.3	3.0 80.8	3.0 84.9	3.0 89.1
25000 (280 KIAS)	PITCH ATT %N1	2.0 70.7	2.5 73.2	3.5 76.2	3.5 80.2	3.5 83.8
20000 (270 KIAS)	PITCH ATT %N1	2.0 65.9	3.0 68.4	4.0 71.6	5.0 75.1	5.0 79.3
15000 (270 KIAS)	PITCH ATT %N1	2.0 61.9	3.0 64.5	4.0 67.3	5.0 70.4	5.0 74.2

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-1.0 -2800	0.0 -2800			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -2200	0.0 -2000	1.0 -1900	0.5 -2100	0.0 -2500
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1800	0.5 -1600	1.5 -1600	2.5 -1600	3.0 -1500
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1600	0.0 -1500	1.5 -1400	2.5 -1400	2.5 -1400
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -1400	0.0 -1300	1.0 -1200	2.0 -1200	3.0 -1200

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	PITCH ATT	4.5	5.0	5.5	5.5	5.5
	%N1	52.9	57.6	62.2	66.3	69.8
	KIAS	207	222	238	258	276
5000	PITCH ATT	4.5	5.0	5.5	5.5	5.5
	%N1	49.5	53.9	58.1	62.1	65.7
	KIAS	207	222	237	256	274

Terminal Area (5000 FT)**Set Thrust for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS UP GEAR UP (VREF30+80)	PITCH ATT	5.0	5.5	6.0	6.0	6.5
	%N1	49.5	54.2	58.5	62.6	66.4
	KIAS	207	222	235	252	264
FLAPS 1 GEAR UP (VREF30+60)	PITCH ATT	6.5	7.0	7.5	7.5	8.0
	%N1	50.4	55.4	60.0	64.3	68.0
	KIAS	187	202	215	232	244
FLAPS 5 GEAR UP (VREF30+40)	PITCH ATT	5.5	6.0	6.5	6.5	6.5
	%N1	50.9	56.1	61.0	65.2	69.1
	KIAS	167	182	195	212	224
FLAPS 15 GEAR UP (VREF30+20)	PITCH ATT	6.5	7.0	7.0	7.0	7.0
	%N1	52.1	57.7	62.7	66.9	71.2
	KIAS	147	162	175	192	204
FLAPS 20 GEAR DOWN (VREF30+20)	PITCH ATT	5.0	5.5	5.5	5.5	5.5
	%N1	57.9	63.7	69.3	74.0	78.1
	KIAS	147	162	175	192	204

Final Approach (1500 FT)**Gear Down, Set Thrust for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS 20 (VREF20+10)	PITCH ATT	1.0	1.0	1.5	1.5	2.0
	%N1	39.7	43.9	47.9	51.1	53.8
	KIAS	153	170	185	199	209
FLAPS 25 (VREF25+10)	PITCH ATT	1.5	2.0	2.0	2.0	2.0
	%N1	50.0	54.5	58.5	62.2	64.7
	KIAS	144	159	173	186	196
FLAPS 30 (VREF30+10)	PITCH ATT	1.0	1.5	1.5	1.0	1.0
	%N1	54.3	59.4	63.6	69.6	73.5
	KIAS	137	152	165	182	194

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	PITCH ATT	18.0	14.5	12.5	10.5	9.0
	V/S (FT/MIN)	4000	3100	2500	2000	1600
	KIAS	147	162	176	193	205
5000	PITCH ATT	22.5	18.0	15.0	12.5	11.0
	V/S (FT/MIN)	5000	4000	3300	2700	2200
	KIAS	147	162	176	192	205
SEA LEVEL	PITCH ATT	27.0	21.5	18.0	15.0	13.0
	V/S (FT/MIN)	5800	4700	3900	3300	2800
	KIAS	147	162	175	192	204

Performance Inflight**All Engine****Chapter PI****Section 51****Long Range Cruise Maximum Operating Altitude****Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)****ISA + 10°C and Below**

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	30800	29100	27600
760	28800	2	31300	29700	28200
740	29400	0	31800	30200	28700
720	30000	-1	32300	30700	29100
700	30700	-2	32800	31100	29600
680	31300	-4	33200	31600	30100
660	31900	-5	33700	32100	30600
640	32600	-7	34300	32700	31200
620	33300	-8	34800	33200	31700
600	34000	-10	35300	33800	32300
580	34700	-11	35900	34300	32900
560	35400	-13	36500	34900	33500
540	36200	-15	37100	35600	34100
520	37000	-15	37800	36200	34800
500	37800	-15	38400	36900	35500
480	38600	-15	39100	37600	36200
460	39500	-15	39900	38300	37000
440	40400	-15	40600	39100	37700
420	41400	-15	41400	39900	38600
400	42400	-15	42300	40800	39500
380	43100	-15	43100	41800	40500

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	30800	29100	27600
760	28800	8	31300	29700	28200
740	29400	6	31800	30200	28700
720	30000	5	32300	30700	29100
700	30700	3	32800	31100	29600
680	31300	2	33200	31600	30100
660	31900	1	33700	32100	30600
640	32600	-1	34300	32700	31200
620	33300	-2	34800	33200	31700
600	34000	-4	35300	33800	32300
580	34700	-6	35900	34300	32900
560	35400	-7	36500	34900	33500
540	36200	-9	37100	35600	34100
520	37000	-9	37800	36200	34800
500	37800	-9	38400	36900	35500
480	38600	-9	39100	37600	36200
460	39500	-9	39900	38300	37000
440	40400	-9	40600	39100	37700
420	41400	-9	41400	39900	38600
400	42400	-9	42300	40800	39500
380	43100	-9	43100	41800	40500

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	30800	29100	27600
760	28800	13	31300	29700	28200
740	29400	12	31800	30200	28700
720	30000	11	32300	30700	29100
700	30700	9	32800	31100	29600
680	31300	8	33200	31600	30100
660	31900	6	33700	32100	30600
640	32600	5	34300	32700	31200
620	33300	3	34800	33200	31700
600	34000	2	35300	33800	32300
580	34700	0	35900	34300	32900
560	35400	-2	36500	34900	33500
540	36200	-3	37100	35600	34100
520	37000	-3	37800	36200	34800
500	37800	-3	38400	36900	35500
480	38600	-3	39100	37600	36200
460	39500	-3	39900	38300	37000
440	40400	-3	40600	39100	37700
420	41400	-3	41400	39900	38600
400	42400	-3	42300	40800	39500
380	43100	-3	43100	41800	40500

Long Range Cruise Maximum Operating Altitude**Max Climb Thrust, Mid C.G. (30% MAC)****ISA + 10°C and Below**

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	31800	30200	28600
760	28800	2	32400	30700	29200
740	29400	0	32900	31300	29700
720	30000	-1	33300	31700	30200
700	30700	-2	33800	32200	30700
680	31300	-4	34300	32700	31200
660	31900	-5	34800	33200	31700
640	32600	-7	35300	33700	32200
620	33300	-8	35800	34200	32700
600	34000	-10	36300	34800	33300
580	34700	-11	36900	35300	33900
560	35400	-13	37500	35900	34500
540	36200	-15	38100	36600	35100
520	37000	-15	38800	37200	35800
500	37800	-15	39400	37900	36400
480	38600	-15	40100	38600	37100
460	39500	-15	40900	39300	37900
440	40400	-15	41600	40100	38700
420	41400	-15	42400	40900	39500
400	42400	-15	43100	41700	40300
380	43100	-15	43100	42800	41400

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	31800	30200	28600
760	28800	8	32400	30700	29200
740	29400	6	32900	31300	29700
720	30000	5	33300	31700	30200
700	30700	3	33800	32200	30700
680	31300	2	34300	32700	31200
660	31900	1	34800	33200	31700
640	32600	-1	35300	33700	32200
620	33300	-2	35800	34200	32700
600	34000	-4	36300	34800	33300
580	34700	-6	36900	35300	33900
560	35400	-7	37500	35900	34500
540	36200	-9	38100	36600	35100
520	37000	-9	38800	37200	35800
500	37800	-9	39400	37900	36400
480	38600	-9	40100	38600	37100
460	39500	-9	40900	39300	37900
440	40400	-9	41600	40100	38700
420	41400	-9	42400	40900	39500
400	42400	-9	43100	41700	40300
380	43100	-9	43100	42800	41400

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Mid C.G. (30% MAC)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	31700*	30200	28600
760	28800	13	32400	30700	29200
740	29400	12	32900	31300	29700
720	30000	11	33300	31700	30200
700	30700	9	33800	32200	30700
680	31300	8	34300	32700	31200
660	31900	6	34800	33200	31700
640	32600	5	35300	33700	32200
620	33300	3	35800	34200	32700
600	34000	2	36300	34800	33300
580	34700	0	36900	35300	33900
560	35400	-2	37500	35900	34500
540	36200	-3	38100	36600	35100
520	37000	-3	38800	37200	35800
500	37800	-3	39400	37900	36400
480	38600	-3	40100	38600	37100
460	39500	-3	40900	39300	37900
440	40400	-3	41600	40100	38700
420	41400	-3	42400	40900	39500
400	42400	-3	43100	41700	40300
380	43100	-3	43100	42800	41400

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		25	27	29	31	33	35	37	39	41	43
780	%N1	84.3	86.1	87.5	90.1						
	MACH	.819	.840	.840	.837						
	KIAS	346	342	327	313						
	FF/ENG	11528	11536	11395	11738						
740	%N1	83.6	85.0	86.2	88.1	91.0					
	MACH	.819	.837	.840	.839	.836					
	KIAS	346	340	328	313	299					
	FF/ENG	11218	11080	10831	10888	11301					
700	%N1	82.6	83.8	85.1	86.4	88.8					
	MACH	.810	.830	.839	.840	.838					
	KIAS	342	337	327	314	299					
	FF/ENG	10755	10600	10368	10193	10441					
660	%N1	81.2	82.6	83.9	85.1	86.8	89.5				
	MACH	.797	.818	.834	.840	.839	.837				
	KIAS	336	332	325	314	300	286				
	FF/ENG	10168	10061	9897	9689	9630	9973				
620	%N1	79.6	81.3	82.6	84.0	85.1	87.2				
	MACH	.776	.803	.824	.837	.840	.839				
	KIAS	327	325	321	313	300	287				
	FF/ENG	9454	9493	9375	9236	9039	9129				
580	%N1	77.8	79.6	81.2	82.5	83.8	85.1	87.9			
	MACH	.751	.784	.808	.829	.839	.840	.838			
	KIAS	315	317	314	309	300	287	273			
	FF/ENG	8699	8857	8803	8745	8584	8426	8656			
540	%N1	76.0	77.7	79.5	81.0	82.4	83.7	85.5	89.5		
	MACH	.727	.757	.790	.812	.832	.840	.840	.837		
	KIAS	304	305	306	302	297	287	274	261		
	FF/ENG	8034	8129	8224	8180	8115	7945	7865	8384		
500	%N1	74.4	75.8	77.5	79.4	80.8	82.2	83.7	86.7		
	MACH	.707	.730	.762	.794	.817	.834	.840	.839		
	KIAS	296	293	295	295	291	285	274	262		
	FF/ENG	7492	7442	7538	7619	7572	7488	7333	7534		
460	%N1	72.9	74.0	75.4	77.2	79.1	80.5	82.2	84.7	87.7	
	MACH	.691	.708	.732	.765	.797	.819	.836	.840	.839	
	KIAS	288	284	282	283	283	279	273	262	250	
	FF/ENG	7013	6888	6850	6946	7011	6963	6887	6935	7160	
420	%N1	71.1	72.4	73.5	74.9	76.7	78.6	80.3	83.1	85.4	88.6
	MACH	.671	.690	.708	.732	.766	.798	.820	.836	.840	.839
	KIAS	280	276	272	270	271	271	267	260	250	238
	FF/ENG	6524	6407	6294	6258	6346	6401	6372	6489	6509	6722
380	%N1	68.8	70.4	71.8	72.9	74.2	76.1	78.3	81.1	83.6	86.0
	MACH	.642	.668	.688	.706	.730	.764	.797	.819	.836	.840
	KIAS	267	267	264	260	257	258	258	255	249	239
	FF/ENG	5951	5915	5819	5710	5672	5736	5801	5962	6060	6053
340	%N1	65.8	67.8	69.5	70.9	72.1	73.4	75.5	78.8	81.5	84.1
	MACH	.599	.634	.662	.685	.702	.725	.758	.792	.816	.834
	KIAS	248	252	253	251	247	244	245	245	242	237
	FF/ENG	5274	5348	5320	5247	5143	5086	5135	5365	5508	5594

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes
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	191	183	175	168	162
552	513	479	449	423	400	383	367	353	339	327
828	770	719	674	635	600	575	552	531	511	493
1104	1027	958	899	847	800	767	736	708	682	658
1381	1285	1199	1125	1059	1000	959	921	886	853	823
1660	1544	1440	1350	1271	1200	1151	1105	1062	1023	988
1939	1803	1681	1576	1483	1400	1343	1289	1240	1194	1152
2219	2063	1923	1802	1696	1600	1534	1473	1416	1364	1317
2499	2322	2164	2028	1908	1800	1726	1658	1594	1535	1481
2780	2583	2407	2254	2121	2000	1918	1841	1770	1705	1645

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	8.8	0:37	7.7	0:35	6.3	0:34	5.5	0:33	4.9	0:33
400	18.6	1:09	16.9	1:05	14.6	1:02	13.4	1:00	12.5	0:58
600	28.3	1:42	26.2	1:35	22.9	1:30	21.2	1:27	20.0	1:23
800	38.0	2:15	35.3	2:06	31.2	1:58	28.9	1:54	27.4	1:48
1000	47.5	2:49	44.3	2:37	39.3	2:27	36.6	2:21	34.8	2:14
1200	57.0	3:23	53.3	3:08	47.5	2:55	44.2	2:49	42.2	2:39
1400	66.5	3:57	62.1	3:40	55.5	3:24	51.8	3:16	49.4	3:05
1600	75.9	4:31	71.0	4:12	63.6	3:52	59.3	3:44	56.6	3:31
1800	85.3	5:05	79.8	4:44	71.6	4:21	66.7	4:12	63.8	3:57
2000	94.6	5:40	88.6	5:17	79.6	4:50	74.1	4:39	70.9	4:23

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)									
	400	450	500	550	600	650	700	750	800	
10	-1.3	-1.0	-0.6	-0.3	0.0	0.4	0.8	1.3	1.8	
20	-2.8	-2.0	-1.3	-0.7	0.0	0.9	1.8	2.9	4.0	
30	-4.2	-3.0	-1.9	-1.0	0.0	1.4	2.9	4.5	6.1	
40	-5.7	-4.1	-2.6	-1.4	0.0	1.9	3.9	6.1	8.3	
50	-7.2	-5.2	-3.3	-1.8	0.0	2.5	5.0	7.7	10.4	
60	-8.7	-6.3	-4.0	-2.1	0.0	3.0	6.1	9.3	12.6	
70	-10.3	-7.4	-4.8	-2.5	0.0	3.5	7.2	10.9	14.7	
80	-11.8	-8.6	-5.6	-2.9	0.0	4.1	8.3	12.5	16.8	
90	-13.4	-9.8	-6.4	-3.3	0.0	4.7	9.4	14.1	18.9	
100	-14.9	-11.0	-7.2	-3.7	0.0	5.2	10.5	15.7	21.0	

Long Range Cruise Enroute Fuel and Time - High Altitudes
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
1023	970	920	876	837	800	767	736	708	682	658
1529	1451	1378	1313	1254	1200	1151	1106	1064	1025	990
2037	1933	1837	1751	1672	1600	1535	1475	1419	1368	1321
2546	2416	2296	2188	2090	2000	1920	1844	1775	1711	1652
3056	2899	2755	2626	2509	2400	2304	2214	2131	2054	1983
3568	3385	3216	3064	2927	2800	2688	2583	2486	2397	2314
4083	3871	3677	3504	3346	3200	3072	2953	2842	2739	2646
4599	4360	4140	3943	3765	3600	3456	3322	3197	3082	2977
5117	4849	4603	4384	4184	4000	3840	3692	3553	3425	3308
5637	5340	5068	4824	4604	4400	4225	4061	3909	3768	3639
6159	5832	5534	5266	5024	4800	4609	4430	4265	4111	3971
6682	6326	6000	5708	5444	5200	4993	4799	4620	4454	4301
7207	6821	6467	6151	5864	5600	5377	5168	4975	4796	4632
7733	7316	6935	6593	6284	6000	5760	5537	5329	5138	4962
8261	7813	7402	7036	6705	6400	6144	5905	5684	5479	5292
8790	8310	7871	7480	7126	6800	6528	6274	6038	5820	5621
9320	8809	8341	7924	7547	7200	6911	6642	6392	6161	5949
9853	9309	8811	8368	7968	7600	7295	7010	6746	6501	6277
10386	9810	9283	8813	8390	8000	7678	7378	7099	6841	6605

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)
800	27.2	1:47	26.4	1:46	25.7	1:46	25.4	1:47	26.3	1:48
1200	41.4	2:38	40.3	2:36	39.3	2:36	38.8	2:36	39.8	2:37
1600	55.7	3:29	54.2	3:26	53.0	3:25	52.2	3:26	53.2	3:27
2000	69.9	4:20	68.2	4:16	66.6	4:14	65.6	4:16	66.7	4:17
2400	83.6	5:13	81.6	5:07	79.7	5:04	78.4	5:05	79.3	5:07
2800	97.2	6:05	94.9	5:58	92.8	5:54	91.2	5:55	91.9	5:57
3200	110.6	6:59	108.1	6:50	105.6	6:45	103.8	6:45	104.2	6:47
3600	123.7	7:53	120.9	7:42	118.2	7:36	116.1	7:35	116.2	7:36
4000	136.7	8:47	133.7	8:34	130.8	8:27	128.4	8:25	128.2	8:26
4400	149.3	9:43	146.0	9:28	142.8	9:19	140.2	9:16	139.7	9:16
4800	161.8	10:39	158.3	10:22	154.9	10:11	152.0	10:07	151.2	10:06
5200	174.2	11:35	170.3	11:16	166.7	11:03	163.6	10:58	162.5	10:57
5600	186.3	12:33	182.0	12:12	178.2	11:57	174.9	11:50	173.6	11:47
6000	198.5	13:30	193.7	13:08	189.8	12:50	186.2	12:42	184.6	12:38
6400	210.3	14:28	205.0	14:05	200.8	13:46	197.1	13:35	195.2	13:29
6800	222.0	15:27	216.3	15:02	211.8	14:41	207.9	14:28	205.8	14:21
7200	233.5	16:26	227.3	16:00	222.6	15:37	218.5	15:22	216.1	15:13
7600	244.9	17:26	238.2	16:59	233.2	16:34	228.9	16:17	226.3	16:06
8000	256.2	18:26	249.0	17:57	243.8	17:31	239.3	17:11	236.4	16:58

Long Range Cruise Enroute Fuel and Time - High Altitudes
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	400	450	500	550	600	650	700	750	800
20	-3.8	-3.0	-2.1	-1.0	0.0	2.7	8.4	17.0	28.6
40	-7.8	-6.1	-4.3	-2.1	0.0	4.7	13.0	24.9	40.4
60	-11.7	-9.2	-6.4	-3.2	0.0	6.6	17.2	32.1	51.0
80	-15.6	-12.2	-8.5	-4.3	0.0	8.3	21.2	38.6	60.6
100	-19.5	-15.2	-10.6	-5.3	0.0	9.9	24.8	44.5	69.1
120	-23.3	-18.2	-12.6	-6.3	0.0	11.4	28.0	49.7	76.5
140	-27.2	-21.1	-14.5	-7.4	0.0	12.8	30.9	54.2	82.9
160	-31.0	-24.0	-16.5	-8.3	0.0	14.1	33.5	58.1	88.1
180	-34.8	-26.8	-18.3	-9.3	0.0	15.2	35.7	61.4	92.4
200	-38.6	-29.6	-20.2	-10.2	0.0	16.2	37.5	64.0	95.5
220	-42.4	-32.3	-21.9	-11.1	0.0	17.1	39.1	65.9	97.6
240	-46.1	-35.1	-23.7	-12.0	0.0	17.9	40.3	67.2	98.6
260	-49.9	-37.7	-25.4	-12.9	0.0	18.5	41.1	67.8	98.5

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)										
	780	740	700	660	620	580	540	500	460	420	380
43							161	82	32	6	0
41						131	67	27	6	0	6
39						51	20	4	0	6	19
37				73	36	13	2	1	7	18	33
35		88	49	23	7	1	1	8	19	32	46
33	58	30	13	3	0	3	10	20	32	45	57
31	17	6	1	1	5	13	22	34	45	57	66
29	2	0	3	8	16	25	36	46	57	66	73
27	1	5	12	20	29	38	48	57	65	72	76
25	9	16	24	32	41	50	58	66	72	76	78

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 at .84M/310/250

PRESSURE ALTITUDE (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	102	109	116	123	129	134	139	145	150	155
TIME (MINUTES)	20	21	22	23	24	24	25	26	26	27

**Holding
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
800	%N1	62.8	65.7	70.1	74.8	79.2	83.9				
	KIAS	273	274	294	307	311	322				
	FF/ENG	10590	10480	10580	10860	11070	11580				
760	%N1	61.4	64.3	68.7	73.2	77.7	82.7				
	KIAS	266	267	285	295	303	314				
	FF/ENG	10060	9970	10000	10180	10460	10900				
720	%N1	60.0	62.8	67.1	71.5	76.3	81.2	85.7			
	KIAS	259	259	268	284	294	304	310			
	FF/ENG	9530	9450	9340	9570	9850	10200	10590			
680	%N1	58.6	61.3	65.5	70.0	74.8	79.3	84.2			
	KIAS	251	252	253	276	286	289	300			
	FF/ENG	9010	8930	8780	9010	9250	9410	9890			
640	%N1	57.1	59.7	63.9	68.1	73.2	77.6	82.5			
	KIAS	244	244	246	262	274	279	290			
	FF/ENG	8500	8410	8270	8380	8620	8790	9220			
600	%N1	55.6	58.1	62.2	66.3	71.2	75.9	80.8	85.5		
	KIAS	236	237	238	248	261	270	280	279		
	FF/ENG	8010	7890	7760	7780	7980	8200	8560	8870		
560	%N1	54.0	56.5	60.3	64.5	69.3	74.0	78.8	83.7		
	KIAS	231	231	231	231	251	260	266	274		
	FF/ENG	7530	7400	7250	7200	7420	7610	7820	8180		
520	%N1	52.4	54.8	58.5	62.6	67.1	72.1	76.7	81.8		
	KIAS	225	225	225	225	237	249	253	263		
	FF/ENG	7080	6930	6760	6690	6800	7000	7150	7500		
480	%N1	50.8	53.1	56.7	60.6	64.8	69.8	74.5	79.6		
	KIAS	220	220	220	220	220	234	242	252		
	FF/ENG	6670	6490	6300	6210	6190	6370	6540	6840		
440	%N1	48.9	51.3	54.8	58.5	62.7	67.4	72.3	77.2	84.3	
	KIAS	213	213	213	213	213	222	232	236	244	
	FF/ENG	6260	6070	5860	5770	5700	5810	5950	6110	6730	
400	%N1	46.9	49.5	52.9	56.4	60.5	64.8	69.8	74.6	81.9	86.5
	KIAS	207	207	207	207	207	207	216	223	231	232
	FF/ENG	5870	5670	5450	5360	5260	5230	5340	5480	6020	6420
360	%N1	44.8	47.2	50.8	54.3	58.1	62.5	66.9	71.9	79.1	83.8
	KIAS	200	200	200	200	200	200	203	210	218	220
	FF/ENG	5610	5410	5190	5070	4950	4880	4810	4910	5320	5670

This table includes 5% additional fuel for holding in a racetrack pattern.

Holding**Flaps 1**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
800	%N1	65.2	68.1	72.7	77.2	82.2
	KIAS	242	242	242	242	242
	FF/ENG	11520	11490	11420	11560	11820
760	%N1	63.7	66.5	70.9	75.4	80.5
	KIAS	242	242	242	242	242
	FF/ENG	10880	10830	10740	10840	11080
720	%N1	62.2	65.0	69.2	73.8	78.8
	KIAS	236	236	236	236	236
	FF/ENG	10280	10220	10130	10190	10400
680	%N1	60.6	63.5	67.6	72.2	77.1
	KIAS	228	228	228	228	228
	FF/ENG	9690	9620	9540	9570	9740
640	%N1	59.0	61.8	65.9	70.5	75.3
	KIAS	221	221	221	221	221
	FF/ENG	9120	9030	8950	8960	9080
600	%N1	57.3	60.0	64.1	68.4	73.2
	KIAS	216	216	216	216	216
	FF/ENG	8550	8450	8360	8350	8420
560	%N1	55.6	58.1	62.2	66.4	71.2
	KIAS	211	211	211	211	211
	FF/ENG	8010	7880	7770	7750	7790
520	%N1	53.9	56.3	60.2	64.3	68.9
	KIAS	205	205	205	205	205
	FF/ENG	7490	7330	7200	7170	7180
480	%N1	52.1	54.4	58.1	62.2	66.5
	KIAS	200	200	200	200	200
	FF/ENG	6990	6820	6660	6600	6590
440	%N1	50.1	52.4	56.0	59.9	64.1
	KIAS	193	193	193	193	193
	FF/ENG	6510	6320	6130	6050	6010
400	%N1	48.0	50.3	53.8	57.4	61.7
	KIAS	187	187	187	187	187
	FF/ENG	6050	5850	5640	5540	5470
360	%N1	45.5	48.1	51.5	54.9	59.0
	KIAS	180	180	180	180	180
	FF/ENG	5730	5530	5300	5180	5100

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight

Advisory Information

Chapter PI

Section 52

ADVISORY INFORMATION

Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

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	VREF ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4280	90/-50	80	-150/490	50/-50	80/-80	140	80	180
AUTOBRAKE MAX	5590	80/-70	130	-210/710	0/0	130/-130	250	0	0
AUTOBRAKE 4	7120	120/-90	170	-300/1010	0/0	180/-180	360	0	0
AUTOBRAKE 3	8340	140/-120	220	-370/1270	0/-50	220/-220	400	0	0
AUTOBRAKE 2	9190	160/-140	260	-430/1450	100/-200	240/-240	320	240	240
AUTOBRAKE 1	9940	180/-160	310	-490/1690	290/-300	260/-260	320	970	1210

Good Reported Braking Action

MAX MANUAL	5810	80/-70	140	-240/860	130/-120	130/-130	200	350	810
AUTOBRAKE MAX	6010	90/-70	150	-250/890	120/-90	140/-140	230	370	850
AUTOBRAKE 4	7150	120/-90	170	-300/1040	30/-10	180/-180	360	20	140
AUTOBRAKE 3	8340	140/-120	220	-370/1270	10/-50	220/-220	400	0	0
AUTOBRAKE 2	9190	160/-140	260	-430/1450	100/-200	240/-240	320	240	240
AUTOBRAKE 1	9940	180/-160	310	-490/1690	290/-300	260/-260	320	970	1210

Good To Medium Reported Braking Action

MAX MANUAL	6700	100/-90	180	-310/1130	220/-180	160/-160	220	630	1580
AUTOBRAKE MAX	6810	110/-90	180	-320/1140	210/-170	160/-160	250	640	1600
AUTOBRAKE 4	7500	130/-100	200	-350/1220	140/-80	190/-190	360	440	1230
AUTOBRAKE 3	8510	140/-120	220	-400/1390	80/-90	220/-220	400	200	790
AUTOBRAKE 2	9270	160/-140	260	-440/1540	160/-220	240/-240	320	350	740
AUTOBRAKE 1	9950	180/-160	320	-490/1710	320/-310	260/-270	320	1010	1410

Medium Reported Braking Action

MAX MANUAL	7600	130/-100	220	-380/1390	310/-240	180/-180	250	920	2360
AUTOBRAKE MAX	7600	130/-100	220	-380/1390	310/-240	180/-180	260	910	2350
AUTOBRAKE 4	7840	140/-100	220	-390/1410	240/-150	200/-200	360	850	2320
AUTOBRAKE 3	8680	150/-130	230	-430/1520	150/-140	230/-230	400	390	1590
AUTOBRAKE 2	9360	160/-140	260	-460/1620	220/-250	240/-240	320	450	1230
AUTOBRAKE 1	9960	180/-160	320	-490/1740	360/-320	260/-280	320	1050	1610

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	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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

Medium To Poor Reported Braking Action

MAX MANUAL	8540	150/-130	260	-470/1750	490/-350	210/-210	270	1410	3980
AUTOBRAKE MAX	8550	150/-130	260	-470/1750	490/-360	210/-210	280	1410	3970
AUTOBRAKE 4	8670	160/-130	260	-470/1770	460/-290	220/-220	340	1380	3960
AUTOBRAKE 3	9240	170/-140	260	-490/1830	360/-250	240/-250	400	1050	3510
AUTOBRAKE 2	9780	170/-150	290	-520/1910	400/-350	250/-250	320	990	3160
AUTOBRAKE 1	10260	190/-170	330	-550/2000	510/-400	270/-280	320	1430	3250

Poor Reported Braking Action

MAX MANUAL	9490	170/-150	310	-550/2120	670/-460	240/-240	290	1910	5600
AUTOBRAKE MAX	9500	170/-150	310	-550/2120	680/-470	240/-240	290	1910	5600
AUTOBRAKE 4	9500	180/-150	310	-550/2120	680/-440	240/-240	320	1910	5600
AUTOBRAKE 3	9800	180/-150	300	-560/2150	560/-370	250/-260	390	1710	5440
AUTOBRAKE 2	10200	180/-160	320	-580/2200	590/-450	260/-260	320	1530	5090
AUTOBRAKE 1	10560	200/-170	350	-600/2250	670/-480	280/-280	320	1810	4890

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 240 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.

Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Dry Runway

MAX MANUAL	4460	80/-50	90	-150/510	50/-50	80/-80	140	90	210
AUTOBRAKE MAX	5970	70/-70	140	-220/740	0/0	140/-140	260	0	0
AUTOBRAKE 4	7660	90/-100	200	-310/1060	0/0	200/-200	370	0	0
AUTOBRAKE 3	8990	120/-130	240	-390/1320	0/-80	240/-240	400	10	10
AUTOBRAKE 2	9830	140/-150	290	-450/1510	140/-220	260/-260	330	370	370
AUTOBRAKE 1	10600	170/-170	350	-520/1750	320/-330	290/-290	330	1140	1500

Good Reported Braking Action

MAX MANUAL	6120	70/-80	150	-250/890	140/-120	140/-140	200	380	900
AUTOBRAKE MAX	6350	80/-80	160	-260/910	130/-70	150/-150	250	400	950
AUTOBRAKE 4	7690	90/-100	200	-320/1080	30/-10	200/-200	380	20	140
AUTOBRAKE 3	8990	120/-130	240	-390/1320	10/-80	240/-240	400	10	10
AUTOBRAKE 2	9830	140/-150	290	-450/1510	140/-220	260/-260	330	370	370
AUTOBRAKE 1	10600	170/-170	350	-520/1750	320/-330	290/-290	330	1140	1500

Good To Medium Reported Braking Action

MAX MANUAL	7080	90/-100	200	-320/1160	230/-190	170/-170	220	700	1760
AUTOBRAKE MAX	7190	100/-100	200	-330/1170	230/-160	170/-170	260	710	1790
AUTOBRAKE 4	8040	100/-110	220	-360/1270	130/-80	210/-210	380	440	1330
AUTOBRAKE 3	9170	120/-130	250	-410/1450	90/-130	240/-250	400	220	850
AUTOBRAKE 2	9920	140/-150	290	-460/1590	200/-250	260/-260	330	480	890
AUTOBRAKE 1	10620	170/-170	350	-520/1780	360/-340	290/-290	330	1180	1710

Medium Reported Braking Action

MAX MANUAL	8040	120/-120	240	-390/1430	320/-260	200/-200	250	1010	2620
AUTOBRAKE MAX	8040	120/-120	240	-390/1430	330/-240	200/-200	280	1010	2620
AUTOBRAKE 4	8400	120/-120	240	-400/1460	230/-150	220/-220	380	860	2520
AUTOBRAKE 3	9340	130/-140	250	-440/1580	160/-170	240/-250	390	430	1680
AUTOBRAKE 2	10020	140/-150	300	-470/1670	250/-280	260/-260	330	590	1410
AUTOBRAKE 1	10640	170/-170	350	-520/1810	390/-350	290/-290	330	1220	1920

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 25**

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	9040	140/-140	290	-480/1790	510/-370	230/-230	270	1560	4430
AUTOBRAKE MAX	9050	140/-140	290	-480/1790	520/-370	230/-230	290	1560	4430
AUTOBRAKE 4	9230	140/-140	290	-480/1810	470/-300	240/-240	350	1480	4390
AUTOBRAKE 3	9910	140/-150	290	-510/1890	370/-290	260/-260	390	1120	3840
AUTOBRAKE 2	10440	160/-160	330	-530/1960	440/-370	280/-280	330	1160	3540
AUTOBRAKE 1	10940	180/-180	360	-570/2060	540/-430	290/-290	330	1620	3700

Poor Reported Braking Action

MAX MANUAL	10040	160/-160	330	-560/2160	700/-480	260/-260	290	2100	6230
AUTOBRAKE MAX	10060	160/-160	330	-560/2160	710/-490	260/-260	300	2100	6240
AUTOBRAKE 4	10070	160/-160	330	-560/2160	700/-450	260/-260	320	2100	6260
AUTOBRAKE 3	10480	160/-160	330	-590/2210	580/-400	280/-280	390	1810	5990
AUTOBRAKE 2	10870	170/-170	360	-600/2250	630/-470	290/-290	330	1730	5660
AUTOBRAKE 1	11250	180/-180	370	-620/2320	690/-520	300/-300	330	2010	5490

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 250 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 220 ft.

Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Dry Runway

MAX MANUAL	4800	100/-50	100	-160/530	60/-50	90/-90	150	120	240
AUTOBRAKE MAX	6540	80/-80	150	-230/780	0/0	160/-160	280	0	0
AUTOBRAKE 4	8490	100/-120	220	-330/1130	0/0	230/-230	400	0	0
AUTOBRAKE 3	9980	140/-150	280	-410/1400	10/-90	280/-280	430	30	30
AUTOBRAKE 2	10930	160/-170	330	-470/1600	160/-250	300/-300	360	490	490
AUTOBRAKE 1	11780	200/-200	400	-540/1850	360/-380	330/-330	360	1400	1830

Good Reported Braking Action

MAX MANUAL	6660	80/-90	170	-260/930	150/-140	160/-160	210	460	1080
AUTOBRAKE MAX	6920	90/-90	180	-280/950	130/-70	160/-160	280	460	1120
AUTOBRAKE 4	8500	100/-120	220	-350/1150	30/-10	230/-230	400	20	160
AUTOBRAKE 3	9980	140/-150	280	-410/1400	10/-90	280/-280	430	30	30
AUTOBRAKE 2	10930	160/-170	330	-470/1600	160/-250	300/-300	360	490	490
AUTOBRAKE 1	11780	200/-200	400	-540/1850	360/-380	330/-330	360	1400	1830

Good To Medium Reported Braking Action

MAX MANUAL	7730	100/-110	220	-340/1210	250/-210	190/-200	240	830	2110
AUTOBRAKE MAX	7870	110/-110	230	-350/1220	250/-170	200/-200	280	830	2120
AUTOBRAKE 4	8870	120/-130	250	-390/1340	140/-90	240/-240	400	490	1560
AUTOBRAKE 3	10160	140/-150	290	-440/1530	100/-140	280/-280	430	260	1020
AUTOBRAKE 2	11010	160/-170	340	-490/1680	220/-280	300/-300	360	610	1100
AUTOBRAKE 1	11790	200/-200	400	-550/1880	400/-390	330/-330	360	1440	2080

Medium Reported Braking Action

MAX MANUAL	8810	130/-130	260	-410/1500	360/-290	220/-230	260	1210	3140
AUTOBRAKE MAX	8810	130/-130	280	-410/1500	370/-260	230/-230	290	1200	3130
AUTOBRAKE 4	9250	130/-140	280	-430/1530	250/-160	240/-240	400	970	2960
AUTOBRAKE 3	10340	140/-150	300	-470/1660	180/-180	280/-280	430	490	2000
AUTOBRAKE 2	11100	160/-170	350	-510/1760	280/-310	300/-300	360	720	1710
AUTOBRAKE 1	11810	200/-200	400	-550/1910	440/-390	330/-330	360	1480	2320

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	9930	160/-160	320	-510/1870	560/-410	250/-260	290	1840	5300
AUTOBRAKE MAX	9940	160/-160	330	-510/1880	570/-400	260/-260	300	1830	5300
AUTOBRAKE 4	10150	160/-160	330	-510/1900	510/-330	270/-270	380	1720	5210
AUTOBRAKE 3	10940	160/-170	340	-550/1980	410/-320	290/-290	420	1290	4560
AUTOBRAKE 2	11550	180/-180	370	-570/2060	480/-410	310/-310	350	1390	4240
AUTOBRAKE 1	12120	200/-200	410	-600/2170	600/-480	340/-340	360	1930	4430

Poor Reported Braking Action

MAX MANUAL	11050	180/-180	380	-600/2250	760/-530	290/-290	310	2470	7450
AUTOBRAKE MAX	11060	180/-180	380	-600/2270	770/-540	300/-300	310	2470	7460
AUTOBRAKE 4	11060	180/-180	380	-600/2270	770/-490	300/-300	360	2470	7460
AUTOBRAKE 3	11550	180/-180	380	-620/2310	630/-450	310/-310	410	2090	7120
AUTOBRAKE 2	11990	200/-200	400	-630/2360	690/-520	320/-320	350	2050	6760
AUTOBRAKE 1	12420	210/-210	430	-660/2430	760/-560	350/-350	360	2380	6540

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 280 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 230 ft.

Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 20)

VREF20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	100/-60	110	-160/540	60/-60	110/-110	N/A	160	340
AUTOBRAKE MAX	6160	70/-70	150	-220/720	0/0	150/-150	N/A	0	0
AUTOBRAKE 2	10690	150/-170	330	-450/1490	110/-170	300/-300	N/A	260	260

Good Reported Braking Action

MAX MANUAL	6980	90/-90	190	-270/920	170/-150	170/-170	N/A	580	1410
AUTOBRAKE MAX	6960	90/-90	190	-270/920	170/-150	170/-170	N/A	580	1410
AUTOBRAKE 2	10690	150/-170	330	-450/1490	110/-170	300/-300	N/A	260	260

Good To Medium Reported Braking Action

MAX MANUAL	8040	110/-120	240	-340/1180	280/-230	210/-210	N/A	1010	2670
AUTOBRAKE MAX	8020	120/-120	240	-340/1180	290/-240	210/-210	N/A	1010	2670
AUTOBRAKE 2	10780	150/-170	330	-470/1570	190/-210	310/-310	N/A	410	1280

Medium Reported Braking Action

MAX MANUAL	9090	130/-140	290	-410/1430	390/-310	240/-240	N/A	1440	3930
AUTOBRAKE MAX	9070	140/-140	290	-400/1430	410/-330	240/-240	N/A	1440	3920
AUTOBRAKE 3	10000	130/-140	290	-440/1530	210/-170	280/-280	N/A	670	3100

Medium To Poor Reported Braking Action

MAX MANUAL	10160	160/-170	350	-490/1780	590/-430	270/-270	N/A	2130	6460
AUTOBRAKE MAX	10160	170/-170	350	-490/1780	610/-450	280/-280	N/A	2130	6460
AUTOBRAKE 3	10730	160/-160	340	-510/1840	480/-330	300/-300	N/A	1640	5950

Poor Reported Braking Action

MAX MANUAL	11230	190/-190	400	-570/2130	790/-550	300/-300	N/A	2810	8990
AUTOBRAKE MAX	11240	190/-190	410	-570/2130	810/-570	310/-310	N/A	2820	9000
AUTOBRAKE 3	11450	180/-180	390	-580/2150	740/-480	320/-320	N/A	2610	8800

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ANTISKID (Flaps 25)****VREF25**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	6990	100/-100	210	-340/1240	280/-230	170/-170	220	880	2280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6990	100/-100	210	-340/1240	280/-230	170/-170	220	880	2280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7860	120/-120	250	-420/1560	450/-330	200/-200	240	1360	3850
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8730	140/-140	290	-490/1880	610/-420	230/-230	250	1830	5420
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10080	180/-170	350	-650/2670	2060/-670	270/-270	270	3320	7250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11430	210/-200	410	-810/3460	3500/-910	300/-300	280	4800	9070
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	6610	110/-90	190	-330/1210	270/-210	160/-160	220	800	2050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6610	110/-90	190	-330/1210	270/-210	160/-160	220	800	2050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7430	130/-110	230	-410/1530	430/-310	190/-190	240	1230	3460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8250	150/-130	270	-480/1840	580/-400	210/-210	250	1660	4870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9530	190/-160	330	-630/2620	1980/-640	250/-250	270	3050	7290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10800	220/-190	380	-780/3390	3380/-870	280/-280	280	4430	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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R (Flaps 20)****VREF20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4220	100/-50	90	-140/480	50/-50	90/-90	130	0	110
AUTOBRAKE MAX	5690	70/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9870	130/-140	280	-430/1430	40/-110	280/-280	430	0	0

Good Reported Braking Action

MAX MANUAL	6070	80/-80	160	-250/860	160/-140	150/-150	200	0	510
AUTOBRAKE MAX	6320	80/-80	160	-260/880	150/-130	150/-160	230	0	540
AUTOBRAKE 2	9870	130/-140	280	-430/1430	40/-110	280/-280	430	0	0

Good To Medium Reported Braking Action

MAX MANUAL	7260	100/-110	210	-330/1150	290/-240	190/-190	240	0	1030
AUTOBRAKE MAX	7390	110/-110	210	-340/1160	280/-220	190/-200	270	0	1050
AUTOBRAKE 2	10000	140/-150	290	-450/1530	140/-150	290/-290	430	0	360

Medium Reported Braking Action

MAX MANUAL	8440	120/-130	250	-410/1440	420/-330	230/-230	270	0	1550
AUTOBRAKE MAX	8460	130/-130	260	-410/1440	410/-310	230/-230	300	0	1550
AUTOBRAKE 3	9280	130/-140	270	-430/1520	270/-200	260/-260	390	0	1120

Medium To Poor Reported Braking Action

MAX MANUAL	9820	150/-160	310	-520/1870	720/-500	280/-280	300	0	2660
AUTOBRAKE MAX	9830	160/-160	320	-520/1870	720/-500	280/-280	320	0	2660
AUTOBRAKE 3	10310	160/-170	330	-530/1910	640/-410	290/-290	380	0	2470

Poor Reported Braking Action

MAX MANUAL	11190	180/-190	370	-620/2290	1020/-670	320/-320	330	0	3770
AUTOBRAKE MAX	11200	190/-190	380	-620/2290	1030/-680	320/-320	330	0	3770
AUTOBRAKE 3	11340	190/-190	380	-620/2300	1000/-620	320/-320	370	0	3820

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ENG SHUTDOWN L, R (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	80/-40	70	-130/440	40/-40	70/-70	120	0	80
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8140	140/-110	220	-380/1280	40/-70	220/-230	390	0	0

Good Reported Braking Action

MAX MANUAL	5250	80/-60	130	-230/790	130/-120	120/-120	190	0	370
AUTOBRAKE MAX	5460	80/-70	130	-230/810	120/-110	130/-130	210	0	400
AUTOBRAKE 2	8140	140/-110	220	-380/1280	40/-70	220/-230	390	0	0

Good To Medium Reported Braking Action

MAX MANUAL	6210	100/-80	170	-300/1060	240/-200	150/-160	220	0	760
AUTOBRAKE MAX	6320	100/-90	170	-300/1070	240/-180	160/-160	250	0	770
AUTOBRAKE 2	8260	150/-120	230	-400/1380	130/-110	230/-230	390	0	280

Medium Reported Braking Action

MAX MANUAL	7170	120/-100	200	-370/1320	350/-280	180/-190	250	0	1140
AUTOBRAKE MAX	7180	120/-100	210	-370/1320	350/-250	190/-190	280	0	1140
AUTOBRAKE 3	7760	130/-110	220	-390/1390	240/-190	210/-210	350	0	880

Medium To Poor Reported Braking Action

MAX MANUAL	8290	150/-130	250	-470/1720	610/-420	220/-230	270	0	1950
AUTOBRAKE MAX	8300	150/-130	260	-470/1720	620/-410	230/-230	290	0	1960
AUTOBRAKE 3	8650	160/-130	260	-480/1760	550/-370	240/-240	330	0	1840

Poor Reported Braking Action

MAX MANUAL	9410	170/-150	300	-560/2110	860/-560	260/-260	290	0	2760
AUTOBRAKE MAX	9420	180/-150	300	-560/2110	880/-570	260/-260	290	0	2770
AUTOBRAKE 3	9540	180/-150	300	-560/2120	850/-550	260/-260	310	0	2800

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAP / SLAT CONTROL (Flaps 20)****VREF20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4170	90/-40	90	-140/460	50/-40	80/-80	130	100	210
AUTOBRAKE MAX	5690	70/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430

Good Reported Braking Action

MAX MANUAL	5790	70/-80	150	-230/810	130/-120	140/-140	180	400	940
AUTOBRAKE MAX	6020	80/-80	160	-240/830	110/-60	140/-140	240	400	970
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430

Good To Medium Reported Braking Action

MAX MANUAL	6730	90/-100	190	-300/1060	220/-190	170/-170	210	730	1840
AUTOBRAKE MAX	6840	100/-100	200	-300/1070	220/-150	170/-170	250	720	1850
AUTOBRAKE 2	9580	140/-150	300	-430/1460	190/-250	260/-260	310	530	960

Medium Reported Braking Action

MAX MANUAL	7660	110/-110	230	-360/1300	310/-250	190/-200	230	1050	2730
AUTOBRAKE MAX	7660	110/-110	240	-360/1300	320/-230	200/-200	250	1040	2720
AUTOBRAKE 3	8990	120/-130	260	-410/1440	160/-160	240/-240	370	430	1740

Medium To Poor Reported Braking Action

MAX MANUAL	8640	140/-140	280	-440/1630	490/-360	220/-230	250	1600	4610
AUTOBRAKE MAX	8640	140/-140	290	-440/1640	500/-350	230/-230	260	1600	4610
AUTOBRAKE 3	9520	140/-150	300	-480/1730	360/-280	260/-260	370	1130	3970

Poor Reported Braking Action

MAX MANUAL	9610	160/-160	330	-520/1960	660/-460	250/-250	270	2150	6480
AUTOBRAKE MAX	9620	160/-160	330	-520/1970	670/-470	260/-260	270	2150	6490
AUTOBRAKE 3	10040	160/-160	330	-540/2010	550/-390	270/-270	360	1820	6190

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≤ 5)

VREF30 + 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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW/ 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4620	150/-50	130	-150/630	50/-50	120/-100	170	150	380
AUTOBRAKE MAX	6730	90/-70	170	-230/760	0/0	170/-170	270	0	0
AUTOBRAKE 2	11280	190/-180	370	-460/1520	200/-250	320/-320	360	880	880

Good Reported Braking Action

MAX MANUAL	6450	90/-80	180	-250/850	140/-120	160/-160	180	530	1280
AUTOBRAKE MAX	6960	90/-80	180	-260/890	60/-40	180/-180	270	310	1090
AUTOBRAKE 2	11280	190/-180	370	-460/1520	200/-250	320/-320	360	880	880

Good To Medium Reported Braking Action

MAX MANUAL	7570	120/-100	230	-320/1110	240/-200	200/-200	210	980	2610
AUTOBRAKE MAX	7800	120/-100	230	-320/1130	200/-150	210/-210	270	860	2500
AUTOBRAKE 2	11350	190/-180	380	-470/1600	240/-280	320/-320	360	970	1540

Medium Reported Braking Action

MAX MANUAL	8680	140/-120	280	-380/1360	330/-270	230/-230	240	1430	3940
AUTOBRAKE MAX	8640	140/-120	280	-380/1360	330/-250	230/-230	260	1410	3900
AUTOBRAKE 3	10660	160/-150	320	-450/1560	180/-190	300/-300	380	580	2330

Medium To Poor Reported Braking Action

MAX MANUAL	9830	170/-150	340	-470/1710	520/-390	260/-260	270	2190	6860
AUTOBRAKE MAX	9800	170/-150	340	-470/1710	520/-380	270/-270	280	2180	6830
AUTOBRAKE 3	11160	180/-170	360	-510/1840	390/-300	310/-310	380	1450	5750

Poor Reported Braking Action

MAX MANUAL	10970	200/-170	400	-550/2050	700/-500	290/-290	290	2940	9780
AUTOBRAKE MAX	10960	200/-170	400	-550/2050	710/-510	300/-300	290	2940	9760
AUTOBRAKE 3	11650	200/-180	400	-570/2120	600/-410	320/-320	380	2320	9160

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAPS DRIVE (5 < Flaps < 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4200	110/-40	90	-140/460	50/-40	80/-80	120	100	230
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9710	160/-150	300	-420/1410	120/-180	270/-270	370	360	360

Good Reported Braking Action

MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	440	1040
AUTOBRAKE MAX	6040	90/-70	160	-240/830	110/-70	150/-150	240	430	1070
AUTOBRAKE 2	9710	160/-150	300	-420/1410	120/-180	270/-270	370	360	360

Good To Medium Reported Braking Action

MAX MANUAL	6830	110/-90	200	-300/1060	220/-190	170/-170	210	810	2100
AUTOBRAKE MAX	6910	110/-90	200	-300/1070	220/-170	180/-180	240	800	2100
AUTOBRAKE 2	9780	170/-150	300	-440/1480	170/-210	270/-270	370	460	990

Medium Reported Braking Action

MAX MANUAL	7800	130/-110	240	-360/1310	310/-250	200/-200	240	1170	3150
AUTOBRAKE MAX	7780	130/-110	240	-360/1300	320/-260	200/-200	240	1160	3130
AUTOBRAKE 3	9100	140/-130	260	-410/1450	140/-140	250/-250	390	430	2080

Medium To Poor Reported Braking Action

MAX MANUAL	8810	160/-140	290	-450/1650	490/-360	230/-230	260	1790	5410
AUTOBRAKE MAX	8810	160/-140	290	-450/1640	510/-370	230/-230	260	1790	5400
AUTOBRAKE 3	9630	160/-140	300	-480/1740	370/-260	270/-270	390	1270	4730

Poor Reported Braking Action

MAX MANUAL	9820	180/-160	340	-530/1980	670/-470	260/-260	280	2410	7670
AUTOBRAKE MAX	9830	180/-160	340	-530/1980	690/-480	260/-260	280	2410	7670
AUTOBRAKE 3	10160	180/-150	340	-540/2020	600/-370	280/-280	380	2100	7370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≥ 20)

VREF20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4170	100/-40	90	-140/460	50/-40	80/-80	130	100	210
AUTOBRAKE MAX	5690	70/-70	130	-210/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430

Good Reported Braking Action

MAX MANUAL	5790	70/-80	150	-230/810	130/-120	140/-140	180	400	940
AUTOBRAKE MAX	5990	80/-80	160	-240/830	110/-70	140/-140	240	400	970
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430

Good To Medium Reported Braking Action

MAX MANUAL	6730	90/-90	190	-300/1050	220/-180	170/-170	210	720	1840
AUTOBRAKE MAX	6820	100/-100	200	-300/1060	210/-150	170/-170	250	720	1840
AUTOBRAKE 2	9570	140/-150	300	-430/1460	190/-240	260/-260	310	530	960

Medium Reported Braking Action

MAX MANUAL	7660	110/-110	240	-360/1300	310/-250	200/-200	230	1050	2740
AUTOBRAKE MAX	7650	120/-110	240	-360/1300	320/-230	200/-200	250	1040	2720
AUTOBRAKE 3	8970	120/-130	260	-410/1440	160/-160	240/-240	370	430	1740

Medium To Poor Reported Braking Action

MAX MANUAL	8640	140/-140	280	-440/1630	490/-360	220/-220	250	1600	4610
AUTOBRAKE MAX	8630	140/-140	280	-440/1630	490/-350	230/-230	260	1590	4600
AUTOBRAKE 3	9510	140/-150	290	-470/1720	350/-270	260/-260	360	1130	3960

Poor Reported Braking Action

MAX MANUAL	9610	160/-160	330	-520/1970	660/-460	250/-250	270	2150	6480
AUTOBRAKE MAX	9620	160/-160	330	-520/1970	670/-470	260/-260	270	2150	6490
AUTOBRAKE 3	10050	160/-160	330	-540/2010	550/-390	270/-270	360	1820	6190

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAPS PRIMARY FAIL (Flaps 20)****VREF20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4690	80/-50	100	-150/510	60/-50	100/-100	160	120	270
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170

Good Reported Braking Action

MAX MANUAL	6410	80/-80	170	-250/870	160/-140	150/-150	220	490	1170
AUTOBRAKE MAX	6390	80/-90	170	-250/870	150/-130	150/-150	240	490	1160
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170

Good To Medium Reported Braking Action

MAX MANUAL	7380	110/-110	220	-320/1120	260/-210	180/-180	250	870	2260
AUTOBRAKE MAX	7360	110/-110	220	-320/1120	260/-220	190/-190	260	860	2240
AUTOBRAKE 2	9870	140/-160	300	-440/1500	150/-180	280/-280	400	300	1020

Medium Reported Braking Action

MAX MANUAL	8350	130/-130	260	-390/1370	350/-280	210/-210	280	1240	3340
AUTOBRAKE MAX	8320	130/-130	260	-380/1370	370/-300	220/-220	280	1230	3320
AUTOBRAKE 3	9130	130/-130	260	-410/1460	200/-140	250/-250	410	580	2630

Medium To Poor Reported Braking Action

MAX MANUAL	9350	160/-150	310	-470/1710	540/-400	240/-240	300	1860	5560
AUTOBRAKE MAX	9340	160/-150	310	-470/1710	570/-420	250/-250	300	1860	5560
AUTOBRAKE 3	9820	150/-150	310	-480/1770	450/-290	270/-270	400	1460	5140

Poor Reported Braking Action

MAX MANUAL	10340	180/-170	360	-550/2050	730/-510	270/-270	310	2470	7780
AUTOBRAKE MAX	10360	180/-170	360	-550/2050	760/-530	280/-280	310	2480	7790
AUTOBRAKE 3	10500	170/-170	350	-550/2070	700/-440	290/-290	380	2330	7640

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLIGHT CONTROL MODE (Flaps 20)

VREF20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100

Good Reported Braking Action

MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100

Good To Medium Reported Braking Action

MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130

Medium Reported Braking Action

MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980

Medium To Poor Reported Braking Action

MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680

Poor Reported Braking Action

MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLIGHT CONTROLS (Flaps 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4910	90/-50	110	-160/540	80/-70	110/-110	210	190	430
AUTOBRAKE MAX	5740	70/-60	130	-210/690	0/0	140/-140	240	0	30
AUTOBRAKE 2	10010	160/-150	290	-430/1440	30/-120	290/-290	440	60	60

Good Reported Braking Action

MAX MANUAL	6820	100/-90	190	-270/920	200/-170	170/-170	280	680	1700
AUTOBRAKE MAX	6770	100/-90	190	-270/920	210/-180	170/-170	280	670	1660
AUTOBRAKE 2	10010	160/-150	290	-430/1440	30/-120	290/-290	440	60	60

Good To Medium Reported Braking Action

MAX MANUAL	7870	130/-110	240	-340/1180	320/-260	200/-200	310	1160	3160
AUTOBRAKE MAX	7830	130/-110	250	-340/1180	330/-270	210/-210	310	1150	3130
AUTOBRAKE 2	10110	160/-150	300	-450/1520	120/-150	290/-290	440	290	1700

Medium Reported Braking Action

MAX MANUAL	8910	150/-130	290	-410/1440	430/-340	230/-230	330	1630	4610
AUTOBRAKE MAX	8890	150/-130	300	-410/1440	440/-350	240/-240	330	1630	4600
AUTOBRAKE 3	9300	150/-120	280	-420/1480	310/-150	250/-260	410	1220	4190

Medium To Poor Reported Braking Action

MAX MANUAL	9960	180/-160	350	-500/1790	640/-470	270/-270	350	2360	7490
AUTOBRAKE MAX	9950	180/-160	360	-500/1790	650/-480	270/-270	350	2370	7490
AUTOBRAKE 3	10170	180/-150	340	-500/1810	580/-340	280/-280	400	2140	7270

Poor Reported Braking Action

MAX MANUAL	11000	210/-180	410	-580/2130	840/-590	300/-300	360	3090	10360
AUTOBRAKE MAX	11010	210/-180	410	-580/2130	860/-600	300/-300	360	3100	10380
AUTOBRAKE 3	11040	210/-170	400	-580/2140	840/-530	300/-300	390	3060	10340

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS C (Flaps 20)

VREF20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4690	80/-50	100	-150/510	60/-50	100/-100	160	120	270
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170

Good Reported Braking Action

MAX MANUAL	6410	80/-80	170	-250/870	160/-140	150/-150	220	490	1170
AUTOBRAKE MAX	6390	80/-90	170	-250/870	150/-130	150/-150	240	490	1160
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170

Good To Medium Reported Braking Action

MAX MANUAL	7380	110/-110	220	-320/1120	260/-210	180/-180	250	870	2260
AUTOBRAKE MAX	7360	110/-110	220	-320/1120	260/-220	190/-190	260	860	2240
AUTOBRAKE 2	9870	140/-160	300	-440/1500	150/-180	280/-280	400	300	1020

Medium Reported Braking Action

MAX MANUAL	8350	130/-130	260	-390/1370	350/-280	210/-210	280	1240	3340
AUTOBRAKE MAX	8320	130/-130	260	-380/1370	370/-300	220/-220	280	1230	3320
AUTOBRAKE 3	9130	130/-130	260	-410/1460	200/-140	250/-250	410	580	2630

Medium To Poor Reported Braking Action

MAX MANUAL	9350	160/-150	310	-470/1710	540/-400	240/-240	300	1860	5560
AUTOBRAKE MAX	9340	160/-150	310	-470/1710	570/-420	250/-250	300	1860	5560
AUTOBRAKE 3	9820	150/-150	310	-480/1770	450/-290	270/-270	400	1460	5140

Poor Reported Braking Action

MAX MANUAL	10340	180/-170	360	-550/2050	730/-510	270/-270	310	2470	7780
AUTOBRAKE MAX	10360	180/-170	360	-550/2050	760/-530	280/-280	310	2480	7790
AUTOBRAKE 3	10500	170/-170	350	-550/2070	700/-440	290/-290	380	2330	7640

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L (Flaps 25)****VREF25**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4150	80/-40	90	-140/480	50/-50	80/-90	150	0	120
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8900	120/-130	250	-400/1350	0/-10	250/-250	470	0	0

Good Reported Braking Action

MAX MANUAL	5980	70/-80	150	-250/880	170/-150	150/-150	220	0	540
AUTOBRAKE MAX	6100	70/-80	160	-260/890	160/-130	150/-150	250	0	560
AUTOBRAKE 2	8900	120/-130	250	-400/1350	0/-10	250/-250	470	0	0

Good To Medium Reported Braking Action

MAX MANUAL	7190	100/-100	200	-340/1200	320/-260	190/-190	260	0	1120
AUTOBRAKE MAX	7240	100/-100	210	-340/1200	320/-250	190/-190	280	0	1130
AUTOBRAKE 2	9100	130/-130	260	-430/1480	140/-80	260/-260	470	0	550

Medium Reported Braking Action

MAX MANUAL	8390	120/-120	250	-420/1510	470/-360	220/-220	300	0	1700
AUTOBRAKE MAX	8380	120/-120	260	-420/1510	480/-370	230/-230	300	0	1700
AUTOBRAKE 3	8640	120/-130	260	-430/1530	400/-220	240/-240	400	0	1640

Medium To Poor Reported Braking Action

MAX MANUAL	9840	150/-150	320	-550/2010	860/-560	270/-270	330	0	3030
AUTOBRAKE MAX	9850	150/-150	330	-550/2010	870/-570	280/-280	330	0	3040
AUTOBRAKE 3	9980	150/-160	330	-550/2020	830/-480	280/-280	390	0	3010

Poor Reported Braking Action

MAX MANUAL	11290	170/-180	380	-670/2510	1240/-760	320/-320	350	0	4360
AUTOBRAKE MAX	11320	180/-180	390	-670/2510	1260/-770	320/-320	350	0	4370
AUTOBRAKE 3	11320	180/-180	390	-670/2510	1260/-740	320/-320	380	0	4370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	3970	80/-40	80	-140/470	50/-50	80/-80	150	0	100
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8220	140/-120	220	-380/1290	0/0	230/-230	450	0	0

Good Reported Braking Action

MAX MANUAL	5680	90/-70	140	-250/860	170/-140	140/-140	220	0	490
AUTOBRAKE MAX	5770	90/-70	150	-250/870	150/-130	140/-140	240	0	500
AUTOBRAKE 2	8220	140/-120	220	-380/1290	0/0	230/-230	450	0	0

Good To Medium Reported Braking Action

MAX MANUAL	6810	110/-90	190	-330/1170	310/-240	180/-180	260	0	1020
AUTOBRAKE MAX	6850	110/-90	200	-330/1170	310/-240	180/-180	270	0	1030
AUTOBRAKE 2	8420	150/-120	240	-410/1420	140/-70	240/-240	450	0	550

Medium Reported Braking Action

MAX MANUAL	7940	130/-110	240	-410/1470	450/-340	210/-210	290	0	1550
AUTOBRAKE MAX	7930	130/-110	240	-410/1470	460/-350	210/-210	300	0	1550
AUTOBRAKE 3	8080	140/-120	240	-410/1480	420/-230	220/-220	370	0	1560

Medium To Poor Reported Braking Action

MAX MANUAL	9320	160/-140	300	-530/1960	830/-540	260/-260	320	0	2770
AUTOBRAKE MAX	9320	160/-140	300	-530/1970	840/-550	260/-260	330	0	2780
AUTOBRAKE 3	9400	170/-140	300	-530/1970	820/-480	260/-260	370	0	2780

Poor Reported Braking Action

MAX MANUAL	10690	190/-160	360	-650/2450	1200/-730	300/-300	350	0	3990
AUTOBRAKE MAX	10710	190/-160	360	-650/2460	1220/-740	300/-300	350	0	4000
AUTOBRAKE 3	10710	200/-160	360	-650/2460	1220/-720	300/-300	360	0	4000

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L+C (Flaps 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	5110	100/-50	110	-170/570	80/-70	110/-110	210	0	190
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	10070	160/-140	280	-430/1450	0/0	290/-290	510	0	0

Good Reported Braking Action

MAX MANUAL	7370	110/-90	200	-300/1010	240/-200	190/-190	300	0	850
AUTOBRAKE MAX	7240	110/-90	200	-290/1000	260/-190	190/-190	310	0	820
AUTOBRAKE 2	10070	160/-140	280	-430/1450	0/0	290/-290	510	0	0

Good To Medium Reported Braking Action

MAX MANUAL	8820	140/-120	260	-390/1350	430/-340	240/-240	340	0	1710
AUTOBRAKE MAX	8730	140/-120	270	-390/1350	460/-350	240/-240	350	0	1680
AUTOBRAKE 2	10360	170/-140	300	-470/1590	240/-100	300/-300	510	0	1120

Medium Reported Braking Action

MAX MANUAL	10260	170/-140	320	-480/1690	620/-470	280/-280	380	0	2560
AUTOBRAKE MAX	10210	170/-140	330	-480/1690	650/-500	280/-280	380	0	2540
AUTOBRAKE 3	10240	170/-150	330	-480/1690	640/-420	290/-290	400	0	2550

Medium To Poor Reported Braking Action

MAX MANUAL	11970	210/-180	400	-620/2230	1090/-710	340/-340	410	0	4460
AUTOBRAKE MAX	11950	210/-180	410	-620/2230	1130/-740	340/-340	410	0	4460
AUTOBRAKE 3	11970	210/-180	410	-620/2230	1120/-700	350/-350	420	0	4460

Poor Reported Braking Action

MAX MANUAL	13670	240/-210	480	-750/2760	1560/-950	390/-390	440	0	6360
AUTOBRAKE MAX	13690	250/-210	490	-750/2760	1600/-980	400/-400	440	0	6370
AUTOBRAKE 3	13690	250/-210	490	-750/2760	1600/-980	400/-400	440	0	6370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L+R (Flaps 20)

VREF30 + 20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	5510	100/-60	130	-200/670	120/-100	130/-130	230	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8760	120/-100	240	-380/1300	440/-350	240/-240	370	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	11280	160/-140	330	-540/1880	980/-670	330/-330	440	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	13800	200/-170	410	-700/2450	1520/-990	420/-420	510	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	17750	250/-200	550	-1010/3660	4490/-1810	560/-560	570	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	21700	290/-230	680	-1310/4860	7450/-2620	690/-690	630	0	0
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R (Flaps 25)****VREF25**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4530	60/-50	100	-160/560	70/-70	100/-100	170	0	180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6520	80/-90	180	-290/1010	220/-190	160/-160	240	0	740
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7760	110/-110	230	-380/1360	410/-310	200/-200	280	0	1440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	9000	130/-130	280	-470/1700	590/-430	240/-240	310	0	2130
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10460	160/-160	350	-600/2260	1090/-660	290/-290	330	0	3670
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11910	190/-190	410	-730/2820	1590/-880	330/-330	350	0	5210
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4310	60/-50	90	-160/540	70/-60	90/-90	160	0	160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6110	90/-80	160	-280/970	210/-170	150/-150	230	0	640
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7240	120/-100	210	-370/1310	380/-290	190/-190	260	0	1240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8370	140/-120	250	-450/1640	540/-400	220/-220	290	0	1840
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9700	170/-150	310	-580/2180	1010/-610	260/-260	310	0	3160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11020	200/-170	370	-700/2720	1480/-810	300/-300	330	0	4470
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R+C (Flaps 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	6200	80/-70	150	-230/770	140/-130	150/-150	260	0	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8890	140/-120	260	-390/1340	410/-330	240/-240	350	0	1610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	10490	180/-150	340	-500/1770	710/-520	290/-290	390	0	2950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	12090	210/-180	410	-610/2200	1010/-700	340/-340	420	0	4290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	13900	250/-220	500	-780/2890	1920/-1020	400/-400	450	0	7180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	15700	290/-250	580	-940/3570	2820/-1330	450/-450	470	0	10060
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH DOWN AUTHORITY (Flaps 25)

VREF25

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4410	80/-40	80	-150/490	50/-40	80/-80	150	60	140
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8760	120/-130	250	-390/1330	70/-130	240/-240	360	140	140

Good Reported Braking Action

MAX MANUAL	5860	70/-70	140	-240/820	130/-110	130/-130	200	300	700
AUTOBRAKE MAX	5840	70/-70	140	-240/820	140/-120	130/-130	210	300	690
AUTOBRAKE 2	8760	120/-130	250	-390/1330	80/-130	240/-240	360	140	140

Good To Medium Reported Braking Action

MAX MANUAL	6700	90/-90	180	-300/1060	210/-180	160/-160	220	570	1430
AUTOBRAKE MAX	6690	90/-90	180	-300/1060	230/-190	160/-160	230	570	1420
AUTOBRAKE 2	8900	120/-130	260	-410/1410	150/-180	240/-240	360	250	610

Medium Reported Braking Action

MAX MANUAL	7540	100/-100	210	-360/1290	290/-240	180/-180	240	830	2160
AUTOBRAKE MAX	7540	100/-100	220	-360/1290	310/-250	180/-180	250	830	2150
AUTOBRAKE 3	8320	110/-110	230	-390/1380	190/-140	220/-220	390	350	1440

Medium To Poor Reported Braking Action

MAX MANUAL	8420	120/-120	260	-440/1610	460/-340	210/-210	260	1300	3710
AUTOBRAKE MAX	8440	130/-120	260	-440/1620	480/-350	210/-210	260	1300	3710
AUTOBRAKE 3	8930	130/-130	260	-460/1670	390/-270	240/-240	370	970	3260

Poor Reported Braking Action

MAX MANUAL	9300	140/-140	300	-510/1930	620/-430	230/-230	270	1760	5250
AUTOBRAKE MAX	9340	150/-140	300	-510/1940	640/-450	240/-240	270	1770	5260
AUTOBRAKE 3	9540	140/-140	290	-520/1960	580/-390	250/-250	340	1580	5070

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PITCH DOWN AUTHORITY (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4220	80/-40	80	-140/480	50/-40	80/-80	150	60	120
AUTOBRAKE MAX	4860	70/-60	110	-180/620	10/0	110/-110	230	0	0
AUTOBRAKE 2	8150	140/-120	230	-380/1280	40/-100	220/-220	360	70	70

Good Reported Braking Action

MAX MANUAL	5570	80/-60	130	-230/800	120/-110	120/-120	200	270	620
AUTOBRAKE MAX	5540	80/-60	130	-230/800	130/-120	120/-120	210	260	610
AUTOBRAKE 2	8150	140/-120	230	-380/1280	50/-100	220/-220	360	70	70

Good To Medium Reported Braking Action

MAX MANUAL	6350	100/-80	170	-290/1030	200/-170	150/-150	220	510	1270
AUTOBRAKE MAX	6340	100/-80	170	-290/1030	220/-180	150/-150	230	510	1260
AUTOBRAKE 2	8280	140/-120	240	-400/1360	120/-150	220/-220	360	170	510

Medium Reported Braking Action

MAX MANUAL	7130	110/-100	200	-350/1260	280/-220	170/-170	240	750	1920
AUTOBRAKE MAX	7130	110/-100	200	-350/1260	300/-240	170/-170	240	750	1910
AUTOBRAKE 3	7720	120/-100	210	-370/1330	190/-120	200/-200	380	340	1360

Medium To Poor Reported Braking Action

MAX MANUAL	7950	130/-120	240	-430/1580	440/-320	200/-200	260	1180	3310
AUTOBRAKE MAX	7970	130/-120	240	-430/1580	460/-340	200/-200	260	1180	3310
AUTOBRAKE 3	8320	140/-120	240	-440/1620	390/-240	220/-220	360	920	2980

Poor Reported Braking Action

MAX MANUAL	8770	150/-130	270	-500/1890	600/-410	220/-220	270	1600	4700
AUTOBRAKE MAX	8810	150/-130	280	-500/1890	620/-430	220/-220	270	1600	4700
AUTOBRAKE 3	8920	150/-130	270	-500/1910	580/-360	230/-230	340	1490	4590

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4680	140/-50	100	-150/500	50/-50	100/-100	130	130	290
AUTOBRAKE MAX	6530	80/-70	160	-230/740	0/0	160/-170	260	0	0
AUTOBRAKE 2	10740	170/-160	350	-440/1480	230/-260	300/-300	300	920	940

Good Reported Braking Action

MAX MANUAL	6560	90/-80	180	-250/860	150/-130	160/-160	180	520	1240
AUTOBRAKE MAX	6820	90/-80	180	-260/880	80/-60	170/-170	260	370	1110
AUTOBRAKE 2	10740	170/-160	350	-440/1480	230/-260	300/-300	300	920	940

Good To Medium Reported Braking Action

MAX MANUAL	7620	120/-100	230	-320/1110	240/-200	200/-200	210	920	2390
AUTOBRAKE MAX	7670	120/-100	230	-320/1120	200/-160	200/-200	260	830	2280
AUTOBRAKE 2	10820	180/-160	350	-460/1550	280/-290	310/-310	300	1020	1530

Medium Reported Braking Action

MAX MANUAL	8680	140/-120	280	-380/1360	330/-270	230/-230	230	1320	3530
AUTOBRAKE MAX	8520	140/-120	270	-380/1350	320/-250	220/-220	250	1280	3440
AUTOBRAKE 3	10280	160/-140	310	-440/1540	220/-230	280/-280	340	630	2130

Medium To Poor Reported Braking Action

MAX MANUAL	9750	170/-150	330	-470/1710	520/-380	260/-260	250	1970	5860
AUTOBRAKE MAX	9570	170/-140	330	-460/1690	510/-380	260/-260	260	1930	5740
AUTOBRAKE 3	10800	180/-160	350	-500/1820	410/-340	300/-300	340	1350	4840

Poor Reported Braking Action

MAX MANUAL	10820	190/-170	380	-550/2050	700/-490	290/-290	270	2620	8180
AUTOBRAKE MAX	10620	190/-160	380	-540/2030	700/-500	290/-290	270	2570	8040
AUTOBRAKE 3	11310	190/-170	390	-560/2100	600/-450	310/-310	330	2070	7550

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY (Flaps ≥ 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4230	100/-40	90	-140/470	50/-40	90/-90	130	100	220
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500

Good Reported Braking Action

MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	410	960
AUTOBRAKE MAX	6080	90/-70	160	-240/830	110/-70	150/-150	240	410	1000
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500

Good To Medium Reported Braking Action

MAX MANUAL	6800	110/-90	200	-300/1060	220/-190	170/-170	210	740	1870
AUTOBRAKE MAX	6900	110/-90	200	-300/1070	220/-150	180/-180	250	730	1880
AUTOBRAKE 2	9620	160/-150	300	-430/1470	210/-250	270/-270	300	600	1030

Medium Reported Braking Action

MAX MANUAL	7730	130/-110	240	-360/1300	310/-250	200/-200	230	1060	2770
AUTOBRAKE MAX	7720	130/-110	240	-360/1300	320/-230	200/-200	260	1050	2750
AUTOBRAKE 3	9070	150/-130	260	-410/1450	170/-180	250/-250	350	460	1760

Medium To Poor Reported Braking Action

MAX MANUAL	8690	160/-130	290	-440/1640	490/-360	230/-230	250	1610	4620
AUTOBRAKE MAX	8690	160/-130	290	-440/1640	500/-350	230/-230	270	1600	4610
AUTOBRAKE 3	9600	170/-150	300	-480/1730	360/-290	260/-270	350	1130	3960

Poor Reported Braking Action

MAX MANUAL	9650	180/-150	330	-520/1970	660/-460	260/-260	270	2150	6470
AUTOBRAKE MAX	9660	180/-150	330	-520/1970	670/-470	260/-260	270	2150	6470
AUTOBRAKE 3	10120	180/-160	330	-540/2010	550/-400	270/-280	340	1800	6160

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PRI FLIGHT COMPUTERS (Flaps 20)

VREF20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100

Good Reported Braking Action

MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100

Good To Medium Reported Braking Action

MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130

Medium Reported Braking Action

MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980

Medium To Poor Reported Braking Action

MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680

Poor Reported Braking Action

MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SLATS DRIVE (Flaps 20)****VREF30 + 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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4500	120/-40	100	-140/490	50/-50	90/-100	130	120	260
AUTOBRAKE MAX	6230	80/-70	150	-220/720	0/0	150/-150	260	0	0
AUTOBRAKE 2	10250	170/-150	320	-430/1450	220/-240	290/-290	310	730	740

Good Reported Braking Action

MAX MANUAL	6270	90/-80	170	-240/850	140/-130	150/-150	190	460	1090
AUTOBRAKE MAX	6580	90/-80	170	-250/870	100/-70	160/-160	260	420	1090
AUTOBRAKE 2	10250	170/-150	320	-430/1450	220/-240	290/-290	310	730	740

Good To Medium Reported Braking Action

MAX MANUAL	7270	110/-100	220	-310/1100	240/-200	180/-190	220	820	2080
AUTOBRAKE MAX	7440	120/-100	220	-320/1110	210/-160	190/-190	260	800	2080
AUTOBRAKE 2	10330	170/-160	330	-450/1520	270/-270	290/-290	310	830	1300

Medium Reported Braking Action

MAX MANUAL	8260	130/-120	260	-380/1340	330/-270	210/-220	240	1170	3060
AUTOBRAKE MAX	8290	140/-120	260	-380/1340	320/-250	220/-220	260	1170	3060
AUTOBRAKE 3	9840	150/-140	290	-430/1500	210/-230	270/-270	320	570	1930

Medium To Poor Reported Braking Action

MAX MANUAL	9280	160/-140	310	-460/1680	510/-380	250/-250	260	1750	5050
AUTOBRAKE MAX	9300	170/-140	310	-460/1680	510/-370	250/-250	270	1750	5050
AUTOBRAKE 3	10370	170/-160	330	-500/1790	410/-350	290/-290	320	1240	4290

Poor Reported Braking Action

MAX MANUAL	10300	190/-160	360	-540/2020	690/-480	280/-280	270	2330	7030
AUTOBRAKE MAX	10310	190/-160	360	-540/2020	700/-490	280/-280	270	2330	7040
AUTOBRAKE 3	10900	190/-170	370	-560/2070	600/-460	300/-300	320	1910	6640

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SPOILERS (Flaps 25)

VREF25

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4010	70/-40	80	-130/460	50/-40	80/-80	130	90	200
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8700	120/-130	260	-390/1330	80/-170	240/-240	340	210	210

Good Reported Braking Action

MAX MANUAL	5510	70/-70	140	-230/790	130/-110	130/-130	190	380	890
AUTOBRAKE MAX	5640	70/-70	140	-230/810	120/-100	130/-130	210	390	930
AUTOBRAKE 2	8700	120/-130	260	-390/1330	80/-170	240/-240	340	210	210

Good To Medium Reported Braking Action

MAX MANUAL	6370	90/-90	180	-290/1030	220/-180	160/-160	220	680	1740
AUTOBRAKE MAX	6440	90/-90	180	-290/1040	220/-180	160/-160	230	690	1760
AUTOBRAKE 2	8780	130/-140	260	-410/1400	140/-200	240/-240	340	320	790

Medium Reported Braking Action

MAX MANUAL	7230	110/-110	220	-350/1270	300/-240	180/-180	240	980	2580
AUTOBRAKE MAX	7240	110/-110	220	-350/1270	310/-250	180/-180	240	980	2580
AUTOBRAKE 3	8150	110/-120	230	-390/1370	150/-110	220/-220	380	430	1890

Medium To Poor Reported Braking Action

MAX MANUAL	8130	130/-130	260	-430/1600	470/-340	210/-210	260	1500	4330
AUTOBRAKE MAX	8140	130/-130	270	-430/1600	490/-360	210/-210	260	1500	4340
AUTOBRAKE 3	8690	130/-140	270	-450/1660	370/-230	240/-240	380	1150	3920

Poor Reported Braking Action

MAX MANUAL	9030	150/-150	300	-510/1920	640/-440	230/-230	270	2010	6080
AUTOBRAKE MAX	9040	150/-150	310	-510/1920	660/-460	240/-240	270	2010	6090
AUTOBRAKE 3	9230	150/-150	300	-510/1940	590/-340	250/-250	370	1860	5950

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SPOILERS (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	3840	70/-40	80	-130/440	40/-40	70/-70	130	80	180
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8090	140/-120	230	-380/1280	60/-140	220/-220	330	130	130

Good Reported Braking Action

MAX MANUAL	5230	80/-60	130	-220/770	120/-110	120/-120	190	340	800
AUTOBRAKE MAX	5340	80/-70	130	-220/780	110/-100	120/-120	210	350	830
AUTOBRAKE 2	8090	140/-120	230	-380/1280	60/-140	220/-220	330	130	130

Good To Medium Reported Braking Action

MAX MANUAL	6040	100/-80	170	-280/1010	210/-170	150/-150	210	620	1560
AUTOBRAKE MAX	6090	100/-90	170	-280/1010	210/-170	150/-150	230	620	1570
AUTOBRAKE 2	8180	140/-120	240	-390/1350	110/-170	220/-220	330	230	680

Medium Reported Braking Action

MAX MANUAL	6840	110/-100	200	-340/1240	290/-230	170/-170	230	890	2310
AUTOBRAKE MAX	6840	110/-100	200	-340/1240	300/-240	170/-170	240	880	2300
AUTOBRAKE 3	7570	130/-100	210	-370/1320	150/-100	200/-200	370	420	1770

Medium To Poor Reported Braking Action

MAX MANUAL	7680	140/-120	240	-420/1560	460/-330	200/-200	250	1360	3870
AUTOBRAKE MAX	7690	140/-120	240	-420/1560	470/-340	200/-200	260	1350	3870
AUTOBRAKE 3	8110	150/-120	250	-440/1610	370/-220	220/-220	370	1080	3570

Poor Reported Braking Action

MAX MANUAL	8510	160/-130	280	-490/1880	620/-420	220/-220	270	1820	5430
AUTOBRAKE MAX	8530	160/-140	280	-490/1880	630/-430	220/-220	270	1820	5440
AUTOBRAKE 3	8640	160/-130	280	-500/1890	580/-330	230/-230	360	1730	5360

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

STABILIZER (Flaps 20)

VREF30 + 20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4230	100/-40	90	-140/470	50/-40	90/-90	130	100	220
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500

Good Reported Braking Action

MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	410	960
AUTOBRAKE MAX	6080	90/-70	160	-240/830	110/-70	150/-150	240	410	1000
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500

Good To Medium Reported Braking Action

MAX MANUAL	6800	110/-90	200	-300/1060	220/-190	170/-170	210	740	1870
AUTOBRAKE MAX	6900	110/-90	200	-300/1070	220/-150	180/-180	250	730	1880
AUTOBRAKE 2	9620	160/-150	300	-430/1470	210/-250	270/-270	300	600	1030

Medium Reported Braking Action

MAX MANUAL	7730	130/-110	240	-360/1300	310/-250	200/-200	230	1060	2770
AUTOBRAKE MAX	7720	130/-110	240	-360/1300	320/-230	200/-200	260	1050	2750
AUTOBRAKE 3	9070	150/-130	260	-410/1450	170/-180	250/-250	350	460	1760

Medium To Poor Reported Braking Action

MAX MANUAL	8690	160/-130	290	-440/1640	490/-360	230/-230	250	1610	4620
AUTOBRAKE MAX	8690	160/-130	290	-440/1640	500/-350	230/-230	270	1600	4610
AUTOBRAKE 3	9600	170/-150	300	-480/1730	360/-290	260/-270	350	1130	3960

Poor Reported Braking Action

MAX MANUAL	9650	180/-150	330	-520/1970	660/-460	260/-260	270	2150	6470
AUTOBRAKE MAX	9660	180/-150	330	-520/1970	670/-470	260/-260	270	2150	6470
AUTOBRAKE 3	10120	180/-160	330	-540/2010	550/-400	270/-280	340	1800	6160

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Approach or Landing Climb Limited Weight****Valid for approach with flaps 20 and landing with flaps 30**

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	672.3	628.0				
52	126	690.0	643.1				
50	122	707.9	659.3	605.6			
48	118	725.5	677.8	619.9			
46	115	743.7	696.5	635.4	581.4		
44	111	761.0	714.1	652.5	596.0		
42	108	780.4	732.3	671.6	610.3	559.0	
40	104	796.2	750.7	689.9	624.4	570.9	
38	100	812.3	772.2	707.1	638.3	582.6	521.9
36	97	826.7	788.8	722.9	650.1	593.9	531.2
34	93	835.0	804.3	739.6	664.3	603.4	540.4
32	90	835.0	820.0	753.4	678.3	612.5	550.1
30	86	835.0	833.7	766.6	692.9	621.8	558.8
28	82	835.0	834.0	778.6	704.3	631.8	567.1
26	79	835.0	834.2	790.6	714.0	642.3	575.8
24	75	835.0	834.4	790.8	722.9	651.2	585.1
22	72	835.0	834.6	790.9	732.3	660.0	595.0
20	68	835.0	834.9	791.1	732.6	667.3	602.2
18	64	835.0	835.0	791.3	732.8	675.5	607.4
16	61	835.0	835.0	791.5	732.9	675.6	612.2
14	57	835.0	835.0	791.6	733.1	675.8	617.4
12	54	835.0	835.0	791.8	733.3	675.9	617.7
10	50	835.0	835.0	792.0	733.4	675.9	617.8
8	46	835.0	835.0	792.1	733.6	676.0	617.8
6	43	835.0	835.0	792.2	733.7	676.0	617.7
4	40	835.0	835.0	781.7	706.7	645.9	570.8
2	36	835.0	835.0	781.9	706.7	646.0	570.9
0	32	835.0	835.0	781.9	706.8	646.1	570.9
-40	-40	835.0	835.0	781.9	706.8	646.1	571.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 2900 lb.

With engine and wing anti-ice on, decrease weight by 5000 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 51700 lb.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	680.0	638.0				
52	126	695.9	653.6				
50	122	712.4	668.9	615.7			
48	118	729.4	684.9	630.1			
46	115	746.7	701.6	645.6	591.1		
44	111	764.2	718.1	662.4	606.0		
42	108	782.9	735.6	679.3	620.8	567.8	
40	104	798.7	753.2	695.5	635.2	580.4	
38	100	814.9	775.2	711.9	649.3	592.6	531.3
36	97	829.6	791.2	727.2	661.8	604.5	540.8
34	93	835.0	806.7	743.2	674.4	614.6	550.2
32	90	835.0	822.8	756.3	686.9	623.9	560.3
30	86	835.0	833.7	770.0	699.8	633.9	569.5
28	82	835.0	835.0	781.3	710.0	643.8	578.1
26	79	835.0	835.0	793.6	719.1	654.8	587.0
24	75	835.0	835.0	793.7	727.7	663.6	596.2
22	72	835.0	835.0	793.9	736.6	671.3	606.6
20	68	835.0	835.0	794.0	736.9	677.6	613.8
18	64	835.0	835.0	794.2	737.0	684.6	619.2
16	61	835.0	835.0	794.4	737.2	684.7	624.2
14	57	835.0	835.0	794.6	737.4	684.8	629.6
12	54	835.0	835.0	794.7	737.5	684.9	629.8
10	50	835.0	835.0	794.9	737.7	685.0	630.0
8	46	835.0	835.0	795.0	737.9	685.1	630.0
6	43	835.0	835.0	795.1	738.0	685.2	629.9
4	40	835.0	835.0	795.2	738.1	685.2	618.8
2	36	835.0	835.0	795.3	738.2	685.3	618.8
0	32	835.0	835.0	795.3	738.2	685.4	618.9
-40	-40	835.0	835.0	795.6	738.4	685.8	619.2

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 3200 lb.

With engine and wing anti-ice on, decrease weight by 4000 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 52100 lb.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																							
		80				100				120				140				160				180			
WEIGHT (1000 LB)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																							
		0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8			
780	0	21.8	23.8	26.1	32.5	35.8	39.7	45.4	50.5	56.5	59.5	66.5	74.6	74.6	83.6	94.0	90.2	101.1	113.5						
	10	22.4	24.5	26.9	33.4	36.9	40.9	46.8	52.1	58.2	61.4	68.6	77.0	77.0	86.3	96.9	93.1	104.2	116.8						
	15	22.8	24.9	27.4	34.0	37.6	41.7	47.7	53.1	59.3	62.5	69.9	78.4	78.3	87.8	98.6	94.7	106.0	118.7						
	20	23.2	25.4	27.8	34.7	38.2	42.4	48.5	54.0	60.3	63.5	71.1	79.7	79.7	89.3	100.2	96.2	107.7	120.6						
	30	23.8	26.0	28.5	35.5	39.2	43.5	49.8	55.4	62.0	65.3	73.0	81.9	81.9	91.7	102.9	98.9	110.6	123.7						
740	0	23.9	26.1	28.7	35.9	39.7	44.1	50.6	56.3	63.0	66.4	74.4	83.5	83.4	93.5	105.0	100.8	112.8	126.0						
	10	21.0	22.8	25.0	31.1	34.3	38.0	43.5	48.3	53.9	56.8	63.5	71.2	71.3	79.9	89.8	86.3	96.8	108.7						
	15	21.5	23.5	25.7	32.0	35.3	39.1	44.8	49.8	55.6	58.6	65.5	73.5	73.6	82.5	92.6	89.1	99.8	111.9						
	20	21.9	23.9	26.2	32.6	36.0	39.8	45.6	50.7	56.6	59.7	66.7	74.8	74.9	83.9	94.2	90.6	101.5	113.8						
	30	22.3	24.3	26.7	33.2	36.6	40.5	46.4	51.6	57.6	60.7	67.9	76.1	76.2	85.3	95.8	92.1	103.1	115.6						
700	0	22.8	24.9	27.3	34.0	37.5	41.6	47.6	53.0	59.2	62.4	69.7	78.2	78.3	87.7	98.4	94.7	105.9	118.6						
	10	23.0	25.1	27.5	34.4	37.9	42.1	48.3	53.8	60.1	63.4	71.0	79.7	79.7	89.4	100.4	96.5	108.1	120.9						
	15	20.1	21.9	23.9	29.8	32.8	36.2	41.5	46.1	51.4	54.2	60.5	67.8	68.0	76.2	85.6	82.4	92.4	103.8						
	20	20.6	22.5	24.6	30.6	33.7	37.3	42.8	47.5	53.0	55.9	62.4	70.0	70.1	78.6	88.3	85.0	95.2	106.9						
	30	21.0	22.9	25.1	31.2	34.3	38.0	43.6	48.4	53.9	56.9	63.5	71.2	71.4	80.0	89.8	86.4	96.9	108.7						
620	0	21.4	23.3	25.5	31.8	35.0	38.7	44.3	49.2	54.9	57.9	64.6	72.4	72.6	81.3	91.3	87.9	98.5	110.4						
	10	21.9	23.8	26.1	32.5	35.8	39.7	45.5	50.5	56.4	59.5	66.4	74.4	74.6	83.6	93.8	90.3	101.2	113.4						
	15	22.0	24.0	26.3	32.9	36.2	40.2	46.1	51.3	57.3	60.5	67.6	75.8	76.0	85.2	95.7	92.1	103.2	115.6						
	20	18.4	20.0	21.8	27.1	29.7	32.8	37.6	41.6	46.3	48.8	54.4	60.9	61.2	68.4	76.8	74.1	83.1	93.4						
	30	18.9	20.5	22.4	27.9	30.6	33.8	38.7	42.9	47.7	50.4	56.1	62.8	63.1	70.6	79.3	76.5	85.7	96.3						
540	0	19.3	20.9	22.8	28.4	31.2	34.4	39.4	43.6	48.6	51.3	57.1	63.9	64.2	71.9	80.7	77.8	87.2	97.9						
	10	19.6	21.3	23.2	28.9	31.7	35.0	40.1	44.4	49.4	52.2	58.1	65.0	65.4	73.1	82.0	79.2	88.7	99.6						
	15	20.0	21.7	23.8	29.6	32.5	35.9	41.1	45.6	50.7	53.6	59.7	66.8	67.1	75.1	84.3	81.4	91.2	102.3						
	20	20.1	21.9	23.9	29.9	32.8	36.3	41.7	46.2	51.5	54.4	60.7	68.0	68.3	76.5	85.9	82.9	93.0	104.3						
	30	16.8	18.1	19.8	24.4	26.7	29.4	33.6	37.1	41.2	43.4	48.3	53.9	54.2	60.5	67.8	65.5	73.4	82.5						
460	0	17.2	18.6	20.3	25.1	27.5	30.3	34.6	38.2	42.4	44.8	49.8	55.5	55.9	62.4	69.9	67.6	75.7	85.1						
	15	17.5	19.0	20.7	25.6	28.0	30.8	35.2	38.9	43.2	45.6	50.7	56.5	56.9	63.5	71.2	68.8	77.1	86.5						
	20	17.8	19.3	21.0	26.0	28.5	31.4	35.9	39.6	44.0	46.4	51.5	57.5	57.9	64.6	72.4	70.0	78.4	88.0						
	30	18.2	19.7	21.5	26.6	29.2	32.1	36.8	40.6	45.1	47.6	52.9	59.1	59.4	66.4	74.4	71.9	80.6	90.4						
	40	18.3	19.8	21.6	26.9	29.4	32.5	37.2	41.1	45.7	48.3	53.7	60.1	60.4	67.6	75.8	73.3	82.1	92.2						
380	0	15.2	16.4	17.7	21.8	23.8	26.1	29.6	32.6	36.0	37.9	42.0	46.7	47.0	52.3	58.5	56.6	63.3	70.9						
	10	15.6	16.8	18.2	22.4	24.4	26.8	30.5	33.5	37.1	39.1	43.3	48.2	48.4	53.9	60.3	58.4	65.3	73.2						
	15	15.9	17.1	18.6	22.8	24.9	27.3	31.0	34.2	37.8	39.8	44.1	49.1	49.3	54.9	61.4	59.4	66.4	74.5						
	20	16.1	17.4	18.9	23.2	25.3	27.8	31.6	34.8	38.5	40.5	44.9	49.9	50.2	55.9	62.5	60.5	67.6	75.8						
	30	16.5	17.8	19.3	23.7	25.9	28.4	32.4	35.6	39.4	41.5	46.0	51.3	51.5	57.4	64.2	62.1	69.4	77.8						
	0	16.5	17.8	19.4	23.9	26.1	28.7	32.7	36.0	39.9	42.1	46.7	52.0	52.3	58.3	65.3	63.2	70.7	79.3						
	10	13.6	14.6	15.8	19.2	20.8	22.7	25.6	28.1	30.9	32.4	35.7	39.6	39.6	43.9	48.9	47.3	52.7	58.9						
	15	14.0	15.0	16.2	19.7	21.4	23.4	26.3	28.9	31.8	33.3	36.8	40.8	40.8	45.3	50.4	48.8	54.3	60.7						
	20	14.2	15.3	16.5	20.0	21.8	23.8	26.8	29.4	32.4	33.9	37.4	41.5	41.6	46.1	51.4	49.7	55.3	61.8						
	30	14.5	15.5	16.8	20.4	22.2	24.2	27.3	29.9	33.0	34.5	38.1	42.3	42.3	46.9	52.3	50.5	56.3	62.9						
	0	14.8	15.9	17.2	20.8	22.7	24.8	28.0	30.6	33.8	35.4	39.1	43.3	43.4	48.1	53.6	51.9	57.8	64.6						
	40	14.8	15.9	17.2	20.9	22.8	25.0	28.2	30.9	34.2	35.8	39.6	43.9	44.0	48.8	54.5	52.7	58.7	65.8						

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****Event Adjusted Brake Energy (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	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	4.4	14.1	23.7	33.2	42.6	51.9	61.2	70.5	79.9	89.3	98.9	108.7
	MAX AUTO	4.4	13.1	21.7	30.2	38.7	47.3	56.0	65.0	74.3	83.9	94.0	104.6
	AUTOBRAKE 4	4.3	12.5	20.4	28.1	35.7	43.4	51.2	59.3	67.7	76.6	86.1	96.4
	AUTOBRAKE 3	4.2	11.9	19.2	26.3	33.3	40.3	47.4	54.8	62.6	70.8	79.7	89.3
	AUTOBRAKE 2	4.1	11.2	17.9	24.4	30.8	37.2	43.7	50.5	57.6	65.1	73.2	81.9
	AUTOBRAKE 1	4.0	10.3	16.3	22.1	27.8	33.4	39.1	45.1	51.3	58.0	65.1	72.9

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	3.3	12.0	21.0	30.0	38.9	47.5	56.1	64.5	72.8	81.0	89.2	97.5
	MAX AUTO	2.0	8.7	15.5	22.3	29.3	36.4	43.8	51.5	59.6	68.3	77.5	87.4
	AUTOBRAKE 4	1.4	5.6	10.4	15.6	20.9	26.4	32.2	38.3	44.8	51.9	59.6	68.0
	AUTOBRAKE 3	0.9	3.2	6.4	10.3	14.3	18.5	23.0	27.9	33.2	39.0	45.4	52.4
	AUTOBRAKE 2	0.3	1.8	4.0	6.5	9.3	12.3	15.6	19.2	23.3	27.9	33.0	38.7
	AUTOBRAKE 1	0.2	1.2	2.6	4.3	6.1	8.1	10.3	12.8	15.6	18.8	22.3	26.4

Cooling Time (Minutes)

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)											
		16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE		
GEAR DOWN	NO SPECIAL	PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE		
INFLIGHT													
GROUND			11	18	26	42	55	66	73				
BTMS	UP TO 2.4		2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE		

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 for each taxi mile.

For one brake deactivated, increase brake energy by 10 percent.

For two brakes deactivated, increase brake energy by 20 percent.

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 8 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 EICAS 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.

(When inflight with gear extended, the BTMS indications may vary between individual brakes, due to airstream effects.)

Performance Inflight
Engine Inoperative

Chapter PI
Section 53

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for one pack on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	97.9	97.0	97.0
-5	98.4	99.9	101.2	101.3	100.5	100.2	97.0	96.1	96.1
-10	97.4	99.0	100.3	101.6	101.3	101.3	96.1	95.2	95.2
-15	96.5	98.1	99.3	100.6	101.0	102.0	95.2	94.3	94.3
-20	95.6	97.1	98.3	99.6	100.1	101.0	94.2	93.4	93.4
-25	94.6	96.1	97.4	98.6	99.1	100.0	93.3	92.4	92.4
-30	93.7	95.2	96.4	97.6	98.1	99.0	92.4	91.5	91.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	91.4	90.6	90.6
-40	91.7	93.2	94.4	95.6	96.0	96.9	90.4	89.6	89.6

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT													TAT (°C)
CIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.86	92.8	93.8	94.8	95.9	96.9	97.8	98.8	99.8	100.2	99.9	98.9	97.7
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3
35000 FT PRESS ALT													TAT (°C)
CIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1
33000 FT PRESS ALT													TAT (°C)
CIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4
31000 FT PRESS ALT													TAT (°C)
CIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	102.0	100.6	99.1	98.0
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1
29000 FT PRESS ALT													TAT (°C)
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2
27000 FT PRESS ALT													TAT (°C)
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.2
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	37	35	33	31	29	27
ENGINE A/T ON	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/T ON - PACKS ON	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/T ON - PACKS OFF	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

ENGINE INOP**Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****25000 FT to 18000 FT Pressure Altitudes**

25000 FT PRESS ALT												TAT (°C)			
CIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20		
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1		
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6		
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7		
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9		
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9		
24000 FT PRESS ALT												TAT (°C)			
CIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20		
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4		
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8		
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9		
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2		
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6		
22000 FT PRESS ALT												TAT (°C)			
CIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25		
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3		
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5		
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6		
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1		
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8		
20000 FT PRESS ALT												TAT (°C)			
CIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25		
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1		
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1		
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3		
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2		
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3		
18000 FT PRESS ALT												TAT (°C)			
CIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30		
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100.0	100.9	101.8	102.0	100.6	99.4		
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6		
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8		
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2		
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4		

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
16000 FT to 5000 FT Pressure Altitudes

16000 FT PRESS ALT													TAT (°C)	
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2	
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4	
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8	
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9	
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4	
14000 FT PRESS ALT													TAT (°C)	
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5	
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9	
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4	
240	0.47	97.3	98.2	99.2	100.1	101.1	102.0	102.8	102.5	100.6	99.0	97.8	96.7	
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6	
12000 FT PRESS ALT													TAT (°C)	
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40	
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0	
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4	
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1	
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0	
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8	
10000 FT PRESS ALT													TAT (°C)	
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40	
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1	
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6	
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4	
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9	
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6	
5000 FT PRESS ALT													TAT (°C)	
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45	
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5	
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2	
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8	
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4	
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	16	14	12	10	5
ENGINE A/I ON	-0.3	-0.2	-0.4	-0.5	-0.5
WING A/I ON - PACKS ON	-0.4	-0.5	-0.6	-0.7	-0.8
WING A/I ON - PACKS OFF	-0.6	-0.7	-0.8	-0.9	-1.1

ENGINE INOP
MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	758	298	18000	16800	15600
740	720	290	19300	18200	17000
700	682	283	20500	19600	18500
660	642	275	21700	20900	20000
620	601	267	23200	22200	21200
580	562	258	25000	24000	22800
540	524	249	27000	26100	24700
500	485	241	29100	28400	27000
460	448	231	30900	30500	29400
420	409	221	32500	32300	31700
380	370	210	34400	34300	34000

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
134	126	118	111	105	100	95	90	86	82	79
269	251	236	222	210	200	190	181	173	165	159
403	377	354	334	316	300	285	272	260	248	238
536	502	472	445	421	400	380	362	346	332	318
670	627	589	556	526	500	475	453	433	415	398
803	752	707	667	632	600	571	544	520	498	478
936	877	824	778	737	700	666	635	607	582	558
1068	1001	942	889	842	800	761	726	695	665	639
1201	1126	1059	1000	947	900	856	817	782	749	719
1333	1250	1176	1111	1052	1000	952	908	869	833	799
1466	1374	1293	1222	1157	1100	1047	1000	956	916	880
1598	1499	1411	1332	1262	1200	1142	1091	1043	1000	960
1731	1623	1528	1443	1368	1300	1238	1182	1131	1084	1040
1863	1747	1645	1554	1473	1400	1333	1273	1218	1167	1121
1996	1872	1762	1665	1578	1500	1428	1364	1305	1251	1201
2129	1997	1880	1776	1683	1600	1524	1455	1392	1334	1281
2262	2121	1997	1887	1788	1700	1619	1546	1479	1418	1361
2395	2246	2115	1998	1894	1800	1714	1637	1566	1501	1441

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)											TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)											
	380	420	460	500	540	580	620	660	700	740	780	
100	2.4	2.7	2.9	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.2	0:16
200	5.5	6.0	6.5	7.1	7.4	7.8	8.3	8.7	9.0	9.5	9.8	0:31
300	8.7	9.6	10.4	11.2	11.8	12.5	13.2	13.9	14.5	15.4	15.9	0:46
400	12.0	13.1	14.2	15.4	16.3	17.2	18.2	19.2	20.1	21.2	22.1	1:01
500	15.0	16.4	17.8	19.3	20.5	21.7	23.0	24.2	25.4	26.7	27.9	1:16
600	17.9	19.6	21.3	23.1	24.5	26.1	27.6	29.0	30.5	32.1	33.4	1:31
700	20.9	22.8	24.8	26.8	28.5	30.3	32.1	33.8	35.5	37.4	38.9	1:46
800	23.8	26.0	28.2	30.5	32.5	34.6	36.6	38.6	40.5	42.6	44.3	2:01
900	26.6	29.2	31.7	34.2	36.4	38.7	41.0	43.3	45.5	47.8	49.6	2:15
1000	29.5	32.3	35.0	37.9	40.3	42.9	45.4	47.9	50.4	52.9	54.9	2:30
1100	32.3	35.4	38.4	41.5	44.2	47.0	49.8	52.6	55.3	58.1	60.2	2:45
1200	35.1	38.4	41.7	45.1	48.1	51.1	54.2	57.2	60.2	63.2	65.5	3:00
1300	37.9	41.5	45.0	48.7	51.9	55.2	58.5	61.8	65.0	68.2	70.7	3:14
1400	40.6	44.5	48.3	52.2	55.6	59.2	62.8	66.3	69.9	73.2	75.9	3:29
1500	43.4	47.5	51.6	55.7	59.4	63.2	67.0	70.9	74.6	78.2	81.0	3:44
1600	46.1	50.5	54.8	59.2	63.1	67.2	71.3	75.4	79.4	83.2	86.1	3:59
1700	48.8	53.4	58.0	62.6	66.8	71.2	75.5	79.8	84.1	88.1	91.2	4:13
1800	51.5	56.3	61.2	66.0	70.5	75.1	79.7	84.3	88.8	93.0	96.3	4:29

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
780	15300	14000	12400
760	16100	14400	12900
740	16900	15300	13300
720	17700	16100	14300
700	18500	16900	15200
680	19300	17700	16000
660	20100	18600	16800
640	20600	19400	17800
620	21200	20200	18800
600	21800	20800	19800
580	22600	21500	20500
560	23600	22200	21100
540	24500	23200	21800
520	25600	24300	22700
500	26800	25500	23800
480	28100	26800	24900
460	29400	28100	26400
440	30400	29400	27800
420	31300	30600	29200
400	32300	31700	30500
380	33200	32800	31800
360	34300	34100	33200

With engine anti-ice on, no altitude capability adjustment is required.
With engine and wing anti-ice on, decrease altitude capability by 300 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
780	%N1	91.3	96.8								
	MACH	.602	.664								
	KIAS	334	337								
	FF/ENG	24500	24264								
740	%N1	90.4	95.0	97.7							
	MACH	.602	.658	.674							
	KIAS	334	334	330							
	FF/ENG	23824	23001	22479							
700	%N1	89.4	93.4	95.4	98.5						
	MACH	.597	.647	.663	.680						
	KIAS	332	328	324	320						
	FF/ENG	22816	21622	21089	21547						
660	%N1	87.5	91.8	93.5	95.9	99.3					
	MACH	.580	.634	.652	.668	.686					
	KIAS	322	322	318	314	311					
	FF/ENG	20982	20271	19865	20070	20786					
620	%N1	85.6	90.2	91.8	93.6	96.3					
	MACH	.563	.619	.639	.656	.672					
	KIAS	312	313	312	308	304					
	FF/ENG	19232	18864	18716	18769	19158					
580	%N1	83.8	88.3	90.0	91.7	93.6	96.6				
	MACH	.545	.600	.622	.642	.659	.676				
	KIAS	302	304	304	301	298	294				
	FF/ENG	17610	17429	17502	17545	17757	17963				
540	%N1	81.8	86.1	88.1	89.8	91.5	93.6	96.8			
	MACH	.528	.580	.603	.625	.645	.661	.679			
	KIAS	292	293	294	293	291	287	283			
	FF/ENG	16105	15984	16232	16308	16457	16525	16782			
500	%N1	79.7	83.8	85.9	87.7	89.4	91.1	93.4	96.7		
	MACH	.511	.558	.581	.605	.627	.646	.663	.682		
	KIAS	283	282	282	283	283	280	276	273		
	FF/ENG	14733	14576	14921	15031	15157	15233	15296	15613		
460	%N1	77.6	81.4	83.3	85.4	87.2	88.8	90.6	93.0	96.4	
	MACH	.494	.537	.557	.581	.605	.627	.647	.664	.683	
	KIAS	273	271	271	271	272	271	269	265	262	
	FF/ENG	13434	13263	13599	13723	13840	13951	14009	14074	14415	
420	%N1	75.2	78.9	80.8	82.6	84.6	86.4	88.1	89.9	92.3	95.8
	MACH	.476	.516	.534	.555	.579	.603	.626	.646	.664	.683
	KIAS	263	260	259	259	260	260	260	258	254	251
	FF/ENG	12195	12043	12329	12424	12504	12636	12733	12791	12847	13177
380	%N1	72.8	76.4	78.2	79.9	81.7	83.6	85.5	87.2	89.0	91.4
	MACH	.458	.495	.512	.530	.551	.574	.599	.623	.644	.662
	KIAS	253	249	248	247	247	247	248	248	246	242
	FF/ENG	11031	10887	11116	11181	11199	11300	11416	11520	11575	11615
340	%N1	70.0	73.6	75.4	77.1	78.7	80.5	82.3	84.3	86.0	87.9
	MACH	.439	.474	.489	.506	.524	.544	.567	.592	.618	.640
	KIAS	243	238	237	235	234	234	234	235	235	234
	FF/ENG	9966	9777	9927	9993	9976	9996	10085	10198	10303	10361

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
280	260	241	226	212	200	191	182	174	167	161
560	519	483	451	424	400	382	365	349	336	323
841	780	725	678	637	600	573	549	526	505	486
1123	1041	967	904	850	800	765	732	701	673	647
1406	1302	1210	1131	1062	1000	955	914	875	840	809
1690	1565	1454	1358	1275	1200	1146	1096	1051	1009	971
1975	1828	1697	1586	1488	1400	1337	1279	1226	1177	1132
2261	2092	1941	1813	1701	1600	1528	1461	1400	1344	1293
2547	2356	2186	2041	1914	1800	1719	1643	1574	1511	1454
2835	2622	2431	2269	2127	2000	1910	1826	1749	1678	1614

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	9.2	0:38	7.7	0:36	6.9	0:35	6.2	0:34	5.8	0:34
400	19.6	1:12	17.3	1:09	16.0	1:06	15.3	1:04	15.0	1:01
600	29.9	1:46	26.7	1:41	25.1	1:36	24.2	1:33	24.1	1:29
800	40.0	2:21	36.1	2:14	34.1	2:07	33.0	2:03	33.0	1:58
1000	50.0	2:57	45.3	2:47	43.0	2:38	41.7	2:33	41.8	2:26
1200	59.8	3:32	54.4	3:20	51.8	3:09	50.3	3:03	50.4	2:55
1400	69.5	4:08	63.4	3:53	60.5	3:41	58.8	3:33	58.9	3:23
1600	79.1	4:44	72.4	4:27	69.2	4:12	67.2	4:03	67.3	3:52
1800	88.5	5:20	81.2	5:01	77.8	4:44	75.5	4:33	75.5	4:22
2000	97.9	5:57	89.9	5:36	86.3	5:16	83.7	5:04	83.6	4:51

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)									
	400	450	500	550	600	650	700	750	800	
10	-2.1	-1.7	-1.1	-0.6	0.0	0.9	1.9	3.0	4.3	
20	-4.6	-3.5	-2.4	-1.2	0.0	1.9	4.0	6.5	9.2	
30	-7.0	-5.4	-3.7	-1.9	0.0	2.9	6.2	9.9	13.9	
40	-9.3	-7.2	-4.9	-2.5	0.0	3.8	8.2	13.1	18.5	
50	-11.7	-9.0	-6.1	-3.2	0.0	4.8	10.2	16.2	22.9	
60	-14.0	-10.8	-7.3	-3.8	0.0	5.7	12.1	19.3	27.2	
70	-16.3	-12.6	-8.6	-4.4	0.0	6.6	14.0	22.2	31.2	
80	-18.6	-14.3	-9.8	-5.0	0.0	7.4	15.8	25.0	35.2	
90	-20.9	-16.1	-11.0	-5.6	0.0	8.2	17.5	27.7	38.9	
100	-23.1	-17.8	-12.1	-6.2	0.0	9.0	19.1	30.3	42.6	

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
800	%N1	81.3	84.8	89.7	95.2			
	KIAS	273	274	294	307			
	FF/ENG	20590	20800	22300	23380			
760	%N1	79.7	83.0	88.1	93.0			
	KIAS	266	267	285	295			
	FF/ENG	19470	19600	20670	21550			
720	%N1	78.1	81.2	86.2	91.1	99.4		
	KIAS	259	259	268	284	294		
	FF/ENG	18380	18440	18880	19930	22170		
680	%N1	76.5	79.4	84.3	89.3	96.1		
	KIAS	251	252	253	276	286		
	FF/ENG	17310	17320	17410	18530	20220		
640	%N1	74.7	77.7	82.3	87.3	92.9		
	KIAS	244	244	246	262	274		
	FF/ENG	16260	16230	16210	17040	18460		
600	%N1	72.9	75.8	80.2	85.2	90.5		
	KIAS	236	237	238	248	261		
	FF/ENG	15220	15150	15090	15590	16840		
560	%N1	70.9	73.8	78.1	83.0	88.4	95.9	
	KIAS	231	231	231	231	251	260	
	FF/ENG	14200	14110	14030	14260	15440	16800	
520	%N1	68.8	71.9	76.0	80.8	86.1	91.9	
	KIAS	225	225	225	225	237	249	
	FF/ENG	13200	13110	13020	13140	14040	15010	
480	%N1	66.7	69.6	73.8	78.3	83.5	88.7	98.2
	KIAS	220	220	220	220	220	234	242
	FF/ENG	12240	12130	12040	12080	12500	13390	15110
440	%N1	64.6	67.3	71.6	75.9	80.8	86.0	93.3
	KIAS	213	213	213	213	213	222	232
	FF/ENG	11300	11160	11080	11070	11270	12010	13040
400	%N1	62.4	65.0	69.1	73.4	78.1	83.2	88.6
	KIAS	207	207	207	207	207	207	216
	FF/ENG	10390	10240	10140	10110	10170	10640	11320
360	%N1	60.0	62.6	66.4	70.7	75.3	80.3	85.1
	KIAS	200	200	200	200	200	200	203
	FF/ENG	9500	9340	9220	9200	9170	9520	9890

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

**Gear Down Landing Rate of Climb Available
Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	430	320				
50	480	370	210			
48	530	420	270			
46	570	470	320	150		
44	620	530	370	190		
42	670	570	410	230	70	
40	710	620	460	270	100	
38	740	670	510	310	130	
36	740	710	540	350	160	-30
34	740	760	580	390	190	-10
32	750	760	610	420	220	20
30	750	770	640	450	260	50
20	770	780	650	510	350	160
10	790	800	600	420	260	120
0	810	810	590	360	130	-110
-20	840	850	610	370	130	-110
-40	880	880	640	390	140	-120

Rate of climb capability shown is valid for 500000 lb, gear down at VREF20 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Flaps 25

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	80	-20				
50	130	20	-130			
48	180	70	-80			
46	220	120	-30	-200		
44	260	170	20	-160		
42	310	210	60	-120	-290	
40	350	260	100	-90	-250	
38	380	300	140	-50	-230	
36	380	340	170	-20	-200	-390
34	380	380	210	20	-170	-370
32	380	390	230	50	-140	-350
30	390	390	260	80	-110	-320
20	400	400	270	130	-20	-210
10	410	410	270	-10	-190	-350
0	420	420	200	-20	-250	-480
-20	440	440	210	-20	-250	-500
-40	460	460	220	-20	-260	-520

Rate of climb capability shown is valid for 500000 lb, gear down at VREF25 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

ENGINE INOP

ADVISORY INFORMATION

**Gear Down Landing Rate of Climb Available
Flaps 30**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-140	-250				
50	-100	-210	-360			
48	-60	-160	-320			
46	-10	-120	-270	-430		
44	30	-70	-220	-390		
42	70	-30	-180	-350	-520	
40	100	20	-150	-320	-490	
38	140	60	-110	-290	-470	
36	140	100	-70	-260	-440	-630
34	140	130	-40	-230	-420	-610
32	140	150	-20	-200	-390	-590
30	140	150	10	-170	-360	-560
20	150	150	20	-120	-270	-460
10	160	160	0	-150	-300	-660
0	160	160	-50	-270	-500	-730
-20	170	170	-60	-280	-510	-750
-40	180	170	-60	-300	-530	-780

Rate of climb capability shown is valid for 500000 lb, gear down at VREF30 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Performance Inflight

Alternate Mode EEC

Chapter PI

Section 54

ALTERNATE MODE EEC

Alternate Mode EEC Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (1000 FT)											
°C	°F	-2	-1	0	1	2	3	4	5	6	7	8	8.4
55	131	96.6	96.7	97.0	96.8	96.5	96.2	95.5	94.9	93.7	92.4	91.1	90.6
50	122	98.0	98.1	98.6	98.3	98.1	98.0	97.3	96.5	95.4	94.1	92.8	92.3
45	113	99.5	99.6	100.1	99.9	99.6	99.6	99.3	98.9	97.8	95.9	94.4	93.9
40	104	100.8	101.2	101.9	101.5	101.3	101.1	100.7	100.5	100.1	99.4	97.9	97.1
35	95	101.5	102.7	104.7	104.3	103.3	102.8	102.3	101.8	101.2	100.3	99.7	99.5
30	86	100.7	103.7	106.9	106.5	105.8	105.2	104.5	103.8	102.7	101.4	100.6	100.4
25	77	99.9	102.8	106.0	106.8	107.6	107.5	106.8	106.6	105.3	103.6	102.2	101.7
20	68	99.0	101.9	105.1	105.9	106.7	107.0	107.3	107.6	106.8	105.9	104.8	104.2
15	59	98.2	101.1	104.2	104.9	105.8	106.1	106.4	106.7	106.4	106.1	105.5	105.2
10	50	97.3	100.2	103.3	104.0	104.8	105.2	105.4	105.7	105.5	105.2	104.9	104.7
5	41	96.5	99.3	102.4	103.1	103.9	104.3	104.5	104.8	104.6	104.2	103.9	103.8
0	32	95.6	98.4	101.4	102.2	103.0	103.3	103.6	103.8	103.6	103.3	103.0	102.9
-10	14	93.8	96.6	99.6	100.3	101.1	101.4	101.6	101.9	101.7	101.4	101.1	101.0
-20	-4	92.0	94.7	97.7	98.4	99.1	99.5	99.7	100.0	99.8	99.5	99.2	99.0
-30	-22	90.2	92.8	95.7	96.4	97.2	97.5	97.7	98.0	97.8	97.5	97.2	97.1
-40	-40	88.3	90.9	93.7	94.4	95.1	95.5	95.7	95.9	95.7	95.4	95.2	95.0
-50	-58	86.4	88.9	91.7	92.4	93.1	93.4	93.6	93.9	93.7	93.4	93.1	93.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)											
	-2	-1	0	1	2	3	4	5	6	7	8	8.4
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Intentionally
Blank

Performance Inflight**Gear Down****Chapter PI****Section 55****GEAR DOWN****220 KIAS Max Climb %N1**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	90.1	89.2	88.5	87.9	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.8	90.1	89.4	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	90.5	90.8	91.0	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	90.3	90.0	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.8	92.2	92.1	90.7	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.5	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.3	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

*Packs on or off with 2 bleed sources.

**Packs off with 1 bleed source.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18500	16500	14100
760	19000	17100	14700
740	19600	17800	15400
720	20100	18400	16000
700	20900	19300	17100
680	21800	20400	18100
660	22800	21400	19300
640	23800	22400	20500
620	24900	23400	21800
600	25900	24500	23000
580	26900	25600	24100
560	27900	26900	25300
540	29000	28100	26600
520	30000	29400	27900
500	30800	30400	29300
480	31600	31200	30400
460	32400	32100	31500
440	33200	33000	32500
420	34000	33900	33600
400	34800	34700	34500
380	35700	35600	35400
360	36600	36400	36200

GEAR DOWN**Long Range Cruise Control**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
800	%N1	85.0	89.3	91.4	94.1						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16922	17308	17656	18131						
760	%N1	84.1	88.4	90.4	92.6						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16389	16720	16973	17390						
720	%N1	83.3	87.6	89.5	91.5	94.4					
	MACH	.488	.535	.556	.578	.600					
	KIAS	270	270	270	270	270					
	FF/ENG	15935	16219	16387	16707	17149					
680	%N1	81.5	85.9	87.8	89.7	91.9					
	MACH	.475	.521	.542	.564	.587					
	KIAS	263	263	263	263	264					
	FF/ENG	14958	15165	15355	15554	15923					
640	%N1	79.6	84.0	86.1	87.9	89.8	92.2				
	MACH	.461	.506	.526	.548	.570	.594				
	KIAS	255	255	255	255	256	256				
	FF/ENG	13995	14143	14285	14442	14692	15058				
600	%N1	77.7	82.1	84.2	86.1	87.8	89.8	92.7			
	MACH	.447	.491	.511	.531	.553	.576	.600			
	KIAS	247	247	247	247	248	248	248			
	FF/ENG	13039	13165	13244	13389	13540	13809	14178			
560	%N1	75.6	80.1	82.1	84.1	85.9	87.6	89.7	92.9		
	MACH	.433	.475	.494	.514	.535	.557	.581	.606		
	KIAS	239	239	239	239	239	240	240	240		
	FF/ENG	12104	12206	12259	12335	12492	12640	12900	13295		
520	%N1	73.4	77.9	79.9	81.9	83.8	85.5	87.3	89.5	93.0	
	MACH	.418	.459	.477	.496	.516	.538	.560	.584	.610	
	KIAS	231	231	231	231	231	231	231	232	232	
	FF/ENG	11197	11248	11303	11344	11438	11591	11723	11982	12393	
480	%N1	71.2	75.6	77.5	79.5	81.4	83.3	85.0	86.9	89.1	93.0
	MACH	.402	.442	.459	.478	.497	.517	.539	.562	.587	.614
	KIAS	222	222	222	222	222	222	222	222	223	223
	FF/ENG	10306	10304	10351	10394	10437	10545	10668	10809	11048	11464
440	%N1	68.7	73.2	75.0	76.9	79.0	80.8	82.7	84.4	86.3	88.6
	MACH	.387	.425	.442	.460	.478	.498	.519	.540	.563	.588
	KIAS	213	213	213	213	213	213	213	213	213	214
	FF/ENG	9442	9436	9458	9498	9526	9578	9668	9775	9892	10101
400	%N1	66.6	71.1	72.9	74.8	76.8	78.8	80.5	82.4	84.1	86.0
	MACH	.375	.413	.429	.446	.465	.484	.504	.525	.548	.571
	KIAS	207	207	207	207	207	207	207	207	207	207
	FF/ENG	8742	8740	8740	8763	8784	8819	8874	8965	9057	9165
360	%N1	64.4	68.7	70.6	72.4	74.4	76.4	78.3	80.0	81.9	83.6
	MACH	.363	.399	.415	.432	.450	.468	.488	.508	.530	.553
	KIAS	200	200	200	200	200	200	200	200	200	200
	FF/ENG	8039	8038	8035	8035	8031	8059	8106	8165	8248	8326

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
320	286	258	235	216	200	189	180	171	162	155
648	580	520	473	434	400	378	358	340	324	310
980	875	784	711	652	600	567	537	510	485	464
1315	1171	1048	950	870	800	756	716	679	647	618
1653	1470	1314	1190	1088	1000	945	894	849	808	772
1993	1771	1580	1430	1307	1200	1134	1073	1018	969	925
2336	2073	1848	1671	1526	1400	1322	1251	1187	1129	1078
2682	2378	2117	1912	1745	1600	1510	1428	1354	1288	1230
3031	2684	2387	2154	1965	1800	1698	1606	1522	1448	1382
3383	2992	2659	2397	2184	2000	1887	1783	1690	1607	1534
3738	3302	2931	2640	2404	2200	2075	1961	1858	1766	1685
4096	3614	3204	2883	2624	2400	2263	2139	2026	1925	1836
4457	3928	3479	3128	2845	2600	2451	2316	2193	2084	1987
4821	4245	3755	3373	3066	2800	2639	2493	2360	2242	2138
5189	4563	4032	3618	3287	3000	2827	2669	2527	2400	2288
5560	4884	4310	3865	3508	3200	3014	2845	2693	2557	2438
5935	5207	4589	4112	3730	3400	3202	3021	2859	2715	2588
6313	5532	4870	4359	3952	3600	3389	3198	3025	2872	2737
6695	5860	5153	4608	4174	3800	3577	3374	3191	3028	2886
7080	6189	5436	4857	4397	4000	3764	3549	3356	3184	3034

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	14.9	0:48	13.6	0:46	11.9	0:43	11.0	0:41	10.2	0:39
400	30.8	1:35	28.6	1:30	25.8	1:23	24.2	1:19	23.0	1:14
600	46.7	2:22	43.6	2:15	39.6	2:03	37.5	1:56	35.8	1:50
800	62.0	3:11	58.0	3:00	53.0	2:45	50.2	2:35	48.0	2:26
1000	77.2	4:00	72.5	3:46	66.4	3:26	63.0	3:14	60.3	3:02
1200	92.0	4:50	86.5	4:33	79.3	4:09	75.3	3:54	72.1	3:39
1400	106.8	5:39	100.5	5:19	92.2	4:51	87.6	4:33	83.9	4:16
1600	121.0	6:30	114.0	6:07	104.7	5:34	99.5	5:13	95.3	4:54
1800	135.2	7:21	127.5	6:55	117.2	6:17	111.4	5:54	106.8	5:31
2000	149.0	8:14	140.6	7:44	129.3	7:01	122.9	6:35	117.8	6:10
2200	162.7	9:06	153.7	8:32	141.4	7:45	134.4	7:16	128.9	6:48
2400	176.0	9:59	166.3	9:22	153.1	8:30	145.6	7:57	139.5	7:27
2600	189.3	10:53	178.9	10:12	164.8	9:15	156.7	8:39	150.2	8:06
2800	202.1	11:47	191.1	11:03	176.1	10:01	167.5	9:22	160.6	8:45
3000	214.9	12:42	203.3	11:54	187.4	10:46	178.2	10:04	170.9	9:25
3200	227.3	13:38	215.1	12:46	198.4	11:33	188.7	10:48	180.9	10:05
3400	239.7	14:34	226.8	13:38	209.3	12:20	199.1	11:31	190.9	10:45
3600	251.8	15:31	238.2	14:31	220.0	13:07	209.1	12:15	200.6	11:26
3800	263.8	16:28	249.6	15:24	230.6	13:55	219.2	12:59	210.3	12:07
4000	275.5	17:27	260.7	16:18	241.0	14:43	229.0	13:44	219.7	12:49

GEAR DOWN**Long Range Cruise Enroute Fuel and Time****Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
20	-2.9	-2.0	-1.0	0.0	1.7	4.1	6.7	9.6
40	-6.4	-4.3	-2.2	0.0	3.2	7.5	12.5	18.2
60	-9.7	-6.6	-3.3	0.0	4.8	10.8	18.0	26.2
80	-13.0	-8.8	-4.4	0.0	6.2	14.0	23.1	33.6
100	-16.2	-10.9	-5.5	0.0	7.6	17.0	28.0	40.5
120	-19.3	-13.0	-6.6	0.0	9.0	19.8	32.5	46.9
140	-22.3	-15.1	-7.6	0.0	10.3	22.5	36.6	52.7
160	-25.3	-17.1	-8.7	0.0	11.5	25.0	40.5	58.0
180	-28.1	-19.1	-9.7	0.0	12.7	27.4	44.0	62.7
200	-30.9	-21.0	-10.7	0.0	13.9	29.6	47.2	66.9
220	-33.6	-22.9	-11.7	0.0	15.0	31.6	50.0	70.5
240	-36.2	-24.7	-12.6	0.0	16.1	33.5	52.5	73.6
260	-38.7	-26.5	-13.6	0.0	17.1	35.2	54.7	76.1
280	-41.1	-28.2	-14.5	0.0	18.0	36.8	56.6	78.1

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30+80

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	42	46	50	54	59	63	67	71	75	80
TIME (MINUTES)	11	12	13	14	14	15	16	16	17	18

GEAR DOWN

**Holding
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
800	%N1	76.5						
	KIAS	262						
	FF/ENG	17310						
760	%N1	75.5	78.6					
	KIAS	262	262					
	FF/ENG	16720	16760					
720	%N1	74.0	77.0					
	KIAS	256	256					
	FF/ENG	15810	15810					
680	%N1	72.2	75.2	79.7				
	KIAS	248	248	248				
	FF/ENG	14840	14820	14740				
640	%N1	70.3	73.4	77.8				
	KIAS	241	241	241				
	FF/ENG	13880	13860	13780				
600	%N1	68.6	71.8	76.2				
	KIAS	236	236	236				
	FF/ENG	13070	13060	12970				
560	%N1	67.0	70.0	74.4	79.0			
	KIAS	231	231	231	231			
	FF/ENG	12290	12270	12180	12280			
520	%N1	65.3	68.2	72.6	77.2	82.0		
	KIAS	225	225	225	225	225		
	FF/ENG	11540	11490	11410	11460	11580		
480	%N1	63.7	66.4	70.8	75.3	80.1		
	KIAS	220	220	220	220	220		
	FF/ENG	10820	10750	10680	10680	10790		
440	%N1	61.8	64.5	68.7	73.2	77.9	82.7	
	KIAS	213	213	213	213	213	213	
	FF/ENG	10090	9990	9910	9910	9990	10150	
400	%N1	59.8	62.6	66.6	71.1	75.7	80.5	85.0
	KIAS	207	207	207	207	207	207	207
	FF/ENG	9400	9280	9180	9180	9220	9320	9550
360	%N1	57.7	60.5	64.4	68.7	73.4	78.3	82.8
	KIAS	200	200	200	200	200	200	200
	FF/ENG	8690	8580	8440	8440	8440	8510	8710

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

**Holding
Flaps 1**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
800	%N1	76.0	79.1	84.0	88.5	94.6
	KIAS	242	242	242	242	242
	FF/ENG	16940	17040	16980	17320	18210
760	%N1	74.9	78.0	82.7	87.3	92.6
	KIAS	242	242	242	242	242
	FF/ENG	16290	16350	16290	16590	17270
720	%N1	73.3	76.4	80.9	85.7	90.6
	KIAS	236	236	236	236	236
	FF/ENG	15350	15370	15340	15550	16070
680	%N1	71.5	74.5	78.9	83.9	88.7
	KIAS	228	228	228	228	228
	FF/ENG	14360	14350	14350	14500	14860
640	%N1	69.4	72.6	77.0	81.9	86.7
	KIAS	221	221	221	221	221
	FF/ENG	13400	13370	13370	13510	13760
600	%N1	67.6	70.8	75.2	79.9	84.9
	KIAS	216	216	216	216	216
	FF/ENG	12580	12530	12510	12650	12840
560	%N1	65.9	68.9	73.3	77.9	83.0
	KIAS	211	211	211	211	211
	FF/ENG	11780	11720	11680	11790	11930
520	%N1	64.1	66.9	71.3	75.8	81.0
	KIAS	205	205	205	205	205
	FF/ENG	10990	10910	10850	10940	11050
480	%N1	62.2	64.9	69.3	73.8	78.7
	KIAS	200	200	200	200	200
	FF/ENG	10240	10150	10060	10120	10210
440	%N1	60.1	62.8	66.9	71.4	76.2
	KIAS	193	193	193	193	193
	FF/ENG	9480	9370	9250	9300	9370
400	%N1	57.9	60.7	64.6	69.1	73.7
	KIAS	187	187	187	187	187
	FF/ENG	8750	8630	8490	8500	8540
360	%N1	55.6	58.2	62.2	66.4	71.0
	KIAS	180	180	180	180	180
	FF/ENG	8020	7900	7740	7710	7740

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight
Gear Down, Engine INOP

Chapter PI
Section 56

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		VREF30 + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
700	674	253	5200	4000	1700
660	635	246	7100	6200	4600
620	596	239	9100	8400	7200
580	557	232	10900	10200	9100
540	519	227	12700	12100	10900
500	480	222	14500	14000	12900
460	442	216	16500	15900	15000
420	404	210	18600	18200	17000
380	366	203	20800	20500	19700

GEAR DOWN

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
740	800		
720	2200		
700	3600	1100	
680	4600	2700	
660	5600	4200	1400
640	6600	5400	3200
620	7600	6700	4800
600	8700	7900	6300
580	9700	9000	7900
560	10700	10100	9000
540	11700	11000	9900
520	12700	12000	10900
500	13600	13000	11800
480	14500	14000	12900
460	15500	15100	14000
440	16600	16000	15100
420	17700	17000	16100
400	18800	18400	17200
380	20000	19800	18700
360	21200	20800	20100

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
680	%N1	97.1						
	MACH	.418						
	KIAS	253						
	FF/ENG	29585						
640	%N1	94.7	97.1					
	MACH	.407	.421					
	KIAS	246	246					
	FF/ENG	27531	27847					
600	%N1	92.6	94.4	97.1				
	MACH	.395	.409	.423				
	KIAS	239	239	238				
	FF/ENG	25687	25736	26148				
560	%N1	90.5	92.1	94.1	97.1			
	MACH	.383	.396	.410	.425			
	KIAS	232	231	231	231			
	FF/ENG	23929	23856	23975	24495			
520	%N1	88.5	90.1	91.9	94.1	97.5		
	MACH	.372	.386	.400	.415	.431		
	KIAS	225	225	225	225	225		
	FF/ENG	22184	22234	22313	22545	23183		
480	%N1	86.4	88.2	89.8	91.7	94.1	97.9	
	MACH	.363	.376	.391	.405	.421	.437	
	KIAS	220	220	220	220	220	220	
	FF/ENG	20623	20688	20771	20903	21169	21872	
440	%N1	84.0	85.9	87.7	89.4	91.3	93.8	97.9
	MACH	.353	.366	.380	.394	.409	.425	.442
	KIAS	213	213	213	213	213	213	213
	FF/ENG	19032	19063	19143	19279	19430	19702	20398
400	%N1	81.5	83.5	85.3	87.2	89.0	90.9	93.5
	MACH	.342	.355	.368	.382	.397	.413	.429
	KIAS	207	207	207	207	207	207	207
	FF/ENG	17523	17522	17554	17692	17835	17981	18237
360	%N1	78.9	80.8	82.7	84.6	86.5	88.3	90.2
	MACH	.331	.343	.356	.370	.384	.399	.415
	KIAS	200	200	200	200	200	200	200
	FF/ENG	16007	16004	15995	16077	16230	16351	16486
								16688

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
163	146	132	119	109	100	93	87	82	78	76
334	296	264	239	218	200	187	175	165	156	149
506	448	398	359	327	300	281	263	247	234	222
679	600	532	480	437	400	374	350	329	311	295
852	752	666	600	546	500	467	437	410	387	367
1026	904	801	720	656	600	560	524	492	464	440
1201	1058	937	842	766	700	653	610	573	540	512
1377	1212	1072	963	876	800	746	697	654	617	585
1554	1367	1208	1084	986	900	839	784	735	693	657
1731	1522	1344	1206	1096	1000	932	871	817	769	729

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME	FUEL	TIME
	(1000 LB)	(HR:MIN)	(1000 LB)	(HR:MIN)	(1000 LB)	(HR:MIN)	(1000 LB)	(HR:MIN)	(1000 LB)	(HR:MIN)
100	8.0	0:26	7.5	0:25	7.0	0:25	6.6	0:24	6.4	0:24
200	16.7	0:51	16.0	0:50	15.4	0:49	14.8	0:47	14.4	0:46
300	25.5	1:16	24.6	1:14	23.7	1:12	23.0	1:10	22.5	1:08
400	34.2	1:41	33.0	1:39	32.0	1:36	31.1	1:33	30.5	1:31
500	42.8	2:07	41.4	2:03	40.1	2:00	39.0	1:56	38.4	1:53
600	51.2	2:32	49.7	2:28	48.2	2:24	47.0	2:20	46.2	2:16
700	59.7	2:58	57.9	2:53	56.2	2:48	54.8	2:43	53.9	2:39
800	68.0	3:24	66.0	3:18	64.2	3:12	62.5	3:07	61.5	3:01
900	76.2	3:50	74.0	3:43	72.0	3:37	70.2	3:31	69.0	3:24
1000	84.3	4:16	81.9	4:09	79.8	4:01	77.8	3:54	76.4	3:48

GEAR DOWN**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Diversion Fuel and Time
Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
10	-1.6	-1.1	-0.6	0.0	1.0	2.2	3.5	4.7
15	-2.5	-1.7	-0.9	0.0	1.5	3.3	5.4	7.4
20	-3.4	-2.3	-1.2	0.0	2.0	4.4	7.3	10.0
25	-4.3	-2.9	-1.5	0.0	2.5	5.5	9.1	12.5
30	-5.2	-3.5	-1.8	0.0	3.0	6.6	10.9	15.0
35	-6.1	-4.0	-2.0	0.0	3.4	7.6	12.6	17.5
40	-6.9	-4.6	-2.3	0.0	3.9	8.6	14.3	19.8
45	-7.8	-5.2	-2.6	0.0	4.3	9.5	15.9	22.2
50	-8.7	-5.8	-2.9	0.0	4.7	10.5	17.4	24.4
55	-9.6	-6.4	-3.2	0.0	5.1	11.4	18.9	26.6
60	-10.5	-7.0	-3.5	0.0	5.5	12.2	20.4	28.7
65	-11.4	-7.6	-3.8	0.0	5.8	13.1	21.7	30.8
70	-12.3	-8.2	-4.1	0.0	6.2	13.9	23.1	32.8
75	-13.1	-8.8	-4.4	0.0	6.5	14.7	24.3	34.8
80	-14.0	-9.4	-4.7	0.0	6.8	15.4	25.6	36.7
85	-14.9	-9.9	-5.0	0.0	7.1	16.1	26.7	38.5

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
760	%N1	96.6			
	KIAS	262			
	FF/ENG	34170			
720	%N1	94.7			
	KIAS	256			
	FF/ENG	32150			
680	%N1	92.8	96.4		
	KIAS	248	248		
	FF/ENG	30180	30350		
640	%N1	90.8	94.0		
	KIAS	241	241		
	FF/ENG	28240	28200		
600	%N1	89.1	92.1	98.5	
	KIAS	236	236	236	
	FF/ENG	26520	26530	27590	
560	%N1	87.2	90.3	95.3	
	KIAS	231	231	231	
	FF/ENG	24810	24950	25360	
520	%N1	85.2	88.5	92.8	
	KIAS	225	225	225	
	FF/ENG	23130	23290	23530	
480	%N1	83.0	86.4	90.7	97.9
	KIAS	220	220	220	220
	FF/ENG	21540	21650	21870	22970
440	%N1	80.7	84.0	88.5	93.8
	KIAS	213	213	213	213
	FF/ENG	19910	19980	20170	20690
400	%N1	78.4	81.5	86.3	90.9
	KIAS	207	207	207	207
	FF/ENG	18340	18400	18490	18880
360	%N1	76.0	78.9	83.6	88.3
	KIAS	200	200	200	200
	FF/ENG	16790	16810	16820	17170

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight**Text****Chapter PI****Section 57**

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. 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 Flight Manual, the Flight Manual shall always take precedence.

General**FMC Takeoff Speeds**

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/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 colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush 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 is determined as follows:

- (1) Determine the dry field/obstacle limit weight for the takeoff flap setting.
- (2) 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.
- (3) Adjust field length available for temperature by amount shown on chart.
- (4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Takeoff speed determination:

(1) Determine takeoff speeds V_1 , V_R and V_2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If $V_1(\text{MCG})$ limited, set $V_1 = V_1(\text{MCG})$. If not limited by $V_1(\text{MCG})$ considerations, enter the V_1 Adjustment table with actual brake release weight to determine the V_1 reduction to apply to V_1 speed. If the adjusted V_1 is less than $V_1(\text{MCG})$, set $V_1 = V_1(\text{MCG})$.

Slippery Runway

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. Good reported braking action denotes wet runway conditions or runways covered by compact snow. Similarly, poor braking action denotes runways covered with wet ice. Performance is based on reversers operating and 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.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V_1 less than minimum V_1 for control on the ground, $V_1(\text{MCG})$, and V_R less than minimum V_R , $(1.05) \text{ VMCA}$. It is therefore necessary to compare the adjusted V_1 and V_R to $V_1(\text{MCG})$ and Minimum V_R respectively. To find $V_1(\text{MCG})$ and Minimum V_R , enter the $V_1(\text{MCG})$, Minimum V_R table with the airport pressure altitude and actual OAT. If the adjusted V_1 is less than $V_1(\text{MCG})$, set V_1 equal to $V_1(\text{MCG})$. If the adjusted V_R is less than Min V_R , set V_R equal to Min V_R and determine a new V_2 by adding the difference between the normal V_R and Min V_R to the normal V_2 . No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around %N1

To find Go-Around %N1 based on normal engine bleed for packs on and anti-ice off, enter the Go-Around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for engine bleeds for various conditions.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables 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 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 at two center of gravity positions: 7.5% MAC (FMC default) for use when no center of gravity is entered on the PERF INIT page, and 30% MAC (typical mid cruise center of gravity) for use when 30% MAC is entered. Crews may interpolate between these values to determine the airplane's capability at other specific center of gravity positions. Note that these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 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, .84 Mach approximates the Long Range Cruise Mach schedule.

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 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 .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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.

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 at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. 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 30 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 for the selected flap setting. Flaps 1 is based on VREF30 + 60 speed schedule. 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

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

The table "Approach or Landing Climb Limited Weight" presents the data which are the more limiting of Approach Climb Limit Weight and Landing Climb Limit Weight.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding 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.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy 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 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, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

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 Mach number of .84 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 engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude 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/Cruise 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 correct 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 Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC 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 PENALTY (LB/HR)				
	GROSS WEIGHT (1000 LB)				
	700	600	500	400	300
43				360	310
39			420	360	310
35		470	420	380	300
31	520	500	450	370	310
25	510	490	440	380	340
20	520	520	460	410	360
15	520	520	480	440	400
10	540	520	510	490	440
5	590	590	570	530	480

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 .84/310/250 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 corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required 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 is planned. The tables show gear down rate of climb available for Flaps 20, Flaps 25 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

For most conditions, no takeoff speed adjustments or other performance adjustments other than takeoff power setting adjustments are required for operation of EEC in the ALTERNATE mode. For pressure altitudes between -2000 feet and -1000 feet and temperatures greater than ISA + 15°C, a thrust reduction occurs with EEC in the ALTERNATE mode. Performance software must be used to account for appropriate takeoff performance in this environmental region.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. 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 will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

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 60****777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA****Pkg Model Identification PI.ModID.60.1****General PI.60.1**

VREF	PI.60.1
Flap Maneuver Speed	PI.60.2
Slush/Standing Water Takeoff	PI.60.3
Slippery Runway Takeoff	PI.60.7
TO1 Slush/Standing Water Takeoff	PI.60.11
TO1 Slippery Runway Takeoff	PI.60.15
TO2 Slush/Standing Water Takeoff	PI.60.19
TO2 Slippery Runway Takeoff	PI.60.23
Minimum Control Speeds	PI.60.27
Go-Around %N1	PI.60.28
Max Climb %N1	PI.60.29
Flight With Unreliable Airspeed / Turbulent Air Penetration	PI.60.30

All Engine PI.61.1

Long Range Cruise Maximum Operating Altitude	PI.61.1
Long Range Cruise Control	PI.61.5
Long Range Cruise Enroute Fuel and Time - Low Altitudes ..	PI.61.6
Long Range Cruise Enroute Fuel and Time - High Altitudes ..	PI.61.7
Long Range Cruise Wind-Altitude Trade	PI.61.9
Descent at .84M/310/250	PI.61.9
Holding	PI.61.10

Advisory Information..... PI.62.1

Runway Surface Condition Correlation	PI.62.1
Normal Configuration Landing Distance	PI.62.2
Non-Normal Configuration Landing Distance	PI.62.8
Airspeed Unreliable (Flaps 20)	PI.62.8

ANTISKID (Flaps 25)	PI.62.9
ANTISKID (Flaps 30)	PI.62.10
ENG SHUTDOWN L, R (Flaps 20)	PI.62.11
ENG SHUTDOWN L, R (Flaps 30)	PI.62.12
FLAP / SLAT CONTROL (Flaps 20)	PI.62.13
FLAPS DRIVE (Flaps ≤ 5)	PI.62.14
FLAPS DRIVE ($5 < \text{Flaps} < 20$)	PI.62.15
FLAPS DRIVE (Flaps ≥ 20)	PI.62.16
FLAPS PRIMARY FAIL (Flaps 20)	PI.62.17
FLIGHT CONTROL MODE (Flaps 20)	PI.62.18
FLIGHT CONTROLS (Flaps 20)	PI.62.19
HYD PRESS SYS C (Flaps 20)	PI.62.20
HYD PRESS SYS L (Flaps 25)	PI.62.21
HYD PRESS SYS L (Flaps 30)	PI.62.22
HYD PRESS SYS L+C (Flaps 20)	PI.62.23
HYD PRESS SYS L+R (Flaps 20)	PI.62.24
HYD PRESS SYS R (Flaps 25)	PI.62.25
HYD PRESS SYS R (Flaps 30)	PI.62.26
HYD PRESS SYS R+C (Flaps 20)	PI.62.27
PITCH DOWN AUTHORITY (Flaps 25)	PI.62.28
PITCH DOWN AUTHORITY (Flaps 30)	PI.62.29
PITCH UP AUTHORITY (Flaps ≤ 15)	PI.62.30
PITCH UP AUTHORITY (Flaps ≥ 20)	PI.62.31
PRI FLIGHT COMPUTERS (Flaps 20)	PI.62.32
SLATS DRIVE (Flaps 20)	PI.62.33
SPOILERS (Flaps 25)	PI.62.34
SPOILERS (Flaps 30)	PI.62.35
STABILIZER (Flaps 20)	PI.62.36
Approach or Landing Climb Limited Weight	PI.62.37
Recommended Brake Cooling Schedule.	PI.62.39

Engine Inoperative PI.63.1

Initial Max Continuous %N1	PI.63.1
Max Continuous %N1	PI.63.2

777 Flight Crew Operations Manual

Driftdown Speed/Level Off Altitude	PI.63.5
Driftdown/LRC Cruise Range Capability	PI.63.6
Long Range Cruise Altitude Capability	PI.63.7
Long Range Cruise Control	PI.63.8
Long Range Cruise Diversion Fuel and Time	PI.63.9
Holding	PI.63.10
Gear Down Landing Rate of Climb Available	PI.63.11
Alternate Mode EEC	PI.64.1
Alternate Mode EEC Max Takeoff %N1	PI.64.1
Gear Down	PI.65.1
220 KIAS Max Climb %N1	PI.65.1
Long Range Cruise Altitude Capability	PI.65.2
Long Range Cruise Control	PI.65.3
Long Range Cruise Enroute Fuel and Time	PI.65.4
Descent at VREF30+80	PI.65.5
Holding	PI.65.6
Gear Down, Engine Inoperative	PI.66.1
Driftdown Speed/Level Off Altitude	PI.66.1
Long Range Cruise Altitude Capability	PI.66.2
Long Range Cruise Control	PI.66.3
Long Range Cruise Diversion Fuel and Time	PI.66.4
Holding	PI.66.6
Text	PI.67.1
Introduction	PI.67.1
General	PI.67.1
All Engines	PI.67.4
Advisory Information	PI.67.6
Engine Inoperative	PI.67.9
Alternate Mode EEC	PI.67.12
Gear Down	PI.67.12

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Performance Inflight
Pkg Model Identification**Chapter PI**
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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
300ER	777-300ER	7350	WY350

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Performance Inflight
General

Chapter PI
Section 60

VREF

WEIGHT (1000 LB)	VREF (KIAS)		
	FLAPS		
	30	25	20
800	185	187	200
750	180	183	196
700	173	177	189
650	162	171	183
600	156	164	176
550	149	157	168
500	142	150	161
450	135	142	152
400	127	134	144
350	118	125	134

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

ADVISORY INFORMATION**Slush/Standing Water Takeoff****Maximum Reverse Thrust****Weight Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-83.3	-94.5	-105.7	-98.7	-109.9	-121.1	-124.4	-135.6	-146.8
800	-80.4	-91.6	-102.8	-94.8	-106.0	-117.2	-118.5	-129.7	-140.9
760	-77.3	-88.5	-99.7	-90.6	-101.8	-113.0	-112.4	-123.6	-134.8
720	-73.5	-84.7	-95.9	-85.8	-97.0	-108.2	-105.5	-116.7	-127.9
680	-69.1	-80.3	-91.5	-80.2	-91.4	-102.6	-97.9	-109.1	-120.3
640	-63.9	-75.1	-86.3	-73.8	-85.0	-96.2	-89.5	-100.7	-111.9
600	-58.1	-69.3	-80.5	-66.8	-78.0	-89.2	-80.3	-91.5	-102.7
560	-51.6	-62.8	-74.0	-59.0	-70.2	-81.4	-70.3	-81.5	-92.7
520	-44.5	-55.7	-66.9	-50.5	-61.7	-72.9	-59.6	-70.8	-82.0
480	-36.6	-47.8	-59.0	-41.3	-52.5	-63.7	-48.1	-59.3	-70.5
440	-28.1	-39.3	-50.5	-31.4	-42.6	-53.8	-35.8	-47.0	-58.2
400	-19.1	-30.3	-41.5	-20.9	-32.1	-43.3	-22.9	-34.1	-45.3
360	-10.1	-21.3	-32.5	-10.4	-21.6	-32.8	-10.1	-21.3	-32.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7000	343.3			371.4			419.6		
7400	396.8			425.4			475.2	370.4	
7800	450.6	348.7		480.7	376.8		532.2	425.1	
8200	506.2	402.1		537.5	430.9		590.6	480.8	375.9
8600	563.6	456.1	354.0	596.2	486.3	382.2	650.7	537.9	430.7
9000	623.2	511.8	407.5	656.9	543.3	436.4	712.6	596.6	486.5
9400	685.1	569.5	461.6	719.8	602.2	491.9	776.3	656.8	543.7
9800	749.7	629.2	517.5	785.2	663.1	549.1		718.9	602.5
10200	817.0	691.4	575.4		726.2	608.2		782.9	662.9
10600		756.3	635.3		791.9	669.3			725.2
11000		823.8	697.8			732.7			789.4
11400			763.0			798.6			

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 -180 ft/+170 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-25	-23	-21	-21	-19	-17	-14	-12	-10
760	-27	-25	-23	-23	-21	-19	-15	-13	-11
720	-29	-27	-25	-25	-23	-21	-16	-14	-12
680	-30	-28	-26	-26	-24	-22	-18	-16	-14
640	-31	-29	-27	-27	-25	-23	-19	-17	-15
600	-31	-29	-27	-28	-26	-24	-20	-18	-16
560	-31	-29	-27	-28	-26	-24	-22	-20	-18
520	-31	-29	-27	-28	-26	-24	-23	-21	-19
480	-30	-28	-26	-28	-26	-24	-23	-21	-19
440	-29	-27	-25	-28	-26	-24	-24	-22	-20
400	-29	-27	-25	-27	-25	-23	-24	-22	-20
360	-28	-26	-24	-26	-24	-22	-24	-22	-20

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 Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-115.4	-127.8	-140.2	-134.1	-146.5	-158.9	-164.7	-177.1	-189.5
800	-110.3	-122.7	-135.1	-127.5	-139.9	-152.3	-155.2	-167.6	-180.0
760	-105.1	-117.5	-129.9	-120.8	-133.2	-145.6	-145.5	-157.9	-170.3
720	-99.3	-111.7	-124.1	-113.4	-125.8	-138.2	-135.4	-147.8	-160.2
680	-92.9	-105.3	-117.7	-105.5	-117.9	-130.3	-124.7	-137.1	-149.5
640	-85.9	-98.3	-110.7	-97.0	-109.4	-121.8	-113.5	-125.9	-138.3
600	-78.3	-90.7	-103.1	-88.0	-100.4	-112.8	-101.8	-114.2	-126.6
560	-70.1	-82.5	-94.9	-78.3	-90.7	-103.1	-89.6	-102.0	-114.4
520	-61.3	-73.7	-86.1	-68.1	-80.5	-92.9	-76.9	-89.3	-101.7
480	-51.9	-64.3	-76.7	-57.3	-69.7	-82.1	-63.7	-76.1	-88.5
440	-42.0	-54.4	-66.8	-45.9	-58.3	-70.7	-49.9	-62.3	-74.7
400	-31.6	-44.0	-56.4	-34.1	-46.5	-58.9	-35.8	-48.2	-60.6
360	-21.2	-33.6	-46.0	-22.2	-34.6	-47.0	-21.7	-34.1	-46.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
10200							429.6		
10600							495.1	384.7	
11000				363.8			562.5	449.1	339.8
11400				431.9	316.1		632.0	515.1	403.9
11800	363.6			502.3	384.2		703.7	583.1	468.7
12200	434.3	314.3		575.7	452.7	336.6	778.0	653.3	535.3
12600	508.2	384.8		652.8	523.9	404.6		725.7	603.9
13000	586.7	456.1	335.4	734.1	598.5	473.8		800.8	674.8
13400	670.7	531.2	405.9	820.0	676.7	545.9			748.0
13800	761.9	611.3	478.2		759.4	621.5			823.6
14200	859.2	697.2	554.7		846.1	701.0			
14600		790.9	636.4			785.2			
15000			724.4						

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 -280 ft/+270 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-41	-37	-33	-35	-31	-27	-23	-19	-15
760	-43	-39	-35	-37	-33	-29	-25	-21	-17
720	-45	-41	-37	-39	-35	-31	-27	-23	-19
680	-46	-42	-38	-41	-37	-33	-29	-25	-21
640	-47	-43	-39	-42	-38	-34	-32	-28	-24
600	-47	-43	-39	-43	-39	-35	-34	-30	-26
560	-47	-43	-39	-44	-40	-36	-36	-32	-28
520	-47	-43	-39	-44	-40	-36	-37	-33	-29
480	-47	-43	-39	-44	-40	-36	-39	-35	-31
440	-46	-42	-38	-44	-40	-36	-40	-36	-32
400	-46	-42	-38	-44	-40	-36	-40	-36	-32
360	-45	-41	-37	-44	-40	-36	-41	-37	-33

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	-3.2	-6.4	-45.4	-48.6	-51.8	-85.6	-88.8	-92.0
800	0.0	-3.2	-6.4	-46.4	-49.6	-52.8	-83.4	-86.6	-89.8
760	-2.4	-5.6	-8.8	-47.3	-50.5	-53.7	-81.1	-84.3	-87.5
720	-7.6	-10.8	-14.0	-47.7	-50.9	-54.1	-78.5	-81.7	-84.9
680	-11.3	-14.5	-17.7	-47.6	-50.8	-54.0	-75.7	-78.9	-82.1
640	-13.2	-16.4	-19.6	-47.0	-50.2	-53.4	-72.5	-75.7	-78.9
600	-13.9	-17.1	-20.3	-45.2	-48.4	-51.6	-68.3	-71.5	-74.7
560	-13.6	-16.8	-20.0	-42.2	-45.4	-48.6	-62.7	-65.9	-69.1
520	-12.4	-15.6	-18.8	-37.9	-41.1	-44.3	-55.7	-58.9	-62.1
480	-10.3	-13.5	-16.7	-32.1	-35.3	-38.5	-47.3	-50.5	-53.7
440	-7.2	-10.4	-13.6	-25.1	-28.3	-31.5	-37.5	-40.7	-43.9
400	-3.2	-6.4	-9.6	-16.8	-20.0	-23.2	-26.3	-29.5	-32.7
360	0.0	-1.4	-4.6	-7.1	-10.3	-13.5	-13.7	-16.9	-20.1

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5000	396.3								
5400	513.2	396.3							
5800	629.1	513.2	396.3						
6200	744.1	629.1	513.2	317.2					
6600	858.4	744.1	629.1	391.6					
7000		858.4	744.1	468.4	361.7				
7400			858.4	548.5	437.4	332.1			
7800				632.2	516.0	406.8			
8200				720.2	598.3	484.2	369.2		
8600				812.9	684.4	564.9	414.9		
9000					775.2	649.4	462.2	360.3	
9400						738.3	511.2	405.7	
9800						831.7	562.3	452.6	351.4
10200							615.7	501.3	396.4
10600							671.7	551.9	443.0
11000							730.6	604.8	491.4
11400							793.3	660.2	541.6
11800								718.6	594.0
12200								780.4	648.9
12600									706.6
13000									767.8

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 -90 ft/+90 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -190 ft/+180 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-7	-5	-3	-18	-16	-14	-32	-30	-28
760	-9	-7	-5	-21	-19	-17	-35	-33	-31
720	-10	-8	-6	-23	-21	-19	-37	-35	-33
680	-11	-9	-7	-24	-22	-20	-39	-37	-35
640	-12	-10	-8	-25	-23	-21	-40	-38	-36
600	-13	-11	-9	-26	-24	-22	-41	-39	-37
560	-13	-11	-9	-26	-24	-22	-41	-39	-37
520	-13	-11	-9	-27	-25	-23	-42	-40	-38
480	-14	-12	-10	-27	-25	-23	-42	-40	-38
440	-14	-12	-10	-27	-25	-23	-42	-40	-38
400	-14	-12	-10	-28	-26	-24	-42	-40	-38
360	-15	-13	-11	-29	-27	-25	-41	-39	-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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-6.4	-6.4	-6.4	-74.5	-74.5	-74.5	-126.1	-126.1	-126.1
800	-11.5	-11.5	-11.5	-73.4	-73.4	-73.4	-120.9	-120.9	-120.9
760	-16.3	-16.3	-16.3	-72.4	-72.4	-72.4	-115.8	-115.8	-115.8
720	-20.5	-20.5	-20.5	-71.5	-71.5	-71.5	-111.2	-111.2	-111.2
680	-23.8	-23.8	-23.8	-70.8	-70.8	-70.8	-107.0	-107.0	-107.0
640	-26.4	-26.4	-26.4	-70.2	-70.2	-70.2	-103.2	-103.2	-103.2
600	-27.7	-27.7	-27.7	-68.3	-68.3	-68.3	-98.4	-98.4	-98.4
560	-27.6	-27.6	-27.6	-64.5	-64.5	-64.5	-92.0	-92.0	-92.0
520	-26.1	-26.1	-26.1	-58.9	-58.9	-58.9	-83.7	-83.7	-83.7
480	-23.2	-23.2	-23.2	-51.3	-51.3	-51.3	-73.8	-73.8	-73.8
440	-18.9	-18.9	-18.9	-42.0	-42.0	-42.0	-62.3	-62.3	-62.3
400	-13.2	-13.2	-13.2	-30.7	-30.7	-30.7	-49.0	-49.0	-49.0
360	-6.0	-6.0	-6.0	-17.5	-17.5	-17.5	-33.9	-33.9	-33.9

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
6200	502.7	311.8							
6600	678.3	541.9	365.2						
7000	820.6	708.7	578.6						
7400		847.7	737.9						
7800			874.7						
9400				405.5					
9800				613.9	380.0				
10200				775.2	595.7	353.1			
10600					760.3	577.1			
11000					905.4	745.3			
11400						890.9			
...									
15400							324.8		
15800							570.0	294.2	
16200							738.4	550.3	
16600							879.7	723.4	529.9
17000								865.7	708.0
17400									851.7

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 -100 ft/+90 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -270 ft/+270 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-10	-6	-2	-27	-23	-19	-52	-48	-44
760	-12	-8	-4	-30	-26	-22	-55	-51	-47
720	-14	-10	-6	-32	-28	-24	-58	-54	-50
680	-15	-11	-7	-35	-31	-27	-61	-57	-53
640	-17	-13	-9	-36	-32	-28	-64	-60	-56
600	-18	-14	-10	-38	-34	-30	-67	-63	-59
560	-18	-14	-10	-40	-36	-32	-69	-65	-61
520	-19	-15	-11	-41	-37	-33	-70	-66	-62
480	-20	-16	-12	-43	-39	-35	-71	-67	-63
440	-21	-17	-13	-44	-40	-36	-71	-67	-63
400	-22	-18	-14	-46	-42	-38	-71	-67	-63
360	-23	-19	-15	-48	-44	-40	-71	-67	-63

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**TO1 Slush/Standing Water Takeoff****10% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 LB)**

TO1 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-78.3	-89.5	-100.7	-93.6	-104.8	-116.0	-119.3	-130.5	-141.7
800	-75.4	-86.6	-97.8	-89.7	-100.9	-112.1	-113.6	-124.8	-136.0
760	-72.7	-83.9	-95.1	-86.1	-97.3	-108.5	-108.3	-119.5	-130.7
720	-70.3	-81.5	-92.7	-82.7	-93.9	-105.1	-103.1	-114.3	-125.5
680	-67.3	-78.5	-89.7	-78.7	-89.9	-101.1	-97.2	-108.4	-119.6
640	-63.5	-74.7	-85.9	-73.8	-85.0	-96.2	-90.3	-101.5	-112.7
600	-58.8	-70.0	-81.2	-68.0	-79.2	-90.4	-82.6	-93.8	-105.0
560	-53.4	-64.6	-75.8	-61.4	-72.6	-83.8	-73.8	-85.0	-96.2
520	-47.2	-58.4	-69.6	-53.9	-65.1	-76.3	-64.2	-75.4	-86.6
480	-40.2	-51.4	-62.6	-45.6	-56.8	-68.0	-53.7	-64.9	-76.1
440	-32.4	-43.6	-54.8	-36.5	-47.7	-58.9	-42.2	-53.4	-64.6
400	-23.8	-35.0	-46.2	-26.5	-37.7	-48.9	-29.9	-41.1	-52.3
360	-14.8	-26.0	-37.2	-16.0	-27.2	-38.4	-17.0	-28.2	-39.4

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800							313.5		
6200	298.1			325.6			373.3		
6600	356.6			384.7			433.3	319.5	
7000	415.2	303.9		444.3	331.5		494.7	379.3	
7400	475.2	362.4		505.8	390.7		558.0	439.3	325.5
7800	537.5	421.1	309.7	569.5	450.4	337.4	623.5	501.0	385.3
8200	602.5	481.3	368.3	635.8	512.1	396.6	691.1	564.5	445.4
8600	670.4	543.9	427.0	704.9	576.1	456.5	761.3	630.1	507.2
9000	741.8	609.1	487.5	777.2	642.6	518.3	833.8	698.0	570.9
9400	816.8	677.4	550.3	851.9	712.0	582.6	906.6	768.5	636.8
9800	892.7	749.1	615.8		784.7	649.4		841.0	704.9
10200		824.4	684.4		859.4	719.1		913.9	775.7
10600		900.3	756.5			792.2			848.3
11000			832.0			866.9			
11400			907.9						

1. Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -180 ft/+170 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

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-22	-20	-18	-17	-15	-13	-9	-7	-5
760	-24	-22	-20	-20	-18	-16	-11	-9	-7
720	-26	-24	-22	-21	-19	-17	-12	-10	-8
680	-27	-25	-23	-23	-21	-19	-14	-12	-10
640	-28	-26	-24	-24	-22	-20	-15	-13	-11
600	-28	-26	-24	-25	-23	-21	-17	-15	-13
560	-28	-26	-24	-25	-23	-21	-18	-16	-14
520	-28	-26	-24	-25	-23	-21	-19	-17	-15
480	-27	-25	-23	-25	-23	-21	-20	-18	-16
440	-26	-24	-22	-24	-22	-20	-20	-18	-16
400	-26	-24	-22	-24	-22	-20	-20	-18	-16
360	-25	-23	-21	-23	-21	-19	-20	-18	-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**TO1 Slush/Standing Water Takeoff****10% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 LB)**

TO1 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-111.3	-123.7	-136.1	-130.5	-142.9	-155.3	-162.7	-175.1	-187.5
800	-106.4	-118.8	-131.2	-124.1	-136.5	-148.9	-153.4	-165.8	-178.2
760	-101.6	-114.0	-126.4	-117.8	-130.2	-142.6	-144.3	-156.7	-169.1
720	-96.9	-109.3	-121.7	-111.7	-124.1	-136.5	-135.3	-147.7	-160.1
680	-91.7	-104.1	-116.5	-105.0	-117.4	-129.8	-125.8	-138.2	-150.6
640	-85.8	-98.2	-110.6	-97.7	-110.1	-122.5	-115.7	-128.1	-140.5
600	-79.3	-91.7	-104.1	-89.7	-102.1	-114.5	-105.0	-117.4	-129.8
560	-72.0	-84.4	-96.8	-80.9	-93.3	-105.7	-93.7	-106.1	-118.5
520	-64.1	-76.5	-88.9	-71.5	-83.9	-96.3	-81.8	-94.2	-106.6
480	-55.4	-67.8	-80.2	-61.5	-73.9	-86.3	-69.2	-81.6	-94.0
440	-46.1	-58.5	-70.9	-50.7	-63.1	-75.5	-56.1	-68.5	-80.9
400	-36.1	-48.5	-60.9	-39.3	-51.7	-64.1	-42.4	-54.8	-67.2
360	-25.7	-38.1	-50.5	-27.5	-39.9	-52.3	-28.3	-40.7	-53.1

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
8600							302.3		
9000							375.7		
9400							450.3	324.3	
9800				329.4			528.3	397.8	
10200				410.6			610.1	473.2	346.3
10600	356.7			495.2	353.6		696.5	552.3	420.2
11000	443.9	296.6		585.8	435.3	297.2	788.1	635.4	496.6
11400	537.9	382.5		683.6	521.6	377.9	883.3	723.3	576.8
11800	641.5	471.2	322.2	790.5	614.2	460.6		816.4	661.3
12200	757.9	567.8	408.4	903.3	714.6	548.6		912.1	750.7
12600	886.3	674.7	499.2		824.0	643.4			844.9
13000		795.8	598.6			746.4			
13400			709.4			857.8			
13800			834.4						

1. Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -280 ft/+270 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

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-36	-32	-28	-29	-25	-21	-16	-12	-8
760	-39	-35	-31	-32	-28	-24	-18	-14	-10
720	-41	-37	-33	-34	-30	-26	-20	-16	-12
680	-42	-38	-34	-36	-32	-28	-23	-19	-15
640	-43	-39	-35	-37	-33	-29	-25	-21	-17
600	-43	-39	-35	-39	-35	-31	-28	-24	-20
560	-43	-39	-35	-39	-35	-31	-30	-26	-22
520	-43	-39	-35	-40	-36	-32	-32	-28	-24
480	-43	-39	-35	-40	-36	-32	-34	-30	-26
440	-42	-38	-34	-40	-36	-32	-35	-31	-27
400	-41	-37	-33	-39	-35	-31	-35	-31	-27
360	-41	-37	-33	-39	-35	-31	-36	-32	-28

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**TO1 Slippery Runway Takeoff****10% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 LB)**

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	-3.2	-6.4	-39.0	-42.2	-45.4	-79.4	-82.6	-85.8
800	0.0	-3.2	-6.4	-40.0	-43.2	-46.4	-77.2	-80.4	-83.6
760	0.0	-3.2	-6.4	-41.1	-44.3	-47.5	-75.3	-78.5	-81.7
720	-0.9	-4.1	-7.3	-42.4	-45.6	-48.8	-73.8	-77.0	-80.2
680	-6.4	-9.6	-12.8	-43.4	-46.6	-49.8	-72.0	-75.2	-78.4
640	-10.3	-13.5	-16.7	-43.8	-47.0	-50.2	-69.9	-73.1	-76.3
600	-12.3	-15.5	-18.7	-43.6	-46.8	-50.0	-67.4	-70.6	-73.8
560	-13.0	-16.2	-19.4	-42.1	-45.3	-48.5	-63.6	-66.8	-70.0
520	-12.7	-15.9	-19.1	-39.2	-42.4	-45.6	-58.2	-61.4	-64.6
480	-11.4	-14.6	-17.8	-34.8	-38.0	-41.2	-51.3	-54.5	-57.7
440	-9.1	-12.3	-15.5	-29.0	-32.2	-35.4	-42.9	-46.1	-49.3
400	-5.7	-8.9	-12.1	-21.7	-24.9	-28.1	-32.8	-36.0	-39.2
360	-1.3	-4.5	-7.7	-12.9	-16.1	-19.3	-21.1	-24.3	-27.5

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4600	364.9								
5000	488.8	364.9							
5400	611.7	488.8	364.9						
5800	733.7	611.7	488.8	310.5					
6200	855.0	733.7	611.7	389.4					
6600		855.0	733.7	470.9	357.7				
7000			855.0	556.1	437.9	326.3	284.0		
7400				645.6	521.6	405.4	331.5		
7800				740.0	609.2	487.6	379.1		
8200				839.5	701.6	573.7	428.1	322.0	
8600					799.4	664.1	479.0	369.5	
9000					899.6	759.6	532.1	418.1	312.5
9400						859.5	587.5	468.6	360.0
9800							645.8	521.3	408.3
10200							707.4	576.2	458.4
10600							772.8	633.9	510.6
11000							841.4	694.8	565.0
11400							910.2	759.4	622.2
11800								827.7	682.3
12200								896.5	746.1
12600									813.9
13000									882.7

1. Enter Weight Adjustment table with reported braking action and TO1 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 -130 ft/+120 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -190 ft/+180 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

TO1 Slippery Runway Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-6	-4	-2	-16	-14	-12	-29	-27	-25
760	-8	-6	-4	-19	-17	-15	-32	-30	-28
720	-9	-7	-5	-20	-18	-16	-34	-32	-30
680	-10	-8	-6	-22	-20	-18	-35	-33	-31
640	-11	-9	-7	-23	-21	-19	-37	-35	-33
600	-11	-9	-7	-23	-21	-19	-37	-35	-33
560	-12	-10	-8	-24	-22	-20	-38	-36	-34
520	-12	-10	-8	-24	-22	-20	-38	-36	-34
480	-12	-10	-8	-24	-22	-20	-38	-36	-34
440	-12	-10	-8	-25	-23	-21	-38	-36	-34
400	-13	-11	-9	-25	-23	-21	-38	-36	-34
360	-13	-11	-9	-26	-24	-22	-38	-36	-34

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**TO1 Slippery Runway Takeoff****10% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 LB)**

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	0.0	0.0	-68.2	-68.2	-68.2	-120.4	-120.4	-120.4
800	-3.6	-3.6	-3.6	-67.1	-67.1	-67.1	-115.5	-115.5	-115.5
760	-8.7	-8.7	-8.7	-66.3	-66.3	-66.3	-110.9	-110.9	-110.9
720	-13.7	-13.7	-13.7	-65.8	-65.8	-65.8	-106.5	-106.5	-106.5
680	-18.2	-18.2	-18.2	-65.5	-65.5	-65.5	-102.6	-102.6	-102.6
640	-21.8	-21.8	-21.8	-65.3	-65.3	-65.3	-99.2	-99.2	-99.2
600	-24.5	-24.5	-24.5	-65.2	-65.2	-65.2	-96.2	-96.2	-96.2
560	-25.9	-25.9	-25.9	-63.7	-63.7	-63.7	-91.9	-91.9	-91.9
520	-25.8	-25.8	-25.8	-60.1	-60.1	-60.1	-85.7	-85.7	-85.7
480	-24.2	-24.2	-24.2	-54.4	-54.4	-54.4	-77.7	-77.7	-77.7
440	-21.1	-21.1	-21.1	-46.7	-46.7	-46.7	-67.7	-67.7	-67.7
400	-16.4	-16.4	-16.4	-36.9	-36.9	-36.9	-55.8	-55.8	-55.8
360	-10.2	-10.2	-10.2	-24.9	-24.9	-24.9	-41.8	-41.8	-41.8

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800	519.6	314.6							
6200	705.4	561.1	372.9						
6600	857.4	737.4	600.0						
7000		887.0	768.3						
7400			916.7						
8600				341.7					
9000				588.1	311.8				
9400				769.2	567.4	282.0			
9800					752.8	546.0			
10200					912.9	736.0			
10600						896.9			
...									
14200							401.0		
14600							637.8	369.0	
15000							808.0	618.2	335.0
15400								792.4	597.9
15800									776.8

1. Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -100 ft/+90 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -270 ft/+270 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

TO1 Slippery Runway Takeoff

10% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-9	-5	-1	-24	-20	-16	-47	-43	-39
760	-11	-7	-3	-26	-22	-18	-50	-46	-42
720	-12	-8	-4	-29	-25	-21	-53	-49	-45
680	-14	-10	-6	-31	-27	-23	-56	-52	-48
640	-15	-11	-7	-32	-28	-24	-58	-54	-50
600	-16	-12	-8	-34	-30	-26	-61	-57	-53
560	-16	-12	-8	-35	-31	-27	-63	-59	-55
520	-17	-13	-9	-37	-33	-29	-64	-60	-56
480	-18	-14	-10	-38	-34	-30	-65	-61	-57
440	-18	-14	-10	-40	-36	-32	-65	-61	-57
400	-19	-15	-11	-41	-37	-33	-65	-61	-57
360	-20	-16	-12	-43	-39	-35	-65	-61	-57

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**TO2 Slush/Standing Water Takeoff****20% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 LB)**

TO2 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-74.8	-86.0	-97.2	-90.1	-101.3	-112.5	-116.1	-127.3	-138.5
800	-71.8	-83.0	-94.2	-86.1	-97.3	-108.5	-110.2	-121.4	-132.6
760	-68.9	-80.1	-91.3	-82.2	-93.4	-104.6	-104.5	-115.7	-126.9
720	-66.2	-77.4	-88.6	-78.6	-89.8	-101.0	-99.3	-110.5	-121.7
680	-64.0	-75.2	-86.4	-75.6	-86.8	-98.0	-94.6	-105.8	-117.0
640	-61.6	-72.8	-84.0	-72.2	-83.4	-94.6	-89.5	-100.7	-111.9
600	-58.3	-69.5	-80.7	-67.9	-79.1	-90.3	-83.2	-94.4	-105.6
560	-54.1	-65.3	-76.5	-62.5	-73.7	-84.9	-76.0	-87.2	-98.4
520	-48.9	-60.1	-71.3	-56.2	-67.4	-78.6	-67.5	-78.7	-89.9
480	-42.8	-54.0	-65.2	-48.8	-60.0	-71.2	-58.1	-69.3	-80.5
440	-35.8	-47.0	-58.2	-40.6	-51.8	-63.0	-47.6	-58.8	-70.0
400	-27.9	-39.1	-50.3	-31.3	-42.5	-53.7	-36.0	-47.2	-58.4
360	-19.2	-30.4	-41.6	-21.1	-32.3	-43.5	-23.5	-34.7	-45.9

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400							315.6		
5800	306.4			334.0			381.9		
6200	371.3			399.6			448.5	322.3	
6600	436.5	312.9		466.1	340.6		517.2	388.5	
7000	504.0	377.8		535.2	406.2	281.7	588.3	455.3	328.9
7400	574.5	443.1	319.4	607.3	472.9	347.1	662.0	524.2	395.1
7800	648.6	510.9	384.3	682.7	542.3	412.7	738.8	595.5	462.1
8200	726.6	581.7	449.7	761.9	614.7	479.7	818.6	669.6	531.2
8600	809.2	656.1	517.8	844.5	690.5	549.4	899.3	746.6	602.8
9000	893.4	734.7	589.0		770.0	622.1		826.7	677.1
9400		817.6	663.8		852.7	698.2		907.4	754.5
9800		901.8	742.8			778.2			834.7
10200			826.0			861.0			915.5
10600			910.2						

1. Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -180 ft/+170 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

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-19	-17	-15	-14	-12	-10	-5	-3	-1
760	-21	-19	-17	-16	-14	-12	-6	-4	-2
720	-23	-21	-19	-18	-16	-14	-8	-6	-4
680	-24	-22	-20	-20	-18	-16	-10	-8	-6
640	-25	-23	-21	-21	-19	-17	-11	-9	-7
600	-26	-24	-22	-22	-20	-18	-13	-11	-9
560	-25	-23	-21	-22	-20	-18	-14	-12	-10
520	-25	-23	-21	-22	-20	-18	-15	-13	-11
480	-24	-22	-20	-22	-20	-18	-16	-14	-12
440	-23	-21	-19	-21	-19	-17	-17	-15	-13
400	-23	-21	-19	-21	-19	-17	-17	-15	-13
360	-22	-20	-18	-20	-18	-16	-17	-15	-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**TO2 Slush/Standing Water Takeoff****20% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 LB)**

TO2 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-109.4	-121.8	-134.2	-129.3	-141.7	-154.1	-163.0	-175.4	-187.8
800	-104.3	-116.7	-129.1	-122.7	-135.1	-147.5	-153.5	-165.9	-178.3
760	-99.3	-111.7	-124.1	-116.2	-128.6	-141.0	-144.3	-156.7	-169.1
720	-94.5	-106.9	-119.3	-109.9	-122.3	-134.7	-135.2	-147.6	-160.0
680	-89.9	-102.3	-114.7	-103.8	-116.2	-128.6	-126.2	-138.6	-151.0
640	-85.0	-97.4	-109.8	-97.5	-109.9	-122.3	-117.0	-129.4	-141.8
600	-79.3	-91.7	-104.1	-90.3	-102.7	-115.1	-107.1	-119.5	-131.9
560	-72.8	-85.2	-97.6	-82.4	-94.8	-107.2	-96.5	-108.9	-121.3
520	-65.6	-78.0	-90.4	-73.7	-86.1	-98.5	-85.2	-97.6	-110.0
480	-57.6	-70.0	-82.4	-64.3	-76.7	-89.1	-73.3	-85.7	-98.1
440	-48.9	-61.3	-73.7	-54.1	-66.5	-78.9	-60.7	-73.1	-85.5
400	-39.4	-51.8	-64.2	-43.2	-55.6	-68.0	-47.4	-59.8	-72.2
360	-29.1	-41.5	-53.9	-31.6	-44.0	-56.4	-33.5	-45.9	-58.3

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7800							295.8		
8200							383.1		
8600							473.0	322.0	
9000				370.5			569.3	409.6	
9400	333.9			472.2	302.1		673.2	501.3	348.2
9800	441.8			583.6	400.5		786.0	599.7	436.6
10200	561.3	365.8		707.9	504.5	331.3	905.9	706.0	530.1
10600	699.2	476.0	291.8	848.1	619.3	430.6		821.4	630.6
11000	862.5	600.4	397.7		748.3	537.4			739.4
11400		745.9	511.6		892.3	656.4			857.4
11800		913.7	641.6			790.6			
12200			794.8						

1. Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -280 ft/+270 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

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-31	-27	-23	-23	-19	-15	-7	-3	0
760	-34	-30	-26	-26	-22	-18	-10	-6	-2
720	-36	-32	-28	-29	-25	-21	-12	-8	-4
680	-37	-33	-29	-31	-27	-23	-15	-11	-7
640	-38	-34	-30	-32	-28	-24	-18	-14	-10
600	-39	-35	-31	-34	-30	-26	-21	-17	-13
560	-39	-35	-31	-34	-30	-26	-24	-20	-16
520	-39	-35	-31	-35	-31	-27	-26	-22	-18
480	-38	-34	-30	-35	-31	-27	-28	-24	-20
440	-38	-34	-30	-35	-31	-27	-29	-25	-21
400	-37	-33	-29	-35	-31	-27	-30	-26	-22
360	-36	-32	-28	-34	-30	-26	-31	-27	-23

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**TO2 Slippery Runway Takeoff****20% Thrust Reduction****Maximum Reverse Thrust****Weight Adjustment (1000 LB)**

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	-3.2	-6.4	-34.0	-37.2	-40.4	-75.3	-78.5	-81.7
800	0.0	-3.2	-6.4	-35.0	-38.2	-41.4	-73.1	-76.3	-79.5
760	0.0	-3.2	-6.4	-36.0	-39.2	-42.4	-70.9	-74.1	-77.3
720	0.0	-3.2	-6.4	-37.0	-40.2	-43.4	-69.1	-72.3	-75.5
680	0.0	-3.2	-6.4	-38.6	-41.8	-45.0	-67.9	-71.1	-74.3
640	-5.6	-8.8	-12.0	-39.9	-43.1	-46.3	-66.6	-69.8	-73.0
600	-9.6	-12.8	-16.0	-40.6	-43.8	-47.0	-64.9	-68.1	-71.3
560	-11.5	-14.7	-17.9	-40.6	-43.8	-47.0	-62.8	-66.0	-69.2
520	-12.2	-15.4	-18.6	-39.2	-42.4	-45.6	-59.1	-62.3	-65.5
480	-11.8	-15.0	-18.2	-36.3	-39.5	-42.7	-53.8	-57.0	-60.2
440	-10.3	-13.5	-16.7	-31.7	-34.9	-38.1	-46.7	-49.9	-53.1
400	-7.7	-10.9	-14.1	-25.5	-28.7	-31.9	-37.9	-41.1	-44.3
360	-4.0	-7.2	-10.4	-17.8	-21.0	-24.2	-27.4	-30.6	-33.8

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4200	324.0								
4600	455.9	324.0							
5000	586.8	455.9	324.0						
5400	716.7	586.8	455.9	299.5					
5800	845.8	716.7	586.8	383.3					
6200		845.8	716.7	470.0	349.7				
6600			845.8	560.9	434.9	316.2	286.7		
7000				656.8	524.0	400.4	337.3		
7400				758.6	617.9	487.8	388.3		
7800				865.4	717.1	579.7	441.1	327.2	
8200					822.5	676.7	496.2	378.0	
8600						779.7	553.9	430.4	317.0
9000						886.8	614.6	485.0	367.7
9400							678.8	542.1	419.7
9800							747.2	602.2	473.8
10200							820.2	665.6	530.5
10600							894.1	733.1	589.9
11000								805.4	652.6
11400								879.3	719.3
11800									790.6
12200									864.5

1. Enter Weight Adjustment table with reported braking action and TO2 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 -130 ft/+120 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -190 ft/+180 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

TO2 Slippery Runway Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-6	-4	-2	-15	-13	-11	-27	-25	-23
760	-7	-5	-3	-17	-15	-13	-29	-27	-25
720	-9	-7	-5	-19	-17	-15	-31	-29	-27
680	-9	-7	-5	-20	-18	-16	-32	-30	-28
640	-10	-8	-6	-21	-19	-17	-33	-31	-29
600	-10	-8	-6	-21	-19	-17	-34	-32	-30
560	-11	-9	-7	-22	-20	-18	-35	-33	-31
520	-11	-9	-7	-22	-20	-18	-35	-33	-31
480	-11	-9	-7	-22	-20	-18	-35	-33	-31
440	-11	-9	-7	-23	-21	-19	-35	-33	-31
400	-12	-10	-8	-23	-21	-19	-35	-33	-31
360	-12	-10	-8	-23	-21	-19	-35	-33	-31

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**TO2 Slippery Runway Takeoff****20% Thrust Reduction****No Reverse Thrust****Weight Adjustment (1000 LB)**

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	0.0	0.0	-64.0	-64.0	-64.0	-117.7	-117.7	-117.7
800	0.0	0.0	0.0	-63.0	-63.0	-63.0	-112.5	-112.5	-112.5
760	-1.6	-1.6	-1.6	-61.9	-61.9	-61.9	-107.6	-107.6	-107.6
720	-6.7	-6.7	-6.7	-61.0	-61.0	-61.0	-103.1	-103.1	-103.1
680	-11.8	-11.8	-11.8	-60.7	-60.7	-60.7	-99.0	-99.0	-99.0
640	-16.4	-16.4	-16.4	-60.6	-60.6	-60.6	-95.4	-95.4	-95.4
600	-20.2	-20.2	-20.2	-60.7	-60.7	-60.7	-92.4	-92.4	-92.4
560	-23.0	-23.0	-23.0	-60.9	-60.9	-60.9	-89.7	-89.7	-89.7
520	-24.4	-24.4	-24.4	-59.4	-59.4	-59.4	-85.6	-85.6	-85.6
480	-24.1	-24.1	-24.1	-55.6	-55.6	-55.6	-79.4	-79.4	-79.4
440	-22.2	-22.2	-22.2	-49.6	-49.6	-49.6	-71.1	-71.1	-71.1
400	-18.6	-18.6	-18.6	-41.4	-41.4	-41.4	-60.7	-60.7	-60.7
360	-13.5	-13.5	-13.5	-30.9	-30.9	-30.9	-48.1	-48.1	-48.1

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400	522.5	295.8							
5800	723.4	567.7	359.8						
6200	888.7	757.9	610.0						
6600			790.9						
8200				528.9					
8600				740.6	503.8				
9000				918.2	721.8	477.7			
9400					900.6	702.6			
9800						882.9			
...									
13000							416.2		
13400							669.3	381.7	
13800							852.7	648.5	344.2
14200								835.2	627.0
14600									817.8

1. Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -100 ft/+90 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -270 ft/+270 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

TO2 Slippery Runway Takeoff

20% Thrust Reduction

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-8	-4	0	-21	-17	-13	-42	-38	-34
760	-10	-6	-2	-23	-19	-15	-44	-40	-36
720	-11	-7	-3	-26	-22	-18	-47	-43	-39
680	-12	-8	-4	-27	-23	-19	-50	-46	-42
640	-13	-9	-5	-29	-25	-21	-52	-48	-44
600	-14	-10	-6	-30	-26	-22	-55	-51	-47
560	-15	-11	-7	-32	-28	-24	-56	-52	-48
520	-15	-11	-7	-33	-29	-25	-58	-54	-50
480	-16	-12	-8	-34	-30	-26	-58	-54	-50
440	-16	-12	-8	-35	-31	-27	-58	-54	-50
400	-17	-13	-9	-37	-33	-29	-58	-54	-50
360	-18	-14	-10	-38	-34	-30	-58	-54	-50

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.

Minimum Control Speeds**V1(MCG), Minimum VR****Max Takeoff Thrust**

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111				
50	122	119	121	116	118	111	113	109	111	106	109	103	106
40	104	126	127	123	124	118	120	113	115	108	111	103	106
30	86	128	130	128	130	123	125	118	120	112	115	106	109
20	68	129	130	129	130	125	126	120	122	116	118	110	113
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114

TO1 V1(MCG), Minimum VR**10% Thrust Reduction**

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	111	112	107	110	105	107	103	106				
50	122	113	115	110	112	105	108	103	106	101	104	98	101
40	104	119	121	117	119	112	114	107	110	103	105	98	101
30	86	122	123	121	123	116	118	112	114	107	109	101	104
20	68	122	124	121	123	118	119	114	116	110	112	104	107
-60	-76	124	124	123	123	119	120	115	116	111	112	106	108

TO2 V1(MCG), Minimum VR**20% Thrust Reduction**

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	105	107	102	104	100	102	98	101						
50	122	107	109	105	107	100	103	98	101	96	99	93	96	89	92
40	104	113	115	111	113	106	108	102	104	97	100	93	96	89	92
30	86	115	117	115	117	110	112	106	108	101	104	96	99	91	94
20	68	115	117	115	117	112	114	108	110	104	106	99	102	94	97
-60	-76	117	117	116	117	113	114	109	111	105	107	101	103	97	99

Go-Around %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

REPORTED OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (1000 FT)													
°C	°F		-2	-1	0	1	2	3	4	5	6	7	8	9	10	
66	150	70	93.7	93.8	94.1	93.9	93.8	93.7	93.6	93.4	93.3	92.6	91.5	90.5	89.6	
56	133	60	96.5	96.6	96.9	96.7	96.6	96.5	96.4	96.2	96.1	95.4	94.3	93.4	92.5	
51	124	55	97.8	98.0	98.3	98.1	97.9	97.9	97.7	97.6	97.4	96.7	95.7	94.7	93.9	
46	115	50	99.1	99.3	99.6	99.4	99.3	99.2	99.1	98.9	98.7	98.0	97.0	96.1	95.2	
41	106	45	100.2	100.7	101.1	101.0	100.9	100.7	100.5	100.4	100.0	99.3	98.3	97.3	96.5	
36	97	40	101.5	102.4	103.2	103.2	102.8	102.6	102.3	102.0	101.4	100.5	99.5	98.6	97.8	
31	88	35	101.2	103.9	105.8	105.4	105.1	104.7	104.3	103.8	102.7	101.7	100.6	99.7	98.9	
26	79	30	100.4	103.1	105.9	106.3	106.8	106.6	106.4	105.0	103.4	101.9	100.8	100.0		
21	70	25	99.5	102.2	105.0	105.9	106.5	107.0	107.4	107.4	106.8	105.7	104.0	102.3	101.3	
16	61	20	98.7	101.4	104.1	105.0	105.6	106.1	106.5	107.0	106.8	106.3	105.2	104.2	103.3	
11	53	15	97.9	100.5	103.2	104.1	104.7	105.2	105.6	106.1	105.9	105.5	104.9	104.4	103.4	
7	44	10	97.0	99.6	102.3	103.2	103.8	104.3	104.7	105.1	105.0	104.6	104.0	103.5	103.0	
2	35	5	96.1	98.7	101.4	102.3	102.9	103.4	103.8	104.2	104.1	103.7	103.1	102.6	102.5	
-3	26	0	95.3	97.8	100.5	101.4	102.0	102.4	102.8	103.3	103.1	102.7	102.2	101.7	101.6	
-13	8	-10	93.5	96.0	98.6	99.5	100.1	100.5	100.9	101.4	101.2	100.8	100.3	99.8	99.7	
-23	-10	-20	91.7	94.2	96.7	97.6	98.2	98.6	99.0	99.4	99.3	98.9	98.3	97.9	97.8	
-33	-27	-30	89.9	92.3	94.8	95.6	96.2	96.6	97.0	97.4	97.3	96.9	96.4	95.9	95.8	
-43	-45	-40	88.0	90.4	92.8	93.6	94.2	94.6	95.0	95.4	95.3	94.9	94.4	93.9	93.9	
-53	-63	-50	86.1	88.4	90.8	91.6	92.2	92.6	93.0	93.3	93.2	92.9	92.3	91.9	91.8	

%N1 Adjustments for Engine Bleed

[illegible]

Max Climb %N1**Based on engine bleed for packs on or off and anti-ice off**

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

*Packs on or off with 2 bleed sources.

**Packs off with 1 bleed source.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	PITCH ATT V/S (FT/MIN)	4.5 1100	4.0 700			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	5.5 2800	5.0 2100	5.0 1500	4.5 1100	4.0 800
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	8.5 4100	7.5 3100	7.5 2400	7.5 1700	7.0 1300
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	11.5 5400	10.5 4100	9.5 3300	9.5 2600	9.0 2100
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	15.0 6300	13.0 4900	12.0 3900	11.5 3200	11.0 2600

Cruise

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	PITCH ATT %N1	2.5 82.1	3.0 87.2			
35000 (280 KIAS)	PITCH ATT %N1	1.5 78.9	2.5 81.6	3.0 85.3	3.5 92.0	
30000 (280 KIAS)	PITCH ATT %N1	2.0 74.5	2.5 77.2	3.0 80.7	3.0 84.8	3.0 88.8
25000 (280 KIAS)	PITCH ATT %N1	2.0 70.6	2.5 73.0	3.5 76.1	3.5 80.0	3.5 83.7
20000 (270 KIAS)	PITCH ATT %N1	2.0 65.8	3.0 68.3	4.0 71.4	4.0 75.2	4.0 78.9
15000 (270 KIAS)	PITCH ATT %N1	2.0 61.8	3.0 64.4	4.0 67.2	4.5 70.4	4.5 74.3

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-1.0 -2700	0.0 -2700			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -2200	0.0 -2000	1.0 -1900	0.5 -2100	0.5 -2500
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-0.5 -1800	0.5 -1600	1.5 -1500	2.0 -1500	1.5 -1600
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1600	0.0 -1400	1.5 -1400	2.5 -1400	2.5 -1400
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1400	0.0 -1300	1.0 -1200	2.0 -1200	2.5 -1300

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	PITCH ATT	4.5	5.0	5.5	5.5	5.5
	%N1	52.8	57.5	62.0	66.1	69.7
	KIAS	207	222	238	258	276
5000	PITCH ATT	4.5	5.0	5.5	5.5	5.5
	%N1	49.3	53.8	58.0	61.9	65.6
	KIAS	207	222	237	256	274

Terminal Area (5000 FT)**Set Thrust for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS UP GEAR UP (VREF30+80)	PITCH ATT	5.0	5.5	6.0	6.0	6.5
	%N1	49.5	54.2	58.5	62.6	66.4
	KIAS	207	222	235	252	264
FLAPS 1 GEAR UP (VREF30+60)	PITCH ATT	6.5	7.0	7.5	7.5	8.0
	%N1	50.4	55.4	60.0	64.3	68.0
	KIAS	187	202	215	232	244
FLAPS 5 GEAR UP (VREF30+40)	PITCH ATT	5.5	6.0	6.5	6.5	6.5
	%N1	50.9	56.1	61.0	65.2	69.1
	KIAS	167	182	195	212	224
FLAPS 15 GEAR UP (VREF30+20)	PITCH ATT	6.5	7.0	7.0	7.0	7.0
	%N1	52.1	57.7	62.7	66.9	71.2
	KIAS	147	162	175	192	204
FLAPS 20 GEAR DOWN (VREF30+20)	PITCH ATT	5.0	5.5	5.5	5.5	5.5
	%N1	57.9	63.7	69.3	74.0	78.1
	KIAS	147	162	175	192	204

Final Approach (1500 FT)**Gear Down, Set Thrust for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS 20 (VREF20+10)	PITCH ATT	1.0	1.0	1.5	1.5	2.0
	%N1	39.7	43.9	47.9	51.1	53.8
	KIAS	153	170	185	199	209
FLAPS 25 (VREF25+10)	PITCH ATT	1.5	2.0	2.0	2.0	2.0
	%N1	50.0	54.5	58.5	62.2	64.7
	KIAS	144	159	173	186	196
FLAPS 30 (VREF30+10)	PITCH ATT	1.0	1.5	1.5	1.0	1.0
	%N1	54.3	59.4	63.6	69.6	73.5
	KIAS	137	152	165	182	194

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	PITCH ATT	18.0	14.5	12.5	10.5	9.0
	V/S (FT/MIN)	4000	3100	2500	2000	1600
	KIAS	147	162	176	193	205
5000	PITCH ATT	22.5	18.0	15.0	12.5	11.0
	V/S (FT/MIN)	5000	4000	3300	2700	2200
	KIAS	147	162	176	192	205
SEA LEVEL	PITCH ATT	27.0	21.5	18.0	15.0	13.0
	V/S (FT/MIN)	5800	4700	3900	3300	2800
	KIAS	147	162	175	192	204

Performance Inflight
All Engine

Chapter PI
Section 61

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)
ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	30800	29100	27600
760	28800	2	31300	29700	28200
740	29400	0	31800	30200	28700
720	30000	-1	32300	30700	29100
700	30700	-2	32800	31100	29600
680	31300	-4	33200	31600	30100
660	31900	-5	33700	32100	30600
640	32600	-7	34300	32700	31200
620	33300	-8	34800	33200	31700
600	34000	-10	35300	33800	32300
580	34700	-11	35900	34300	32900
560	35400	-13	36500	34900	33500
540	36200	-15	37100	35600	34100
520	37000	-15	37800	36200	34800
500	37800	-15	38400	36900	35500
480	38600	-15	39100	37600	36200
460	39500	-15	39900	38300	36900
440	40400	-15	40600	39100	37700
420	41400	-15	41400	39900	38600
400	42400	-15	42300	40800	39400
380	43100	-15	43100	41800	40500

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	30800	29100	27600
760	28800	8	31300	29700	28200
740	29400	6	31800	30200	28700
720	30000	5	32300	30700	29100
700	30700	3	32800	31100	29600
680	31300	2	33200	31600	30100
660	31900	1	33700	32100	30600
640	32600	-1	34300	32700	31200
620	33300	-2	34800	33200	31700
600	34000	-4	35300	33800	32300
580	34700	-6	35900	34300	32900
560	35400	-7	36500	34900	33500
540	36200	-9	37100	35600	34100
520	37000	-9	37800	36200	34800
500	37800	-9	38400	36900	35500
480	38600	-9	39100	37600	36200
460	39500	-9	39900	38300	36900
440	40400	-9	40600	39100	37700
420	41400	-9	41400	39900	38600
400	42400	-9	42300	40800	39400
380	43100	-9	43100	41800	40500

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	30800	29100	27600
760	28800	13	31300	29700	28200
740	29400	12	31800	30200	28700
720	30000	11	32300	30700	29100
700	30700	9	32800	31100	29600
680	31300	8	33200	31600	30100
660	31900	6	33700	32100	30600
640	32600	5	34300	32700	31200
620	33300	3	34800	33200	31700
600	34000	2	35300	33800	32300
580	34700	0	35900	34300	32900
560	35400	-2	36500	34900	33500
540	36200	-3	37100	35600	34100
520	37000	-3	37800	36200	34800
500	37800	-3	38400	36900	35500
480	38600	-3	39100	37600	36200
460	39500	-3	39900	38300	36900
440	40400	-3	40600	39100	37700
420	41400	-3	41400	39900	38600
400	42400	-3	42300	40800	39400
380	43100	-3	43100	41800	40500

Long Range Cruise Maximum Operating Altitude**Max Climb Thrust, Mid C.G. (30% MAC)****ISA + 10°C and Below**

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	31800	30200	28600
760	28800	2	32400	30700	29200
740	29400	0	32900	31300	29700
720	30000	-1	33300	31700	30200
700	30700	-2	33800	32200	30700
680	31300	-4	34300	32700	31200
660	31900	-5	34800	33200	31700
640	32600	-7	35300	33700	32200
620	33300	-8	35800	34200	32700
600	34000	-10	36300	34800	33300
580	34700	-11	36900	35300	33900
560	35400	-13	37500	35900	34500
540	36200	-15	38100	36600	35100
520	37000	-15	38800	37200	35800
500	37800	-15	39400	37900	36400
480	38600	-15	40100	38600	37100
460	39500	-15	40900	39300	37900
440	40400	-15	41600	40100	38700
420	41400	-15	42400	40900	39500
400	42400	-15	43100	41700	40300
380	43100	-15	43100	42800	41400

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	31800	30200	28600
760	28800	8	32400	30700	29200
740	29400	6	32900	31300	29700
720	30000	5	33300	31700	30200
700	30700	3	33800	32200	30700
680	31300	2	34300	32700	31200
660	31900	1	34800	33200	31700
640	32600	-1	35300	33700	32200
620	33300	-2	35800	34200	32700
600	34000	-4	36300	34800	33300
580	34700	-6	36900	35300	33900
560	35400	-7	37500	35900	34500
540	36200	-9	38100	36600	35100
520	37000	-9	38800	37200	35800
500	37800	-9	39400	37900	36400
480	38600	-9	40100	38600	37100
460	39500	-9	40900	39300	37900
440	40400	-9	41600	40100	38700
420	41400	-9	42400	40900	39500
400	42400	-9	43100	41700	40300
380	43100	-9	43100	42800	41400

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Mid C.G. (30% MAC)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	31800	30200	28600
760	28800	13	32400	30700	29200
740	29400	12	32900	31300	29700
720	30000	11	33300	31700	30200
700	30700	9	33800	32200	30700
680	31300	8	34300	32700	31200
660	31900	6	34800	33200	31700
640	32600	5	35300	33700	32200
620	33300	3	35800	34200	32700
600	34000	2	36300	34800	33300
580	34700	0	36900	35300	33900
560	35400	-2	37500	35900	34500
540	36200	-3	38100	36600	35100
520	37000	-3	38800	37200	35800
500	37800	-3	39400	37900	36400
480	38600	-3	40100	38600	37100
460	39500	-3	40900	39300	37900
440	40400	-3	41600	40100	38700
420	41400	-3	42400	40900	39500
400	42400	-3	43100	41700	40300
380	43100	-3	43100	42800	41400

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		25	27	29	31	33	35	37	39	41	43
780	%N1	84.2	85.9	87.1	89.6						
	MACH	.819	.840	.839	.838						
	KIAS	346	342	327	313						
	FF/ENG	11439	11411	11201	11537						
740	%N1	83.4	84.8	85.9	87.7	90.7					
	MACH	.819	.837	.840	.839	.837					
	KIAS	346	341	328	313	299					
	FF/ENG	11096	10974	10668	10708	11189					
700	%N1	82.5	83.7	84.9	86.1	88.3					
	MACH	.812	.831	.839	.840	.838					
	KIAS	343	338	327	314	300					
	FF/ENG	10640	10513	10229	10021	10265					
660	%N1	81.0	82.5	83.7	84.9	86.4	89.1				
	MACH	.795	.819	.835	.840	.839	.837				
	KIAS	335	332	325	314	300	286				
	FF/ENG	10011	9983	9794	9536	9480	9831				
620	%N1	79.4	81.1	82.5	83.8	84.9	86.7				
	MACH	.775	.803	.825	.838	.840	.839				
	KIAS	326	325	321	313	300	287				
	FF/ENG	9341	9384	9307	9103	8893	8984				
580	%N1	77.6	79.4	81.1	82.4	83.6	84.8	87.5			
	MACH	.751	.782	.809	.830	.839	.840	.838			
	KIAS	315	316	314	310	300	287	274			
	FF/ENG	8646	8743	8740	8651	8448	8289	8522			
540	%N1	75.9	77.5	79.3	81.0	82.3	83.4	85.2	88.6		
	MACH	.728	.757	.788	.814	.833	.840	.839	.837		
	KIAS	305	305	305	303	298	287	274	261		
	FF/ENG	8016	8060	8128	8113	8011	7814	7757	8113		
500	%N1	74.4	75.7	77.3	79.1	80.7	82.1	83.5	85.9		
	MACH	.709	.731	.761	.792	.818	.835	.840	.839		
	KIAS	296	294	294	294	292	285	274	262		
	FF/ENG	7478	7417	7468	7518	7504	7376	7226	7293		
460	%N1	72.8	74.0	75.3	77.0	78.9	80.4	82.1	84.0	86.5	
	MACH	.691	.710	.733	.764	.795	.821	.836	.840	.839	
	KIAS	288	285	282	283	283	280	273	262	250	
	FF/ENG	6982	6872	6822	6874	6918	6892	6790	6706	6803	
420	%N1	70.8	72.3	73.5	74.8	76.5	78.4	80.3	82.4	84.2	86.8
	MACH	.669	.690	.710	.733	.764	.796	.822	.837	.840	.839
	KIAS	278	276	273	270	271	271	268	261	250	238
	FF/ENG	6457	6375	6276	6235	6280	6311	6314	6265	6188	6260
380	%N1	68.5	70.1	71.6	72.8	74.2	75.9	78.2	80.4	82.5	84.3
	MACH	.639	.665	.688	.708	.731	.762	.795	.821	.836	.840
	KIAS	266	266	264	260	258	258	258	255	249	239
	FF/ENG	5889	5850	5779	5697	5655	5676	5727	5783	5742	5644
340	%N1	65.9	67.6	69.2	70.7	72.0	73.3	75.3	78.0	80.3	82.5
	MACH	.604	.632	.659	.683	.704	.726	.757	.790	.817	.835
	KIAS	250	251	252	251	247	244	244	245	242	237
	FF/ENG	5299	5296	5253	5205	5135	5071	5094	5184	5243	5194

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes
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
282	261	242	226	213	200	191	182	174	167	160
561	520	484	452	425	400	382	366	351	337	325
840	779	725	678	637	600	574	550	528	508	489
1120	1039	966	904	849	800	766	734	705	678	653
1401	1299	1208	1130	1062	1000	957	918	881	848	817
1683	1560	1451	1357	1274	1200	1149	1101	1057	1017	980
1966	1822	1694	1583	1487	1400	1340	1285	1234	1187	1144
2250	2085	1937	1811	1700	1600	1532	1469	1410	1356	1307
2535	2348	2181	2038	1913	1800	1723	1652	1586	1525	1470
2820	2611	2425	2265	2126	2000	1915	1835	1762	1695	1633

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	9.1	0:37	7.9	0:36	6.5	0:35	5.8	0:34	5.1	0:33
400	18.7	1:09	17.1	1:06	14.8	1:03	13.6	1:01	12.6	0:58
600	28.4	1:42	26.3	1:36	23.1	1:31	21.4	1:28	20.1	1:24
800	37.9	2:15	35.3	2:07	31.3	1:59	29.1	1:55	27.5	1:49
1000	47.3	2:48	44.3	2:38	39.4	2:27	36.8	2:22	34.8	2:15
1200	56.7	3:22	53.2	3:09	47.5	2:56	44.4	2:49	42.1	2:40
1400	66.1	3:55	62.1	3:41	55.5	3:24	51.9	3:17	49.3	3:06
1600	75.3	4:29	70.8	4:12	63.5	3:53	59.4	3:44	56.4	3:32
1800	84.5	5:04	79.5	4:44	71.4	4:22	66.8	4:12	63.5	3:58
2000	93.6	5:38	88.2	5:17	79.2	4:51	74.2	4:40	70.6	4:24

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)									
	400	450	500	550	600	650	700	750	800	
10	-1.4	-1.0	-0.7	-0.3	0.0	0.4	0.8	1.2	1.7	
20	-2.9	-2.2	-1.5	-0.7	0.0	0.9	1.8	2.8	3.8	
30	-4.5	-3.4	-2.3	-1.1	0.0	1.4	2.9	4.4	5.9	
40	-6.1	-4.6	-3.1	-1.5	0.0	1.9	3.9	6.0	8.1	
50	-7.6	-5.8	-3.9	-1.9	0.0	2.5	5.0	7.6	10.2	
60	-9.2	-7.0	-4.7	-2.3	0.0	3.0	6.1	9.2	12.3	
70	-10.7	-8.1	-5.5	-2.7	0.0	3.6	7.2	10.8	14.4	
80	-12.3	-9.3	-6.3	-3.1	0.0	4.2	8.3	12.4	16.5	
90	-13.8	-10.5	-7.1	-3.5	0.0	4.8	9.4	14.0	18.5	
100	-15.3	-11.6	-7.8	-3.9	0.0	5.4	10.6	15.7	20.6	
110	-16.9	-12.8	-8.6	-4.3	0.0	6.0	11.7	17.3	22.7	
120	-18.4	-13.9	-9.4	-4.7	0.0	6.6	12.9	19.0	24.8	

Long Range Cruise Enroute Fuel and Time - High Altitudes
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
1032	976	925	879	838	800	767	736	708	682	657
1543	1460	1385	1317	1256	1200	1151	1106	1063	1024	989
2056	1946	1846	1756	1675	1600	1535	1475	1419	1367	1320
2571	2433	2308	2195	2094	2000	1920	1845	1775	1710	1651
3088	2922	2771	2635	2513	2400	2304	2214	2131	2053	1982
3606	3412	3235	3076	2932	2800	2688	2583	2486	2396	2313
4126	3904	3699	3517	3352	3200	3072	2953	2842	2739	2645
4649	4396	4165	3959	3772	3600	3456	3322	3197	3082	2976
5172	4890	4631	4400	4192	4000	3840	3691	3552	3424	3307
5697	5384	5098	4843	4612	4400	4224	4060	3908	3767	3637
6223	5880	5565	5285	5033	4800	4608	4429	4263	4109	3967
6751	6376	6034	5729	5453	5200	4992	4798	4617	4450	4297
7281	6874	6503	6172	5874	5600	5375	5166	4971	4791	4626
7812	7373	6973	6616	6295	6000	5759	5534	5324	5131	4954
8345	7874	7444	7061	6716	6400	6142	5901	5678	5471	5282
8880	8376	7915	7506	7138	6800	6525	6269	6030	5811	5610
9418	8880	8388	7952	7560	7200	6908	6636	6383	6150	5936
9959	9385	8863	8399	7982	7600	7291	7002	6735	6488	6262
10502	9893	9338	8846	8405	8000	7674	7369	7086	6826	6587

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)
800	27.2	1:48	26.3	1:47	25.5	1:47	25.3	1:48	26.2	1:48
1200	41.3	2:39	40.1	2:36	39.0	2:36	38.4	2:37	39.5	2:38
1600	55.4	3:30	53.9	3:26	52.4	3:25	51.6	3:27	52.7	3:28
2000	69.6	4:21	67.7	4:16	65.8	4:15	64.8	4:16	66.0	4:18
2400	83.1	5:13	80.9	5:07	78.8	5:05	77.4	5:06	78.5	5:07
2800	96.7	6:06	94.1	5:58	91.7	5:55	90.1	5:55	90.9	5:57
3200	109.9	6:59	107.1	6:50	104.4	6:45	102.4	6:45	103.0	6:47
3600	122.9	7:54	119.8	7:42	116.9	7:36	114.6	7:35	114.9	7:37
4000	135.9	8:48	132.6	8:34	129.3	8:27	126.7	8:25	126.7	8:27
4400	148.4	9:43	144.8	9:28	141.3	9:19	138.4	9:16	138.1	9:17
4800	160.8	10:39	157.0	10:22	153.2	10:10	150.1	10:07	149.5	10:07
5200	173.0	11:36	168.9	11:17	165.0	11:03	161.5	10:58	160.6	10:57
5600	185.0	12:33	180.6	12:12	176.4	11:57	172.8	11:50	171.6	11:47
6000	197.0	13:30	192.3	13:08	187.9	12:50	184.0	12:41	182.5	12:38
6400	208.5	14:28	203.5	14:05	198.9	13:45	194.8	13:34	193.0	13:29
6800	220.0	15:27	214.8	15:02	209.9	14:41	205.5	14:27	203.5	14:21
7200	231.4	16:26	225.8	16:00	220.7	15:37	216.1	15:21	213.8	15:13
7600	242.5	17:26	236.6	16:58	231.2	16:33	226.4	16:16	223.9	16:05
8000	253.6	18:26	247.4	17:56	241.8	17:30	236.7	17:11	234.0	16:58

Long Range Cruise Enroute Fuel and Time - High Altitudes
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	400	450	500	550	600	650	700	750	800
20	-3.7	-2.7	-1.7	-0.8	0.0	2.7	8.7	17.9	30.3
40	-8.1	-6.1	-4.1	-2.0	0.0	4.9	13.5	26.0	42.2
60	-12.3	-9.4	-6.4	-3.2	0.0	6.8	17.9	33.3	53.0
80	-16.5	-12.7	-8.7	-4.3	0.0	8.6	22.0	40.0	62.6
100	-20.6	-15.9	-10.9	-5.4	0.0	10.3	25.6	45.9	71.2
120	-24.5	-19.0	-13.1	-6.5	0.0	11.8	28.9	51.1	78.6
140	-28.4	-22.0	-15.1	-7.5	0.0	13.2	31.8	55.7	84.9
160	-32.2	-24.9	-17.1	-8.6	0.0	14.5	34.3	59.5	90.0
180	-35.9	-27.8	-19.1	-9.6	0.0	15.5	36.4	62.6	94.1
200	-39.5	-30.5	-21.0	-10.6	0.0	16.5	38.1	65.0	97.0
220	-43.0	-33.2	-22.8	-11.5	0.0	17.3	39.5	66.7	98.9
240	-46.4	-35.8	-24.6	-12.4	0.0	17.9	40.4	67.7	99.6
260	-49.7	-38.3	-26.3	-13.3	0.0	18.4	41.0	68.0	99.2
280	-52.9	-40.8	-27.9	-14.2	0.0	18.7	41.2	67.5	97.6
300	-56.0	-43.1	-29.5	-15.1	0.0	18.9	41.1	66.4	95.0
320	-59.0	-45.4	-31.0	-15.9	0.0	19.0	40.5	64.6	91.2
340	-61.9	-47.5	-32.4	-16.7	0.0	18.9	39.5	62.0	86.4

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)										
	780	740	700	660	620	580	540	500	460	420	380
43							188	94	35	6	0
41						153	77	29	6	0	8
39					117	58	22	4	0	8	23
37			147	84	40	14	2	1	9	22	38
35		101	56	25	7	0	2	10	23	37	52
33	66	34	14	3	0	4	13	24	38	52	64
31	18	6	0	1	7	16	27	39	52	63	72
29	1	0	4	10	19	30	42	53	63	71	76
27	2	7	15	24	34	44	55	64	71	76	77
25	12	20	29	38	48	57	65	71	75	77	76

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 at .84M/310/250

PRESSURE ALTITUDE (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	96	104	111	118	124	129	135	140	145	150
TIME (MINUTES)	20	21	22	23	24	24	25	26	26	27

Holding Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
800	%N1	62.7	65.6	69.7	74.5	79.1	83.7	88.8			
	KIAS	273	275	276	301	314	318	312			
	FF/ENG	10540	10420	10330	10690	11040	11440	12000			
760	%N1	61.3	64.2	68.3	72.8	77.7	82.4	87.0			
	KIAS	266	268	269	285	306	309	312			
	FF/ENG	10010	9920	9800	9990	10430	10760	11180			
720	%N1	59.9	62.7	66.8	71.0	76.2	80.9	85.5			
	KIAS	259	260	261	271	297	300	305			
	FF/ENG	9490	9400	9280	9340	9830	10070	10400			
680	%N1	58.5	61.2	65.4	69.3	74.6	79.3	84.0			
	KIAS	252	253	254	256	286	291	296			
	FF/ENG	8980	8890	8760	8740	9200	9410	9720			
640	%N1	57.0	59.6	63.8	67.7	72.8	77.6	82.2			
	KIAS	245	245	246	248	267	282	286			
	FF/ENG	8470	8370	8250	8210	8480	8780	9070			
600	%N1	55.5	58.0	62.0	66.1	70.7	75.8	80.6	85.3		
	KIAS	236	237	238	239	251	273	276	279		
	FF/ENG	7980	7860	7740	7680	7800	8190	8420	8790		
560	%N1	53.9	56.4	60.2	64.4	68.7	74.0	78.7	83.5		
	KIAS	231	231	231	231	234	263	266	270		
	FF/ENG	7500	7370	7230	7170	7180	7600	7780	8020		
520	%N1	52.3	54.7	58.4	62.5	66.7	71.8	76.6	81.5		
	KIAS	225	225	225	225	225	243	256	259		
	FF/ENG	7060	6910	6740	6660	6650	6880	7150	7370		
480	%N1	50.7	53.0	56.6	60.5	64.7	69.3	74.5	79.3		
	KIAS	220	220	220	220	220	224	245	248		
	FF/ENG	6640	6470	6270	6190	6160	6210	6540	6720		
440	%N1	48.8	51.2	54.7	58.4	62.6	66.9	72.2	77.1	83.5	
	KIAS	213	213	213	213	213	213	232	237	240	
	FF/ENG	6240	6050	5840	5750	5680	5670	5920	6090	6440	
400	%N1	46.8	49.3	52.8	56.3	60.4	64.7	69.4	74.5	81.0	
	KIAS	207	207	207	207	207	207	209	225	228	
	FF/ENG	5850	5660	5430	5340	5250	5200	5230	5480	5760	
360	%N1	44.7	47.1	50.7	54.2	57.9	62.4	66.6	71.8	78.3	82.3
	KIAS	200	200	200	200	200	200	200	212	215	217
	FF/ENG	5590	5400	5170	5050	4940	4870	4840	4900	5110	5270

This table includes 5% additional fuel for holding in a racetrack pattern.

Holding**Flaps 1**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
800	%N1	65.2	68.1	72.7	77.2	82.2
	KIAS	242	242	242	242	242
	FF/ENG	11530	11500	11450	11560	11820
760	%N1	63.7	66.5	70.9	75.4	80.5
	KIAS	242	242	242	242	242
	FF/ENG	10890	10840	10770	10840	11080
720	%N1	62.2	65.0	69.2	73.8	78.8
	KIAS	236	236	236	236	236
	FF/ENG	10290	10230	10160	10190	10400
680	%N1	60.6	63.5	67.6	72.2	77.1
	KIAS	228	228	228	228	228
	FF/ENG	9700	9640	9560	9570	9740
640	%N1	59.0	61.8	65.9	70.5	75.3
	KIAS	221	221	221	221	221
	FF/ENG	9130	9050	8960	8960	9090
600	%N1	57.3	60.0	64.1	68.4	73.2
	KIAS	216	216	216	216	216
	FF/ENG	8560	8480	8360	8360	8430
560	%N1	55.6	58.1	62.2	66.4	71.2
	KIAS	211	211	211	211	211
	FF/ENG	8010	7910	7790	7760	7810
520	%N1	53.9	56.3	60.2	64.3	68.9
	KIAS	205	205	205	205	205
	FF/ENG	7480	7350	7220	7180	7200
480	%N1	52.1	54.4	58.1	62.2	66.5
	KIAS	200	200	200	200	200
	FF/ENG	6990	6830	6670	6610	6600
440	%N1	50.1	52.4	56.0	59.9	64.1
	KIAS	193	193	193	193	193
	FF/ENG	6510	6330	6140	6050	6030
400	%N1	48.0	50.3	53.8	57.4	61.7
	KIAS	187	187	187	187	187
	FF/ENG	6050	5850	5650	5540	5490
360	%N1	45.5	48.1	51.5	54.9	59.0
	KIAS	180	180	180	180	180
	FF/ENG	5730	5530	5300	5180	5100

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight

Advisory Information

Chapter PI

Section 62

ADVISORY INFORMATION

Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

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	VREF ADJ	REVERSE THRUST ADJ
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4280	90/-50	80	-150/490	50/-50	80/-80	140	80	180
AUTOBRAKE MAX	5590	80/-70	130	-210/710	0/0	130/-130	250	0	0
AUTOBRAKE 4	7120	120/-90	170	-300/1010	0/0	180/-180	360	0	0
AUTOBRAKE 3	8340	140/-120	220	-370/1270	0/-50	220/-220	400	0	0
AUTOBRAKE 2	9190	160/-140	260	-430/1450	100/-200	240/-240	320	240	240
AUTOBRAKE 1	9940	180/-160	310	-490/1690	290/-300	260/-260	320	970	1210

Good Reported Braking Action

MAX MANUAL	5810	80/-70	140	-240/860	130/-120	130/-130	200	350	810
AUTOBRAKE MAX	6010	90/-70	150	-250/890	120/-90	140/-140	230	370	850
AUTOBRAKE 4	7150	120/-90	170	-300/1040	30/-10	180/-180	360	20	140
AUTOBRAKE 3	8340	140/-120	220	-370/1270	10/-50	220/-220	400	0	0
AUTOBRAKE 2	9190	160/-140	260	-430/1450	100/-200	240/-240	320	240	240
AUTOBRAKE 1	9940	180/-160	310	-490/1690	290/-300	260/-260	320	970	1210

Good To Medium Reported Braking Action

MAX MANUAL	6700	100/-90	180	-310/1130	220/-180	160/-160	220	630	1580
AUTOBRAKE MAX	6810	110/-90	180	-320/1140	210/-170	160/-160	250	640	1600
AUTOBRAKE 4	7500	130/-100	200	-350/1220	140/-80	190/-190	360	440	1230
AUTOBRAKE 3	8510	140/-120	220	-400/1390	80/-90	220/-220	400	200	790
AUTOBRAKE 2	9270	160/-140	260	-440/1540	160/-220	240/-240	320	350	740
AUTOBRAKE 1	9950	180/-160	320	-490/1710	320/-310	260/-270	320	1010	1410

Medium Reported Braking Action

MAX MANUAL	7600	130/-100	220	-380/1390	310/-240	180/-180	250	920	2360
AUTOBRAKE MAX	7600	130/-100	220	-380/1390	310/-240	180/-180	260	910	2350
AUTOBRAKE 4	7840	140/-100	220	-390/1410	240/-150	200/-200	360	850	2320
AUTOBRAKE 3	8680	150/-130	230	-430/1520	150/-140	230/-230	400	390	1590
AUTOBRAKE 2	9360	160/-140	260	-460/1620	220/-250	240/-240	320	450	1230
AUTOBRAKE 1	9960	180/-160	320	-490/1740	360/-320	260/-280	320	1050	1610

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	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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

Medium To Poor Reported Braking Action

MAX MANUAL	8540	150/-130	260	-470/1750	490/-350	210/-210	270	1410	3980
AUTOBRAKE MAX	8550	150/-130	260	-470/1750	490/-360	210/-210	280	1410	3970
AUTOBRAKE 4	8670	160/-130	260	-470/1770	460/-290	220/-220	340	1380	3960
AUTOBRAKE 3	9240	170/-140	260	-490/1830	360/-250	240/-250	400	1050	3510
AUTOBRAKE 2	9780	170/-150	290	-520/1910	400/-350	250/-250	320	990	3160
AUTOBRAKE 1	10260	190/-170	330	-550/2000	510/-400	270/-280	320	1430	3250

Poor Reported Braking Action

MAX MANUAL	9490	170/-150	310	-550/2120	670/-460	240/-240	290	1910	5600
AUTOBRAKE MAX	9500	170/-150	310	-550/2120	680/-470	240/-240	290	1910	5600
AUTOBRAKE 4	9500	180/-150	310	-550/2120	680/-440	240/-240	320	1910	5600
AUTOBRAKE 3	9800	180/-150	300	-560/2150	560/-370	250/-260	390	1710	5440
AUTOBRAKE 2	10200	180/-160	320	-580/2200	590/-450	260/-260	320	1530	5090
AUTOBRAKE 1	10560	200/-170	350	-600/2250	670/-480	280/-280	320	1810	4890

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 240 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.

Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Dry Runway

MAX MANUAL	4460	80/-50	90	-150/510	50/-50	80/-80	140	90	210
AUTOBRAKE MAX	5970	70/-70	140	-220/740	0/0	140/-140	260	0	0
AUTOBRAKE 4	7660	90/-100	200	-310/1060	0/0	200/-200	370	0	0
AUTOBRAKE 3	8990	120/-130	240	-390/1320	0/-80	240/-240	400	10	10
AUTOBRAKE 2	9830	140/-150	290	-450/1510	140/-220	260/-260	330	370	370
AUTOBRAKE 1	10600	170/-170	350	-520/1750	320/-330	290/-290	330	1140	1500

Good Reported Braking Action

MAX MANUAL	6120	70/-80	150	-250/890	140/-120	140/-140	200	380	900
AUTOBRAKE MAX	6350	80/-80	160	-260/910	130/-70	150/-150	250	400	950
AUTOBRAKE 4	7690	90/-100	200	-320/1080	30/-10	200/-200	380	20	140
AUTOBRAKE 3	8990	120/-130	240	-390/1320	10/-80	240/-240	400	10	10
AUTOBRAKE 2	9830	140/-150	290	-450/1510	140/-220	260/-260	330	370	370
AUTOBRAKE 1	10600	170/-170	350	-520/1750	320/-330	290/-290	330	1140	1500

Good To Medium Reported Braking Action

MAX MANUAL	7080	90/-100	200	-320/1160	230/-190	170/-170	220	700	1760
AUTOBRAKE MAX	7190	100/-100	200	-330/1170	230/-160	170/-170	260	710	1790
AUTOBRAKE 4	8040	100/-110	220	-360/1270	130/-80	210/-210	380	440	1330
AUTOBRAKE 3	9170	120/-130	250	-410/1450	90/-130	240/-250	400	220	850
AUTOBRAKE 2	9920	140/-150	290	-460/1590	200/-250	260/-260	330	480	890
AUTOBRAKE 1	10620	170/-170	350	-520/1780	360/-340	290/-290	330	1180	1710

Medium Reported Braking Action

MAX MANUAL	8040	120/-120	240	-390/1430	320/-260	200/-200	250	1010	2620
AUTOBRAKE MAX	8040	120/-120	240	-390/1430	330/-240	200/-200	280	1010	2620
AUTOBRAKE 4	8400	120/-120	240	-400/1460	230/-150	220/-220	380	860	2520
AUTOBRAKE 3	9340	130/-140	250	-440/1580	160/-170	240/-250	390	430	1680
AUTOBRAKE 2	10020	140/-150	300	-470/1670	250/-280	260/-260	330	590	1410
AUTOBRAKE 1	10640	170/-170	350	-520/1810	390/-350	290/-290	330	1220	1920

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 25**

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	9040	140/-140	290	-480/1790	510/-370	230/-230	270	1560	4430
AUTOBRAKE MAX	9050	140/-140	290	-480/1790	520/-370	230/-230	290	1560	4430
AUTOBRAKE 4	9230	140/-140	290	-480/1810	470/-300	240/-240	350	1480	4390
AUTOBRAKE 3	9910	140/-150	290	-510/1890	370/-290	260/-260	390	1120	3840
AUTOBRAKE 2	10440	160/-160	330	-530/1960	440/-370	280/-280	330	1160	3540
AUTOBRAKE 1	10940	180/-180	360	-570/2060	540/-430	290/-290	330	1620	3700

Poor Reported Braking Action

MAX MANUAL	10040	160/-160	330	-560/2160	700/-480	260/-260	290	2100	6230
AUTOBRAKE MAX	10060	160/-160	330	-560/2160	710/-490	260/-260	300	2100	6240
AUTOBRAKE 4	10070	160/-160	330	-560/2160	700/-450	260/-260	320	2100	6260
AUTOBRAKE 3	10480	160/-160	330	-590/2210	580/-400	280/-280	390	1810	5990
AUTOBRAKE 2	10870	170/-170	360	-600/2250	630/-470	290/-290	330	1730	5660
AUTOBRAKE 1	11250	180/-180	370	-620/2320	690/-520	300/-300	330	2010	5490

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 250 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 220 ft.

Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Dry Runway

MAX MANUAL	4800	100/-50	100	-160/530	60/-50	90/-90	150	120	240
AUTOBRAKE MAX	6540	80/-80	150	-230/780	0/0	160/-160	280	0	0
AUTOBRAKE 4	8490	100/-120	220	-330/1130	0/0	230/-230	400	0	0
AUTOBRAKE 3	9980	140/-150	280	-410/1400	10/-90	280/-280	430	30	30
AUTOBRAKE 2	10930	160/-170	330	-470/1600	160/-250	300/-300	360	490	490
AUTOBRAKE 1	11780	200/-200	400	-540/1850	360/-380	330/-330	360	1400	1830

Good Reported Braking Action

MAX MANUAL	6660	80/-90	170	-260/930	150/-140	160/-160	210	460	1080
AUTOBRAKE MAX	6920	90/-90	180	-280/950	130/-70	160/-160	280	460	1120
AUTOBRAKE 4	8500	100/-120	220	-350/1150	30/-10	230/-230	400	20	160
AUTOBRAKE 3	9980	140/-150	280	-410/1400	10/-90	280/-280	430	30	30
AUTOBRAKE 2	10930	160/-170	330	-470/1600	160/-250	300/-300	360	490	490
AUTOBRAKE 1	11780	200/-200	400	-540/1850	360/-380	330/-330	360	1400	1830

Good To Medium Reported Braking Action

MAX MANUAL	7730	100/-110	220	-340/1210	250/-210	190/-200	240	830	2110
AUTOBRAKE MAX	7870	110/-110	230	-350/1220	250/-170	200/-200	280	830	2120
AUTOBRAKE 4	8870	120/-130	250	-390/1340	140/-90	240/-240	400	490	1560
AUTOBRAKE 3	10160	140/-150	290	-440/1530	100/-140	280/-280	430	260	1020
AUTOBRAKE 2	11010	160/-170	340	-490/1680	220/-280	300/-300	360	610	1100
AUTOBRAKE 1	11790	200/-200	400	-550/1880	400/-390	330/-330	360	1440	2080

Medium Reported Braking Action

MAX MANUAL	8810	130/-130	260	-410/1500	360/-290	220/-230	260	1210	3140
AUTOBRAKE MAX	8810	130/-130	280	-410/1500	370/-260	230/-230	290	1200	3130
AUTOBRAKE 4	9250	130/-140	280	-430/1530	250/-160	240/-240	400	970	2960
AUTOBRAKE 3	10340	140/-150	300	-470/1660	180/-180	280/-280	430	490	2000
AUTOBRAKE 2	11100	160/-170	350	-510/1760	280/-310	300/-300	360	720	1710
AUTOBRAKE 1	11810	200/-200	400	-550/1910	440/-390	330/-330	360	1480	2320

ADVISORY INFORMATION**Normal Configuration Landing Distance****Flaps 20**

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	9930	160/-160	320	-510/1870	560/-410	250/-260	290	1840	5300
AUTOBRAKE MAX	9940	160/-160	330	-510/1880	570/-400	260/-260	300	1830	5300
AUTOBRAKE 4	10150	160/-160	330	-510/1900	510/-330	270/-270	380	1720	5210
AUTOBRAKE 3	10940	160/-170	340	-550/1980	410/-320	290/-290	420	1290	4560
AUTOBRAKE 2	11550	180/-180	370	-570/2060	480/-410	310/-310	350	1390	4240
AUTOBRAKE 1	12120	200/-200	410	-600/2170	600/-480	340/-340	360	1930	4430

Poor Reported Braking Action

MAX MANUAL	11050	180/-180	380	-600/2250	760/-530	290/-290	310	2470	7450
AUTOBRAKE MAX	11060	180/-180	380	-600/2270	770/-540	300/-300	310	2470	7460
AUTOBRAKE 4	11060	180/-180	380	-600/2270	770/-490	300/-300	360	2470	7460
AUTOBRAKE 3	11550	180/-180	380	-620/2310	630/-450	310/-310	410	2090	7120
AUTOBRAKE 2	11990	200/-200	400	-630/2360	690/-520	320/-320	350	2050	6760
AUTOBRAKE 1	12420	210/-210	430	-660/2430	760/-560	350/-350	360	2380	6540

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 280 ft.

For autobrake and manual speedbrakes, increase reference landing distance by 230 ft.

Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 20)

VREF20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	100/-60	110	-160/540	60/-60	110/-110	N/A	160	340
AUTOBRAKE MAX	6160	70/-70	150	-220/720	0/0	150/-150	N/A	0	0
AUTOBRAKE 2	10690	150/-170	330	-450/1490	110/-170	300/-300	N/A	260	260

Good Reported Braking Action

MAX MANUAL	6980	90/-90	190	-270/920	170/-150	170/-170	N/A	580	1410
AUTOBRAKE MAX	6960	90/-90	190	-270/920	170/-150	170/-170	N/A	580	1410
AUTOBRAKE 2	10690	150/-170	330	-450/1490	110/-170	300/-300	N/A	260	260

Good To Medium Reported Braking Action

MAX MANUAL	8040	110/-120	240	-340/1180	280/-230	210/-210	N/A	1010	2670
AUTOBRAKE MAX	8020	120/-120	240	-340/1180	290/-240	210/-210	N/A	1010	2670
AUTOBRAKE 2	10780	150/-170	330	-470/1570	190/-210	310/-310	N/A	410	1280

Medium Reported Braking Action

MAX MANUAL	9090	130/-140	290	-410/1430	390/-310	240/-240	N/A	1440	3930
AUTOBRAKE MAX	9070	140/-140	290	-400/1430	410/-330	240/-240	N/A	1440	3920
AUTOBRAKE 3	10000	130/-140	290	-440/1530	210/-170	280/-280	N/A	670	3100

Medium To Poor Reported Braking Action

MAX MANUAL	10160	160/-170	350	-490/1780	590/-430	270/-270	N/A	2130	6460
AUTOBRAKE MAX	10160	170/-170	350	-490/1780	610/-450	280/-280	N/A	2130	6460
AUTOBRAKE 3	10730	160/-160	340	-510/1840	480/-330	300/-300	N/A	1640	5950

Poor Reported Braking Action

MAX MANUAL	11230	190/-190	400	-570/2130	790/-550	300/-300	N/A	2810	8990
AUTOBRAKE MAX	11240	190/-190	410	-570/2130	810/-570	310/-310	N/A	2820	9000
AUTOBRAKE 3	11450	180/-180	390	-580/2150	740/-480	320/-320	N/A	2610	8800

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ANTISKID (Flaps 25)****VREF25**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	6990	100/-100	210	-340/1240	280/-230	170/-170	220	880	2280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6990	100/-100	210	-340/1240	280/-230	170/-170	220	880	2280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7860	120/-120	250	-420/1560	450/-330	200/-200	240	1360	3850
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8730	140/-140	290	-490/1880	610/-420	230/-230	250	1830	5420
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10080	180/-170	350	-650/2670	2060/-670	270/-270	270	3320	7250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11430	210/-200	410	-810/3460	3500/-910	300/-300	280	4800	9070
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	6610	110/-90	190	-330/1210	270/-210	160/-160	220	800	2050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6610	110/-90	190	-330/1210	270/-210	160/-160	220	800	2050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7430	130/-110	230	-410/1530	430/-310	190/-190	240	1230	3460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8250	150/-130	270	-480/1840	580/-400	210/-210	250	1660	4870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9530	190/-160	330	-630/2620	1980/-640	250/-250	270	3050	7290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10800	220/-190	380	-780/3390	3380/-870	280/-280	280	4430	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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R (Flaps 20)****VREF20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4220	100/-50	90	-140/480	50/-50	90/-90	130	0	110
AUTOBRAKE MAX	5690	70/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9870	130/-140	280	-430/1430	40/-110	280/-280	430	0	0

Good Reported Braking Action

MAX MANUAL	6070	80/-80	160	-250/860	160/-140	150/-150	200	0	510
AUTOBRAKE MAX	6320	80/-80	160	-260/880	150/-130	150/-160	230	0	540
AUTOBRAKE 2	9870	130/-140	280	-430/1430	40/-110	280/-280	430	0	0

Good To Medium Reported Braking Action

MAX MANUAL	7260	100/-110	210	-330/1150	290/-240	190/-190	240	0	1030
AUTOBRAKE MAX	7390	110/-110	210	-340/1160	280/-220	190/-200	270	0	1050
AUTOBRAKE 2	10000	140/-150	290	-450/1530	140/-150	290/-290	430	0	360

Medium Reported Braking Action

MAX MANUAL	8440	120/-130	250	-410/1440	420/-330	230/-230	270	0	1550
AUTOBRAKE MAX	8460	130/-130	260	-410/1440	410/-310	230/-230	300	0	1550
AUTOBRAKE 3	9280	130/-140	270	-430/1520	270/-200	260/-260	390	0	1120

Medium To Poor Reported Braking Action

MAX MANUAL	9820	150/-160	310	-520/1870	720/-500	280/-280	300	0	2660
AUTOBRAKE MAX	9830	160/-160	320	-520/1870	720/-500	280/-280	320	0	2660
AUTOBRAKE 3	10310	160/-170	330	-530/1910	640/-410	290/-290	380	0	2470

Poor Reported Braking Action

MAX MANUAL	11190	180/-190	370	-620/2290	1020/-670	320/-320	330	0	3770
AUTOBRAKE MAX	11200	190/-190	380	-620/2290	1030/-680	320/-320	330	0	3770
AUTOBRAKE 3	11340	190/-190	380	-620/2300	1000/-620	320/-320	370	0	3820

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	80/-40	70	-130/440	40/-40	70/-70	120	0	80
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8140	140/-110	220	-380/1280	40/-70	220/-230	390	0	0

Good Reported Braking Action

MAX MANUAL	5250	80/-60	130	-230/790	130/-120	120/-120	190	0	370
AUTOBRAKE MAX	5460	80/-70	130	-230/810	120/-110	130/-130	210	0	400
AUTOBRAKE 2	8140	140/-110	220	-380/1280	40/-70	220/-230	390	0	0

Good To Medium Reported Braking Action

MAX MANUAL	6210	100/-80	170	-300/1060	240/-200	150/-160	220	0	760
AUTOBRAKE MAX	6320	100/-90	170	-300/1070	240/-180	160/-160	250	0	770
AUTOBRAKE 2	8260	150/-120	230	-400/1380	130/-110	230/-230	390	0	280

Medium Reported Braking Action

MAX MANUAL	7170	120/-100	200	-370/1320	350/-280	180/-190	250	0	1140
AUTOBRAKE MAX	7180	120/-100	210	-370/1320	350/-250	190/-190	280	0	1140
AUTOBRAKE 3	7760	130/-110	220	-390/1390	240/-190	210/-210	350	0	880

Medium To Poor Reported Braking Action

MAX MANUAL	8290	150/-130	250	-470/1720	610/-420	220/-230	270	0	1950
AUTOBRAKE MAX	8300	150/-130	260	-470/1720	620/-410	230/-230	290	0	1960
AUTOBRAKE 3	8650	160/-130	260	-480/1760	550/-370	240/-240	330	0	1840

Poor Reported Braking Action

MAX MANUAL	9410	170/-150	300	-560/2110	860/-560	260/-260	290	0	2760
AUTOBRAKE MAX	9420	180/-150	300	-560/2110	880/-570	260/-260	290	0	2770
AUTOBRAKE 3	9540	180/-150	300	-560/2120	850/-550	260/-260	310	0	2800

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAP / SLAT CONTROL (Flaps 20)****VREF20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4170	90/-40	90	-140/460	50/-40	80/-80	130	100	210
AUTOBRAKE MAX	5690	70/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430

Good Reported Braking Action

MAX MANUAL	5790	70/-80	150	-230/810	130/-120	140/-140	180	400	940
AUTOBRAKE MAX	6020	80/-80	160	-240/830	110/-60	140/-140	240	400	970
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430

Good To Medium Reported Braking Action

MAX MANUAL	6730	90/-100	190	-300/1060	220/-190	170/-170	210	730	1840
AUTOBRAKE MAX	6840	100/-100	200	-300/1070	220/-150	170/-170	250	720	1850
AUTOBRAKE 2	9580	140/-150	300	-430/1460	190/-250	260/-260	310	530	960

Medium Reported Braking Action

MAX MANUAL	7660	110/-110	230	-360/1300	310/-250	190/-200	230	1050	2730
AUTOBRAKE MAX	7660	110/-110	240	-360/1300	320/-230	200/-200	250	1040	2720
AUTOBRAKE 3	8990	120/-130	260	-410/1440	160/-160	240/-240	370	430	1740

Medium To Poor Reported Braking Action

MAX MANUAL	8640	140/-140	280	-440/1630	490/-360	220/-230	250	1600	4610
AUTOBRAKE MAX	8640	140/-140	290	-440/1640	500/-350	230/-230	260	1600	4610
AUTOBRAKE 3	9520	140/-150	300	-480/1730	360/-280	260/-260	370	1130	3970

Poor Reported Braking Action

MAX MANUAL	9610	160/-160	330	-520/1960	660/-460	250/-250	270	2150	6480
AUTOBRAKE MAX	9620	160/-160	330	-520/1970	670/-470	260/-260	270	2150	6490
AUTOBRAKE 3	10040	160/-160	330	-540/2010	550/-390	270/-270	360	1820	6190

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≤ 5)

VREF30 + 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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW/ 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4620	150/-50	130	-150/630	50/-50	120/-100	170	150	380
AUTOBRAKE MAX	6730	90/-70	170	-230/760	0/0	170/-170	270	0	0
AUTOBRAKE 2	11280	190/-180	370	-460/1520	200/-250	320/-320	360	880	880

Good Reported Braking Action

MAX MANUAL	6450	90/-80	180	-250/850	140/-120	160/-160	180	530	1280
AUTOBRAKE MAX	6960	90/-80	180	-260/890	60/-40	180/-180	270	310	1090
AUTOBRAKE 2	11280	190/-180	370	-460/1520	200/-250	320/-320	360	880	880

Good To Medium Reported Braking Action

MAX MANUAL	7570	120/-100	230	-320/1110	240/-200	200/-200	210	980	2610
AUTOBRAKE MAX	7800	120/-100	230	-320/1130	200/-150	210/-210	270	860	2500
AUTOBRAKE 2	11350	190/-180	380	-470/1600	240/-280	320/-320	360	970	1540

Medium Reported Braking Action

MAX MANUAL	8680	140/-120	280	-380/1360	330/-270	230/-230	240	1430	3940
AUTOBRAKE MAX	8640	140/-120	280	-380/1360	330/-250	230/-230	260	1410	3900
AUTOBRAKE 3	10660	160/-150	320	-450/1560	180/-190	300/-300	380	580	2330

Medium To Poor Reported Braking Action

MAX MANUAL	9830	170/-150	340	-470/1710	520/-390	260/-260	270	2190	6860
AUTOBRAKE MAX	9800	170/-150	340	-470/1710	520/-380	270/-270	280	2180	6830
AUTOBRAKE 3	11160	180/-170	360	-510/1840	390/-300	310/-310	380	1450	5750

Poor Reported Braking Action

MAX MANUAL	10970	200/-170	400	-550/2050	700/-500	290/-290	290	2940	9780
AUTOBRAKE MAX	10960	200/-170	400	-550/2050	710/-510	300/-300	290	2940	9760
AUTOBRAKE 3	11650	200/-180	400	-570/2120	600/-410	320/-320	380	2320	9160

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAPS DRIVE (5 < Flaps < 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4200	110/-40	90	-140/460	50/-40	80/-80	120	100	230
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9710	160/-150	300	-420/1410	120/-180	270/-270	370	360	360

Good Reported Braking Action

MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	440	1040
AUTOBRAKE MAX	6040	90/-70	160	-240/830	110/-70	150/-150	240	430	1070
AUTOBRAKE 2	9710	160/-150	300	-420/1410	120/-180	270/-270	370	360	360

Good To Medium Reported Braking Action

MAX MANUAL	6830	110/-90	200	-300/1060	220/-190	170/-170	210	810	2100
AUTOBRAKE MAX	6910	110/-90	200	-300/1070	220/-170	180/-180	240	800	2100
AUTOBRAKE 2	9780	170/-150	300	-440/1480	170/-210	270/-270	370	460	990

Medium Reported Braking Action

MAX MANUAL	7800	130/-110	240	-360/1310	310/-250	200/-200	240	1170	3150
AUTOBRAKE MAX	7780	130/-110	240	-360/1300	320/-260	200/-200	240	1160	3130
AUTOBRAKE 3	9100	140/-130	260	-410/1450	140/-140	250/-250	390	430	2080

Medium To Poor Reported Braking Action

MAX MANUAL	8810	160/-140	290	-450/1650	490/-360	230/-230	260	1790	5410
AUTOBRAKE MAX	8810	160/-140	290	-450/1640	510/-370	230/-230	260	1790	5400
AUTOBRAKE 3	9630	160/-140	300	-480/1740	370/-260	270/-270	390	1270	4730

Poor Reported Braking Action

MAX MANUAL	9820	180/-160	340	-530/1980	670/-470	260/-260	280	2410	7670
AUTOBRAKE MAX	9830	180/-160	340	-530/1980	690/-480	260/-260	280	2410	7670
AUTOBRAKE 3	10160	180/-150	340	-540/2020	600/-370	280/-280	380	2100	7370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≥ 20)

VREF20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4170	100/-40	90	-140/460	50/-40	80/-80	130	100	210
AUTOBRAKE MAX	5690	70/-70	130	-210/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430

Good Reported Braking Action

MAX MANUAL	5790	70/-80	150	-230/810	130/-120	140/-140	180	400	940
AUTOBRAKE MAX	5990	80/-80	160	-240/830	110/-70	140/-140	240	400	970
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430

Good To Medium Reported Braking Action

MAX MANUAL	6730	90/-90	190	-300/1050	220/-180	170/-170	210	720	1840
AUTOBRAKE MAX	6820	100/-100	200	-300/1060	210/-150	170/-170	250	720	1840
AUTOBRAKE 2	9570	140/-150	300	-430/1460	190/-240	260/-260	310	530	960

Medium Reported Braking Action

MAX MANUAL	7660	110/-110	240	-360/1300	310/-250	200/-200	230	1050	2740
AUTOBRAKE MAX	7650	120/-110	240	-360/1300	320/-230	200/-200	250	1040	2720
AUTOBRAKE 3	8970	120/-130	260	-410/1440	160/-160	240/-240	370	430	1740

Medium To Poor Reported Braking Action

MAX MANUAL	8640	140/-140	280	-440/1630	490/-360	220/-220	250	1600	4610
AUTOBRAKE MAX	8630	140/-140	280	-440/1630	490/-350	230/-230	260	1590	4600
AUTOBRAKE 3	9510	140/-150	290	-470/1720	350/-270	260/-260	360	1130	3960

Poor Reported Braking Action

MAX MANUAL	9610	160/-160	330	-520/1970	660/-460	250/-250	270	2150	6480
AUTOBRAKE MAX	9620	160/-160	330	-520/1970	670/-470	260/-260	270	2150	6490
AUTOBRAKE 3	10050	160/-160	330	-540/2010	550/-390	270/-270	360	1820	6190

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLAPS PRIMARY FAIL (Flaps 20)****VREF20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4690	80/-50	100	-150/510	60/-50	100/-100	160	120	270
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170

Good Reported Braking Action

MAX MANUAL	6410	80/-80	170	-250/870	160/-140	150/-150	220	490	1170
AUTOBRAKE MAX	6390	80/-90	170	-250/870	150/-130	150/-150	240	490	1160
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170

Good To Medium Reported Braking Action

MAX MANUAL	7380	110/-110	220	-320/1120	260/-210	180/-180	250	870	2260
AUTOBRAKE MAX	7360	110/-110	220	-320/1120	260/-220	190/-190	260	860	2240
AUTOBRAKE 2	9870	140/-160	300	-440/1500	150/-180	280/-280	400	300	1020

Medium Reported Braking Action

MAX MANUAL	8350	130/-130	260	-390/1370	350/-280	210/-210	280	1240	3340
AUTOBRAKE MAX	8320	130/-130	260	-380/1370	370/-300	220/-220	280	1230	3320
AUTOBRAKE 3	9130	130/-130	260	-410/1460	200/-140	250/-250	410	580	2630

Medium To Poor Reported Braking Action

MAX MANUAL	9350	160/-150	310	-470/1710	540/-400	240/-240	300	1860	5560
AUTOBRAKE MAX	9340	160/-150	310	-470/1710	570/-420	250/-250	300	1860	5560
AUTOBRAKE 3	9820	150/-150	310	-480/1770	450/-290	270/-270	400	1460	5140

Poor Reported Braking Action

MAX MANUAL	10340	180/-170	360	-550/2050	730/-510	270/-270	310	2470	7780
AUTOBRAKE MAX	10360	180/-170	360	-550/2050	760/-530	280/-280	310	2480	7790
AUTOBRAKE 3	10500	170/-170	350	-550/2070	700/-440	290/-290	380	2330	7640

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLIGHT CONTROL MODE (Flaps 20)

VREF20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100

Good Reported Braking Action

MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100

Good To Medium Reported Braking Action

MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130

Medium Reported Braking Action

MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980

Medium To Poor Reported Braking Action

MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680

Poor Reported Braking Action

MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLIGHT CONTROLS (Flaps 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4910	90/-50	110	-160/540	80/-70	110/-110	210	190	430
AUTOBRAKE MAX	5740	70/-60	130	-210/690	0/0	140/-140	240	0	30
AUTOBRAKE 2	10010	160/-150	290	-430/1440	30/-120	290/-290	440	60	60

Good Reported Braking Action

MAX MANUAL	6820	100/-90	190	-270/920	200/-170	170/-170	280	680	1700
AUTOBRAKE MAX	6770	100/-90	190	-270/920	210/-180	170/-170	280	670	1660
AUTOBRAKE 2	10010	160/-150	290	-430/1440	30/-120	290/-290	440	60	60

Good To Medium Reported Braking Action

MAX MANUAL	7870	130/-110	240	-340/1180	320/-260	200/-200	310	1160	3160
AUTOBRAKE MAX	7830	130/-110	250	-340/1180	330/-270	210/-210	310	1150	3130
AUTOBRAKE 2	10110	160/-150	300	-450/1520	120/-150	290/-290	440	290	1700

Medium Reported Braking Action

MAX MANUAL	8910	150/-130	290	-410/1440	430/-340	230/-230	330	1630	4610
AUTOBRAKE MAX	8890	150/-130	300	-410/1440	440/-350	240/-240	330	1630	4600
AUTOBRAKE 3	9300	150/-120	280	-420/1480	310/-150	250/-260	410	1220	4190

Medium To Poor Reported Braking Action

MAX MANUAL	9960	180/-160	350	-500/1790	640/-470	270/-270	350	2360	7490
AUTOBRAKE MAX	9950	180/-160	360	-500/1790	650/-480	270/-270	350	2370	7490
AUTOBRAKE 3	10170	180/-150	340	-500/1810	580/-340	280/-280	400	2140	7270

Poor Reported Braking Action

MAX MANUAL	11000	210/-180	410	-580/2130	840/-590	300/-300	360	3090	10360
AUTOBRAKE MAX	11010	210/-180	410	-580/2130	860/-600	300/-300	360	3100	10380
AUTOBRAKE 3	11040	210/-170	400	-580/2140	840/-530	300/-300	390	3060	10340

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS C (Flaps 20)****VREF20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4690	80/-50	100	-150/510	60/-50	100/-100	160	120	270
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170

Good Reported Braking Action

MAX MANUAL	6410	80/-80	170	-250/870	160/-140	150/-150	220	490	1170
AUTOBRAKE MAX	6390	80/-90	170	-250/870	150/-130	150/-150	240	490	1160
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170

Good To Medium Reported Braking Action

MAX MANUAL	7380	110/-110	220	-320/1120	260/-210	180/-180	250	870	2260
AUTOBRAKE MAX	7360	110/-110	220	-320/1120	260/-220	190/-190	260	860	2240
AUTOBRAKE 2	9870	140/-160	300	-440/1500	150/-180	280/-280	400	300	1020

Medium Reported Braking Action

MAX MANUAL	8350	130/-130	260	-390/1370	350/-280	210/-210	280	1240	3340
AUTOBRAKE MAX	8320	130/-130	260	-380/1370	370/-300	220/-220	280	1230	3320
AUTOBRAKE 3	9130	130/-130	260	-410/1460	200/-140	250/-250	410	580	2630

Medium To Poor Reported Braking Action

MAX MANUAL	9350	160/-150	310	-470/1710	540/-400	240/-240	300	1860	5560
AUTOBRAKE MAX	9340	160/-150	310	-470/1710	570/-420	250/-250	300	1860	5560
AUTOBRAKE 3	9820	150/-150	310	-480/1770	450/-290	270/-270	400	1460	5140

Poor Reported Braking Action

MAX MANUAL	10340	180/-170	360	-550/2050	730/-510	270/-270	310	2470	7780
AUTOBRAKE MAX	10360	180/-170	360	-550/2050	760/-530	280/-280	310	2480	7790
AUTOBRAKE 3	10500	170/-170	350	-550/2070	700/-440	290/-290	380	2330	7640

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L (Flaps 25)****VREF25**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4150	80/-40	90	-140/480	50/-50	80/-90	150	0	120
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8900	120/-130	250	-400/1350	0/-10	250/-250	470	0	0

Good Reported Braking Action

MAX MANUAL	5980	70/-80	150	-250/880	170/-150	150/-150	220	0	540
AUTOBRAKE MAX	6100	70/-80	160	-260/890	160/-130	150/-150	250	0	560
AUTOBRAKE 2	8900	120/-130	250	-400/1350	0/-10	250/-250	470	0	0

Good To Medium Reported Braking Action

MAX MANUAL	7190	100/-100	200	-340/1200	320/-260	190/-190	260	0	1120
AUTOBRAKE MAX	7240	100/-100	210	-340/1200	320/-250	190/-190	280	0	1130
AUTOBRAKE 2	9100	130/-130	260	-430/1480	140/-80	260/-260	470	0	550

Medium Reported Braking Action

MAX MANUAL	8390	120/-120	250	-420/1510	470/-360	220/-220	300	0	1700
AUTOBRAKE MAX	8380	120/-120	260	-420/1510	480/-370	230/-230	300	0	1700
AUTOBRAKE 3	8640	120/-130	260	-430/1530	400/-220	240/-240	400	0	1640

Medium To Poor Reported Braking Action

MAX MANUAL	9840	150/-150	320	-550/2010	860/-560	270/-270	330	0	3030
AUTOBRAKE MAX	9850	150/-150	330	-550/2010	870/-570	280/-280	330	0	3040
AUTOBRAKE 3	9980	150/-160	330	-550/2020	830/-480	280/-280	390	0	3010

Poor Reported Braking Action

MAX MANUAL	11290	170/-180	380	-670/2510	1240/-760	320/-320	350	0	4360
AUTOBRAKE MAX	11320	180/-180	390	-670/2510	1260/-770	320/-320	350	0	4370
AUTOBRAKE 3	11320	180/-180	390	-670/2510	1260/-740	320/-320	380	0	4370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	3970	80/-40	80	-140/470	50/-50	80/-80	150	0	100
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8220	140/-120	220	-380/1290	0/0	230/-230	450	0	0

Good Reported Braking Action

MAX MANUAL	5680	90/-70	140	-250/860	170/-140	140/-140	220	0	490
AUTOBRAKE MAX	5770	90/-70	150	-250/870	150/-130	140/-140	240	0	500
AUTOBRAKE 2	8220	140/-120	220	-380/1290	0/0	230/-230	450	0	0

Good To Medium Reported Braking Action

MAX MANUAL	6810	110/-90	190	-330/1170	310/-240	180/-180	260	0	1020
AUTOBRAKE MAX	6850	110/-90	200	-330/1170	310/-240	180/-180	270	0	1030
AUTOBRAKE 2	8420	150/-120	240	-410/1420	140/-70	240/-240	450	0	550

Medium Reported Braking Action

MAX MANUAL	7940	130/-110	240	-410/1470	450/-340	210/-210	290	0	1550
AUTOBRAKE MAX	7930	130/-110	240	-410/1470	460/-350	210/-210	300	0	1550
AUTOBRAKE 3	8080	140/-120	240	-410/1480	420/-230	220/-220	370	0	1560

Medium To Poor Reported Braking Action

MAX MANUAL	9320	160/-140	300	-530/1960	830/-540	260/-260	320	0	2770
AUTOBRAKE MAX	9320	160/-140	300	-530/1970	840/-550	260/-260	330	0	2780
AUTOBRAKE 3	9400	170/-140	300	-530/1970	820/-480	260/-260	370	0	2780

Poor Reported Braking Action

MAX MANUAL	10690	190/-160	360	-650/2450	1200/-730	300/-300	350	0	3990
AUTOBRAKE MAX	10710	190/-160	360	-650/2460	1220/-740	300/-300	350	0	4000
AUTOBRAKE 3	10710	200/-160	360	-650/2460	1220/-720	300/-300	360	0	4000

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L+C (Flaps 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	5110	100/-50	110	-170/570	80/-70	110/-110	210	0	190
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	10070	160/-140	280	-430/1450	0/0	290/-290	510	0	0

Good Reported Braking Action

MAX MANUAL	7370	110/-90	200	-300/1010	240/-200	190/-190	300	0	850
AUTOBRAKE MAX	7240	110/-90	200	-290/1000	260/-190	190/-190	310	0	820
AUTOBRAKE 2	10070	160/-140	280	-430/1450	0/0	290/-290	510	0	0

Good To Medium Reported Braking Action

MAX MANUAL	8820	140/-120	260	-390/1350	430/-340	240/-240	340	0	1710
AUTOBRAKE MAX	8730	140/-120	270	-390/1350	460/-350	240/-240	350	0	1680
AUTOBRAKE 2	10360	170/-140	300	-470/1590	240/-100	300/-300	510	0	1120

Medium Reported Braking Action

MAX MANUAL	10260	170/-140	320	-480/1690	620/-470	280/-280	380	0	2560
AUTOBRAKE MAX	10210	170/-140	330	-480/1690	650/-500	280/-280	380	0	2540
AUTOBRAKE 3	10240	170/-150	330	-480/1690	640/-420	290/-290	400	0	2550

Medium To Poor Reported Braking Action

MAX MANUAL	11970	210/-180	400	-620/2230	1090/-710	340/-340	410	0	4460
AUTOBRAKE MAX	11950	210/-180	410	-620/2230	1130/-740	340/-340	410	0	4460
AUTOBRAKE 3	11970	210/-180	410	-620/2230	1120/-700	350/-350	420	0	4460

Poor Reported Braking Action

MAX MANUAL	13670	240/-210	480	-750/2760	1560/-950	390/-390	440	0	6360
AUTOBRAKE MAX	13690	250/-210	490	-750/2760	1600/-980	400/-400	440	0	6370
AUTOBRAKE 3	13690	250/-210	490	-750/2760	1600/-980	400/-400	440	0	6370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L+R (Flaps 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	5510	100/-60	130	-200/670	120/-100	130/-130	230	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8760	120/-100	240	-380/1300	440/-350	240/-240	370	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	11280	160/-140	330	-540/1880	980/-670	330/-330	440	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	13800	200/-170	410	-700/2450	1520/-990	420/-420	510	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	17750	250/-200	550	-1010/3660	4490/-1810	560/-560	570	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	21700	290/-230	680	-1310/4860	7450/-2620	690/-690	630	0	0
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R (Flaps 25)****VREF25**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4530	60/-50	100	-160/560	70/-70	100/-100	170	0	180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6520	80/-90	180	-290/1010	220/-190	160/-160	240	0	740
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7760	110/-110	230	-380/1360	410/-310	200/-200	280	0	1440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	9000	130/-130	280	-470/1700	590/-430	240/-240	310	0	2130
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10460	160/-160	350	-600/2260	1090/-660	290/-290	330	0	3670
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11910	190/-190	410	-730/2820	1590/-880	330/-330	350	0	5210
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4310	60/-50	90	-160/540	70/-60	90/-90	160	0	160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6110	90/-80	160	-280/970	210/-170	150/-150	230	0	640
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7240	120/-100	210	-370/1310	380/-290	190/-190	260	0	1240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8370	140/-120	250	-450/1640	540/-400	220/-220	290	0	1840
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9700	170/-150	310	-580/2180	1010/-610	260/-260	310	0	3160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11020	200/-170	370	-700/2720	1480/-810	300/-300	330	0	4470
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS R+C (Flaps 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	6200	80/-70	150	-230/770	140/-130	150/-150	260	0	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8890	140/-120	260	-390/1340	410/-330	240/-240	350	0	1610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	10490	180/-150	340	-500/1770	710/-520	290/-290	390	0	2950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	12090	210/-180	410	-610/2200	1010/-700	340/-340	420	0	4290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	13900	250/-220	500	-780/2890	1920/-1020	400/-400	450	0	7180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	15700	290/-250	580	-940/3570	2820/-1330	450/-450	470	0	10060
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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH DOWN AUTHORITY (Flaps 25)

VREF25

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW/ 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4410	80/-40	80	-150/490	50/-40	80/-80	150	60	140
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8760	120/-130	250	-390/1330	70/-130	240/-240	360	140	140

Good Reported Braking Action

MAX MANUAL	5860	70/-70	140	-240/820	130/-110	130/-130	200	300	700
AUTOBRAKE MAX	5840	70/-70	140	-240/820	140/-120	130/-130	210	300	690
AUTOBRAKE 2	8760	120/-130	250	-390/1330	80/-130	240/-240	360	140	140

Good To Medium Reported Braking Action

MAX MANUAL	6700	90/-90	180	-300/1060	210/-180	160/-160	220	570	1430
AUTOBRAKE MAX	6690	90/-90	180	-300/1060	230/-190	160/-160	230	570	1420
AUTOBRAKE 2	8900	120/-130	260	-410/1410	150/-180	240/-240	360	250	610

Medium Reported Braking Action

MAX MANUAL	7540	100/-100	210	-360/1290	290/-240	180/-180	240	830	2160
AUTOBRAKE MAX	7540	100/-100	220	-360/1290	310/-250	180/-180	250	830	2150
AUTOBRAKE 3	8320	110/-110	230	-390/1380	190/-140	220/-220	390	350	1440

Medium To Poor Reported Braking Action

MAX MANUAL	8420	120/-120	260	-440/1610	460/-340	210/-210	260	1300	3710
AUTOBRAKE MAX	8440	130/-120	260	-440/1620	480/-350	210/-210	260	1300	3710
AUTOBRAKE 3	8930	130/-130	260	-460/1670	390/-270	240/-240	370	970	3260

Poor Reported Braking Action

MAX MANUAL	9300	140/-140	300	-510/1930	620/-430	230/-230	270	1760	5250
AUTOBRAKE MAX	9340	150/-140	300	-510/1940	640/-450	240/-240	270	1770	5260
AUTOBRAKE 3	9540	140/-140	290	-520/1960	580/-390	250/-250	340	1580	5070

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PITCH DOWN AUTHORITY (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4220	80/-40	80	-140/480	50/-40	80/-80	150	60	120
AUTOBRAKE MAX	4860	70/-60	110	-180/620	10/0	110/-110	230	0	0
AUTOBRAKE 2	8150	140/-120	230	-380/1280	40/-100	220/-220	360	70	70

Good Reported Braking Action

MAX MANUAL	5570	80/-60	130	-230/800	120/-110	120/-120	200	270	620
AUTOBRAKE MAX	5540	80/-60	130	-230/800	130/-120	120/-120	210	260	610
AUTOBRAKE 2	8150	140/-120	230	-380/1280	50/-100	220/-220	360	70	70

Good To Medium Reported Braking Action

MAX MANUAL	6350	100/-80	170	-290/1030	200/-170	150/-150	220	510	1270
AUTOBRAKE MAX	6340	100/-80	170	-290/1030	220/-180	150/-150	230	510	1260
AUTOBRAKE 2	8280	140/-120	240	-400/1360	120/-150	220/-220	360	170	510

Medium Reported Braking Action

MAX MANUAL	7130	110/-100	200	-350/1260	280/-220	170/-170	240	750	1920
AUTOBRAKE MAX	7130	110/-100	200	-350/1260	300/-240	170/-170	240	750	1910
AUTOBRAKE 3	7720	120/-100	210	-370/1330	190/-120	200/-200	380	340	1360

Medium To Poor Reported Braking Action

MAX MANUAL	7950	130/-120	240	-430/1580	440/-320	200/-200	260	1180	3310
AUTOBRAKE MAX	7970	130/-120	240	-430/1580	460/-340	200/-200	260	1180	3310
AUTOBRAKE 3	8320	140/-120	240	-440/1620	390/-240	220/-220	360	920	2980

Poor Reported Braking Action

MAX MANUAL	8770	150/-130	270	-500/1890	600/-410	220/-220	270	1600	4700
AUTOBRAKE MAX	8810	150/-130	280	-500/1890	620/-430	220/-220	270	1600	4700
AUTOBRAKE 3	8920	150/-130	270	-500/1910	580/-360	230/-230	340	1490	4590

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4680	140/-50	100	-150/500	50/-50	100/-100	130	130	290
AUTOBRAKE MAX	6530	80/-70	160	-230/740	0/0	160/-170	260	0	0
AUTOBRAKE 2	10740	170/-160	350	-440/1480	230/-260	300/-300	300	920	940

Good Reported Braking Action

MAX MANUAL	6560	90/-80	180	-250/860	150/-130	160/-160	180	520	1240
AUTOBRAKE MAX	6820	90/-80	180	-260/880	80/-60	170/-170	260	370	1110
AUTOBRAKE 2	10740	170/-160	350	-440/1480	230/-260	300/-300	300	920	940

Good To Medium Reported Braking Action

MAX MANUAL	7620	120/-100	230	-320/1110	240/-200	200/-200	210	920	2390
AUTOBRAKE MAX	7670	120/-100	230	-320/1120	200/-160	200/-200	260	830	2280
AUTOBRAKE 2	10820	180/-160	350	-460/1550	280/-290	310/-310	300	1020	1530

Medium Reported Braking Action

MAX MANUAL	8680	140/-120	280	-380/1360	330/-270	230/-230	230	1320	3530
AUTOBRAKE MAX	8520	140/-120	270	-380/1350	320/-250	220/-220	250	1280	3440
AUTOBRAKE 3	10280	160/-140	310	-440/1540	220/-230	280/-280	340	630	2130

Medium To Poor Reported Braking Action

MAX MANUAL	9750	170/-150	330	-470/1710	520/-380	260/-260	250	1970	5860
AUTOBRAKE MAX	9570	170/-140	330	-460/1690	510/-380	260/-260	260	1930	5740
AUTOBRAKE 3	10800	180/-160	350	-500/1820	410/-340	300/-300	340	1350	4840

Poor Reported Braking Action

MAX MANUAL	10820	190/-170	380	-550/2050	700/-490	290/-290	270	2620	8180
AUTOBRAKE MAX	10620	190/-160	380	-540/2030	700/-500	290/-290	270	2570	8040
AUTOBRAKE 3	11310	190/-170	390	-560/2100	600/-450	310/-310	330	2070	7550

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PITCH UP AUTHORITY (Flaps ≥ 20)****VREF30 + 20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4230	100/-40	90	-140/470	50/-40	90/-90	130	100	220
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500

Good Reported Braking Action

MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	410	960
AUTOBRAKE MAX	6080	90/-70	160	-240/830	110/-70	150/-150	240	410	1000
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500

Good To Medium Reported Braking Action

MAX MANUAL	6800	110/-90	200	-300/1060	220/-190	170/-170	210	740	1870
AUTOBRAKE MAX	6900	110/-90	200	-300/1070	220/-150	180/-180	250	730	1880
AUTOBRAKE 2	9620	160/-150	300	-430/1470	210/-250	270/-270	300	600	1030

Medium Reported Braking Action

MAX MANUAL	7730	130/-110	240	-360/1300	310/-250	200/-200	230	1060	2770
AUTOBRAKE MAX	7720	130/-110	240	-360/1300	320/-230	200/-200	260	1050	2750
AUTOBRAKE 3	9070	150/-130	260	-410/1450	170/-180	250/-250	350	460	1760

Medium To Poor Reported Braking Action

MAX MANUAL	8690	160/-130	290	-440/1640	490/-360	230/-230	250	1610	4620
AUTOBRAKE MAX	8690	160/-130	290	-440/1640	500/-350	230/-230	270	1600	4610
AUTOBRAKE 3	9600	170/-150	300	-480/1730	360/-290	260/-270	350	1130	3960

Poor Reported Braking Action

MAX MANUAL	9650	180/-150	330	-520/1970	660/-460	260/-260	270	2150	6470
AUTOBRAKE MAX	9660	180/-150	330	-520/1970	670/-470	260/-260	270	2150	6470
AUTOBRAKE 3	10120	180/-160	330	-540/2010	550/-400	270/-280	340	1800	6160

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PRI FLIGHT COMPUTERS (Flaps 20)****VREF20**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100

Good Reported Braking Action

MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100

Good To Medium Reported Braking Action

MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130

Medium Reported Braking Action

MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980

Medium To Poor Reported Braking Action

MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680

Poor Reported Braking Action

MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SLATS DRIVE (Flaps 20)****VREF30 + 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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4500	120/-40	100	-140/490	50/-50	90/-100	130	120	260
AUTOBRAKE MAX	6230	80/-70	150	-220/720	0/0	150/-150	260	0	0
AUTOBRAKE 2	10250	170/-150	320	-430/1450	220/-240	290/-290	310	730	740

Good Reported Braking Action

MAX MANUAL	6270	90/-80	170	-240/850	140/-130	150/-150	190	460	1090
AUTOBRAKE MAX	6580	90/-80	170	-250/870	100/-70	160/-160	260	420	1090
AUTOBRAKE 2	10250	170/-150	320	-430/1450	220/-240	290/-290	310	730	740

Good To Medium Reported Braking Action

MAX MANUAL	7270	110/-100	220	-310/1100	240/-200	180/-190	220	820	2080
AUTOBRAKE MAX	7440	120/-100	220	-320/1110	210/-160	190/-190	260	800	2080
AUTOBRAKE 2	10330	170/-160	330	-450/1520	270/-270	290/-290	310	830	1300

Medium Reported Braking Action

MAX MANUAL	8260	130/-120	260	-380/1340	330/-270	210/-220	240	1170	3060
AUTOBRAKE MAX	8290	140/-120	260	-380/1340	320/-250	220/-220	260	1170	3060
AUTOBRAKE 3	9840	150/-140	290	-430/1500	210/-230	270/-270	320	570	1930

Medium To Poor Reported Braking Action

MAX MANUAL	9280	160/-140	310	-460/1680	510/-380	250/-250	260	1750	5050
AUTOBRAKE MAX	9300	170/-140	310	-460/1680	510/-370	250/-250	270	1750	5050
AUTOBRAKE 3	10370	170/-160	330	-500/1790	410/-350	290/-290	320	1240	4290

Poor Reported Braking Action

MAX MANUAL	10300	190/-160	360	-540/2020	690/-480	280/-280	270	2330	7030
AUTOBRAKE MAX	10310	190/-160	360	-540/2020	700/-490	280/-280	270	2330	7040
AUTOBRAKE 3	10900	190/-170	370	-560/2070	600/-460	300/-300	320	1910	6640

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SPOILERS (Flaps 25)****VREF25**

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4010	70/-40	80	-130/460	50/-40	80/-80	130	90	200
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8700	120/-130	260	-390/1330	80/-170	240/-240	340	210	210

Good Reported Braking Action

MAX MANUAL	5510	70/-70	140	-230/790	130/-110	130/-130	190	380	890
AUTOBRAKE MAX	5640	70/-70	140	-230/810	120/-100	130/-130	210	390	930
AUTOBRAKE 2	8700	120/-130	260	-390/1330	80/-170	240/-240	340	210	210

Good To Medium Reported Braking Action

MAX MANUAL	6370	90/-90	180	-290/1030	220/-180	160/-160	220	680	1740
AUTOBRAKE MAX	6440	90/-90	180	-290/1040	220/-180	160/-160	230	690	1760
AUTOBRAKE 2	8780	130/-140	260	-410/1400	140/-200	240/-240	340	320	790

Medium Reported Braking Action

MAX MANUAL	7230	110/-110	220	-350/1270	300/-240	180/-180	240	980	2580
AUTOBRAKE MAX	7240	110/-110	220	-350/1270	310/-250	180/-180	240	980	2580
AUTOBRAKE 3	8150	110/-120	230	-390/1370	150/-110	220/-220	380	430	1890

Medium To Poor Reported Braking Action

MAX MANUAL	8130	130/-130	260	-430/1600	470/-340	210/-210	260	1500	4330
AUTOBRAKE MAX	8140	130/-130	270	-430/1600	490/-360	210/-210	260	1500	4340
AUTOBRAKE 3	8690	130/-140	270	-450/1660	370/-230	240/-240	380	1150	3920

Poor Reported Braking Action

MAX MANUAL	9030	150/-150	300	-510/1920	640/-440	230/-230	270	2010	6080
AUTOBRAKE MAX	9040	150/-150	310	-510/1920	660/-460	240/-240	270	2010	6090
AUTOBRAKE 3	9230	150/-150	300	-510/1940	590/-340	250/-250	370	1860	5950

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****SPOILERS (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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	3840	70/-40	80	-130/440	40/-40	70/-70	130	80	180
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8090	140/-120	230	-380/1280	60/-140	220/-220	330	130	130

Good Reported Braking Action

MAX MANUAL	5230	80/-60	130	-220/770	120/-110	120/-120	190	340	800
AUTOBRAKE MAX	5340	80/-70	130	-220/780	110/-100	120/-120	210	350	830
AUTOBRAKE 2	8090	140/-120	230	-380/1280	60/-140	220/-220	330	130	130

Good To Medium Reported Braking Action

MAX MANUAL	6040	100/-80	170	-280/1010	210/-170	150/-150	210	620	1560
AUTOBRAKE MAX	6090	100/-90	170	-280/1010	210/-170	150/-150	230	620	1570
AUTOBRAKE 2	8180	140/-120	240	-390/1350	110/-170	220/-220	330	230	680

Medium Reported Braking Action

MAX MANUAL	6840	110/-100	200	-340/1240	290/-230	170/-170	230	890	2310
AUTOBRAKE MAX	6840	110/-100	200	-340/1240	300/-240	170/-170	240	880	2300
AUTOBRAKE 3	7570	130/-100	210	-370/1320	150/-100	200/-200	370	420	1770

Medium To Poor Reported Braking Action

MAX MANUAL	7680	140/-120	240	-420/1560	460/-330	200/-200	250	1360	3870
AUTOBRAKE MAX	7690	140/-120	240	-420/1560	470/-340	200/-200	260	1350	3870
AUTOBRAKE 3	8110	150/-120	250	-440/1610	370/-220	220/-220	370	1080	3570

Poor Reported Braking Action

MAX MANUAL	8510	160/-130	280	-490/1880	620/-420	220/-220	270	1820	5430
AUTOBRAKE MAX	8530	160/-140	280	-490/1880	630/-430	220/-220	270	1820	5440
AUTOBRAKE 3	8640	160/-130	280	-500/1890	580/-330	230/-230	360	1730	5360

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

STABILIZER (Flaps 20)

VREF30 + 20

	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	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	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	4230	100/-40	90	-140/470	50/-40	90/-90	130	100	220
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500

Good Reported Braking Action

MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	410	960
AUTOBRAKE MAX	6080	90/-70	160	-240/830	110/-70	150/-150	240	410	1000
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500

Good To Medium Reported Braking Action

MAX MANUAL	6800	110/-90	200	-300/1060	220/-190	170/-170	210	740	1870
AUTOBRAKE MAX	6900	110/-90	200	-300/1070	220/-150	180/-180	250	730	1880
AUTOBRAKE 2	9620	160/-150	300	-430/1470	210/-250	270/-270	300	600	1030

Medium Reported Braking Action

MAX MANUAL	7730	130/-110	240	-360/1300	310/-250	200/-200	230	1060	2770
AUTOBRAKE MAX	7720	130/-110	240	-360/1300	320/-230	200/-200	260	1050	2750
AUTOBRAKE 3	9070	150/-130	260	-410/1450	170/-180	250/-250	350	460	1760

Medium To Poor Reported Braking Action

MAX MANUAL	8690	160/-130	290	-440/1640	490/-360	230/-230	250	1610	4620
AUTOBRAKE MAX	8690	160/-130	290	-440/1640	500/-350	230/-230	270	1600	4610
AUTOBRAKE 3	9600	170/-150	300	-480/1730	360/-290	260/-270	350	1130	3960

Poor Reported Braking Action

MAX MANUAL	9650	180/-150	330	-520/1970	660/-460	260/-260	270	2150	6470
AUTOBRAKE MAX	9660	180/-150	330	-520/1970	670/-470	260/-260	270	2150	6470
AUTOBRAKE 3	10120	180/-160	330	-540/2010	550/-400	270/-280	340	1800	6160

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 1500 ft from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Approach or Landing Climb Limited Weight****Valid for approach with flaps 20 and landing with flaps 30**

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	672.3	628.0				
52	126	690.0	643.1				
50	122	707.8	659.3	605.6			
48	118	725.5	677.8	619.9			
46	115	743.7	696.5	635.4	585.0		
44	111	761.0	714.1	652.5	600.2		
42	108	777.3	732.3	671.6	614.6	563.6	
40	104	793.0	750.7	689.9	629.6	576.5	
38	100	809.0	769.5	707.1	644.2	589.2	523.7
36	97	823.4	785.6	722.9	658.1	600.0	534.2
34	93	834.9	801.0	739.6	671.9	609.6	544.6
32	90	835.0	816.7	753.4	684.7	618.5	554.2
30	86	835.0	830.3	765.2	699.0	627.8	562.5
28	82	835.0	830.6	775.5	709.9	638.0	570.7
26	79	835.0	830.8	787.4	718.4	648.3	578.8
24	75	835.0	831.0	787.5	725.5	659.0	587.6
22	72	835.0	831.2	787.7	732.4	666.4	596.9
20	68	835.0	831.5	787.8	732.6	671.0	604.8
18	64	835.0	831.6	788.0	732.8	675.5	610.3
16	61	835.0	831.8	788.2	732.9	675.6	614.2
14	57	835.0	831.9	788.4	733.1	675.8	617.6
12	54	835.0	832.1	788.5	733.3	675.9	617.8
10	50	835.0	832.1	788.7	733.4	675.9	617.9
8	46	835.0	832.2	788.9	733.6	676.0	617.9
6	43	835.0	832.3	788.9	733.7	676.0	617.8
4	40	835.0	832.4	781.7	706.6	645.9	570.9
2	36	835.0	832.4	781.9	706.7	646.0	570.9
0	32	835.0	832.5	781.9	706.8	646.1	571.0
-40	-40	835.0	832.7	781.9	706.8	646.1	571.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 2900 lb.

With engine and wing anti-ice on, decrease weight by 4800 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 48400 lb.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	680.0	637.9				
52	126	695.9	653.6				
50	122	712.4	668.9	615.7			
48	118	729.4	684.9	630.1			
46	115	746.7	701.5	645.6	594.1		
44	111	763.5	718.1	662.4	609.4		
42	108	779.7	735.6	679.3	624.3	572.7	
40	104	795.5	753.2	695.5	639.7	586.1	
38	100	811.6	771.9	711.8	655.4	599.2	533.2
36	97	826.3	788.0	727.2	668.7	611.1	543.8
34	93	835.0	803.5	743.1	681.2	620.9	554.2
32	90	835.0	819.5	756.3	692.2	630.5	564.5
30	86	835.0	833.3	767.7	705.0	639.8	573.1
28	82	835.0	833.5	778.2	715.2	650.4	581.7
26	79	835.0	833.7	790.3	723.4	660.6	589.8
24	75	835.0	834.0	790.5	730.1	670.3	598.7
22	72	835.0	834.2	790.6	736.7	676.8	608.2
20	68	835.0	834.4	790.8	736.9	680.7	616.4
18	64	835.0	834.6	791.0	737.0	684.6	622.2
16	61	835.0	834.7	791.2	737.2	684.7	626.3
14	57	835.0	834.9	791.3	737.4	684.8	629.8
12	54	835.0	835.0	791.5	737.5	684.9	630.0
10	50	835.0	835.0	791.7	737.7	685.0	630.1
8	46	835.0	835.0	791.8	737.9	685.1	630.1
6	43	835.0	835.0	791.9	738.0	685.2	630.0
4	40	835.0	835.0	792.0	738.1	685.2	618.9
2	36	835.0	835.0	792.1	738.2	685.3	619.0
0	32	835.0	835.0	792.1	738.2	685.4	619.0
-40	-40	835.0	835.0	792.4	738.4	685.8	619.3

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 3200 lb.

With engine and wing anti-ice on, decrease weight by 4000 lb.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 49000 lb.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT (1000 LB)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8
780	0	21.8	23.8	26.1	32.5	35.8	39.7	45.4	50.5	56.5	59.5	66.5	74.6	74.6	83.6	94.0	90.2	101.1	113.5
	10	22.4	24.5	26.9	33.4	36.9	40.9	46.8	52.1	58.2	61.4	68.6	77.0	77.0	86.3	96.9	93.1	104.2	116.8
	15	22.9	24.9	27.4	34.0	37.6	41.7	47.7	53.1	59.3	62.5	69.9	78.4	78.3	87.8	98.6	94.7	106.0	118.7
	20	23.2	25.4	27.8	34.7	38.2	42.4	48.5	54.0	60.3	63.5	71.1	79.7	79.7	89.3	100.2	96.2	107.7	120.6
	30	23.8	26.0	28.5	35.5	39.2	43.5	49.8	55.4	62.0	65.3	73.0	81.9	81.9	91.7	102.9	98.9	110.6	123.1
	40	23.9	26.1	28.7	35.9	39.7	44.1	50.6	56.3	63.0	66.4	74.4	83.5	83.4	93.5	105.0	100.8	112.8	126.0
740	0	21.0	22.8	25.0	31.1	34.3	38.0	43.5	48.3	53.9	56.8	63.5	71.2	71.3	79.9	89.8	86.3	96.8	108.7
	10	21.5	23.5	25.7	32.0	35.3	39.1	44.8	49.8	55.6	58.6	65.5	73.5	73.6	82.5	92.6	89.1	99.8	111.9
	15	21.9	23.9	26.2	32.6	36.0	39.8	45.6	50.7	56.6	59.7	66.7	74.8	74.9	83.9	94.2	90.6	101.5	113.8
	20	22.3	24.3	26.7	33.2	36.6	40.5	46.4	51.6	57.6	60.7	67.9	76.1	76.2	85.3	95.8	92.1	103.1	115.6
	30	22.8	24.9	27.3	34.0	37.5	41.6	47.6	53.0	59.2	62.4	69.7	78.2	78.3	87.7	98.4	94.7	105.9	118.6
	40	23.0	25.1	27.5	34.4	37.9	42.1	48.3	53.8	60.1	63.4	71.0	79.7	79.7	89.4	100.4	96.5	108.1	120.9
700	0	20.1	21.9	23.9	29.8	32.8	36.2	41.5	46.1	51.4	54.2	60.5	67.8	68.0	76.2	85.6	82.4	92.4	103.8
	10	20.6	22.5	24.6	30.6	33.7	37.3	42.8	47.5	53.0	55.9	62.4	70.0	70.1	78.6	88.3	85.0	95.2	106.9
	15	21.0	22.9	25.1	31.2	34.3	38.0	43.6	48.4	53.9	56.9	63.5	71.2	71.4	80.0	89.8	86.4	96.9	108.7
	20	21.4	23.3	25.5	31.8	35.0	38.7	44.3	49.2	54.9	57.9	64.6	72.4	72.6	81.3	91.3	87.9	98.5	110.4
	30	21.9	23.8	26.1	32.5	35.8	39.7	45.5	50.5	56.4	59.5	66.4	74.4	74.6	83.6	93.8	90.3	101.2	113.4
	40	22.0	24.0	26.3	32.9	36.2	40.2	46.1	51.3	57.3	60.5	67.6	75.8	76.0	85.2	95.7	92.1	103.2	115.6
620	0	18.4	20.0	21.8	27.1	29.7	32.8	37.6	41.6	46.3	48.8	54.4	60.9	61.2	68.4	76.8	74.1	83.1	93.4
	10	18.9	20.5	22.4	27.9	30.6	33.8	38.7	42.9	47.7	50.4	56.1	62.8	63.1	70.6	79.3	76.5	85.7	96.3
	15	19.3	20.9	22.8	28.4	31.2	34.4	39.4	43.6	48.6	51.3	57.1	63.9	64.2	71.9	80.7	77.8	87.2	97.9
	20	19.6	21.3	23.2	28.9	31.7	35.0	40.1	44.4	49.4	52.2	58.1	65.0	65.4	73.1	82.0	79.2	88.7	99.6
	30	20.1	21.7	23.8	29.6	32.5	35.9	41.1	45.6	50.7	53.6	59.7	66.8	67.1	75.1	84.3	81.4	91.2	102.3
	40	20.1	21.9	23.9	29.9	32.8	36.3	41.7	46.2	51.5	54.4	60.7	68.0	68.3	76.5	85.9	82.9	93.0	104.3
540	0	16.8	18.1	19.8	24.4	26.7	29.4	33.6	37.1	41.2	43.4	48.3	53.9	54.2	60.5	67.8	65.5	73.4	82.5
	10	17.2	18.6	20.3	25.1	27.5	30.3	34.6	38.2	42.4	44.8	49.8	55.5	55.9	62.4	69.9	67.6	75.7	85.1
	15	17.5	19.0	20.7	25.6	28.0	30.8	35.2	38.9	43.2	45.6	50.7	56.5	56.9	63.5	71.2	68.8	77.1	86.5
	20	17.8	19.3	21.0	26.0	28.5	31.4	35.9	39.6	44.0	46.4	51.5	57.5	57.9	64.6	72.4	70.0	78.4	88.0
	30	18.2	19.7	21.5	26.6	29.2	32.1	36.8	40.6	45.1	47.6	52.9	59.1	59.4	66.4	74.4	71.9	80.6	90.4
	40	18.3	19.8	21.6	26.9	29.4	32.3	37.2	41.1	45.7	48.3	53.7	60.1	60.4	67.6	75.8	73.3	82.1	92.2
460	0	15.2	16.4	17.7	21.8	23.8	26.1	29.6	32.6	36.0	37.9	42.0	46.7	47.0	52.3	58.5	56.6	63.3	70.9
	10	15.6	16.8	18.2	22.4	24.4	26.8	30.5	33.5	37.1	39.1	43.3	48.2	48.4	53.9	60.3	58.4	65.3	73.2
	15	15.9	17.1	18.6	22.8	24.9	27.3	31.0	34.2	37.8	39.8	44.1	49.1	49.3	54.9	61.4	59.4	66.4	74.5
	20	16.1	17.4	18.9	23.2	25.3	27.8	31.6	34.8	38.5	40.5	44.9	49.9	50.2	55.9	62.5	60.5	67.6	75.8
	30	16.5	17.8	19.3	23.7	25.9	28.4	32.4	35.6	39.4	41.5	46.0	51.3	51.5	57.4	64.2	62.1	69.4	77.8
	40	16.5	17.8	19.4	23.9	26.1	28.7	32.7	36.0	39.9	42.1	46.7	52.0	52.3	58.3	65.3	63.2	70.7	79.3
380	0	13.6	14.6	15.8	19.2	20.8	22.7	25.6	28.1	30.9	32.4	35.7	39.6	39.6	43.9	48.9	47.3	52.7	58.9
	10	14.0	15.0	16.2	19.7	21.4	23.4	26.3	28.9	31.8	33.3	36.8	40.8	40.8	45.3	50.4	48.8	54.3	60.7
	15	14.2	15.3	16.5	20.0	21.8	23.8	26.8	29.4	32.4	33.9	37.4	41.5	41.6	46.1	51.4	49.7	55.3	61.8
	20	14.5	15.5	16.8	20.4	22.2	24.2	27.3	29.9	33.0	34.5	38.1	42.3	42.3	46.9	52.3	50.5	56.3	62.9
	30	14.8	15.9	17.2	20.8	22.7	24.8	28.0	30.6	33.8	35.4	39.1	43.3	43.4	48.1	53.6	51.9	57.8	64.6
	40	14.8	15.9	17.2	20.9	22.8	25.0	28.2	30.9	34.2	35.8	39.6	43.9	44.0	48.8	54.5	52.7	58.7	65.8

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****Event Adjusted Brake Energy (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	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	4.4	14.1	23.7	33.2	42.6	51.9	61.2	70.5	79.9	89.3	98.9	108.7
	MAX AUTO	4.4	13.1	21.7	30.2	38.7	47.3	56.0	65.0	74.3	83.9	94.0	104.6
	AUTOBRAKE 4	4.3	12.5	20.4	28.1	35.7	43.4	51.2	59.3	67.7	76.6	86.1	96.4
	AUTOBRAKE 3	4.2	11.9	19.2	26.3	33.3	40.3	47.4	54.8	62.6	70.8	79.7	89.3
	AUTOBRAKE 2	4.1	11.2	17.9	24.4	30.8	37.2	43.7	50.5	57.6	65.1	73.2	81.9
	AUTOBRAKE 1	4.0	10.3	16.3	22.1	27.8	33.4	39.1	45.1	51.3	58.0	65.1	72.9

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	RTO MAX MAN	10	20	30	40	50	60	70	80	90	100	110	120
	MAX MAN	3.3	12.0	21.0	30.0	38.9	47.5	56.1	64.5	72.8	81.0	89.2	97.5
	MAX AUTO	2.0	8.7	15.5	22.3	29.3	36.4	43.8	51.5	59.6	68.3	77.5	87.4
	AUTOBRAKE 4	1.4	5.6	10.4	15.6	20.9	26.4	32.2	38.3	44.8	51.9	59.6	68.0
	AUTOBRAKE 3	0.9	3.2	6.4	10.3	14.3	18.5	23.0	27.9	33.2	39.0	45.4	52.4
	AUTOBRAKE 2	0.3	1.8	4.0	6.5	9.3	12.3	15.6	19.2	23.3	27.9	33.0	38.7
	AUTOBRAKE 1	0.2	1.2	2.6	4.3	6.1	8.1	10.3	12.8	15.6	18.8	22.3	26.4

Cooling Time (Minutes)

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)											
		16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE		
GEAR DOWN	NO SPECIAL	PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE		
INFLIGHT													
GROUND			11	18	26	42	55	66	73				
BTMS	UP TO 2.4		2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE		

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 for each taxi mile.

For one brake deactivated, increase brake energy by 10 percent.

For two brakes deactivated, increase brake energy by 20 percent.

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 8 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 EICAS 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.

(When inflight with gear extended, the BTMS indications may vary between individual brakes, due to airstream effects.)

Performance Inflight

Engine Inoperative

Chapter PI

Section 63

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for one pack on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	98.3	97.9	97.6
-5	98.4	99.9	101.2	101.3	100.5	100.2	99.7	99.3	98.8
-10	97.4	99.0	100.3	101.6	101.3	101.3	100.7	100.3	100.0
-15	96.5	98.1	99.3	100.6	101.0	102.0	101.1	100.8	100.5
-20	95.6	97.1	98.3	99.6	100.1	101.0	100.1	99.8	99.5
-25	94.6	96.1	97.4	98.6	99.1	100.0	99.1	98.8	98.5
-30	93.7	95.2	96.4	97.6	98.1	99.0	98.1	97.8	97.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	97.1	96.8	96.5
-40	91.7	93.2	94.4	95.6	96.0	96.9	96.1	95.8	95.5

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT								TAT (°C)						
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	
280	0.86	94.3	95.4	96.4	97.4	98.4	99.5	100.5	101.4	101.2	100.2	98.9	97.7	
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1	
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3	
35000 FT PRESS ALT								TAT (°C)						
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1	
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2	
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1	
33000 FT PRESS ALT								TAT (°C)						
KLAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8	
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7	
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5	
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4	
31000 FT PRESS ALT								TAT (°C)						
KLAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4	
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	103.0	100.6	99.1	98.0	
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9	
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1	
29000 FT PRESS ALT								TAT (°C)						
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8	
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1	
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0	
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2	
27000 FT PRESS ALT								TAT (°C)						
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1	
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1	
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1	
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.2	
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.5	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	37	35	33	31	29	27
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/I ON - PACKS OFF	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

ENGINE INOP**Max Continuous %N1****Based on engine bleed for packs on or off and anti-ice off****25000 FT to 18000 FT Pressure Altitudes**

25000 FT PRESS ALT												TAT (°C)			
CIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20		
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1		
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6		
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7		
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9		
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9		
24000 FT PRESS ALT												TAT (°C)			
CIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20		
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4		
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8		
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9		
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2		
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6		
22000 FT PRESS ALT												TAT (°C)			
CIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25		
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3		
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5		
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6		
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1		
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8		
20000 FT PRESS ALT												TAT (°C)			
CIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25		
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1		
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1		
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3		
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2		
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3		
18000 FT PRESS ALT												TAT (°C)			
CIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30		
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100.0	100.9	101.8	102.0	100.6	99.4		
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6		
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8		
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2		
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4		

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
16000 FT to 5000 FT Pressure Altitudes

16000 FT PRESS ALT													TAT (°C)	
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2	
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4	
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8	
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9	
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4	
14000 FT PRESS ALT													TAT (°C)	
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5	
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9	
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4	
240	0.47	97.3	98.2	99.2	100.1	101.1	102.0	102.8	102.5	100.6	99.0	97.8	96.7	
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6	
12000 FT PRESS ALT													TAT (°C)	
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40	
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0	
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4	
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1	
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0	
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8	
10000 FT PRESS ALT													TAT (°C)	
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40	
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1	
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6	
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4	
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9	
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6	
5000 FT PRESS ALT													TAT (°C)	
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45	
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5	
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2	
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8	
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4	
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	16	14	12	10	5
ENGINE A/I ON	-0.3	-0.2	-0.4	-0.5	-0.5
WING A/I ON - PACKS ON	-0.4	-0.5	-0.6	-0.7	-0.8
WING A/I ON - PACKS OFF	-0.6	-0.7	-0.8	-0.9	-1.1

ENGINE INOP
MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	758	298	18000	16800	15600
740	720	290	19300	18200	17000
700	682	283	20500	19600	18500
660	642	275	21700	20900	20000
620	601	267	23200	22200	21200
580	562	258	25000	24000	22800
540	524	249	27000	26100	24700
500	485	241	29100	28400	27000
460	448	231	30900	30500	29400
420	409	221	32600	32300	31700
380	369	211	34400	34300	34000

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
134	126	118	111	105	100	95	90	86	82	79
269	251	236	222	210	200	190	181	173	165	159
403	377	354	334	316	300	285	272	260	248	238
536	502	472	445	421	400	380	362	346	332	318
670	627	589	556	526	500	475	453	433	415	398
803	752	707	667	632	600	571	544	520	498	478
936	877	824	778	737	700	666	635	607	582	558
1068	1001	942	889	842	800	761	726	695	665	639
1201	1126	1059	1000	947	900	856	817	782	749	719
1333	1250	1176	1111	1052	1000	952	908	869	833	799
1466	1374	1293	1222	1157	1100	1047	1000	956	916	880
1598	1499	1411	1332	1262	1200	1142	1091	1043	1000	960
1731	1623	1528	1443	1368	1300	1238	1182	1131	1084	1040
1863	1747	1645	1554	1473	1400	1333	1273	1218	1167	1121
1996	1872	1762	1665	1578	1500	1428	1364	1305	1251	1201
2129	1997	1880	1776	1683	1600	1524	1455	1392	1334	1281
2262	2121	1997	1887	1788	1700	1619	1546	1479	1418	1361
2395	2246	2115	1998	1894	1800	1714	1637	1566	1501	1441

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)											TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)											
	380	420	460	500	540	580	620	660	700	740	780	
100	2.4	2.6	2.9	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.2	0:16
200	5.4	6.0	6.5	7.1	7.4	7.8	8.3	8.7	9.0	9.5	9.8	0:31
300	8.7	9.5	10.4	11.2	11.8	12.5	13.2	13.9	14.5	15.4	15.9	0:46
400	11.9	13.1	14.2	15.4	16.3	17.2	18.2	19.2	20.1	21.2	22.1	1:01
500	14.9	16.4	17.8	19.3	20.5	21.7	23.0	24.2	25.3	26.8	28.0	1:16
600	17.9	19.6	21.3	23.1	24.6	26.1	27.5	29.0	30.4	32.2	33.7	1:31
700	20.8	22.8	24.8	26.9	28.6	30.4	32.1	33.8	35.4	37.5	39.3	1:46
800	23.7	26.0	28.3	30.6	32.5	34.6	36.5	38.5	40.4	42.7	44.9	2:01
900	26.6	29.2	31.7	34.3	36.5	38.8	41.0	43.2	45.4	48.0	50.5	2:15
1000	29.5	32.3	35.1	37.9	40.4	42.9	45.4	47.9	50.3	53.2	56.0	2:30
1100	32.3	35.4	38.4	41.5	44.3	47.1	49.8	52.5	55.2	58.3	61.4	2:44
1200	35.1	38.5	41.8	45.1	48.1	51.2	54.1	57.1	60.1	63.5	66.8	2:59
1300	37.9	41.5	45.1	48.7	51.9	55.2	58.5	61.7	64.9	68.6	72.2	3:14
1400	40.7	44.6	48.4	52.2	55.7	59.3	62.8	66.2	69.7	73.6	77.5	3:28
1500	43.4	47.6	51.6	55.7	59.5	63.3	67.0	70.7	74.5	78.6	82.8	3:43
1600	46.1	50.5	54.9	59.2	63.2	67.3	71.3	75.2	79.2	83.6	88.1	3:58
1700	48.8	53.5	58.1	62.7	66.9	71.2	75.5	79.7	83.9	88.6	93.3	4:13
1800	51.5	56.4	61.2	66.1	70.6	75.2	79.6	84.1	88.6	93.5	98.5	4:27

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
780	15300	14000	12400
760	16000	14400	12900
740	16700	15200	13300
720	17500	16000	14200
700	18300	16800	15100
680	19100	17600	16000
660	20000	18500	16800
640	20500	19300	17700
620	21100	20100	18700
600	21700	20800	19700
580	22500	21400	20400
560	23400	22100	21100
540	24300	23100	21700
520	25400	24200	22600
500	26600	25300	23700
480	27900	26600	24900
460	29300	27900	26200
440	30400	29200	27600
420	31300	30400	29000
400	32200	31600	30400
380	33200	32700	31700
360	34200	33900	33000

With engine anti-ice on, no altitude capability adjustment is required.
With engine and wing anti-ice on, decrease altitude capability by 300 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
780	%N1	91.3	96.8								
	MACH	.602	.664								
	KIAS	334	337								
	FF/ENG	22536	24156								
740	%N1	90.4	95.1	97.9							
	MACH	.602	.660	.678							
	KIAS	334	335	332							
	FF/ENG	21826	22989	23330							
700	%N1	89.4	93.5	95.6	98.8						
	MACH	.599	.649	.665	.684						
	KIAS	333	329	325	322						
	FF/ENG	21042	21608	21727	22025						
660	%N1	87.7	91.9	93.6	96.1						
	MACH	.583	.637	.653	.670						
	KIAS	324	323	319	315						
	FF/ENG	19683	20284	20323	20423						
620	%N1	85.9	90.2	91.9	93.6	96.5					
	MACH	.567	.621	.641	.657	.675					
	KIAS	315	315	313	309	305					
	FF/ENG	18411	18905	19032	19011	19194					
580	%N1	84.1	88.4	90.1	91.8	93.7	96.8				
	MACH	.551	.602	.625	.644	.661	.680				
	KIAS	306	305	305	302	298	295				
	FF/ENG	17177	17504	17683	17733	17760	18050				
540	%N1	82.1	86.3	88.2	89.9	91.6	93.7	97.0			
	MACH	.534	.582	.605	.627	.646	.663	.683			
	KIAS	296	294	295	294	292	288	285			
	FF/ENG	15983	16124	16312	16429	16476	16562	16922			
500	%N1	80.1	84.1	86.0	87.8	89.5	91.2	93.5	97.0		
	MACH	.516	.563	.583	.606	.629	.648	.665	.686		
	KIAS	286	284	284	284	284	281	277	274		
	FF/ENG	14812	14796	14951	15098	15202	15263	15363	15748		
460	%N1	77.9	81.8	83.6	85.5	87.2	88.9	90.7	93.1	96.7	
	MACH	.498	.543	.563	.583	.607	.630	.649	.666	.688	
	KIAS	276	274	273	273	273	272	270	266	264	
	FF/ENG	13638	13500	13643	13767	13886	13996	14052	14137	14531	
420	%N1	75.5	79.3	81.2	82.9	84.8	86.5	88.2	90.0	92.4	96.1
	MACH	.480	.521	.540	.560	.581	.605	.628	.648	.666	.688
	KIAS	266	263	262	262	261	261	261	258	255	252
	FF/ENG	12483	12254	12367	12495	12575	12676	12787	12829	12899	13288
380	%N1	73.1	76.7	78.5	80.3	82.0	83.8	85.6	87.3	89.1	91.5
	MACH	.462	.500	.517	.536	.556	.578	.601	.625	.646	.664
	KIAS	255	252	251	250	249	249	249	249	247	243
	FF/ENG	11350	11040	11139	11257	11323	11376	11460	11565	11610	11661
340	%N1	70.3	73.9	75.7	77.4	79.1	80.8	82.5	84.3	86.1	88.0
	MACH	.443	.478	.494	.511	.530	.550	.571	.594	.620	.642
	KIAS	245	240	239	238	237	236	236	236	236	234
	FF/ENG	10261	9890	9952	10062	10110	10131	10176	10235	10339	10404

ENGINE INOP**MAX CONTINUOUS THRUST****Long Range Cruise Diversion Fuel and Time****Ground to Air Miles Conversion**

AIR DISTANCE (NM)					GROUND DISTANCE	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		(NM)	20	40	60	80
286	264	244	227	213	200	190	181	173	166	159
569	525	487	454	425	400	381	364	348	333	320
853	788	730	681	638	600	572	546	522	501	482
1138	1051	974	908	851	800	763	729	698	669	643
1424	1316	1219	1136	1064	1000	954	911	872	836	803
1711	1580	1464	1364	1278	1200	1144	1093	1046	1003	964
1999	1846	1709	1592	1491	1400	1335	1275	1220	1170	1124
2288	2111	1954	1820	1704	1600	1526	1457	1394	1337	1285
2578	2378	2201	2049	1918	1800	1717	1639	1568	1504	1445
2869	2646	2447	2278	2132	2000	1907	1821	1742	1670	1605

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	9.2	0:38	8.1	0:37	7.3	0:36	6.5	0:35	6.1	0:34
400	19.3	1:12	17.7	1:09	16.5	1:06	15.6	1:04	15.3	1:02
600	29.2	1:46	27.2	1:41	25.7	1:37	24.5	1:34	24.4	1:30
800	39.0	2:21	36.6	2:14	34.7	2:07	33.2	2:03	33.3	1:58
1000	48.7	2:56	45.9	2:47	43.7	2:38	41.9	2:33	42.1	2:26
1200	58.4	3:31	55.1	3:20	52.6	3:09	50.5	3:03	50.7	2:55
1400	67.9	4:06	64.2	3:53	61.4	3:41	59.0	3:33	59.2	3:24
1600	77.4	4:41	73.2	4:27	70.1	4:12	67.4	4:03	67.6	3:53
1800	86.8	5:17	82.1	5:01	78.6	4:44	75.6	4:33	75.8	4:22
2000	96.1	5:53	90.9	5:35	87.2	5:16	83.8	5:03	84.0	4:51

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)									
	400	450	500	550	600	650	700	750	800	
10	-1.7	-1.3	-0.8	-0.4	0.0	0.8	1.8	2.9	4.2	
20	-3.7	-2.7	-1.8	-0.9	0.0	1.8	3.9	6.3	9.0	
30	-5.7	-4.2	-2.7	-1.4	0.0	2.8	6.0	9.6	13.7	
40	-7.7	-5.7	-3.7	-1.9	0.0	3.8	8.0	12.8	18.1	
50	-9.8	-7.2	-4.7	-2.4	0.0	4.7	10.0	15.9	22.4	
60	-11.8	-8.7	-5.7	-2.8	0.0	5.6	11.9	18.9	26.6	
70	-13.9	-10.2	-6.7	-3.3	0.0	6.5	13.7	21.8	30.6	
80	-15.9	-11.7	-7.7	-3.8	0.0	7.3	15.5	24.5	34.5	
90	-18.0	-13.2	-8.7	-4.3	0.0	8.1	17.2	27.2	38.1	
100	-20.1	-14.8	-9.7	-4.8	0.0	8.9	18.8	29.7	41.7	

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
800	%N1	81.3	84.8	89.5	94.9			
	KIAS	273	275	276	301			
	FF/ENG	20620	20800	21460	23060			
760	%N1	79.7	83.0	87.8	92.7			
	KIAS	266	268	269	285			
	FF/ENG	19500	19610	20160	21200			
720	%N1	78.2	81.2	86.1	90.8	99.6		
	KIAS	259	260	261	271	297		
	FF/ENG	18410	18460	18870	19520	22300		
680	%N1	76.5	79.4	84.3	88.9	96.1		
	KIAS	252	253	254	256	286		
	FF/ENG	17340	17340	17630	18000	20240		
640	%N1	74.7	77.7	82.3	87.1	92.7		
	KIAS	245	245	246	248	267		
	FF/ENG	16280	16250	16430	16710	18210		
600	%N1	72.9	75.8	80.2	85.1	90.3		
	KIAS	236	237	238	239	251		
	FF/ENG	15240	15180	15250	15440	16560		
560	%N1	70.9	73.8	78.1	83.0	88.0	96.0	
	KIAS	231	231	231	231	234	263	
	FF/ENG	14210	14140	14130	14260	15010	16930	
520	%N1	68.8	71.9	76.0	80.8	85.8	91.6	
	KIAS	225	225	225	225	225	243	
	FF/ENG	13210	13140	13070	13140	13740	14810	
480	%N1	66.7	69.6	73.8	78.3	83.5	88.4	98.4
	KIAS	220	220	220	220	220	224	245
	FF/ENG	12240	12170	12060	12090	12540	13170	15210
440	%N1	64.6	67.3	71.6	75.9	80.8	85.7	93.3
	KIAS	213	213	213	213	213	213	232
	FF/ENG	11280	11200	11070	11080	11390	11800	13060
400	%N1	62.4	65.0	69.1	73.4	78.1	83.2	88.3
	KIAS	207	207	207	207	207	207	209
	FF/ENG	10360	10250	10130	10120	10320	10640	11140
360	%N1	60.0	62.6	66.4	70.7	75.3	80.3	85.0
	KIAS	200	200	200	200	200	200	200
	FF/ENG	9480	9350	9220	9210	9310	9520	9830

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP**ADVISORY INFORMATION****Gear Down Landing Rate of Climb Available****Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	430	320				
50	480	370	210			
48	530	420	270			
46	570	470	320	160		
44	620	530	370	210		
42	670	570	410	250	90	
40	710	620	460	290	120	
38	740	670	510	330	150	
36	740	710	540	370	180	-20
34	740	760	580	400	210	0
32	750	760	610	440	240	30
30	750	770	640	460	280	60
20	770	780	650	510	350	170
10	790	800	600	420	260	130
0	810	810	590	360	130	-110
-20	840	850	610	370	130	-110
-40	880	880	640	390	140	-120

Rate of climb capability shown is valid for 500000 lb, gear down at VREF20 + 5.

Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.

Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Flaps 25

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	80	-20				
50	130	20	-130			
48	180	70	-80			
46	220	120	-30	-190		
44	260	170	20	-140		
42	310	210	60	-100	-270	
40	350	260	100	-60	-240	
38	380	300	140	-30	-210	-410
36	380	340	170	0	-180	-380
34	380	380	210	30	-150	-360
32	380	390	240	70	-130	-330
30	390	390	260	90	-90	-310
20	400	400	270	130	-20	-210
10	410	410	270	-10	-190	-350
0	420	420	200	-20	-250	-480
-20	440	440	210	-20	-250	-500
-40	460	460	220	-20	-260	-520

Rate of climb capability shown is valid for 500000 lb, gear down at VREF25 + 5.

Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.

Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

ADVISORY INFORMATION

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-140	-250				
50	-100	-210	-360			
48	-60	-160	-320			
46	-10	-120	-270	-420		
44	30	-70	-220	-380		
42	70	-30	-180	-340	-500	
40	100	20	-150	-310	-470	
38	140	60	-110	-280	-450	
36	140	100	-70	-250	-420	-620
34	140	130	-40	-210	-400	-600
32	140	150	-10	-180	-370	-580
30	140	150	10	-160	-340	-550
20	150	150	20	-120	-270	-460
10	160	160	0	-150	-300	-660
0	160	160	-50	-270	-500	-730
-20	170	170	-60	-280	-510	-750
-40	180	170	-60	-300	-530	-780

Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Performance Inflight

Alternate Mode EEC

Chapter PI

Section 64

ALTERNATE MODE EEC

Alternate Mode EEC Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (1000 FT)											
°C	°F	-2	-1	0	1	2	3	4	5	6	7	8	8.4
55	131	94.3	96.7	97.0	96.7	96.5	96.6	96.4	96.3	96.1	95.5	94.6	94.2
50	122	95.7	98.1	98.6	98.2	97.9	97.9	97.8	97.6	97.4	96.8	95.9	95.6
45	113	97.2	99.6	100.1	99.8	99.4	99.3	99.1	98.9	98.8	98.2	97.3	96.9
40	104	98.9	101.2	101.9	101.4	101.0	100.8	100.6	100.4	100.0	99.4	98.6	98.2
35	95	100.9	102.7	104.7	104.2	103.1	102.6	102.1	101.7	101.1	100.4	99.6	99.3
30	86	100.5	103.7	106.9	106.4	105.6	105.0	104.3	103.7	102.6	101.5	100.7	100.3
25	77	99.7	102.8	106.0	106.7	107.3	107.2	106.7	106.5	105.3	103.8	102.4	101.8
20	68	98.8	101.9	105.1	105.8	106.4	106.8	107.1	107.5	106.8	105.9	104.8	104.3
15	59	98.0	101.1	104.2	104.9	105.5	105.8	106.2	106.5	106.4	106.1	105.6	105.3
10	50	97.1	100.2	103.3	104.0	104.6	104.9	105.3	105.6	105.5	105.2	104.9	104.8
5	41	96.3	99.3	102.4	103.0	103.7	104.0	104.3	104.7	104.5	104.2	104.0	103.8
0	32	95.4	98.4	101.4	102.1	102.7	103.1	103.4	103.7	103.6	103.3	103.0	102.9
-10	14	93.6	96.6	99.6	100.2	100.8	101.2	101.5	101.8	101.7	101.4	101.1	101.0
-20	-4	91.8	94.7	97.7	98.3	98.9	99.2	99.5	99.9	99.7	99.5	99.2	99.0
-30	-22	90.0	92.8	95.7	96.3	96.9	97.2	97.5	97.9	97.7	97.5	97.2	97.1
-40	-40	88.1	90.9	93.7	94.3	94.9	95.2	95.5	95.8	95.7	95.4	95.2	95.0
-50	-58	86.2	88.9	91.7	92.3	92.9	93.1	93.4	93.8	93.6	93.4	93.1	93.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)											
	-2	-1	0	1	2	3	4	5	6	7	8	8.4
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Intentionally
Blank

Performance Inflight**Gear Down****Chapter PI****Section 65****GEAR DOWN****220 KIAS Max Climb %N1**

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	91.4	91.1	92.1	91.3	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.4	91.4	92.1	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	89.7	90.7	91.4	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	89.7	89.9	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.3	92.2	92.1	90.6	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.2	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.2	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

*Packs on or off with 2 bleed sources.

**Packs off with 1 bleed source.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18600	16600	14200
760	19100	17200	14800
740	19700	17900	15500
720	20200	18500	16100
700	21000	19400	17100
680	21900	20400	18200
660	22900	21500	19400
640	23900	22500	20600
620	25000	23500	21900
600	25900	24600	23000
580	27000	25700	24200
560	28000	27000	25400
540	29100	28200	26700
520	30100	29500	28000
500	30900	30500	29300
480	31600	31300	30500
460	32400	32200	31500
440	33300	33100	32600
420	34100	33900	33600
400	34900	34800	34600
380	35800	35700	35600
360	36700	36600	36400

GEAR DOWN**Long Range Cruise Control**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
800	%N1	84.9	89.2	91.3	93.9						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16879	17230	17550	18041						
760	%N1	84.0	88.3	90.3	92.5						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16350	16643	16893	17295						
720	%N1	83.2	87.5	89.4	91.4	94.2					
	MACH	.488	.535	.556	.578	.600					
	KIAS	270	270	270	270	270					
	FF/ENG	15899	16146	16324	16639	17073					
680	%N1	81.4	85.8	87.8	89.6	91.8					
	MACH	.475	.521	.542	.564	.587					
	KIAS	263	263	263	263	264					
	FF/ENG	14938	15104	15281	15498	15865					
640	%N1	79.5	83.9	86.0	87.8	89.7	92.1				
	MACH	.461	.506	.526	.548	.570	.594				
	KIAS	255	255	255	255	256	256				
	FF/ENG	13989	14087	14216	14393	14638	14997				
600	%N1	77.6	82.1	84.1	86.0	87.7	89.7	92.5			
	MACH	.447	.491	.511	.531	.553	.576	.600			
	KIAS	247	247	247	247	248	248	248			
	FF/ENG	13042	13113	13185	13337	13490	13756	14123			
560	%N1	75.5	80.0	82.0	84.0	85.8	87.6	89.6	92.7		
	MACH	.433	.475	.494	.514	.535	.557	.581	.606		
	KIAS	239	239	239	239	239	240	240	240		
	FF/ENG	12107	12162	12207	12291	12445	12584	12856	13237		
520	%N1	73.3	77.8	79.8	81.8	83.7	85.4	87.3	89.4	92.8	
	MACH	.418	.459	.477	.496	.516	.538	.560	.584	.610	
	KIAS	231	231	231	231	231	231	231	232	232	
	FF/ENG	11193	11213	11263	11306	11394	11539	11679	11939	12332	
480	%N1	71.1	75.5	77.4	79.4	81.3	83.2	85.0	86.8	89.1	92.8
	MACH	.402	.442	.459	.478	.497	.517	.539	.562	.587	.614
	KIAS	222	222	222	222	222	222	222	222	223	223
	FF/ENG	10294	10279	10324	10368	10407	10495	10627	10769	11006	11406
440	%N1	68.6	73.1	75.0	76.8	78.9	80.7	82.7	84.4	86.2	88.5
	MACH	.387	.425	.442	.460	.478	.498	.519	.540	.563	.588
	KIAS	213	213	213	213	213	213	213	213	213	214
	FF/ENG	9429	9422	9440	9486	9514	9547	9627	9739	9856	10065
400	%N1	66.5	71.0	72.8	74.7	76.7	78.7	80.4	82.3	84.0	85.9
	MACH	.375	.413	.429	.446	.465	.484	.504	.525	.548	.571
	KIAS	207	207	207	207	207	207	207	207	207	207
	FF/ENG	8736	8731	8729	8756	8786	8810	8845	8930	9028	9136
360	%N1	64.3	68.7	70.5	72.3	74.4	76.4	78.2	79.9	81.8	83.6
	MACH	.363	.399	.415	.432	.450	.468	.488	.508	.530	.553
	KIAS	200	200	200	200	200	200	200	200	200	200
	FF/ENG	8041	8029	8026	8031	8049	8072	8095	8137	8220	8303

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
316	284	257	235	216	200	189	180	171	162	155
634	570	515	470	433	400	379	359	341	326	312
956	859	774	706	650	600	568	539	512	489	468
1282	1149	1035	943	867	800	757	718	683	651	623
1610	1442	1297	1180	1084	1000	947	898	853	813	778
1942	1737	1560	1419	1302	1200	1136	1077	1024	976	933
2276	2034	1825	1658	1520	1400	1325	1256	1193	1137	1087
2614	2333	2091	1898	1739	1600	1514	1434	1362	1298	1241
2954	2634	2358	2138	1958	1800	1702	1613	1531	1459	1394
3297	2936	2626	2379	2176	2000	1891	1791	1701	1619	1547
3642	3240	2894	2620	2396	2200	2080	1969	1869	1780	1700
3991	3546	3164	2862	2615	2400	2268	2147	2037	1939	1852
4342	3853	3435	3104	2835	2600	2456	2324	2205	2098	2004
4697	4164	3707	3347	3055	2800	2644	2502	2373	2258	2156
5054	4476	3981	3591	3275	3000	2832	2679	2541	2416	2307
5414	4789	4255	3836	3495	3200	3020	2856	2708	2575	2458
5778	5105	4531	4081	3716	3400	3208	3033	2875	2734	2609
6146	5424	4808	4326	3937	3600	3396	3210	3041	2891	2759
6516	5744	5086	4572	4159	3800	3584	3386	3208	3049	2909
6889	6066	5365	4819	4380	4000	3772	3564	3375	3207	3059

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	15.5	0:49	14.1	0:47	12.4	0:44	11.4	0:42	10.6	0:40
400	31.3	1:36	29.1	1:31	26.2	1:24	24.6	1:20	23.3	1:15
600	47.2	2:24	44.0	2:16	40.0	2:04	37.8	1:57	36.1	1:51
800	62.4	3:12	58.4	3:02	53.3	2:46	50.5	2:36	48.3	2:27
1000	77.7	4:01	72.9	3:47	66.7	3:27	63.2	3:15	60.5	3:03
1200	92.4	4:51	86.8	4:34	79.6	4:10	75.4	3:55	72.2	3:40
1400	107.2	5:41	100.8	5:21	92.5	4:52	87.7	4:34	84.0	4:17
1600	121.4	6:32	114.3	6:08	105.0	5:35	99.5	5:14	95.4	4:55
1800	135.6	7:23	127.8	6:56	117.5	6:18	111.4	5:55	106.8	5:32
2000	149.4	8:15	140.8	7:45	129.6	7:02	122.9	6:36	117.8	6:10
2200	163.1	9:07	153.9	8:34	141.7	7:46	134.4	7:17	128.8	6:49
2400	176.4	10:01	166.5	9:23	153.4	8:31	145.6	7:58	139.5	7:28
2600	189.6	10:54	179.1	10:13	165.0	9:16	156.7	8:40	150.1	8:07
2800	202.5	11:49	191.2	11:04	176.4	10:02	167.5	9:23	160.4	8:46
3000	215.3	12:44	203.4	11:55	187.7	10:47	178.3	10:05	170.7	9:26
3200	227.7	13:40	215.1	12:47	198.7	11:34	188.7	10:49	180.7	10:06
3400	240.1	14:36	226.9	13:39	209.6	12:21	199.2	11:32	190.7	10:46
3600	252.1	15:33	238.3	14:32	220.3	13:08	209.3	12:16	200.3	11:27
3800	264.1	16:30	249.6	15:26	230.9	13:56	219.4	13:00	210.0	12:08
4000	275.9	17:28	260.7	16:20	241.3	14:44	229.3	13:45	219.4	12:50

GEAR DOWN**Long Range Cruise Enroute Fuel and Time****Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
20	-2.9	-2.0	-1.1	0.0	1.7	4.0	6.6	9.5
40	-6.3	-4.3	-2.2	0.0	3.2	7.4	12.3	18.0
60	-9.7	-6.5	-3.3	0.0	4.7	10.7	17.8	25.9
80	-12.9	-8.7	-4.4	0.0	6.2	13.9	22.9	33.3
100	-16.1	-10.8	-5.5	0.0	7.6	16.8	27.7	40.2
120	-19.2	-12.9	-6.5	0.0	8.9	19.7	32.2	46.5
140	-22.2	-15.0	-7.6	0.0	10.2	22.3	36.3	52.3
160	-25.2	-17.0	-8.6	0.0	11.5	24.8	40.2	57.6
180	-28.0	-19.0	-9.6	0.0	12.7	27.2	43.7	62.3
200	-30.8	-20.9	-10.6	0.0	13.8	29.4	46.9	66.5
220	-33.5	-22.8	-11.6	0.0	14.9	31.5	49.8	70.1
240	-36.2	-24.7	-12.6	0.0	16.0	33.4	52.3	73.3
260	-38.7	-26.5	-13.6	0.0	17.0	35.1	54.5	75.8
280	-41.2	-28.2	-14.5	0.0	17.9	36.7	56.4	77.9

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30+80

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	35	39	43	48	52	56	60	64	69	73
TIME (MINUTES)	11	12	12	13	14	15	15	16	17	17

GEAR DOWN

**Holding
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
800	%N1	76.4						
	KIAS	262						
	FF/ENG	17280						
760	%N1	75.4	78.5					
	KIAS	262	262					
	FF/ENG	16690	16710					
720	%N1	73.9	76.9					
	KIAS	256	256					
	FF/ENG	15790	15760					
680	%N1	72.1	75.1	79.6				
	KIAS	248	248	248				
	FF/ENG	14820	14790	14740				
640	%N1	70.2	73.3	77.7				
	KIAS	241	241	241				
	FF/ENG	13860	13840	13780				
600	%N1	68.5	71.7	76.1				
	KIAS	236	236	236				
	FF/ENG	13050	13040	12960				
560	%N1	66.9	69.9	74.3	78.9			
	KIAS	231	231	231	231			
	FF/ENG	12270	12260	12180	12240			
520	%N1	65.3	68.1	72.5	77.1	81.9		
	KIAS	225	225	225	225	225		
	FF/ENG	11520	11490	11400	11430	11550		
480	%N1	63.6	66.3	70.7	75.2	80.0		
	KIAS	220	220	220	220	220		
	FF/ENG	10800	10750	10660	10660	10770		
440	%N1	61.7	64.5	68.6	73.1	77.8	82.7	
	KIAS	213	213	213	213	213	213	
	FF/ENG	10080	10000	9900	9890	9980	10110	
400	%N1	59.8	62.5	66.5	71.0	75.6	80.4	85.0
	KIAS	207	207	207	207	207	207	207
	FF/ENG	9380	9290	9170	9170	9210	9290	9520
360	%N1	57.7	60.4	64.3	68.7	73.3	78.2	82.7
	KIAS	200	200	200	200	200	200	200
	FF/ENG	8670	8580	8440	8430	8440	8500	8680

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

**Holding
Flaps 1**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
800	%N1	76.0	79.1	84.0	88.5	94.6
	KIAS	242	242	242	242	242
	FF/ENG	16960	17050	17030	17300	18200
760	%N1	74.9	78.0	82.7	87.3	92.6
	KIAS	242	242	242	242	242
	FF/ENG	16320	16370	16340	16570	17270
720	%N1	73.3	76.4	80.9	85.7	90.6
	KIAS	236	236	236	236	236
	FF/ENG	15370	15390	15380	15540	16070
680	%N1	71.5	74.5	78.9	83.9	88.7
	KIAS	228	228	228	228	228
	FF/ENG	14380	14390	14380	14500	14850
640	%N1	69.4	72.6	77.0	81.9	86.7
	KIAS	221	221	221	221	221
	FF/ENG	13410	13410	13390	13510	13770
600	%N1	67.6	70.8	75.2	79.9	84.9
	KIAS	216	216	216	216	216
	FF/ENG	12590	12580	12530	12660	12860
560	%N1	65.9	68.9	73.3	77.9	83.0
	KIAS	211	211	211	211	211
	FF/ENG	11790	11760	11700	11810	11950
520	%N1	64.1	66.9	71.3	75.8	81.0
	KIAS	205	205	205	205	205
	FF/ENG	11000	10950	10880	10950	11070
480	%N1	62.2	64.9	69.3	73.8	78.7
	KIAS	200	200	200	200	200
	FF/ENG	10250	10170	10090	10130	10240
440	%N1	60.1	62.8	66.9	71.4	76.2
	KIAS	193	193	193	193	193
	FF/ENG	9480	9380	9290	9300	9400
400	%N1	57.9	60.7	64.6	69.1	73.7
	KIAS	187	187	187	187	187
	FF/ENG	8740	8640	8520	8500	8570
360	%N1	55.6	58.2	62.2	66.4	71.0
	KIAS	180	180	180	180	180
	FF/ENG	8010	7900	7760	7710	7760

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight
Gear Down, Engine INOP

Chapter PI
Section 66

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		VREF30 + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
700	674	253	5200	4000	1700
660	635	246	7100	6200	4600
620	596	239	9100	8400	7200
580	557	232	10900	10200	9100
540	519	227	12700	12100	10900
500	480	222	14500	14000	12900
460	442	216	16500	15900	15000
420	404	210	18600	18200	17000
380	366	203	20800	20500	19700

GEAR DOWN

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
740	800		
720	2200		
700	3600	1100	
680	4600	2700	
660	5600	4200	1400
640	6600	5400	3200
620	7600	6700	4800
600	8700	7900	6300
580	9700	9000	7900
560	10700	10100	9000
540	11700	11000	9900
520	12700	12000	10900
500	13600	13000	11800
480	14500	14000	12900
460	15500	15100	14000
440	16600	16000	15100
420	17700	17000	16100
400	18800	18400	17200
380	20000	19800	18700
360	21200	20800	20100

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
680	%N1	97.1						
	MACH	.418						
	KIAS	253						
	FF/ENG	29597						
640	%N1	94.7	97.1					
	MACH	.407	.421					
	KIAS	246	246					
	FF/ENG	27548	27915					
600	%N1	92.6	94.4	97.1				
	MACH	.395	.409	.423				
	KIAS	239	239	238				
	FF/ENG	25711	25775	26281				
560	%N1	90.5	92.1	94.1	97.1			
	MACH	.383	.396	.410	.425			
	KIAS	232	231	231	231			
	FF/ENG	23975	23881	24040	24623			
520	%N1	88.5	90.1	91.9	94.1	97.5		
	MACH	.372	.386	.400	.415	.431		
	KIAS	225	225	225	225	225		
	FF/ENG	22233	22269	22345	22621	23249		
480	%N1	86.4	88.2	89.8	91.7	94.1	97.9	
	MACH	.363	.376	.391	.405	.421	.437	
	KIAS	220	220	220	220	220	220	
	FF/ENG	20677	20727	20792	20944	21208	21887	
440	%N1	84.0	85.9	87.7	89.4	91.3	93.8	97.9
	MACH	.353	.366	.380	.394	.409	.425	.442
	KIAS	213	213	213	213	213	213	213
	FF/ENG	19092	19110	19166	19293	19457	19720	20473
400	%N1	81.5	83.5	85.3	87.2	89.0	90.9	93.5
	MACH	.342	.355	.368	.382	.397	.413	.429
	KIAS	207	207	207	207	207	207	207
	FF/ENG	17577	17577	17585	17695	17852	18003	18297
360	%N1	78.9	80.7	82.7	84.6	86.5	88.3	90.2
	MACH	.331	.343	.356	.370	.384	.399	.415
	KIAS	200	200	200	200	200	200	200
	FF/ENG	16044	16055	16035	16082	16230	16375	16525
								16831

GEAR DOWN**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Diversion Fuel and Time
Fuel Required Adjustment (1000 LB)**

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
15	-2.5	-1.7	-0.8	0.0	1.6	3.3	5.2	7.3
20	-3.4	-2.3	-1.1	0.0	2.1	4.4	7.0	9.9
25	-4.3	-2.8	-1.4	0.0	2.6	5.5	8.8	12.5
30	-5.2	-3.4	-1.7	0.0	3.0	6.5	10.5	14.9
35	-6.0	-4.0	-2.0	0.0	3.5	7.6	12.2	17.4
40	-6.9	-4.6	-2.3	0.0	3.9	8.5	13.8	19.7
45	-7.8	-5.2	-2.6	0.0	4.4	9.5	15.4	22.0
50	-8.7	-5.8	-2.9	0.0	4.8	10.4	16.9	24.3
55	-9.6	-6.4	-3.2	0.0	5.2	11.3	18.4	26.5
60	-10.5	-7.0	-3.5	0.0	5.6	12.2	19.9	28.6
65	-11.4	-7.6	-3.8	0.0	6.0	13.1	21.3	30.7
70	-12.3	-8.2	-4.0	0.0	6.3	13.9	22.7	32.7
75	-13.1	-8.7	-4.3	0.0	6.7	14.7	24.0	34.6
80	-14.0	-9.3	-4.6	0.0	7.0	15.4	25.3	36.5
85	-14.9	-9.9	-4.9	0.0	7.3	16.1	26.5	38.4
90	-15.8	-10.5	-5.2	0.0	7.6	16.8	27.7	40.1

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
760	%N1	96.6			
	KIAS	262			
	FF/ENG	34160			
720	%N1	94.7			
	KIAS	256			
	FF/ENG	32150			
680	%N1	92.8	96.4		
	KIAS	248	248		
	FF/ENG	30210	30360		
640	%N1	90.8	94.0		
	KIAS	241	241		
	FF/ENG	28280	28220		
600	%N1	89.1	92.1	98.5	
	KIAS	236	236	236	
	FF/ENG	26550	26560	27770	
560	%N1	87.2	90.3	95.3	
	KIAS	231	231	231	
	FF/ENG	24850	25010	25470	
520	%N1	85.2	88.5	92.8	
	KIAS	225	225	225	
	FF/ENG	23170	23340	23590	
480	%N1	83.0	86.4	90.7	97.9
	KIAS	220	220	220	220
	FF/ENG	21570	21710	21890	22980
440	%N1	80.7	84.0	88.5	93.8
	KIAS	213	213	213	213
	FF/ENG	19930	20050	20190	20710
400	%N1	78.4	81.5	86.3	90.9
	KIAS	207	207	207	207
	FF/ENG	18360	18460	18510	18900
360	%N1	76.0	78.9	83.6	88.3
	KIAS	200	200	200	200
	FF/ENG	16800	16850	16850	17190

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight**Text****Chapter PI****Section 67**

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. 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 Flight Manual, the Flight Manual shall always take precedence.

General**FMC Takeoff Speeds**

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. 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.

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. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/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 colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush 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 is determined as follows:

- (1) Determine the dry field/obstacle limit weight for the takeoff flap setting.
- (2) 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.
- (3) Adjust field length available for temperature by amount shown on chart.
- (4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Takeoff speed determination:

(1) Determine takeoff speeds V_1 , V_R and V_2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If $V_1(\text{MCG})$ limited, set $V_1 = V_1(\text{MCG})$. If not limited by $V_1(\text{MCG})$ considerations, enter the V_1 Adjustment table with actual brake release weight to determine the V_1 reduction to apply to V_1 speed. If the adjusted V_1 is less than $V_1(\text{MCG})$, set $V_1 = V_1(\text{MCG})$.

Slippery Runway

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. Good reported braking action denotes wet runway conditions or runways covered by compact snow. Similarly, poor braking action denotes runways covered with wet ice. Performance is based on reversers operating and 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.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V_1 less than minimum V_1 for control on the ground, $V_1(\text{MCG})$, and V_R less than minimum V_R , $(1.05) \text{ VMCA}$. It is therefore necessary to compare the adjusted V_1 and V_R to $V_1(\text{MCG})$ and Minimum V_R respectively. To find $V_1(\text{MCG})$ and Minimum V_R , enter the $V_1(\text{MCG})$, Minimum V_R table with the airport pressure altitude and actual OAT. If the adjusted V_1 is less than $V_1(\text{MCG})$, set V_1 equal to $V_1(\text{MCG})$. If the adjusted V_R is less than Min V_R , set V_R equal to Min V_R and determine a new V_2 by adding the difference between the normal V_R and Min V_R to the normal V_2 . No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around %N1

To find Go-Around %N1 based on normal engine bleed for packs on and anti-ice off, enter the Go-Around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for engine bleeds for various conditions.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables 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 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 at two center of gravity positions: 7.5% MAC (FMC default) for use when no center of gravity is entered on the PERF INIT page, and 30% MAC (typical mid cruise center of gravity) for use when 30% MAC is entered. Crews may interpolate between these values to determine the airplane's capability at other specific center of gravity positions. Note that these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 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, .84 Mach approximates the Long Range Cruise Mach schedule.

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 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 .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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.

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 at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. 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 30 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 for the selected flap setting. Flaps 1 is based on VREF30 + 60 speed schedule. 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

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

The table "Approach or Landing Climb Limited Weight" presents the data which are the more limiting of Approach Climb Limit Weight and Landing Climb Limit Weight.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding 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.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy 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 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, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

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 Mach number of .84 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 engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude 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/Cruise 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 correct 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 Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC 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 PENALTY (LB/HR)				
	GROSS WEIGHT (1000 LB)				
	700	600	500	400	300
43				360	310
39			420	360	310
35		470	420	380	300
31	520	500	450	370	310
25	510	490	440	380	340
20	520	520	460	410	360
15	520	520	480	440	400
10	540	520	510	490	440
5	590	590	570	530	480

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 .84/310/250 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 corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required 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 is planned. The tables show gear down rate of climb available for Flaps 20, Flaps 25 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

For most conditions, no takeoff speed adjustments or other performance adjustments other than takeoff power setting adjustments are required for operation of EEC in the ALTERNATE mode. For pressure altitudes between -2000 feet and -1000 feet and temperatures greater than ISA + 15°C, a thrust reduction occurs with EEC in the ALTERNATE mode. Performance software must be used to account for appropriate takeoff performance in this environmental region.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. 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 will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

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 70

777F GE90-110B1L KG M EASA TALPA

Pkg Model Identification PI.ModID.70.1

General PI.70.1

VREF PI.70.1

Flap Maneuver Speed PI.70.3

Slush/Standing Water Takeoff..... PI.70.4

Slippery Runway Takeoff..... PI.70.8

Minimum Control Speeds..... PI.70.12

Go-around %N1 PI.70.13

Max Climb %N1..... PI.70.14

Flight With Unreliable Airspeed / Turbulent Air Penetration PI.70.15

All Engine PI.71.1

Long Range Cruise Maximum Operating Altitude..... PI.71.1

Long Range Cruise Control PI.71.3

Long Range Cruise Enroute Fuel and Time - Low Altitude.. PI.71.4

Long Range Cruise Enroute Fuel and Time - High Altitude . PI.71.5

Long Range Cruise Wind-Altitude Trade..... PI.71.7

Descent at .84M/310/250 PI.71.7

Holding..... PI.71.8

Advisory Information..... PI.72.1

Runway Surface Condition Correlation PI.72.1

Normal Configuration Landing Distance PI.72.2

Non-Normal Configuration Landing Distance PI.72.8

Airspeed Unreliable (Flaps 20) PI.72.8

ANTISKID (Flaps 25)..... PI.72.9

ANTISKID (Flaps 30)..... PI.72.10

ENG SHUTDOWN L, R (Flaps 20) PI.72.11

ENG SHUTDOWN L, R (Flaps 30) PI.72.12

FLAP / SLAT CONTROL (Flaps 20)	PI.72.13
FLAPS DRIVE (Flaps ≤ 5)	PI.72.14
FLAPS DRIVE (5 < Flaps < 20)	PI.72.15
FLAPS DRIVE (Flaps ≥ 20)	PI.72.16
FLAPS PRIMARY FAIL (Flaps 20)	PI.72.17
FLIGHT CONTROL MODE (Flaps 20)	PI.72.18
FLIGHT CONTROLS (Flaps 20)	PI.72.19
HYD PRESS SYS C (Flaps 20)	PI.72.20
HYD PRESS SYS L (Flaps 25)	PI.72.21
HYD PRESS SYS L (Flaps 30)	PI.72.22
HYD PRESS SYS L+C (Flaps 20)	PI.72.23
HYD PRESS SYS L+R (Flaps 20)	PI.72.24
HYD PRESS SYS R (Flaps 25)	PI.72.25
HYD PRESS SYS R (Flaps 30)	PI.72.26
HYD PRESS SYS R+C (Flaps 20)	PI.72.27
PITCH DOWN AUTHORITY (Flaps 25)	PI.72.28
PITCH DOWN AUTHORITY (Flaps 30)	PI.72.29
PITCH UP AUTHORITY (Flaps ≤ 15)	PI.72.30
PITCH UP AUTHORITY (Flaps ≥ 20)	PI.72.31
PRI FLIGHT COMPUTERS (Flaps 20)	PI.72.32
SLATS DRIVE (Flaps 20)	PI.72.33
SPOILERS (Flaps 25)	PI.72.34
SPOILERS (Flaps 30)	PI.72.35
STABILIZER (Flaps 20)	PI.72.36
Approach or Landing Climb Limited Weight	PI.72.37
Recommended Brake Cooling Schedule.	PI.72.39

Engine Inoperative PI.73.1

Initial Max Continuous %N1	PI.73.1
Max Continuous %N1	PI.73.2
Driftdown Speed/Level Off Altitude.	PI.73.5
Driftdown/LRC Cruise Range Capability.	PI.73.6
Long Range Cruise Altitude Capability	PI.73.7
Long Range Cruise Control	PI.73.8

777 Flight Crew Operations Manual

Long Range Cruise Diversion Fuel and Time	PI.73.9
Holding	PI.73.10
Gear Down Landing Rate of Climb Available	PI.73.11
Alternate Mode EEC	PI.74.1
Alternate Mode EEC Max Takeoff %N1	PI.74.1
Gear Down	PI.75.1
220 KIAS Max Climb %N1	PI.75.1
Long Range Cruise Altitude Capability	PI.75.2
Long Range Cruise Control	PI.75.3
Long Range Cruise Enroute Fuel and Time	PI.75.4
Descent at VREF30 + 80	PI.75.5
Holding	PI.75.6
Gear Down, Engine Inoperative	PI.76.1
Driftdown Speed/Level Off Altitude	PI.76.1
Long Range Cruise Altitude Capability	PI.76.1
Long Range Cruise Control	PI.76.2
Long Range Cruise Diversion Fuel and Time	PI.76.3
Holding	PI.76.4
Text	PI.77.1
Introduction	PI.77.1
General	PI.77.1
All Engines	PI.77.5
Advisory Information	PI.77.6
Engine Inoperative	PI.77.9
Alternate Mode EEC	PI.77.12
Gear Down	PI.77.12

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Performance Inflight
Pkg Model Identification**Chapter PI**
Section 70**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.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
300	777-300	7300	WY300

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Performance Inflight General	Chapter PI Section 70
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VREF
Flaps 30

WEIGHT (KG)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360000	186	186	186	186	187	187
340000	180	180	180	180	180	180
320000	173	173	173	173	173	173
300000	164	164	164	164	164	165
280000	158	158	158	158	158	158
260000	149	149	149	150	150	150
240000	143	144	144	144	144	144
220000	137	137	138	138	138	138
200000	137	134	131	131	131	131
180000	137	134	130	126	124	124
160000	137	134	130	126	121	117
154221	137	134	130	126	121	116
154220 & BELOW	143	140	137	134	132	128

Flaps 25

WEIGHT (KG)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360000	185	185	185	185	185	185
340000	180	180	180	180	181	181
320000	175	175	175	175	175	176
300000	169	170	170	170	170	170
280000	164	164	164	164	164	164
260000	158	158	158	158	158	158
240000	152	152	152	152	152	152
220000	145	145	146	146	146	146
200000	139	139	139	139	139	139
180000	137	134	131	131	131	132
160000	137	134	130	126	124	124
154221	137	134	130	126	124	124
154220 & BELOW	143	140	137	134	132	128

VREF

Flaps 20

WEIGHT (KG)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
360000	195	195	195	196	196	198
340000	190	190	190	191	191	192
320000	185	185	185	185	185	186
300000	179	179	179	179	180	180
280000	173	173	173	173	174	174
260000	167	167	167	167	167	167
240000	160	160	161	161	161	161
220000	154	154	154	154	154	154
200000	147	147	147	147	147	147
180000	139	139	139	139	139	139
160000	137	134	131	131	131	131
154221	137	134	130	128	128	129
154220 & BELOW	143	140	137	134	132	129

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS 0	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
Weight Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
400	-46.6	-52.1	-57.5	-54.5	-60.0	-65.4	-68.0	-73.4	-78.9
380	-43.7	-49.1	-54.6	-51.1	-56.5	-61.9	-63.3	-68.8	-74.2
360	-40.8	-46.2	-51.7	-47.6	-53.0	-58.5	-58.7	-64.2	-69.6
340	-37.8	-43.2	-48.7	-44.0	-49.5	-54.9	-54.0	-59.5	-64.9
320	-34.7	-40.1	-45.6	-40.3	-45.7	-51.2	-49.2	-54.6	-60.0
300	-31.4	-36.8	-42.3	-36.3	-41.8	-47.2	-44.1	-49.6	-55.0
280	-27.9	-33.4	-38.8	-32.2	-37.7	-43.1	-38.9	-44.3	-49.8
260	-24.4	-29.8	-35.2	-27.9	-33.3	-38.8	-33.5	-38.9	-44.4
240	-20.6	-26.0	-31.5	-23.4	-28.8	-34.3	-27.9	-33.4	-38.8
220	-16.7	-22.1	-27.6	-18.7	-24.1	-29.5	-22.2	-27.6	-33.1
200	-12.6	-18.1	-23.5	-13.8	-19.2	-24.6	-16.3	-21.7	-27.1
180	-8.4	-13.9	-19.3	-8.6	-14.1	-19.5	-10.2	-15.6	-21.1
160	-4.2	-9.6	-15.0	-3.5	-8.9	-14.4	-4.0	-9.4	-14.9

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2200				133.1			154.8		
2400	154.6			167.7			189.4		
2600	188.9	124.0		202.3	136.9		224.3	158.6	
2800	223.6	158.3		237.3	171.5		259.5	193.2	127.8
3000	258.7	192.7	127.7	272.7	206.1	140.7	295.1	228.1	162.4
3200	294.3	227.4	162.1	308.6	241.2	175.3	331.1	263.4	197.0
3400	330.4	262.6	196.5	345.0	276.7	210.0	367.5	299.0	232.0
3600	367.0	298.3	231.3	381.7	312.6	245.0		335.1	267.3
3800		334.4	266.5		349.0	280.6		371.5	303.0
4000		371.1	302.2		385.8	316.6			339.1
4200			338.5			353.0			375.5
4400			375.1			389.8			

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 -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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-29	-27	-25	-25	-23	-21	-16	-14	-12
340	-31	-29	-27	-26	-24	-22	-17	-15	-13
320	-32	-30	-28	-27	-25	-23	-18	-16	-14
300	-32	-30	-28	-28	-26	-24	-19	-17	-15
280	-32	-30	-28	-28	-26	-24	-20	-18	-16
260	-32	-30	-28	-28	-26	-24	-22	-20	-18
240	-31	-29	-27	-29	-27	-25	-23	-21	-19
220	-31	-29	-27	-29	-27	-25	-24	-22	-20
200	-31	-29	-27	-29	-27	-25	-25	-23	-21
180	-31	-29	-27	-30	-28	-26	-26	-24	-22
160	-32	-30	-28	-30	-28	-26	-27	-25	-23

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 Adjustment (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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
400	-61.2	-66.6	-72.1	-70.8	-76.3	-81.7	-86.6	-92.0	-97.5
380	-57.3	-62.8	-68.2	-66.2	-71.6	-77.0	-80.3	-85.7	-91.2
360	-53.5	-59.0	-64.4	-61.5	-66.9	-72.4	-74.0	-79.4	-84.9
340	-49.7	-55.1	-60.5	-56.7	-62.2	-67.6	-67.7	-73.1	-78.6
320	-45.7	-51.1	-56.5	-51.9	-57.4	-62.8	-61.4	-66.8	-72.3
300	-41.5	-47.0	-52.4	-47.0	-52.4	-57.9	-55.1	-60.5	-66.0
280	-37.3	-42.7	-48.1	-42.0	-47.4	-52.8	-48.8	-54.3	-59.7
260	-32.9	-38.3	-43.8	-36.8	-42.3	-47.7	-42.6	-48.0	-53.5
240	-28.3	-33.8	-39.2	-31.6	-37.0	-42.5	-36.3	-41.8	-47.2
220	-23.7	-29.1	-34.6	-26.2	-31.7	-37.1	-30.1	-35.5	-41.0
200	-18.9	-24.3	-29.8	-20.8	-26.2	-31.7	-23.9	-29.3	-34.8
180	-14.0	-19.4	-24.9	-15.3	-20.7	-26.1	-17.7	-23.1	-28.6
160	-9.0	-14.5	-19.9	-9.7	-15.1	-20.6	-11.5	-16.9	-22.4

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
3200							130.5		
3400							177.6		
3600							223.1	127.1	
3800				166.4			265.4	174.2	
4000	133.8			220.4			304.9	220.0	123.7
4200	198.1			267.2	162.3		342.1	262.4	170.8
4400	251.9	129.2		308.9	216.8		377.7	302.1	216.8
4600	297.1	193.7		347.0	264.0	158.3		339.5	259.5
4800	336.8	248.3	124.5	382.7	306.1	213.1		375.2	299.3
5000	372.9	294.0	189.3		344.3	260.8			336.9
5200		334.1	244.8		380.1	303.2			372.6
5400		370.4	290.9			341.7			
5600			331.3			377.6			

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 -100 m/+100 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-45	-41	-37	-39	-35	-31	-26	-22	-18
340	-47	-43	-39	-40	-36	-32	-27	-23	-19
320	-47	-43	-39	-42	-38	-34	-29	-25	-21
300	-48	-44	-40	-43	-39	-35	-31	-27	-23
280	-48	-44	-40	-43	-39	-35	-33	-29	-25
260	-48	-44	-40	-44	-40	-36	-35	-31	-27
240	-47	-43	-39	-44	-40	-36	-37	-33	-29
220	-47	-43	-39	-45	-41	-37	-39	-35	-31
200	-48	-44	-40	-46	-42	-38	-41	-37	-33
180	-48	-44	-40	-47	-43	-39	-43	-39	-35
160	-49	-45	-41	-48	-44	-40	-44	-40	-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
Maximum 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
400	0.0	-0.1	-1.9	-20.7	-22.5	-24.4	-40.6	-42.4	-44.2
380	-1.2	-3.0	-4.8	-22.4	-24.2	-26.0	-40.6	-42.4	-44.2
360	-4.1	-6.0	-7.8	-24.1	-25.9	-27.7	-40.6	-42.4	-44.2
340	-6.6	-8.4	-10.2	-25.3	-27.1	-28.9	-40.2	-42.0	-43.8
320	-7.8	-9.6	-11.5	-25.1	-27.0	-28.8	-38.6	-40.4	-42.3
300	-7.8	-9.6	-11.4	-23.8	-25.6	-27.4	-36.0	-37.8	-39.6
280	-6.9	-8.7	-10.5	-21.4	-23.2	-25.1	-32.6	-34.4	-36.2
260	-5.9	-7.7	-9.6	-19.1	-20.9	-22.7	-29.1	-30.9	-32.7
240	-5.0	-6.8	-8.6	-16.8	-18.6	-20.4	-25.5	-27.4	-29.2
220	-4.1	-5.9	-7.8	-14.5	-16.3	-18.1	-22.0	-23.8	-25.6
200	-3.3	-5.1	-6.9	-12.2	-14.0	-15.8	-18.4	-20.2	-22.0
180	-2.5	-4.3	-6.1	-9.9	-11.7	-13.5	-14.8	-16.6	-18.4
160	-1.6	-3.5	-5.3	-7.7	-9.5	-11.3	-11.1	-13.0	-14.8

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
1600	142.0								
1800	209.7	143.6							
2000	277.1	211.3	145.2						
2200	344.2	278.7	212.9	167.0					
2400		345.8	280.3	215.2	150.7				
2600			347.4	265.0	198.6	134.3	138.0		
2800				316.4	247.8	182.2	169.4		
3000				369.7	298.6	230.8	201.0	137.6	
3200					351.3	281.0	233.5	169.0	
3400						333.1	267.0	200.6	137.2
3600						386.8	301.7	233.1	168.7
3800							337.7	266.6	200.2
4000							374.9	301.3	232.7
4200								337.2	266.2
4400								374.5	300.8

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 -35 m/+35 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 Maximum Reverse Thrust V1 Adjustments (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-9	-7	-5	-21	-19	-17	-36	-34	-32
340	-11	-9	-7	-24	-22	-20	-39	-37	-35
320	-13	-11	-9	-26	-24	-22	-41	-39	-37
300	-13	-11	-9	-27	-25	-23	-42	-40	-38
280	-14	-12	-10	-28	-26	-24	-43	-41	-39
260	-14	-12	-10	-28	-26	-24	-44	-42	-40
240	-14	-12	-10	-29	-27	-25	-45	-43	-41
220	-15	-13	-11	-29	-27	-25	-45	-43	-41
200	-16	-14	-12	-30	-28	-26	-46	-44	-42
180	-17	-15	-13	-32	-30	-28	-47	-45	-43
160	-18	-16	-14	-33	-31	-29	-48	-46	-44

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 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
400	-5.8	-7.7	-9.5	-36.3	-38.1	-39.9	-61.5	-63.3	-65.1
380	-8.4	-10.2	-12.0	-36.6	-38.4	-40.2	-59.5	-61.3	-63.1
360	-11.0	-12.8	-14.6	-36.9	-38.7	-40.5	-57.5	-59.3	-61.1
340	-13.1	-14.9	-16.7	-36.8	-38.7	-40.5	-55.2	-57.0	-58.9
320	-14.1	-15.9	-17.7	-35.9	-37.7	-39.5	-52.3	-54.1	-55.9
300	-13.9	-15.7	-17.5	-33.9	-35.7	-37.5	-48.6	-50.5	-52.3
280	-12.9	-14.7	-16.5	-31.2	-33.1	-34.9	-44.5	-46.3	-48.1
260	-11.8	-13.6	-15.4	-28.5	-30.3	-32.1	-40.3	-42.1	-43.9
240	-10.6	-12.4	-14.2	-25.6	-27.4	-29.2	-36.0	-37.8	-39.6
220	-9.4	-11.2	-13.0	-22.6	-24.4	-26.2	-31.6	-33.5	-35.3
200	-8.1	-9.9	-11.7	-19.5	-21.3	-23.1	-27.3	-29.1	-30.9
180	-6.8	-8.6	-10.4	-16.2	-18.1	-19.9	-22.8	-24.6	-26.4
160	-5.5	-7.3	-9.1	-13.0	-14.8	-16.6	-18.4	-20.2	-22.0

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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
2000	160.6								
2200	267.0	170.8							
2400	350.7	274.9	180.9						
2600		357.2	282.6						
2800			363.7						
3200				220.8					
3400				315.4	182.3				
3600				385.0	292.7	138.1			
3800					366.4	267.6			
4000						347.5			
5000							193.4		
5200							265.6	140.7	
5400							334.4	215.0	
5600								286.2	162.6

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/+35 m for every 5°C above/below 4°C.
Adjust “Medium” field length available by -60 m/+60 m for every 5°C above/below 4°C.
Adjust “Poor” field length available by -90 m/+90 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.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
360	-13	-9	-5	-31	-27	-23	-57	-53	-49
340	-15	-11	-7	-33	-29	-25	-61	-57	-53
320	-16	-12	-8	-36	-32	-28	-64	-60	-56
300	-18	-14	-10	-38	-34	-30	-67	-63	-59
280	-19	-15	-11	-40	-36	-32	-69	-65	-61
260	-20	-16	-12	-42	-38	-34	-71	-67	-63
240	-21	-17	-13	-43	-39	-35	-73	-69	-65
220	-22	-18	-14	-45	-41	-37	-75	-71	-67
200	-23	-19	-15	-47	-43	-39	-77	-73	-69
180	-24	-20	-16	-50	-46	-42	-79	-75	-71
160	-26	-22	-18	-53	-49	-45	-81	-77	-73

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.

Minimum Control Speeds

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	125	127	121	124	119	122	117	120	115	118	111	114
50	122	129	131	125	128	119	122	117	120	115	118	111	114
40	104	136	138	133	135	127	130	122	125	117	120	111	114
30	86	138	140	138	140	133	136	128	130	122	125	115	118
20	68	139	140	138	140	134	137	131	133	126	129	119	123
-60	-76	140	140	139	140	136	137	132	133	127	129	121	124

Go-around %N1

Based on engine bleed for packs on and anti-ice off

REPORTED OAT		TAT	AIRPORT PRESSURE ALTITUDE (1000 FT)												
°C	°F	°C	-2	-1	0	1	2	3	4	5	6	7	8	9	10
66	150	70	93.2	93.3	93.6	93.4	93.3	93.3	93.3	93.4	93.3	92.6	91.5	90.5	89.6
56	133	60	95.9	96.1	96.4	96.2	96.1	96.1	96.1	96.2	96.1	95.4	94.3	93.4	92.5
51	124	55	97.2	97.6	97.9	97.7	97.5	97.5	97.5	97.5	97.4	96.7	95.7	94.7	93.9
46	115	50	98.5	98.9	99.3	99.2	98.9	98.8	98.8	98.8	98.7	98.0	97.0	96.1	95.2
41	106	45	99.6	100.1	100.6	100.5	100.2	100.2	100.1	100.2	100.0	99.3	98.3	97.3	96.5
36	97	40	100.4	101.6	102.4	102.3	101.9	101.8	101.7	101.7	101.3	100.5	99.5	98.6	97.8
31	88	35	99.6	101.2	103.2	104.4	103.9	103.7	103.6	103.5	102.7	101.7	100.6	99.7	98.9
26	79	30	98.8	100.4	102.3	103.8	105.1	105.9	105.9	106.1	105.0	103.4	101.9	100.8	100.0
21	70	25	97.9	99.5	101.5	102.9	104.2	105.2	106.3	107.2	106.8	105.7	104.0	102.3	101.3
16	61	20	97.1	98.7	100.6	102.0	103.3	104.3	105.4	106.5	106.8	106.3	105.2	104.2	103.3
11	53	15	96.3	97.9	99.8	101.2	102.4	103.4	104.5	105.6	105.9	105.5	104.9	104.4	104.0
7	44	10	95.4	97.0	98.9	100.3	101.5	102.5	103.6	104.6	105.0	104.6	104.0	103.5	103.4
2	35	5	94.6	96.1	98.0	99.4	100.6	101.6	102.7	103.7	104.1	103.7	103.1	102.5	102.5
-3	26	0	93.7	95.3	97.1	98.5	99.7	100.7	101.7	102.8	103.1	102.7	102.1	101.6	101.6
-13	8	-10	92.0	93.5	95.3	96.7	97.9	98.8	99.8	100.9	101.2	100.8	100.3	99.7	99.7
-23	-10	-20	90.2	91.7	93.5	94.8	96.0	96.9	97.9	98.9	99.3	98.9	98.3	97.8	97.8
-33	-27	-30	88.4	89.9	91.7	92.9	94.1	95.0	96.0	97.0	97.3	96.9	96.4	95.9	95.8
-43	-45	-40	86.6	88.0	89.7	91.0	92.1	93.0	94.0	95.0	95.3	94.9	94.4	93.9	93.9
-53	-63	-50	84.7	86.1	87.8	89.0	90.1	91.0	91.9	92.9	93.2	92.9	92.3	91.8	91.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)												
	-2	-1	0	1	2	3	4	5	6	7	8	9	10
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
1 PACK ON	-0.2	-0.2	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	.84	.84	.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

*Packs on or packs off with 2 bleed sources.

**Packs off with 1 bleed source.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb**Flaps Up, Set Max Climb Thrust**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT V/S (FT/MIN)	5.0 2500	4.5 1500			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	6.5 3700	5.5 2600	5.5 1800	5.0 1300	4.5 900
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	9.5 5000	8.5 3600	8.0 2700	7.5 2000	7.5 1400
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	14.0 6700	11.5 4900	10.0 3700	9.5 2900	9.5 2200
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	17.5 7800	14.5 5700	12.5 4400	11.5 3500	11.0 2800

Cruise**Flaps Up, %N1 for Level Flight**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT %N1	2.0 78.6	3.0 83.2			
35000 (.82M)	PITCH ATT %N1	1.5 76.5	2.0 78.9	3.0 82.8	3.5 88.0	
30000 (280 KIAS)	PITCH ATT %N1	1.5 72.6	2.5 74.7	3.0 78.1	3.5 82.4	3.5 87.3
25000 (280 KIAS)	PITCH ATT %N1	1.5 68.6	2.5 70.7	3.5 73.8	4.0 77.7	4.0 82.3
20000 (270 KIAS)	PITCH ATT %N1	2.0 63.4	2.5 65.8	3.5 69.0	4.5 72.8	5.5 77.4
15000 (270 KIAS)	PITCH ATT %N1	1.5 59.6	2.5 61.8	3.5 65.0	4.5 68.2	5.5 72.5

Descent**Flaps Up, Set Idle Thrust**

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 KG)				
		150	200	250	300	350
40000 (.82M)	PITCH ATT V/S (FT/MIN)	-1.5 -2900	0.0 -2600			
30000 (280 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -2500	-0.5 -2000	0.5 -1900	1.0 -1900	0.5 -2400
20000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.0 -1900	0.5 -1600	1.5 -1500	2.5 -1400	3.0 -1400
10000 (270 KIAS)	PITCH ATT V/S (FT/MIN)	-1.5 -1700	0.0 -1400	1.0 -1300	2.0 -1300	3.0 -1300
SEA LEVEL (270 KIAS)	PITCH ATT V/S (FT/MIN)	-2.0 -1500	-0.5 -1300	1.0 -1200	2.0 -1200	3.0 -1200

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		150	200	250	300	350
10000	PITCH ATT	3.0	4.5	5.5	6.0	6.0
	%N1	50.2	54.4	59.1	63.9	68.2
	KIAS	216	216	226	244	262
5000	PITCH ATT	3.0	4.5	5.5	6.0	6.0
	%N1	46.6	50.9	55.4	59.7	64.2
	KIAS	216	216	226	244	262

Terminal Area (5000 FT)

%N1 for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		150	200	250	300	350
FLAPS UP GEAR UP (VREF30+80)	PITCH ATT	3.5	5.0	6.0	6.0	6.5
	%N1	46.7	51.3	56.1	60.7	65.0
	KIAS	217	217	226	244	262
FLAPS 1 GEAR UP (VREF30+60)	PITCH ATT	5.0	6.5	7.5	8.0	8.0
	%N1	47.5	52.4	57.6	62.6	66.8
	KIAS	197	197	206	224	242
FLAPS 5 GEAR UP (VREF30+40)	PITCH ATT	3.5	5.5	6.5	6.5	6.5
	%N1	47.9	52.9	58.4	63.4	67.7
	KIAS	177	177	186	204	222
FLAPS 15 GEAR UP (VREF30+20)	PITCH ATT	3.5	6.5	7.5	7.5	7.0
	%N1	48.0	54.1	60.5	65.3	69.8
	KIAS	157	157	166	184	202
FLAPS 20 GEAR DOWN (VREF30+20)	PITCH ATT	2.0	4.5	6.0	5.5	5.5
	%N1	55.2	60.2	66.1	71.7	76.6
	KIAS	157	157	166	184	202

Final Approach (1500 FT)

Gear Down, %N1 for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		150	200	250	300	350
FLAPS 20 (VREF20+10)	PITCH ATT	0.0	1.5	2.0	2.0	2.5
	%N1	36.9	40.5	44.9	49.0	52.2
	KIAS	147	157	174	189	201
FLAPS 25 (VREF25+10)	PITCH ATT	0.5	1.5	1.5	1.5	2.0
	%N1	51.8	50.0	54.5	58.9	62.8
	KIAS	147	149	165	180	191
FLAPS 30 (VREF30+10)	PITCH ATT	-0.5	0.5	1.0	1.0	1.0
	%N1	57.2	56.3	60.1	65.3	70.9
	KIAS	147	147	156	174	192

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		150	200	250	300	350
10000	PITCH ATT	22.0	17.0	14.0	11.5	9.5
	V/S (FT/MIN)	4900	3600	2800	2200	1700
	KIAS	136	151	167	185	203
5000	PITCH ATT	25.5	21.0	17.0	14.0	11.5
	V/S (FT/MIN)	6400	4500	3600	2900	2400
	KIAS	148	151	167	184	202
SEA LEVEL	PITCH ATT	28.0	23.0	19.0	15.5	13.0
	V/S (FT/MIN)	7200	5100	4000	3300	2800
	KIAS	157	157	166	184	202

Intentionally
Blank

Performance Inflight**All Engine****Chapter PI****Section 71****Long Range Cruise Maximum Operating Altitude****Max Climb Thrust****ISA + 10°C and Below**

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30(39°)	1.40(44°)	1.50(48°)
360	27300	5	30400	28800	27200
350	27900	4	31000	29400	27800
340	28500	3	31700	30000	28500
330	29200	1	32200	30500	29000
320	29900	0	32700	31000	29500
310	30600	-2	33200	31600	30000
300	31300	-4	33700	32100	30600
290	32000	-5	34300	32700	31200
280	32800	-7	34900	33300	31800
270	33600	-9	35500	33900	32400
260	34400	-11	36100	34500	33100
250	35200	-12	36800	35200	33800
240	36000	-14	37500	35900	34500
230	36900	-15	38200	36600	35200
220	37800	-15	39000	37400	36000
210	38800	-15	39800	38200	36800
200	39800	-15	40600	39000	37700
190	40900	-15	41500	39900	38600
180	42000	-15	42500	40900	39600
170	43100	-15	43100	42100	40800
160	43100	-15	43100	43100	42000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	11	30400	28800	27200
350	27900	10	31000	29400	27800
340	28500	8	31700	30000	28500
330	29200	7	32200	30500	29000
320	29900	5	32700	31000	29500
310	30600	4	33200	31600	30000
300	31300	2	33700	32100	30600
290	32000	0	34300	32700	31200
280	32800	-1	34900	33300	31800
270	33600	-3	35500	33900	32400
260	34400	-5	36100	34500	33100
250	35200	-7	36800	35200	33800
240	36000	-9	37500	35900	34500
230	36900	-9	38200	36600	35200
220	37800	-9	39000	37400	36000
210	38800	-9	39800	38200	36800
200	39800	-9	40600	39000	37700
190	40900	-9	41500	39900	38600
180	42000	-9	42500	40900	39600
170	43100	-9	43100	42100	40800
160	43100	-9	43100	43100	42000

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust
ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
360	27300	17	30400	28800	27200
350	27900	15	31000	29400	27800
340	28500	14	31700	30000	28500
330	29200	12	32200	30500	29000
320	29900	11	32700	31000	29500
310	30600	9	33200	31600	30000
300	31300	8	33700	32100	30600
290	32000	6	34300	32700	31200
280	32800	4	34900	33300	31800
270	33600	3	35500	33900	32400
260	34400	1	36100	34500	33100
250	35200	-1	36800	35200	33800
240	36000	-3	37500	35900	34500
230	36900	-3	38200	36600	35200
220	37800	-3	39000	37400	36000
210	38800	-3	39800	38200	36800
200	39800	-3	40600	39000	37700
190	40900	-3	41500	39900	38600
180	42000	-3	42500	40900	39600
170	43100	-3	43100	42100	40800
160	43100	-3	43100	43100	42000

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		25	27	29	31	33	35	37	39	41	43
360	%N1	84.0	86.0	87.6	90.1						
	MACH	.819	.840	.837	.830						
	KIAS	346	342	326	310						
	FF/ENG	5139	5211	5162	5303						
340	%N1	83.0	84.7	86.1	88.1						
	MACH	.819	.839	.840	.835						
	KIAS	346	341	328	312						
	FF/ENG	4943	4959	4875	4910						
320	%N1	81.9	83.1	84.6	86.0	88.3					
	MACH	.818	.833	.840	.839	.833					
	KIAS	346	339	327	313	297					
	FF/ENG	4735	4662	4585	4523	4633					
300	%N1	80.2	81.8	82.9	84.5	86.1					
	MACH	.800	.823	.836	.840	.837					
	KIAS	337	334	326	314	299					
	FF/ENG	4416	4391	4316	4248	4232					
280	%N1	78.4	80.1	81.6	82.9	84.4	86.2				
	MACH	.775	.806	.827	.838	.840	.836				
	KIAS	326	326	322	313	300	285				
	FF/ENG	4088	4112	4069	4004	3948	3972				
260	%N1	76.6	78.3	80.0	81.3	82.8	84.2	86.6			
	MACH	.746	.780	.810	.830	.839	.839	.834			
	KIAS	313	315	315	309	300	287	272			
	FF/ENG	3751	3796	3803	3758	3703	3653	3726			
240	%N1	74.7	76.3	78.0	79.7	81.0	82.5	84.3			
	MACH	.720	.749	.783	.813	.831	.839	.839			
	KIAS	302	302	303	303	297	287	274			
	FF/ENG	3448	3464	3501	3503	3460	3406	3378			
220	%N1	73.1	74.2	75.8	77.6	79.3	80.6	82.5	84.7		
	MACH	.701	.721	.750	.785	.815	.832	.840	.838		
	KIAS	293	289	289	291	290	284	274	261		
	FF/ENG	3203	3158	3175	3207	3211	3165	3130	3132		
200	%N1	71.1	72.5	73.6	75.2	77.0	78.8	80.4	82.7	84.9	
	MACH	.680	.700	.719	.748	.784	.814	.832	.840	.838	
	KIAS	284	280	277	276	278	277	271	262	249	
	FF/ENG	2958	2915	2872	2886	2917	2918	2888	2878	2879	
180	%N1	68.6	70.2	71.7	72.8	74.4	76.2	78.4	80.4	82.7	84.8
	MACH	.648	.675	.697	.715	.744	.780	.812	.831	.839	.839
	KIAS	270	270	267	263	263	264	264	259	250	238
	FF/ENG	2673	2665	2631	2592	2599	2622	2636	2634	2624	2609
160	%N1	65.8	67.4	69.1	70.7	71.9	73.3	75.5	78.1	80.2	82.5
	MACH	.612	.639	.667	.691	.710	.735	.772	.806	.828	.838
	KIAS	254	254	255	253	250	248	249	250	246	238
	FF/ENG	2392	2386	2375	2356	2321	2308	2335	2372	2379	2356

Shaded area approximates optimum altitude.

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
282	261	242	226	213	200	191	182	174	167	160
559	519	482	451	424	400	382	366	351	337	325
837	777	723	677	637	600	574	550	528	508	489
1115	1035	964	902	849	800	766	734	705	678	653
1395	1295	1206	1129	1061	1000	957	918	881	848	817
1675	1555	1447	1354	1273	1200	1149	1101	1057	1017	980
1956	1815	1689	1581	1486	1400	1340	1285	1234	1187	1144
2237	2075	1931	1807	1698	1600	1532	1469	1410	1356	1307
2520	2338	2174	2034	1911	1800	1723	1652	1586	1525	1470
2803	2599	2417	2260	2124	2000	1915	1835	1762	1695	1633

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	3.8	0:38	3.3	0:37	2.8	0:35	2.5	0:35	2.2	0:34
400	7.9	1:11	7.2	1:09	6.3	1:04	5.7	1:02	5.3	1:00
600	11.9	1:45	11.0	1:40	9.8	1:33	9.0	1:30	8.4	1:26
800	15.9	2:19	14.8	2:13	13.2	2:02	12.2	1:58	11.5	1:52
1000	19.9	2:53	18.6	2:45	16.6	2:31	15.4	2:26	14.5	2:19
1200	23.8	3:27	22.3	3:17	20.0	3:01	18.6	2:54	17.5	2:45
1400	27.8	4:02	26.0	3:50	23.4	3:31	21.8	3:23	20.5	3:12
1600	31.6	4:37	29.7	4:23	26.8	4:01	24.9	3:51	23.5	3:39
1800	35.5	5:12	33.3	4:56	30.1	4:31	28.1	4:19	26.5	4:06
2000	39.3	5:47	36.9	5:30	33.4	5:01	31.2	4:48	29.4	4:33

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	150	200	250	300	350
5	-0.7	-0.4	0.0	0.4	1.1
10	-1.6	-0.8	0.0	1.1	2.5
15	-2.5	-1.3	0.0	1.7	3.9
20	-3.3	-1.7	0.0	2.3	5.2
25	-4.1	-2.2	0.0	2.9	6.5
30	-4.9	-2.6	0.0	3.6	7.8
35	-5.7	-3.1	0.0	4.2	9.0
40	-6.4	-3.5	0.0	4.8	10.2

Long Range Cruise Enroute Fuel and Time - High Altitude
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
649	613	580	551	524	500	479	459	441	424	409
1286	1217	1154	1098	1047	1000	959	921	886	853	823
1926	1824	1730	1646	1570	1500	1439	1383	1330	1282	1237
2569	2432	2307	2195	2094	2000	1920	1845	1775	1710	1651
3215	3043	2886	2745	2617	2500	2400	2306	2219	2139	2065
3864	3656	3466	3296	3142	3000	2880	2768	2664	2568	2479
4516	4271	4047	3847	3666	3500	3360	3229	3108	2996	2893
5170	4888	4630	4400	4192	4000	3840	3691	3552	3424	3306
5826	5506	5214	4953	4717	4500	4320	4152	3996	3852	3719
6485	6126	5798	5506	5242	5000	4800	4613	4440	4279	4132
7146	6748	6384	6061	5768	5500	5280	5074	4883	4706	4545
7809	7371	6972	6616	6295	6000	5759	5534	5326	5133	4956
8474	7996	7559	7171	6821	6500	6238	5994	5768	5558	5367
9144	8624	8149	7728	7348	7000	6717	6454	6209	5983	5776
9818	9255	8741	8286	7876	7500	7196	6912	6649	6406	6184
10496	9889	9335	8845	8404	8000	7674	7371	7089	6829	6591
11179	10526	9932	9406	8933	8500	8153	7829	7528	7251	6997
11866	11167	10530	9968	9462	9000	8631	8286	7966	7671	7401
12559	11811	11131	10531	9993	9500	9108	8742	8403	8090	7804
13256	12459	11735	11096	10523	10000	9585	9198	8839	8508	8206

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)
500	6.9	1:10	6.7	1:10	6.5	1:10	6.4	1:10	6.4	1:11
1000	14.3	2:17	13.8	2:13	13.5	2:12	13.2	2:12	13.2	2:13
1500	21.6	3:23	21.0	3:17	20.4	3:15	20.1	3:14	20.0	3:15
2000	29.0	4:29	28.2	4:21	27.4	4:17	26.9	4:17	26.8	4:18
2500	36.0	5:37	35.1	5:27	34.2	5:21	33.5	5:19	33.2	5:20
3000	43.1	6:46	42.0	6:33	40.9	6:25	40.0	6:22	39.7	6:22
3500	49.9	7:56	48.6	7:41	47.4	7:30	46.3	7:25	45.8	7:25
4000	56.7	9:06	55.2	8:49	53.8	8:35	52.7	8:29	52.0	8:27
4500	63.2	10:18	61.6	9:59	60.1	9:42	58.7	9:34	57.9	9:31
5000	69.7	11:30	68.0	11:09	66.3	10:50	64.8	10:38	63.9	10:34
5500	76.0	12:44	74.1	12:21	72.3	11:59	70.7	11:45	69.6	11:38
6000	82.3	13:57	80.2	13:32	78.3	13:09	76.5	12:52	75.3	12:42
6500	88.4	15:13	86.1	14:46	84.1	14:21	82.1	14:01	80.7	13:48
7000	94.5	16:28	92.0	15:59	89.8	15:32	87.8	15:10	86.2	14:54
7500	100.4	17:46	97.7	17:14	95.4	16:46	93.2	16:21	91.5	16:02
8000	106.2	19:05	103.4	18:30	100.9	17:59	98.6	17:32	96.8	17:10
8500	112.0	20:26	109.0	19:47	106.3	19:14	103.8	18:45	101.9	18:20
9000	117.7	21:48	114.5	21:05	111.7	20:29	109.0	19:58	106.9	19:30
9500	123.3	23:12	119.9	22:26	116.9	21:46	114.1	21:13	111.8	20:43
10000	129.0	24:37	125.3	23:47	122.0	23:03	119.1	22:28	116.7	21:55

Long Range Cruise Enroute Fuel and Time - High Altitude Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	150	200	250	300	350
10	-2.3	-1.2	0.0	3.2	13.1
20	-4.4	-2.4	0.0	5.4	18.3
30	-6.5	-3.6	0.0	7.4	23.1
40	-8.6	-4.8	0.0	9.3	27.5
50	-10.8	-5.9	0.0	11.1	31.4
60	-13.0	-7.0	0.0	12.7	35.0
70	-15.2	-8.1	0.0	14.2	38.1
80	-17.5	-9.2	0.0	15.6	40.9
90	-19.8	-10.3	0.0	16.8	43.2
100	-22.1	-11.3	0.0	18.0	45.1
110	-24.4	-12.3	0.0	19.0	46.6
120	-26.8	-13.3	0.0	19.8	47.7
130	-29.2	-14.3	0.0	20.6	48.4

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)										
	360	340	320	300	280	260	240	220	200	180	160
43							120	55	17	1	3
41						105	50	17	2	1	12
39					87	43	15	2	1	10	25
37			119	68	33	11	1	1	9	22	40
35		89	50	24	8	1	1	9	21	36	54
33	64	35	15	4	0	2	9	21	35	50	67
31	22	9	2	0	4	11	21	34	49	64	79
29	4	0	1	5	13	23	35	48	62	76	89
27	0	3	8	16	25	36	48	61	74	86	97
25	5	11	19	28	38	50	61	73	84	94	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 at .84M/310/250

PRESSURE ALTITUDE (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	96	103	110	117	123	128	133	139	145	150
TIME (MINUTES)	20	21	22	23	24	24	25	26	26	27

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
360	%N1	62.0	64.9	69.0	73.3	78.3	83.1	88.2			
	KIAS	264	264	265	269	308	312	310			
	FF/ENG	4660	4620	4570	4590	4840	5020	5300			
340	%N1	60.5	63.4	67.5	71.7	76.7	81.6	86.4			
	KIAS	260	260	260	260	299	302	307			
	FF/ENG	4410	4360	4310	4310	4540	4680	4890			
320	%N1	58.8	61.5	65.7	69.8	74.9	79.6	84.4	91.3		
	KIAS	253	253	253	253	289	293	297	278		
	FF/ENG	4130	4080	4030	4020	4210	4320	4480	4980		
300	%N1	57.2	59.7	63.9	67.9	72.6	77.6	82.3	88.0		
	KIAS	244	244	244	244	259	283	287	278		
	FF/ENG	3860	3810	3760	3740	3800	3990	4130	4430		
280	%N1	55.6	58.0	62.1	66.1	70.7	75.7	80.5	85.6		
	KIAS	238	238	238	238	238	272	276	278		
	FF/ENG	3630	3570	3510	3480	3500	3690	3810	4030		
260	%N1	53.9	56.3	60.1	64.3	68.6	73.7	78.5	83.5	93.7	
	KIAS	229	229	229	229	229	262	265	269	247	
	FF/ENG	3390	3330	3270	3230	3240	3400	3500	3630	4260	
240	%N1	52.2	54.5	58.2	62.3	66.5	71.1	76.2	81.2	88.6	
	KIAS	223	223	223	223	223	228	254	258	247	
	FF/ENG	3180	3110	3030	2990	2990	3010	3190	3290	3640	
220	%N1	50.4	52.7	56.2	60.1	64.3	68.7	73.9	78.9	85.6	92.1
	KIAS	217	217	217	217	217	217	242	246	247	231
	FF/ENG	2970	2890	2800	2760	2740	2740	2890	2980	3220	3530
200	%N1	48.4	50.9	54.4	58.0	62.2	66.3	71.3	76.3	82.8	87.4
	KIAS	217	217	217	217	217	217	226	233	237	231
	FF/ENG	2790	2710	2610	2570	2530	2520	2570	2670	2830	3010
180	%N1	46.6	49.1	52.7	56.2	60.1	64.3	68.7	73.4	79.9	84.1
	KIAS	217	217	217	217	217	217	217	220	223	226
	FF/ENG	2630	2550	2450	2400	2360	2380	2320	2370	2500	2610
160	%N1	45.1	47.4	51.0	54.5	58.2	62.3	66.5	71.0	77.1	81.1
	KIAS	217	217	217	217	217	217	217	217	217	217
	FF/ENG	2560	2470	2370	2300	2250	2220	2170	2160	2230	2280

This table includes 5% additional fuel for holding in a racetrack pattern.

Holding Flaps 1

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
360	%N1	64.8	67.6	72.3	76.7	81.7
	KIAS	244	244	244	244	244
	FF/ENG	5150	5130	5110	5150	5270
340	%N1	63.2	66.0	70.3	74.9	79.9
	KIAS	240	240	240	240	240
	FF/ENG	4840	4810	4790	4810	4920
320	%N1	61.5	64.4	68.5	73.1	78.0
	KIAS	233	233	233	233	233
	FF/ENG	4540	4510	4480	4490	4580
300	%N1	59.7	62.6	66.6	71.3	76.1
	KIAS	224	224	224	224	224
	FF/ENG	4250	4220	4190	4190	4260
280	%N1	57.9	60.6	64.7	69.1	74.0
	KIAS	218	218	218	218	218
	FF/ENG	3970	3930	3890	3880	3930
260	%N1	56.1	58.6	62.8	66.9	71.8
	KIAS	209	209	209	209	209
	FF/ENG	3700	3650	3600	3600	3620
240	%N1	54.2	56.6	60.6	64.6	69.4
	KIAS	203	203	203	203	203
	FF/ENG	3430	3370	3310	3300	3310
220	%N1	52.1	54.5	58.2	62.3	66.7
	KIAS	197	197	197	197	197
	FF/ENG	3170	3100	3030	3010	3010
200	%N1	50.1	52.3	55.9	59.8	64.0
	KIAS	197	197	197	197	197
	FF/ENG	2940	2860	2770	2730	2720
180	%N1	47.9	50.3	53.8	57.4	61.6
	KIAS	197	197	197	197	197
	FF/ENG	2740	2650	2550	2510	2480
160	%N1	45.9	48.4	51.8	55.2	59.2
	KIAS	197	197	197	197	197
	FF/ENG	2630	2540	2430	2380	2330

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight
Advisory Information

Chapter PI
Section 72

ADVISORY INFORMATION
Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1315	30/-5	25	-45/150	10/-10	25/-25	40	25	50
AUTOBRAKE MAX	1710	30/-5	40	-65/220	0/0	40/-40	75	0	0
AUTOBRAKE 4	2175	45/-5	50	-90/310	0/0	50/-60	110	0	0
AUTOBRAKE 3	2550	50/-15	70	-115/385	0/-5	70/-70	130	0	0
AUTOBRAKE 2	2840	60/-30	80	-130/450	25/-60	75/-75	105	50	50
AUTOBRAKE 1	3085	70/-35	100	-150/525	85/-90	85/-85	105	280	330

Good Reported Braking Action

MAX MANUAL	1795	35/-10	45	-75/265	40/-35	40/-40	65	100	230
AUTOBRAKE MAX	1855	35/-10	45	-80/270	35/-30	40/-40	70	105	245
AUTOBRAKE 4	2190	45/-5	60	-90/315	10/-5	60/-60	110	5	40
AUTOBRAKE 3	2550	50/-15	70	-115/385	0/-5	70/-70	130	0	0
AUTOBRAKE 2	2840	60/-30	80	-130/450	25/-60	75/-75	105	50	50
AUTOBRAKE 1	3085	70/-35	100	-150/525	85/-90	85/-85	105	280	330

Good To Medium Reported Braking Action

MAX MANUAL	2085	40/-15	60	-100/350	70/-60	50/-50	70	180	460
AUTOBRAKE MAX	2115	40/-15	60	-100/350	70/-55	50/-50	75	185	470
AUTOBRAKE 4	2310	50/-10	65	-105/375	50/-30	60/-60	110	130	365
AUTOBRAKE 3	2615	55/-15	70	-125/430	25/-25	70/-70	130	60	240
AUTOBRAKE 2	2870	60/-30	85	-140/475	45/-70	75/-80	105	85	200
AUTOBRAKE 1	3090	70/-35	100	-150/530	100/-95	85/-85	105	295	390

Medium Reported Braking Action

MAX MANUAL	2370	45/-25	70	-120/430	100/-80	60/-60	80	265	690
AUTOBRAKE MAX	2380	45/-25	70	-120/430	105/-80	60/-60	80	265	690
AUTOBRAKE 4	2435	50/-10	70	-120/435	85/-50	65/-65	110	255	690
AUTOBRAKE 3	2680	60/-15	75	-130/470	50/-40	75/-75	130	115	475
AUTOBRAKE 2	2905	60/-30	85	-145/500	70/-80	75/-80	105	115	350
AUTOBRAKE 1	3095	70/-35	100	-155/535	115/-100	85/-85	105	305	455

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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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

Medium To Poor Reported Braking Action

MAX MANUAL	2685	55/-30	85	-150/550	165/-120	70/-70	85	410	1170
AUTOBRAKE MAX	2695	55/-30	85	-150/550	165/-120	70/-70	85	410	1175
AUTOBRAKE 4	2725	60/-20	85	-150/550	160/-100	70/-70	105	405	1175
AUTOBRAKE 3	2880	65/-25	85	-155/575	125/-80	80/-80	130	315	1050
AUTOBRAKE 2	3060	65/-30	95	-165/595	130/-115	80/-85	105	270	930
AUTOBRAKE 1	3210	70/-35	105	-175/625	170/-130	90/-90	105	415	945

Poor Reported Braking Action

MAX MANUAL	3000	65/-35	100	-180/665	230/-155	80/-80	90	550	1650
AUTOBRAKE MAX	3010	65/-35	105	-180/665	230/-155	80/-80	90	560	1655
AUTOBRAKE 4	3010	65/-30	105	-180/665	230/-150	80/-80	100	560	1655
AUTOBRAKE 3	3075	70/-30	100	-180/680	200/-120	85/-85	125	520	1620
AUTOBRAKE 2	3215	70/-35	105	-185/690	195/-150	85/-85	105	425	1505
AUTOBRAKE 1	3325	75/-40	110	-190/715	225/-160	90/-90	105	525	1430

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 75 m.

For autobrake and manual speedbrakes, increase reference landing distance by 60 m.

For landing weights below 154500 kg, increase reference landing distance by 135 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION**Normal Configuration Landing Distance
Flaps 25**

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Dry Runway

MAX MANUAL	1375	30/-10	30	-45/155	15/-10	30/-30	40	30	60
AUTOBRAKE MAX	1835	25/-10	40	-70/225	0/0	40/-40	80	0	0
AUTOBRAKE 4	2360	35/-15	60	-100/330	0/0	65/-65	115	0	0
AUTOBRAKE 3	2780	40/-30	75	-120/405	0/-15	75/-75	125	0	0
AUTOBRAKE 2	3060	45/-40	90	-140/465	35/-70	80/-80	105	90	90
AUTOBRAKE 1	3320	60/-45	110	-160/540	100/-105	90/-90	105	340	425

Good Reported Braking Action

MAX MANUAL	1900	25/-15	45	-80/275	45/-40	45/-45	65	110	265
AUTOBRAKE MAX	1975	30/-15	50	-80/280	40/-30	45/-45	75	115	280
AUTOBRAKE 4	2370	35/-15	65	-100/335	10/-5	65/-65	115	5	45
AUTOBRAKE 3	2780	40/-30	75	-120/405	0/-15	75/-75	125	0	0
AUTOBRAKE 2	3060	45/-40	90	-140/465	35/-70	80/-80	105	90	90
AUTOBRAKE 1	3320	60/-45	110	-160/540	100/-105	90/-90	105	340	425

Good To Medium Reported Braking Action

MAX MANUAL	2215	30/-25	60	-100/360	75/-65	55/-55	70	200	520
AUTOBRAKE MAX	2250	35/-25	65	-105/365	75/-55	55/-55	80	205	530
AUTOBRAKE 4	2500	35/-20	70	-110/395	45/-30	65/-65	115	130	400
AUTOBRAKE 3	2845	40/-30	80	-130/445	25/-35	80/-80	125	60	250
AUTOBRAKE 2	3095	50/-40	90	-145/490	60/-80	85/-85	105	125	250
AUTOBRAKE 1	3325	60/-45	110	-160/550	110/-105	90/-90	105	350	490

Medium Reported Braking Action

MAX MANUAL	2525	40/-30	75	-120/450	105/-85	65/-65	80	295	775
AUTOBRAKE MAX	2525	40/-30	75	-125/450	110/-80	65/-65	85	295	775
AUTOBRAKE 4	2625	40/-25	75	-125/455	80/-50	70/-70	115	260	755
AUTOBRAKE 3	2910	40/-30	80	-140/490	50/-50	80/-80	125	115	500
AUTOBRAKE 2	3130	50/-40	90	-150/520	80/-90	85/-85	105	155	410
AUTOBRAKE 1	3330	60/-45	110	-160/560	125/-110	90/-90	105	360	560

ADVISORY INFORMATION

Normal Configuration Landing Distance Flaps 25

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	2860	50/-35	90	-150/565	170/-125	75/-75	85	455	1315
AUTOBRAKE MAX	2865	50/-35	90	-155/565	175/-125	75/-75	90	455	1320
AUTOBRAKE 4	2915	50/-30	90	-155/570	160/-105	80/-80	110	440	1310
AUTOBRAKE 3	3115	50/-35	95	-160/590	125/-90	85/-85	125	330	1145
AUTOBRAKE 2	3290	55/-45	105	-170/615	145/-125	90/-90	105	320	1045
AUTOBRAKE 1	3450	60/-50	115	-180/645	185/-140	95/-95	105	475	1090

Poor Reported Braking Action

MAX MANUAL	3195	60/-40	110	-185/685	235/-160	85/-85	90	615	1855
AUTOBRAKE MAX	3205	60/-40	110	-185/685	240/-165	85/-85	90	615	1865
AUTOBRAKE 4	3205	60/-40	110	-185/685	240/-155	85/-85	105	620	1865
AUTOBRAKE 3	3315	60/-40	110	-185/695	200/-130	90/-90	125	540	1795
AUTOBRAKE 2	3455	60/-45	115	-190/715	215/-160	100/-100	105	490	1680
AUTOBRAKE 1	3570	65/-50	120	-195/730	240/-175	100/-100	105	590	1620

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 80 m.

For autobrake and manual speedbrakes, increase reference landing distance by 65 m.

For landing weights below 154500 kg, increase reference landing distance by 135 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION**Normal Configuration Landing Distance
Flaps 20**

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Dry Runway

MAX MANUAL	1465	35/-10	30	-45/160	15/-15	30/-30	45	30	70
AUTOBRAKE MAX	1980	25/-25	45	-70/235	0/0	45/-45	85	0	0
AUTOBRAKE 4	2565	35/-30	70	-105/340	0/0	70/-70	120	0	0
AUTOBRAKE 3	3025	45/-40	80	-125/425	0/-15	85/-85	140	0	0
AUTOBRAKE 2	3350	50/-50	105	-145/490	40/-70	90/-90	115	110	110
AUTOBRAKE 1	3635	65/-60	120	-165/570	105/-115	105/-105	115	405	490

Good Reported Braking Action

MAX MANUAL	2045	30/-25	50	-80/290	45/-40	45/-45	65	130	310
AUTOBRAKE MAX	2120	30/-25	60	-85/295	40/-30	50/-50	80	140	330
AUTOBRAKE 4	2575	35/-30	70	-105/350	10/0	70/-70	120	10	50
AUTOBRAKE 3	3025	45/-40	80	-125/425	0/-15	85/-85	140	0	0
AUTOBRAKE 2	3350	50/-50	105	-145/490	40/-70	90/-90	115	110	110
AUTOBRAKE 1	3635	65/-60	120	-165/570	105/-115	105/-105	115	405	490

Good To Medium Reported Braking Action

MAX MANUAL	2390	35/-30	70	-105/375	80/-65	60/-60	75	240	615
AUTOBRAKE MAX	2425	35/-30	70	-110/380	80/-60	65/-65	85	240	620
AUTOBRAKE 4	2705	40/-30	80	-120/415	50/-30	70/-70	120	155	470
AUTOBRAKE 3	3095	45/-45	85	-135/470	30/-35	85/-85	140	65	295
AUTOBRAKE 2	3385	55/-50	105	-150/520	65/-85	95/-95	115	145	295
AUTOBRAKE 1	3645	65/-60	120	-170/580	120/-120	105/-105	115	415	565

Medium Reported Braking Action

MAX MANUAL	2735	45/-40	85	-130/465	115/-90	70/-70	85	345	920
AUTOBRAKE MAX	2735	45/-40	85	-130/465	120/-90	75/-75	85	345	915
AUTOBRAKE 4	2840	45/-35	85	-130/475	85/-60	75/-75	120	300	885
AUTOBRAKE 3	3165	45/-45	90	-145/510	60/-50	85/-85	140	130	590
AUTOBRAKE 2	3420	60/-50	105	-155/545	85/-100	100/-100	115	180	475
AUTOBRAKE 1	3650	65/-60	120	-175/585	130/-120	105/-105	115	430	640

ADVISORY INFORMATION

Normal Configuration Landing Distance Flaps 20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Medium To Poor Reported Braking Action

MAX MANUAL	3105	55/-45	105	-160/590	185/-135	85/-85	90	530	1560
AUTOBRAKE MAX	3110	55/-45	105	-160/590	195/-135	85/-85	90	530	1560
AUTOBRAKE 4	3160	55/-45	105	-160/595	175/-110	85/-85	110	510	1545
AUTOBRAKE 3	3385	55/-50	105	-170/620	140/-95	95/-95	135	380	1355
AUTOBRAKE 2	3590	60/-55	115	-180/645	155/-135	105/-105	115	370	1235
AUTOBRAKE 1	3770	65/-60	130	-190/675	195/-155	105/-105	110	560	1275

Poor Reported Braking Action

MAX MANUAL	3475	65/-50	120	-190/715	260/-180	100/-100	100	720	2200
AUTOBRAKE MAX	3480	65/-50	120	-190/715	265/-180	100/-100	100	720	2200
AUTOBRAKE 4	3480	65/-50	120	-190/715	265/-165	100/-100	105	720	2200
AUTOBRAKE 3	3600	65/-50	120	-195/725	220/-140	105/-105	130	625	2120
AUTOBRAKE 2	3760	65/-60	125	-200/740	225/-175	110/-110	115	565	1995
AUTOBRAKE 1	3895	70/-65	140	-205/765	260/-190	110/-110	110	690	1910

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 85 m.

For autobrake and manual speedbrakes, increase reference landing distance by 70 m.

For landing weights below 154500 kg, increase reference landing distance by 135 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

All reference distances and adjustments shown have been increased by 15%.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Airspeed Unreliable (Flaps 20)****VREF20**

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1545	35/-15	35	-50/165	20/-20	35/-35	N/A	45	100
AUTOBRAKE MAX	1865	25/-20	45	-65/220	0/0	45/-45	N/A	0	0
AUTOBRAKE 2	3260	50/-50	100	-135/455	25/-45	95/-95	N/A	50	50

Good Reported Braking Action

MAX MANUAL	2145	30/-25	60	-85/285	55/-50	55/-55	N/A	165	410
AUTOBRAKE MAX	2130	30/-25	60	-85/280	55/-45	55/-55	N/A	165	405
AUTOBRAKE 2	3260	50/-50	100	-135/455	25/-45	95/-95	N/A	50	50

Good To Medium Reported Braking Action

MAX MANUAL	2485	40/-35	75	-105/365	90/-75	65/-65	N/A	295	785
AUTOBRAKE MAX	2470	40/-35	75	-105/365	95/-75	65/-65	N/A	290	780
AUTOBRAKE 2	3300	50/-50	100	-140/480	55/-60	95/-95	N/A	95	365

Medium Reported Braking Action

MAX MANUAL	2825	45/-40	90	-125/445	125/-100	75/-75	N/A	420	1160
AUTOBRAKE MAX	2810	45/-40	90	-125/445	135/-105	75/-75	N/A	415	1150
AUTOBRAKE 3	3060	45/-40	90	-135/470	75/-50	85/-85	N/A	205	935

Medium To Poor Reported Braking Action

MAX MANUAL	3180	55/-50	110	-155/560	195/-145	90/-90	N/A	625	1920
AUTOBRAKE MAX	3170	55/-50	110	-155/560	205/-150	90/-90	N/A	625	1915
AUTOBRAKE 3	3320	55/-50	110	-160/575	165/-105	95/-95	N/A	495	1785

Poor Reported Braking Action

MAX MANUAL	3535	65/-55	125	-185/670	265/-185	100/-100	N/A	830	2675
AUTOBRAKE MAX	3530	65/-55	130	-185/670	275/-190	100/-100	N/A	830	2675
AUTOBRAKE 3	3575	60/-55	125	-185/675	255/-160	105/-105	N/A	785	2630

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (Flaps 25)

VREF25

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	2195	35/-25	65	-105/390	90/-75	55/-55	70	255	675
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2195	35/-25	65	-105/390	90/-75	55/-55	70	255	675
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	2485	45/-30	80	-135/495	150/-110	65/-65	75	395	1145
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2775	50/-35	95	-160/595	205/-140	75/-75	80	535	1615
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	3245	65/-50	120	-215/855	735/-230	95/-95	85	985	2245
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3715	75/-60	140	-265/1110	1265/-315	110/-110	90	1435	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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID (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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	2060	40/-20	60	-105/375	85/-70	50/-50	65	230	600
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2060	40/-20	60	-105/375	85/-70	50/-50	65	230	600
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	2335	50/-25	75	-130/480	145/-105	60/-60	75	355	1020
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2605	55/-30	85	-155/580	200/-135	70/-70	80	480	1435
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	3050	70/-40	110	-205/835	710/-220	85/-85	85	900	2040
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3495	80/-45	130	-255/1090	1220/-305	100/-100	85	1320	2640
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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ENG SHUTDOWN L, R (Flaps 20)

VREF20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1280	35/-10	25	-45/145	15/-15	25/-25	40	0	30
AUTOBRAKE MAX	1720	20/-20	40	-60/205	0/0	40/-40	75	0	0
AUTOBRAKE 2	2990	45/-40	85	-130/435	5/-20	85/-85	140	0	0

Good Reported Braking Action

MAX MANUAL	1850	25/-20	50	-75/265	50/-45	45/-45	60	0	150
AUTOBRAKE MAX	1925	25/-25	50	-80/270	45/-40	50/-50	70	0	160
AUTOBRAKE 2	2990	45/-40	85	-130/435	5/-20	85/-85	140	0	0

Good To Medium Reported Braking Action

MAX MANUAL	2225	35/-30	65	-100/355	95/-75	60/-60	75	0	305
AUTOBRAKE MAX	2265	35/-30	65	-105/360	90/-70	60/-60	85	0	310
AUTOBRAKE 2	3035	45/-40	90	-135/465	40/-35	90/-90	140	0	110

Medium Reported Braking Action

MAX MANUAL	2595	40/-35	80	-125/445	135/-105	70/-70	85	0	460
AUTOBRAKE MAX	2600	40/-35	80	-125/445	135/-95	70/-70	95	0	455
AUTOBRAKE 3	2825	45/-35	85	-135/465	90/-60	80/-80	125	0	345

Medium To Poor Reported Braking Action

MAX MANUAL	3035	50/-45	100	-160/580	235/-160	85/-85	95	0	795
AUTOBRAKE MAX	3040	50/-45	100	-160/580	235/-155	85/-85	100	0	795
AUTOBRAKE 3	3170	55/-45	105	-165/590	205/-135	90/-95	120	0	745

Poor Reported Braking Action

MAX MANUAL	3475	60/-55	115	-195/710	330/-215	100/-100	105	0	1125
AUTOBRAKE MAX	3480	60/-55	120	-195/710	335/-215	100/-100	105	0	1130
AUTOBRAKE 3	3515	65/-55	120	-195/715	320/-205	100/-105	110	0	1140

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****ENG SHUTDOWN L, R (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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1145	30/-5	20	-40/135	15/-10	20/-20	40	0	25
AUTOBRAKE MAX	1485	25/-5	35	-55/190	0/0	35/-35	65	0	0
AUTOBRAKE 2	2495	55/-15	70	-115/390	10/-15	70/-70	125	0	0

Good Reported Braking Action

MAX MANUAL	1610	30/-10	40	-70/245	40/-35	40/-40	60	0	110
AUTOBRAKE MAX	1675	30/-10	40	-70/250	40/-35	40/-40	65	0	120
AUTOBRAKE 2	2495	55/-15	70	-115/390	10/-15	70/-70	125	0	0

Good To Medium Reported Braking Action

MAX MANUAL	1915	40/-15	55	-95/330	75/-60	50/-50	70	0	225
AUTOBRAKE MAX	1950	40/-15	55	-95/330	80/-60	50/-50	75	0	230
AUTOBRAKE 2	2535	55/-15	70	-120/420	40/-30	70/-70	125	0	85

Medium Reported Braking Action

MAX MANUAL	2220	45/-20	65	-115/410	110/-85	60/-60	75	0	340
AUTOBRAKE MAX	2220	45/-15	65	-115/410	115/-80	60/-60	85	0	340
AUTOBRAKE 3	2385	50/-15	70	-120/425	80/-55	65/-65	110	0	270

Medium To Poor Reported Braking Action

MAX MANUAL	2580	55/-25	80	-145/535	195/-135	75/-75	85	0	585
AUTOBRAKE MAX	2585	55/-25	80	-145/535	200/-130	75/-75	90	0	585
AUTOBRAKE 3	2685	60/-25	85	-150/545	175/-120	75/-75	105	0	555

Poor Reported Braking Action

MAX MANUAL	2940	65/-30	95	-175/655	280/-180	85/-85	90	0	825
AUTOBRAKE MAX	2945	65/-30	95	-175/655	285/-180	85/-85	95	0	830
AUTOBRAKE 3	2980	65/-30	95	-175/660	270/-180	85/-85	95	0	840

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAP / SLAT CONTROL (Flaps 20)

VREF20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1270	30/-10	25	-40/140	15/-15	25/-25	40	25	60
AUTOBRAKE MAX	1720	20/-20	40	-60/205	0/0	40/-40	75	0	0
AUTOBRAKE 2	2910	45/-45	90	-125/425	35/-60	80/-80	100	95	95

Good Reported Braking Action

MAX MANUAL	1775	25/-20	45	-70/250	40/-35	40/-40	55	115	270
AUTOBRAKE MAX	1840	25/-20	50	-75/255	35/-25	45/-45	70	120	285
AUTOBRAKE 2	2910	45/-45	90	-125/425	35/-60	80/-80	100	95	95

Good To Medium Reported Braking Action

MAX MANUAL	2075	35/-30	60	-95/330	70/-60	50/-50	65	210	535
AUTOBRAKE MAX	2110	35/-30	65	-95/330	70/-55	55/-55	75	210	540
AUTOBRAKE 2	2940	50/-45	90	-130/450	55/-75	85/-85	100	125	255

Medium Reported Braking Action

MAX MANUAL	2375	40/-35	75	-115/405	100/-80	60/-60	75	300	800
AUTOBRAKE MAX	2375	40/-35	75	-115/405	105/-80	65/-65	75	300	795
AUTOBRAKE 3	2750	40/-40	80	-125/445	50/-45	75/-75	120	115	515

Medium To Poor Reported Braking Action

MAX MANUAL	2700	50/-40	90	-140/515	165/-120	75/-75	80	465	1360
AUTOBRAKE MAX	2700	50/-40	90	-140/515	170/-120	75/-75	80	465	1355
AUTOBRAKE 3	2940	50/-45	95	-150/540	120/-85	85/-85	120	330	1180

Poor Reported Braking Action

MAX MANUAL	3020	55/-45	105	-165/620	225/-155	85/-85	85	625	1915
AUTOBRAKE MAX	3025	55/-45	105	-165/620	230/-155	85/-85	85	625	1915
AUTOBRAKE 3	3130	55/-45	105	-170/630	190/-120	90/-90	115	545	1845

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≤ 5)

VREF30 + 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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BW/ 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1450	55/-10	45	-45/205	20/-15	40/-30	55	55	130
AUTOBRAKE MAX	2055	35/-5	50	-70/230	0/0	50/-50	80	0	0
AUTOBRAKE 2	3495	70/-40	115	-140/470	60/-75	100/-100	115	225	225

Good Reported Braking Action

MAX MANUAL	2000	30/-15	55	-75/265	45/-40	50/-50	55	155	375
AUTOBRAKE MAX	2140	35/-10	55	-80/275	20/-15	55/-55	80	95	330
AUTOBRAKE 2	3495	70/-40	115	-140/470	60/-75	100/-100	115	225	225

Good To Medium Reported Braking Action

MAX MANUAL	2360	40/-20	75	-100/345	80/-65	65/-65	65	285	775
AUTOBRAKE MAX	2425	45/-20	75	-100/350	65/-50	65/-65	80	255	745
AUTOBRAKE 2	3525	70/-40	120	-145/495	75/-85	100/-100	115	255	425

Medium Reported Braking Action

MAX MANUAL	2720	50/-25	90	-120/425	110/-90	75/-75	75	415	1170
AUTOBRAKE MAX	2705	50/-25	90	-120/425	110/-80	75/-75	80	410	1155
AUTOBRAKE 3	3310	60/-30	100	-140/485	60/-60	95/-95	120	150	690

Medium To Poor Reported Braking Action

MAX MANUAL	3105	60/-35	110	-150/540	180/-130	90/-90	85	645	2050
AUTOBRAKE MAX	3095	60/-35	110	-150/540	180/-125	90/-90	85	640	2040
AUTOBRAKE 3	3495	70/-35	115	-165/580	140/-100	100/-105	120	420	1720

Poor Reported Braking Action

MAX MANUAL	3485	70/-40	130	-175/655	245/-170	100/-100	90	870	2925
AUTOBRAKE MAX	3485	70/-40	130	-175/655	245/-170	100/-100	90	870	2925
AUTOBRAKE 3	3675	75/-40	130	-185/670	215/-140	105/-110	120	690	2750

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (5 < Flaps < 20)

VREF30 + 20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1285	40/-5	25	-40/145	15/-15	25/-25	40	30	65
AUTOBRAKE MAX	1755	30/-5	40	-65/210	0/0	40/-40	75	0	0
AUTOBRAKE 2	2995	60/-30	90	-130/430	30/-50	85/-85	115	85	85

Good Reported Braking Action

MAX MANUAL	1810	30/-10	50	-75/250	40/-35	45/-45	60	125	305
AUTOBRAKE MAX	1865	35/-5	50	-75/255	35/-25	45/-45	70	125	315
AUTOBRAKE 2	2995	60/-30	90	-130/430	30/-50	85/-85	115	85	85

Good To Medium Reported Braking Action

MAX MANUAL	2125	40/-15	65	-95/330	75/-60	55/-55	70	235	620
AUTOBRAKE MAX	2150	45/-15	65	-95/335	70/-55	55/-55	75	230	620
AUTOBRAKE 2	3025	65/-30	95	-135/455	50/-60	85/-85	115	115	275

Medium Reported Braking Action

MAX MANUAL	2440	50/-20	75	-115/410	105/-85	65/-65	75	340	930
AUTOBRAKE MAX	2435	50/-20	75	-115/410	105/-85	65/-65	75	335	925
AUTOBRAKE 3	2810	55/-20	80	-130/450	50/-45	80/-80	125	120	625

Medium To Poor Reported Braking Action

MAX MANUAL	2780	60/-30	95	-145/520	170/-125	75/-75	85	525	1605
AUTOBRAKE MAX	2780	60/-30	95	-145/520	170/-125	75/-80	85	525	1605
AUTOBRAKE 3	3005	65/-25	95	-150/545	130/-85	85/-85	125	375	1415

Poor Reported Braking Action

MAX MANUAL	3115	65/-35	110	-170/630	230/-160	85/-85	90	710	2280
AUTOBRAKE MAX	3120	65/-35	110	-170/630	235/-160	85/-90	90	710	2285
AUTOBRAKE 3	3200	70/-30	110	-170/640	210/-125	90/-90	120	630	2205

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (Flaps ≥ 20)

VREF20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1270	30/-10	25	-40/140	15/-15	25/-25	40	25	60
AUTOBRAKE MAX	1720	20/-20	40	-60/205	0/0	40/-40	75	0	0
AUTOBRAKE 2	2910	45/-45	90	-125/425	35/-60	80/-80	100	95	95

Good Reported Braking Action

MAX MANUAL	1775	25/-20	45	-70/250	40/-35	40/-40	55	115	270
AUTOBRAKE MAX	1840	25/-20	50	-75/255	35/-25	45/-45	70	120	285
AUTOBRAKE 2	2910	45/-45	90	-125/425	35/-60	80/-80	100	95	95

Good To Medium Reported Braking Action

MAX MANUAL	2075	35/-30	60	-95/330	70/-60	50/-50	65	210	535
AUTOBRAKE MAX	2110	35/-30	65	-95/330	70/-55	55/-55	75	210	540
AUTOBRAKE 2	2940	50/-45	90	-130/450	55/-75	85/-85	100	125	255

Medium Reported Braking Action

MAX MANUAL	2375	40/-35	75	-115/405	100/-80	60/-60	75	300	800
AUTOBRAKE MAX	2375	40/-35	75	-115/405	105/-80	65/-65	75	300	795
AUTOBRAKE 3	2750	40/-40	80	-125/445	50/-45	75/-75	120	115	515

Medium To Poor Reported Braking Action

MAX MANUAL	2700	50/-40	90	-140/515	165/-120	75/-75	80	465	1360
AUTOBRAKE MAX	2700	50/-40	90	-140/515	170/-120	75/-75	80	465	1355
AUTOBRAKE 3	2940	50/-45	95	-150/540	120/-85	85/-85	120	330	1180

Poor Reported Braking Action

MAX MANUAL	3020	55/-45	105	-165/620	225/-155	85/-85	85	625	1915
AUTOBRAKE MAX	3025	55/-45	105	-165/620	230/-155	85/-85	85	625	1915
AUTOBRAKE 3	3130	55/-45	105	-170/630	190/-120	90/-90	115	545	1845

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS PRIMARY FAIL (Flaps 20)

VREF20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1430	30/-15	30	-45/155	15/-15	30/-30	50	35	75
AUTOBRAKE MAX	1720	20/-20	40	-60/205	0/0	40/-40	75	0	0
AUTOBRAKE 2	2975	45/-45	85	-130/430	15/-35	85/-85	125	30	30

Good Reported Braking Action

MAX MANUAL	1965	25/-25	50	-80/270	50/-40	45/-45	70	140	335
AUTOBRAKE MAX	1950	30/-25	55	-80/270	50/-40	50/-50	75	135	335
AUTOBRAKE 2	2975	45/-45	85	-130/430	15/-35	85/-85	125	30	30

Good To Medium Reported Braking Action

MAX MANUAL	2280	35/-30	65	-100/350	85/-65	60/-60	80	250	660
AUTOBRAKE MAX	2265	35/-30	70	-100/350	85/-70	60/-60	80	245	655
AUTOBRAKE 2	3010	50/-45	90	-135/455	45/-50	85/-85	125	70	295

Medium Reported Braking Action

MAX MANUAL	2590	40/-35	80	-120/430	115/-90	70/-70	85	360	980
AUTOBRAKE MAX	2575	40/-35	80	-120/425	120/-95	70/-70	85	355	970
AUTOBRAKE 3	2790	40/-35	80	-130/450	70/-45	80/-80	125	180	790

Medium To Poor Reported Braking Action

MAX MANUAL	2925	50/-45	100	-150/540	185/-130	80/-80	95	545	1645
AUTOBRAKE MAX	2915	50/-45	100	-150/540	190/-135	80/-80	95	540	1640
AUTOBRAKE 3	3035	50/-45	100	-155/550	160/-100	90/-90	120	440	1535

Poor Reported Braking Action

MAX MANUAL	3255	60/-50	115	-175/650	250/-170	90/-90	100	725	2305
AUTOBRAKE MAX	3255	60/-50	115	-175/650	255/-175	90/-90	100	725	2305
AUTOBRAKE 3	3280	60/-50	115	-175/650	245/-150	95/-95	115	695	2275

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****FLIGHT CONTROL MODE (Flaps 20)****VREF20**

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1445	30/-15	30	-45/160	20/-15	30/-30	50	35	80
AUTOBRAKE MAX	1720	20/-20	40	-60/205	0/0	40/-40	75	0	0
AUTOBRAKE 2	2995	45/-45	85	-130/435	5/-30	85/-85	135	10	10

Good Reported Braking Action

MAX MANUAL	1995	30/-25	55	-80/275	50/-45	50/-50	75	145	360
AUTOBRAKE MAX	1975	30/-25	55	-80/270	50/-45	50/-50	75	145	350
AUTOBRAKE 2	2995	45/-45	85	-130/435	5/-30	85/-85	135	10	10

Good To Medium Reported Braking Action

MAX MANUAL	2320	40/-30	70	-105/355	85/-70	60/-60	85	265	705
AUTOBRAKE MAX	2300	40/-30	70	-100/350	90/-75	60/-60	85	265	695
AUTOBRAKE 2	3035	45/-45	90	-135/460	35/-45	85/-85	135	55	325

Medium Reported Braking Action

MAX MANUAL	2645	45/-35	85	-125/435	120/-95	70/-70	90	380	1050
AUTOBRAKE MAX	2625	45/-35	85	-120/430	125/-100	70/-70	90	380	1040
AUTOBRAKE 3	2800	40/-35	80	-130/450	75/-45	80/-80	130	220	890

Medium To Poor Reported Braking Action

MAX MANUAL	2985	55/-45	105	-155/545	190/-135	85/-85	100	580	1780
AUTOBRAKE MAX	2975	55/-45	105	-150/545	195/-145	85/-85	100	580	1775
AUTOBRAKE 3	3070	50/-45	100	-155/555	170/-105	90/-90	125	490	1690

Poor Reported Braking Action

MAX MANUAL	3325	60/-50	120	-180/655	260/-175	95/-95	105	775	2505
AUTOBRAKE MAX	3325	60/-50	120	-180/655	265/-185	95/-95	105	775	2505
AUTOBRAKE 3	3340	60/-50	120	-180/660	260/-160	95/-95	115	755	2490

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLIGHT CONTROLS (Flaps 20)

VREF30 + 20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1500	35/-5	35	-50/165	25/-20	35/-35	65	55	120
AUTOBRAKE MAX	1755	30/-5	40	-65/210	0/0	40/-40	75	0	5
AUTOBRAKE 2	3070	60/-25	85	-130/440	5/-30	90/-90	140	5	5

Good Reported Braking Action

MAX MANUAL	2100	40/-10	60	-85/285	65/-55	55/-55	85	195	495
AUTOBRAKE MAX	2085	40/-10	60	-85/285	65/-55	55/-55	85	195	485
AUTOBRAKE 2	3070	60/-25	85	-130/440	5/-30	90/-90	140	5	5

Good To Medium Reported Braking Action

MAX MANUAL	2440	50/-20	75	-110/370	105/-85	65/-65	95	335	930
AUTOBRAKE MAX	2430	50/-20	80	-110/370	105/-85	65/-65	95	335	925
AUTOBRAKE 2	3110	60/-25	90	-135/470	40/-45	90/-90	140	80	505

Medium Reported Braking Action

MAX MANUAL	2775	55/-25	90	-130/450	140/-110	75/-75	100	475	1360
AUTOBRAKE MAX	2775	60/-25	95	-130/450	145/-115	75/-75	105	475	1360
AUTOBRAKE 3	2880	55/-15	90	-130/460	105/-55	80/-80	125	370	1255

Medium To Poor Reported Braking Action

MAX MANUAL	3125	65/-35	110	-160/565	215/-155	90/-90	105	695	2225
AUTOBRAKE MAX	3130	70/-35	115	-160/565	220/-160	90/-90	110	700	2230
AUTOBRAKE 3	3185	70/-25	110	-160/570	200/-120	90/-90	125	645	2175

Poor Reported Braking Action

MAX MANUAL	3475	75/-40	130	-185/675	285/-195	100/-100	110	915	3090
AUTOBRAKE MAX	3485	80/-40	130	-185/675	290/-200	100/-100	110	920	3100
AUTOBRAKE 3	3490	80/-35	130	-185/675	290/-180	100/-100	120	915	3095

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS C (Flaps 20)****VREF20**

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1430	30/-15	30	-45/155	15/-15	30/-30	50	35	75
AUTOBRAKE MAX	1720	20/-20	40	-60/205	0/0	40/-40	75	0	0
AUTOBRAKE 2	2975	45/-45	85	-130/430	15/-35	85/-85	125	30	30

Good Reported Braking Action

MAX MANUAL	1965	25/-25	50	-80/270	50/-40	45/-45	70	140	335
AUTOBRAKE MAX	1950	30/-25	55	-80/270	50/-40	50/-50	75	135	335
AUTOBRAKE 2	2975	45/-45	85	-130/430	15/-35	85/-85	125	30	30

Good To Medium Reported Braking Action

MAX MANUAL	2280	35/-30	65	-100/350	85/-65	60/-60	80	250	660
AUTOBRAKE MAX	2265	35/-30	70	-100/350	85/-70	60/-60	80	245	655
AUTOBRAKE 2	3010	50/-45	90	-135/455	45/-50	85/-85	125	70	295

Medium Reported Braking Action

MAX MANUAL	2590	40/-35	80	-120/430	115/-90	70/-70	85	360	980
AUTOBRAKE MAX	2575	40/-35	80	-120/425	120/-95	70/-70	85	355	970
AUTOBRAKE 3	2790	40/-35	80	-130/450	70/-45	80/-80	125	180	790

Medium To Poor Reported Braking Action

MAX MANUAL	2925	50/-45	100	-150/540	185/-130	80/-80	95	545	1645
AUTOBRAKE MAX	2915	50/-45	100	-150/540	190/-135	80/-80	95	540	1640
AUTOBRAKE 3	3035	50/-45	100	-155/550	160/-100	90/-90	120	440	1535

Poor Reported Braking Action

MAX MANUAL	3255	60/-50	115	-175/650	250/-170	90/-90	100	725	2305
AUTOBRAKE MAX	3255	60/-50	115	-175/650	255/-175	90/-90	100	725	2305
AUTOBRAKE 3	3280	60/-50	115	-175/650	245/-150	95/-95	115	695	2275

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (Flaps 25)

VREF25

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1275	25/-10	25	-45/150	15/-15	25/-25	45	0	35
AUTOBRAKE MAX	1595	20/-10	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2745	40/-25	75	-125/415	0/0	75/-75	145	0	0

Good Reported Braking Action

MAX MANUAL	1850	25/-15	50	-80/270	55/-45	45/-45	70	0	160
AUTOBRAKE MAX	1890	25/-15	50	-80/275	50/-40	45/-45	75	0	165
AUTOBRAKE 2	2745	40/-25	75	-125/415	0/0	75/-75	145	0	0

Good To Medium Reported Braking Action

MAX MANUAL	2230	35/-25	65	-105/370	105/-80	60/-60	80	0	335
AUTOBRAKE MAX	2255	35/-25	65	-105/370	105/-80	60/-60	85	0	340
AUTOBRAKE 2	2815	45/-25	80	-135/455	45/-25	80/-80	145	0	165

Medium Reported Braking Action

MAX MANUAL	2610	40/-30	80	-130/465	150/-115	70/-70	90	0	510
AUTOBRAKE MAX	2615	40/-30	80	-130/465	155/-115	70/-70	95	0	510
AUTOBRAKE 3	2685	40/-25	80	-135/470	130/-70	75/-75	120	0	500

Medium To Poor Reported Braking Action

MAX MANUAL	3080	50/-40	100	-170/625	275/-180	90/-90	100	0	910
AUTOBRAKE MAX	3085	50/-40	105	-170/625	280/-180	90/-90	105	0	910
AUTOBRAKE 3	3120	50/-35	105	-175/625	270/-155	90/-90	120	0	905

Poor Reported Braking Action

MAX MANUAL	3545	60/-45	120	-210/780	400/-245	105/-105	110	0	1310
AUTOBRAKE MAX	3555	60/-45	125	-210/780	405/-245	105/-105	110	0	1310
AUTOBRAKE 3	3555	60/-45	125	-210/780	405/-235	105/-105	115	0	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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L (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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1210	30/-5	25	-40/145	15/-15	25/-25	45	0	30
AUTOBRAKE MAX	1485	25/-5	35	-55/190	0/0	35/-35	65	0	0
AUTOBRAKE 2	2510	55/-10	70	-115/395	0/0	70/-70	135	0	0

Good Reported Braking Action

MAX MANUAL	1745	30/-10	45	-75/265	50/-45	40/-40	70	0	145
AUTOBRAKE MAX	1770	35/-10	45	-75/265	45/-40	45/-45	75	0	145
AUTOBRAKE 2	2510	55/-10	70	-115/395	0/0	70/-70	135	0	0

Good To Medium Reported Braking Action

MAX MANUAL	2100	40/-15	60	-100/360	100/-80	55/-55	80	0	305
AUTOBRAKE MAX	2115	45/-15	60	-100/360	95/-75	55/-55	85	0	305
AUTOBRAKE 2	2580	60/-10	75	-125/435	45/-25	75/-75	135	0	170

Medium Reported Braking Action

MAX MANUAL	2455	50/-20	75	-125/455	145/-110	65/-65	90	0	460
AUTOBRAKE MAX	2455	50/-20	75	-125/455	145/-110	65/-65	90	0	460
AUTOBRAKE 3	2495	55/-15	75	-130/455	135/-75	70/-70	110	0	465

Medium To Poor Reported Braking Action

MAX MANUAL	2895	60/-30	95	-165/610	265/-170	80/-80	100	0	825
AUTOBRAKE MAX	2900	60/-30	95	-165/610	270/-175	80/-80	100	0	830
AUTOBRAKE 3	2920	65/-25	95	-165/610	265/-155	85/-85	110	0	830

Poor Reported Braking Action

MAX MANUAL	3335	70/-35	115	-200/760	385/-230	95/-95	110	0	1190
AUTOBRAKE MAX	3345	70/-35	115	-200/760	390/-235	95/-95	110	0	1195
AUTOBRAKE 3	3345	70/-35	115	-200/760	390/-230	95/-95	110	0	1195

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS L+C (Flaps 20)

VREF30 + 20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1565	40/-5	35	-50/175	25/-20	35/-35	65	0	55
AUTOBRAKE MAX	1755	30/-5	40	-65/210	0/0	40/-40	75	0	0
AUTOBRAKE 2	3080	60/-10	85	-130/440	0/0	90/-90	155	0	0

Good Reported Braking Action

MAX MANUAL	2270	40/-10	60	-90/310	75/-65	60/-60	90	0	250
AUTOBRAKE MAX	2220	40/-10	60	-90/305	80/-60	60/-60	95	0	240
AUTOBRAKE 2	3080	60/-10	85	-130/440	0/0	90/-90	155	0	0

Good To Medium Reported Braking Action

MAX MANUAL	2725	55/-20	80	-120/415	135/-110	75/-75	105	0	510
AUTOBRAKE MAX	2690	55/-20	80	-120/415	145/-110	75/-75	110	0	500
AUTOBRAKE 2	3175	65/-15	95	-145/485	80/-35	95/-95	155	0	340

Medium Reported Braking Action

MAX MANUAL	3180	65/-25	100	-150/520	195/-150	90/-90	120	0	765
AUTOBRAKE MAX	3160	65/-25	100	-150/520	205/-155	90/-90	120	0	755
AUTOBRAKE 3	3170	65/-20	100	-150/520	200/-135	90/-90	125	0	760

Medium To Poor Reported Braking Action

MAX MANUAL	3730	80/-35	130	-195/690	350/-230	110/-110	130	0	1340
AUTOBRAKE MAX	3720	80/-35	130	-195/690	360/-235	110/-110	130	0	1335
AUTOBRAKE 3	3725	80/-35	130	-195/690	360/-225	110/-110	135	0	1335

Poor Reported Braking Action

MAX MANUAL	4280	90/-45	155	-235/855	500/-305	125/-125	140	0	1910
AUTOBRAKE MAX	4275	90/-45	155	-235/855	515/-315	125/-130	140	0	1910
AUTOBRAKE 3	4275	90/-45	155	-235/855	515/-315	125/-130	140	0	1910

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****HYD PRESS SYS L+R (Flaps 20)****VREF30 + 20**

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1675	40/-5	40	-60/205	35/-30	40/-40	70	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2695	50/-10	75	-120/400	135/-110	75/-75	115	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	3470	65/-15	100	-170/575	305/-210	100/-105	140	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	4240	75/-20	125	-215/745	470/-305	125/-130	160	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	5465	95/-30	170	-310/1110	1360/-560	170/-170	180	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	6690	110/-35	210	-400/1475	2250/-810	210/-210	200	0	0
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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R (Flaps 25)

VREF25

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	20/-10	30	-50/170	25/-20	30/-30	50	0	50
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2020	30/-20	55	-90/310	70/-60	50/-50	75	0	220
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	2415	40/-25	75	-120/420	130/-100	65/-65	85	0	430
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2810	45/-30	90	-145/525	185/-135	80/-80	95	0	640
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	3280	55/-40	110	-190/700	350/-210	95/-95	105	0	1105
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3745	65/-50	130	-230/875	515/-280	110/-110	110	0	1565
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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R (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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1315	20/-5	30	-50/165	20/-20	30/-30	50	0	45
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1880	35/-10	50	-85/300	65/-55	45/-45	70	0	190
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	2235	45/-15	65	-115/405	120/-90	60/-60	80	0	370
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2590	55/-20	80	-140/505	170/-125	70/-70	90	0	545
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	3020	65/-30	100	-180/675	325/-195	85/-85	100	0	940
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3445	70/-35	120	-220/845	480/-260	100/-100	105	0	1330
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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

HYD PRESS SYS R+C (Flaps 20)

VREF30 + 20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1905	30/-5	45	-70/235	45/-40	45/-45	80	0	130
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2750	55/-15	80	-120/410	130/-105	75/-75	110	0	480
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	3265	70/-25	105	-155/545	230/-165	95/-95	125	0	890
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3775	80/-35	130	-190/680	325/-225	110/-110	135	0	1295
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	4360	95/-45	160	-245/895	620/-330	130/-130	145	0	2165
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	4945	105/-55	185	-295/1110	915/-430	150/-150	150	0	3035
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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PITCH DOWN AUTHORITY (Flaps 25)****VREF25**

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1360	25/-10	25	-45/150	15/-15	25/-25	45	20	40
AUTOBRAKE MAX	1595	20/-10	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2715	40/-30	80	-120/410	15/-35	75/-75	115	30	30

Good Reported Braking Action

MAX MANUAL	1825	25/-15	45	-75/255	40/-35	40/-40	60	85	205
AUTOBRAKE MAX	1810	25/-15	45	-75/255	45/-40	40/-40	65	85	200
AUTOBRAKE 2	2715	40/-30	80	-120/410	20/-35	75/-75	115	30	30

Good To Medium Reported Braking Action

MAX MANUAL	2100	30/-20	60	-95/330	70/-55	50/-50	70	165	425
AUTOBRAKE MAX	2090	30/-20	60	-95/330	75/-60	50/-50	75	165	420
AUTOBRAKE 2	2765	40/-30	80	-125/435	45/-55	75/-75	115	65	170

Medium Reported Braking Action

MAX MANUAL	2370	35/-25	70	-115/405	95/-75	60/-60	75	245	640
AUTOBRAKE MAX	2365	35/-25	70	-115/405	100/-80	60/-60	80	240	635
AUTOBRAKE 3	2585	35/-25	70	-120/430	65/-45	70/-70	125	100	430

Medium To Poor Reported Braking Action

MAX MANUAL	2665	45/-30	85	-140/510	155/-110	70/-70	80	385	1105
AUTOBRAKE MAX	2665	45/-30	85	-140/510	160/-115	70/-70	85	380	1100
AUTOBRAKE 3	2800	45/-30	85	-145/525	135/-90	80/-80	120	285	975

Poor Reported Braking Action

MAX MANUAL	2960	50/-35	95	-165/615	210/-145	80/-80	85	520	1565
AUTOBRAKE MAX	2965	50/-35	95	-165/615	220/-150	80/-80	85	520	1565
AUTOBRAKE 3	3015	50/-35	95	-165/620	200/-130	85/-85	110	470	1520

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH DOWN AUTHORITY (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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1290	30/-5	25	-45/145	15/-15	25/-25	45	15	35
AUTOBRAKE MAX	1485	25/0	35	-55/190	0/0	35/-35	65	0	0
AUTOBRAKE 2	2500	55/-20	70	-115/390	5/-25	65/-70	115	10	10

Good Reported Braking Action

MAX MANUAL	1720	30/-10	40	-70/245	40/-35	40/-40	60	75	180
AUTOBRAKE MAX	1705	30/-5	40	-70/245	40/-35	40/-40	65	75	175
AUTOBRAKE 2	2500	55/-20	70	-115/390	10/-25	65/-70	115	10	10

Good To Medium Reported Braking Action

MAX MANUAL	1975	35/-15	50	-90/320	65/-55	50/-50	70	145	375
AUTOBRAKE MAX	1965	35/-10	55	-90/320	70/-55	50/-50	70	145	370
AUTOBRAKE 2	2550	55/-20	75	-120/415	35/-45	70/-70	115	40	140

Medium Reported Braking Action

MAX MANUAL	2225	40/-15	60	-110/390	90/-75	55/-55	75	215	565
AUTOBRAKE MAX	2220	40/-15	65	-110/390	95/-75	55/-55	75	215	560
AUTOBRAKE 3	2380	50/-10	65	-115/415	70/-45	65/-65	115	100	405

Medium To Poor Reported Braking Action

MAX MANUAL	2500	50/-25	75	-135/495	145/-105	65/-65	80	340	980
AUTOBRAKE MAX	2500	50/-25	80	-135/495	155/-110	65/-65	80	340	975
AUTOBRAKE 3	2595	55/-20	80	-140/510	135/-85	70/-70	110	270	885

Poor Reported Braking Action

MAX MANUAL	2775	55/-30	90	-160/595	200/-135	75/-75	85	465	1390
AUTOBRAKE MAX	2780	55/-30	90	-160/595	210/-145	75/-75	85	465	1385
AUTOBRAKE 3	2805	60/-25	90	-160/600	200/-120	75/-75	105	440	1365

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1440	50/-5	35	-45/175	15/-15	30/-30	40	40	85
AUTOBRAKE MAX	2055	35/-5	50	-70/230	0/0	50/-50	80	0	0
AUTOBRAKE 2	3410	65/-40	110	-140/460	70/-85	95/-95	100	280	285

Good Reported Braking Action

MAX MANUAL	2030	35/-15	55	-80/265	45/-40	50/-50	60	150	365
AUTOBRAKE MAX	2160	35/-10	55	-80/275	25/-20	55/-55	80	110	335
AUTOBRAKE 2	3410	65/-40	110	-140/460	70/-85	95/-95	100	280	285

Good To Medium Reported Braking Action

MAX MANUAL	2375	45/-20	70	-100/350	80/-65	65/-65	70	270	710
AUTOBRAKE MAX	2445	45/-20	75	-100/355	65/-55	65/-65	80	250	695
AUTOBRAKE 2	3440	65/-40	115	-145/485	90/-95	100/-100	100	310	465

Medium Reported Braking Action

MAX MANUAL	2715	50/-25	85	-120/430	110/-90	75/-75	75	385	1050
AUTOBRAKE MAX	2725	50/-25	90	-120/430	105/-85	75/-75	80	385	1050
AUTOBRAKE 3	3280	60/-30	100	-140/485	75/-75	95/-95	105	185	640

Medium To Poor Reported Braking Action

MAX MANUAL	3075	60/-35	105	-150/540	175/-130	90/-90	80	580	1750
AUTOBRAKE MAX	3080	60/-35	110	-150/540	175/-130	90/-90	85	580	1750
AUTOBRAKE 3	3470	70/-35	115	-160/580	145/-115	100/-100	105	405	1470

Poor Reported Braking Action

MAX MANUAL	3430	70/-40	125	-175/650	240/-165	100/-100	85	775	2445
AUTOBRAKE MAX	3435	70/-40	125	-175/650	240/-170	100/-100	85	775	2450
AUTOBRAKE 3	3655	75/-40	125	-180/670	210/-155	105/-105	105	620	2295

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≥ 20)

VREF30 + 20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1295	40/-5	25	-45/145	15/-15	25/-25	40	30	65
AUTOBRAKE MAX	1755	30/-5	40	-65/210	0/0	40/-40	75	0	0
AUTOBRAKE 2	2955	60/-30	90	-125/430	40/-65	80/-80	95	120	120

Good Reported Braking Action

MAX MANUAL	1810	30/-10	45	-75/250	45/-35	45/-45	55	115	280
AUTOBRAKE MAX	1875	35/-5	50	-75/260	40/-25	45/-45	70	120	295
AUTOBRAKE 2	2955	60/-30	90	-125/430	40/-65	80/-80	95	120	120

Good To Medium Reported Braking Action

MAX MANUAL	2115	40/-15	60	-95/330	75/-60	55/-55	65	215	550
AUTOBRAKE MAX	2145	45/-15	65	-95/335	75/-50	55/-55	75	215	555
AUTOBRAKE 2	2985	60/-30	95	-130/455	60/-75	85/-85	95	150	280

Medium Reported Braking Action

MAX MANUAL	2415	45/-20	75	-115/405	100/-80	65/-65	75	310	815
AUTOBRAKE MAX	2415	50/-20	75	-115/405	105/-75	65/-65	80	305	815
AUTOBRAKE 3	2810	55/-25	80	-130/450	55/-55	80/-80	115	120	520

Medium To Poor Reported Braking Action

MAX MANUAL	2735	55/-30	90	-140/515	165/-120	75/-75	80	470	1370
AUTOBRAKE MAX	2740	60/-30	90	-140/515	170/-115	75/-75	85	470	1370
AUTOBRAKE 3	2995	60/-30	95	-150/545	125/-95	85/-85	115	330	1185

Poor Reported Braking Action

MAX MANUAL	3055	65/-35	105	-165/620	225/-155	85/-85	85	630	1925
AUTOBRAKE MAX	3060	65/-35	105	-165/625	230/-155	85/-85	85	630	1925
AUTOBRAKE 3	3180	65/-35	105	-170/635	190/-130	90/-90	110	540	1845

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****PRI FLIGHT COMPUTERS (Flaps 20)****VREF20**

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1445	30/-15	30	-45/160	20/-15	30/-30	50	35	80
AUTOBRAKE MAX	1720	20/-20	40	-60/205	0/0	40/-40	75	0	0
AUTOBRAKE 2	2995	45/-45	85	-130/435	5/-30	85/-85	135	10	10

Good Reported Braking Action

MAX MANUAL	1995	30/-25	55	-80/275	50/-45	50/-50	75	145	360
AUTOBRAKE MAX	1975	30/-25	55	-80/270	50/-45	50/-50	75	145	350
AUTOBRAKE 2	2995	45/-45	85	-130/435	5/-30	85/-85	135	10	10

Good To Medium Reported Braking Action

MAX MANUAL	2320	40/-30	70	-105/355	85/-70	60/-60	85	265	705
AUTOBRAKE MAX	2300	40/-30	70	-100/350	90/-75	60/-60	85	265	695
AUTOBRAKE 2	3035	45/-45	90	-135/460	35/-45	85/-85	135	55	325

Medium Reported Braking Action

MAX MANUAL	2645	45/-35	85	-125/435	120/-95	70/-70	90	380	1050
AUTOBRAKE MAX	2625	45/-35	85	-120/430	125/-100	70/-70	90	380	1040
AUTOBRAKE 3	2800	40/-35	80	-130/450	75/-45	80/-80	130	220	890

Medium To Poor Reported Braking Action

MAX MANUAL	2985	55/-45	105	-155/545	190/-135	85/-85	100	580	1780
AUTOBRAKE MAX	2975	55/-45	105	-150/545	195/-145	85/-85	100	580	1775
AUTOBRAKE 3	3070	50/-45	100	-155/555	170/-105	90/-90	125	490	1690

Poor Reported Braking Action

MAX MANUAL	3325	60/-50	120	-180/655	260/-175	95/-95	105	775	2505
AUTOBRAKE MAX	3325	60/-50	120	-180/655	265/-185	95/-95	105	775	2505
AUTOBRAKE 3	3340	60/-50	120	-180/660	260/-160	95/-95	115	755	2490

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

SLATS DRIVE (Flaps 20)

VREF30 + 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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1380	45/-5	30	-45/150	15/-15	30/-30	40	35	75
AUTOBRAKE MAX	1900	30/-5	45	-65/220	0/0	45/-45	80	0	0
AUTOBRAKE 2	3180	60/-35	100	-135/445	60/-75	90/-90	95	190	190

Good Reported Braking Action

MAX MANUAL	1935	30/-15	50	-75/260	45/-40	50/-50	60	135	320
AUTOBRAKE MAX	2020	35/-10	55	-80/270	35/-20	50/-50	80	130	325
AUTOBRAKE 2	3180	60/-35	100	-135/445	60/-75	90/-90	95	190	190

Good To Medium Reported Braking Action

MAX MANUAL	2260	40/-20	65	-100/340	80/-65	60/-60	70	240	615
AUTOBRAKE MAX	2305	45/-20	70	-100/345	75/-50	60/-60	80	235	615
AUTOBRAKE 2	3210	65/-35	100	-140/470	80/-85	90/-90	95	220	360

Medium Reported Braking Action

MAX MANUAL	2580	50/-25	80	-120/420	110/-85	70/-70	75	340	905
AUTOBRAKE MAX	2590	50/-25	80	-120/420	110/-80	70/-70	80	340	905
AUTOBRAKE 3	3050	55/-30	90	-135/470	65/-70	85/-85	105	150	565

Medium To Poor Reported Braking Action

MAX MANUAL	2920	60/-35	100	-145/530	175/-125	80/-80	80	515	1505
AUTOBRAKE MAX	2930	60/-35	100	-145/530	175/-125	85/-85	85	515	1505
AUTOBRAKE 3	3240	65/-35	105	-155/565	135/-110	95/-95	105	360	1280

Poor Reported Braking Action

MAX MANUAL	3255	65/-40	115	-170/640	235/-160	90/-90	85	685	2100
AUTOBRAKE MAX	3265	65/-40	115	-170/640	240/-165	95/-95	85	685	2100
AUTOBRAKE 3	3430	70/-40	115	-175/655	200/-150	100/-100	105	565	1990

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance SPOILERS (Flaps 25) VREF25

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1235	25/-10	25	-40/140	15/-15	25/-25	40	25	60
AUTOBRAKE MAX	1595	20/-10	35	-60/195	0/0	35/-35	70	0	0
AUTOBRAKE 2	2700	40/-30	80	-120/410	20/-45	75/-75	110	50	50

Good Reported Braking Action

MAX MANUAL	1710	25/-15	45	-70/245	40/-35	40/-40	60	110	260
AUTOBRAKE MAX	1755	25/-15	45	-70/250	35/-30	40/-40	65	115	275
AUTOBRAKE 2	2700	40/-30	80	-120/410	20/-45	75/-75	110	50	50

Good To Medium Reported Braking Action

MAX MANUAL	1990	30/-20	60	-90/325	70/-60	50/-50	70	200	515
AUTOBRAKE MAX	2015	30/-20	60	-90/325	70/-55	50/-50	70	200	520
AUTOBRAKE 2	2735	45/-35	80	-125/435	40/-60	75/-75	110	80	225

Medium Reported Braking Action

MAX MANUAL	2270	35/-25	70	-110/400	100/-80	60/-60	75	285	765
AUTOBRAKE MAX	2275	35/-25	70	-110/400	100/-80	60/-60	75	285	765
AUTOBRAKE 3	2540	40/-25	70	-120/430	50/-35	70/-70	120	125	570

Medium To Poor Reported Braking Action

MAX MANUAL	2570	45/-35	85	-135/505	160/-115	70/-70	80	440	1290
AUTOBRAKE MAX	2580	45/-35	85	-135/505	165/-115	70/-70	80	440	1290
AUTOBRAKE 3	2735	45/-30	85	-145/525	130/-75	80/-80	120	340	1175

Poor Reported Braking Action

MAX MANUAL	2870	50/-40	100	-160/610	220/-150	80/-80	85	590	1810
AUTOBRAKE MAX	2880	50/-40	100	-160/610	225/-150	80/-80	85	590	1815
AUTOBRAKE 3	2925	50/-35	95	-165/615	205/-115	85/-85	115	555	1780

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance SPOILERS (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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1175	25/-5	25	-40/135	15/-10	25/-25	40	25	50
AUTOBRAKE MAX	1485	25/-5	35	-55/190	0/0	35/-35	65	0	0
AUTOBRAKE 2	2490	50/-20	70	-115/390	10/-35	65/-65	110	25	25

Good Reported Braking Action

MAX MANUAL	1610	30/-10	40	-70/240	40/-35	35/-35	60	95	230
AUTOBRAKE MAX	1645	30/-10	40	-70/240	35/-30	40/-40	65	100	240
AUTOBRAKE 2	2490	50/-20	70	-115/390	10/-35	65/-65	110	25	25

Good To Medium Reported Braking Action

MAX MANUAL	1870	40/-15	55	-90/315	70/-55	45/-45	70	175	455
AUTOBRAKE MAX	1890	40/-15	55	-90/315	65/-55	50/-50	70	180	460
AUTOBRAKE 2	2520	55/-20	75	-120/415	30/-50	70/-70	110	55	190

Medium Reported Braking Action

MAX MANUAL	2130	45/-20	65	-105/385	95/-75	55/-55	75	255	675
AUTOBRAKE MAX	2135	45/-20	65	-105/385	95/-75	55/-55	75	255	675
AUTOBRAKE 3	2335	50/-15	65	-115/410	50/-35	65/-65	115	120	530

Medium To Poor Reported Braking Action

MAX MANUAL	2410	55/-25	80	-130/490	155/-110	65/-65	80	395	1140
AUTOBRAKE MAX	2420	55/-25	80	-130/490	155/-110	65/-65	80	395	1145
AUTOBRAKE 3	2530	55/-20	80	-140/505	130/-75	70/-70	115	315	1060

Poor Reported Braking Action

MAX MANUAL	2690	60/-30	90	-155/595	210/-140	75/-75	85	530	1605
AUTOBRAKE MAX	2700	60/-30	90	-155/595	215/-145	75/-75	85	530	1610
AUTOBRAKE 3	2720	60/-25	90	-160/595	205/-110	75/-75	110	510	1590

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

STABILIZER (Flaps 20)

VREF30 + 20

	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	260000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 260000 KG	PER 1000 FT ABOVE SEA LEVEL	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	1295	40/-5	25	-45/145	15/-15	25/-25	40	30	65
AUTOBRAKE MAX	1755	30/-5	40	-65/210	0/0	40/-40	75	0	0
AUTOBRAKE 2	2955	60/-30	90	-125/430	40/-65	80/-80	95	120	120

Good Reported Braking Action

MAX MANUAL	1810	30/-10	45	-75/250	45/-35	45/-45	55	115	280
AUTOBRAKE MAX	1875	35/-5	50	-75/260	40/-25	45/-45	70	120	295
AUTOBRAKE 2	2955	60/-30	90	-125/430	40/-65	80/-80	95	120	120

Good To Medium Reported Braking Action

MAX MANUAL	2115	40/-15	60	-95/330	75/-60	55/-55	65	215	550
AUTOBRAKE MAX	2145	45/-15	65	-95/335	75/-50	55/-55	75	215	555
AUTOBRAKE 2	2985	60/-30	95	-130/455	60/-75	85/-85	95	150	280

Medium Reported Braking Action

MAX MANUAL	2415	45/-20	75	-115/405	100/-80	65/-65	75	310	815
AUTOBRAKE MAX	2415	50/-20	75	-115/405	105/-75	65/-65	80	305	815
AUTOBRAKE 3	2810	55/-25	80	-130/450	55/-55	80/-80	115	120	520

Medium To Poor Reported Braking Action

MAX MANUAL	2735	55/-30	90	-140/515	165/-120	75/-75	80	470	1370
AUTOBRAKE MAX	2740	60/-30	90	-140/515	170/-115	75/-75	85	470	1370
AUTOBRAKE 3	2995	60/-30	95	-150/545	125/-95	85/-85	115	330	1185

Poor Reported Braking Action

MAX MANUAL	3055	65/-35	105	-165/620	225/-155	85/-85	85	630	1925
AUTOBRAKE MAX	3060	65/-35	105	-165/625	230/-155	85/-85	85	630	1925
AUTOBRAKE 3	3180	65/-35	105	-170/635	190/-130	90/-90	110	540	1845

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.

For landing weights below 154500 kg, increase reference landing distance by 190 m.

Reference Distance includes an air distance allowance of 455 m from threshold to touchdown.

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	297.3	279.1				
52	126	306.3	287.0				
50	122	315.2	294.5	269.7			
48	118	323.5	303.4	276.9			
46	115	331.8	312.4	284.1	259.6		
44	111	340.4	321.1	291.5	267.7		
42	108	349.8	329.0	299.1	275.0	251.6	
40	104	356.7	337.3	307.2	281.4	257.0	
38	100	363.8	347.0	316.0	287.8	262.8	233.8
36	97	366.6	354.0	323.2	293.4	269.2	238.4
34	93	366.8	360.8	330.4	299.7	274.4	243.0
32	90	367.1	363.3	337.6	306.4	278.7	247.1
30	86	367.3	363.4	344.5	312.9	282.9	250.9
28	82	367.6	363.6	350.2	318.7	287.3	254.6
26	79	367.9	363.7	350.4	322.6	292.2	258.2
24	75	368.1	363.9	350.5	326.0	297.0	263.1
22	72	368.4	364.0	350.5	327.4	300.3	268.1
20	68	368.6	364.1	350.6	327.5	302.5	272.4
18	64	368.9	364.3	350.7	327.6	304.7	275.2
16	61	369.2	364.4	350.8	327.6	304.7	276.9
14	57	369.4	364.5	350.8	327.7	304.8	278.5
12	54	369.6	364.6	350.9	327.8	304.9	278.6
10	50	369.8	364.7	351.0	327.9	304.9	278.7
8	46	369.9	364.8	351.1	327.9	304.9	278.7
6	43	370.0	364.9	349.7	328.0	304.9	272.8
4	40	370.1	365.0	341.5	313.7	286.7	254.9
2	36	370.2	365.1	341.5	313.8	286.8	254.9
0	32	370.3	365.1	341.5	313.8	286.8	255.0
-40	-40	371.0	365.4	341.6	313.8	286.8	255.0

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1250 kg.

With engine anti-ice on, decrease weight by 150 kg.

With engine and wing anti-ice on, decrease weight by 2350 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 24600 kg.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	302.7	284.5				
52	126	310.0	292.5				
50	122	317.6	300.2	275.6			
48	118	325.1	307.8	282.4			
46	115	332.9	315.3	289.8	267.1		
44	111	340.7	322.9	297.4	273.6		
42	108	348.8	330.3	304.4	280.1	258.9	
40	104	355.6	337.9	311.1	286.7	264.5	
38	100	362.7	345.9	318.5	293.4	269.9	241.1
36	97	365.5	352.9	325.0	299.2	275.1	245.9
34	93	365.7	359.6	331.6	305.0	279.9	250.6
32	90	366.0	362.1	338.2	310.6	284.3	254.9
30	86	366.3	362.2	344.3	315.9	288.7	259.0
28	82	366.5	362.4	349.1	320.8	293.2	262.9
26	79	366.8	362.5	349.3	324.4	298.1	266.5
24	75	367.0	362.7	349.4	327.7	302.6	270.7
22	72	367.3	362.8	349.4	329.0	305.5	274.7
20	68	367.5	362.9	349.5	329.1	307.3	278.2
18	64	367.8	363.0	349.6	329.1	309.0	281.0
16	61	368.1	363.2	349.7	329.2	309.1	282.8
14	57	368.3	363.3	349.7	329.3	309.1	284.4
12	54	368.5	363.4	349.8	329.3	309.2	284.5
10	50	368.6	363.5	349.9	329.4	309.2	284.5
8	46	368.8	363.6	350.0	329.5	309.3	284.6
6	43	368.9	363.7	350.0	329.5	309.3	284.5
4	40	369.0	363.8	350.1	329.6	309.3	278.4
2	36	369.1	363.8	350.1	329.6	309.4	278.4
0	32	369.2	363.9	350.1	329.7	309.4	278.4
-40	-40	369.8	364.1	350.3	329.8	309.6	278.5

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.

With engine bleed for packs off, increase weight by 1400 kg.

With engine anti-ice on, decrease weight by 100 kg.

With engine and wing anti-ice on, decrease weight by 2300 kg.

When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 22400 kg.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT 1000 KG	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8
360	0	23.3	25.7	28.3	33.8	37.7	41.9	46.1	51.6	57.8	59.8	67.3	75.6	74.5	84.0	94.5	89.8	101.1	113.6
	10	23.9	26.4	29.2	34.8	38.8	43.2	47.5	53.2	59.6	61.7	69.4	78.0	76.9	86.6	97.4	92.6	104.1	116.9
	15	24.4	26.9	29.7	35.5	39.5	44.0	48.4	54.2	60.7	62.8	70.6	79.4	78.3	88.1	99.1	94.2	105.9	118.8
	20	24.8	27.4	30.2	36.1	40.2	44.8	49.2	55.2	61.8	63.9	71.9	80.8	79.6	89.6	100.8	95.8	107.6	120.6
	30	25.5	28.1	31.0	37.1	41.3	46.1	50.6	56.7	63.6	65.8	74.0	83.1	81.9	92.2	103.6	98.5	110.6	123.9
340	40	25.7	28.4	31.4	37.7	42.0	46.8	51.5	57.8	64.8	67.1	75.5	84.9	83.7	94.2	105.8	100.7	113.0	126.4
	0	22.2	24.5	27.0	32.3	35.9	39.9	43.9	49.1	55.0	56.9	64.0	71.9	71.0	79.9	90.0	85.6	96.4	108.4
	10	22.9	25.2	27.8	33.2	37.0	41.1	45.2	50.6	56.7	58.7	66.0	74.2	73.2	82.4	92.8	88.3	99.3	111.6
	15	23.3	25.7	28.3	33.9	37.7	41.9	46.1	51.6	57.7	59.8	67.2	75.5	74.5	83.9	94.4	89.8	101.0	113.4
	20	23.7	26.2	28.8	34.5	38.4	42.7	46.9	52.5	58.8	60.8	68.4	76.8	75.8	85.4	96.0	91.3	102.7	115.3
320	30	24.3	26.8	29.6	35.4	39.4	43.9	48.2	54.0	60.5	62.6	70.3	79.0	78.0	87.8	98.7	94.0	105.6	118.4
	40	24.6	27.1	30.0	35.9	40.0	44.6	49.0	55.0	61.6	63.8	71.8	80.7	79.7	89.7	100.8	96.0	107.9	120.9
	0	21.2	23.4	25.7	30.7	34.2	37.9	41.7	46.6	52.2	54.0	60.7	68.1	67.3	75.8	85.3	81.3	91.5	103.0
	10	21.8	24.0	26.5	31.6	35.2	39.1	43.0	48.1	53.8	55.7	62.6	70.3	69.5	78.2	88.0	83.8	94.4	106.1
	15	22.2	24.5	27.0	32.2	35.8	39.8	43.8	49.0	54.8	56.7	63.7	71.5	70.7	79.6	89.5	85.3	96.0	107.9
300	20	22.6	24.9	27.5	32.8	36.5	40.5	44.6	49.8	55.7	57.7	64.8	72.8	72.0	81.0	91.1	86.8	97.6	109.7
	30	23.2	25.6	28.2	33.7	37.5	41.6	45.8	51.2	57.3	59.4	66.7	74.9	74.0	83.3	93.7	89.3	100.4	112.7
	40	23.4	25.8	28.5	34.2	38.0	42.3	46.6	52.2	58.4	60.5	68.0	76.5	75.6	85.1	95.7	91.2	102.6	115.1
	0	20.2	22.2	24.5	29.2	32.4	36.0	39.5	44.1	49.3	51.1	57.3	64.3	63.7	71.6	80.6	76.8	86.6	97.5
	10	20.8	22.9	25.1	30.0	33.4	37.0	40.7	45.5	50.8	52.7	59.1	66.4	65.7	73.9	83.1	79.3	89.3	100.4
260	15	21.2	23.3	25.6	30.6	34.0	37.7	41.5	46.3	51.8	53.6	60.2	67.6	66.8	75.2	84.6	80.7	90.8	102.1
	20	21.6	23.7	26.1	31.2	34.6	38.4	42.2	47.2	52.7	54.6	61.3	68.8	68.0	76.5	86.1	82.1	92.4	103.8
	30	22.1	24.3	26.8	32.0	35.5	39.4	43.4	48.5	54.2	56.1	63.0	70.7	70.0	78.8	88.5	84.4	95.0	106.7
	40	22.3	24.6	27.1	32.4	36.0	40.1	44.1	49.3	55.2	57.2	64.3	72.2	71.4	80.4	90.5	86.3	97.1	109.0
	0	18.2	20.0	21.9	26.1	28.9	32.0	35.1	39.1	43.6	45.2	50.6	56.6	56.1	63.1	70.9	67.7	76.2	85.8
220	10	18.7	20.6	22.5	26.9	29.7	32.9	36.2	40.3	44.9	46.5	52.1	58.4	57.9	65.1	73.1	69.8	78.6	88.5
	15	19.1	20.9	23.0	27.4	30.3	33.6	36.8	41.1	45.8	47.4	53.1	59.5	58.9	66.2	74.4	71.1	80.0	90.0
	20	19.4	21.3	23.4	27.9	30.9	34.2	37.5	41.8	46.6	48.3	54.1	60.6	60.0	67.4	75.7	72.4	81.4	91.6
	30	19.9	21.9	24.0	28.6	31.7	35.1	38.5	43.0	47.9	49.6	55.6	62.3	61.7	69.4	77.9	74.4	83.8	94.2
	40	20.1	22.1	24.2	28.9	32.1	35.6	39.1	43.7	48.7	50.5	56.6	63.5	62.9	70.8	79.6	76.0	85.6	96.2
180	0	16.3	17.8	19.5	23.1	25.4	28.1	30.7	34.1	37.9	39.2	43.7	48.9	48.4	54.2	60.8	58.2	65.4	73.5
	10	16.7	18.3	20.0	23.7	26.2	28.9	31.6	35.1	39.0	40.3	45.1	50.4	49.9	55.9	62.7	60.0	67.4	75.8
	15	17.1	18.7	20.4	24.2	26.7	29.4	32.2	35.8	39.8	41.1	45.9	51.3	50.8	57.0	63.9	61.1	68.7	77.2
	20	17.4	19.0	20.8	24.6	27.1	30.0	32.8	36.4	40.5	41.8	46.7	52.2	51.7	58.0	65.0	62.2	69.9	78.5
	30	17.8	19.5	21.3	25.2	27.8	30.7	33.7	37.4	41.6	43.0	48.1	53.7	53.2	59.6	66.9	63.9	71.9	80.8
	40	17.9	19.6	21.5	25.5	28.2	31.1	34.1	38.0	42.3	43.7	48.9	54.7	54.1	60.8	68.2	65.2	73.4	82.5
	0	14.4	15.7	17.1	20.0	22.0	24.2	26.3	29.1	32.2	33.1	36.8	41.0	40.4	45.2	50.5	48.2	54.0	60.6
	10	14.8	16.1	17.6	20.6	22.6	24.9	27.0	29.9	33.1	34.1	37.9	42.2	41.6	46.5	52.0	49.7	55.7	62.5
	15	15.1	16.4	17.9	21.0	23.0	25.3	27.5	30.5	33.7	34.7	38.6	43.0	42.4	47.4	53.0	50.6	56.7	63.6
	20	15.4	16.7	18.2	21.3	23.5	25.8	28.0	31.0	34.4	35.3	39.3	43.8	43.2	48.3	53.9	51.5	57.8	64.8
	30	15.7	17.1	18.7	21.9	24.1	26.5	28.8	31.8	35.3	36.3	40.4	45.0	44.4	49.6	55.5	53.0	59.4	66.6
	40	15.8	17.2	18.8	22.1	24.3	26.8	29.1	32.3	35.8	36.8	41.0	45.7	45.1	50.5	56.5	53.9	60.5	68.0

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****Event Adjusted Brake Energy (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	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	3.6	13.6	23.5	33.2	42.8	52.3	61.8	71.4	81.0	90.6	100.5	110.4
	MAX AUTO	3.5	12.5	21.4	30.2	39.0	47.8	56.8	66.0	75.5	85.5	95.9	106.8
	AUTOBRAKE 4	3.2	11.7	20.0	28.0	36.0	44.0	52.2	60.6	69.4	78.7	88.6	99.2
	AUTOBRAKE 3	2.7	11.0	18.8	26.3	33.7	41.0	48.4	56.1	64.2	72.8	82.0	92.2
	AUTOBRAKE 2	2.3	10.2	17.5	24.5	31.2	37.9	44.6	51.5	58.9	66.7	75.2	84.6
	AUTOBRAKE 1	1.9	9.0	15.6	21.8	27.8	33.8	39.8	45.9	52.4	59.4	66.9	75.1

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	3.4	12.0	21.2	30.6	39.7	48.6	57.4	65.9	74.4	82.8	91.3	99.7
	MAX AUTO	2.0	8.8	15.9	23.2	30.5	38.0	45.7	53.7	62.1	71.0	80.6	90.9
	AUTOBRAKE 4	1.3	5.6	10.9	16.6	22.5	28.3	34.3	40.7	47.5	54.9	63.0	72.0
	AUTOBRAKE 3	0.8	3.1	7.0	11.6	16.2	20.9	25.8	30.9	36.6	42.7	49.6	57.3
	AUTOBRAKE 2	0.0	2.3	5.0	7.8	10.8	14.0	17.4	21.2	25.6	30.4	36.0	42.4
	AUTOBRAKE 1	0.0	1.6	3.3	5.2	7.2	9.4	11.8	14.4	17.4	20.8	24.7	29.2

Cooling Time (Minutes)

		EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
		16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
GEAR DOWN	NO SPECIAL	PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE
INFLIGHT											
GROUND			11	18	26	42	55	66	73		
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE	

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 for each taxi mile.

For one brake deactivated, increase brake energy by 10 percent.

For two brakes deactivated, increase brake energy by 20 percent.

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 8 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 EICAS 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.

(When inflight with gear extended, the BTMS indications may vary between individual brakes, due to airstream effects.)

Performance Inflight

Engine Inoperative

Chapter PI

Section 73

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	98.3	97.9	97.6
-5	98.4	99.9	101.2	101.3	100.5	100.2	99.7	99.3	98.8
-10	97.4	99.0	100.3	101.6	101.3	101.3	100.7	100.3	100.0
-15	96.5	98.1	99.3	100.6	101.0	102.0	101.1	100.8	100.5
-20	95.6	97.1	98.3	99.6	100.1	101.0	100.1	99.8	99.5
-25	94.6	96.1	97.4	98.6	99.1	100.0	99.1	98.8	98.5
-30	93.7	95.2	96.4	97.6	98.1	99.0	98.1	97.8	97.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	97.1	96.8	96.5
-40	91.7	93.2	94.4	95.6	96.0	96.9	96.1	95.8	95.5

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT													TAT (°C)
CIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.86	94.3	95.4	96.4	97.4	98.4	99.5	100.5	101.4	101.2	100.2	98.9	97.7
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3
35000 FT PRESS ALT													TAT (°C)
CIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1
33000 FT PRESS ALT													TAT (°C)
CIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4
31000 FT PRESS ALT													TAT (°C)
CIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	102.0	100.6	99.1	98.0
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1
29000 FT PRESS ALT													TAT (°C)
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2
27000 FT PRESS ALT													TAT (°C)
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.2
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	37	35	33	31	29	27
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/I ON - PACKS OFF	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

25000 FT to 18000 FT Pressure Altitudes

25000 FT PRESS ALT			TAT (°C)											
CIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1	
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6	
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7	
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9	
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9	
24000 FT PRESS ALT			TAT (°C)											
CIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4	
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8	
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9	
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2	
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6	
22000 FT PRESS ALT			TAT (°C)											
CIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3	
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5	
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6	
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1	
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8	
20000 FT PRESS ALT			TAT (°C)											
CIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1	
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1	
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3	
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2	
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3	
18000 FT PRESS ALT			TAT (°C)											
CIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100	100.9	101.8	102.0	100.6	99.4	
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6	
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8	
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2	
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
16000 FT to 5000 FT Pressure Altitudes

16000 FT PRESS ALT			TAT (°C)										
CIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4
14000 FT PRESS ALT			TAT (°C)										
CIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4
240	0.47	97.3	98.2	99.2	100.1	101.0	102.0	102.7	102.5	100.6	99.0	97.8	96.7
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6
12000 FT PRESS ALT			TAT (°C)										
CIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8
10000 FT PRESS ALT			TAT (°C)										
CIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6
5000 FT PRESS ALT			TAT (°C)										
CIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	16	14	12	10	5
ENGINE A/I ON	-0.3	-0.2	-0.4	-0.5	-0.5
WING A/I ON - PACKS ON	-0.4	-0.5	-0.6	-0.7	-0.8
WING A/I ON - PACKS OFF	-0.6	-0.7	-0.8	-0.9	-1.1

ENGINE INOP
MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	350	301	18000	16900	15700
340	331	293	19500	18400	17300
320	312	285	20900	20200	19100
300	291	276	22400	21500	20600
280	272	266	24200	23200	22000
260	252	257	26200	25300	24000
240	233	248	28500	27700	26300
220	214	238	30500	30000	28900
200	195	227	32300	32000	31300
180	175	215	34300	34100	33800
160	155	203	36500	36400	36200

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
134	125	118	111	105	100	95	90	86	82	79
268	251	236	222	210	200	190	181	173	166	159
402	376	354	333	316	300	285	272	260	249	239
535	501	471	445	421	400	380	363	347	332	319
668	626	588	555	526	500	476	454	434	416	399
800	750	706	666	631	600	571	545	521	499	479
932	874	823	777	736	700	666	636	608	583	560
1064	998	940	888	841	800	762	727	696	667	640
1196	1122	1057	998	946	900	857	818	783	751	721
1327	1246	1173	1109	1051	1000	952	910	870	835	801
1459	1369	1290	1220	1156	1100	1048	1001	958	918	882
1590	1493	1407	1330	1262	1200	1143	1092	1045	1002	963
1722	1617	1524	1441	1367	1300	1239	1183	1133	1086	1043
1854	1741	1641	1552	1472	1400	1334	1275	1220	1170	1124
1986	1865	1758	1662	1577	1500	1430	1366	1307	1254	1205
2118	1989	1875	1773	1682	1600	1525	1457	1395	1338	1285
2250	2113	1992	1884	1787	1700	1620	1548	1482	1421	1365
2383	2238	2109	1995	1892	1800	1716	1639	1569	1505	1446

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)											TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)											
	160	180	200	220	240	260	280	300	320	340	360	
100	1.0	1.1	1.2	1.4	1.4	1.6	1.7	1.7	1.8	1.9	2.0	0:15
200	2.3	2.5	2.8	3.0	3.2	3.4	3.6	3.8	4.1	4.3	4.5	0:31
300	3.6	3.9	4.4	4.8	5.1	5.4	5.8	6.1	6.5	6.9	7.2	0:46
400	4.9	5.4	6.0	6.6	7.0	7.5	7.9	8.4	8.9	9.5	10.0	1:01
500	6.2	6.8	7.5	8.2	8.8	9.4	10.0	10.6	11.2	11.9	12.6	1:16
600	7.4	8.1	9.0	9.8	10.6	11.3	12.0	12.7	13.4	14.3	15.2	1:30
700	8.6	9.4	10.4	11.4	12.3	13.1	13.9	14.8	15.6	16.6	17.7	1:45
800	9.7	10.7	11.9	13.0	14.0	14.9	15.9	16.8	17.8	19.0	20.2	1:59
900	10.9	12.0	13.3	14.5	15.6	16.8	17.8	18.9	20.0	21.3	22.7	2:14
1000	12.1	13.3	14.7	16.1	17.3	18.5	19.7	20.9	22.1	23.6	25.2	2:28
1100	13.2	14.6	16.1	17.6	19.0	20.3	21.6	22.9	24.3	25.9	27.6	2:43
1200	14.4	15.9	17.5	19.1	20.6	22.1	23.5	24.9	26.4	28.1	30.0	2:57
1300	15.5	17.2	18.9	20.6	22.3	23.8	25.4	26.9	28.5	30.4	32.4	3:11
1400	16.6	18.4	20.3	22.1	23.9	25.6	27.2	28.9	30.6	32.6	34.8	3:26
1500	17.7	19.6	21.7	23.6	25.5	27.3	29.1	30.9	32.7	34.8	37.2	3:40
1600	18.8	20.9	23.0	25.1	27.1	29.0	30.9	32.8	34.8	37.0	39.5	3:55
1700	19.9	22.1	24.4	26.6	28.7	30.7	32.8	34.8	36.8	39.2	41.9	4:10
1800	21.0	23.3	25.7	28.0	30.2	32.4	34.6	36.7	38.9	41.4	44.2	4:24

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
360	15600	14200	12700
350	16000	14700	13200
340	16900	15200	13700
330	17800	16300	14600
320	18800	17300	15600
310	19800	18300	16600
300	20500	19300	17700
290	21100	20200	18700
280	21800	20800	19800
270	22700	21500	20600
260	23600	22300	21200
250	24600	23400	21900
240	25800	24600	23100
230	27100	25900	24300
220	28500	27300	25600
210	29900	28600	27100
200	30900	30000	28500
190	31900	31200	30100
180	32900	32500	31400
170	34000	33700	32800
160	35200	35100	34300

With engine anti-ice on, no altitude capability adjustment is required.

With engine and wing anti-ice on, decrease altitude capability by 300 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
360	%N1	90.9	96.3								
	MACH	.602	.664								
	KIAS	334	337								
	FF/ENG	10070	10778								
340	%N1	89.9	94.9	97.6							
	MACH	.602	.664	.683							
	KIAS	334	337	335							
	FF/ENG	9696	10338	10505							
320	%N1	88.7	92.9	94.8	97.7						
	MACH	.602	.653	.670	.689						
	KIAS	334	332	328	325						
	FF/ENG	9267	9589	9644	9735						
300	%N1	86.8	91.0	92.7	94.7	97.9					
	MACH	.592	.638	.657	.674	.694					
	KIAS	329	324	321	317	315					
	FF/ENG	8693	8874	8919	8944	9073					
280	%N1	85.0	89.2	90.8	92.6	94.8	98.3				
	MACH	.574	.622	.641	.660	.677	.700				
	KIAS	319	315	313	310	306	305				
	FF/ENG	8068	8218	8264	8284	8332	8544				
260	%N1	82.9	87.2	88.8	90.5	92.3	94.7	98.4			
	MACH	.557	.605	.623	.643	.662	.679	.704			
	KIAS	309	306	304	302	299	295	294			
	FF/ENG	7484	7593	7619	7642	7676	7747	8011			
240	%N1	80.8	84.8	86.8	88.3	90.0	91.8	94.5	98.3		
	MACH	.540	.585	.605	.624	.644	.663	.681	.707		
	KIAS	299	296	295	293	291	288	284	283		
	FF/ENG	6926	6949	7005	7013	7041	7088	7163	7427		
220	%N1	78.6	82.5	84.2	86.1	87.7	89.4	91.2	93.8	97.8	
	MACH	.522	.564	.584	.604	.623	.644	.663	.681	.708	
	KIAS	289	285	284	283	281	279	276	272	272	
	FF/ENG	6372	6314	6372	6413	6419	6456	6501	6563	6820	
200	%N1	76.2	79.9	81.7	83.4	85.3	86.9	88.6	90.4	93.0	96.9
	MACH	.503	.543	.561	.581	.601	.621	.642	.661	.680	.706
	KIAS	278	274	272	271	270	268	267	264	260	260
	FF/ENG	5827	5717	5752	5795	5829	5836	5870	5906	5957	6195
180	%N1	73.8	77.2	78.9	80.7	82.3	84.2	85.8	87.5	89.3	91.9
	MACH	.484	.521	.538	.556	.575	.596	.616	.638	.658	.677
	KIAS	268	263	261	259	258	257	256	254	251	248
	FF/ENG	5301	5135	5167	5198	5215	5244	5254	5279	5309	5352
160	%N1	71.0	74.3	76.0	77.6	79.3	81.0	82.7	84.5	86.1	88.0
	MACH	.464	.498	.514	.530	.548	.567	.589	.609	.631	.652
	KIAS	257	251	249	247	246	244	243	242	240	238
	FF/ENG	4797	4574	4596	4632	4637	4636	4658	4673	4689	4716

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
284	263	244	227	213	200	190	181	173	166	159
565	523	485	453	425	400	381	364	348	334	321
847	784	728	680	638	600	572	546	522	501	482
1129	1045	970	906	850	800	763	729	698	669	643
1413	1308	1214	1133	1063	1000	954	911	872	836	804
1697	1570	1457	1361	1276	1200	1145	1094	1047	1004	965
1982	1834	1701	1588	1489	1400	1336	1276	1221	1171	1125
2268	2097	1945	1815	1702	1600	1526	1458	1395	1338	1286
2554	2362	2190	2043	1915	1800	1717	1640	1569	1505	1446
2842	2626	2434	2270	2128	2000	1908	1822	1743	1671	1606

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	3.8	0:39	3.3	0:38	3.0	0:36	2.7	0:36	2.5	0:35
400	8.0	1:13	7.3	1:10	6.8	1:08	6.4	1:05	6.1	1:03
600	12.1	1:48	11.2	1:44	10.6	1:39	10.0	1:35	9.7	1:32
800	16.2	2:23	15.1	2:17	14.3	2:11	13.6	2:06	13.2	2:01
1000	20.2	2:59	18.9	2:50	18.0	2:43	17.1	2:36	16.7	2:30
1200	24.2	3:34	22.7	3:24	21.7	3:15	20.7	3:06	20.2	2:59
1400	28.2	4:10	26.5	3:58	25.3	3:47	24.1	3:37	23.6	3:29
1600	32.1	4:46	30.2	4:33	28.9	4:19	27.6	4:08	26.9	3:58
1800	36.0	5:22	33.8	5:07	32.4	4:52	31.0	4:39	30.2	4:28
2000	39.8	5:59	37.5	5:42	36.0	5:25	34.4	5:10	33.5	4:58

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)										
	150	170	190	210	230	250	270	290	310	330	350
5	-1.0	-0.8	-0.6	-0.4	-0.2	0.0	0.3	0.7	1.1	1.7	2.4
10	-2.1	-1.7	-1.3	-0.9	-0.4	0.0	0.7	1.5	2.5	3.7	5.0
15	-3.3	-2.6	-2.0	-1.3	-0.7	0.0	1.0	2.3	3.8	5.6	7.6
20	-4.4	-3.5	-2.7	-1.8	-0.9	0.0	1.4	3.1	5.1	7.4	9.9
25	-5.5	-4.4	-3.4	-2.2	-1.1	0.0	1.8	3.9	6.3	9.1	12.2
30	-6.7	-5.4	-4.0	-2.7	-1.3	0.0	2.1	4.6	7.5	10.7	14.3
35	-7.8	-6.3	-4.7	-3.2	-1.6	0.0	2.5	5.3	8.6	12.2	16.2
40	-8.9	-7.2	-5.4	-3.6	-1.8	0.0	2.8	6.0	9.7	13.7	18.1

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
360	%N1	80.5	83.9	88.6	93.4			
	KIAS	264	264	265	269			
	FF/ENG	9070	9130	9370	9670			
340	%N1	78.7	81.9	86.7	91.4	100.4		
	KIAS	260	260	260	260	299		
	FF/ENG	8520	8560	8730	8950	10320		
320	%N1	76.7	79.7	84.6	89.2	96.4		
	KIAS	253	253	253	253	289		
	FF/ENG	7930	7940	8050	8210	9240		
300	%N1	74.7	77.7	82.3	87.1	92.4		
	KIAS	244	244	244	244	259		
	FF/ENG	7380	7360	7430	7550	8120		
280	%N1	72.8	75.7	80.1	85.0	90.1		
	KIAS	238	238	238	238	238		
	FF/ENG	6880	6850	6880	6950	7350		
260	%N1	70.7	73.6	77.8	82.8	87.8	95.1	
	KIAS	229	229	229	229	229	262	
	FF/ENG	6380	6340	6330	6380	6690	7470	
240	%N1	68.5	71.5	75.6	80.3	85.4	90.5	
	KIAS	223	223	223	223	223	228	
	FF/ENG	5910	5870	5820	5850	6110	6420	
220	%N1	66.2	69.1	73.2	77.7	82.8	87.7	96.7
	KIAS	217	217	217	217	217	217	242
	FF/ENG	5440	5400	5330	5350	5530	5760	6550
200	%N1	64.1	66.7	71.0	75.3	80.1	85.0	91.2
	KIAS	217	217	217	217	217	217	226
	FF/ENG	5010	4970	4910	4900	5040	5200	5550
180	%N1	62.0	64.6	68.6	72.9	77.6	82.5	87.2
	KIAS	217	217	217	217	217	217	217
	FF/ENG	4630	4580	4520	4500	4630	4730	4880
160	%N1	59.9	62.6	66.3	70.7	75.2	80.0	84.7
	KIAS	217	217	217	217	217	217	217
	FF/ENG	4300	4240	4160	4140	4250	4340	4450

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

**Gear Down Landing Rate of Climb Available
Flaps 20**

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	170	80				
50	220	130	-10			
48	260	170	30			
46	300	220	70	-70		
44	340	260	110	-30		
42	380	300	150	10	-130	
40	400	340	190	40	-100	
38	400	380	230	80	-70	-260
36	410	390	270	110	-50	-230
34	410	400	300	150	-20	-210
32	410	400	320	180	10	-180
30	420	400	320	200	40	-160
20	430	410	330	220	100	-70
10	440	420	290	170	60	-310
0	450	430	270	80	-110	-320
-20	470	450	280	90	-110	-330
-40	500	470	290	90	-110	-350

Rate of climb capability shown is valid for 260000 kg, gear down at VREF20 + 5.

Decrease rate of climb 30 ft/min per 5000 kg greater than 260000 kg.

Increase rate of climb 40 ft/min per 5000 kg less than 260000 kg.

Flaps 25

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-150	-250				
50	-110	-210	-350			
48	-70	-160	-310			
46	-40	-120	-270	-410		
44	0	-80	-230	-370		
42	40	-50	-190	-340	-480	
40	60	-10	-160	-300	-450	
38	60	30	-120	-270	-420	-610
36	70	50	-90	-240	-400	-580
34	70	50	-60	-210	-380	-560
32	70	50	-30	-180	-350	-540
30	70	50	-30	-160	-320	-520
20	80	50	-30	-140	-270	-430
10	80	60	-90	-240	-370	-500
0	90	60	-100	-280	-470	-690
-20	90	70	-110	-290	-490	-710
-40	100	70	-110	-310	-510	-740

Rate of climb capability shown is valid for 260000 kg, gear down at VREF25 + 5.

Decrease rate of climb 40 ft/min per 5000 kg greater than 260000 kg.

Increase rate of climb 30 ft/min per 5000 kg less than 260000 kg.

ADVISORY INFORMATION

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-400	-490				
50	-360	-450	-600			
48	-320	-410	-560			
46	-290	-380	-520	-660		
44	-250	-340	-490	-620		
42	-220	-300	-450	-590	-730	
40	-190	-260	-420	-560	-700	
38	-190	-230	-380	-530	-680	-860
36	-190	-210	-350	-500	-660	-840
34	-190	-210	-330	-470	-630	-820
32	-190	-210	-300	-450	-610	-800
30	-190	-210	-290	-430	-580	-780
20	-180	-210	-300	-410	-530	-700
10	-180	-210	-310	-540	-690	-840
0	-180	-210	-380	-550	-740	-960
-20	-190	-220	-390	-570	-770	-990
-40	-190	-230	-410	-600	-800	-1030

Increase rate of climb 40 ft/min per 5000 kg less than 260000 kg.

Performance Inflight

Alternate Mode EEC

Chapter PI

Section 74

ALTERNATE MODE EEC

Alternate Mode EEC Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	8400
55	131	95.7	96.0	96.2	96.1	96.0	96.1	96.1	96.1	96.1	95.5	94.6	94.2
50	122	97.1	97.5	98.0	97.6	97.3	97.4	97.5	97.5	97.4	96.8	95.9	95.6
45	113	98.5	98.9	99.4	99.1	98.8	98.7	98.8	98.8	98.7	98.2	97.3	96.9
40	104	99.6	100.2	100.9	100.4	100.2	100.0	99.9	100.0	99.9	99.4	98.6	98.2
35	95	99.3	100.8	102.8	102.3	101.8	101.4	101.2	101.3	101.0	100.4	99.6	99.3
30	86	98.5	99.9	102.7	104.0	104.0	103.8	103.4	103.4	102.6	101.5	100.7	100.3
25	77	97.7	99.1	101.8	103.1	104.4	105.5	105.8	106.3	105.3	103.8	102.4	101.8
20	68	96.9	98.3	101.0	102.3	103.5	104.6	105.8	106.8	106.8	105.9	104.8	104.3
15	59	96.0	97.4	100.1	101.4	102.6	103.7	104.9	105.9	106.4	106.1	105.6	105.3
10	50	95.2	96.6	99.2	100.5	101.7	102.8	103.9	105.0	105.5	105.2	104.9	104.8
5	41	94.4	95.7	98.4	99.6	100.8	101.9	103.0	104.1	104.5	104.2	104.0	103.8
0	32	93.5	94.9	97.5	98.7	99.9	101.0	102.1	103.1	103.6	103.3	103.0	102.9
-10	14	91.8	93.1	95.7	96.9	98.1	99.1	100.2	101.2	101.7	101.4	101.1	101.0
-20	-4	90.0	91.3	93.8	95.0	96.2	97.2	98.3	99.3	99.7	99.4	99.2	99.0
-30	-22	88.2	89.5	92.0	93.1	94.3	95.3	96.3	97.3	97.7	97.5	97.2	97.1
-40	-40	86.4	87.6	90.1	91.2	92.3	93.3	94.3	95.3	95.7	95.4	95.2	95.1
-50	-58	84.5	85.7	88.1	89.2	90.3	91.3	92.3	93.2	93.6	93.4	93.1	93.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)											
	-2	-1	0	1	2	3	4	5	6	7	8	8.4
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Intentionally
Blank

Performance Inflight

Gear Down

Chapter PI

Section 75

GEAR DOWN

220 KIAS Max Climb %N1

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	91.4	91.1	92.1	91.3	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.4	91.4	92.1	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	89.7	90.7	91.4	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	89.7	89.9	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.3	92.2	92.1	90.6	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.2	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.2	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

Anti-ice Adjustment

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

* Packs on or off with 2 bleed sources.

** Packs off with 1 bleed source.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
360	18500	16600	14200
350	19200	17300	14800
340	19700	18000	15500
330	20600	18900	16300
320	21700	20100	17600
310	22800	21300	19000
300	23900	22400	20300
290	25000	23500	21800
280	26000	24600	23000
270	27100	25900	24300
260	28200	27200	25700
250	29400	28600	27100
240	30400	30000	28500
230	31200	30800	29900
220	32000	31700	31000
210	32800	32600	32000
200	33500	33200	32700
190	34000	33900	33400
180	34600	34500	34100
170	35200	35100	34700
160	35800	35700	35300

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
360	%N1	84.4	88.7	90.7	93.0						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	7524	7653	7775	7993						
340	%N1	83.5	87.8	89.7	91.8						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	7296	7405	7486	7646						
320	%N1	82.6	86.7	88.3	90.0	92.1					
	MACH	.488	.534	.550	.568	.588					
	KIAS	270	269	267	265	264					
	FF/ENG	7058	7105	7101	7142	7267					
300	%N1	81.2	84.9	86.6	88.2	89.9	92.1				
	MACH	.481	.520	.537	.554	.572	.594				
	KIAS	266	262	260	258	257	256				
	FF/ENG	6725	6632	6624	6623	6679	6806				
280	%N1	79.3	83.1	84.9	86.4	87.9	89.7	92.3			
	MACH	.468	.507	.523	.540	.557	.576	.598			
	KIAS	259	255	253	252	250	248	248			
	FF/ENG	6283	6189	6167	6168	6164	6230	6361			
260	%N1	77.2	81.1	82.9	84.6	86.0	87.6	89.4	92.3	96.7	
	MACH	.453	.492	.508	.525	.542	.559	.579	.602	.628	
	KIAS	251	248	246	244	243	241	239	239	239	
	FF/ENG	5831	5754	5724	5709	5711	5706	5778	5910	6239	
240	%N1	75.0	79.0	80.8	82.4	84.1	85.5	87.1	89.0	92.0	
	MACH	.438	.476	.492	.508	.525	.543	.561	.581	.605	
	KIAS	242	240	238	237	235	233	231	230	230	
	FF/ENG	5377	5317	5292	5266	5254	5253	5252	5320	5450	
220	%N1	72.6	76.7	78.4	80.2	81.7	83.4	84.9	86.4	88.4	91.5
	MACH	.421	.459	.475	.491	.508	.525	.543	.561	.582	.606
	KIAS	232	231	230	228	227	225	224	222	221	220
	FF/ENG	4925	4872	4859	4836	4811	4800	4799	4799	4859	4983
200	%N1	69.9	74.1	75.8	77.5	79.3	80.9	82.7	84.4	86.3	88.5
	MACH	.403	.441	.456	.473	.489	.506	.526	.548	.571	.596
	KIAS	223	221	220	219	218	217	217	216	217	217
	FF/ENG	4476	4425	4418	4408	4384	4360	4387	4432	4481	4565
180	%N1	67.8	72.2	74.1	75.9	77.9	79.8	81.5	83.3	85.1	87.0
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	4152	4138	4141	4159	4170	4182	4208	4249	4283	4335
160	%N1	66.8	71.3	73.1	74.9	76.9	78.7	80.5	82.4	84.1	85.9
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	4013	3995	3994	4006	4019	4031	4053	4088	4125	4159

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
310	280	254	233	216	200	189	179	170	162	155
622	562	510	467	431	400	378	358	340	324	311
936	845	766	702	648	600	567	538	511	487	466
1253	1131	1024	937	864	800	757	718	682	650	621
1573	1418	1283	1173	1081	1000	946	897	852	812	776
1896	1706	1542	1409	1298	1200	1135	1076	1022	973	930
2222	1997	1803	1646	1515	1400	1324	1254	1191	1134	1084
2552	2291	2066	1884	1733	1600	1513	1433	1361	1296	1238
2883	2586	2329	2122	1951	1800	1702	1612	1530	1457	1392
3215	2881	2593	2361	2169	2000	1890	1790	1699	1618	1545
3547	3177	2857	2600	2387	2200	2079	1968	1868	1778	1699
3880	3472	3120	2838	2604	2400	2268	2147	2038	1940	1853
4213	3768	3384	3076	2822	2600	2457	2326	2207	2101	2007
4545	4063	3648	3315	3040	2800	2646	2505	2377	2262	2161
4878	4359	3912	3554	3258	3000	2835	2683	2546	2424	2315
5211	4655	4176	3792	3476	3200	3023	2862	2716	2585	2468
5544	4951	4440	4031	3694	3400	3212	3041	2885	2746	2622
5876	5246	4703	4269	3912	3600	3401	3220	3055	2907	2776
6209	5541	4967	4507	4130	3800	3590	3398	3224	3068	2930
6542	5837	5230	4746	4348	4000	3778	3576	3393	3229	3084

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	7.4	0:46	6.7	0:44	5.8	0:42	5.3	0:41	5.0	0:39
400	15.0	1:29	13.9	1:25	12.4	1:20	11.6	1:17	11.1	1:13
600	22.6	2:13	21.1	2:06	19.0	1:58	17.9	1:53	17.2	1:48
800	30.0	2:57	28.0	2:48	25.4	2:37	24.0	2:30	23.0	2:23
1000	37.3	3:42	34.9	3:30	31.8	3:15	30.1	3:07	28.9	2:57
1200	44.4	4:28	41.6	4:14	38.0	3:55	35.9	3:44	34.5	3:33
1400	51.5	5:14	48.3	4:57	44.1	4:35	41.8	4:22	40.1	4:09
1600	58.3	6:01	54.7	5:41	50.1	5:15	47.5	5:00	45.6	4:45
1800	65.1	6:49	61.2	6:26	56.1	5:56	53.1	5:38	51.0	5:21
2000	71.7	7:37	67.5	7:11	61.9	6:37	58.7	6:17	56.3	5:57
2200	78.3	8:25	73.7	7:56	67.7	7:18	64.2	6:55	61.6	6:33
2400	84.8	9:13	79.9	8:41	73.4	7:59	69.6	7:34	66.8	7:09
2600	91.3	10:00	86.0	9:26	79.1	8:40	75.0	8:12	72.0	7:45
2800	97.6	10:48	92.0	10:11	84.6	9:21	80.3	8:51	77.1	8:21
3000	104.0	11:36	98.0	10:56	90.2	10:02	85.6	9:29	82.1	8:57
3200	110.2	12:24	103.9	11:41	95.7	10:43	90.8	10:08	87.1	9:33
3400	116.5	13:12	109.8	12:27	101.1	11:24	96.0	10:46	92.1	10:09
3600	122.6	14:00	115.6	13:12	106.5	12:05	101.1	11:25	97.0	10:45
3800	128.7	14:48	121.4	13:57	111.9	12:46	106.2	12:03	101.9	11:21
4000	134.8	15:36	127.2	14:42	117.2	13:27	111.3	12:42	106.8	11:57

GEAR DOWN

Long Range Cruise Enroute Fuel and Time Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)											
	150	170	190	210	230	250	270	290	310	330	350	
10	-1.8	-1.6	-1.3	-0.9	-0.4	0.0	0.8	1.8	2.9	4.1	5.5	
20	-3.6	-3.2	-2.6	-1.8	-0.9	0.0	1.6	3.4	5.5	7.9	10.5	
30	-5.3	-4.7	-3.8	-2.7	-1.4	0.0	2.2	4.9	7.9	11.3	15.1	
40	-6.8	-6.0	-5.0	-3.5	-1.8	0.0	2.9	6.2	10.1	14.4	19.2	
50	-8.3	-7.3	-6.0	-4.2	-2.2	0.0	3.4	7.4	12.0	17.1	22.9	
60	-9.5	-8.4	-6.9	-4.9	-2.5	0.0	3.9	8.4	13.7	19.6	26.1	
70	-10.7	-9.5	-7.8	-5.5	-2.8	0.0	4.3	9.3	15.1	21.6	28.9	
80	-11.7	-10.4	-8.5	-6.1	-3.1	0.0	4.6	10.1	16.3	23.4	31.2	
90	-12.6	-11.2	-9.2	-6.5	-3.4	0.0	4.9	10.7	17.3	24.8	33.1	
100	-13.4	-11.9	-9.8	-7.0	-3.7	0.0	5.1	11.1	18.0	25.9	34.6	
110	-14.1	-12.5	-10.3	-7.3	-3.9	0.0	5.2	11.4	18.5	26.6	35.6	
120	-14.6	-12.9	-10.7	-7.6	-4.0	0.0	5.3	11.6	18.8	27.0	36.1	
130	-15.0	-13.3	-11.0	-7.9	-4.2	0.0	5.3	11.6	18.8	27.0	36.2	
140	-15.2	-13.5	-11.2	-8.1	-4.3	0.0	5.2	11.5	18.6	26.7	35.8	

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30 + 80

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	35	40	44	48	52	57	61	65	69	74
TIME (MINUTES)	11	12	13	14	15	15	16	17	18	18

GEAR DOWN

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
360	%N1	76.1						
	KIAS	264						
	FF/ENG	7750						
340	%N1	74.6	77.7					
	KIAS	260	260					
	FF/ENG	7360	7350					
320	%N1	72.8	75.8					
	KIAS	253	253					
	FF/ENG	6890	6870					
300	%N1	70.6	73.7	78.1				
	KIAS	244	244	244				
	FF/ENG	6380	6370	6340				
280	%N1	68.8	72.0	76.3				
	KIAS	238	238	238				
	FF/ENG	5970	5960	5920				
260	%N1	66.7	69.7	74.1	78.6			
	KIAS	229	229	229	229			
	FF/ENG	5520	5510	5470	5490			
240	%N1	64.9	67.7	72.2	76.7			
	KIAS	223	223	223	223			
	FF/ENG	5150	5130	5100	5100			
220	%N1	63.1	65.8	70.1	74.6	79.4		
	KIAS	217	217	217	217	217		
	FF/ENG	4800	4770	4730	4730	4770		
200	%N1	61.9	64.7	68.8	73.3	78.0	82.7	
	KIAS	217	217	217	217	217	217	
	FF/ENG	4610	4570	4520	4520	4550	4610	
180	%N1	61.0	63.8	67.8	72.2	76.9	81.5	86.0
	KIAS	217	217	217	217	217	217	217
	FF/ENG	4450	4410	4360	4350	4370	4420	4520
160	%N1	60.1	62.9	66.8	71.3	75.9	80.5	84.9
	KIAS	217	217	217	217	217	217	217
	FF/ENG	4320	4270	4210	4190	4210	4260	4350

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

**Holding
Flaps 1**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
360	%N1	75.9	79.0	83.8	88.3	94.3
	KIAS	244	244	244	244	244
	FF/ENG	7660	7700	7690	7810	8200
340	%N1	74.3	77.4	82.1	86.8	91.8
	KIAS	240	240	240	240	240
	FF/ENG	7240	7260	7250	7350	7630
320	%N1	72.5	75.5	80.0	84.9	89.7
	KIAS	233	233	233	233	233
	FF/ENG	6770	6780	6770	6830	7040
300	%N1	70.3	73.4	77.8	82.9	87.6
	KIAS	224	224	224	224	224
	FF/ENG	6270	6270	6270	6320	6450
280	%N1	68.3	71.5	75.8	80.6	85.6
	KIAS	218	218	218	218	218
	FF/ENG	5840	5840	5820	5870	5980
260	%N1	66.0	69.1	73.5	78.1	83.3
	KIAS	209	209	209	209	209
	FF/ENG	5380	5370	5340	5400	5460
240	%N1	64.1	66.9	71.4	75.9	81.0
	KIAS	203	203	203	203	203
	FF/ENG	4980	4960	4930	4970	5020
220	%N1	62.0	64.7	69.0	73.6	78.4
	KIAS	197	197	197	197	197
	FF/ENG	4600	4570	4530	4550	4610
200	%N1	60.5	63.2	67.3	71.8	76.5
	KIAS	197	197	197	197	197
	FF/ENG	4350	4310	4260	4270	4310
180	%N1	59.1	61.8	65.8	70.3	74.9
	KIAS	197	197	197	197	197
	FF/ENG	4140	4100	4040	4050	4070
160	%N1	57.9	60.7	64.6	69.0	73.5
	KIAS	197	197	197	197	197
	FF/ENG	3970	3920	3860	3860	3860

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight

Gear Down, Engine INOP

Chapter PI

Section 76

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
320	307	254	5600	4400	2200
300	288	246	7700	6800	5300
280	269	238	9800	9100	8100
260	250	230	12100	11400	10300
240	230	223	14000	13500	12400
220	210	217	15900	15400	14400
200	191	216	17300	16700	15700
180	172	216	18500	18100	16900
160	153	216	19700	19400	18200

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
340	1800		
330	3300	1000	
320	4500	2700	
310	5700	4400	1900
300	6800	5700	3800
290	7800	7000	5300
280	8800	8100	6700
270	9800	9100	8100
260	11100	10400	9300
250	12100	11400	10300
240	13100	12500	11300
230	14000	13600	12400
220	15100	14600	13600
210	15900	15400	14400
200	16700	16100	15100
190	17400	16700	15800
180	18000	17500	16400
170	18700	18200	16900
160	19300	18900	17700

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
300	%N1	94.3	96.8						
	MACH	.403	.418						
	KIAS	244	244						
	FF/ENG	12328	12507						
280	%N1	92.3	94.1	96.8					
	MACH	.393	.407	.422					
	KIAS	238	238	238					
	FF/ENG	11514	11566	11807					
260	%N1	90.5	91.6	93.6	96.4				
	MACH	.385	.393	.408	.423				
	KIAS	233	229	229	229				
	FF/ENG	10870	10626	10714	10945				
240	%N1	88.9	89.8	91.3	93.4	96.5			
	MACH	.379	.385	.397	.412	.428			
	KIAS	229	225	223	223	223			
	FF/ENG	10228	9966	9915	10023	10245			
220	%N1	86.6	88.0	89.1	90.9	93.1	96.4		
	MACH	.368	.377	.387	.401	.417	.433		
	KIAS	223	220	217	217	217	217		
	FF/ENG	9452	9309	9167	9222	9323	9542		
200	%N1	84.2	86.0	87.8	89.5	91.4	94.0	98.1	
	MACH	.358	.371	.385	.400	.415	.431	.448	
	KIAS	217	217	217	217	217	217	217	
	FF/ENG	8693	8698	8718	8773	8844	8956	9300	
180	%N1	82.9	84.7	86.7	88.4	90.2	92.3	95.5	100.2
	MACH	.358	.371	.385	.400	.415	.431	.448	.466
	KIAS	217	217	217	217	217	217	217	217
	FF/ENG	8330	8328	8342	8399	8458	8533	8740	9239
160	%N1	81.7	83.6	85.4	87.3	89.0	90.9	93.5	97.7
	MACH	.358	.371	.385	.400	.415	.431	.448	.466
	KIAS	217	217	217	217	217	217	217	217
	FF/ENG	8019	8011	8010	8058	8115	8168	8310	8670

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
165	145	129	118	108	100	95	90	84	78	73
332	295	263	238	218	200	187	175	165	155	147
500	444	396	358	327	300	280	262	246	233	221
669	593	528	477	436	400	374	350	329	310	294
837	742	661	597	545	500	467	437	410	387	367
1007	893	795	718	655	600	560	524	492	464	440
1177	1043	928	838	764	700	653	611	574	541	513
1347	1193	1061	958	873	800	746	698	655	618	586
1519	1344	1195	1078	983	900	839	785	737	695	659
1691	1496	1329	1198	1092	1000	933	873	819	772	731

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	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)
100	4.0	0:27	3.8	0:26	3.5	0:26	3.4	0:25	3.3	0:25
200	8.2	0:51	7.8	0:50	7.5	0:49	7.3	0:48	7.2	0:47
300	12.3	1:15	11.8	1:14	11.4	1:12	11.1	1:10	11.1	1:09
400	16.4	1:40	15.8	1:38	15.3	1:36	14.9	1:33	14.9	1:30
500	20.5	2:04	19.7	2:02	19.1	1:59	18.7	1:56	18.7	1:53
600	24.5	2:29	23.6	2:27	22.9	2:23	22.5	2:19	22.4	2:15
700	28.5	2:53	27.5	2:51	26.7	2:46	26.1	2:42	26.0	2:37
800	32.5	3:18	31.3	3:16	30.4	3:10	29.8	3:05	29.6	2:59
900	36.4	3:43	35.1	3:40	34.1	3:34	33.4	3:28	33.2	3:22
1000	40.3	4:08	38.8	4:05	37.8	3:58	37.0	3:51	36.7	3:44

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	150	200	250	300	350
5	-0.8	-0.5	0.0	1.6	2.6
10	-1.8	-1.1	0.0	3.0	5.6
15	-2.8	-1.6	0.0	4.4	8.6
20	-3.7	-2.2	0.0	5.6	11.6
25	-4.5	-2.7	0.0	6.8	14.4
30	-5.4	-3.2	0.0	7.8	17.3
35	-6.2	-3.7	0.0	8.7	20.0
40	-7.0	-4.2	0.0	9.5	22.7
45	-7.7	-4.7	0.0	10.2	25.3

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
340	%N1	95.5			
	KIAS	260			
	FF/ENG	14970			
320	%N1	93.4	97.2		
	KIAS	253	253		
	FF/ENG	13980	14120		
300	%N1	91.1	94.3		
	KIAS	244	244		
	FF/ENG	12970	12940		
280	%N1	89.3	92.3	98.8	
	KIAS	238	238	238	
	FF/ENG	12100	12090	12660	
260	%N1	86.8	90.0	94.8	
	KIAS	229	229	229	
	FF/ENG	11100	11180	11340	
240	%N1	84.6	88.0	92.2	
	KIAS	223	223	223	
	FF/ENG	10310	10380	10460	
220	%N1	82.3	85.7	90.0	96.4
	KIAS	217	217	217	217
	FF/ENG	9540	9590	9650	10020
200	%N1	80.8	84.2	88.6	94.0
	KIAS	217	217	217	217
	FF/ENG	9080	9130	9180	9400
180	%N1	79.6	82.9	87.5	92.3
	KIAS	217	217	217	217
	FF/ENG	8700	8750	8780	8960
160	%N1	78.6	81.7	86.4	90.9
	KIAS	217	217	217	217
	FF/ENG	8380	8420	8430	8580

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight

Text

Chapter PI

Section 77

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. 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 Flight Manual, the Flight Manual shall always take precedence.

General

FMC Takeoff Speeds

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. 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.

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 below those shown in the Minimum Weight for FMC Takeoff Speeds Calculation table. In those cases where the required speed increase exceeds the maximum speed increase built into the FMC, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. This typically occurs at high rated thrust, high flaps setting and light weights. To obtain speeds for the takeoff in these situations, the options are to use available performance software, or select a smaller flap setting, or use reduced takeoff thrust and/or add weight. Selecting derate thrust is the preferred method of reduced takeoff thrust as this will reduce the minimum control speeds.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/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 colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush 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 is determined as follows:

- (1) Determine the dry field/obstacle limit weight for the takeoff flap setting.
- (2) 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.
- (3) Adjust field length available for temperature by amount shown on chart.
- (4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Takeoff speed determination:

(1) Determine takeoff speeds $V1$, VR and $V2$ for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(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

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. Good reported braking action denotes wet runway conditions or runways covered by compact snow. Similarly, poor braking action denotes runways covered with wet ice. Performance is based on reversers operating and 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.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a $V1$ less than minimum $V1$ for control on the ground, $V1(MCG)$, and VR less than minimum VR , $(1.05) VMCA$. It is therefore necessary to compare the adjusted $V1$ and VR to $V1(MCG)$ and Minimum VR respectively. To find $V1(MCG)$ and Minimum VR , enter the $V1(MCG)$, Minimum VR 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 Min VR , set VR equal to Min VR and determine a new $V2$ by adding the difference between the normal VR and Min VR to the normal $V2$. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around %N1

To find Go-Around %N1 based on normal engine bleed for packs on and anti-ice off, enter the Go-Around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for engine bleeds for various conditions.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body 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 may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables 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 may also be unreliable.

Flight at Low Gross Weight

Flight at weights lower than 340000 lb (154221 kg) require the use of the Alternate Low Weight Operations AFM-DPI performance. The Performance Inflight sections contain only data that is considered to be minimal operationally necessary to support flight operations after dispatch. This consists of VREF, Normal Configuration Landing Distances and Non-normal Landing Configuration Distances. Low gross weight operations should be a planned event and the crews should be provided all necessary performance data from their flight planning software.

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. Note that these tables consider 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 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 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, .84 Mach approximates the Long Range Cruise Mach schedule.

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 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 .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

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.

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 at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. 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 30 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 for the selected flap setting. Flaps 1 is based on VREF30 + 60 speed schedule. 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

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

The table "Approach or Landing Climb Limited Weight" presents the data which are the more limiting of Approach Climb Limit Weight and Landing Climb Limit Weight.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding 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.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy 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 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, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

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 Mach number of .84 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 engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude 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/Cruise 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 correct 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 Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC 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 PENALTY (KG/HR)				
	GROSS WEIGHT (1000 KG)				
	300	260	220	180	140
43				160	140
39			180	160	145
35		200	190	170	140
31	230	220	195	165	140
25	230	220	195	175	155
20	235	230	205	185	165
15	235	235	215	200	185
10	240	240	230	220	200
5	270	270	255	240	220

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 .84/310/250 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 corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required 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 is planned. The tables show gear down rate of climb available for Flaps 20, Flaps 25 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

For most conditions, no takeoff speed adjustments or other performance adjustments other than takeoff power setting adjustments are required for operation of EEC in the ALTERNATE mode. For pressure altitudes between -2000 feet and -1000 feet and temperatures greater than ISA + 15°C, a thrust reduction occurs with EEC in the ALTERNATE mode. Performance software must be used to account for appropriate takeoff performance in this environmental region.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. 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 will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

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.

DO NOT USE FOR FLIGHT

777 Flight Crew Operations Manual

777-8 & -9 Incorporation Notice
Incorporation Notice

Chapter 0
Section 1



Flight Crew Operations Manual

777-8 & -9 Incorporation

The Boeing Company
Seattle, Washington 98124-2207



Flight Crew Operations Manual Information

To accommodate incorporation of 777-8 and 777-9 into the FCOM/QRH, some minor changes will appear in all customer manuals.

Specifically, some PDF bookmarks now indicate applicability to minor models. In addition, new abbreviations applicable to the 777-8 and -9 are incorporated. Some of these abbreviations may affect all minor models.

The changes can appear in all manuals, regardless of airplane fleet configuration. Some, but not all, 777-8 and 777-9 changes will be identified by revision bars and associated revision highlights. Examples of changes not identified by revision bars and highlights would be those generated by page formatting, page header and footer content, TOC entries, and bookmarks. All changes that affect chapter content will be identified with revision bars and highlights.

Administrative Information

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

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**Airplane General, Emergency
Equipment, Doors, Windows
Table of Contents****Chapter 1****Section TOC**

Dimensions	1.10
Principal Dimensions	1.10.1
Turning Radius	1.10.5
Instrument Panels.....	1.20
Flight Deck Panels	1.20.1
Inst. Panels, Overhead	1.21
Overhead Panel	1.21.1
Overhead Maintenance Panel	1.21.3
Inst. Panels, Fwd.....	1.22
Left Forward Panel	1.22.1
Right Forward Panel	1.22.2
Glareshield Panel	1.22.3
Center Forward Panel	1.22.4
EICAS Display	1.22.5
Forward Aisle Stand	1.22.6
Multifunction Display.....	1.22.7
Inst. Panels, Aft and Side.....	1.23
Control Stand.....	1.23.1
Aft Aisle Stand.....	1.23.2
Left and Right Sidewall, First Observer, and Maintenance Access Terminal/Second Observer Panels	1.23.4
Controls and Indicators	1.30
Push-Button Switches	1.30.1
Alternate Action Switches	1.30.1
Momentary Action Switches	1.30.2

Signs and Lighting	1.30.3
Lighting Panel	1.30.6
Miscellaneous Lighting Controls	1.30.7
Flight Deck Emergency Lights Switch	1.30.7
Cabin Emergency Lights Switch	1.30.8
Floor Lights Switch	1.30.8
Aisle Stand Panel/Flood Light Control	1.30.9
Map Light Control	1.30.9
Forward Panel Brightness Controls	1.30.9
Doors and Windows	1.30.11
Door Synoptic Display	1.30.11
Entry Door	1.30.14
Overwing Emergency Exit Door	1.30.15
Door Mode Select Panel	1.30.16
Flight Deck Door	1.30.18
Flight Deck Number Two Window	1.30.21
Oxygen Systems	1.30.22
Oxygen Indications	1.30.22
Passenger Oxygen Switch	1.30.23
Supernumerary Oxygen Switch	1.30.24
Oxygen Mask Panel	1.30.25
Oxygen Mask and Regulator	1.30.26
Emergency Evacuation Panel	1.30.27
Fuselage Mounted Emergency Locator Transmitter	1.30.28
Systems Description	1.40
Introduction	1.40.1
Lighting Systems	1.40.1
Exterior Lighting	1.40.1
Exterior Lighting Locations	1.40.3
Flight Deck Lighting	1.40.3
Master Brightness Control System	1.40.4
Cabin Lighting	1.40.5
Cabin Signs	1.40.5

Emergency Lighting	1.40.6
Oxygen Systems	1.40.11
Flight Crew Oxygen System.	1.40.11
Passenger Oxygen System	1.40.12
Supernumerary Oxygen System	1.40.13
Emergency Equipment.	1.45
Emergency Equipment Overview	1.45.1
Emergency Evacuation Signal System	1.45.1
Emergency Locator Transmitter (ELT)	1.45.1
Fuselage Mounted Emergency Locator Transmitter (ELT)	1.45.2
Miscellaneous Portable Emergency Equipment	1.45.2
Fire Extinguishers	1.45.2
Halon and Halon Equivalent Fire Extinguishers	1.45.2
Water Fire Extinguishers	1.45.3
Portable Oxygen Bottles	1.45.3
Flashlights	1.45.4
Emergency Equipment.	1.45.5
Emergency Equipment Symbols	1.45.5
Emergency Equipment Locations - Passenger Airplane	1.45.5
Emergency Equipment Locations - Freighter.	1.45.12
Crew Rest	1.46
Introduction	1.46.1
Crew Rest.	1.46.1
General	1.46.1
Occupancy	1.46.2
Door 1 Overhead Crew Rest.	1.46.2
Lower Crew Rest (LCR).	1.46.2
Door 3 Overhead Crew Rest.	1.46.3
Door 4 Overhead Crew Rest.	1.46.4
Door 5 Overhead Crew Rest.	1.46.5
Flight Crew Rest Layout.	1.46.6

Control and Indicators	1.46.7
Main Control Panel	1.46.7
Lower Crew Rest (LCR) Control Panel	1.46.11
Amenities Module	1.46.15
Oxygen System	1.46.17
Portable Oxygen	1.46.18
Decompression	1.46.18
Smoke and Fire	1.46.18
Crew Rest Smoke Detection	1.46.19
LCR Fire Protection	1.46.22
Emergency Equipment	1.46.23
Emergency Equipment Symbols	1.46.23
Emergency Equipment Location	1.46.23
Evacuation from the Crew Rest Area	1.46.29
Overhead Flight Crew Rest Emergency Hatch	1.46.29
Door 3 Overhead Crew Rest Emergency Hatch	1.46.33
Door 4 Overhead Crew Rest Emergency Hatch	1.46.36
Door 5 Overhead Crew Rest Emergency Hatch	1.46.39
Lower Crew Rest Emergency Hatch	1.46.43
Supernumerary Area	1.47.1
Supernumerary Area Layout	1.47.2
Supernumerary Display and Control Panel	1.47.3
Entry Door	1.47.10
Decompression	1.47.20
Supernumerary Oxygen	1.47.21
Rigid Cargo Barrier	1.47.23
Doors, Windows, Seats	1.50
Introduction	1.50.1
Doors and Windows	1.50.1
Flight Deck Door	1.50.1
Flight Deck Number Two Windows	1.50.3
Entry Doors	1.50.4

Entry Door Slide/Raft	1.50.5
Overwing Escape Slide	1.50.6
Emergency Exit Operation	1.50.6
Cargo Doors	1.50.14
Flight Deck Seats	1.50.15
Pilot Seats	1.50.16
Pilot Seat Adjustment	1.50.19
Observer Seats	1.50.20
EICAS Messages	1.60
Airplane General, Emergency Equipment, Doors, Windows	
EICAS Messages	1.60.1
EICAS Memo Messages	1.60.3

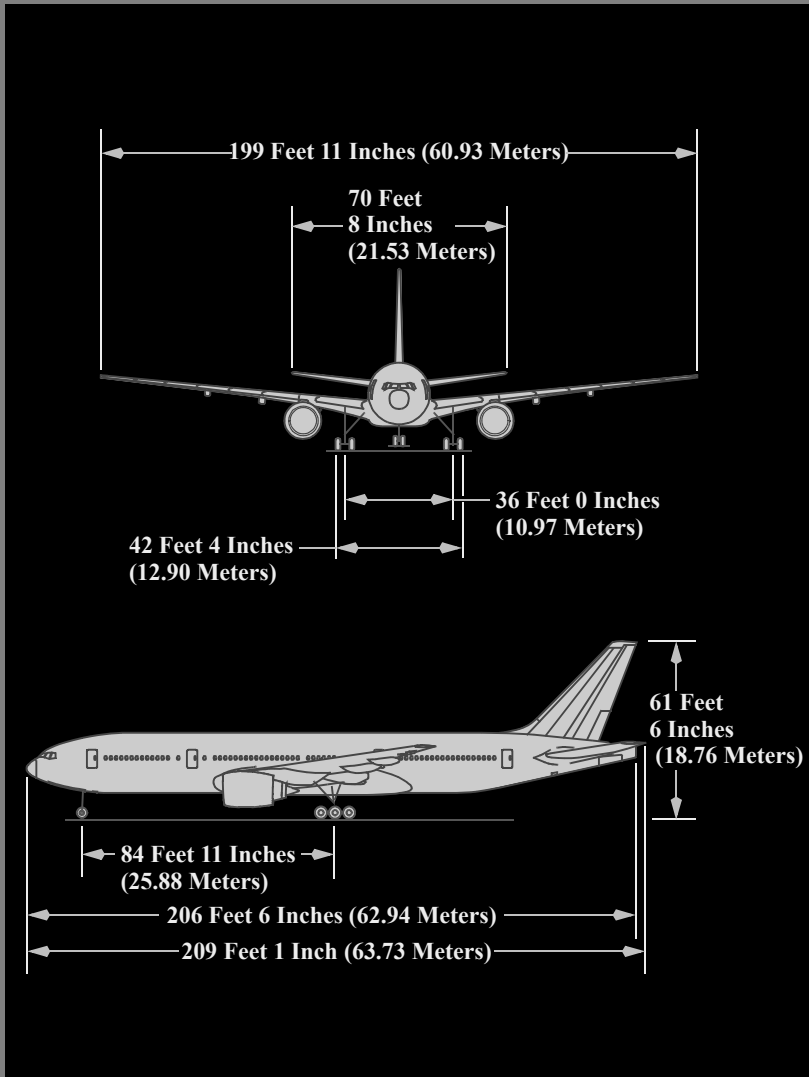
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**Airplane General, Emergency
Equipment, Doors, Windows
Dimensions**

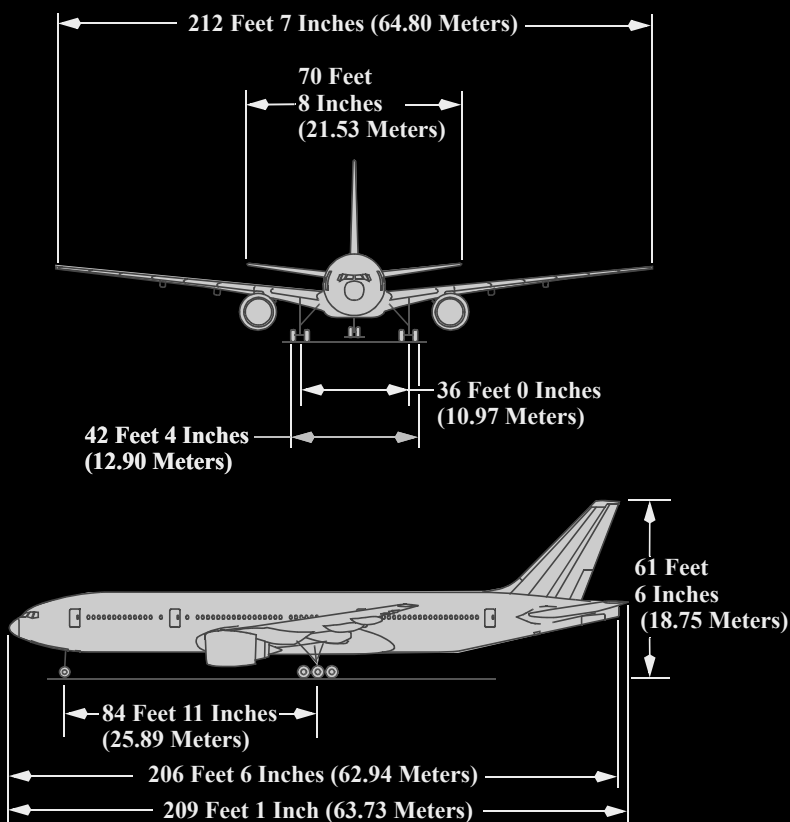
Chapter 1

Section 10

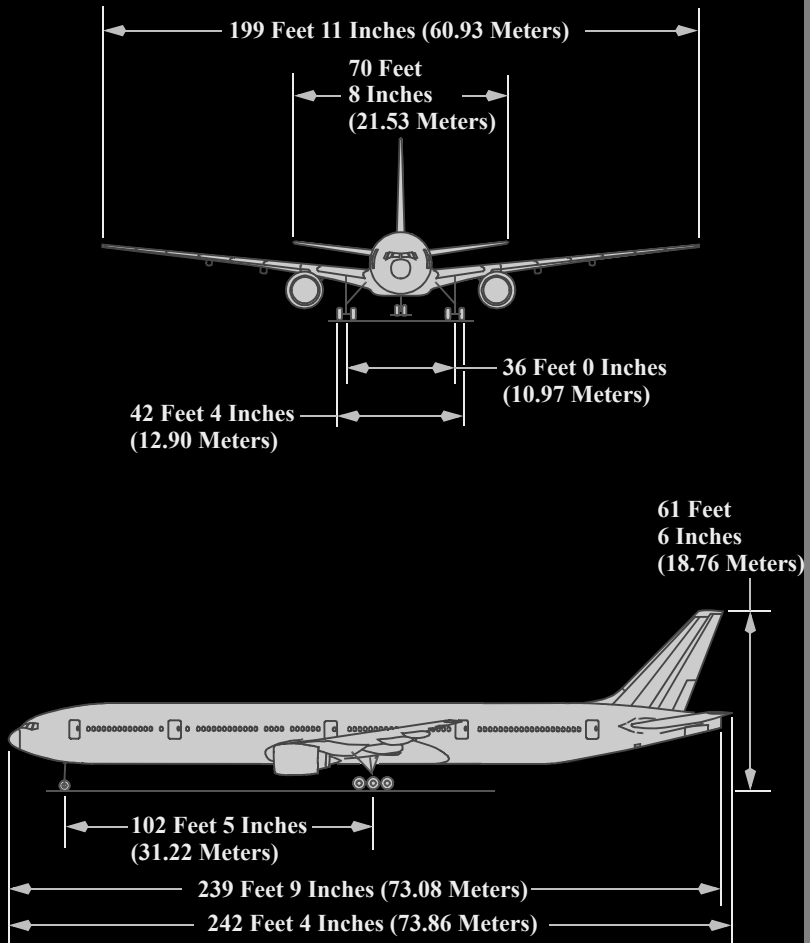
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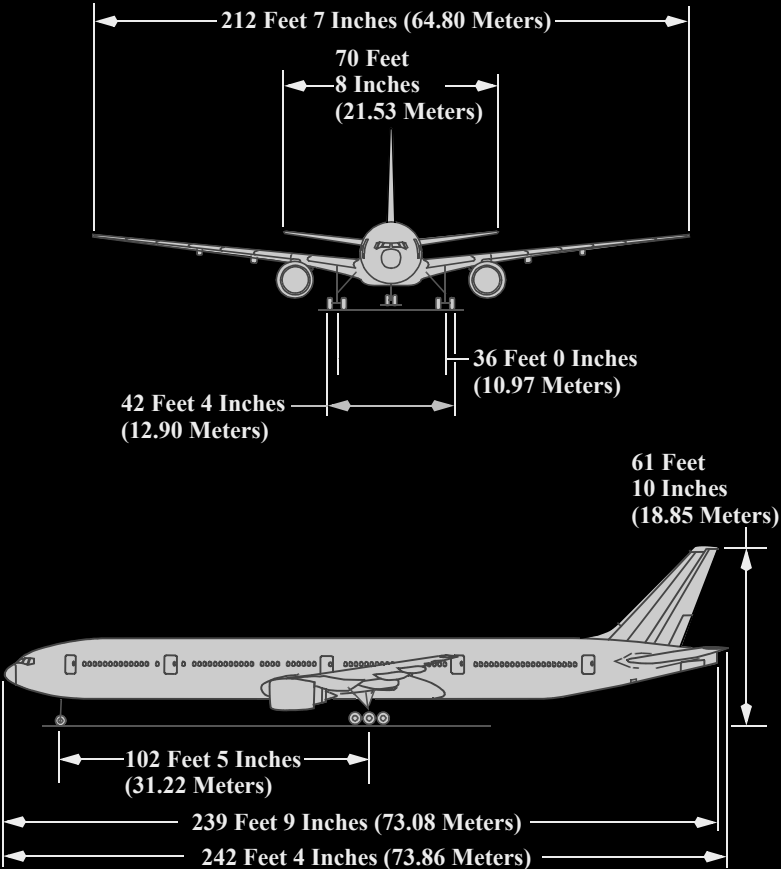
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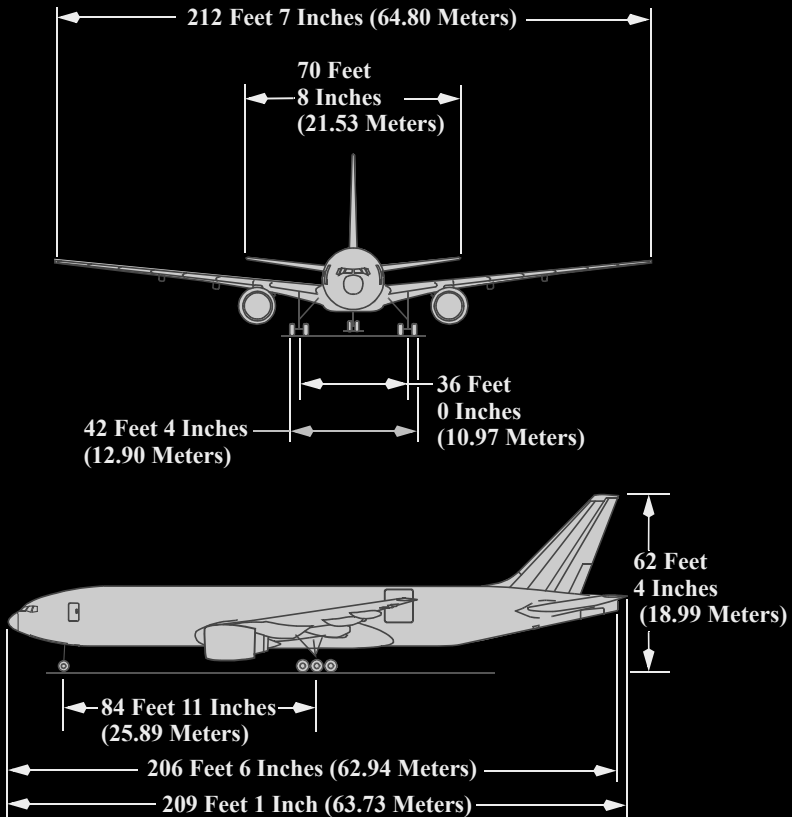
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777-300



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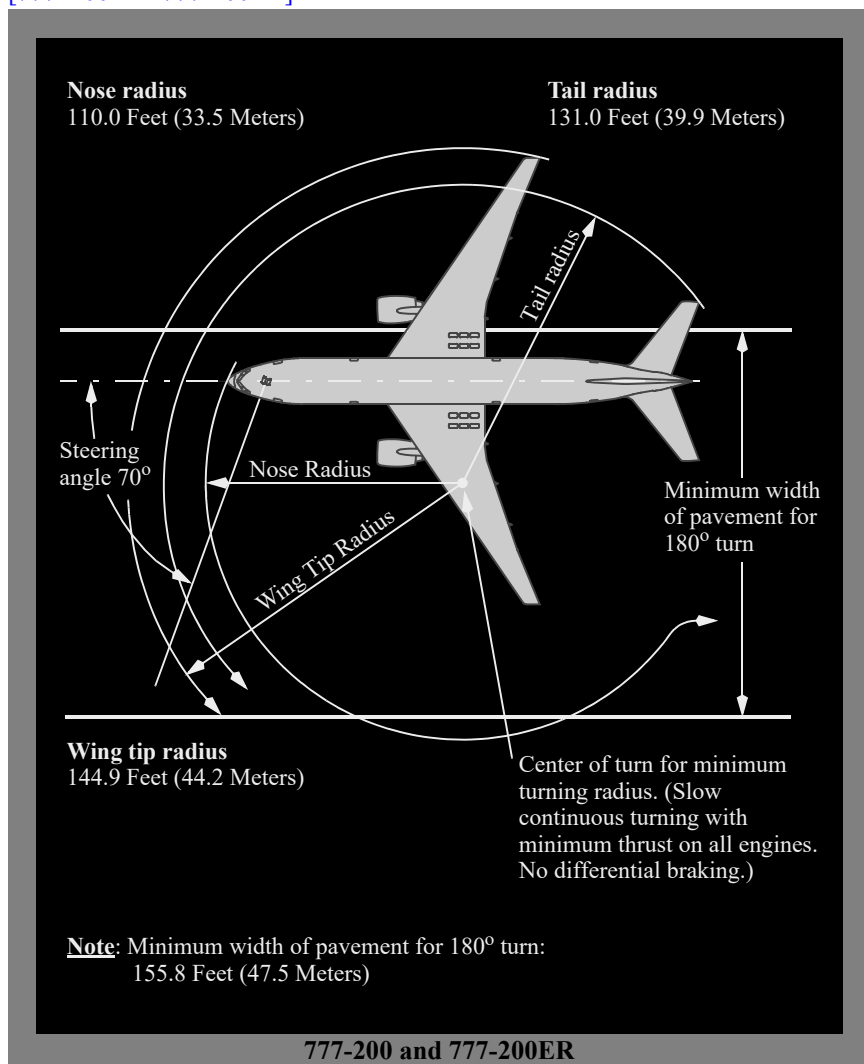


777-Freighter

Turning Radius

The wing tip swings the largest arc while turning and determines the minimum obstruction clearance path. All other portions of the airplane structure remain within this arc.

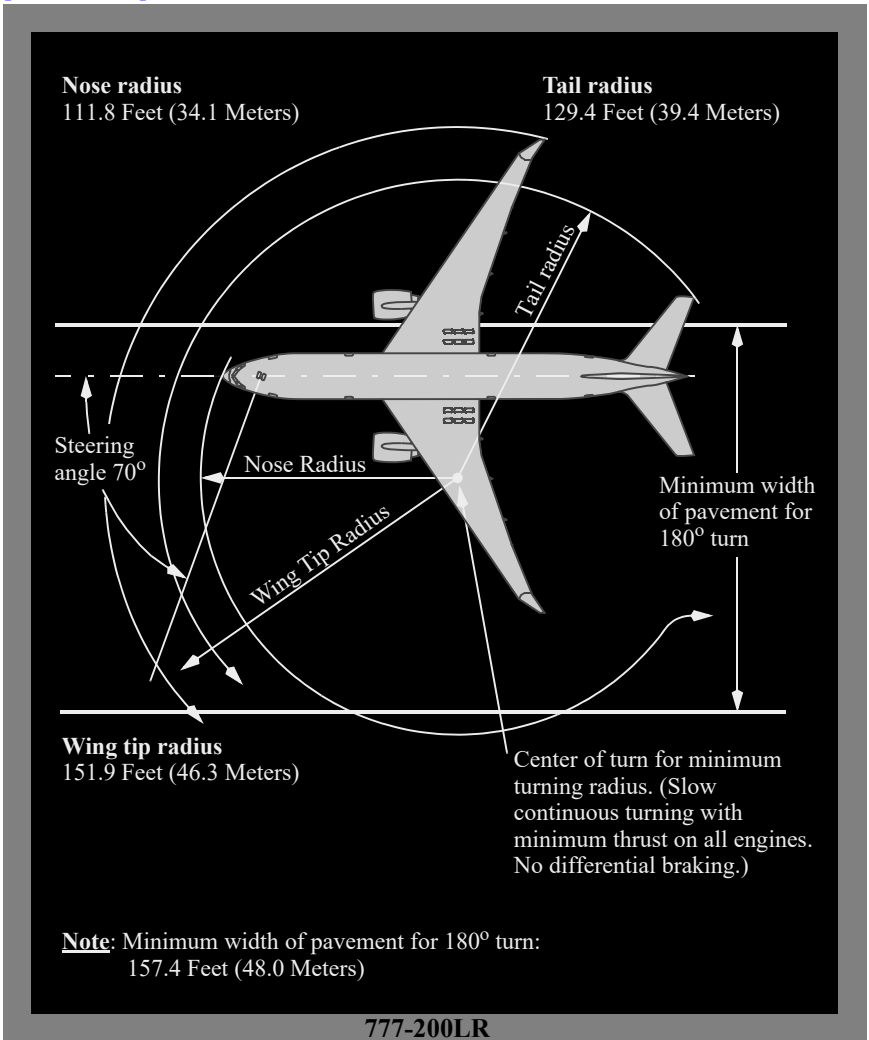
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[777-200 and 777-200ER]

CAUTION: Do not attempt to make a turn away from an obstacle within 15 feet (4.6 m) of the wing tip, or within 50 feet (15.2 m) of the nose.

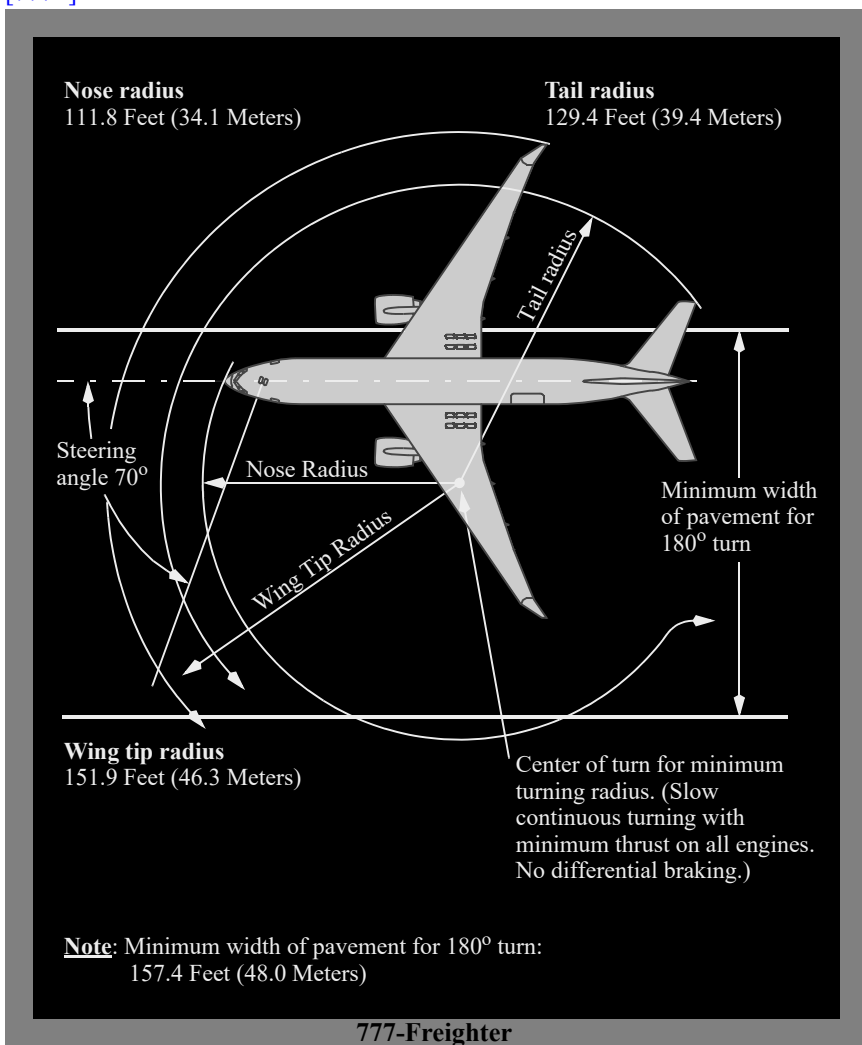
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CAUTION: Do not attempt to make a turn away from an obstacle within 15 feet (4.6 m) of the wing tip, or within 55 feet (16.8 m) of the nose.

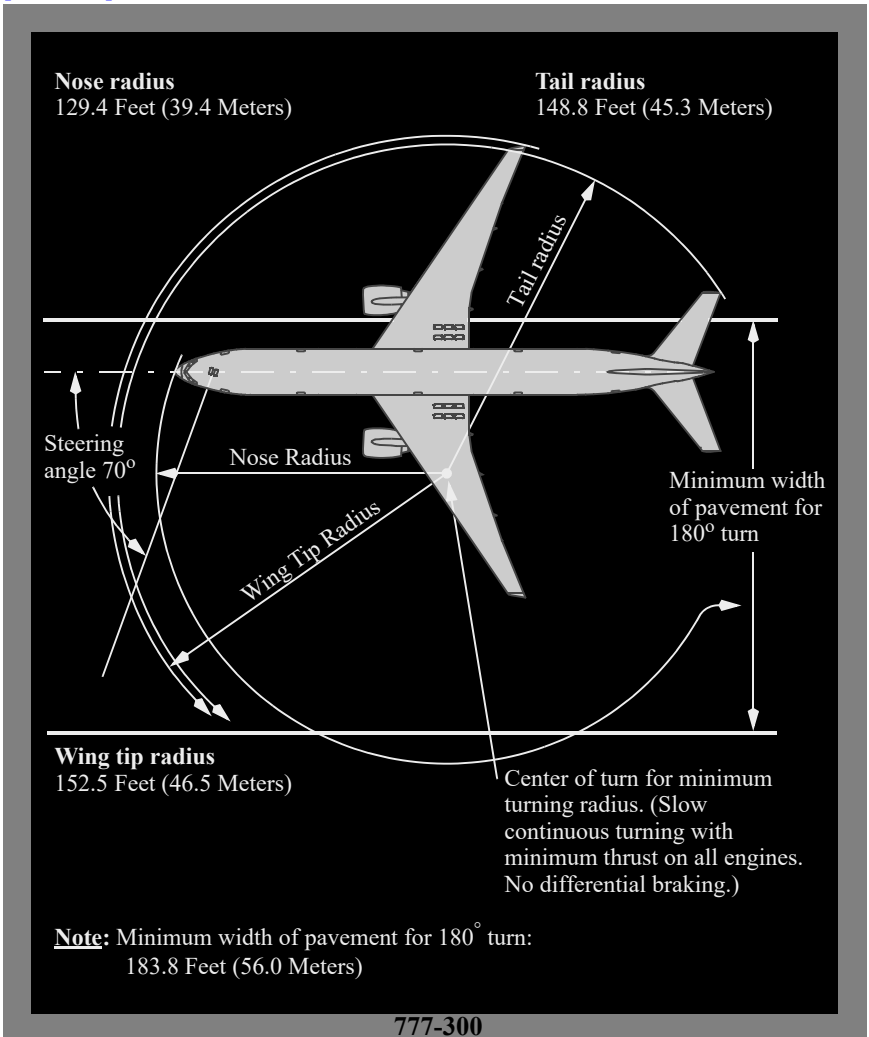
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CAUTION: Do not attempt to make a turn away from an obstacle within 15 feet (4.6 m) of the wing tip, or within 55 feet (16.8 m) of the nose.

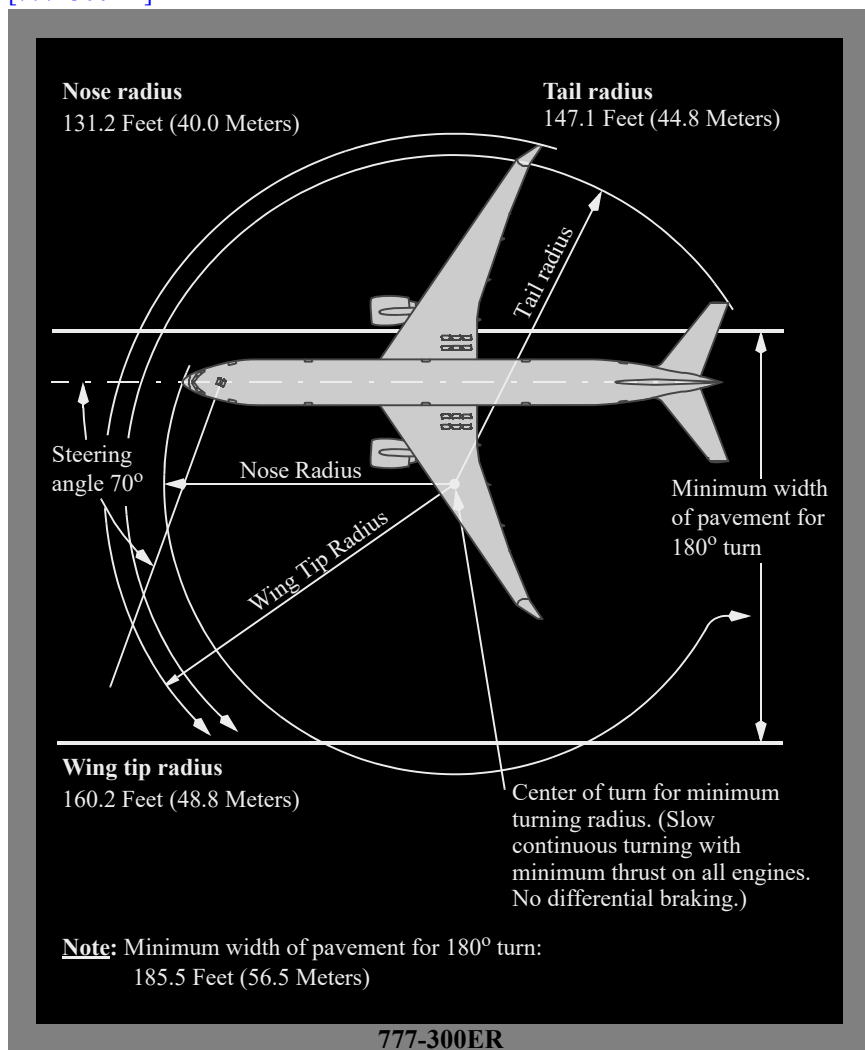
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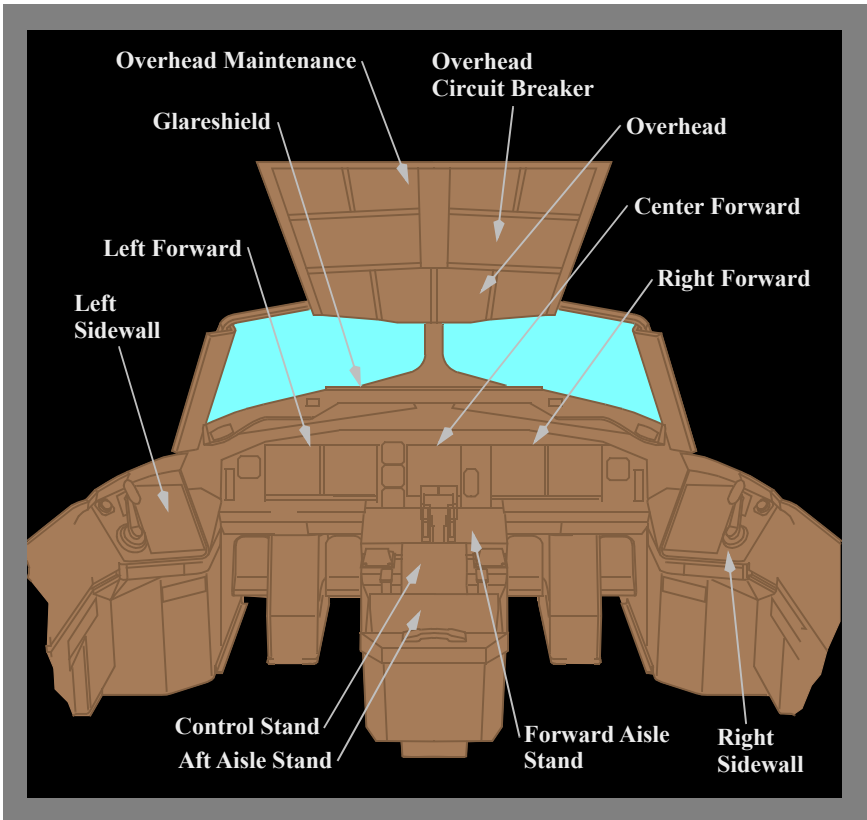
CAUTION: Do not attempt to make a turn away from an obstacle within 15 feet (4.6 m) of the wing tip, or within 39 feet (11.9 m) of the nose.

[777-300ER]



[777-300ER]

CAUTION: Do not attempt to make a turn away from an obstacle within 15 feet (4.6 m) of the wing tip, or within 45 feet (13.9 m) of the nose.

**Airplane General, Emergency
Equipment, Doors, Windows
Instrument Panels****Chapter 1****Section 20****Flight Deck Panels**

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.

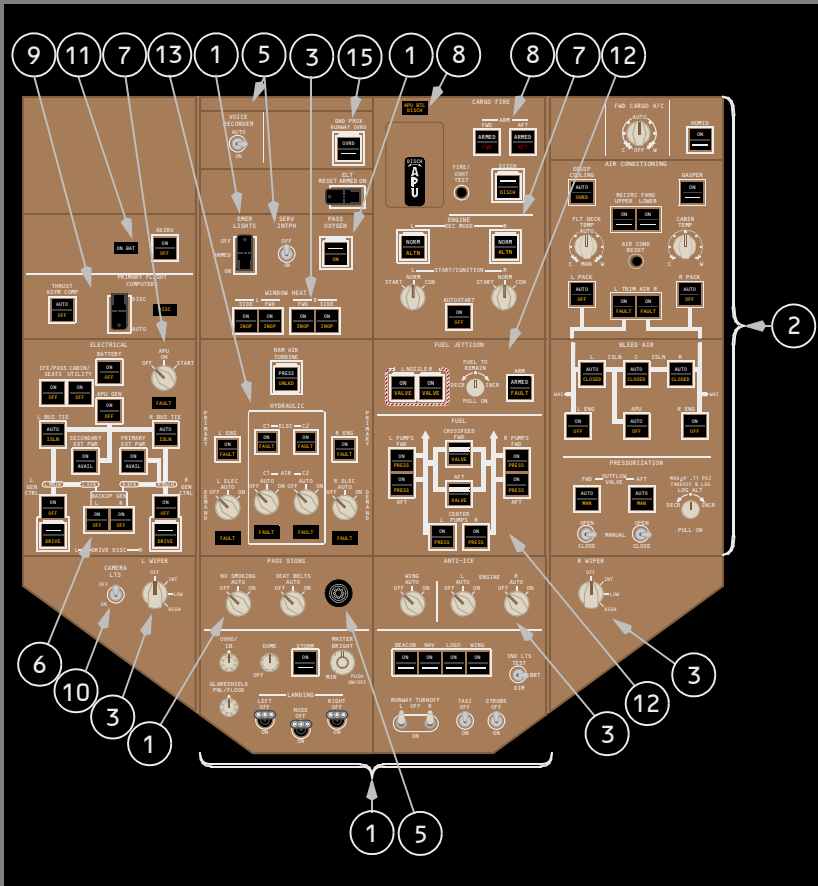
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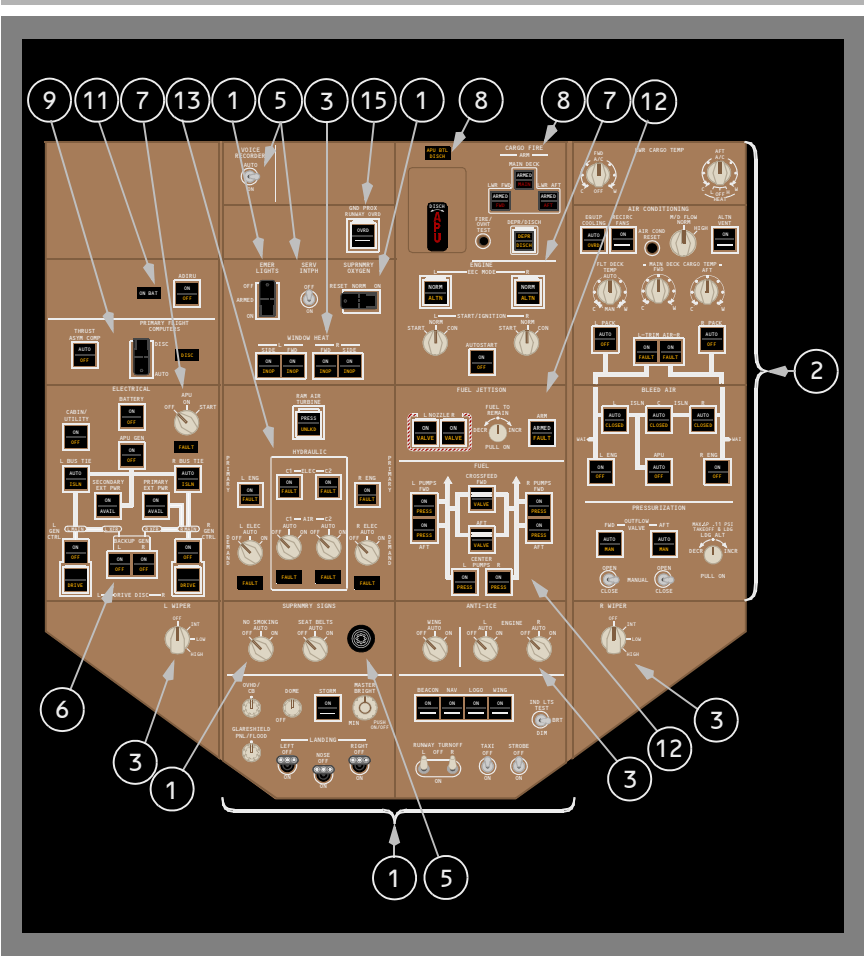
Customer options are shown in [brackets]; for example, [Option – PW Engines] means airplanes with Pratt and Whitney engines.

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777 Flight Crew Operations Manual

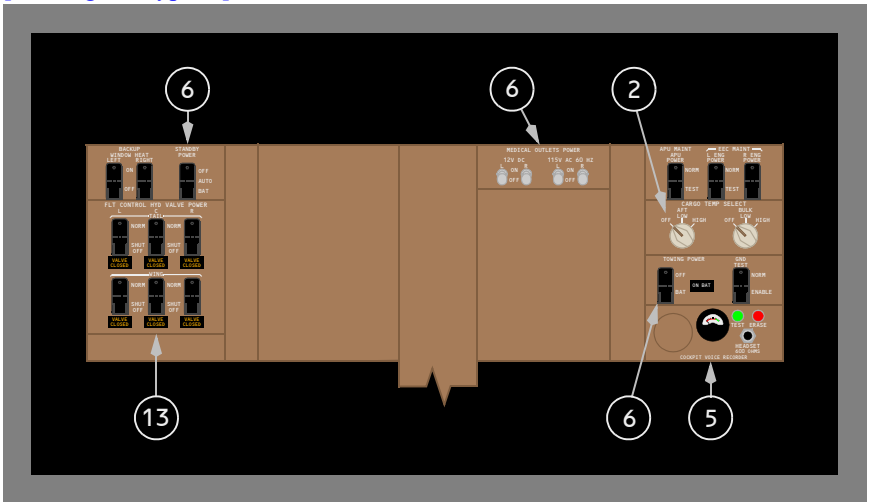
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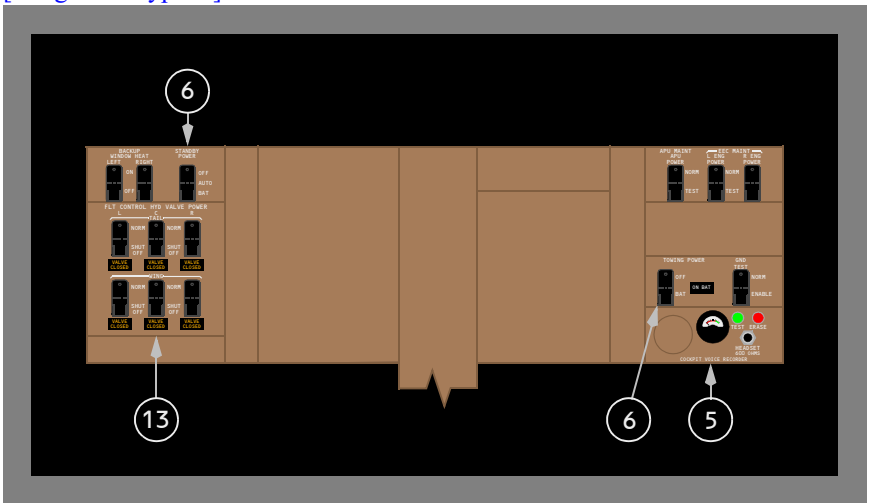


Overhead Maintenance Panel

[Passenger - Typical]



[Freighter - Typical]



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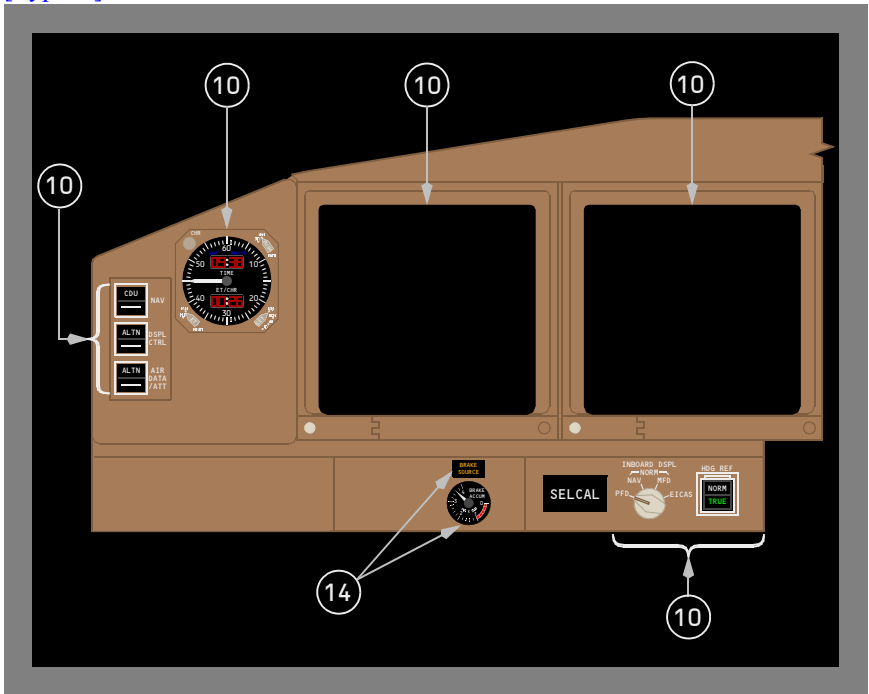
**Airplane General, Emergency
Equipment, Doors, Windows
Inst. Panels, Fwd**

Chapter 1

Section 22

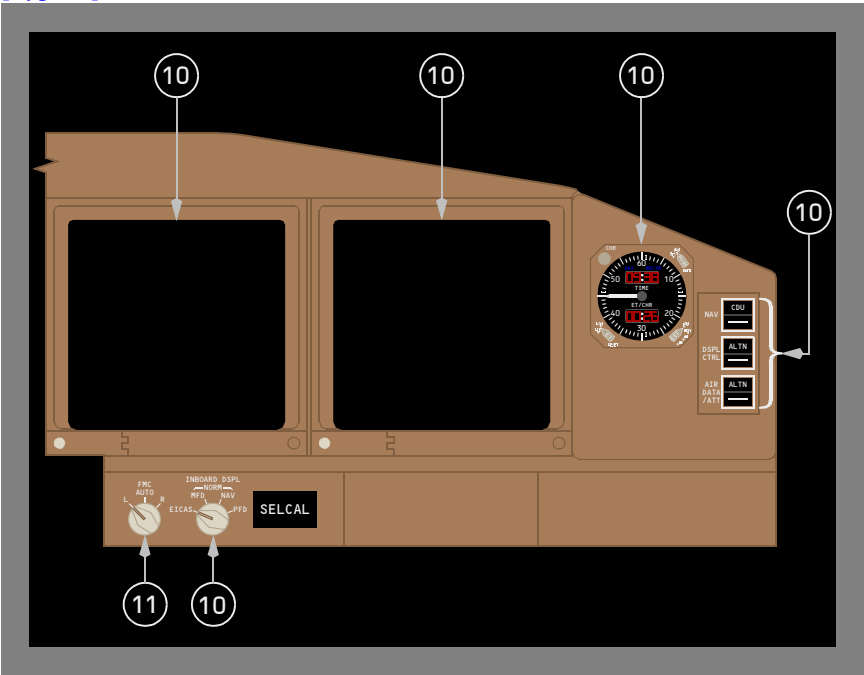
Left Forward Panel

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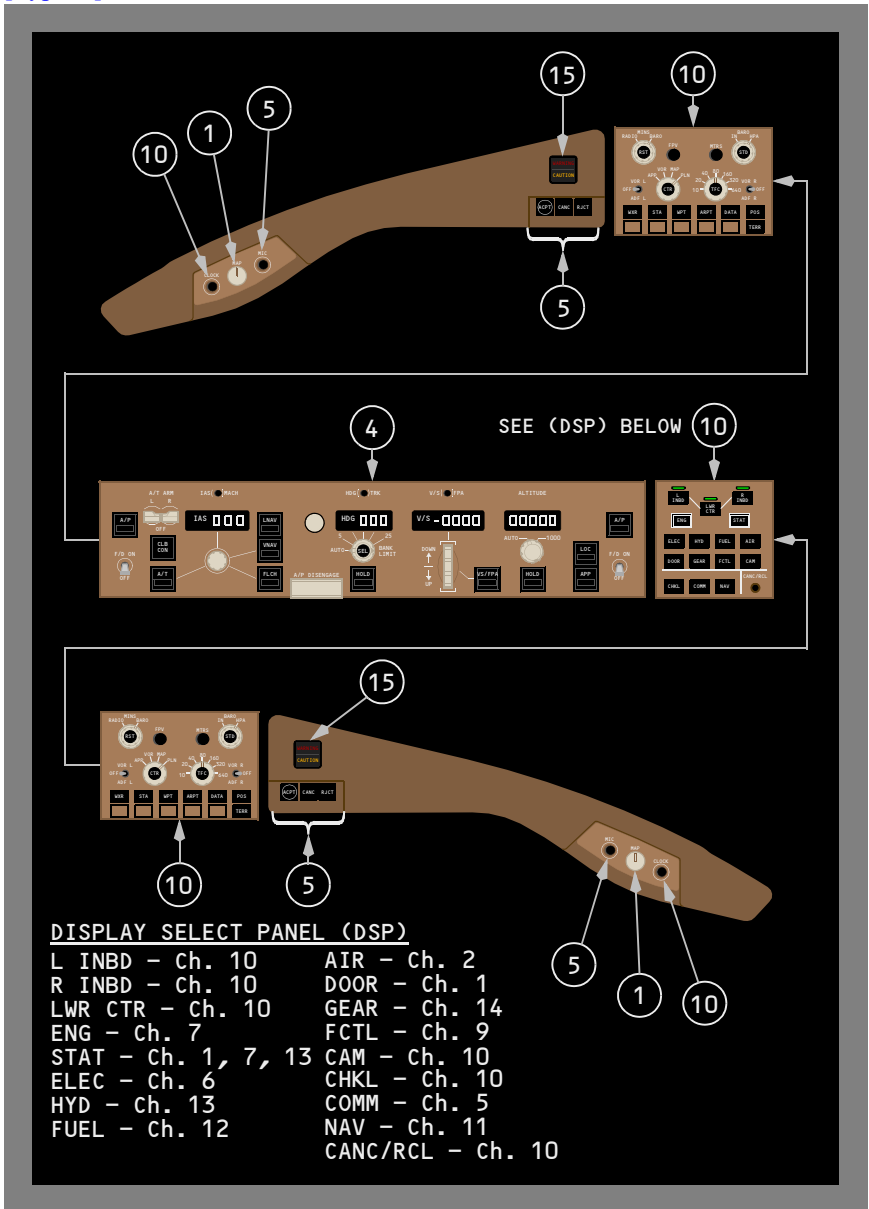
Right Forward Panel

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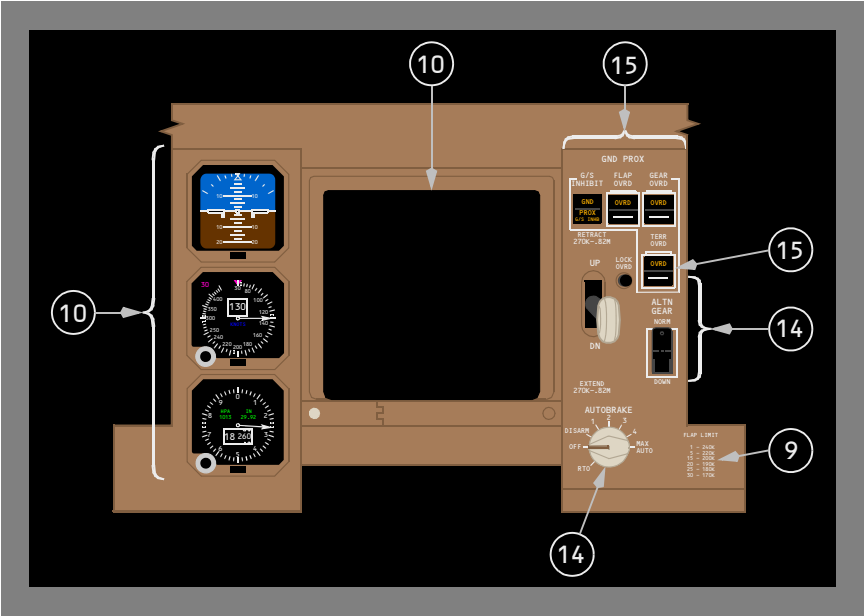


Glareshield Panel

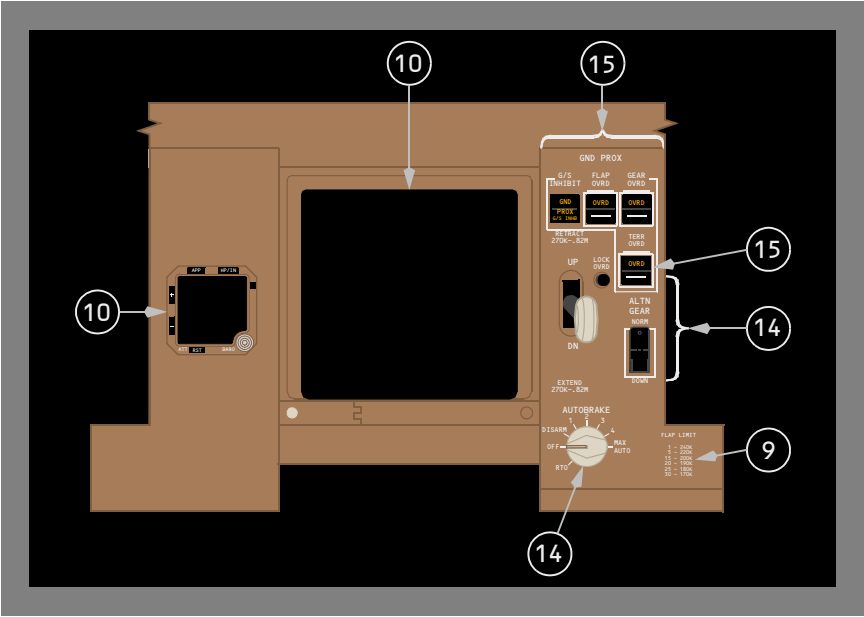
[Typical]



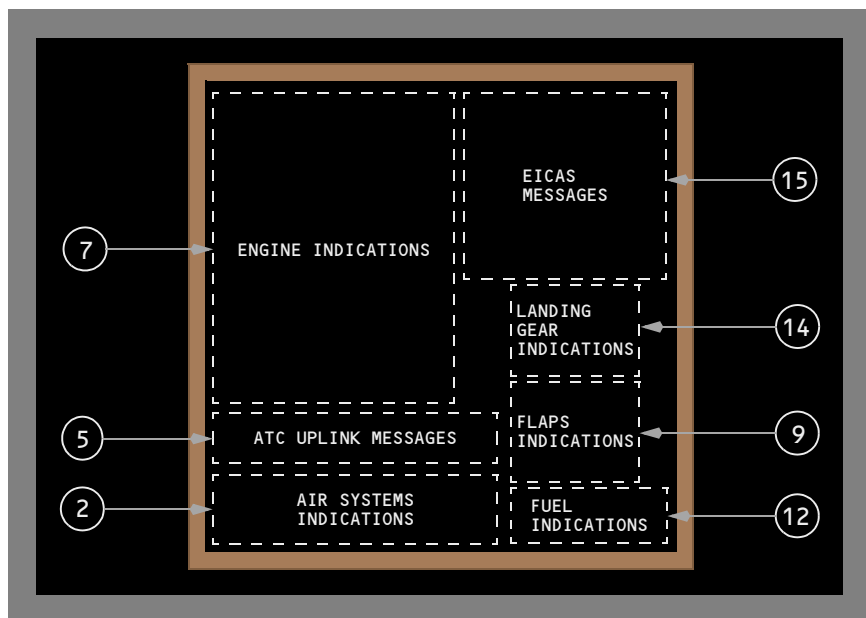
Center Forward Panel



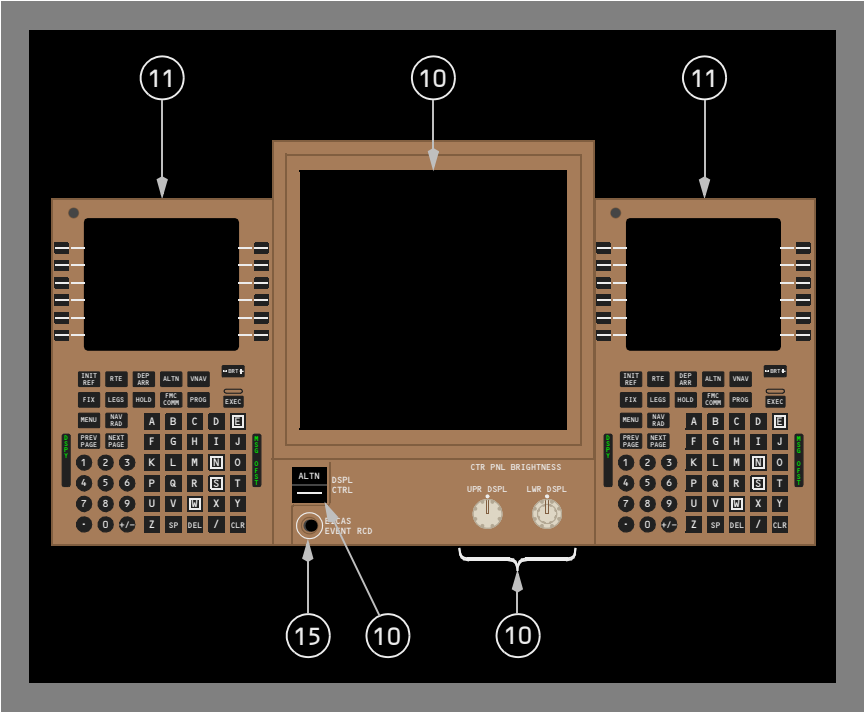
[Integrated Standby Flight Display Installed]



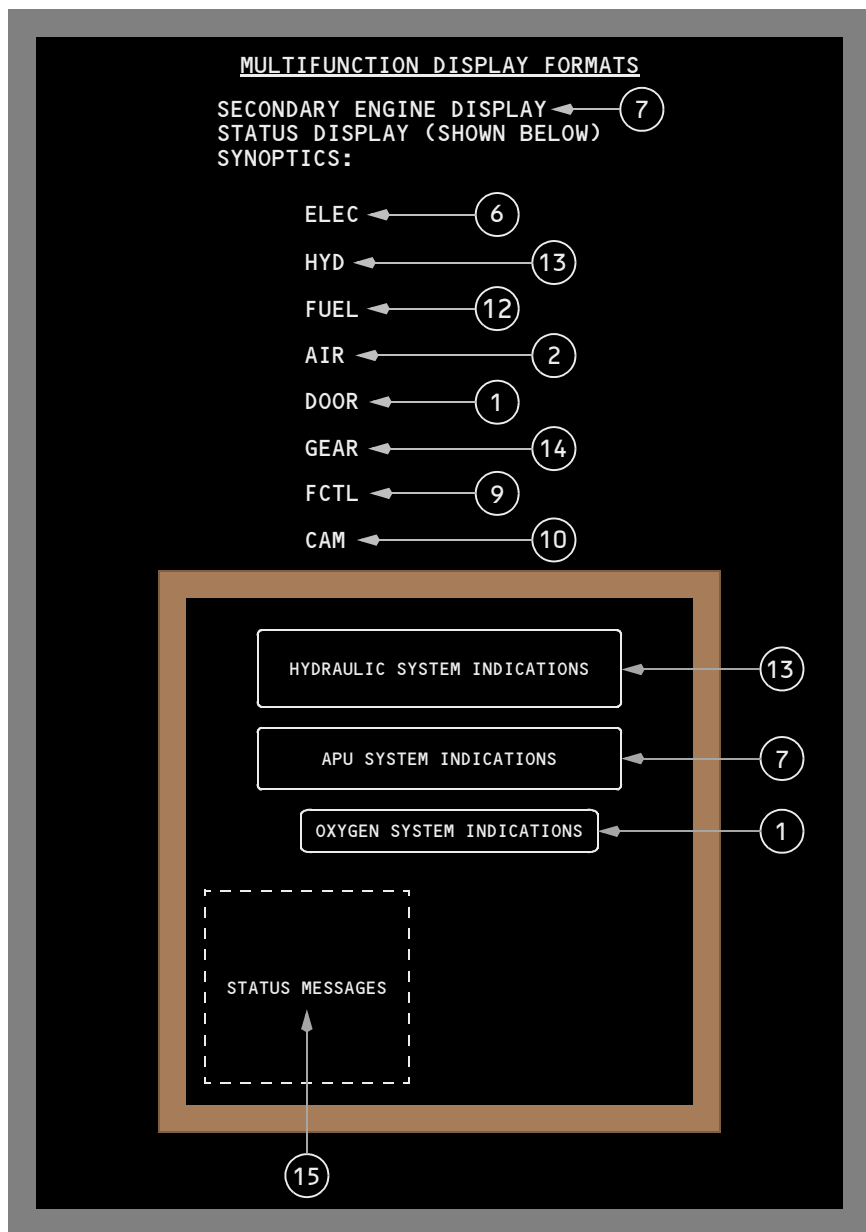
EICAS Display



Forward Aisle Stand



Multifunction Display



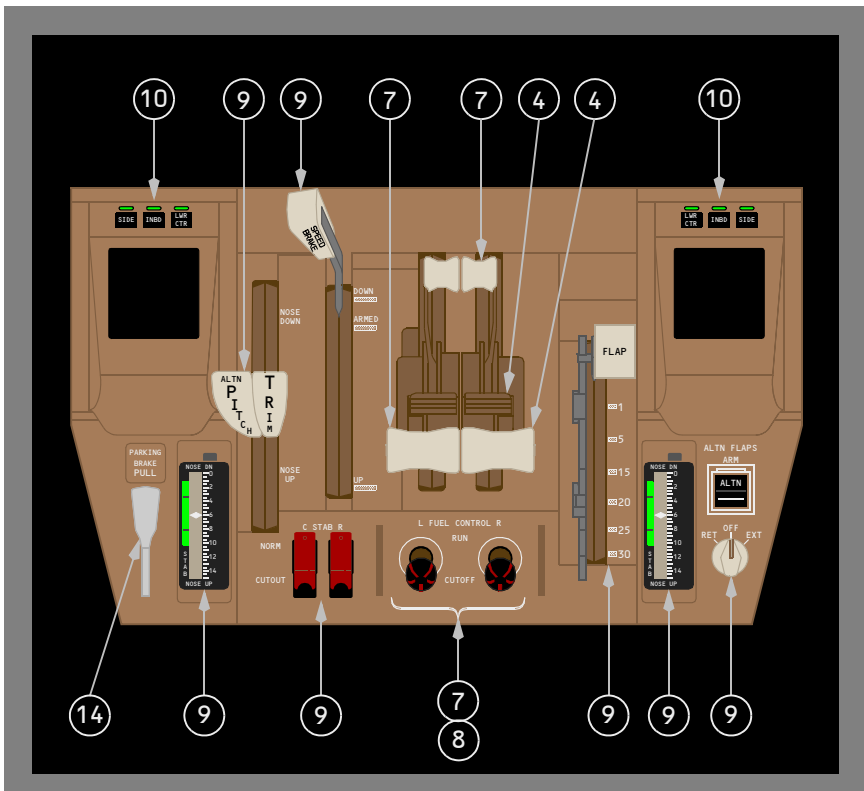
Intentionally
Blank

777 Flight Crew Operations Manual

Chapter 1

Section 23

Control Stand

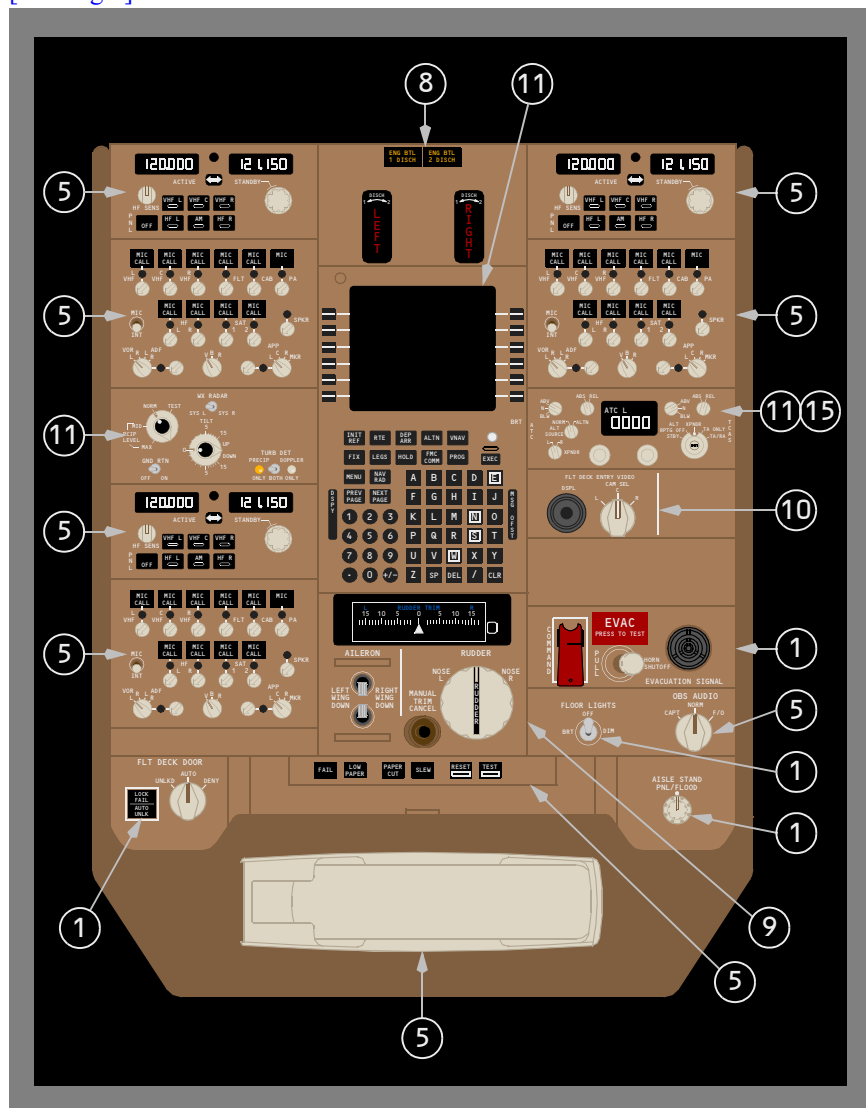


June 14, 2010

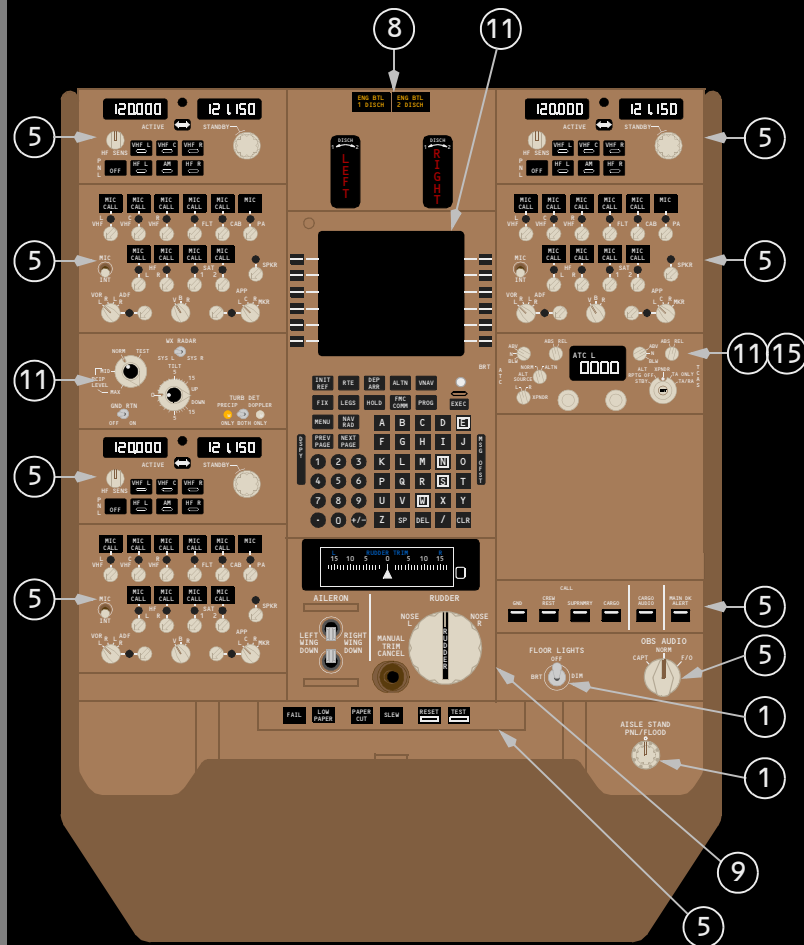
D632W001-TBC

1.23.1

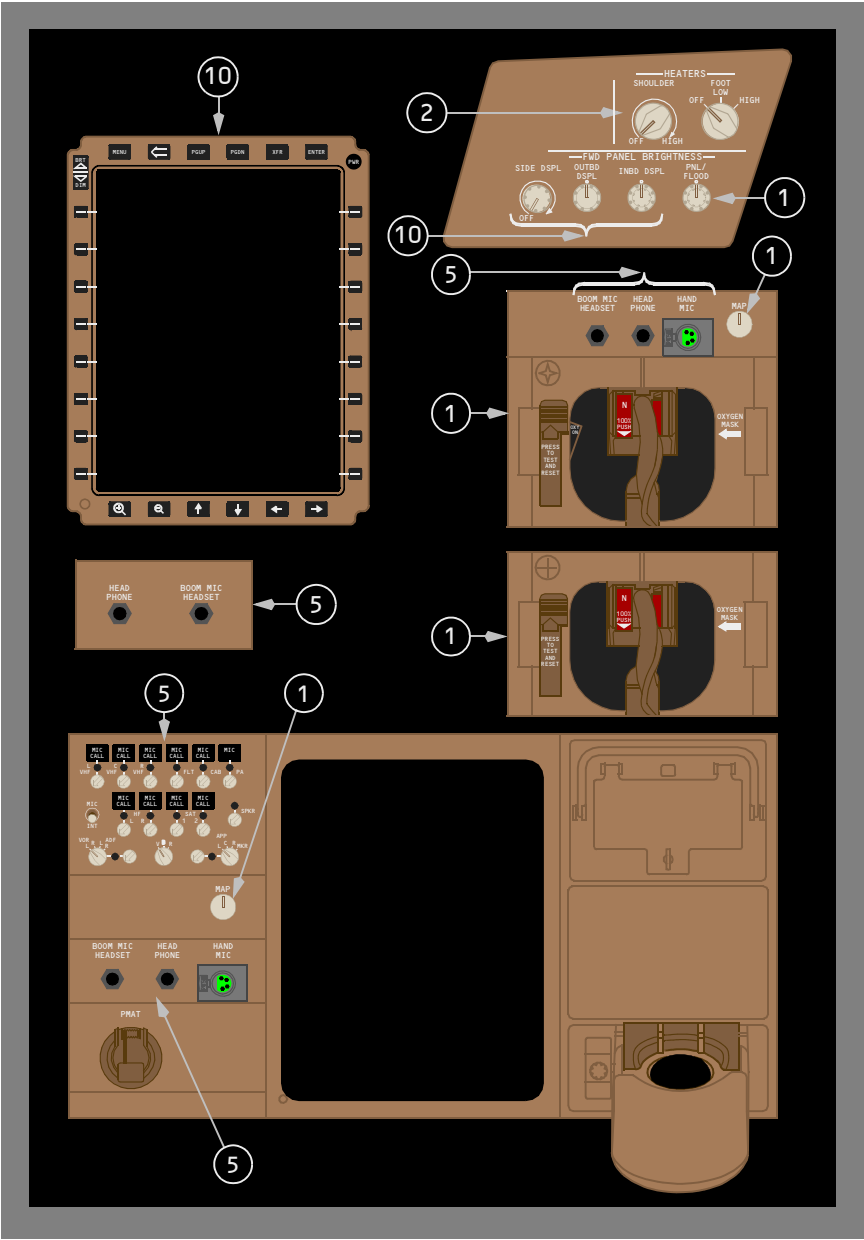
[Passenger]



[Freighter]



Left and Right Sidewall, First Observer, and Maintenance Access Terminal/Second Observer Panels



**Airplane General, Emergency
Equipment, Doors, Windows
Controls and Indicators****Chapter 1****Section 30****Push-Button Switches**

The airplane has two types of push-button switches: alternate action and momentary action. Both types direct crew attention to system status and faults.

Note: Maintenance personnel should change switch lights. Changing the light requires changing the entire switch cap.

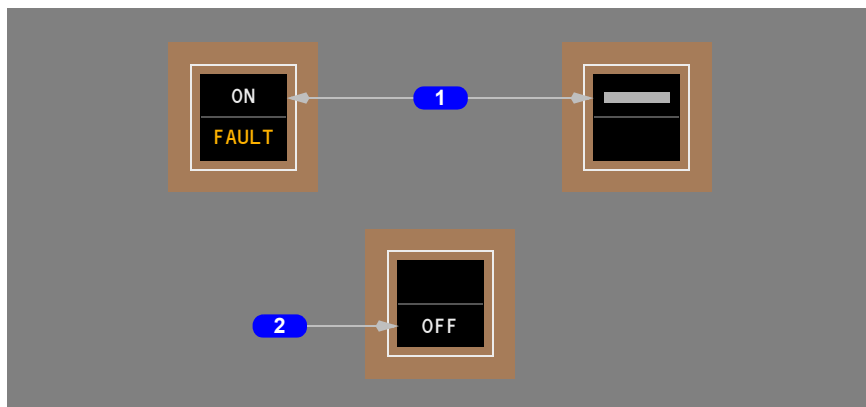
Alternate Action Switches

Alternate action switches have two positions: on and off.

When pushed in and flush with the panel, the switch is on. When the switch is on, a mechanical shutter on the top half of the switch opens to show an illuminated legend, such as "ON", "AUTO" or a flow bar.

When pushed out and extended, the switch is off. When the switch is off, the mechanical shutter closes so the legend is not shown.

Additionally, the bottom half of many switches has a light to indicate system state, such as "PRESS", "FAIL", "INOP", OR "OFF".

**1 Switch is ON**

ON, AUTO, or flow bar visible.

For some switches, system status (FAULT, MAN, OFF, VALVE) may be shown in the lower half of the switch.

2 Switch is OFF

OFF or a line is visible –

- the top of the switch is blank
- a line indicates no label in this portion of the switch.

Momentary Action Switches

Momentary action switches are spring loaded to the extended position. They are used to activate or deactivate systems or to reset system logic. The switch display indicates system status.



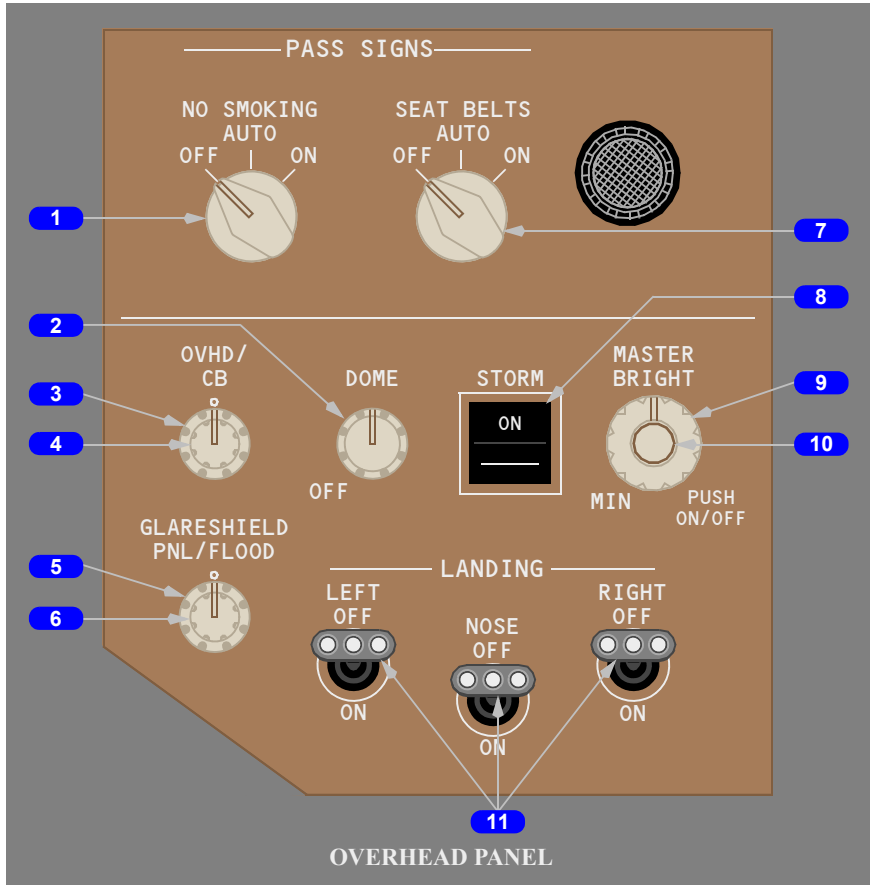
1 Push to Reset

Push – the switch resets the master lights and aural alerts.

2 System Operation

Push – activates or deactivates the system.

Signs and Lighting



1 NO SMOKING Selector

OFF – the NO SMOKING signs are not illuminated.

AUTO – the NO SMOKING signs are illuminated or extinguished automatically with reference to cabin altitude and system configuration (refer to the Lighting System Description section).

ON – the NO SMOKING signs are illuminated.

[Passenger]

Note: Any time passenger oxygen is deployed, the NO SMOKING and FASTEN SEAT BELTS signs illuminate automatically, regardless of the selector position.

[Freighter]

Note: Any time supernumerary oxygen is deployed, the NO SMOKING and FASTEN SEAT BELTS signs illuminate automatically, regardless of the selector position.

2 DOME Light Control

Controls overhead dome light brightness.

3 Overhead (OVHD) Panel Light Control (outer)

Rotate – controls overhead panel light brightness.

4 Circuit Breaker (CB) Panel Light Control (inner)

Rotate – controls circuit breaker panel light brightness.

5 GLARESHIELD Panel (PNL) Light Control (outer)

Rotate – controls glareshield panel light and standby compass brightness.

6 GLARESHIELD FLOOD Panel Light Control (inner)

Rotate – controls glareshield flood light brightness.

7 SEAT BELTS Selector

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 altitude and system configuration (refer to the Lighting System Description section).

[Passenger]

ON – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated.

[Freighter]

ON – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated. When selected, the main deck sidewall lights are flashed for several seconds.

[Passenger]

Note: Any time passenger oxygen is deployed, the NO SMOKING and FASTEN SEAT BELTS signs illuminate automatically, regardless of the selector position.

[Freighter]

Note: Any time supernumerary oxygen is deployed, the NO SMOKING and FASTEN SEAT BELTS signs illuminate automatically, regardless of the selector position.

8 STORM Light Switch

ON – overrides normal controls and illuminates the following lights at maximum brightness:

- all illuminated indicator lights
- glareshield flood lights
- instrument panel flood lights
- aisle stand flood lights
- dome lights.

9 MASTER Brightness (BRIGHT) Light Control (outer)

Rotate (when the MASTER BRIGHTNESS switch is pushed on) –:

- controls the brightness of all panel lights and displays (dome lights, flood lights, and circuit breaker panel lights are not controlled by this switch)
- overrides individual brightness control settings
- limits adjustment range of individual brightness controls
- has full adjustment range of all lights when all individual brightness controls are set to the center detent.

10 MASTER Brightness (BRIGHT) Light Switch (inner)

A black ring on the side of the inner switch is visible when the switch is out (OFF).

PUSH ON (in) – the MASTER BRIGHTNESS control is on.

PUSH OFF (out) – the MASTER BRIGHTNESS control is off.

Note: If display brightness cannot be set as desired when master brightness is on, pushing the MASTER BRIGHTNESS switch off may allow setting display brightness to an appropriate level using individual brightness controls.

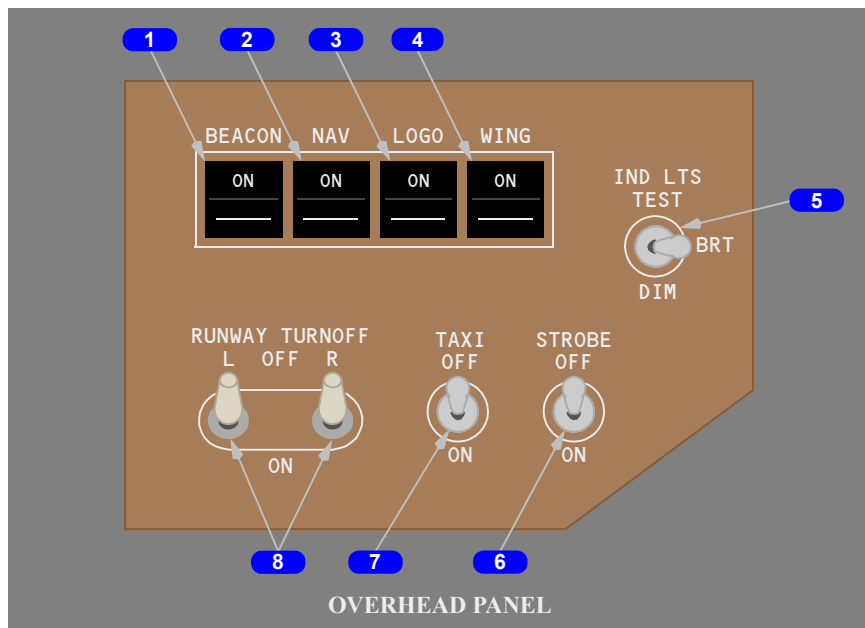
11 LANDING Light Switches

OFF – the landing light is not illuminated.

ON – the landing light is illuminated.

Note: The nose gear landing lights cannot illuminate when the nose landing gear is not down and locked.

Lighting Panel



1 BEACON Light Switch

ON – the red anticollision beacon lights on the top and bottom of the fuselage operate.

2 Navigation (NAV) Position Light Switch

ON – the red, green, and white navigation position lights are illuminated.

3 LOGO Light Switch

ON – the stabilizer-mounted logo lights illuminate the airline logo on the vertical tail surface.

4 WING Light Switch

ON – the wing leading edge illumination lights are illuminated.

5 Indicator Lights (IND LTS) Switch

TEST (spring-loaded):

- illuminates all annunciator lights to full brightness for 10 seconds to check the bulbs, then dims the lights as long as the switch is held
- causes test patterns to display on the stabilizer position indicators, rudder trim indicator, and radio tuning panel displays.

BRT – sets all illuminated annunciator lights to full brightness.

DIM – sets all illuminated annunciator lights to low brightness.

6 STROBE Light Switch

OFF – the white anticollision strobe lights on the tips of each wing and the tailcone are off.

ON – the strobe lights operate.

7 TAXI Light Switch

OFF – the taxi lights are extinguished.

ON – the taxi lights are illuminated.

Note: The taxi lights do not illuminate when the nose landing gear is not down and locked

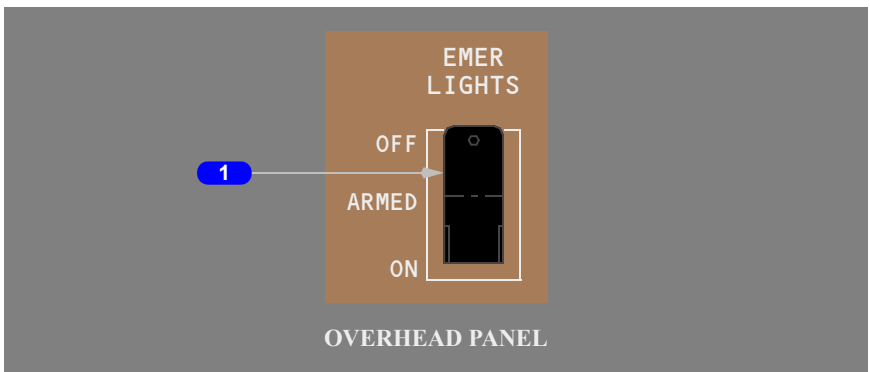
8 RUNWAY TURNOFF Light Switches

OFF – the runway turnoff light is extinguished.

ON – the runway turnoff light is illuminated.

Miscellaneous Lighting Controls

Flight Deck Emergency Lights Switch



1 Emergency (EMER) LIGHTS Switch

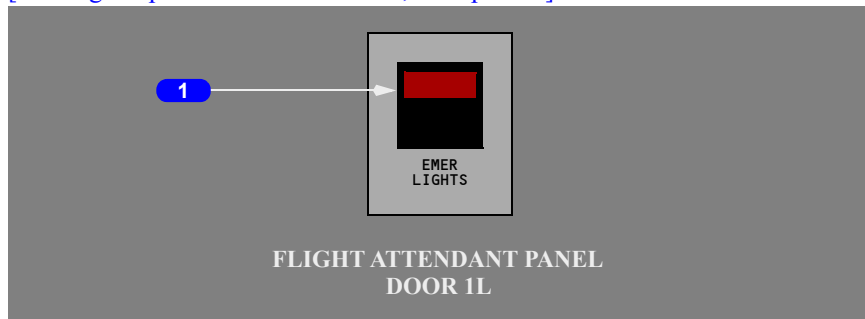
OFF – prevents emergency lights system operation if airplane electrical power fails or is turned off.

ARMED – all emergency lights illuminate automatically if airplane electrical power fails or is turned off.

ON – all emergency lights illuminate.

Cabin Emergency Lights Switch

[Passenger Option – Door 1L Shown, 2L Optional]

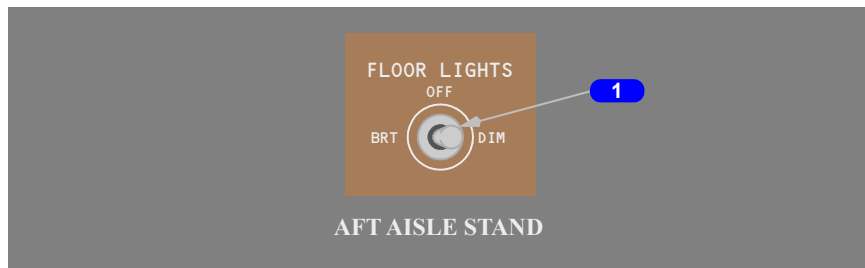


1 Cabin Emergency (EMER) LIGHTS Switch

Push –

- Illuminated (red):
 - all cabin and exterior emergency lights illuminate
 - bypasses the flight deck emergency lights switch
- Extinguished: all cabin and exterior emergency lights extinguish.

Floor Lights Switch



1 FLOOR LIGHTS Switch

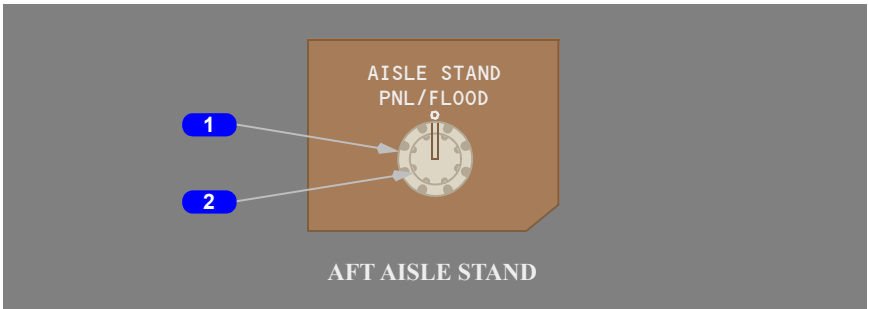
OFF – the flight deck floor lights are not illuminated.

BRT – the floor lights are illuminated bright.

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DIM – the floor lights are illuminated dim.

Aisle Stand Panel/Flood Light Control



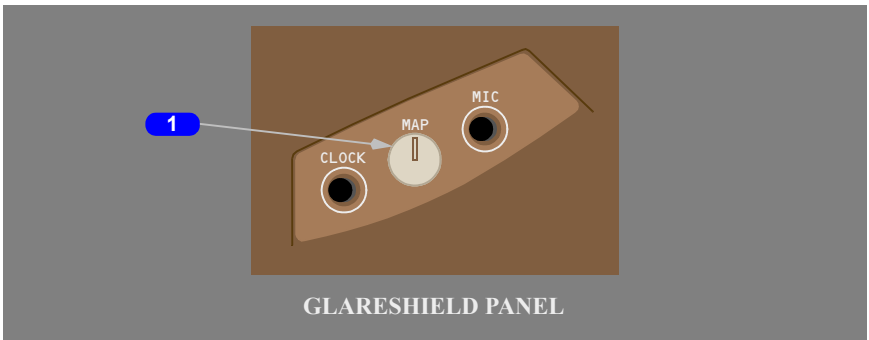
1 AISLE STAND Panel (PNL) Light Control (outer)

Rotate – controls the aisle stand instrument panel light brightness.

2 AISLE STAND FLOOD Light Control (inner)

Rotate – controls the aisle stand flood light brightness.

Map Light Control



1 MAP Light Control

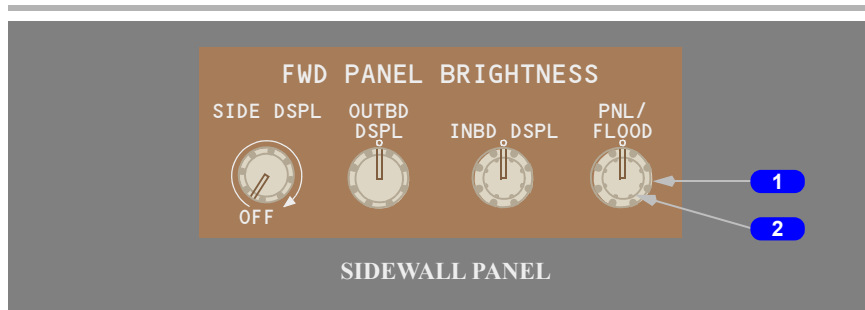
Pull – on.

Push – off.

Rotate – adjusts map light brightness.

Forward Panel Brightness Controls

Note: The display and weather radar brightness controls are described in Chapter 10, Flight Instruments, Displays.



1 Forward (FWD) PANEL BRIGHTNESS Light Control (outer)

Rotate – Controls forward panel lights brightness.

2 Forward (FWD) PANEL FLOOD BRIGHTNESS Light Control (inner)

Rotate – Controls forward panel flood light brightness.

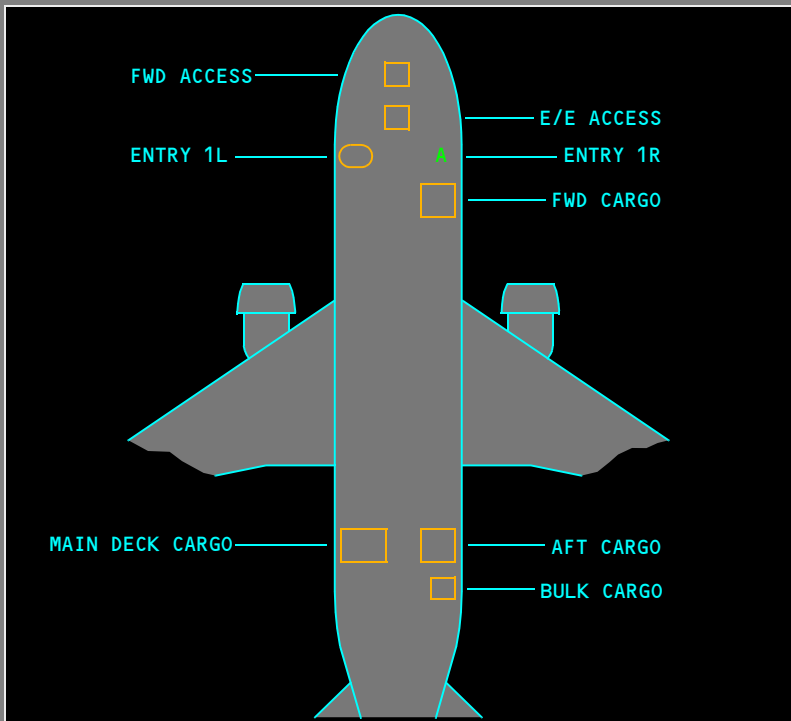
Doors and Windows

Door Synoptic Display

The doors synoptic is displayed by pushing the DOOR synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

[Freighter]

[Option - With Door Arming Annunciations]



A (green) – Door mode is automatic (armed)

M (white) – Door mode is manual (disarmed)

(blank) – Door mode is not available

○ (amber) – passenger door open
(blank) – passenger door closed

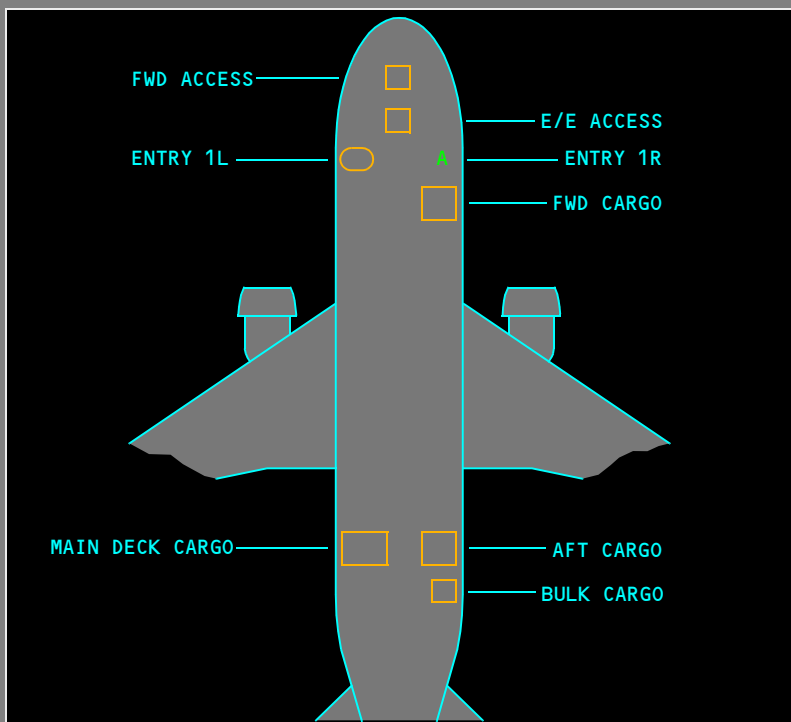
○ (white) – door status is not available

□ (amber) – cargo/access door open
(blank) – cargo/access door closed

□ (white) – door status is not available

MULTIFUNCTION DISPLAY

[Option - With Door Arming Annunciations]
[Freighter]

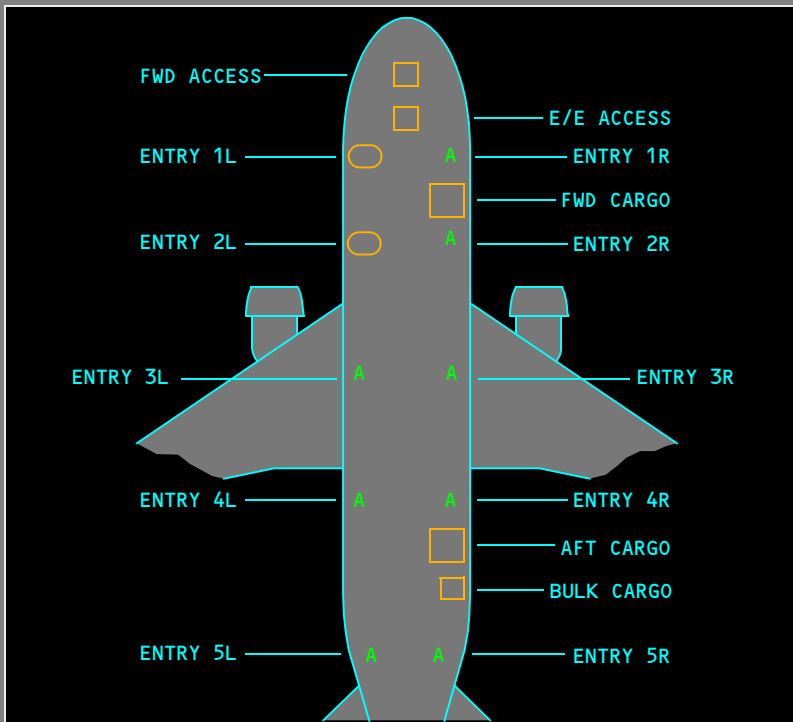


A (green) – Door mode is automatic (flight)
M (white) – Door mode is manual (park)
(blank) – Door mode is not available

○ (amber) – passenger door open
(blank) – passenger door closed
○ (white) – door status is not available
□ (amber) – cargo/access door open
(blank) – cargo/access door closed
□ (white) – door status is not available

MULTIFUNCTION DISPLAY

[Option – With Door Arming Annunciators]
[Passenger. 777-300 shown. 777-200 similar]

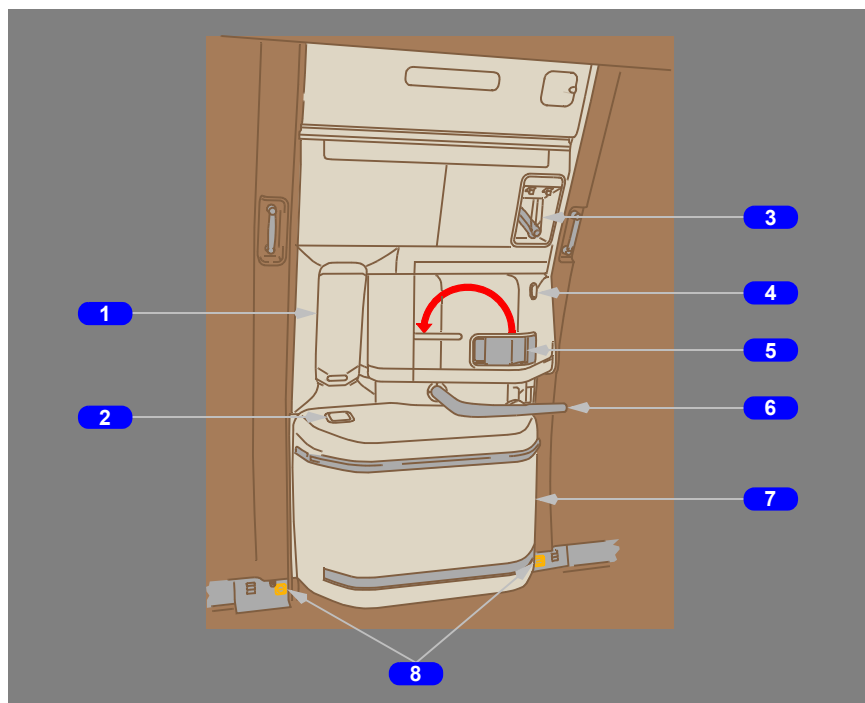


A (green) – Door mode is armed
M (white) – Door mode is manual.
(blank) - Door mode is not available

○ (amber) – passenger door open
(blank) – passenger door closed
○ (white) – door status is not available
□ (amber) – cargo/access door open
(blank) – cargo/access door closed
□ (white) – door status is not available

MULTIFUNCTION DISPLAY

Entry Door



1 Viewing Window

Allows observation outside the airplane.

2 Slide/Raft Gas Bottle Pressure Gage

Maintenance use only.

3 Door Mode Select Panel

See door mode select panel section.

4 Power Assist Reservoir Pressure Gage

If the gage needle is outside the green zone, the system is unusable.

5 Gust Lock Release Lever

Grab and pull inward to close the door.

6 Door Operating Handle

To open the door – rotate in the direction of the arrow.

To close the door – rotate in the opposite direction of the arrow.

7 Slide/Raft

The bustle contains the slide/raft.

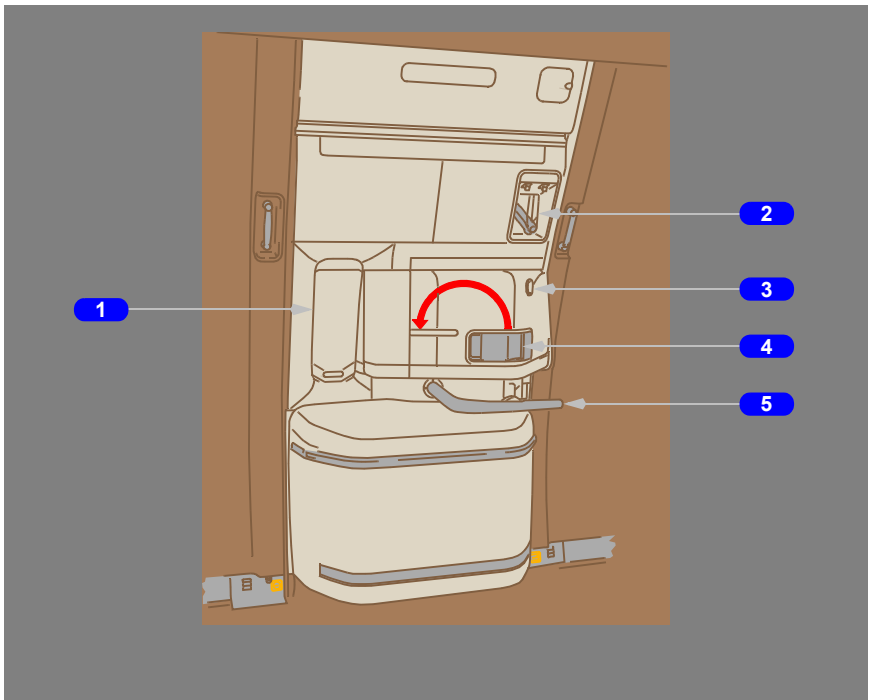
8 Girt Bar Indicator Flag Viewing Windows

Yellow in view – door and slide/raft are armed.

Black in view – door and slide/raft are not armed.

Overwing Emergency Exit Door

[777-300 and 777-300ER]



1 Viewing Window

Allows observation outside the airplane.

2 Door Mode Select Panel

See door mode select panel section.

3 Power Assist Reservoir Pressure Gage

If the gage needle is outside the green zone, the system is unusable.

Boeing Proprietary. Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details.

4 Gust Lock Release Lever

Grab and pull inward to close the door.

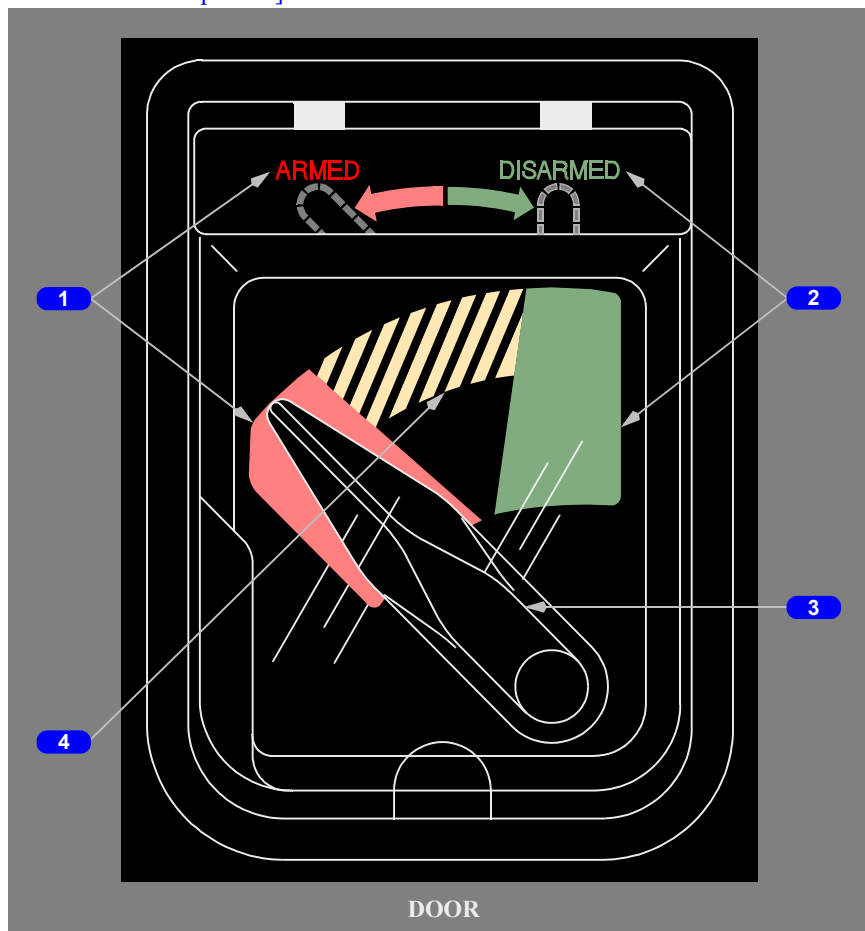
5 Door Operating Handle

To open the door – rotate in the direction of the arrow.

To close the door – rotate in the opposite direction of the arrow.

Door Mode Select Panel

[Option - ARMED/DISARMED shown, AUTOMATIC/MANUAL or
FLIGHT/PARK optional]



1 ARMED

Red.

Door is armed if the mode select lever is in the middle of the red band.

Note: If the door is opened from the outside, the mode select lever automatically moves to the DISARMED position.

2 DISARMED

Green.

Door is disarmed if the mode select lever is in the middle of the green band.

3 Door Mode Select Lever

Used to select the required mode for flight, ARMED, or arrival, DISARMED.

Used to select the required mode for flight, AUTOMATIC, or arrival, MANUAL.

Used to select the required mode for flight, FLIGHT, or arrival, PARK.

4 Unsafe Band

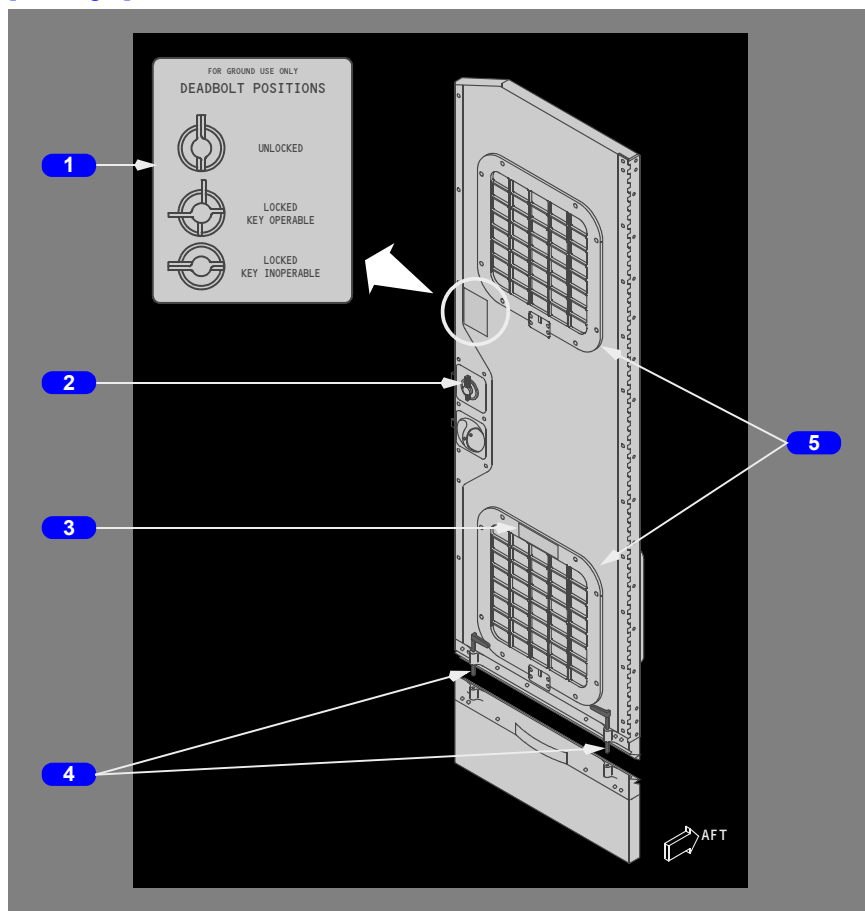
If the mode select lever is anywhere in the unsafe band, the door may be either armed or disarmed.

CAUTION: To ensure that the door is properly armed or disarmed, the door mode selector must be positioned in the middle of the red or green band.

Flight Deck Door

[Option - Flight deck security door]

[Passenger]



1 DEADBOLT POSITIONS Placard

2 Deadbolt Levers

3 Emergency Egress Placard

Describes how to separate lower break-away panel from a jammed door to allow door opening and egress

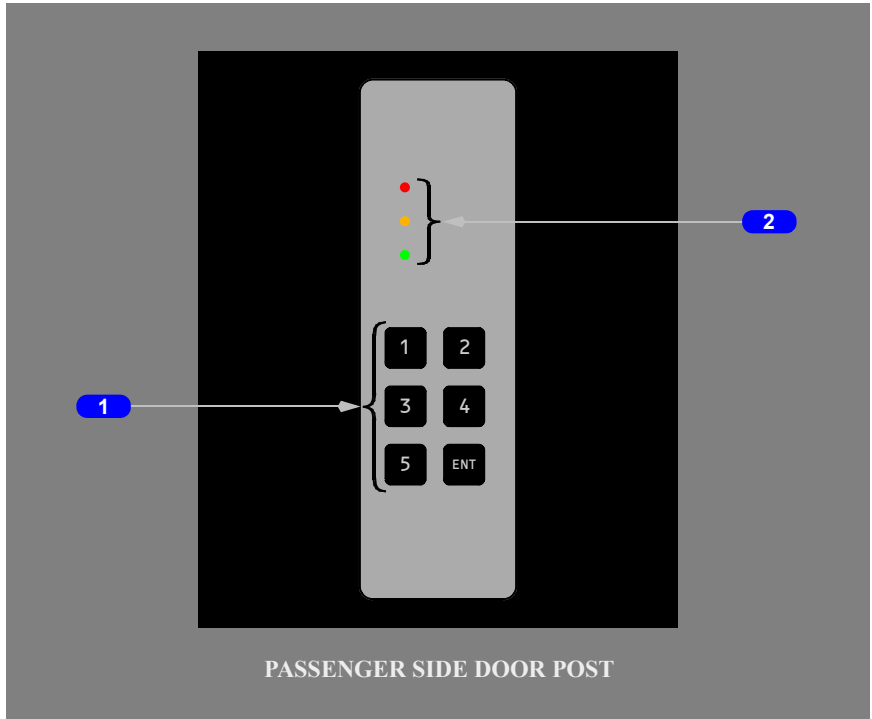
4 Shear Pins

Retract out of lower break-away panel when shear pin levers rotate down.

5 Security Grill

Prevents intrusion into flight deck if decompression panels open due to cabin depressurization.

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.

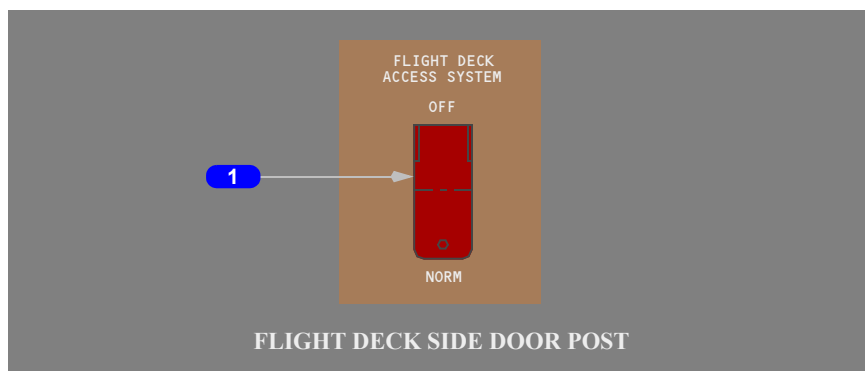
2 Access Lights

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

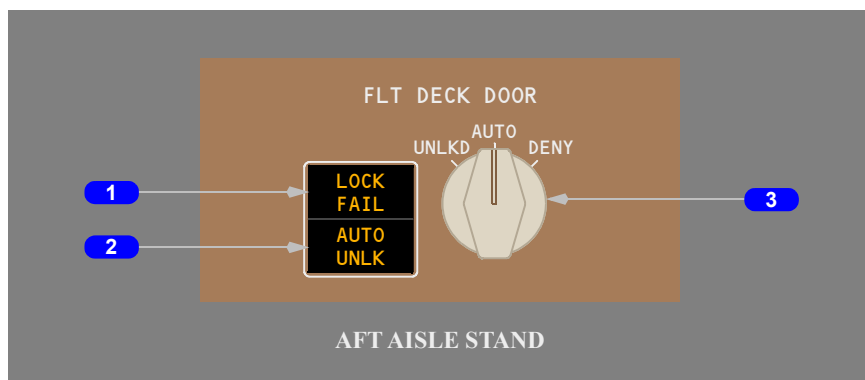


1 FLIGHT DECK ACCESS SYSTEM Switch

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 in 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 (FLT) DECK DOOR Lock Selector

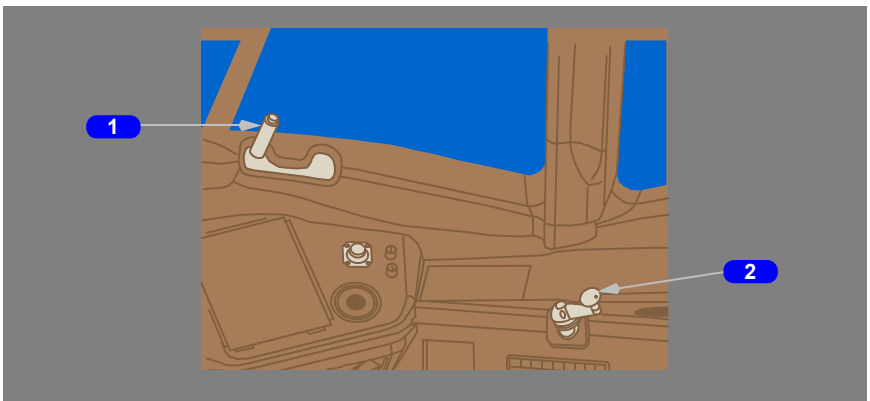
Spring loaded to AUTO. Selector must be pushed in to rotate from AUTO to UNLKD. Selector must not be pushed in to rotate from AUTO to DENY.

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.

Flight Deck Number Two Window



1 Window Lock Lever

Forward – with the window fully closed, locks the window. If the lock lever is properly locked, the orange indicator is not visible below the release button. The EICAS message WINDOW FLT DECK L, R displays if a window is not properly latched.

Aft – unlocks the window so it can be cranked open.

2 Window Crank

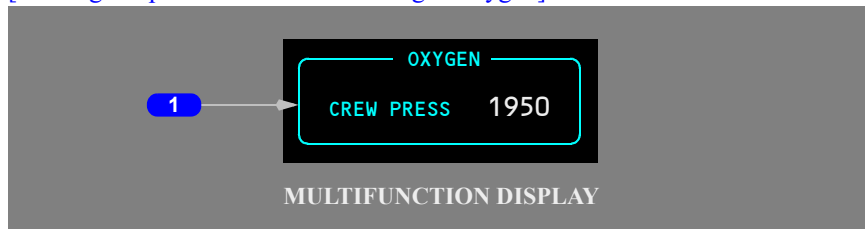
Used to position the window open or closed when the window lock lever is unlocked.

To reposition the window crank without moving the window, push and hold the button in the center of the window crank.

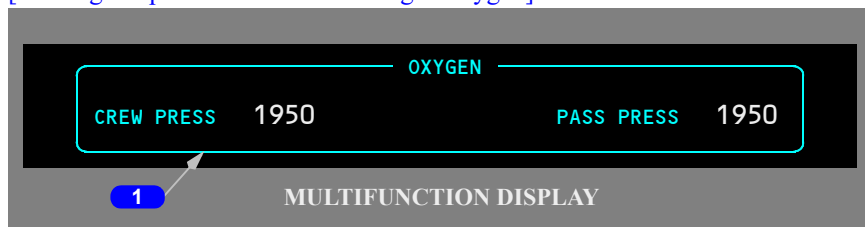
Oxygen Systems

Oxygen Indications

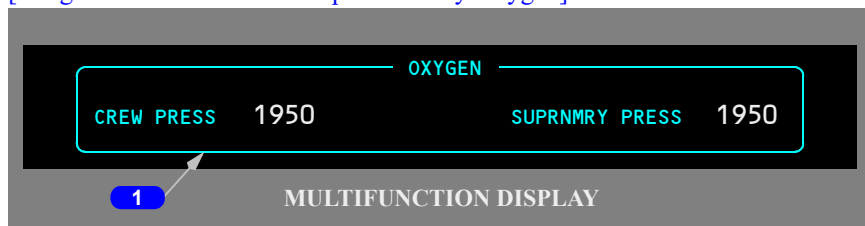
[Passenger Option – Chemical Passenger Oxygen]



[Passenger Option – Gaseous Passenger Oxygen]



[Freighter Basic – Gaseous Supernumerary Oxygen]



1 Oxygen Pressure Display

[Passenger Option – Chemical Passenger Oxygen]

Displays crew oxygen cylinder pressure (PSI).

[Passenger Option – Gaseous Passenger Oxygen]

Displays crew and passenger oxygen cylinder pressure (PSI).

[Freighter Basic – Gaseous Supernumerary Oxygen]

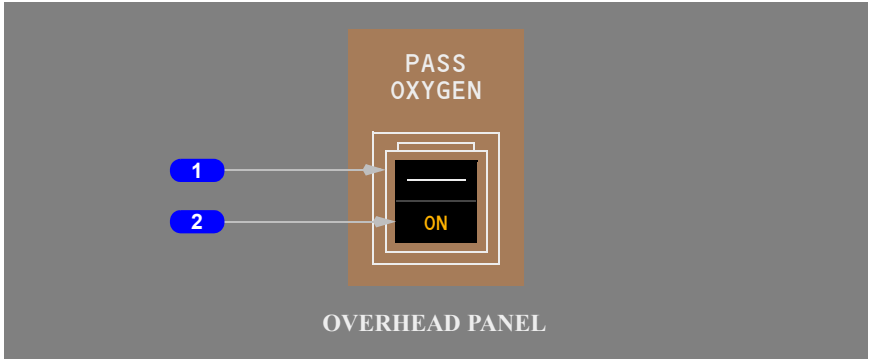
Displays crew and supernumerary oxygen cylinder pressure (PSI).

Note: Access is through the display select panel STATUS switch.

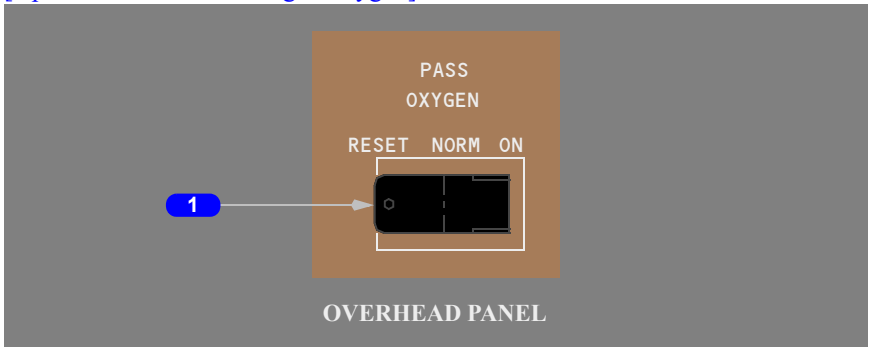
Passenger Oxygen Switch

[Passenger]

[Option – Chemical Passenger Oxygen]



[Option – Gaseous Passenger Oxygen]



[Option – Chemical Passenger Oxygen]

1 Passenger (PASS) OXYGEN Switch

Push – the cabin oxygen masks drop.

[Option – Gaseous Passenger Oxygen]

1 Passenger (PASS) OXYGEN Switch

RESET (spring-loaded) – flow control units close if cabin altitude is below 13,500 feet.

NORM – system automatically activates when cabin altitude reaches approximately 13,500 feet.

ON (spring-loaded) – system activates and cabin oxygen masks drop.

[Option – Chemical Passenger Oxygen]

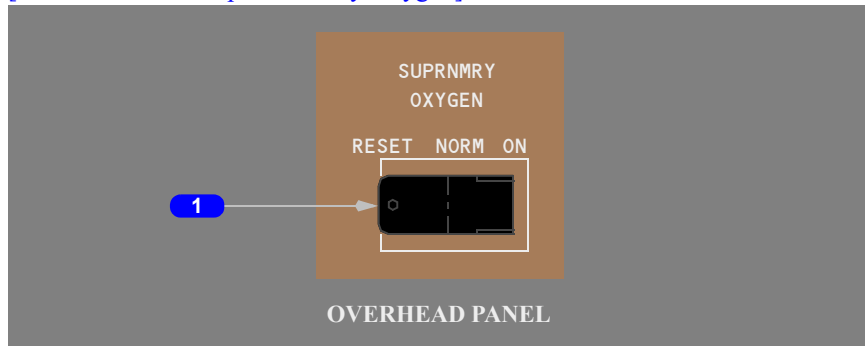
2 Passenger Oxygen ON Light

Illuminated (amber) – The passenger oxygen system is operating and the masks have dropped.

Supernumerary Oxygen Switch

[Freighter]

[Basic – Gaseous Supernumerary Oxygen]



[Basic – Gaseous Supernumerary Oxygen]

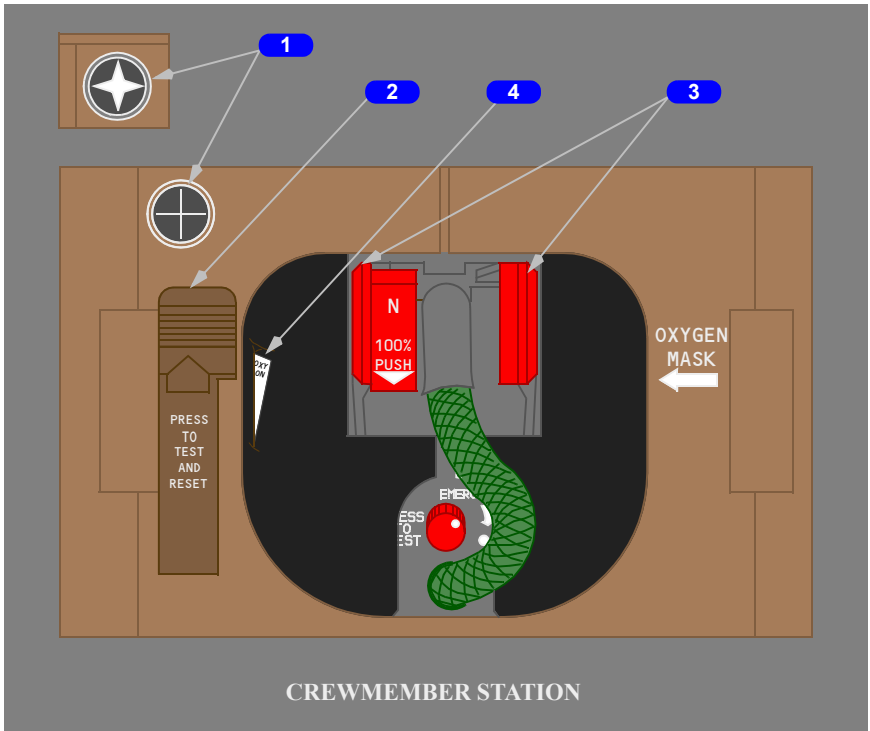
1 Supernumerary (SUPRNMRY) OXYGEN Switch

RESET (spring-loaded) – flow control units close if cabin altitude is below 13,500 feet.

NORM – system activates when cabin altitude reaches approximately 13,500 feet.

ON (spring-loaded) – system activates and cabin oxygen masks drop.

Oxygen Mask Panel



1 Oxygen Flow Indicator

Shows a yellow cross when oxygen is flowing.

2 RESET/TEST Switch

Push –

- with the left oxygen panel door closed and the OXY ON flag not displayed, turns oxygen on momentarily to test the regulator
- with the left oxygen panel door closed and the OXY ON flag displayed:
 - turns oxygen off and deactivates the mask microphone
 - reactivates the boom microphone.

3 Oxygen Mask Release Levers

Squeeze and pull –

- unlocks the oxygen panel doors
- releases the mask
- oxygen turns on when the oxygen panel doors open

- automatically selects the mask microphone when the left oxygen panel door is opened
- disables the boom microphone.

Squeeze (right lever) – inflates the mask harness.

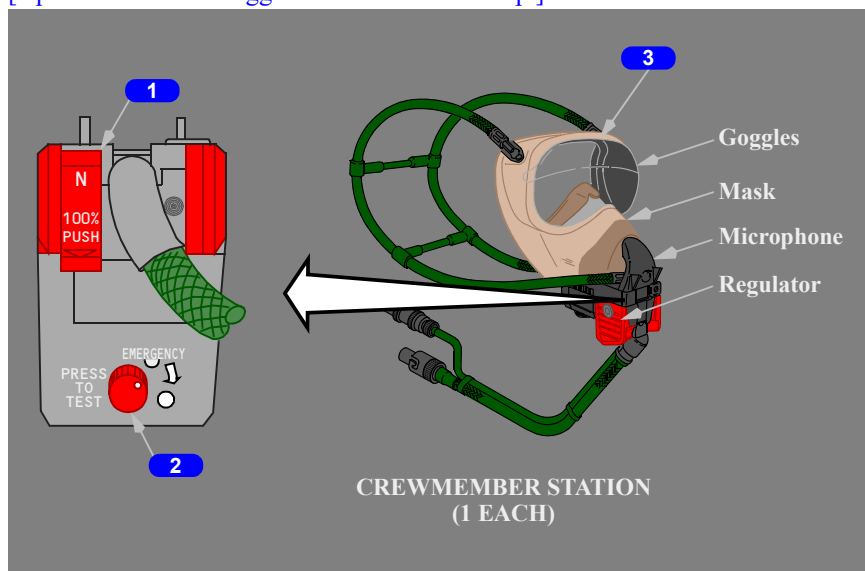
Release – deflates the mask harness into position on the head and face.

4 Oxygen (OXY) ON Flag

In view - oxygen is on.

Oxygen Mask and Regulator

[Option – Built-In Goggles with Protective Strip.]



1 NORMAL/100% Switch

N – supplies an air/oxygen mixture on demand (the ratio depends on cabin altitude).

100% – supplies 100% oxygen on demand (not an air/oxygen mixture).

2 Oxygen Mask Emergency/Test Selector

Normal (non-emergency) position - supplies air/oxygen mixture or 100% oxygen on demand, depending upon the position of the Normal/100% switch.

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 the mask and to remove condensation or fogging from interior of mask lens.

PRESS TO TEST– tests the positive pressure supply to the regulator.

CAUTION: Use of EMER mode depletes oxygen supply at higher rate than 100% or NORM mode. Use EMER mode only as conditions require.

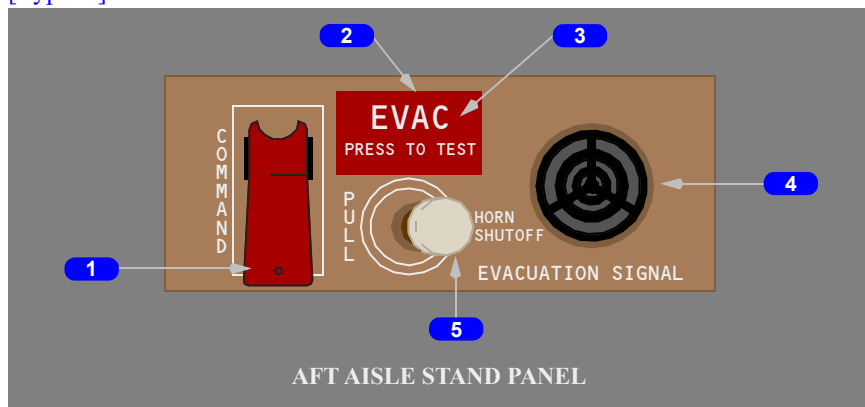
Note: Communication in EMER mode may be difficult. Switch to 100% or NORM mode if conditions allow.

3 Protective Strip

There is a protective strip of clear plastic on the top portion of the lens. This strip can be peeled off using the tab on the right side in case of icing caused by a rapid depressurization.

Emergency Evacuation Panel

[Typical]



1 Evacuation COMMAND Switch

ON –

- the red EVAC light (flight deck) and amber EVAC lights (flight attendant panels) flash
- an audio horn sounds at each panel.

OFF (guarded position) - the evacuation signals can be activated at the flight attendant panels.

2 Evacuation (EVAC) PRESS TO TEST Switch

Push – tests the EVAC light.

3 Evacuation (EVAC) Light

Illuminated (red) – a command switch is in the ON position.

4 EVACUATION SIGNAL Horn

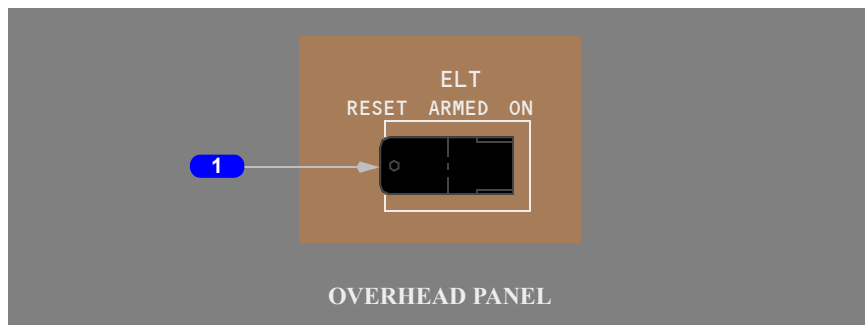
Sounds an audio signal.

5 Evacuation HORN SHUTOFF Switch

PULL – Silences the flight deck evacuation signal horn.

Fuselage Mounted Emergency Locator Transmitter

[Option]



1 Emergency Locator Transmitter (ELT) Switch

RESET (spring-loaded) – ends transmission of emergency locator signal.

ARMED (guarded position) – transmits emergency locator signal if activated by high deceleration forces.

ON – transmits emergency locator signal.

**Airplane General, Emergency
Equipment, Doors, Windows
Systems Description****Chapter 1****Section 40**

Introduction

This section describes miscellaneous airplane systems, including:

- lighting systems
- oxygen systems

Lighting Systems

Lighting systems described in this section include:

- exterior lighting
 - flight deck lighting
- [\[Passenger\]](#)
 - cabin lighting
 - [\[Freighter\]](#)
 - main deck lighting
 - emergency lighting.

Exterior Lighting

Exterior lighting consists of these lights:

- landing
- runway turnoff
- taxi
- strobe
- beacon
- navigation (position)
- logo
- wing leading edge illumination
- escape slide emergency lights.

Landing Lights

The landing lights consist of the left, right, and nose gear landing lights. The left and right landing lights are located in the left and right wing root. These lights are optimized for flare and ground roll. The two nose gear–located landing lights are optimized for approach.

Runway Turnoff Lights

Runway turnoff lights are installed in the left and right wing roots. The lights illuminate the area in front of the main gear.

Taxi Lights

Taxi lights are installed on the non–steerable portion of the nose strut. They are inoperative when the nose landing gear is not down and locked.

Strobe Lights

The strobe lights are white anti-collision strobe lights located on each forward wing tip and on the tail cone.

Beacon Lights

The beacon lights are red anti-collision strobe lights located on the top and bottom of the fuselage.

Navigation Position Lights

The navigation position lights are the standard red (left forward wingtip), green (right forward wingtip), and white (aft tip of both wings and tailcone) position lights.

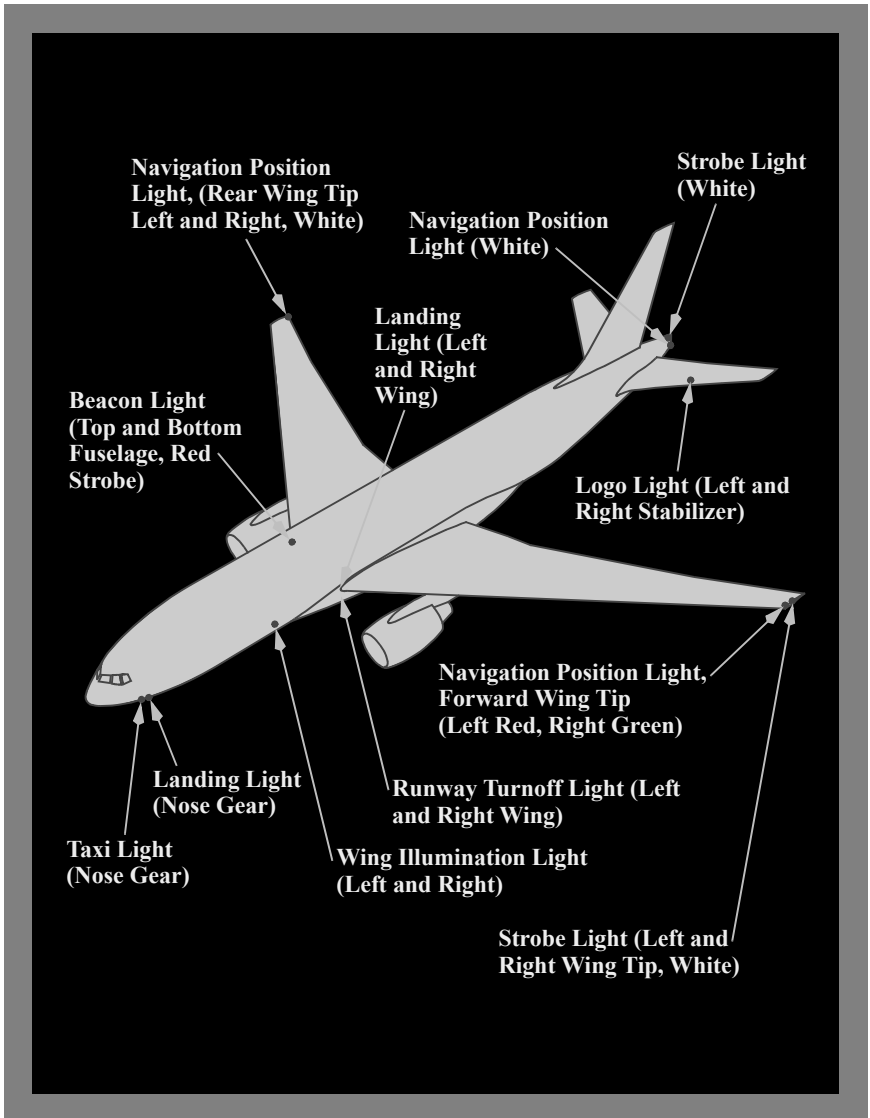
Logo Lights

Logo lights are located on the stabilizer to illuminate the airline logo on the vertical tail surface.

Wing Lights

Wing lights are installed on the fuselage and illuminate the leading edge of the wing.

Exterior Lighting Locations



Flight Deck Lighting

Flight deck lighting is provided for panel illumination, area lighting and localized illumination. Flood lights and light plates provide panel illumination. Dome lights provide flight deck area lighting. Map lights and a single utility light provide localized illumination.

Panel and flood lights illuminate the forward panels, glareshield and aisle stand panels. When the storm light switch is on, the left and right forward panel flood lights, glare shield flood lights, dome lights, aisle stand flood light, and all illuminated annunciator lights illuminate at full brightness.

If normal electrical power is lost, standby electrical power is automatically provided to the primary displays. The aisle stand, left and right forward panel and glareshield flood lights, and the dome lights illuminate automatically at a fixed brightness.

Master Brightness Control System

The MASTER BRIGHTNESS control provides the means of controlling panel and display lighting brightness with the use of one control. Maximum and minimum brightness levels are adjusted as ambient lighting changes. The control is turned on when the MASTER BRIGHTNESS switch is pushed on.

Lighting controlled through the master brightness system are:

- PFDs
- MFDs
- EICAS
- CDUs
- clocks
- standby instruments
- standby compass
- digital displays
- overhead panel
- glareshield panel
- forward panels (left, center, and right)

[Option – Side Panel Displays Shown]

- side panel displays
- aisle stand panels (forward and aft).

The individual lighting controls for the above displays and panels, except the CDUs and side displays, have a center detent position identified by a white dot at the mid-range adjustment position.

Individual controls can be used for dimming individual displays and panels. The individual controls have limited adjustment capability when the MASTER BRIGHTNESS switch is on, and should be centered in the detent when first adjusting the MASTER BRIGHTNESS control. They have full range of brightness control when the MASTER BRIGHTNESS switch is off.

Display brightness is automatically adjusted based on ambient lighting when the MASTER BRIGHTNESS switch is on.

Note: If display brightness cannot be set as desired when master brightness is on, pushing the MASTER BRIGHTNESS switch off may allow setting display brightness to an appropriate level using individual brightness controls.

Cabin Lighting

[Passenger]

Cabin lighting near the flight deck entry door is automatically dimmed or extinguished when the flight deck door is opened while an engine is operating. This reduces the light level entering the flight deck at night.

Cabin Signs

The cabin signs are controlled by overhead panel selectors. The cabin signs illuminate when any of the following conditions occur:

FASTEN SEAT BELTS signs (AUTO selected):

- landing gear not up and locked, or
- flap lever not up, or
- airplane altitude below an airline defined altitude, or

[Freighter]

- airplane altitude below 10,000 feet, or
- cabin altitude above 10,000 feet, or

[Passenger]

- passenger oxygen on.

[Freighter]

- supernumerary oxygen on.

NO SMOKING signs (AUTO selected):

- landing gear not up and locked, or
- cabin altitude above 10,000 feet, or

[Passenger]

- passenger oxygen on.

[Freighter]

- supernumerary oxygen on.

All cabin signs can be controlled manually by positioning the respective switch to ON or OFF. When the SEAT BELTS and NO SMOKING selectors are in the OFF position, and oxygen is ON, the FASTEN SEAT BELTS and NO SMOKING signs illuminate.

RETURN TO SEAT signs are illuminated with the FASTEN SEAT BELTS signs, except when oxygen is deployed.

When the cabin signs illuminate or extinguish, a low tone sounds over the PA system.

Emergency Lighting

The emergency lighting system is powered by remote batteries. Battery charge is maintained by the airplane electrical system. A fully charged battery provides at least 15 minutes of operation.

[Passenger]

Emergency lighting is controlled by the EMERGENCY LIGHTS switch on the overhead panel. The switch can be used to manually activate or arm the system for automatic operation. Automatic operation occurs if DC power fails or is turned off when the system is armed. The emergency lighting system can also be controlled by the EMERGENCY LIGHTS switch on the main flight attendant switch panel.

[Freighter]

Emergency lighting is controlled by the EMERGENCY LIGHTS switch on the overhead panel. The switch can be used to manually activate or arm the system for automatic operation. Automatic operation occurs if DC power fails or is turned off when the system is armed. The emergency lighting system can also be controlled by the EMERGENCY LIGHTS switch at door 1L.

When the EMERGENCY LIGHTS switch in the flight deck is armed, and the door mode select lever is in the armed position, moving the door handle to the open position will cause the exterior fuselage light and the interior emergency lights at that door to illuminate.

The EICAS advisory message EMER LIGHTS is displayed if:

- the emergency lights switch is not in the ARMED position, or

[Passenger]

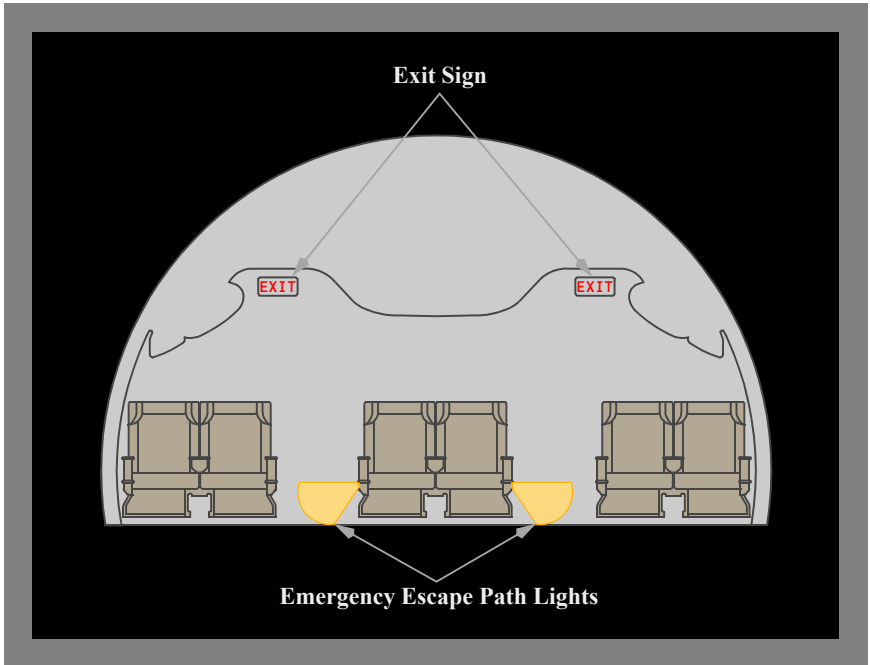
- the emergency lights switch is in the ARMED position, and the emergency lights are activated by the switch at a flight attendant panel.

[Freighter]

- the emergency lights switch is in the ARMED position, and the emergency lights are activated by the switch at door 1L.

Interior Emergency Lighting

[Passenger]



Interior emergency lighting consists of door, aisle, cross-aisle, escape path, exit lights, and luminescent exit signs.

Escape path lighting consists of lights installed in the arm rest of the center passenger seats, and on center galleys, lavatories, closets and partitions spaced at intervals in the aisles and cross-aisles. Escape path lighting illuminates emergency evacuation routes for visual guidance when all sources of lighting more than four feet above the aisle floor are obscured by smoke.

Battery powered exit lights are located at each cabin exit.

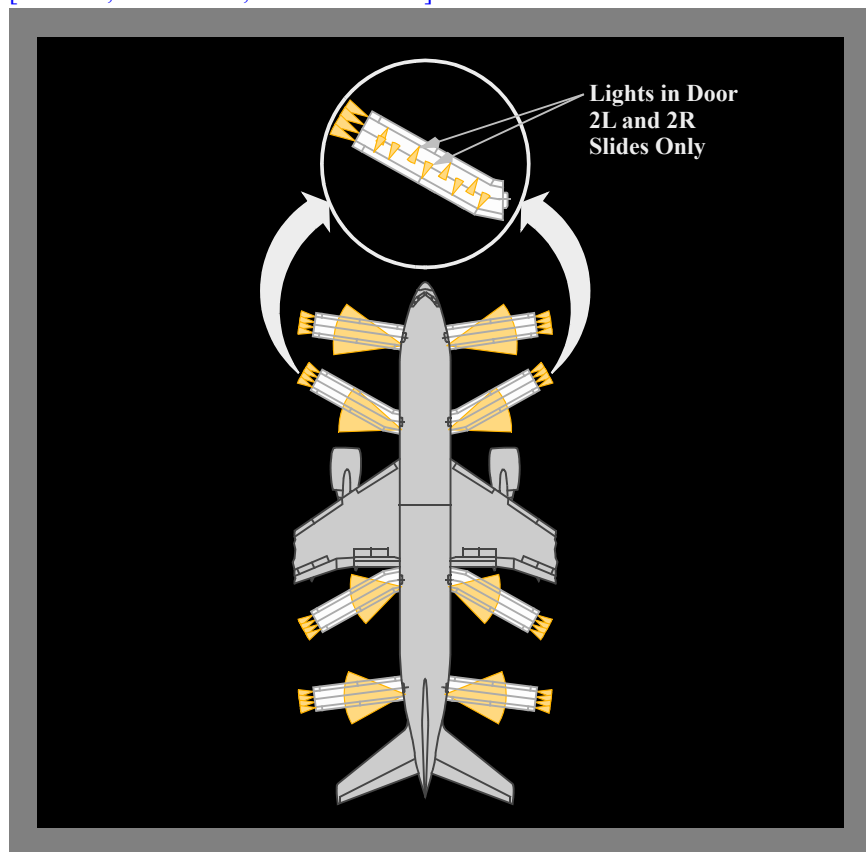
Interior Emergency Lighting

[Freighter]

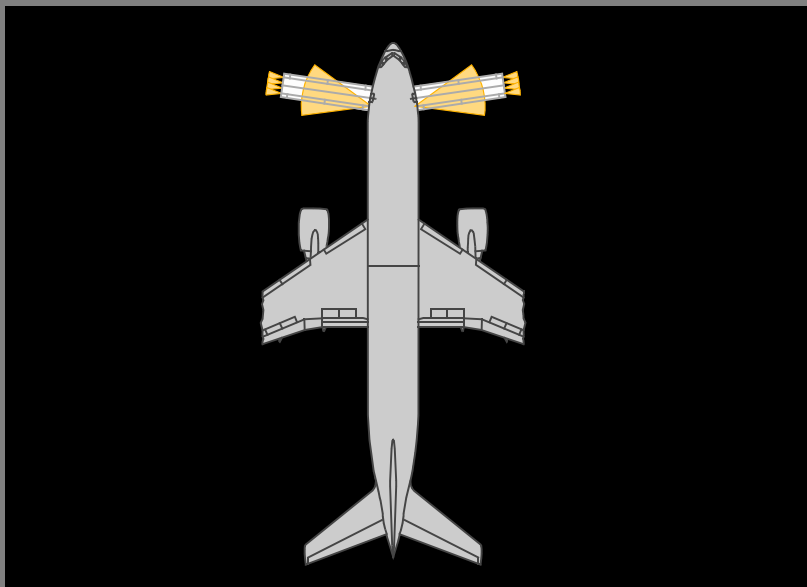
Interior emergency lighting consists of door, aisle, exit lights, and luminescent exit signs. Additional battery-powered exit identifier lights are located at each cabin exit.

Exterior Emergency Lighting

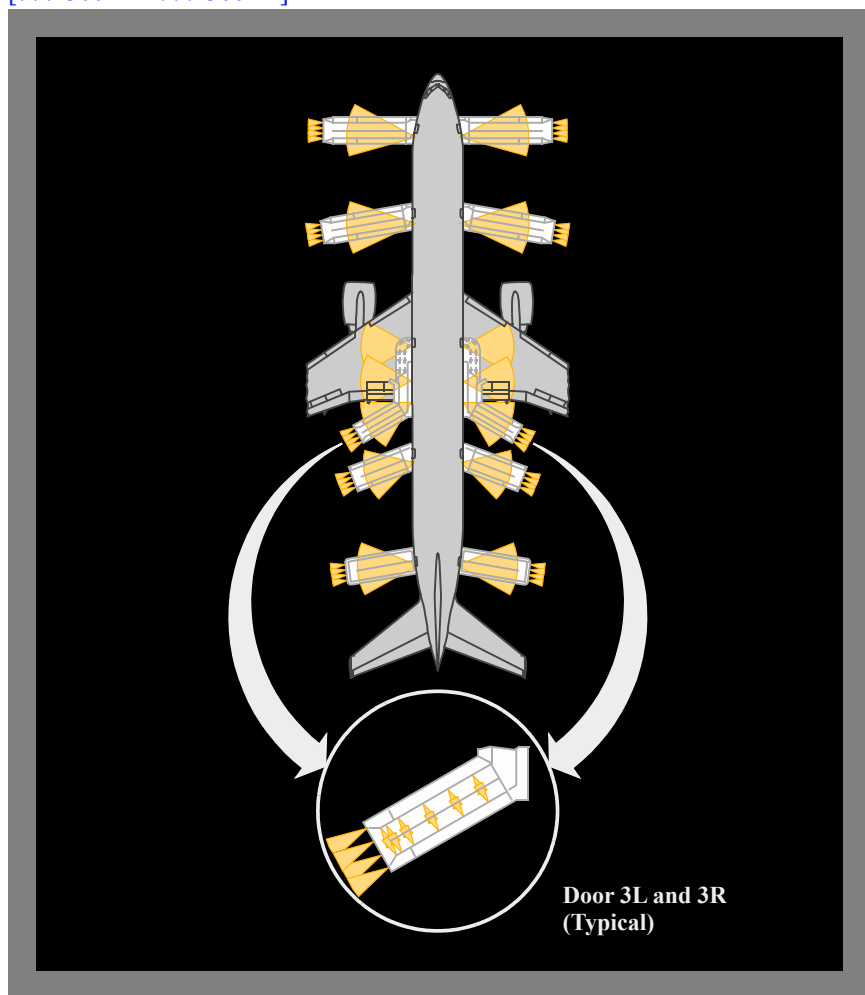
[777-200, 777-200ER, and 777-200LR]



[777F]



[777-300 and 777-300ER]



[777-200, 777-200ER, and 777-200LR]

Exterior emergency lighting consists of escape slide lights. The lights are located aft of each door and illuminate the areas at the base of the escape slides. The slides in doors 2L and 2R have lights built into the sliding lanes. When the slide is deployed, the lights turn on automatically to illuminate the slide lanes.

[777F]

Exterior emergency lighting consists of escape slide lights. The lights are located aft of each door and illuminate the areas at the base of the escape slides.

[\[777-300 and 777-300ER\]](#)

Exterior emergency lighting consists of escape slide lights. The lights are located aft of each door and illuminate the areas at the base of the escape slides. The slides in doors 3L and 3R have lights built into the sliding lanes. When the slide is deployed, the lights turn on automatically to illuminate the slide lanes.

[\[777-300 and 777-300ER\]](#)

The overwing exit lights are located aft of the door and illuminate the evacuation path to the escape slide. When the slide is deployed, the lights turn on automatically to illuminate the slide lanes.

Oxygen Systems

[\[Passenger\]](#)

Two independent oxygen systems are provided, one for the flight crew and one for the passengers. Portable oxygen cylinders are located throughout the airplane for emergency use.

[\[Freighter\]](#)

Two independent oxygen systems are provided, one for the flight crew and one for the supernumeraries. Portable oxygen cylinders are located throughout the airplane for emergency use.

Flight Crew Oxygen System

The flight crew oxygen system uses quick-donning masks and regulators located at each crew station. Oxygen pressure is displayed on the MFD STATUS display. The EICAS advisory message CREW OXYGEN LOW alerts the flight crew of a low oxygen pressure condition.

Flight crew and observer masks and regulators are installed in oxygen mask panels near each seat. Squeezing the red oxygen mask release levers releases the mask from stowage. Removing the mask:

- inflates the mask harness
- momentarily displays the yellow oxygen flow indicator
- selects the mask microphone in the removed mask (the boom microphone is deselected).

The boom microphone can be reselected by closing the left oxygen panel door and pushing and releasing the RESET/TEST switch. This also shuts off oxygen to the mask. The oxygen flow can be restored by opening the left oxygen panel door.

Crew Oxygen Mask Microphone Test

The oxygen mask microphone can be tested without removing it from the storage box.

- Select the FLIGHT interphone transmitter and set the speaker volume as desired.
- Push and hold a MIC switch on either the audio control panel or the glare shield
- Push both the oxygen mask RESET/TEST switch and EMERGENCY/TEST selector.

The sound of oxygen flowing is heard through the speaker, verifying microphone operation.

Passenger Oxygen System

[\[Passenger\]](#)

[\[Passenger - chemical oxygen system\]](#)

The passenger oxygen system is supplied by individual chemical oxygen generators. The oxygen system provides oxygen to:

- passenger seats
- attendant stations
- lower crew rest compartment
- upper crew rest compartment
- lavatory service units.

[\[Passenger - gaseous oxygen system\]](#)

The passenger oxygen system is supplied by a gaseous oxygen system. The oxygen system provides oxygen to:

- passenger seats
- attendant stations
- lower crew rest compartment
- upper crew rest compartment
- lavatory service units.

[\[Option – Chemical Passenger Oxygen, 12 or 22 minutes\]](#)

The passenger oxygen masks and chemical oxygen generators are located in passenger service units (PSUs). Oxygen flows from a PSU generator when any mask hanging from that PSU is pulled. Oxygen is available for approximately 12 minutes. The masks automatically drop from the PSUs if cabin altitude exceeds approximately 13,500 feet. The passenger masks can be manually deployed from the flight deck by pushing the overhead panel PASSENGER OXYGEN switch to the ON position.

[\[Option – Gaseous Passenger Oxygen\]](#)

The passenger oxygen masks are located in passenger service units (PSUs). The masks automatically drop from the PSUs if cabin altitude exceeds approximately 13,500 feet. The passenger masks can be manually deployed from the flight deck by pushing the overhead panel PASSENGER OXYGEN switch to the ON position. Oxygen flow can be reset by selecting the PASSENGER OXYGEN switch to the RESET position.

[\[Option – Gaseous Passenger Oxygen\]](#)

Passenger oxygen pressure is displayed on the MFD STATUS display.

Supernumerary Oxygen System

[\[Freighter\]](#)

The supernumerary oxygen system supplies oxygen to the supernumerary area, lavatory, and crew rest.

The supernumerary oxygen system is supplied by bottled gaseous oxygen. The supernumerary oxygen masks are located in passenger service units (PSUs). The masks automatically drop from the PSUs if cabin altitude exceeds approximately 13,500 feet. The supernumerary masks can be manually deployed from the flight deck by pushing the overhead panel SUPRNMRY OXYGEN switch to the ON position. Oxygen flow can be reset by selecting the SUPRNMRY OXYGEN switch to the RESET position.

Supernumerary gaseous oxygen pressure is displayed on the MFD STATUS display.

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**Airplane General, Emergency
Equipment, Doors, Windows
Emergency Equipment****Chapter 1****Section 45**

Emergency Equipment Overview

This section describes the emergency equipment located throughout the airplane, including:

- emergency evacuation signal system
- emergency locator transmitters (ELTs)
- fire extinguishers
- flight deck emergency equipment location
- portable passenger cabin emergency equipment location

Emergency Evacuation Signal System

The emergency evacuation signal system alerts the flight attendants to evacuate the passenger cabin.

Placing the flight deck evacuation signal COMMAND switch to ON activates the evacuation signal on the flight deck and on the flight attendant panels.

With the flight deck evacuation signal COMMAND switch in the OFF (guard down) position, pressing an EVAC COMMAND switch on a flight attendant panel will activate the evacuation signals on the flight deck and on the flight attendant panels.

Emergency Locator Transmitter (ELT)**[Option: ELTs in Slide/Rafts]**

ELTs are installed in slide/raft bustles, as shown in the Emergency Equipment Locations – Passenger Cabin diagram. The ELTs automatically transmit when the slide/rafts are deployed into water.

[Option: ELTs in Passenger Cabin]

ELTs are installed in the passenger cabin, as shown in the Emergency Equipment Locations – Passenger Cabin diagram.

Two emergency locator transmitters are installed:

- one in the door 1L slide/raft
- one in the door 4R slide/raft

Note: The slide/raft emergency locator transmitter automatically transmit when the slide/raft is deployed in the water.

[Typical]

Two emergency locator transmitters (ELTs) are located in the supernumerary area in the stowage box forward of door 1R.

Fuselage Mounted Emergency Locator Transmitter (ELT)

[Option]

An emergency locator transmitter (ELT) is mounted to the top center of the fuselage in the passenger cabin area.

The ELT automatically transmits distress signals on 121.5 MHZ, 243 MHZ, and 406 MHZ if a high deceleration is sensed, or if the ELT switch is positioned to ON.

The EICAS alert message ELT ON is displayed if the transmitter is activated. The ELT can be deactivated by placing the ELT switch to RESET momentarily, then ARMED.

Miscellaneous Portable Emergency Equipment

Portable emergency equipment is stowed at strategic locations throughout the airplane. See Emergency Equipment Location - Flight Deck and Emergency Equipment - Passenger Cabin below for specific location.

Portable emergency equipment is stowed at strategic locations throughout the airplane. See Emergency Equipment Location - Flight Deck / Supernumerary Area / Main Deck below for specific location.

Fire Extinguishers

Halon, or Halon-equivalent clean agent and water fire extinguishers are located throughout the passenger cabin and on the flight deck.

Halon and Halon Equivalent Fire Extinguishers

Halon or Halon-equivalent clean agent fire extinguishers contain a liquefied gas agent under pressure. The extinguisher pressure indicator shows three pressure ranges:

- acceptable
- recharge
- overcharged

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 is used primarily on electrical, fuel, and grease fires.

WARNING: If a Halon or equivalent fire extinguisher is to be discharged in the flight deck area, all flight crew members 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 byproducts can result in dizziness, difficulty breathing, and eye and nose irritation. After discharge of an entire fire extinguisher, it can take 7 minutes for agent to dissipate. Signs of smoke should be clear and agent dissipated before removal of oxygen masks or protective breathing equipment.

CAUTION: For electrical fires, remove the power source as soon as possible. Avoid discharging directly on persons due to possibility of suffocating effects. Do not discharge too close to fire as the discharge stream may scatter the fire. As with any fire, keep away from the fuel source. Avoid breathing vapors, fumes and heated smoke as much as possible.

Note: The directions for use of the fire extinguisher are printed on the extinguisher.

Water Fire Extinguishers

Water fire extinguishers contain a solution of water mixed with antifreeze. Water fire extinguishers are to be used on fabric or paper fires only. They are not to be used on electrical or grease fires.

Note: The directions for use of the fire extinguisher are printed on the extinguisher.

WARNING: An antifreeze compound has been added to the water which makes it unfit for drinking.

CAUTION: Do not use on electrical or grease type fires.

Portable Oxygen Bottles

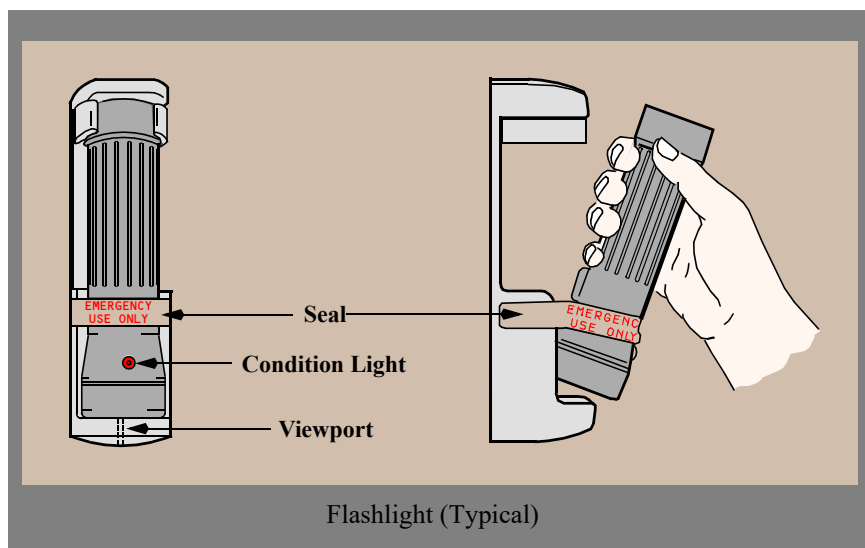
Portable oxygen bottles are stowed in various locations in the cabin. The bottles are fitted with disposable masks and are used for first aid purposes or as walk-around units. All bottles are identical in size and capacity.

There are portable oxygen bottles stowed in various locations in the supernumerary area. The bottles are fitted with disposable mask and safety straps and are used for first aid purposes or as walk-around units. All bottles are identical in size and capacity.

Flashlights

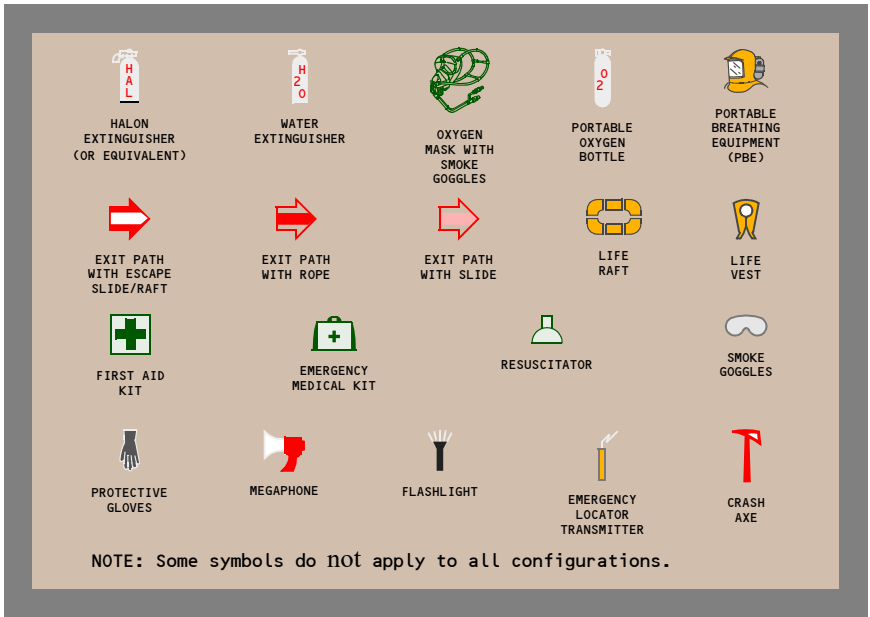
Flashlights are stowed on the flight deck and throughout the passenger cabin. These high intensity flashlights illuminate automatically when they are removed from the stowage brackets. The light can be extinguished only by replacing the flashlight back into the stowage bracket. A battery indicator light flashes every three to four seconds to indicate adequate power. The batteries cannot be recharged.

Flashlights are stowed on the flight deck and in the supernumerary area. These high intensity flashlights illuminate automatically when they are removed from the stowage brackets. The light can be extinguished only by replacing the flashlight back into the stowage bracket. A battery indicator light flashes every three to four seconds to indicate adequate power. The batteries cannot be recharged.

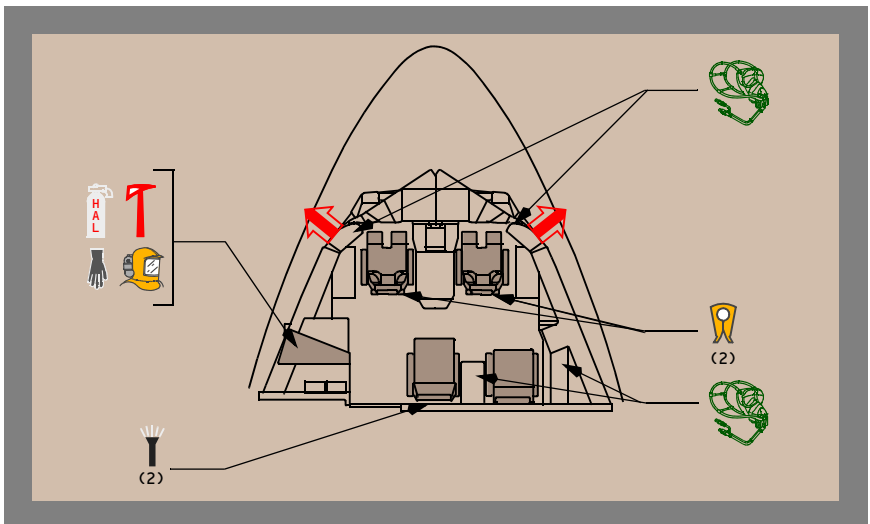


Emergency Equipment

Emergency Equipment Symbols

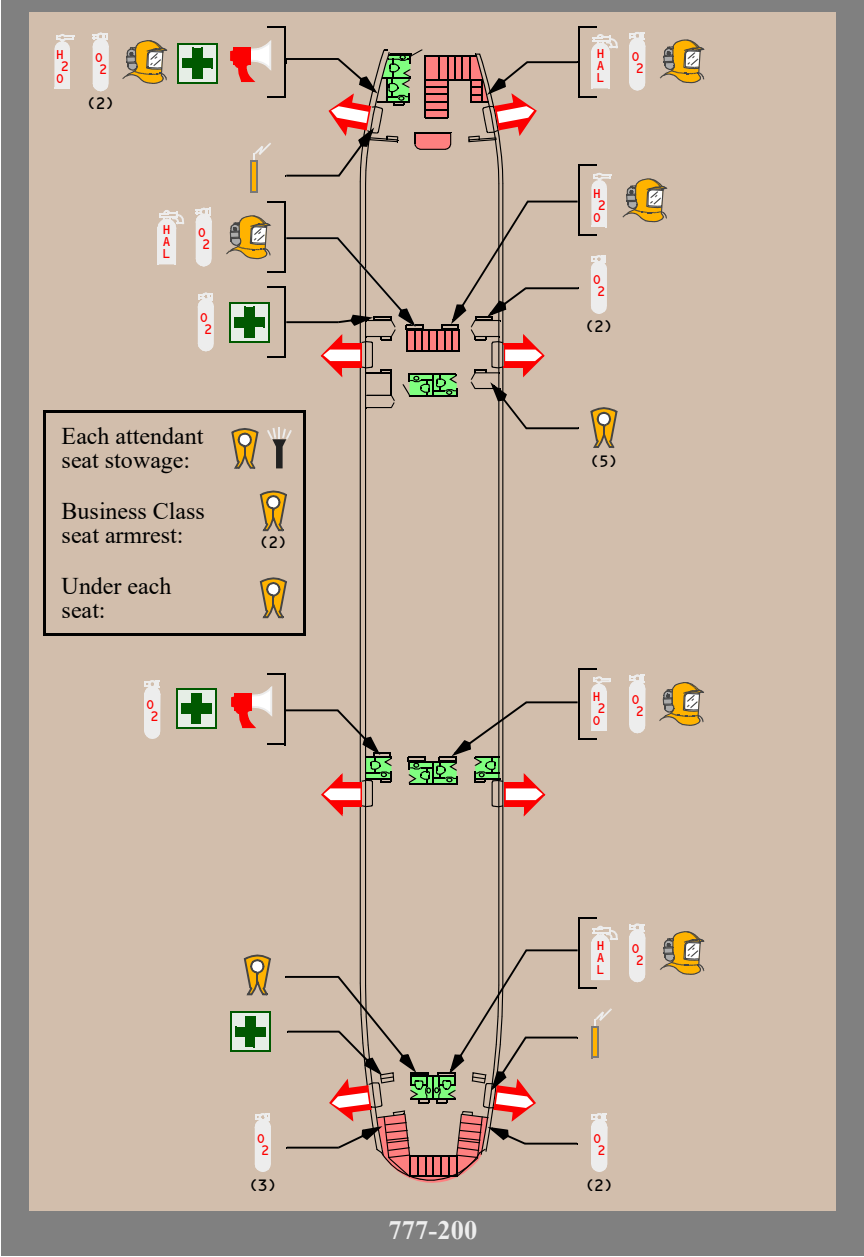


Emergency Equipment Locations - Passenger Airplane Flight Deck

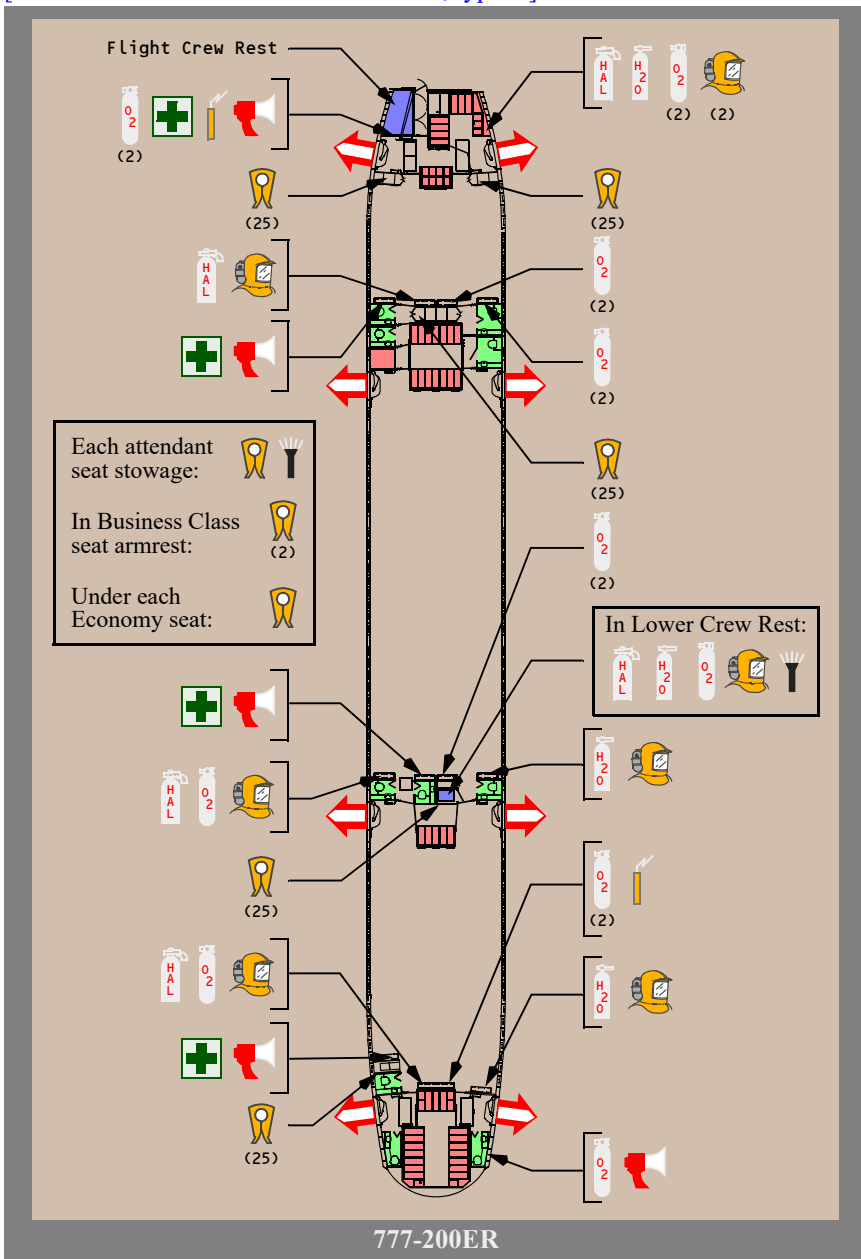


Passenger Cabin

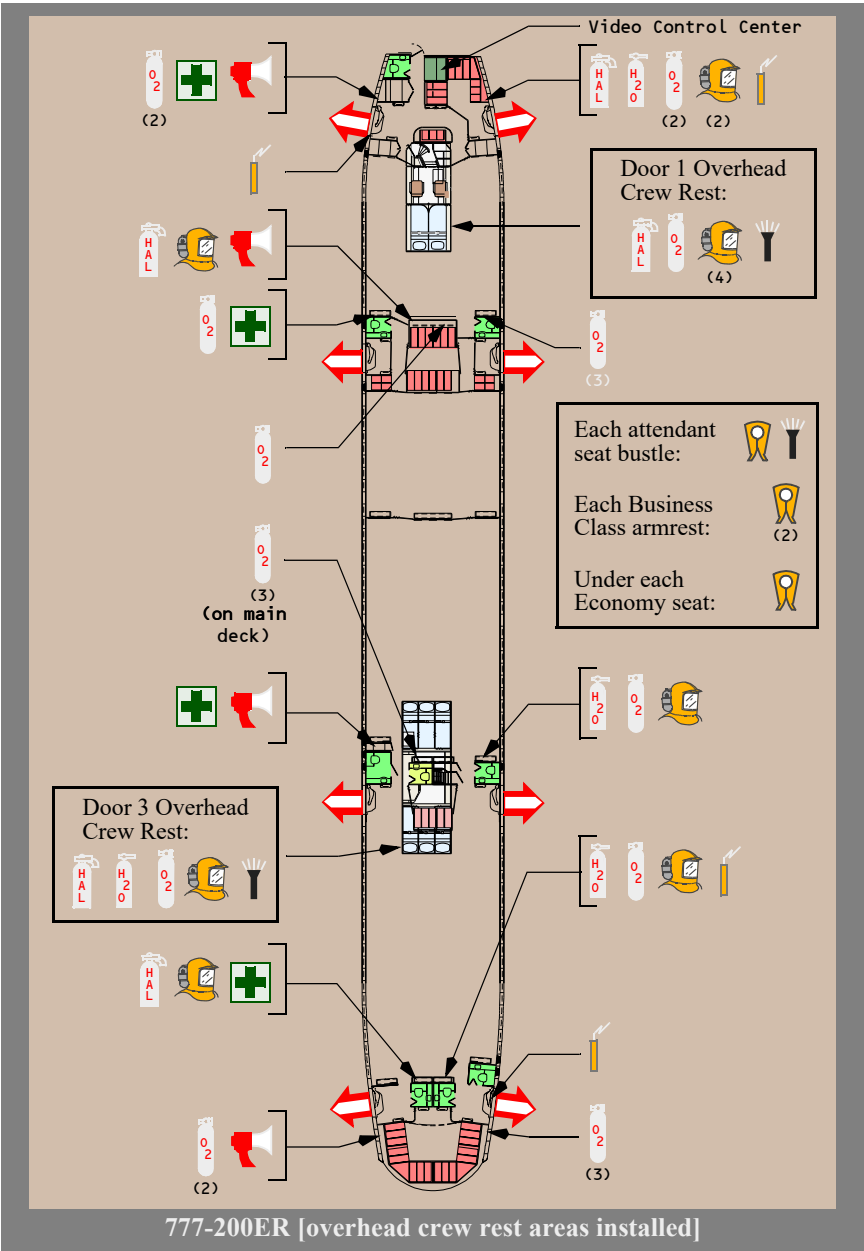
[777-200 typical]



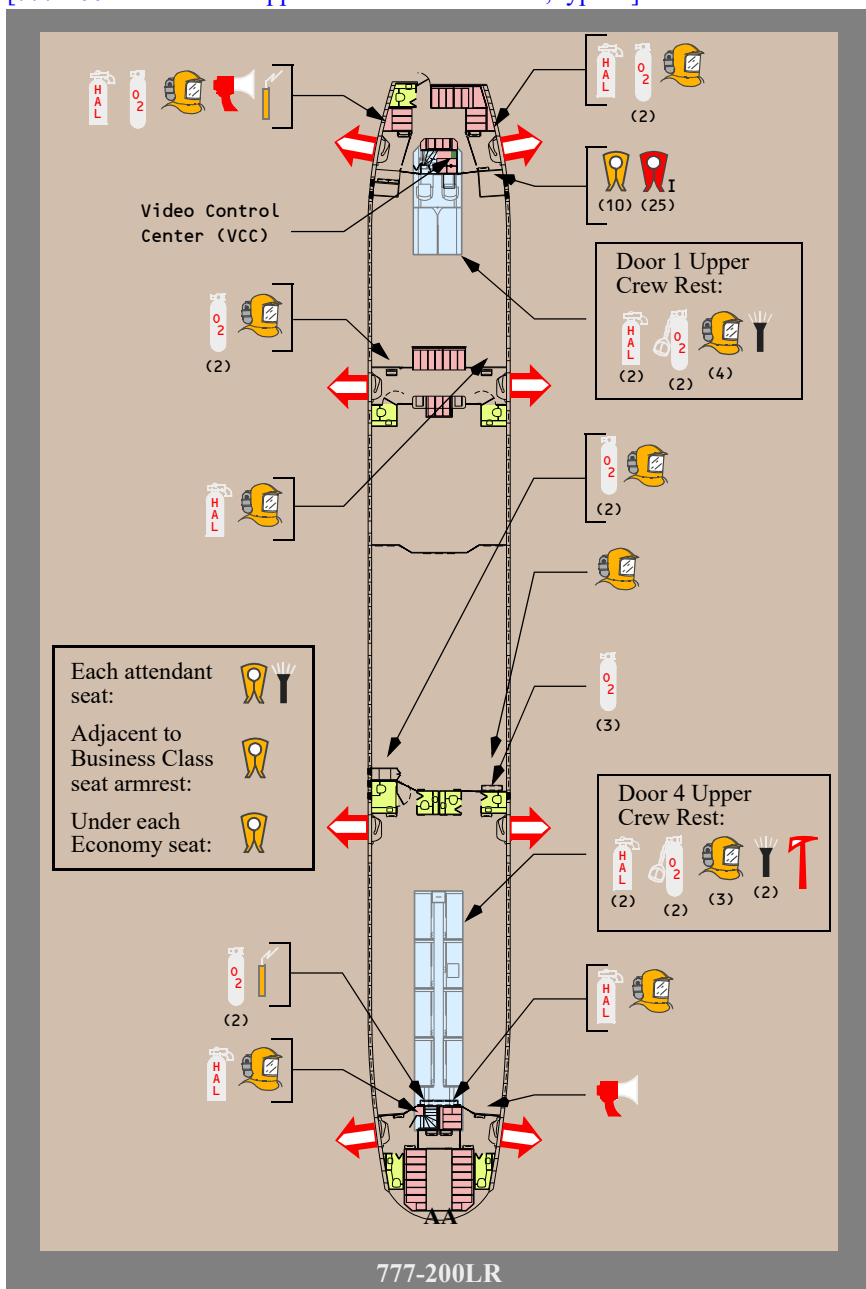
[777-200ER Lower Crew Rest - installed, typical]



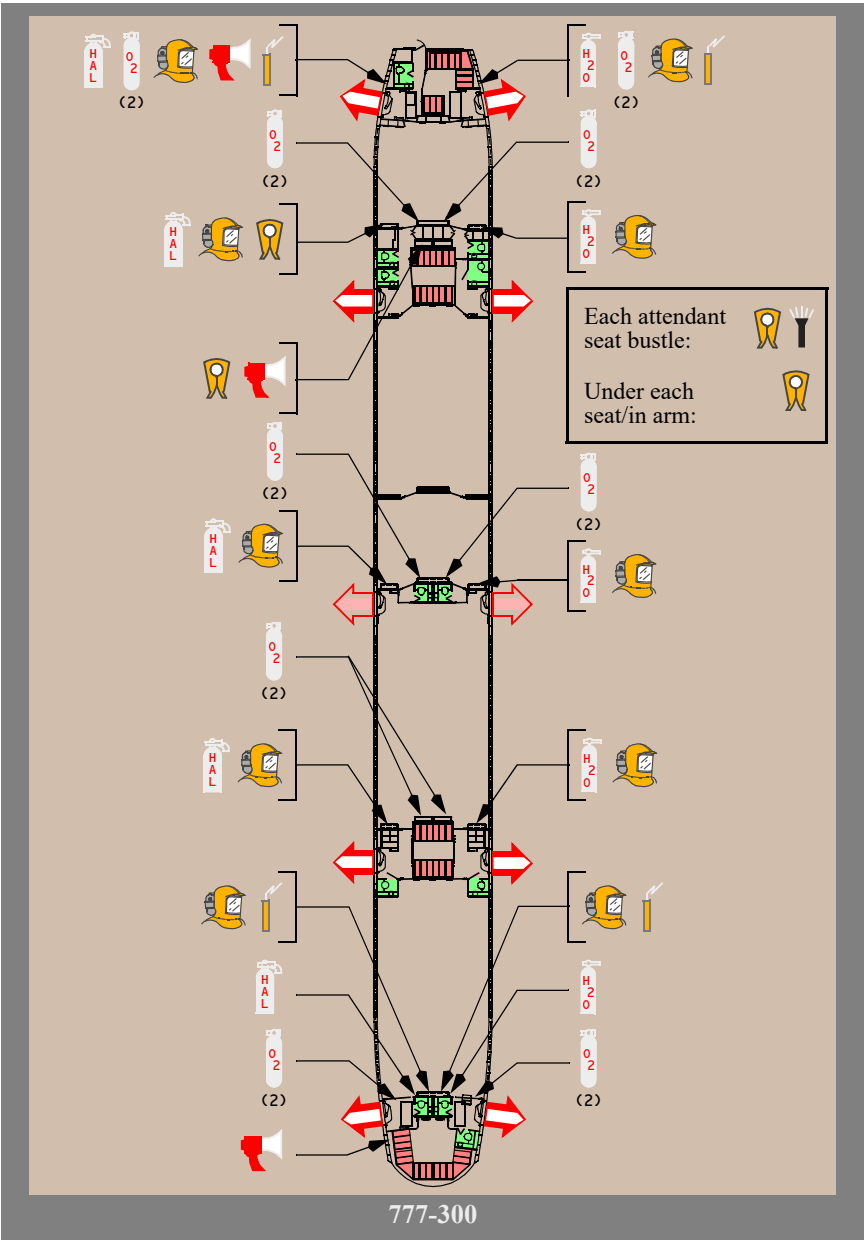
[777-200ER Door 1/3 Upper Crew Rest installed, typical]



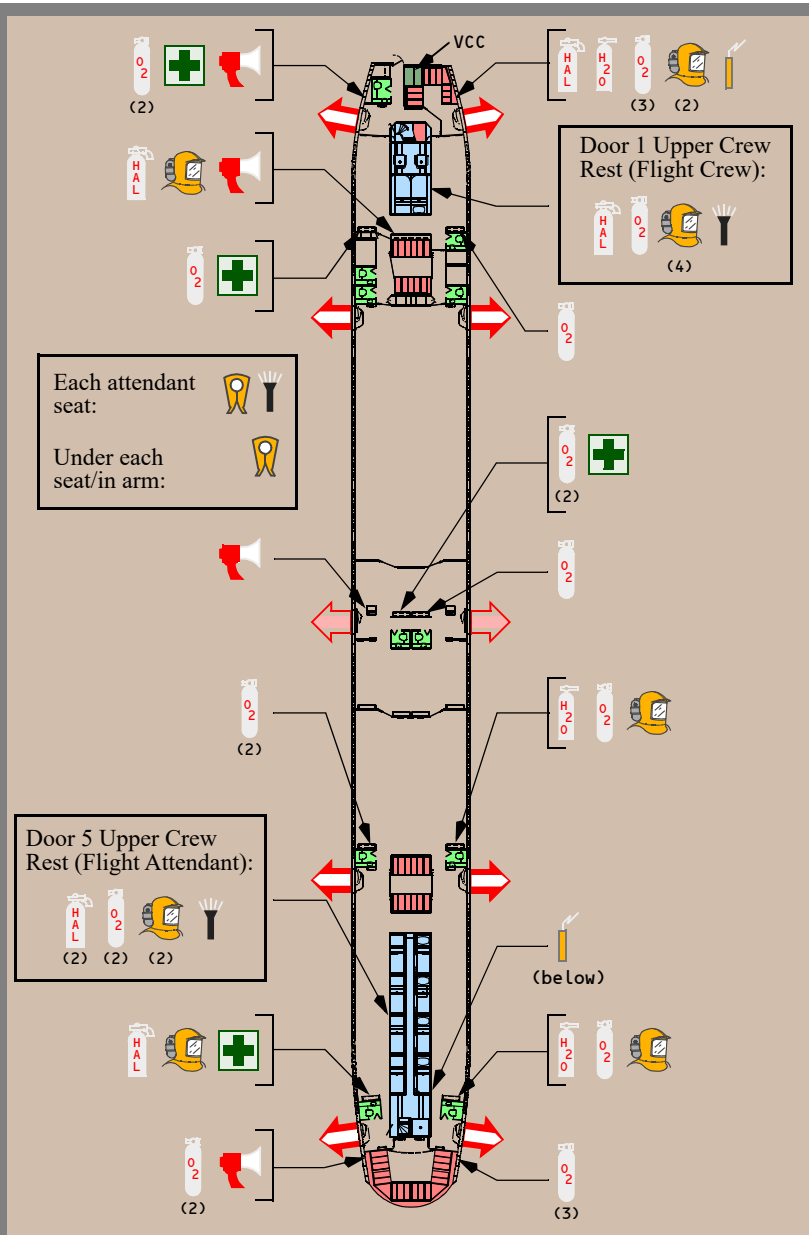
[777-200LR Door 1/4 Upper Crew Rest - installed, typical]



[777-300 typical]



[777-300ER: Door 1/5 Upper Crew Rest - installed, typical]

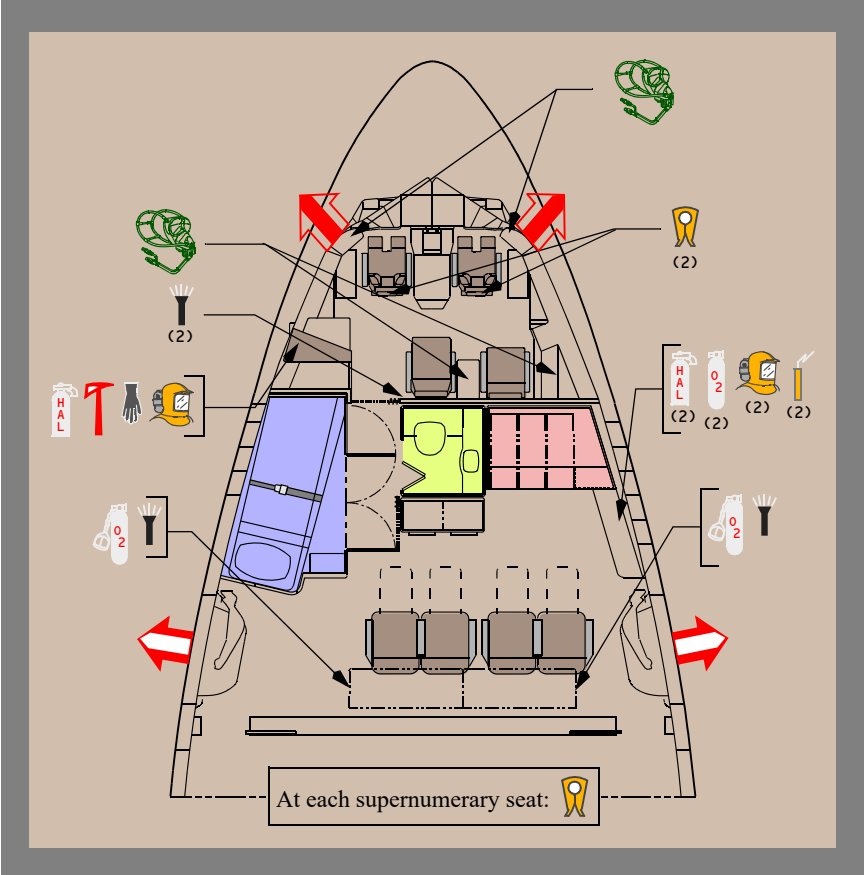


777-300ER

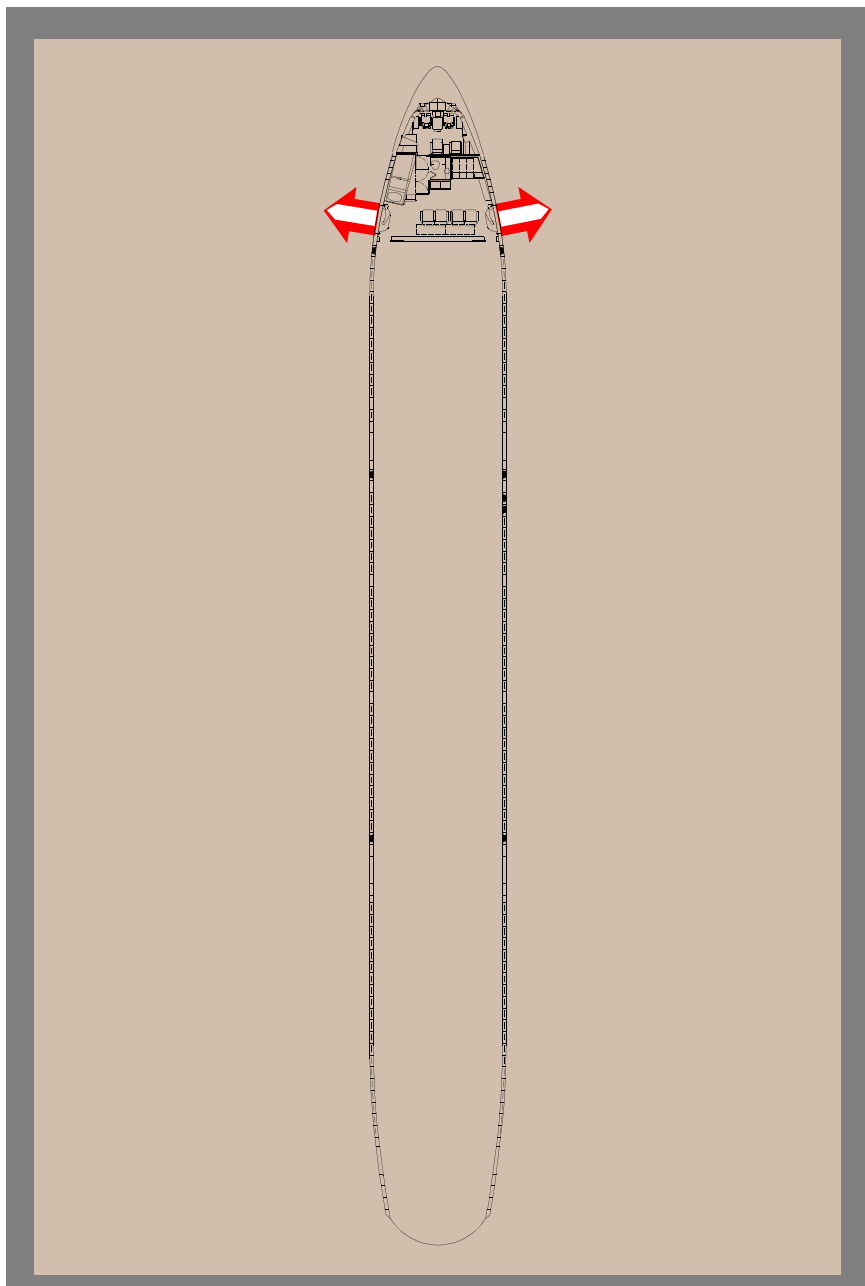
Emergency Equipment Locations - Freighter

[777F typical]

Flight Deck / Supernumerary Area



Main Deck



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**Airplane General, Emergency
Equipment, Doors, Windows
Crew Rest****Chapter 1****Section 46**

Introduction

This section describes the crew rest areas, including:

- location and entry enclosure
- control panels
- smoke detection
- decompression
- emergency equipment and location
- evacuation

**Crew Rest
General****[Passenger]**

A flight crew rest (FCR) area is located forward of the door 1L. The entrance to the FCR is located in the passageway between the passenger cabin and the flight deck.

[Freighter]

A flight crew rest (FCR) area is located forward of the door 1L. The entrance to the FCR is located in the passageway between the supernumerary area and the flight deck.

[Option - Door 1 overhead crew rest installed]

A door 1 overhead flight crew rest area is located in the forward part of the airplane near door 1. Access into the area is through an enclosure located in the passenger cabin near door 1L.

[Option - LCR installed]

A lower crew rest area is located in the forward section of the aft cargo area. The entrance enclosure to the area is located near the center aisle at door 3.

[Option - Door 3 overhead crew rest installed]

A door 3 overhead flight attendant rest area is located in the aft part of the airplane in the overhead above door 3. Entry into the area is through an enclosure located in the passenger cabin near door 3R.

[Option - Door 4 overhead crew rest installed]

A door 4 overhead flight attendant rest area is located in the aft part of the airplane in the overhead between door 3 and door 4. Entry into the area is through an enclosure located in the passenger cabin near door 4L.

A door 5 overhead flight attendant rest area is located in the aft part of the airplane in the overhead between doors 4 and 5. Entry into the area is through an enclosure located in the passenger cabin across from door 5L.

WARNING: The crew rest area should not be occupied when the amber AIRFLOW OFF light is illuminated.

WARNING: The crew rest area should not be occupied when the amber SUPPLY AIRFLOW OFF light is illuminated.

The entrance to the crew rest area has the same external appearance as a lavatory, but is placarded for crew use only.

The crew rest door should remain closed and locked at all times.

Occupancy

[Option - Crew rest certified for occupancy during taxi, take-off, and landing]

The crew rest may be occupied by crew members trained in the use of the crew rest evacuation routes, fire fighting procedures and depressurization procedures.

Note: A placard is installed indicating any crew rest area occupancy restrictions.

Note: The crew rest area is not to be occupied during taxi, takeoff, or landing operations.

Door 1 Overhead Crew Rest

The entrance enclosure contains an area main control panel.

An amber light is mounted on the exterior wall above the entrance door to the overhead crew rest. When smoke is detected in the area, the light flashes. The light will illuminate steady when the attendant call button on a passenger control unit inside the area has been pushed.

Note: The SUPPLY AIRFLOW OFF light will be illuminated when the airplane is below 25,000 feet.

Note: If the airplane is above 25,000 feet and the SUPPLY AIRFLOW OFF light is illuminated, pushing the AIRFLOW / SMOKE RESET switch resets the conditioned air system.

Lower Crew Rest (LCR)

A lower crew rest (LCR) compartment is located in the forward section of the aft cargo compartment. The entrance enclosure to the compartment is located near the center aisle at door 3. Air conditioning is only supplied to the LCR when airplane altitude is 25,000 feet or higher, and the main entry hatch is open.

The LCR compartment has its own smoke detection and fire extinguishing system.

Note: Before entering the LCR, ensure that conditioned air flow is available. Verify that the AIR FLOW OFF light on the attendant switch panel (ASP) in the entrance enclosure is not illuminated.

WARNING: The LCR should not be occupied when the amber AIR FLOW OFF light on the compartment attendant control panel is illuminated or the main entry hatch is shut.

Conditioned air is supplied to the lower crew rest area when the airplane has reached an altitude of 25,000 feet or higher, and the main entry hatch is open. The LCR should be occupied only when the airplane has reached an altitude of 25,000 feet or higher, and the main entry hatch is open.

WARNING: Closing the main entry hatch shuts off air flow to the lower crew rest area.

Before entering the crew rest area, ensure that conditioned air flow is available. Verify that the SUPPLY AIRFLOW OFF light on the control panel in the entrance enclosure is not illuminated.

Door 3 Overhead Crew Rest

Entry into the crew rest area is through an enclosure located in the passenger cabin across from door 3R. The entrance to the crew rest area is placarded for crew use only.

The entrance enclosure contains an area main control panel.

An amber call/reset light/switch is mounted on the exterior wall above the entrance door. When smoke is detected in the area, the light flashes. The light will illuminate steady when the attendant call button on a passenger control unit (PCU) inside the area has been pushed.

Conditioned air is used to provide temperature control and ventilation to the door 3 overhead crew rest area. When using the area, conditioned air flow must be available. An amber AIRFLOW OFF light on the main control panel in the entrance enclosure illuminates when conditioned air is not available.

Before entering the crew rest area, ensure that conditioned air flow is available. Verify that the AIR FLOW OFF light on the control panel in the entrance enclosure is not illuminated.

Note: The AIRFLOW OFF light will be illuminated when the airplane is below 25,000 feet.

Note: If the airplane is above 25,000 feet and the AIRFLOW OFF light is illuminated, pushing the AIRFLOW / SMOKE RESET switch resets the conditioned air system.

WARNING: If the AIRFLOW OFF light remains illuminated after the AIRFLOW / SMOKE RESET switch has been pushed, the door 3 overhead crew rest area should not be occupied.

Door 4 Overhead Crew Rest

The area has its own smoke detection system but no fire extinguishing system.

Entry into the crew rest area is through an enclosure located in the passenger cabin across from door 4R. The entrance to the crew rest area is placarded for crew use only.

The entrance enclosure contains the main control panel.

An amber call/reset light/switch is mounted on the exterior wall above the entrance door. When smoke is detected in the area, the light flashes. The light will illuminate steady when the attendant call button on a passenger control unit (PCU) inside the area has been pushed.

Conditioned air is used to provide temperature control and ventilation to the door 4 overhead crew rest area. When using the area, conditioned air flow must be available. An amber AIRFLOW OFF light on the main control panel in the entrance enclosure illuminates when conditioned air is not available.

Before entering the crew rest area, ensure that conditioned air flow is available. Verify that the AIR FLOW OFF light on the control panel in the entrance enclosure is not illuminated.

Note: The AIRFLOW OFF light will be illuminated when the airplane is below 25,000 feet.

Note: If the airplane is above 25,000 feet and the AIRFLOW OFF light is illuminated, pushing the AIRFLOW / SMOKE RESET switch resets the conditioned air system.

WARNING: If the AIRFLOW OFF light remains illuminated after the AIRFLOW / SMOKE RESET switch has been pushed, the door 4 overhead crew rest area should not be occupied.

Door 5 Overhead Crew Rest

A door 5 overhead crew rest area is located in the aft part of the airplane in the overhead between doors 4 and 5. Entry into the area is through an enclosure located in the passenger cabin across from door 5L. The entrance to the crew rest area is placarded for crew use only.

The area has its own smoke detection system but no fire extinguishing system.

A placard is installed indicating any door 5 overhead crew rest area occupancy restrictions.

The entrance enclosure contains the main control panel.

An amber call/reset light is mounted on the exterior wall above the entrance door. When smoke is detected in the area, the light flashes. The light will illuminate steady when the attendant call button on a passenger control unit (PCU) inside the area has been pushed.

Conditioned air is used to provide temperature control and ventilation to the door 5 overhead crew rest area. When using the area, conditioned air flow must be available. An AIRFLOW OFF light on the main control panel in the entrance enclosure illuminates when conditioned air is not available.

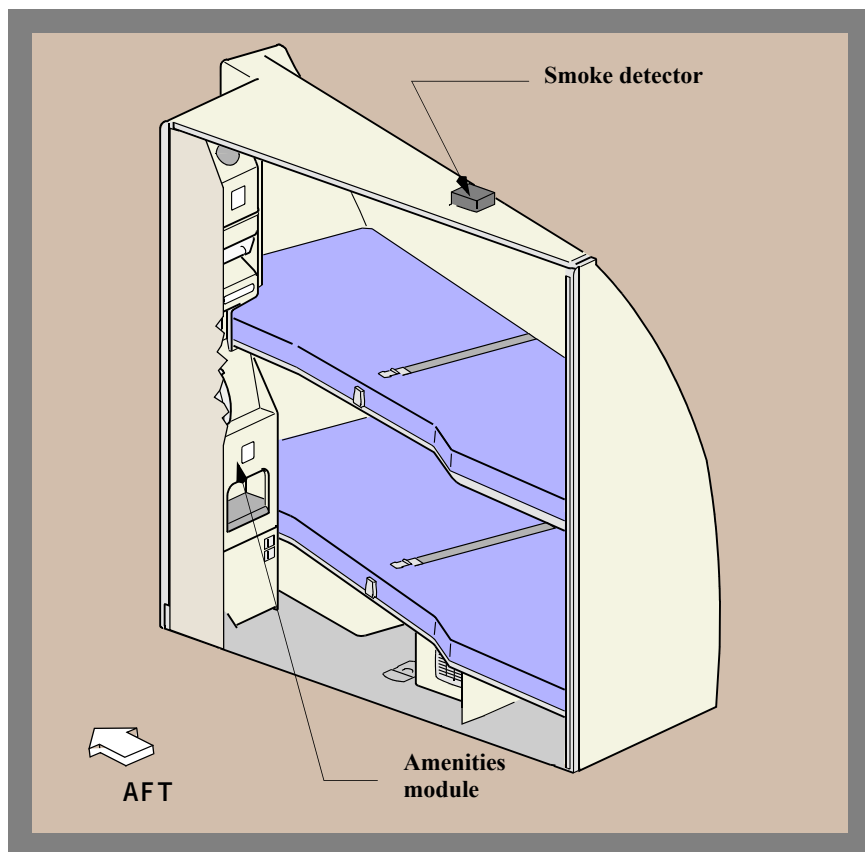
Before entering the crew rest area, ensure that conditioned air flow is available. Verify that the AIRFLOW OFF light on the control panel in the entrance enclosure is not illuminated.

Note: The AIRFLOW OFF light will be illuminated when the airplane is below 25,000 feet.

Note: If the airplane is above 25,000 feet and the AIRFLOW OFF light is illuminated, pushing the AIRFLOW / SMOKE RESET switch resets the conditioned air system.

WARNING: If the AIRFLOW OFF light remains illuminated after the AIRFLOW / SMOKE RESET switch has been pushed, the door 5 overhead crew rest area should not be occupied.

Flight Crew Rest Layout

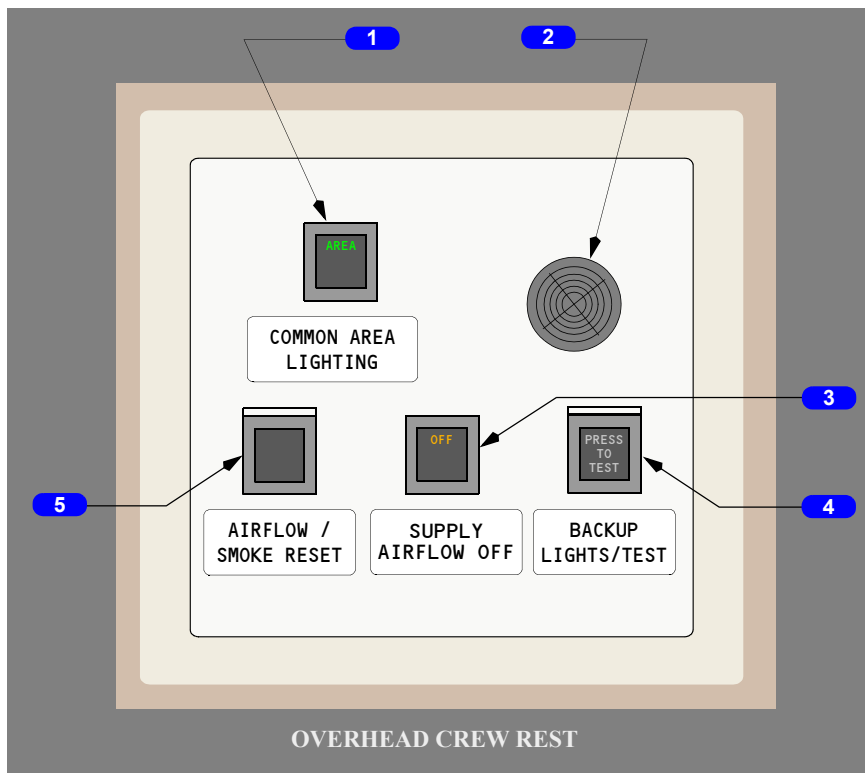


The FCR compartment contains the following:

- an area smoke detector
- two bunks containing:
 - two smoke detectors in each bunk
 - oxygen mask
 - gasper air outlet
 - reading light
- an amenities module containing:
 - a speaker
 - lighting and temperature controls
 - decompression horn and silence switch
 - interphone handset

Control and Indicators

Main Control Panel



1 COMMON AREA LIGHTING Switch

Push -

- turns the common seating area lights in the area on (light illuminated)/off (light extinguished).

2 Alert horn

Horn sounds when:

- airplane decompression occurs (continuous)
- smoke is detected in the overhead crew rest area (pulsating)

3 SUPPLY AIRFLOW OFF Light

Illuminated (amber) -

- area airflow exhaust valves are open or during smoke detection mode operations
- the area airflow is off

Note: A HI/LO chime will sound 5 times in the area whenever the air supply shutoff valve is commanded closed.

Note: The SUPPLY AIRFLOW OFF light will be illuminated when the airplane is below 25,000 feet or in the smoke detection mode.

WARNING: The overhead crew rest area should not be occupied when the amber SUPPLY AIRFLOW OFF light is illuminated.

4 BACKUP LIGHTS/TEST Switch

Guarded switch/light.

Push - illuminated (white) -

- the emergency lights in the area turn on for approximately one minute

5 AIRFLOW / SMOKE RESET Switch

Guarded switch.

The AIRFLOW / SMOKE RESET switch is operative when:

- crew rest area smoke detectors are not in alarm
- the airplane is on the ground and the left pack is off
- the airplane is at or above 25,000 feet

Switch operative:

Push and hold (2 seconds) -

- resets the airflow to the area
- resets aft galley electrical power

Note: In airplanes with a door 1 overhead crew rest and a door 3 overhead crew rest, both AIRFLOW / SMOKE RESET switches must be pushed to ensure proper restoration of the aft galley power.

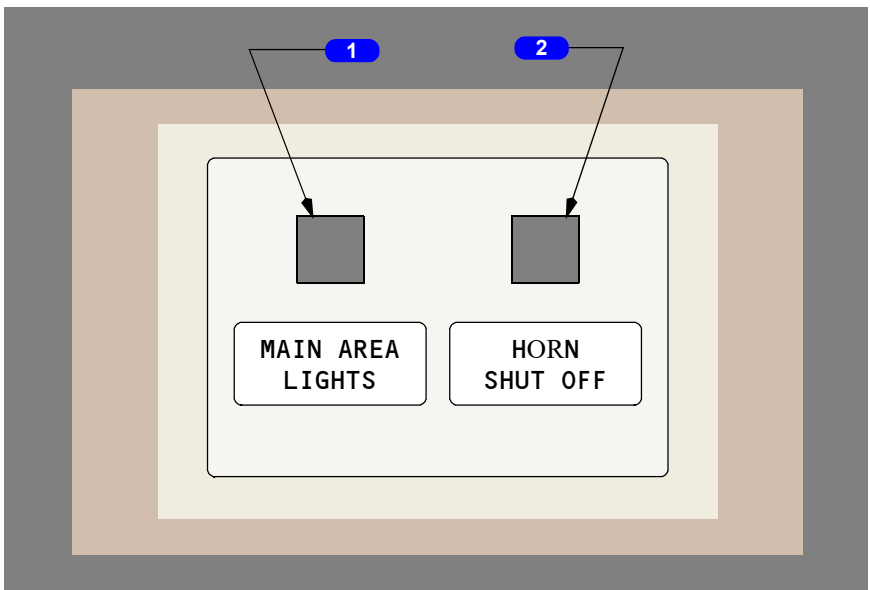
Note: In airplanes with a door 1 overhead crew rest and a door 5 overhead crew rest, both AIRFLOW / SMOKE RESET switch must be pushed to ensure proper restoration of the aft galley power.

Switch inoperative (crew rest area smoke detectors are in alarm):

- the crew rest area airflow remains shutdown
- exhaust ventilation air flow is provided to clear smoke from the crew rest area
- the SUPPLY AIRFLOW OFF light is illuminated
- the aft galley electrical power is shut down

Note: The supply air system will remain inoperative and the aft galley power will remain shutdown until all smoke has been cleared from the rest area and the smoke detectors are not in alarm.

Area Lights/Decompression Reset Panel



1 MAIN AREA LIGHTS Light/Switch

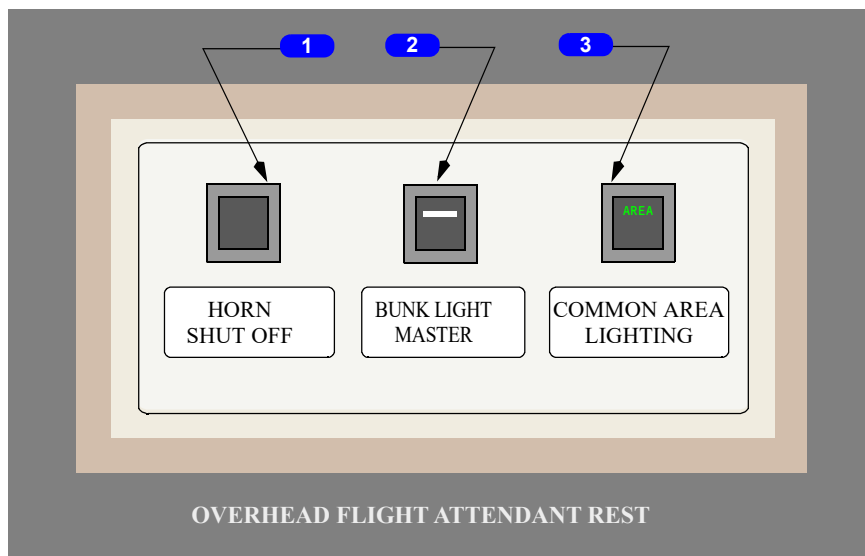
Push - turns area light on/off

2 HORN SHUT OFF Switch

Push -

- silences the smoke detector system alarm horns
- silences the decompression alarm horns

Common Area Lights/Horn Reset Panel



1 HORN SHUT OFF Switch

Push -

- silences the decompression alarm horns
- silences the smoke detector system alarm horns

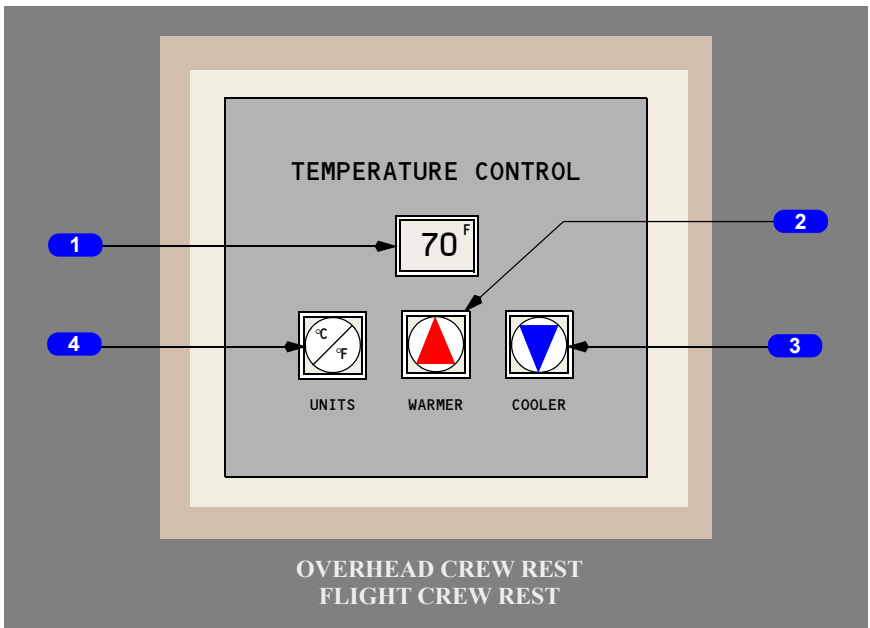
2 BUNK LIGHT MASTER Switch

Push - turns all area lights on/off.

3 COMMON AREA LIGHTING Switch

Push - turns common area lights on/off.

Temperature Control Panel



1 Temperature Display

Displays:

- current ambient air temperature in degrees F or C
- flashing, new temperature set point when warmer or cooler arrows are pushed.

2 WARMER Arrow

Push - increases temperature in crew rest area

3 COOLER Arrow

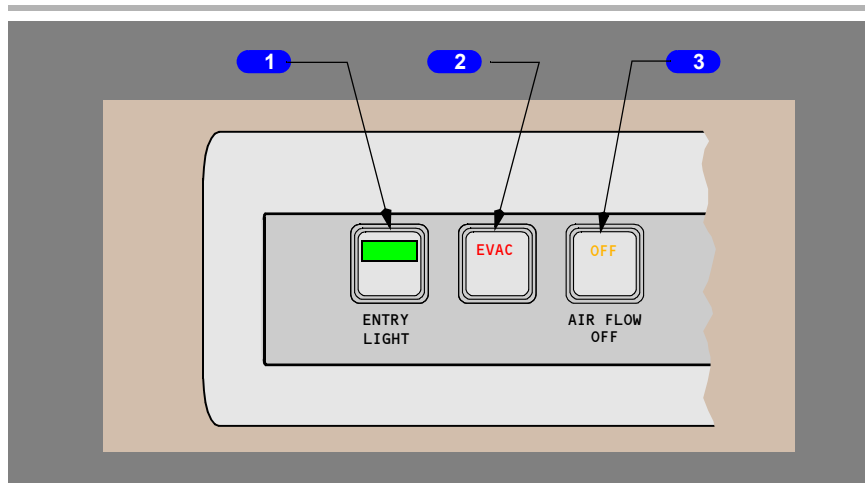
Push - decreases temperature in crew rest area

4 UNITS Selector

Push - toggles between degrees F and degrees C for display and temperature selection

Lower Crew Rest (LCR) Control Panel

The LCR area control panel is located inside the entrance enclosure. The panel has the switches necessary to arm and discharge the fire extinguishing system.



1 ENTRY LIGHT

Illuminated green at all times.

Push –

- turns on the lights in entrance enclosure ceiling and near the stairs

2 Evacuation (EVAC) Light

Illuminated (red) –

- smoke has been detected in the LCR, or
- the aft cargo area fire extinguishing system ARM switch is selected

WARNING: The LCR should not be occupied when the EVAC light is illuminated.

3 AIR FLOW OFF Light

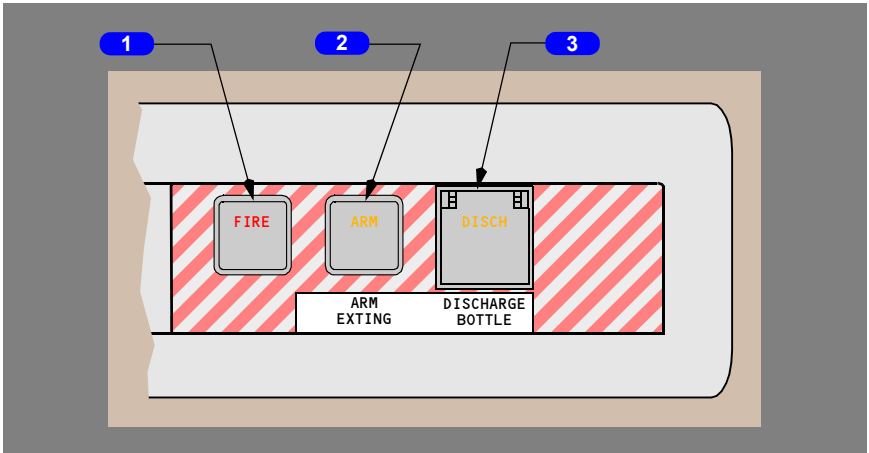
Illuminated (amber) – the valve supplying air to the LCR is commanded closed.

The air supply shutoff valve will close if:

- airplane altitude is less than 25,000 feet
- the main area hatch is closed
- smoke is detected in the LCR
- the LCR fire extinguishing system is armed
- the aft cargo fire extinguishing system is armed, or
- if the airplane is on the ground and the left pack is on

Note: A HI/LO chime will sound 5 times in the area whenever the air supply shutoff valve is commanded closed.

WARNING: The LCR should not be occupied when the amber AIR FLOW OFF light is illuminated.



1 FIRE Light

Illuminated (red) –

- smoke has been detected in the LCR, or
- the FIRE TEST switch is pushed

2 ARM Extinguisher (EXTING) Switch

Push –

- illuminates the amber ARM light
- arms the fire extinguishing system, and
- causes the air supply valve to close

3 DISCHARGE BOTTLE Switch

Push –

- discharges the halon fire extinguisher into the LCR after the ARM switch has been selected

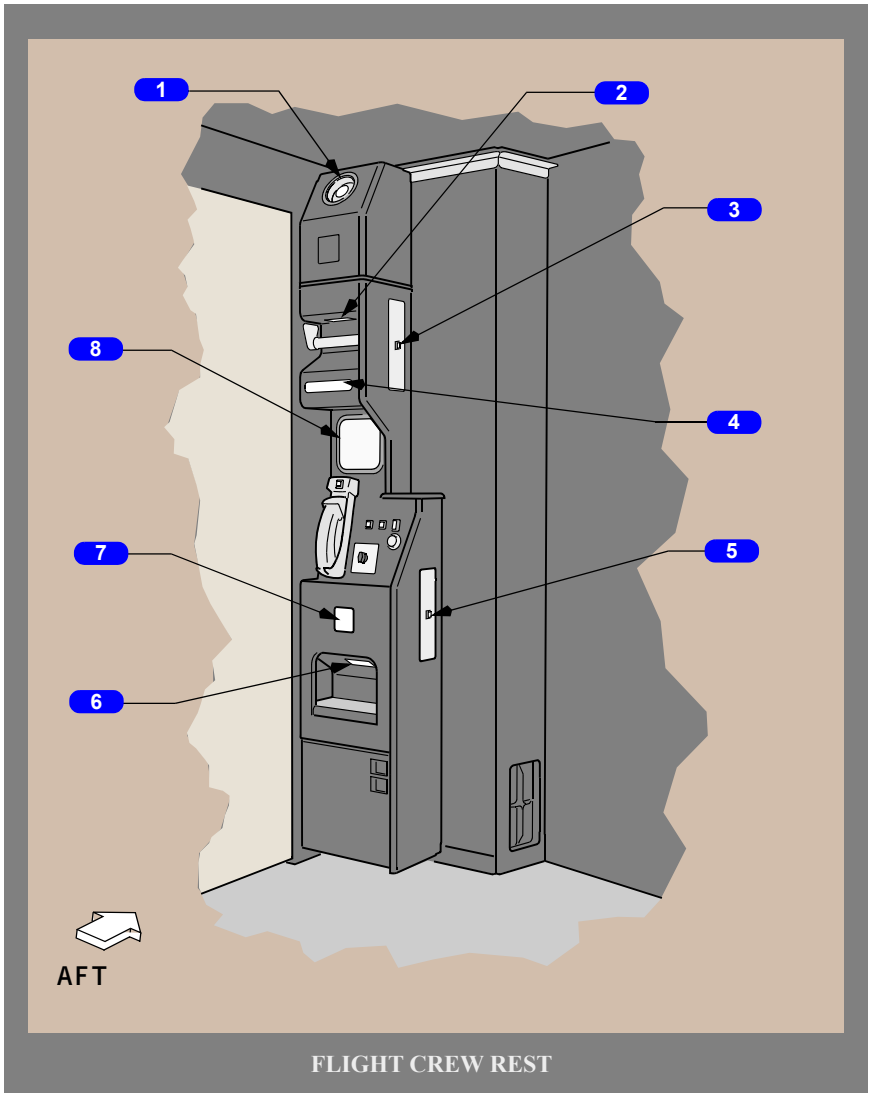
DISCH illuminated (amber) –

- illuminates within 15 seconds after being pushed to indicate that extinguisher bottle has been discharged.
- extinguisher bottle pressure is low

Note: Extinguisher bottle low pressure occurs if the bottle has been discharged, or there is a leak in the extinguisher bottle.

Note: A HI/LO chime will sound 5 times in the area whenever the low pressure switch is activated on the halon bottle.

Amenities Module



- 1 Area Light**
- 2 Handle Light**
- 3 Reading Light Switch**

Turns upper bunk reading light on or off.

4 FASTEN SEAT BELTS Sign

5 Reading Light Switch

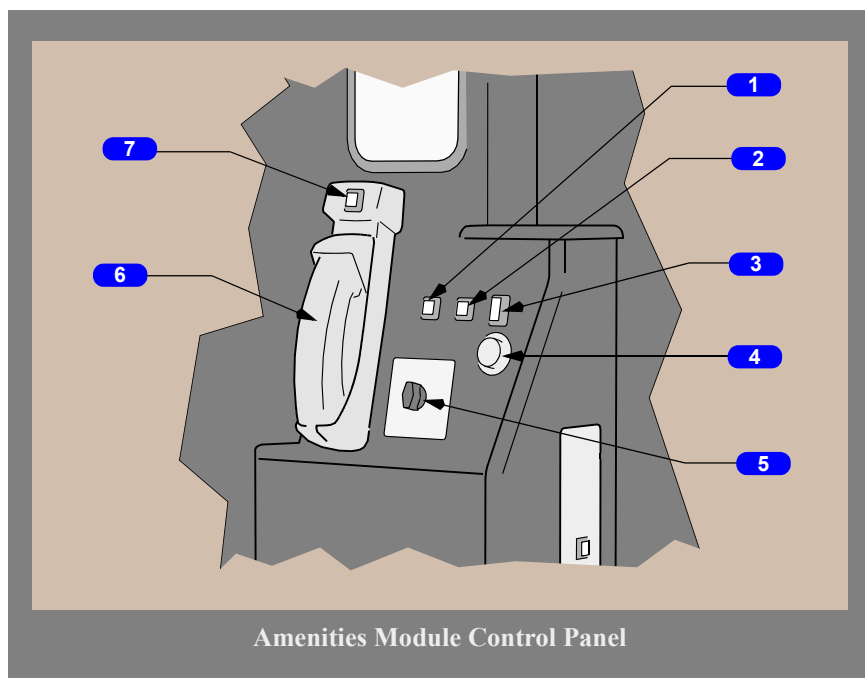
Turns lower bunk reading light on or off.

6 Step Light

7 Back Up Light

Note: Illuminates when normal airplane power fails.

8 Speaker



1 Area Light Switch

2 Horn Shutoff Switch

Push -

- silences the decompression alarm horn

3 Lavatory Occupied Indicator

4 Alert horn

Horn sounds when:

- airplane decompression occurs (continuous)

5 Crew Rest Heater

OFF -

- turns off crew rest area heater

HIGH -

- turns crew rest area heater to high heat

6 Interphone Handset

7 Interphone Call Switch/Light

Illuminated

- incoming call from flight deck

Push -

- calls the flight deck

Oxygen System

The crew rest oxygen system is supplied by pressurized gaseous oxygen.

The oxygen system inside the crew rest is a chemical oxygen generator system which provide oxygen for approximately 12 minutes.

[Option: upper crew rest installed]

The oxygen masks above the bunks and seats will drop automatically in the event of a decompression.

[Option: flight crew rest installed]

The oxygen masks in the bunks will drop automatically in the event of a decompression.

Each mask oxygen valve is held closed by a pin inserted into the valve. Pulling on the mask withdraws the pin, causing the mask oxygen valve to open and oxygen to flow to that mask.

The oxygen masks may be manually released by inserting a hair pin or thin rod into the hole of the oxygen compartment cover.

Note: When the oxygen masks deploy, the green oxygen indicator light in the common area illuminates.

Portable Oxygen

[Option - 6/7 bunks]

There are 7 portable oxygen bottles (POB) with masks installed in the LCR and are located at the foot of each bunk. The 4.25 cubic foot POBs will provide approximately 30 minutes of oxygen.

Decompression

In the event of decompression, the oxygen mask will automatically deploy when the cabin altitude is approximately 13,500 feet. Additionally, the oxygen mask deployment horn will sound continuously and the air flow and oxygen alarm RESET light will illuminate. Oxygen flow is available when the mask is pulled.

Note: Cabin depressurization is indicated by a continuous alarm horn sounding in the crew rest area.

Crew rest occupants should immediately don the oxygen mask.

Evacuate the crew rest when directed.

Smoke and Fire

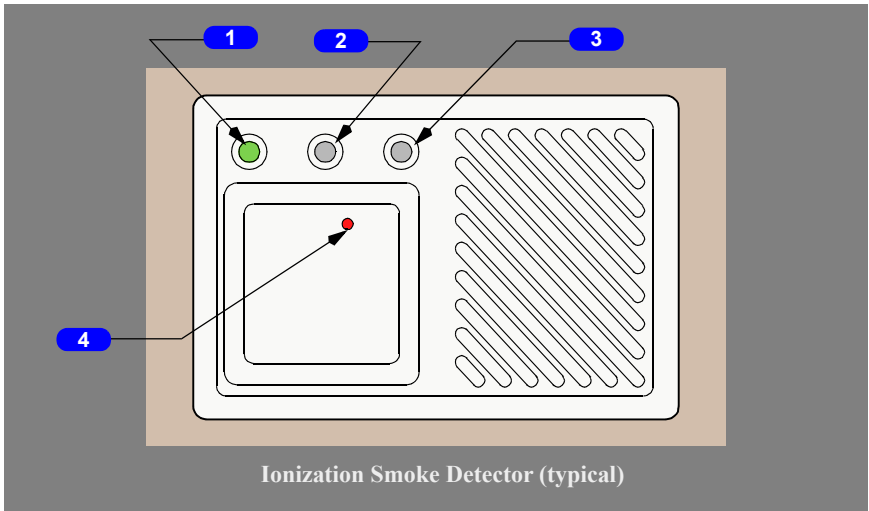
The overhead crew rest has its own smoke detection system but no fire extinguishing system.

The lower crew rest area has its own smoke detection and fire extinguishing system.

Crew Rest Smoke Detection

Crew Rest Smoke Detector

[Ionization smoke detector installed]



1 Power Indicator Light

Illuminated (green) -

- smoke detector has power and is operating

2 Interrupt Switch

Push -

- silences the horn and suppresses all alarm indications as long as the switch is pushed

3 Self Test Switch

Push -

- activates the smoke detector aural and visual alarms

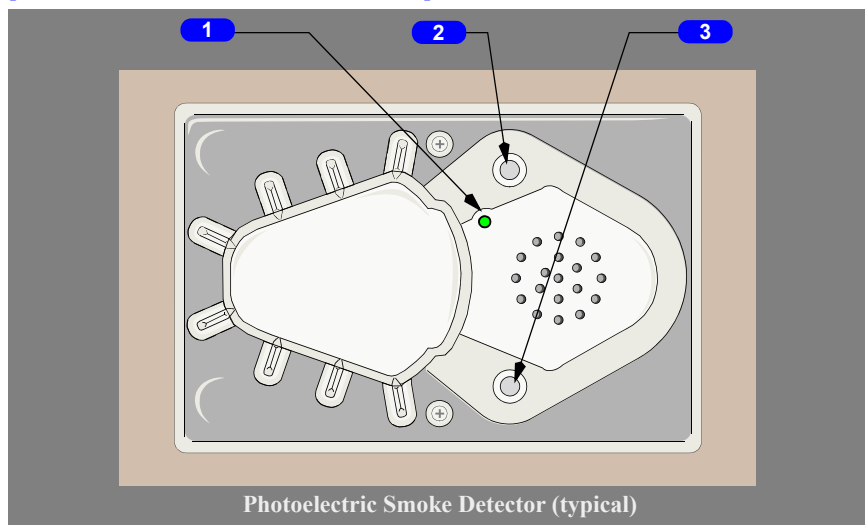
Note: The system automatically resets when the test is concluded.

4 Alarm Indicator Light

Illuminated (red) -

- presence of smoke has been detected

[Photoelectric smoke detector installed]



1 Status Indicator Light

Illuminated (green) -

- steady - smoke detector has power and is operating properly
- blinking - maintenance is required

Illuminated (red) -

- steady - smoke has been detected
- blinking - detector has failed

2 Self-Test Switch

Push -

- alarm horn sounds
- Status Indicator Light illuminates red
- external horn sounds

3 Horn Cancel Switch

Push -

- alarm horn is silenced

Note: When the Cancel switch is released and smoke is not sensed for 30 seconds, the smoke detector is automatically reset.

Crew Rest Smoke Detection

If smoke is detected in the Forward Crew Rest:

- a SMOKE CREW REST F/D EICAS caution message is displayed
- the air supply shutoff valve is closed
- an amber light above the entrance enclosure door flashes
- a continuous chime sounds throughout the cabin
- the smoke detector integral horn sounds

If smoke is detected in the Forward Crew Rest:

- a SMOKE CREW REST F/D EICAS caution message is displayed
- the air supply shutoff valve is closed
- an amber light above the entrance enclosure door flashes
- a continuous chime sounds throughout the supernumerary area
- the smoke detector integral horn sounds

If smoke is detected in the Door 1 Overhead Flight Crew Rest:

- a SMOKE REST UPR DR 1 EICAS caution message is displayed
- the air supply shutoff valve is closed
- an amber light above the entrance enclosure door flashes
- a continuous chime sounds throughout the cabin
- the smoke detector integral horn sounds

If smoke is detected in the Door 3 Overhead Flight Attendant Rest:

- a SMOKE REST UPR DR3 EICAS caution message is displayed
- the air supply shutoff valve is closed
- an amber light above the entrance enclosure door flashes
- a continuous chime sounds throughout the cabin
- the smoke detector integral horn sounds

If smoke is detected in the Door 4 Overhead Flight Attendant Rest:

- a SMOKE REST UPR DR4 EICAS caution message is displayed
- the air supply shutoff valve is closed
- an amber light above the entrance enclosure door flashes
- a continuous chime sounds throughout the cabin
- the smoke detector integral horn sounds

If smoke is detected in the Door 5 Overhead Flight Attendant Rest:

- a SMOKE REST UPR DR5 EICAS caution message is displayed
- the air supply shutoff valve is closed
- an amber light above the entrance enclosure door flashes
- a continuous chime sounds throughout the cabin
- the smoke detector integral horn sounds

LCR Fire Protection

Smoke Detection System

One smoke detector is installed in the LCR. There are ten smoke sniffer ports in the LCR, one in each bunk area and 3 in the common area. The smoke sniffer ports are connected to two smoke detector sensors, which are connected to the smoke detector.

If smoke is detected in the LCR:

- on the flight deck:
 - an aural caution sounds
 - a SMOKE CREW REST LWR EICAS caution message is displayed
- in the LCR area:
 - an intermittent horn sounds

Note: The area smoke horn is intermittent. The area oxygen horn is continuous.

- the EVAC MODULE light illuminates red
- the AIR FLOW OFF light illuminates amber
- the LCR air supply shutoff valve is closed and a chime sounds 5 times
- in the LCR enclosure:
 - the red EVAC light illuminates
 - the AIR FLOW OFF light illuminates amber
 - the red FIRE light illuminates
 - the fire horn sounds
 - the LCR smoke detector integral horn sounds
- in the passenger cabin
 - an amber light above the entrance enclosure door flashes
 - a continuous high chime sounds throughout the cabin
 - the cabin attendant master call lights flash
 - a SMOKE DETECTED LCR message appears on the cabin management system control panels

Fire Extinguishing System

The fire extinguishing system in the LCR area consists of one halon bottle located inside the area. The halon bottle's discharge circuit is monitored during each flight. In the event of a leak, the DISCH lights in the entrance enclosure and the area will illuminate and a HI/LO chime will sound 5 times in the module.

Fire Extinguishing Operation

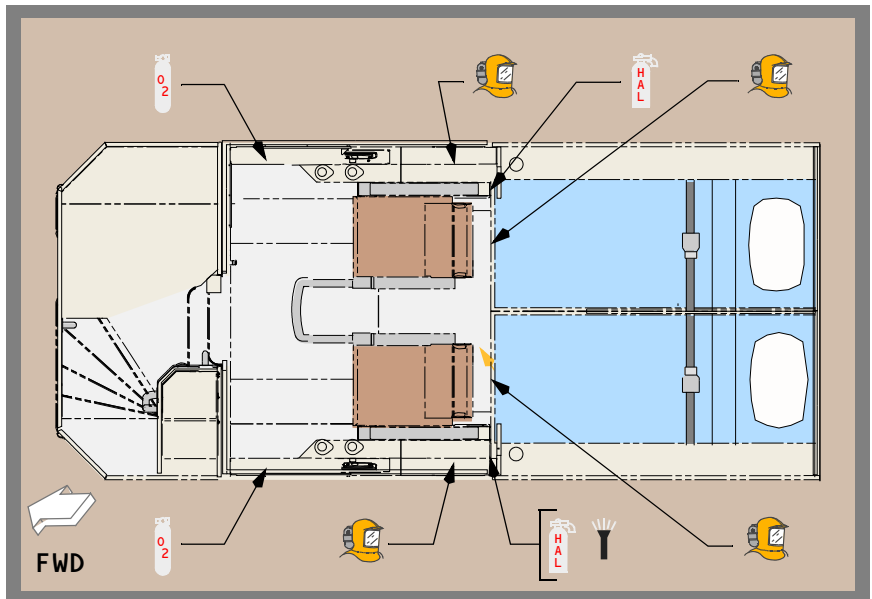
To activate the LCR fire extinguishing system:

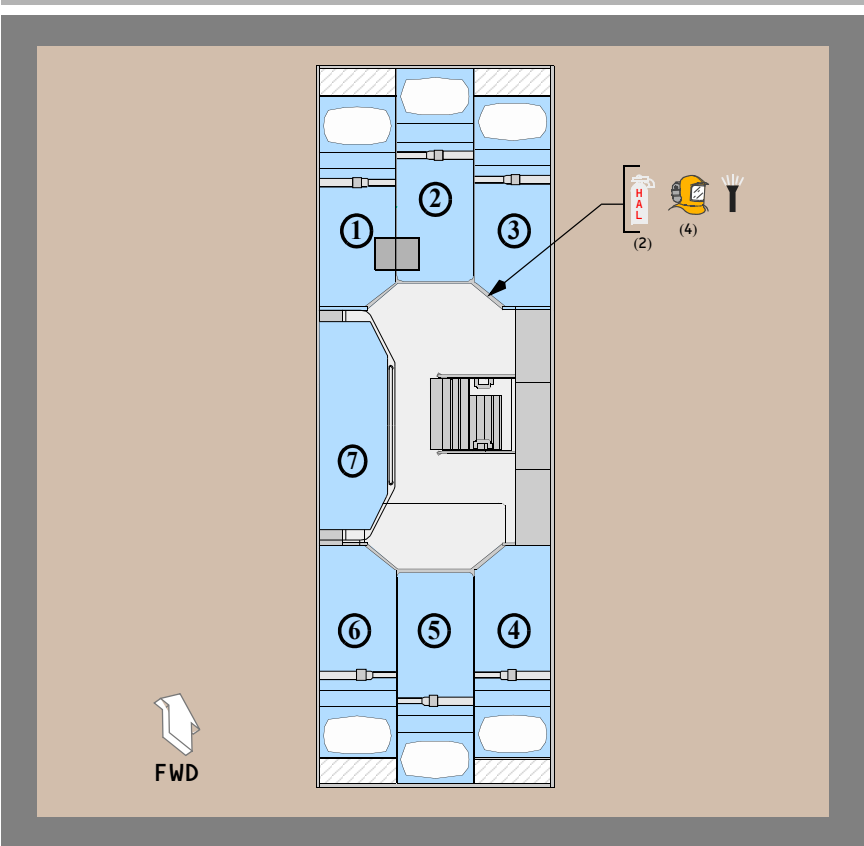
- arm the fire extinguishing system by pushing the ARM switch on the attendant switch panel in the LCR entrance enclosure
 - verify red ARM light illuminates
- lift the guard and push the DISCH switch
 - verify the red DISCH light illuminates within 15 seconds

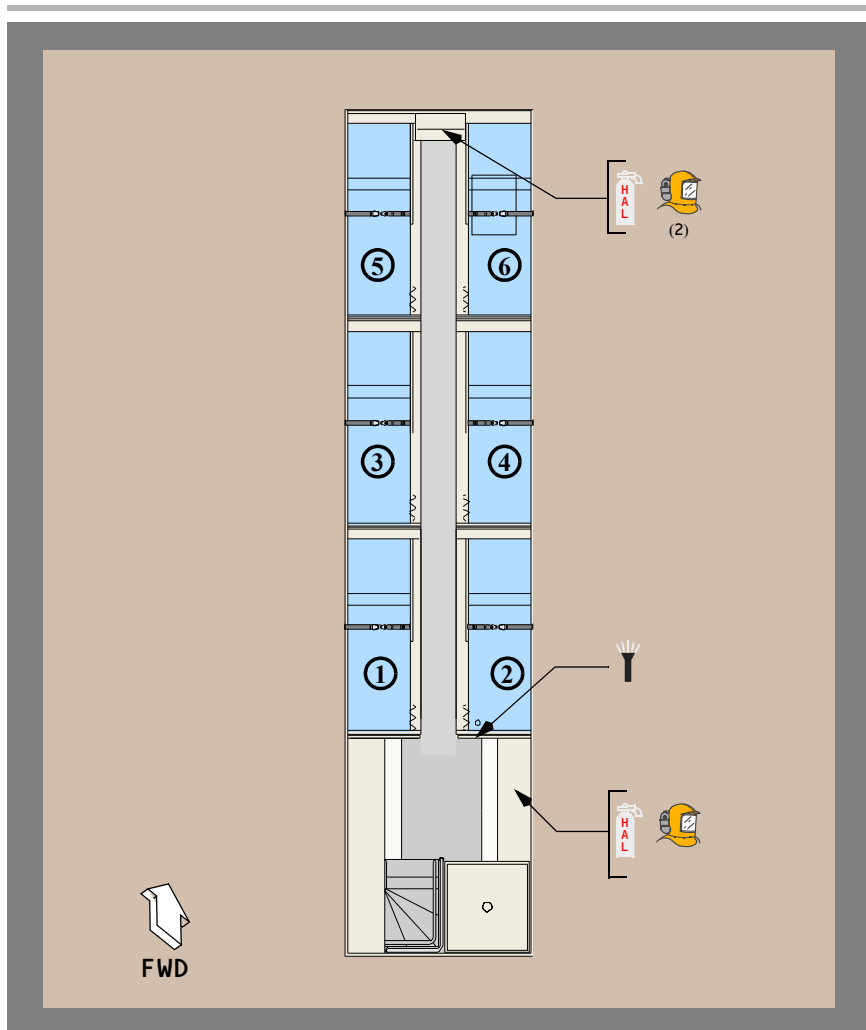
Emergency Equipment Emergency Equipment Symbols

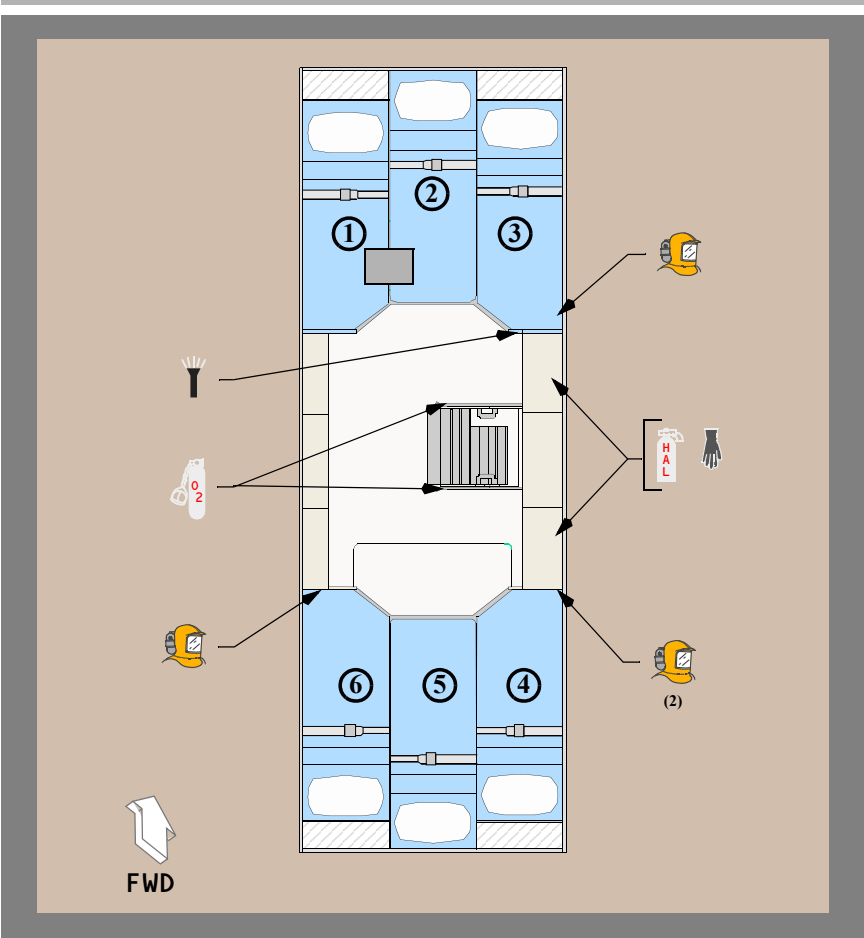


Emergency Equipment Location

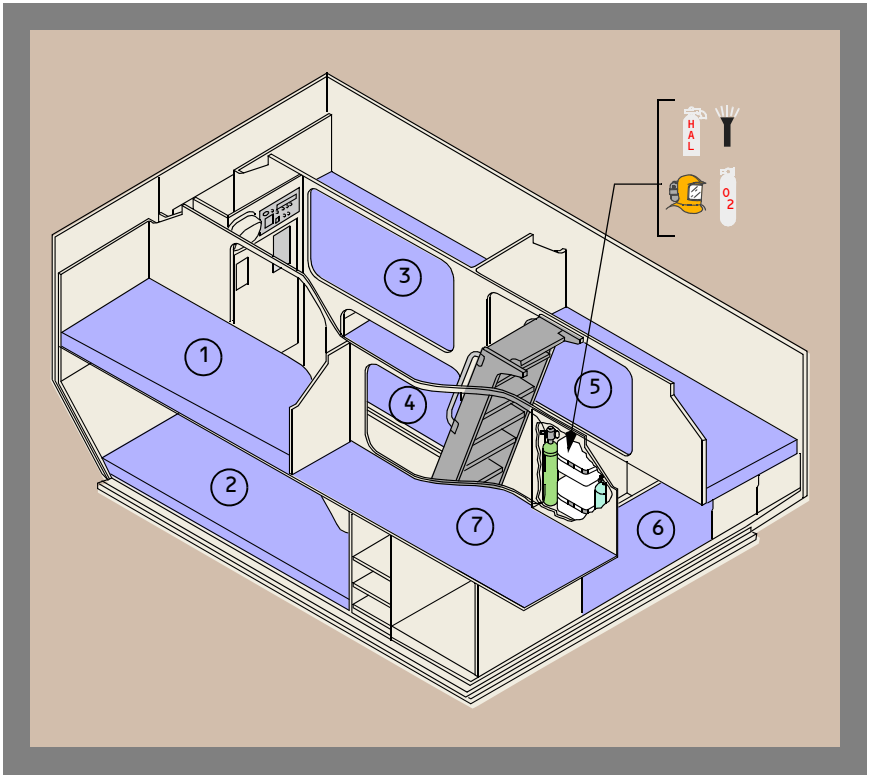




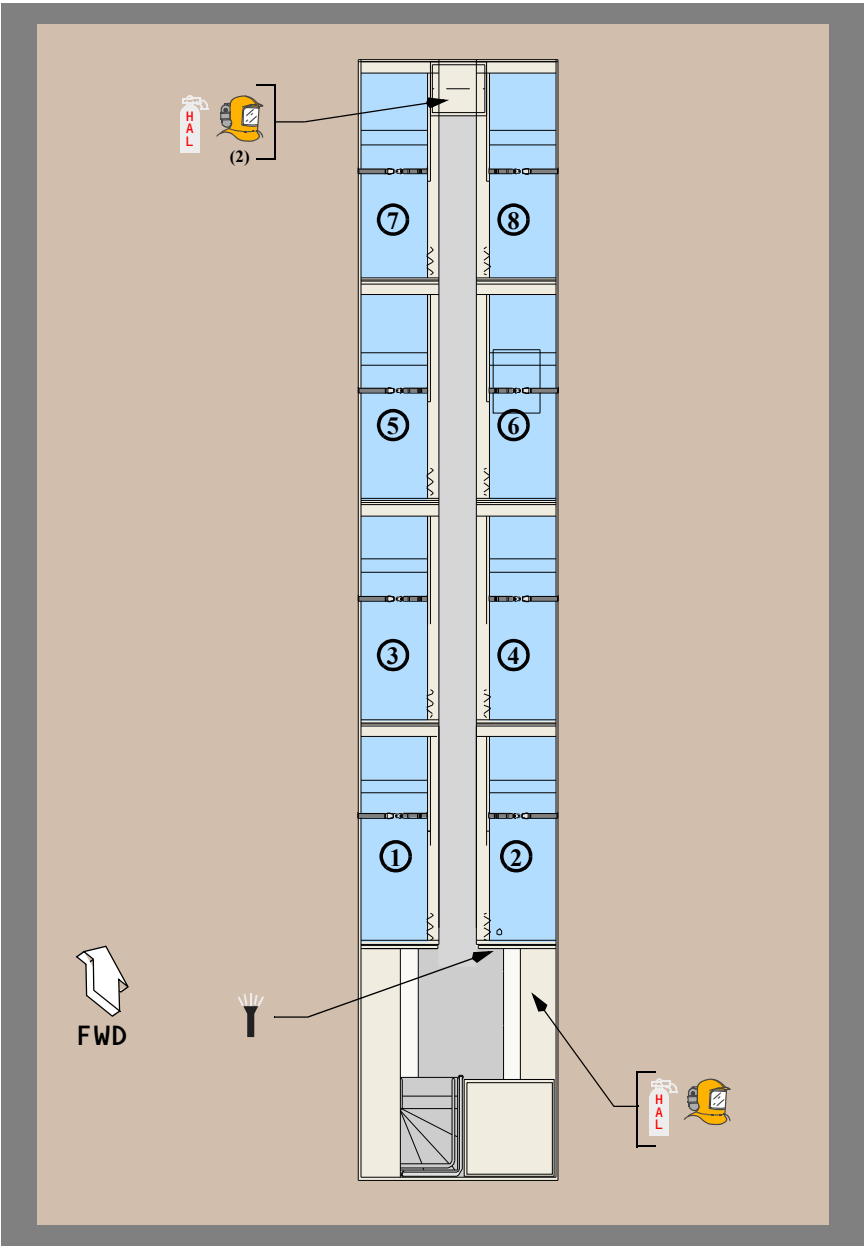




[Option shown: 7 bunks; Option: 6 bunks]



[Option - 8/10 bunks]



Evacuation from the Crew Rest Area

The flight crew rest primary evacuation route is through the entrance enclosure.

The overhead flight crew rest primary evacuation route is through the entrance enclosure. If the main entrance is unusable, evacuation is possible through the emergency hatch.

The overhead flight attendant rest primary evacuation route is through the entrance enclosure. If the main entrance is unusable, evacuation is possible through the emergency hatch.

The lower crew rest primary evacuation route is through the entrance enclosure. If the main entrance is unusable, evacuation is possible through the emergency hatch.

WARNING: During exit to the main deck, stepping on the seat back may cause the seat back to fold forward. If this occurs, the crew member may lose balance and hand grip, resulting in personal injury.

WARNING: If the emergency hatch was used for crew evacuation, the lower hatch must be closed to help prevent the spread of smoke or fire.

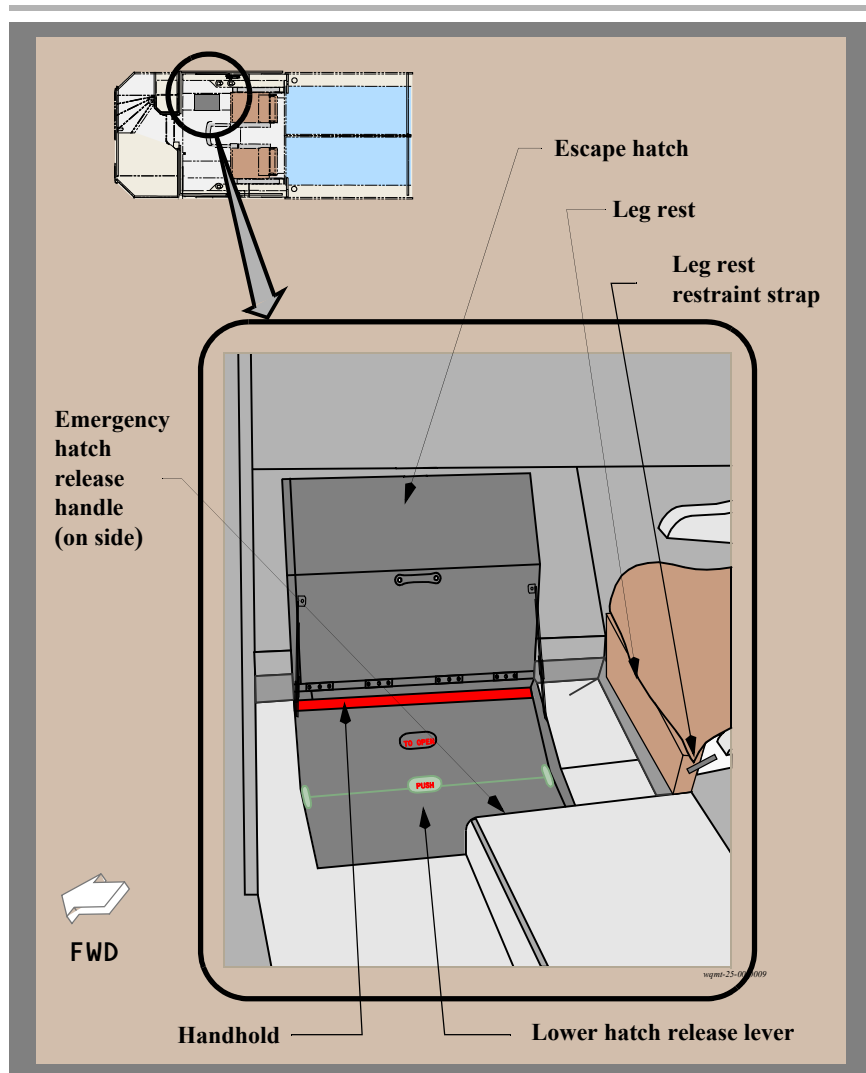
WARNING: If the emergency hatch was used for crew evacuation, the hatch must be closed to help prevent the spread of smoke or fire.

Overhead Flight Crew Rest Emergency Hatch

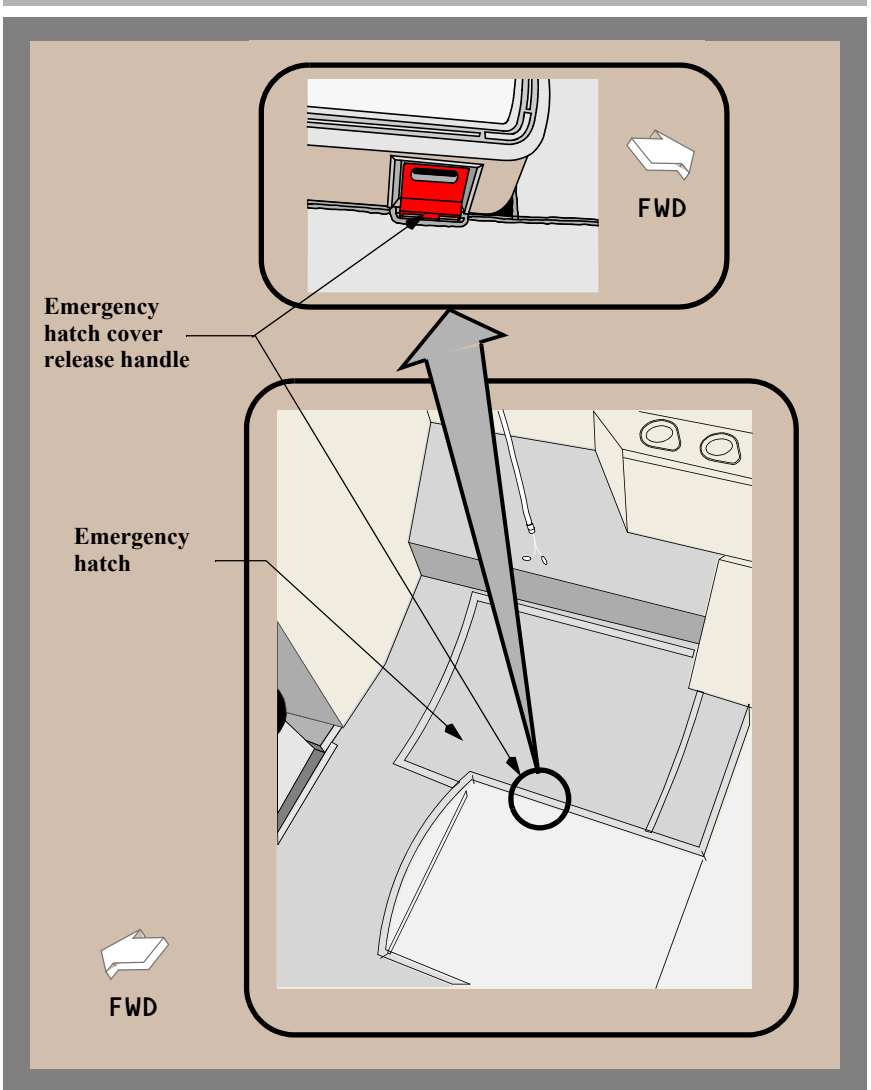
For egress:

- retract right seat leg rest (if required)

Note: Secure the seat leg rest using the seat leg rest restraint straps.

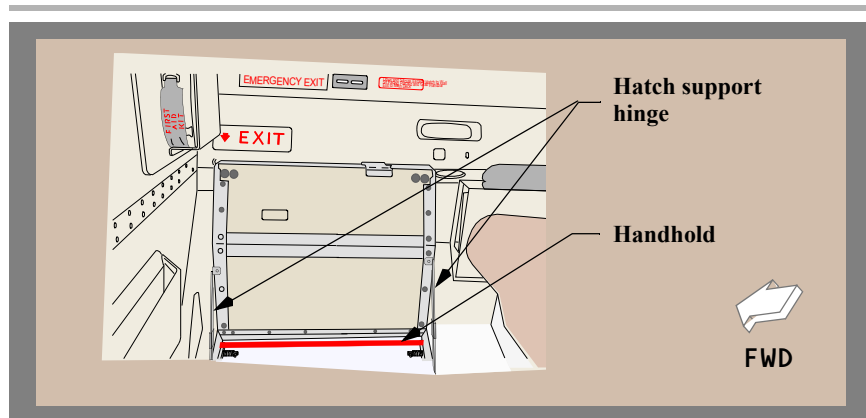


- unlatch upper hatch using the emergency hatch cover release handle

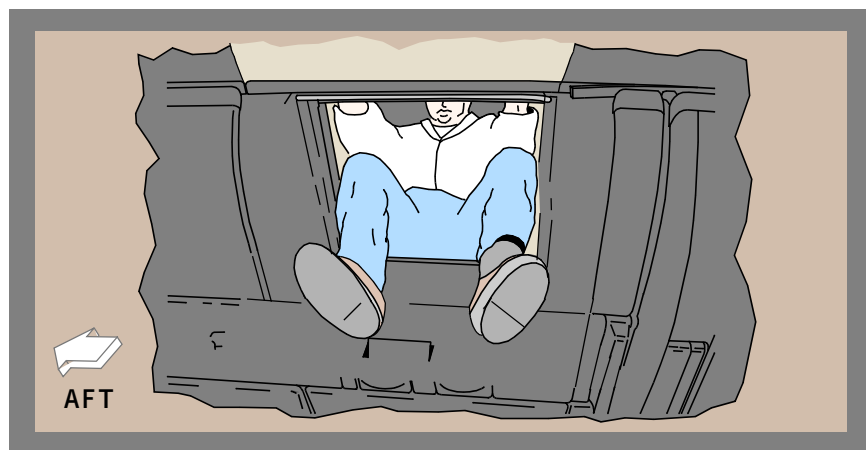


- raise upper hatch cover to fully open position
- lock the hatch support hinge in place
- unlatch lower hatch
- push the lower hatch release lever
- command passengers in immediate area to move clear of evacuation area

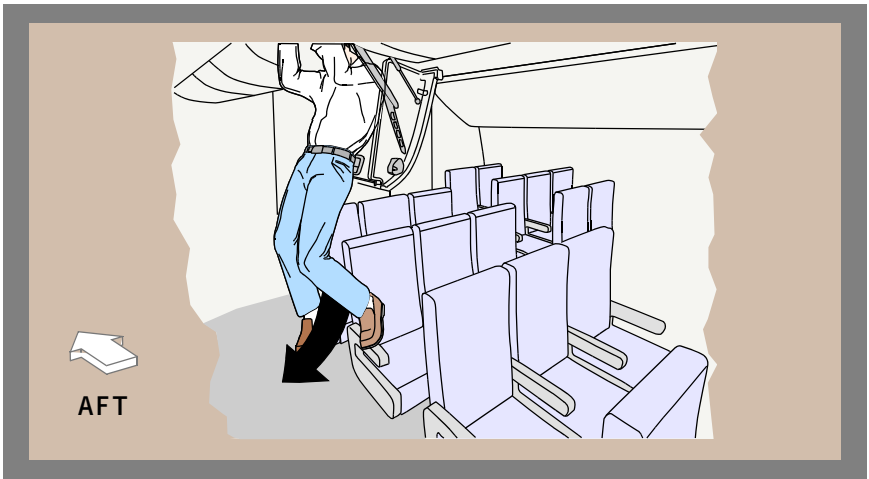
WARNING: Failure to ensure the hatch cover is locked in position may allow the hatch to unexpectedly close causing injury.



- sit on floor facing outboard and lower legs into hatch opening
- reach out and grab the outboard handhold
- keep elbows close to sides



- swing down to main deck



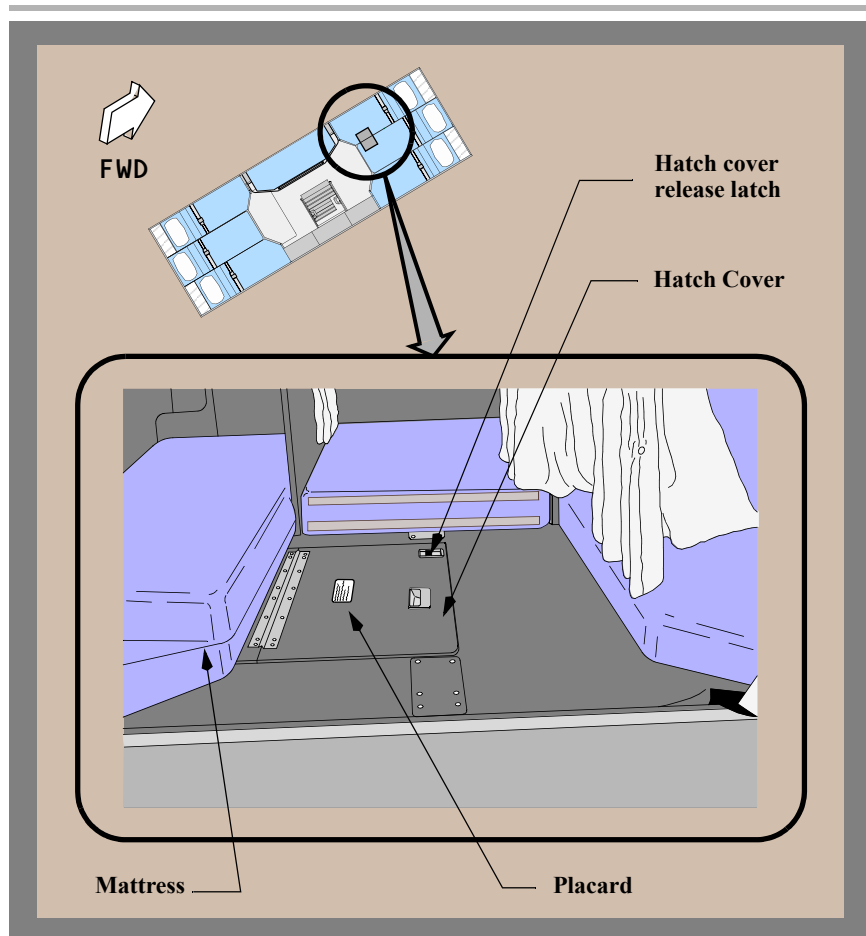
- close the lower hatch when evacuation is complete

Door 3 Overhead Crew Rest Emergency Hatch

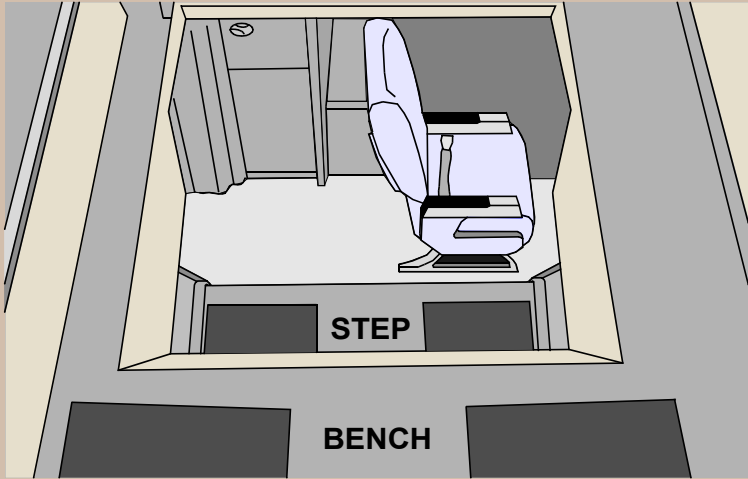
For egress:

- lift and remove the mattress pads
- unlatch and raise upper bunk escape hatch cover
- unlatch lower hatch

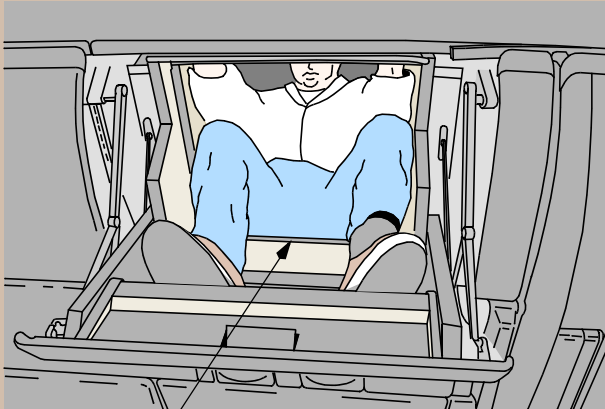
Note: Stow the mattress pad where it can not obstruct emergency hatch or the aisle.



- command passengers in immediate area to move clear of evacuation area

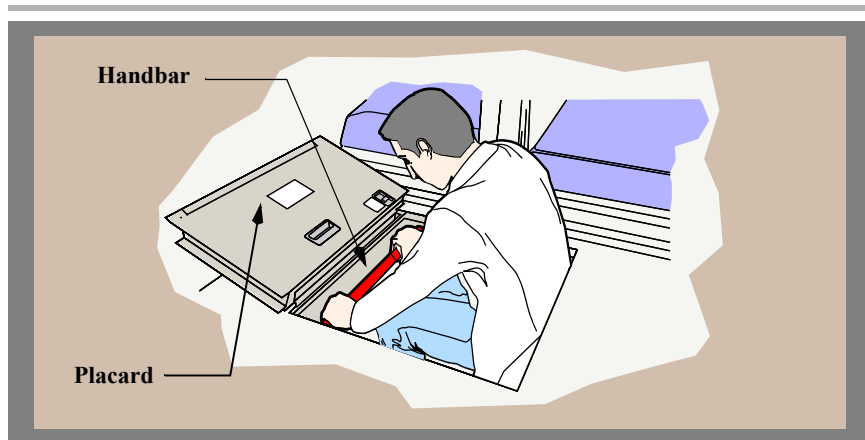


- sit on bunk facing placard
- lower legs into hatch opening
- sit on bench

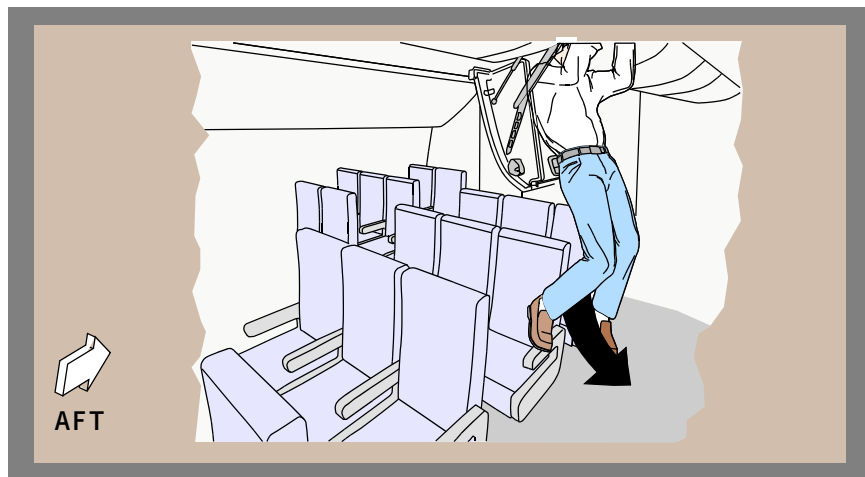


Bench

- reach out and grab the handbar (keep elbows close to sides)



- use step on lower hatch to climb/swing down to main deck
- use the seat armrest to assist in maintaining balance as necessary



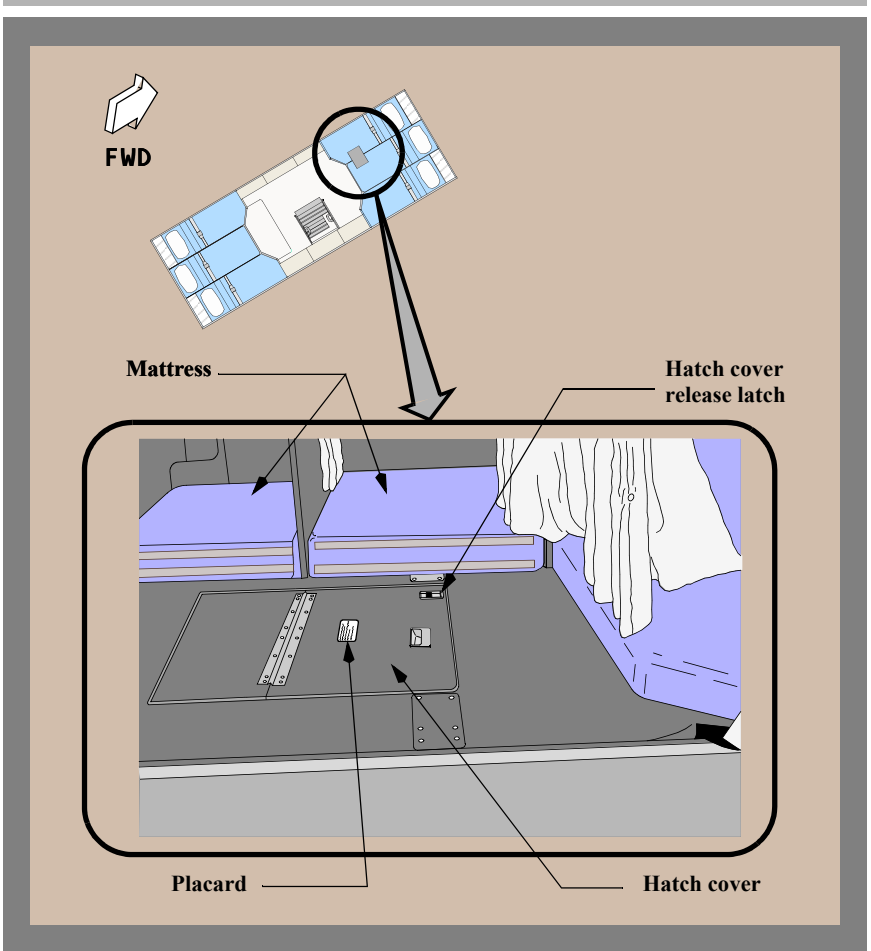
- close the lower hatch when evacuation is complete

Door 4 Overhead Crew Rest Emergency Hatch

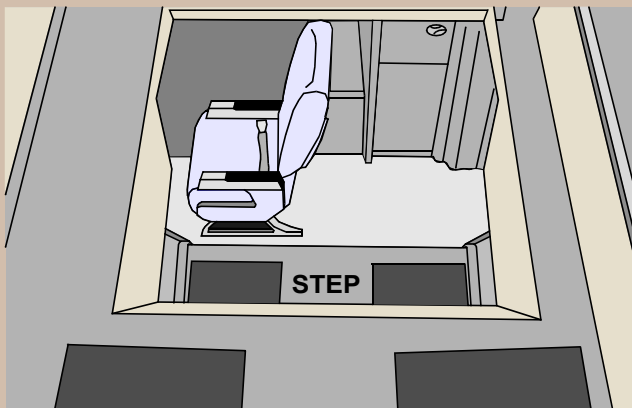
For egress:

- lift and remove the mattress pad
- unlatch bunk escape hatch cover
- raise hatch cover
- unlatch lower hatch
- command passengers in immediate area to move clear of evacuation area

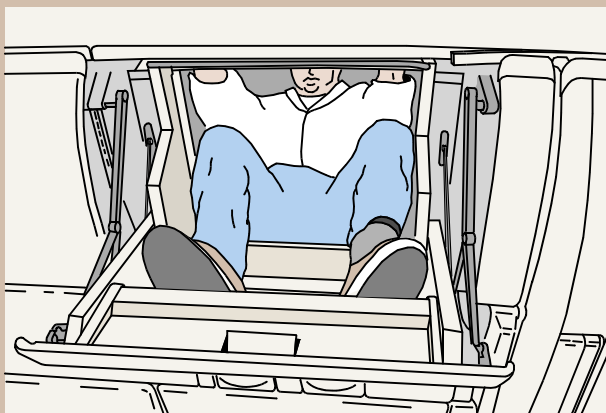
Note: Stow the mattress pad where it can not obstruct emergency hatch.



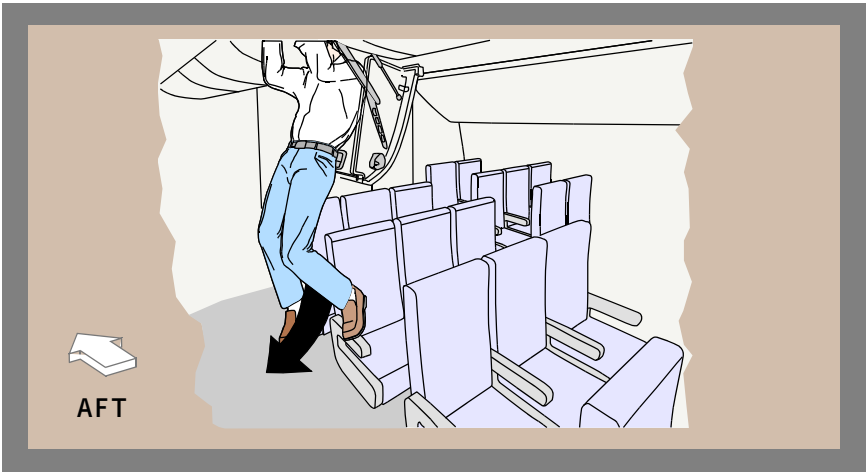
- sit on floor facing outboard
- lower legs into hatch opening



- reach out and grab the outboard handhold (keep elbows close to sides)



- use step on lower hatch to climb/swing down to main deck
- exit to main deck



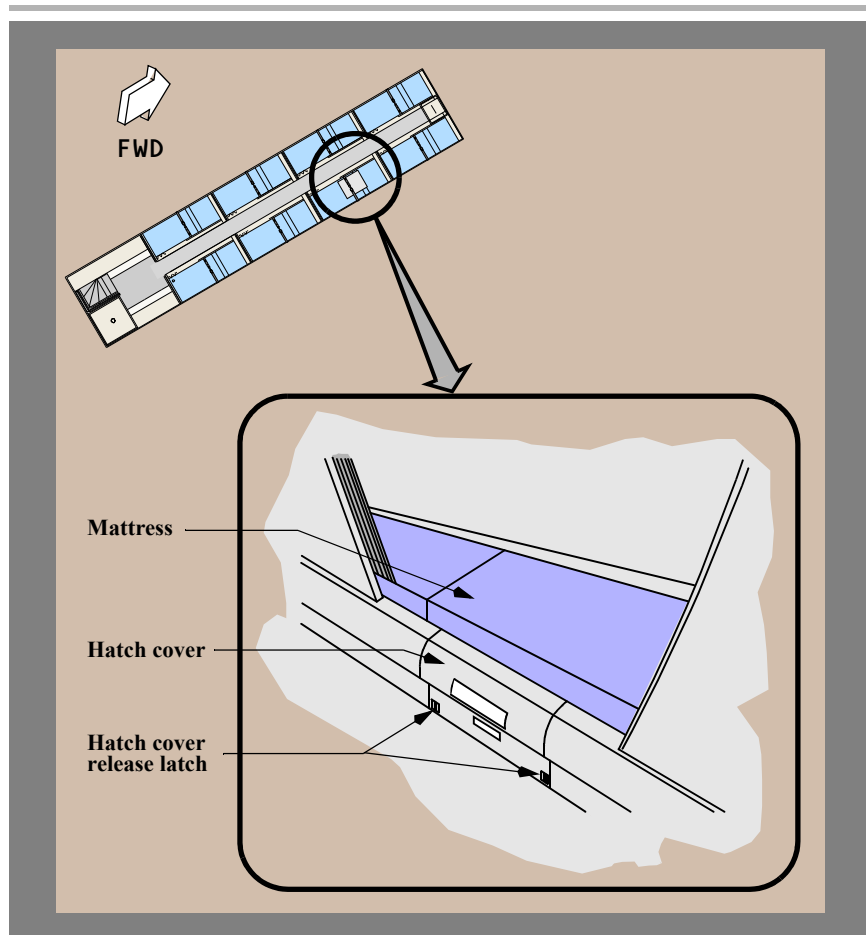
- close the lower hatch when evacuation is complete

Door 5 Overhead Crew Rest Emergency Hatch

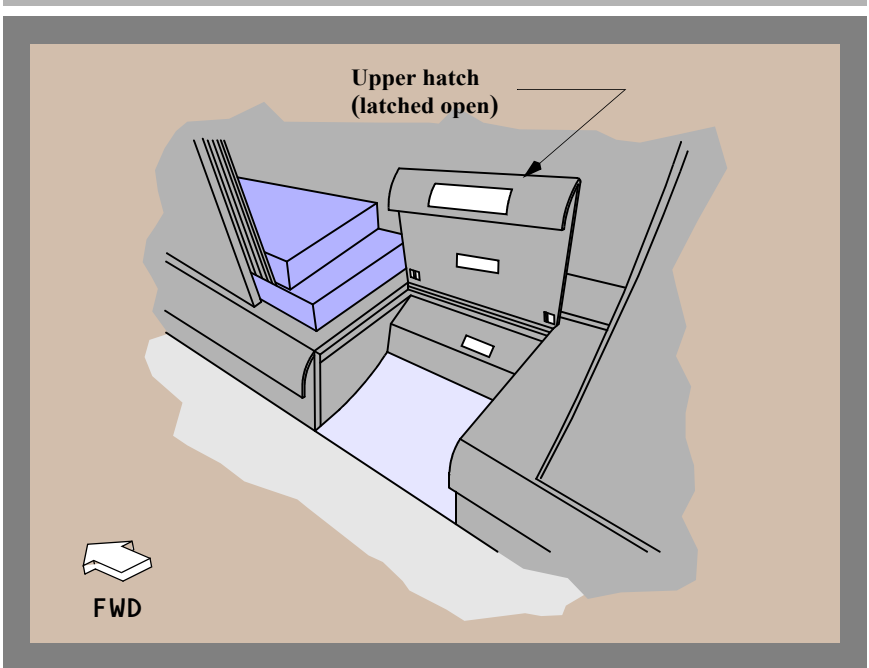
For egress:

- lift and remove the mattress pad

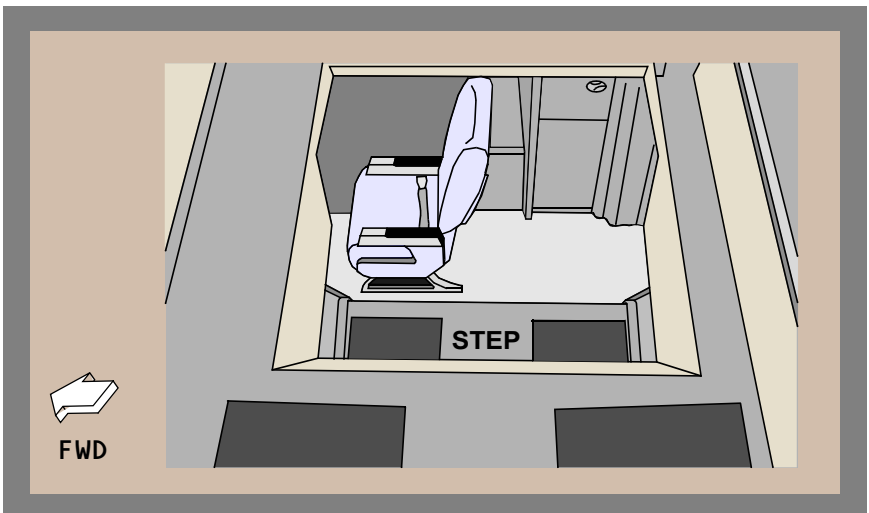
Note: Stow the mattress pad where it can not obstruct emergency hatch or the aisle.



- unlatch and raise upper hatch cover



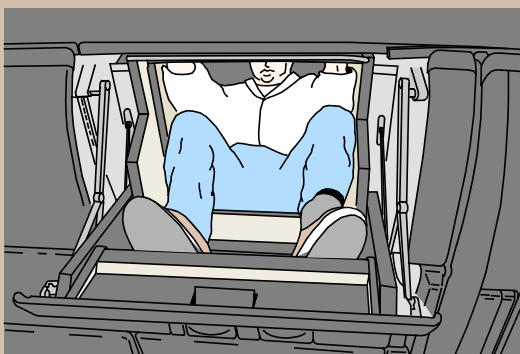
- unlatch lower hatch
- command passenger in immediate area to move clear of evacuation area



- sit on floor facing outboard and lower legs into hatch opening
- reach out and grab the outboard handhold (keep elbows close to sides)



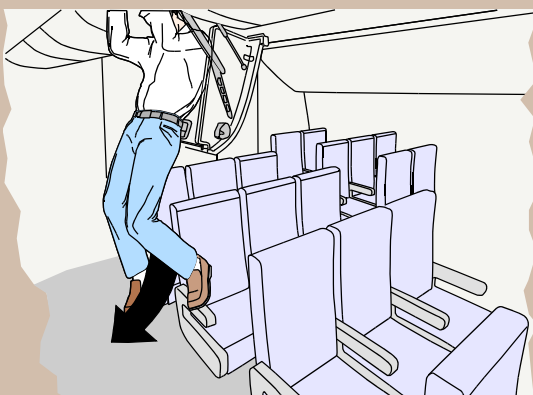
AFT



- use step on lower hatch to climb/swing down to main deck
- exit to main deck



AFT



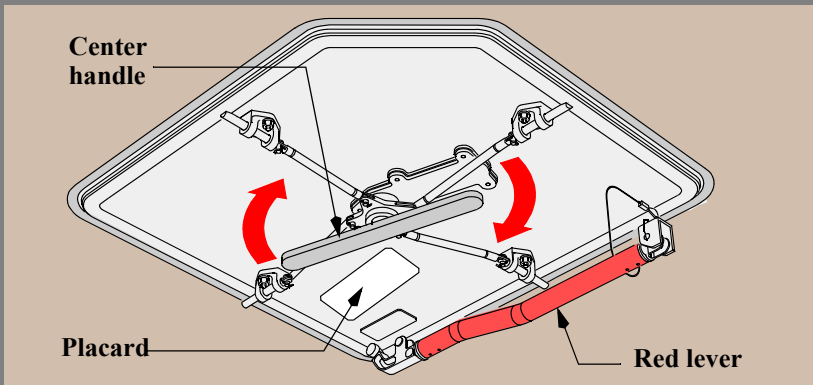
- close the lower hatch when evacuation is complete

Lower Crew Rest Emergency Hatch

To use the emergency hatch, follow the placarded instructions.



Emergency Hatch
(in passenger cabin with carpet folded back)



Emergency Hatch
(inside area looking up)

Intentionally
Blank

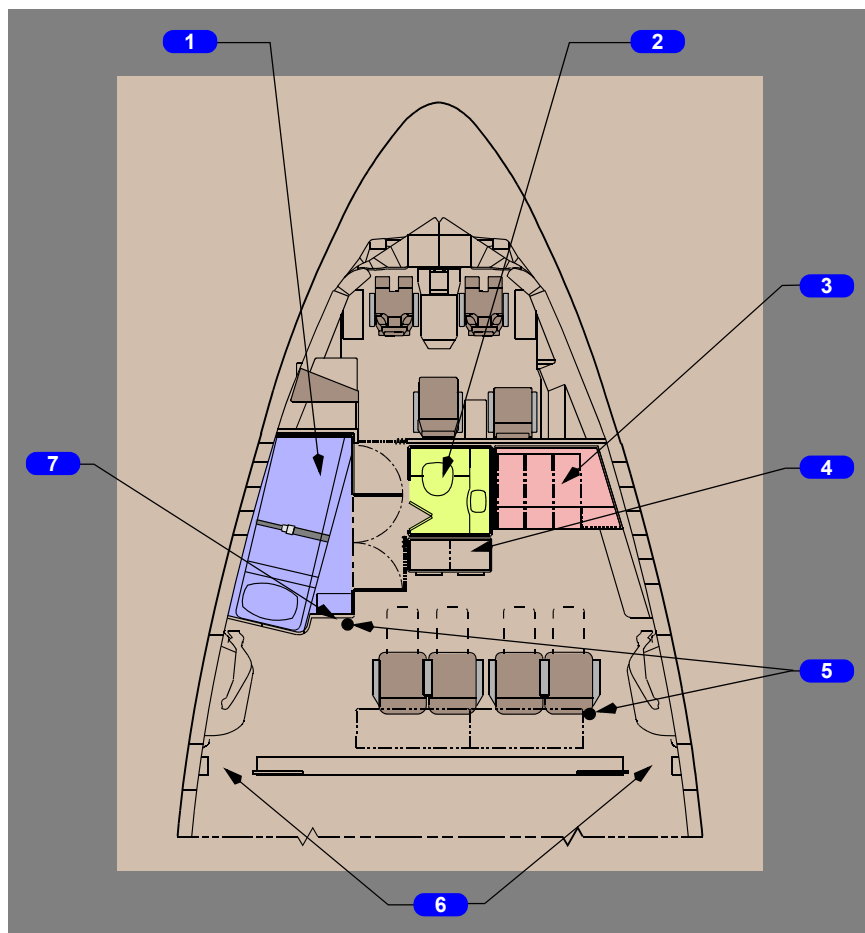
**Airplane General, Emergency
Equipment, Doors, Windows
Supernumerary Area****Chapter 1****Section 47**[\[Freighter\]](#)

Supernumerary Area

This section describes the supernumerary area including:

- Layout
- Control panels
- Entry door
- Evacuation
- Decompression
- Oxygen system
- Rigid cargo barrier

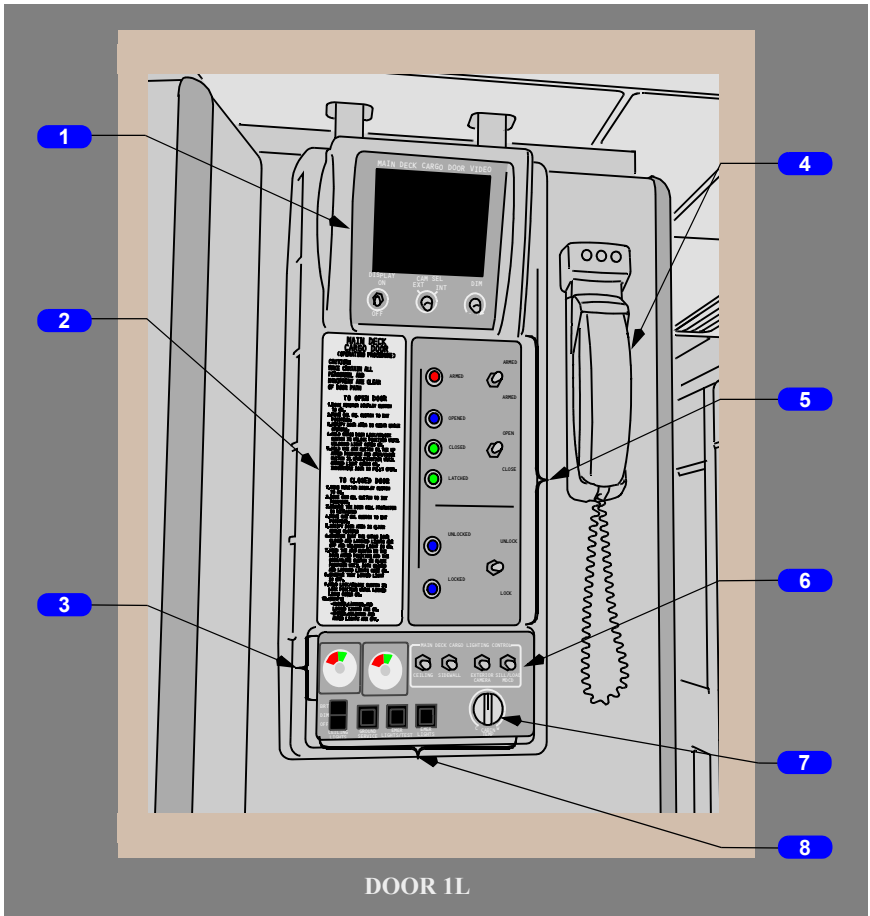
Supernumerary Area Layout



- 1 Flight Crew Rest
- 2 Lavatory
- 3 Galley
- 4 Stowage
- 5 Interphone Handset
- 6 Rigid Cargo Barrier Door

7 Supernumerary Display and Control Panel

Supernumerary Display and Control Panel



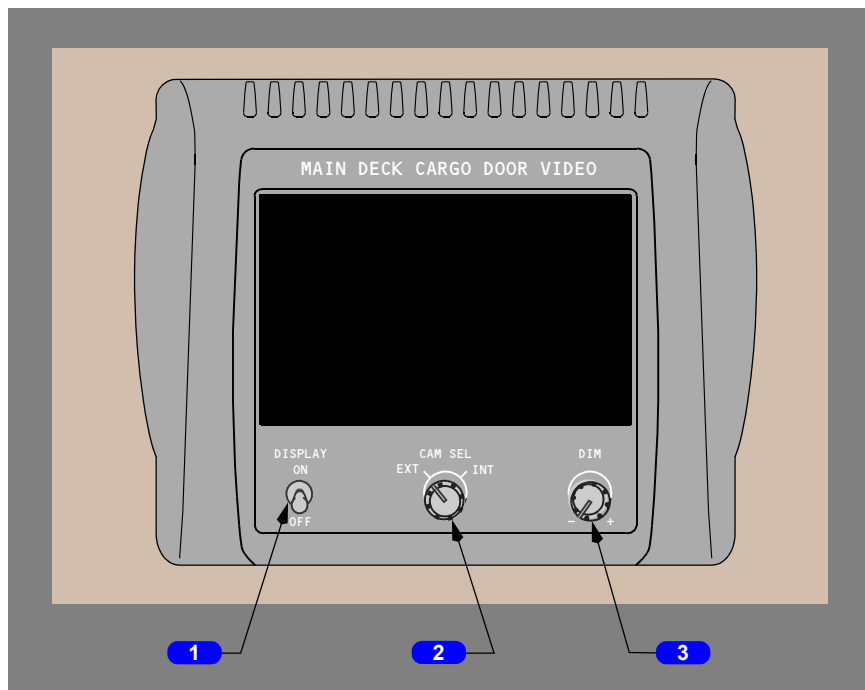
- 1 Main deck Cargo Video**
- 2 Main Deck Cargo Door Operating Procedures**
- 3 Water and Waste Indicators**
- 4 Interphone Handset**
- 5 Main Deck Cargo Door Controls**

6 Main Deck Cargo Lighting Control

7 Cabin Temperature Control

8 Cabin Lighting Control

Main Deck Cargo Door Video



1 Display

ON – the video display is on

OFF – the video display is off

2 Cam Sel (Camera Select)

EXT (exterior) – the video from the exterior camera is displayed

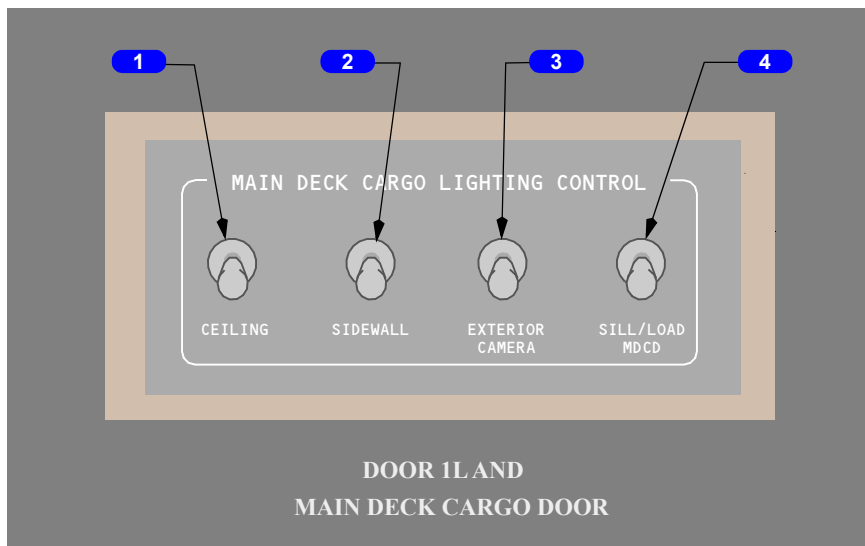
INT (interior) – the video from the interior camera is displayed

3 Dim

Rotate – controls display brightness

Main Deck Cargo Lighting Control

Lights are turned on and off by moving either switch up or down.



1 CEILING

Illuminates the ceiling lights in the main deck cargo area.

2 SIDEWALL

Illuminates the sidewall lights in the main deck cargo area.

3 EXTERIOR CAMERA

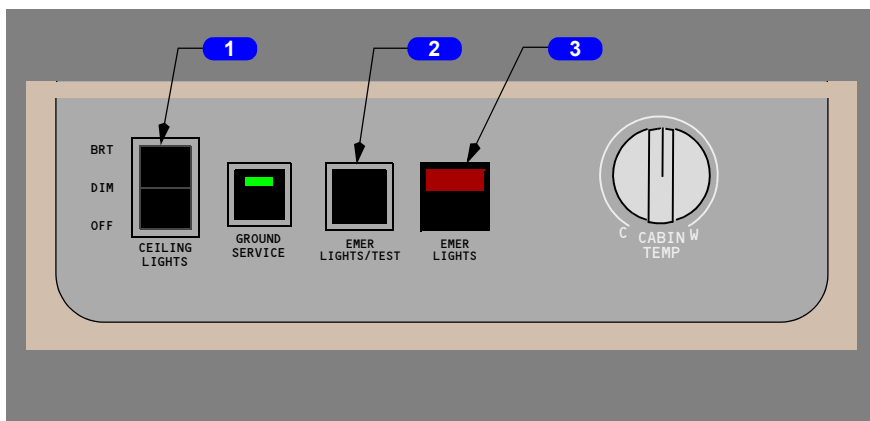
Illuminates the area outside of the main deck cargo door.

4 SILL/LOAD Main Deck Cargo Door (MDCD)

Turns off the main deck cargo door load/sill lights when the door is not closed.

Note: The load/sill lights automatically illuminate when the door is not closed.

Cabin Lighting



1 CEILING LIGHTS

BRT – the ceiling lights in the supernumerary area are illuminated bright

DIM – the ceiling lights in the supernumerary area are illuminated dim

OFF – the ceiling lights in the supernumerary area are not illuminated

2 EMER LIGHTS/TEST

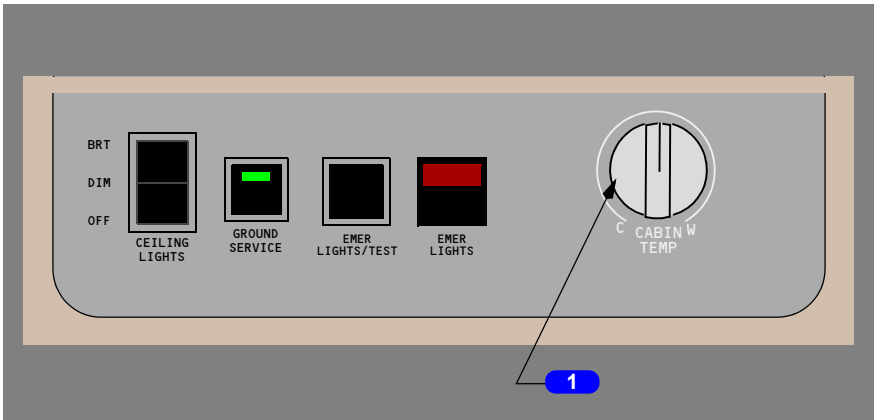
Push and release – Illuminates emergency lights and exit signs for 1 minute

3 Cabin Emergency (EMER) LIGHTS Switch

Push –

- Illuminated (red):
 - all cabin and exterior emergency lights illuminate
 - bypasses the flight deck emergency lights switch
- Extinguished: all cabin and exterior emergency lights extinguish

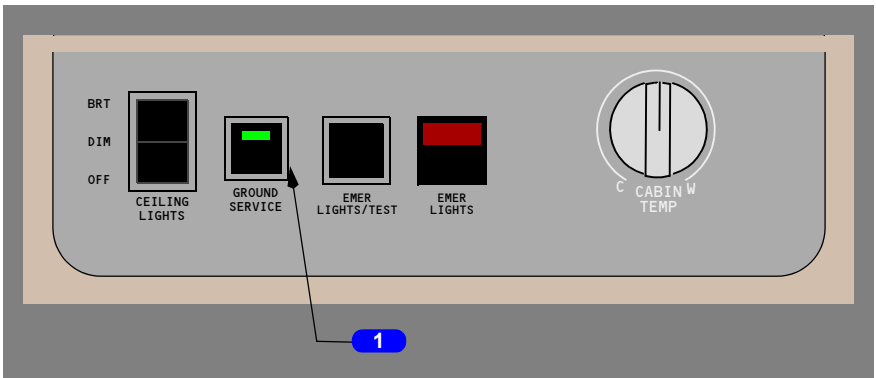
Cabin Temperature



1 CABIN Temperature Switch

Rotate – adjust temperature of supernumerary area

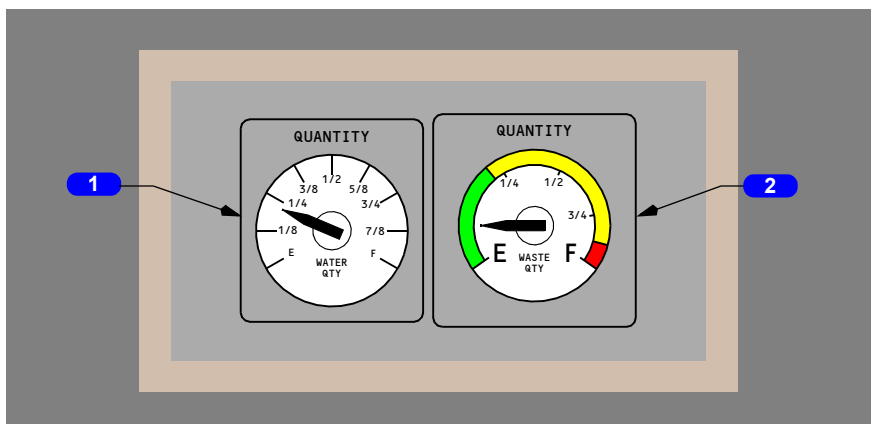
GROUND SERVICE



1 GROUND SERVICE Switch

Push – Powers the Ground Service and Ground Handling electrical buses.

Water and Waste Indicators



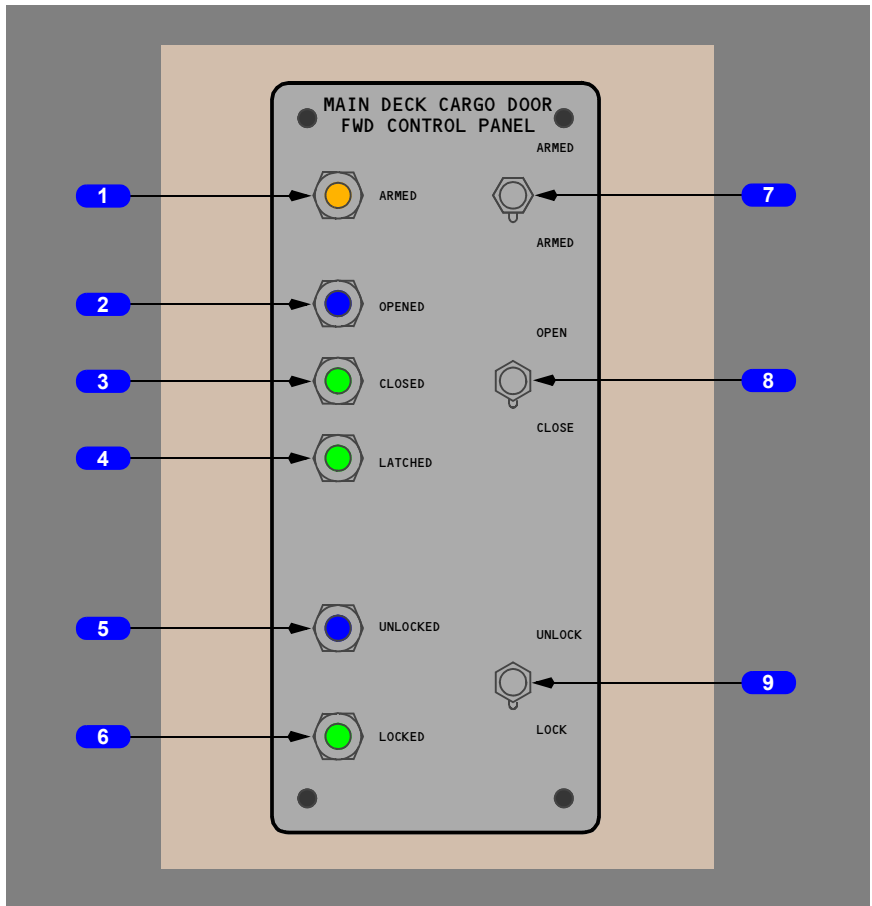
1 WATER QTY

Total water quantity in fractions.

2 WASTE QTY

Total waste quantity in fractions.

Main Deck Cargo Door Controls



1 ARMED Light

Illuminated (amber) – cargo door unlocked and electrical power available.

2 OPENED Light

Illuminated (blue) – cargo door fully open.

3 CLOSED Light

Illuminated (green) – cargo door fully closed.

4 LATCHED Light

Illuminated (green) – cargo door latched.

5 UNLOCKED Light

Illuminated (blue) – cargo door unlocked.

6 LOCKED Light

Illuminated (green) – cargo door locked.

7 ARMED/ARMED Switch

ARMED (push up and hold) – arms cargo door for opening.

ARMED (push down and hold) – arms cargo door for closing.

8 OPEN/CLOSE Switch

OPEN – opens cargo door when armed.

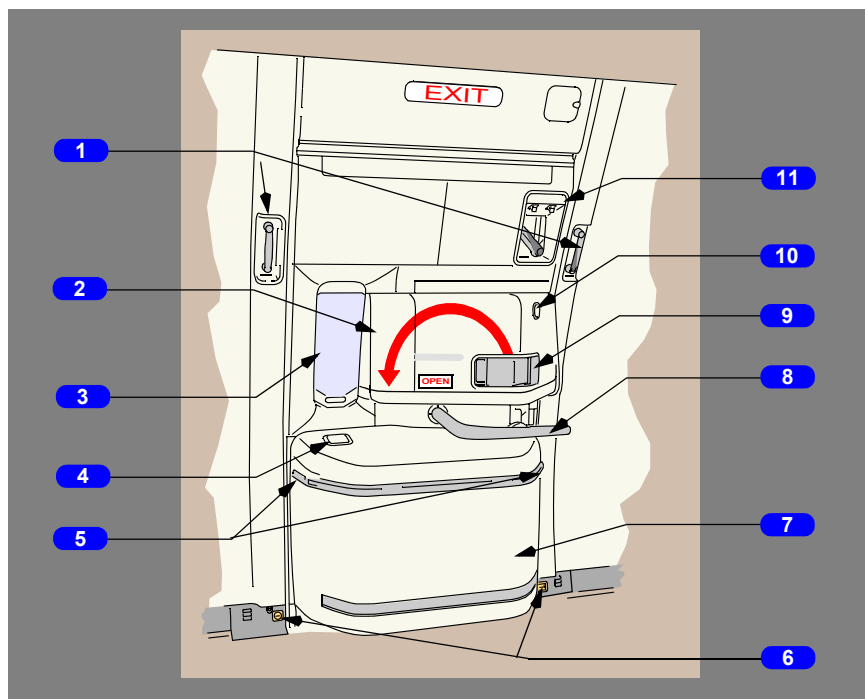
CLOSE – closes cargo door when armed.

9 UNLOCK/LOCK Switch

UNLOCK – unlocks cargo door.

LOCK – locks cargo door.

Entry Door



1 Assist Handle

2 Emergency Power Assist System (EPAS) Battery cover

Spring loaded closed -

- cover flush with the door liner indicates the EPAS system is properly armed

WARNING: If the EPAS battery cover is not flush with the door liner, the EPAS system is unusable. Contact maintenance to service the door.

Note: A green light indicating that the EPAS battery is properly charged may be visible on the door bustle or if the cover is not completely flush with the door liner.

3 Viewing Window

Allows observation outside the airplane.

4 Slide/Raft Gas Bottle Pressure Gauge

Maintenance use only.

Note: If the gauge needle is outside the green zone, the system may be unusable.

5 Door Bustle Release Handle

Pull to remove door bustle for access to slide/raft.

6 Girt Bar Indicator Flag Viewing Windows

Yellow in view -

- door and slide/raft are armed for automatic operation and slide/raft deployment

Black in view -

- door and slide/raft are not armed

7 Door Bustle

The bustle contains the slide/raft.

8 Door Operating Handle

To open the door -

- rotate the door operating handle in the direction of the arrow

To close the door -

- rotate the door operating handle in the opposite direction of the arrow

9 Gust Lock Release Lever

Grab and pull inward to close the door.

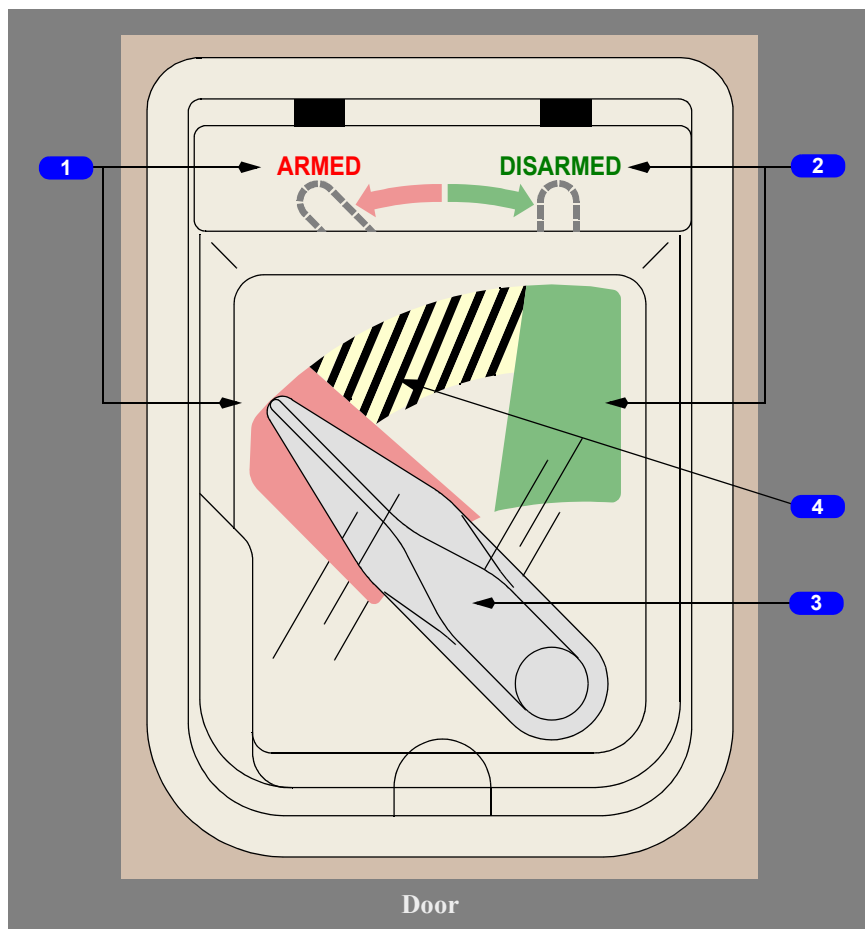
10 Emergency Power Assist System (EPAS) Reservoir Pressure Gauge

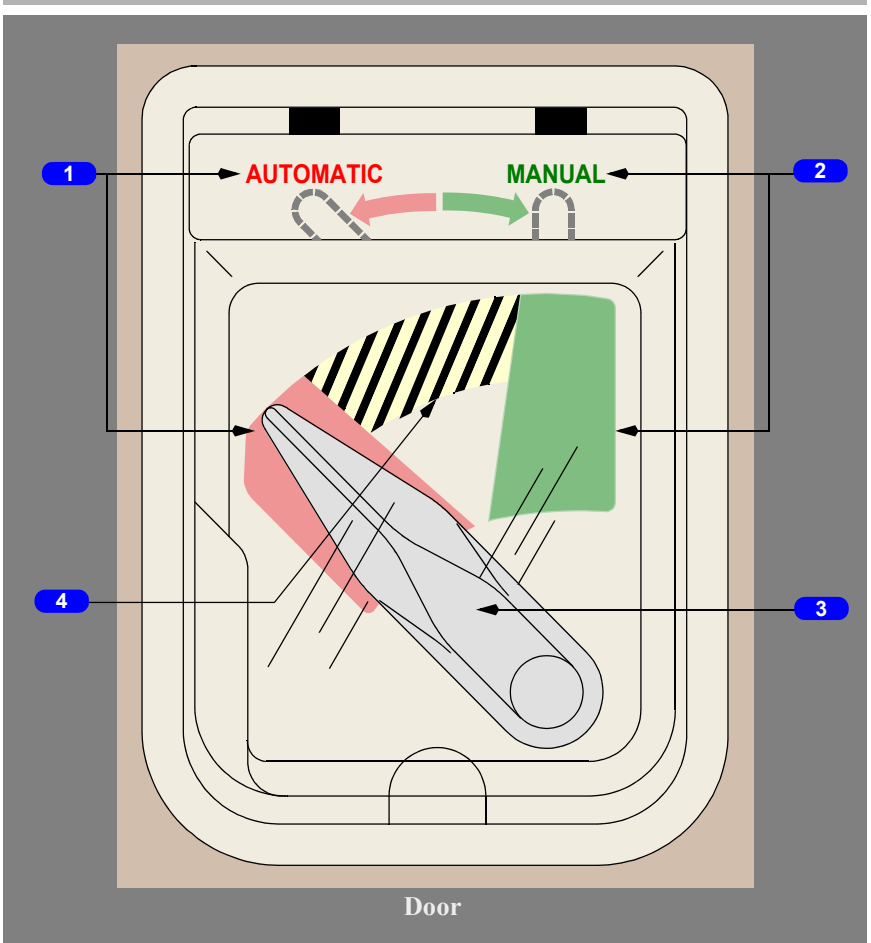
Note: If the gauge needle is outside the green zone, EPAS is unusable.

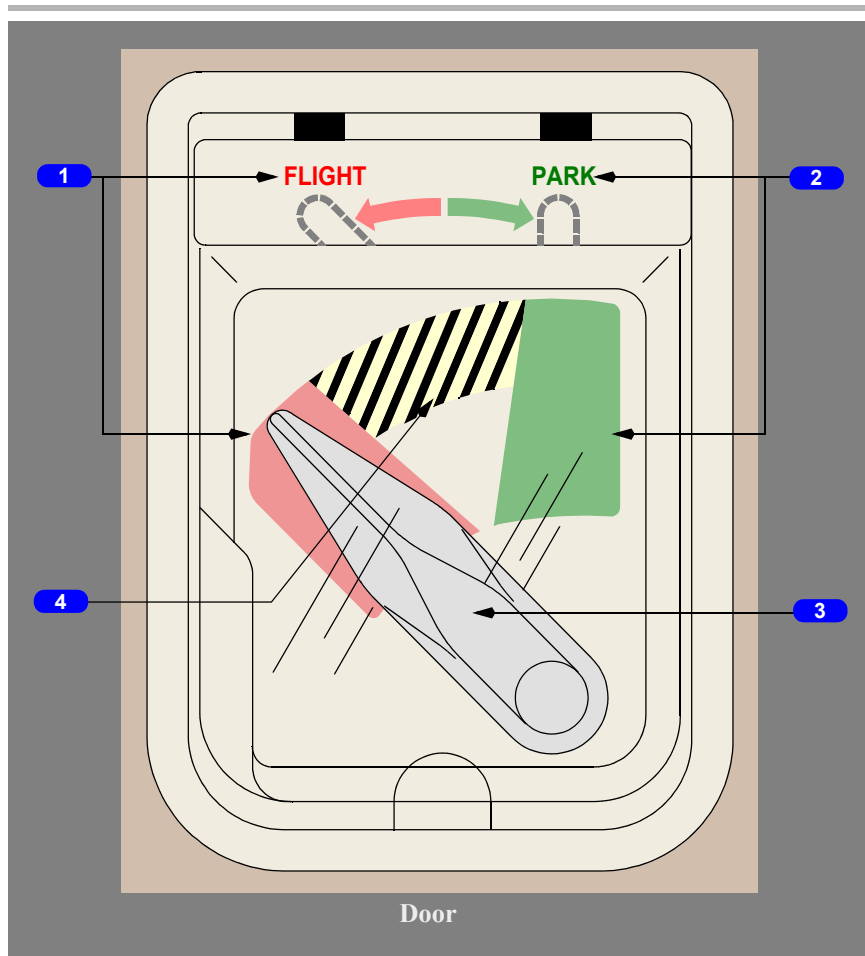
11 Door Mode Select Panel

See following graphic.

Door Mode Select Lever







1 ARMED

Red.

The door is armed if the mode select lever is fully in the red band.

When the door operating handle is moved to the OPEN position:

- the door is powered open
- the slide/raft deploys
- the overwing ramp/slide deploys

Note: If the door is opened from the outside, the mode select lever automatically moves to the DISARMED position.

1 AUTOMATIC

Red.

The door is armed if the mode select lever is fully in the red band.

When the door operating handle is moved to the OPEN position:

- the door is powered open
- the slide/raft deploys
- the overwing ramp/slide deploys

Note: If the door is opened from the outside, the mode select lever automatically moves to the MANUAL position.

1 FLIGHT

Red.

The door is armed if the mode select lever is fully in the red band.

When the door operating handle is moved to the OPEN position:

- the door is powered open
- the slide/raft deploys
- the overwing ramp/slide deploys

Note: If the door is opened from the outside, the mode select lever automatically moves to the PARK position.

2 DISARMED

Green.

The door is disarmed if the mode select lever is fully in the green band.

Moving the door operating handle to the OPEN position raises the door for normal operation and disables:

- the power assist for door opening
- the automatic slide/raft deployment
- the automatic overwing ramp/slide deployment

3 Door Mode Select Lever

Used to select the required mode for flight, ARMED, or arrival, DISARMED.

Used to select the required mode for flight, AUTOMATIC, or arrival, MANUAL.

Used to select the required mode for flight, FLIGHT, or arrival, PARK.

4 Unsafe Band

Yellow and black.

If any portion of the mode select lever is anywhere in the unsafe band, the door may be either armed or disarmed.

CAUTION: To ensure that the door is properly armed or disarmed, the door mode select lever must be positioned fully in the red or green band.

Door Mode Select Lever Operation

The mode select lever on each door controls the arming and disarming of:

- the emergency power assist system (EPAS)
- the escape slide/raft
- the overwing ramp/slide

Setting the mode select lever to DISARMED disarms the EPAS so that the door may be opened normally without power assist and without deploying the slide. Setting the mode select lever to ARMED arms the EPAS so rotation of the inside door operating handle to OPEN activates the EPAS and automatically deploys and inflates the slide. EPAS and manual force are sufficient to open the entry door even if the airplane is not level because of landing gear collapse or uneven terrain.

The door handle on the outside of the airplane is recessed into the door. Pushing in the red flaps at the top of the door handle allows the handle to be pulled out. Pulling the handle fully out moves the mode select lever to DISARMED, which prevents powered door opening and slide deployment and inflation. Rotating the handle then unlocks and unlatches the door. After unlocking, return the handle to the stowed and latched position.

Setting the mode select lever to MANUAL disarms the EPAS so that the door may be opened normally without power assist and without deploying the slide. Setting the mode select lever to AUTOMATIC arms the EPAS so rotation of the inside door operating handle to OPEN activates the EPAS and automatically deploys and inflates the slide. EPAS and manual force are sufficient to open the entry door even if the airplane is not level because of landing gear collapse or uneven terrain.

The door handle on the outside of the airplane is recessed into the door. Pushing in the red flaps at the top of the door handle allows the handle to be pulled out. Pulling the handle fully out moves the mode select lever to MANUAL, which prevents powered door opening and slide deployment and inflation. Rotating the handle then unlocks and unlatches the door. After unlocking, return the handle to the stowed and latched position.

Setting the mode select lever to PARK disarms the EPAS so that the door may be opened normally without power assist and without deploying the slide. Setting the mode select lever to FLIGHT arms the EPAS so rotation of the inside door operating handle to OPEN activates the EPAS and automatically deploys and inflates the slide. EPAS and manual force are sufficient to open the entry door even if the airplane is not level because of landing gear collapse or uneven terrain.

The door handle on the outside of the airplane is recessed into the door. Pushing in the red flaps at the top of the door handle allows the handle to be pulled out. Pulling the handle fully out moves the mode select lever to PARK, which prevents powered door opening and slide deployment and inflation. Rotating the handle then unlocks and unlatches the door. After unlocking, return the handle to the stowed and latched position

CAUTION: To ensure that the door is properly armed or disarmed, the door mode select lever must be positioned fully in the red or green band.

Flight Lock

Each door has a flight lock that automatically engages at speeds greater than 80 knots. The flight lock allows limited travel of the door operating handle sufficient to open the vent panel but prevents the door from opening. The flight lock releases at speeds less than 80 knots.

Entry Door

[Option – ARMED/DISARMED Shown, AUTOMATIC/MANUAL or FLIGHT/PARK Optional]

Crew entry doors 1L and 1R are used to enter and exit the airplane, and also serve as emergency exits. Either door can be opened or closed manually from inside or outside of the airplane.

The entry doors are translating, plug-type doors. During opening, the door first moves inward and upward, then translates outward and forward. Each door is held in the open position by a gust lock. The gust lock drops into a latch as the door nears its forward limit of travel. A window in each door allows observation outside of the airplane.

Placing the mode select lever in the ARMED position:

Placing the mode select lever in the AUTOMATIC position:

Placing the mode select lever in the FLIGHT position:

- arms the emergency power assist system
- engages the girt bar on entry doors
- arms the escape slide/rafts

Once armed, moving the interior door handle to the open position operates the emergency power assist system actuator. The pneumatic actuator drives the door open, and the slide automatically deploys and inflates.

The emergency power assist system and the slide/raft are automatically disarmed when the door is opened from the outside. If the mode select lever is in the ARMED position and the door is opened using the exterior door handle, the mode select lever automatically moves to DISARMED and the door opens without slide/raft deployment.

[\[Option - EICAS Door AUTO/MANUAL Memo Messages\]](#)

The following EICAS memo messages display the overall door mode select lever positions:

- DOORS AUTO
- DOORS MANUAL
- DOORS AUTO/MANUAL.

[\[Option - EICAS Door AUTO/MANUAL Memo Messages\]](#)

The following EICAS memo messages display the overall door mode select lever positions:

- DOORS AUTO (ARMED)
- DOORS MANUAL (DISARMED)
- DOORS AUTO/MANUAL (ARMED/DISARMED).

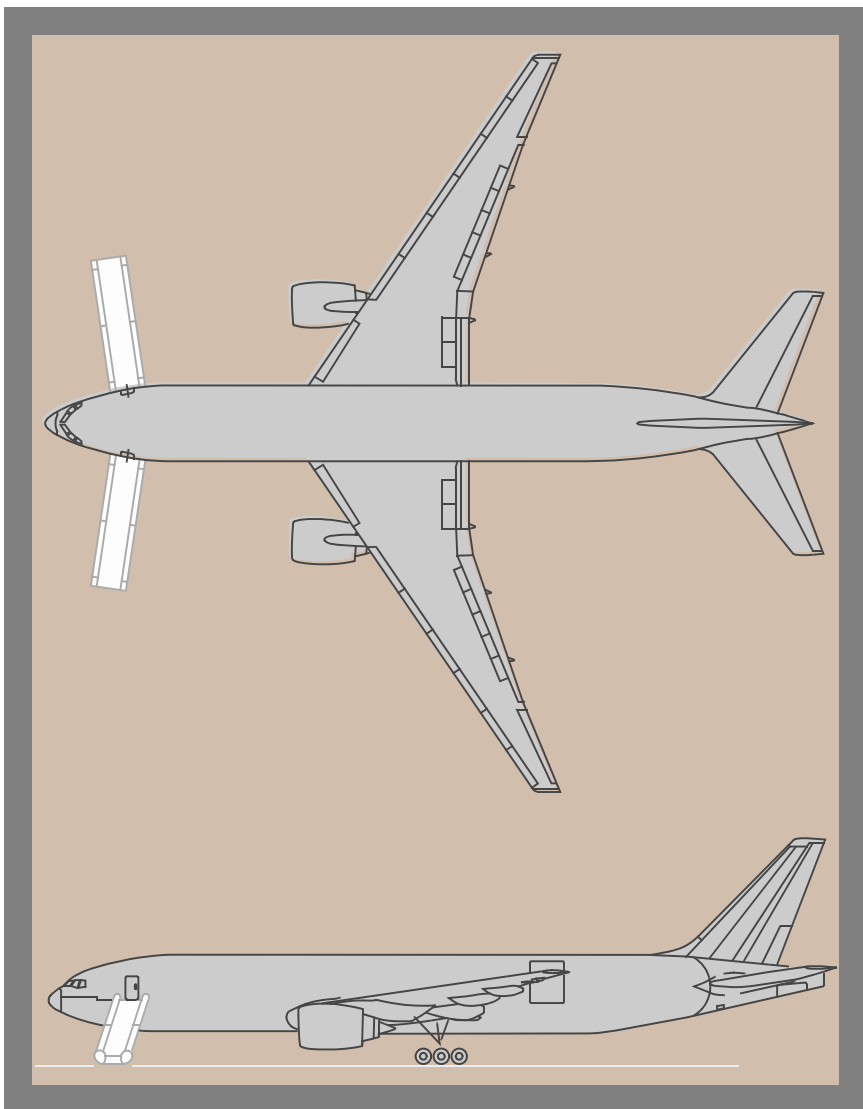
[\[Option - EICAS Door AUTO/MANUAL Memo Messages\]](#)

The following EICAS memo messages display the overall door mode select lever positions:

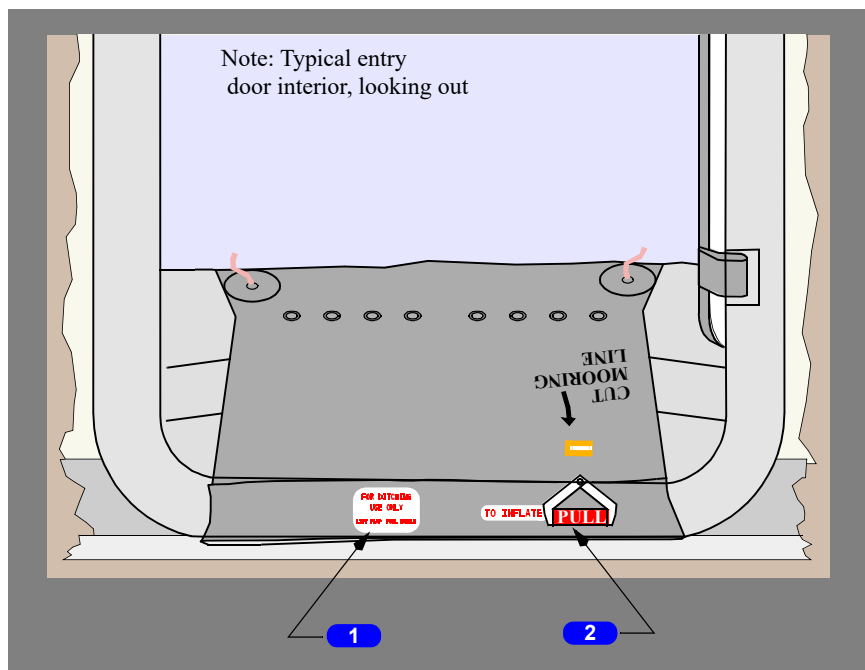
- DOORS AUTO (FLIGHT)
- DOORS MANUAL (PARK)
- DOORS AUTO/MANUAL (FLIGHT/PARK).

The DOORS AUTO/MANUAL message continues to be displayed for two seconds when it is being replaced by the DOORS AUTO or DOORS MANUAL message. During this time, both the DOORS AUTO/MANUAL message and the message replacing it can be displayed.

Evacuation Slide/Rafts



Slide/Raft Controls



1 Slide/Raft Detachment Handle

Lift flap, pull handle to release slide/raft from girt bar.

Note: For ditching use only.

2 Manual Inflation Handle

CAUTION: The entry door slide/raft should deploy and should inflate automatically. If the slide/raft does not automatically inflate, the Manual Inflation Handle must be used.

Pull -

- inflates the slide/raft

Decompression

In the event of decompression, the oxygen mask, located in the overhead, will automatically deploy when the cabin altitude is above 13,500 feet. Additionally, the oxygen mask deployment horn will sound continuously and the air flow and oxygen alarm RESET light will illuminate. Oxygen flow is available when the mask is pulled.

Supernumerary Oxygen

Supernumerary Oxygen System

The supernumerary oxygen system is supplied by bottled gaseous oxygen. The oxygen bottles provide oxygen to the passenger and lavatory service units. The supernumerary oxygen masks are located above the passenger seats in passenger service units (PSUs).

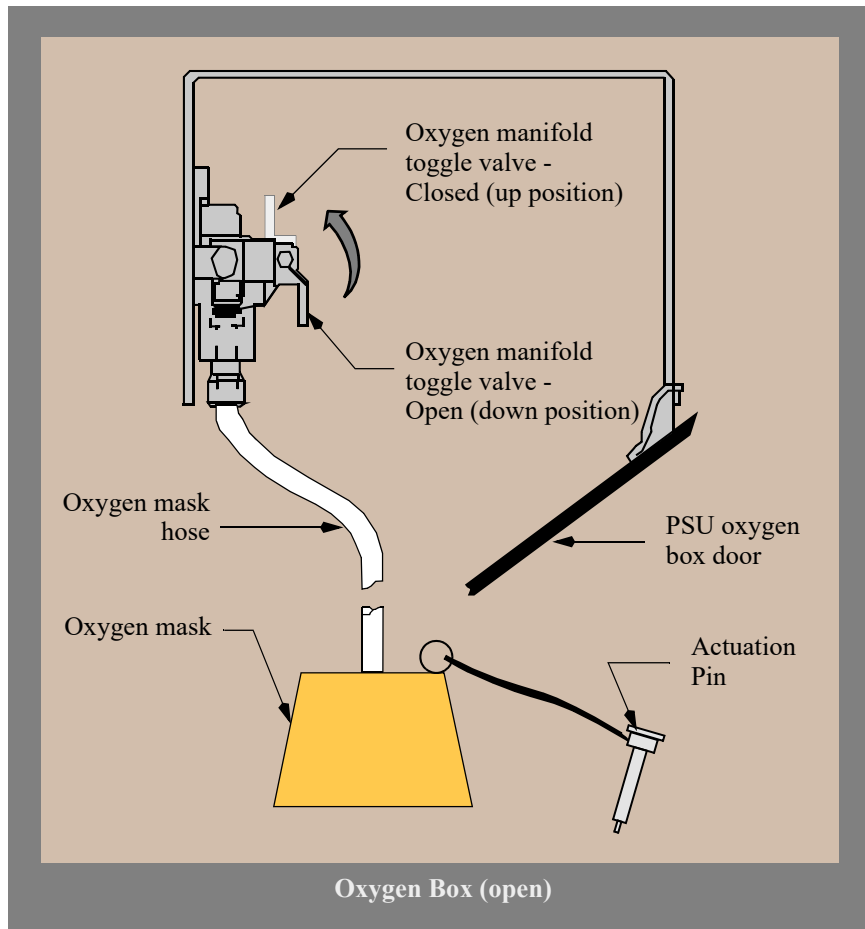
The masks automatically drop from the PSUs if cabin altitude exceeds approximately 13,500 feet.

The supernumerary masks can be manually deployed from the flight deck by pushing the overhead panel SUPRNMRY OXYGEN switch to the ON position. Oxygen flow can be reset by selecting the SUPRNMRY OXYGEN switch to the RESET position.

Supernumerary gaseous oxygen pressure is displayed on the MFD STATUS display.

Individual Mask Shut Off

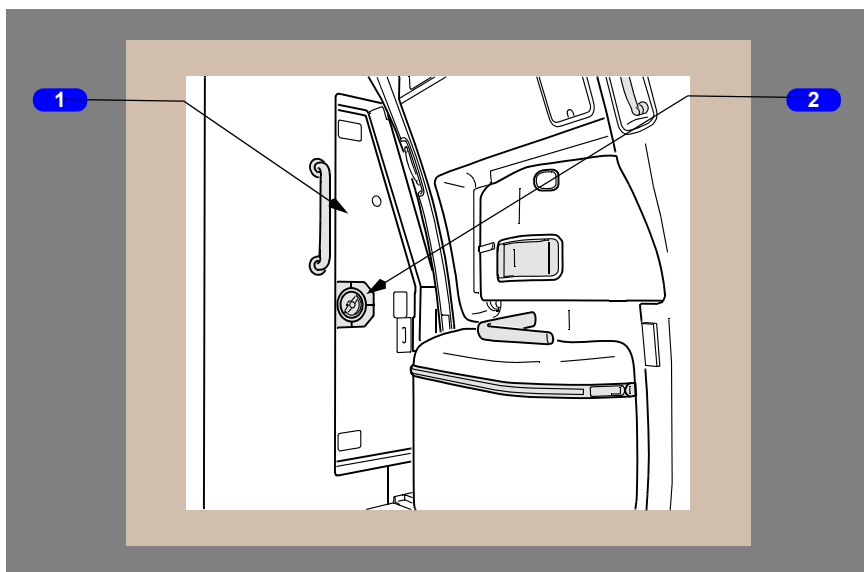
Oxygen flow to each individual oxygen mask may be manually shut off.



To shut off the flow of oxygen to a particular mask:

1. locate the oxygen manifold toggle valve of the mask to be shutdown
2. move the oxygen manifold toggle to the closed (up) position

Rigid Cargo Barrier



1 Rigid Cargo Barrier Door

2 Door Handle

The rigid cargo barrier separates the main deck cargo compartment from the supernumerary area. If there is smoke in the main deck cargo compartment, the rigid cargo barrier helps prevent the smoke from entering the supernumerary area.

Two rigid cargo barrier doors are used for access between the main deck cargo compartment and the supernumerary area. The doors are to remain closed except when entering and exiting the cargo compartment.

Main Deck Cargo Compartment Access Limitations

Occupancy of the main deck cargo compartment is prohibited during taxi, takeoff, and landing.

Main deck cargo compartment access is limited to:

- caring for live animals
- caring for cargo requiring special attention

CAUTION: Portable oxygen must be carried by occupants in the main deck cargo compartment.

Intentionally
Blank

**Airplane General, Emergency
Equipment, Doors, Windows
Doors, Windows, Seats****Chapter 1****Section 50**

Introduction

This section describes miscellaneous airplane systems, including:

- doors and windows
- flight deck seats

Doors and Windows

[777-200, 777-200ER, and 777-200LR]

The airplane has eight passenger entry doors, one flight deck door (the flight deck/cabin entry), and three cargo doors. It also has two center electrical and electronic (E/E) equipment access doors, one forward and one main.

[777F]

The airplane has two crew entry doors and four cargo doors. It also has two center electrical and electronic (E/E) equipment access doors, one forward and one main.

[777-300 and 777-300ER]

The airplane has eight passenger entry doors, two overwing exits, one flight deck door (the flight deck/cabin entry), and three cargo doors. It also has two center electrical and electronic (E/E) equipment access doors, one forward and one main.

CAUTION: Do not operate the entry or cargo doors with winds at the door of more than 40 knots. Do not keep doors open when wind gusts are more than 65 knots. Strong winds can cause damage to the structure 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.

An EICAS message is displayed when an entry door, overwing exit, cargo door, access door, or flight deck window is not closed, latched, and locked.

Flight Deck Door

[Passenger]

The flight deck door meets requirements for resistance to ballistic penetration and intruder entrance. The door opens into the flight deck. 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 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. Rotating both concentric deadbolt levers to the locked (horizontal) position prevents the 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, a chime module, a 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 rotary door lock selector are located on the aft aisle stand. 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. Annunciation of 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 latch system incorporates a pressure rate-sensor that unlocks the door in the event of flight deck depressurization. Two hinged decompression panels open to equalize pressure in the event of cabin depressurization. Each panel opening has a security grill on the flight deck side.

Features are included to prevent a jammed door due to structural deformation. A lower break-away panel is attached to the main door section by interlocking extrusions and two shear pins. If sufficient upward force occurs, the pins will shear and the break-away panel will separate from the door. If the pins fail to shear, they can be retracted manually to aid in egress. An angled door jamb aids in forcing the door open into the flight deck in case of surrounding bulkhead deformation.

Flight Deck Number Two Windows

The flight deck number two windows can be opened on the ground or in flight. The flight deck number two windows can be used for emergency evacuation. The associated window lock lever locks or unlocks the window. With the window unlocked, rotating the window crank opens the window. To open the window:

- rotate the window lock lever aft to the open position
- crank the window to the full open position (the WINDOW NOT CLOSED placard is visible).

When closing the window, the window lock lever must be in the unlocked position. As the window approaches the full closed position, the force required on the crank increases. To close the window:

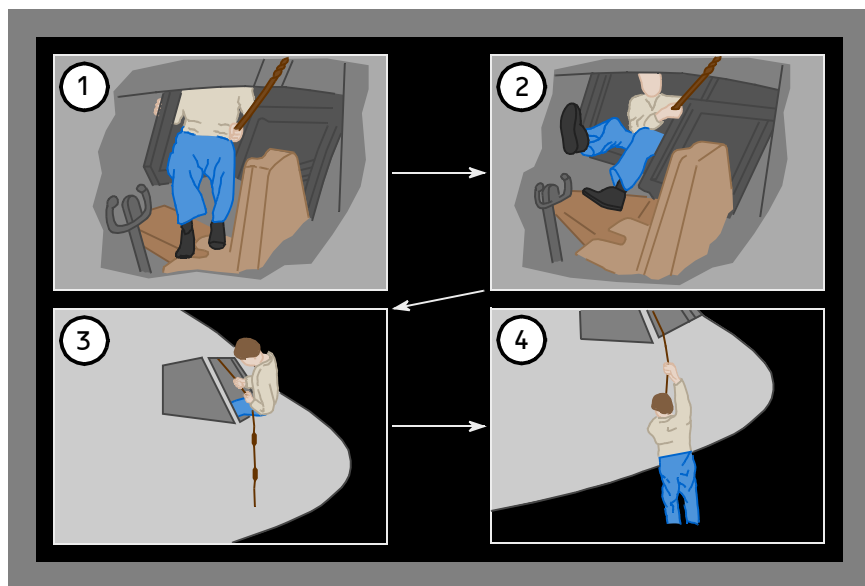
- crank the window to the full closed position (the WINDOW NOT CLOSED placard is not visible)
- rotate the window lock lever forward to the locked position.

The windows can be opened or closed in flight with minor flight deck consequences if the airplane is unpressurized. The force required to move the crank increases with airspeed. With the window open, voice, interphone, and radio audio may not be heard due to high noise levels. Prior communications arrangements with the controlling agency should be established before opening the window. The design provides an area of relatively calm air over the open window. Forward visibility can be maintained by looking out of the open window.

Escape ropes are attached to the airplane structure above both number two flight deck windows. The ropes are stowed in compartments above the pilot seats.

The EICAS advisory message WINDOW FLT DECK (L or R) or WINDOWS (both windows) is displayed if the window(s) are not closed and latched.

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
- remove the bag containing the rope (above and aft of window)
- pull on rope to ensure it is securely attached
- throw the bag out the window (bag falls off)
- check the first rope handhold is green and is located in the window opening
- sit on the window sill with upper body outside
- exit in accordance with the above illustration.

CAUTION: Ensure the rope is securely fastened to the airplane.

Entry Doors

[\[777-200, 777-200ER, and 777-200LR\]](#)

The passenger entry doors are used to enter and exit the airplane, and also serve as emergency exits. There are no other cabin exits. The eight passenger entry doors are paired along the airplane fuselage. The doors are identified 1 through 4 left, and 1 through 4 right. The passenger entry doors can be opened or closed manually from inside or outside of the airplane.

[777-300 and 777-300ER]

The passenger entry doors are used to enter and exit the airplane, and also serve as emergency exits. The two overwing exit doors are only for use as emergency exits. The eight passenger entry doors and two overwing exit doors are paired along the airplane fuselage. The doors are identified 1 through 5 left, and 1 through 5 right. The doors can be opened or closed manually from inside or outside of the airplane.

[777F]

Crew entry doors 1L and 1R are used to enter and exit the airplane, and also serve as emergency exits. Either door can be opened or closed manually from inside or outside of the airplane.

The entry doors are translating, plug-type doors. During opening, the door first moves inward and upward, then translates outward and forward. Each door is held in the open position by a gust lock. The gust lock drops into a latch as the door nears its forward limit of travel. A window in each door allows observation outside of the airplane.

The overwing exit doors are translating, plug-type doors. Operation is the same as the entry doors.

Each door has a vent panel connected to the door handle. The vent is designed to prevent pressurization to an unsafe level if the door is not fully closed, latched, and locked. Forward rotation of the door handle past the latched position closes the vent. Initial aft door handle rotation opens the vent to equalize cabin and ambient pressure. At low differential pressure, the door handle can be rotated to allow the door to open fully. At high differential pressure, the vent can be partially opened; however, a mechanical interlock prevents door opening until the differential pressure is reduced. At very high differential pressure, the vent cannot be opened.

Entry Door Flight Lock

Each door handle is automatically locked when airspeed is greater than 80 knots. The flight lock allows limited door handle rotation sufficient to partially open the door vent, but prevents door opening. If electrical power is removed or fails, the flight lock is spring-loaded to the unlocked position.

Entry Door Slide/Raft

Emergency evacuation slide/raft and emergency power assist systems are contained in each entry door. Each emergency power assist system has enough power to pneumatically open the door unassisted, even if the airplane is not level because of any landing gear collapse condition. A slide/raft cover in the lower face of the door contains the slide/raft.

Overwing Escape Slide

[777-300 and 777-300ER]

An overwing escape slide assembly, consisting of a dual lane ramp with a dual lane slide, is contained in a exterior compartment in the wing body fairing. On activation of the overwing escape slide assembly, the inboard spoilers retract. An EICAS message is displayed if an overwing escape slide is not closed, latched, and locked.

WARNING: If door 3 is used during ditching, the door mode selector lever must be in DISARMED to allow the door to be opened without deploying the ramp/slide.

WARNING: If door 3 is used during ditching, the door mode selector lever must be in MANUAL to allow the door to be opened without deploying the ramp/slide.

WARNING: If door 3 is used during ditching, the door mode selector lever must be in PARK to allow the door to be opened without deploying the ramp/slide.

Emergency Exit Operation

[Option – ARMED/DISARMED Shown, AUTOMATIC/MANUAL or FLIGHT/PARK Optional]

Placing the mode select lever in the ARMED position:

Placing the mode select lever in the AUTOMATIC position:

Placing the mode select lever in the FLIGHT position:

- arms the emergency power assist system
- engages the girt bar on entry doors
- arms the escape slide/rafts

[777-300 and 777-300ER]

- arms the overwing escape slides

Once armed, moving the interior door handle to the open position operates the emergency power assist system actuator. The pneumatic actuator drives the door open, and the slide automatically deploys and inflates.

The emergency power assist system and the slide/raft are automatically disarmed when the door is opened from the outside. If the mode select lever is in the ARMED position and the door is opened using the exterior door handle, the mode select lever automatically moves to DISARMED and the door opens without slide/raft deployment.

[\[Option - EICAS Door AUTO/MANUAL Memo Messages\]](#)

The following EICAS memo messages display the overall door mode select lever positions:

- DOORS AUTO
- DOORS MANUAL
- DOORS AUTO/MANUAL.

[\[Option - EICAS Door AUTO/MANUAL Memo Messages\]](#)

The following EICAS memo messages display the overall door mode select lever positions:

- DOORS AUTO (ARMED)
- DOORS MANUAL (DISARMED)
- DOORS AUTO/MANUAL (ARMED/DISARMED).

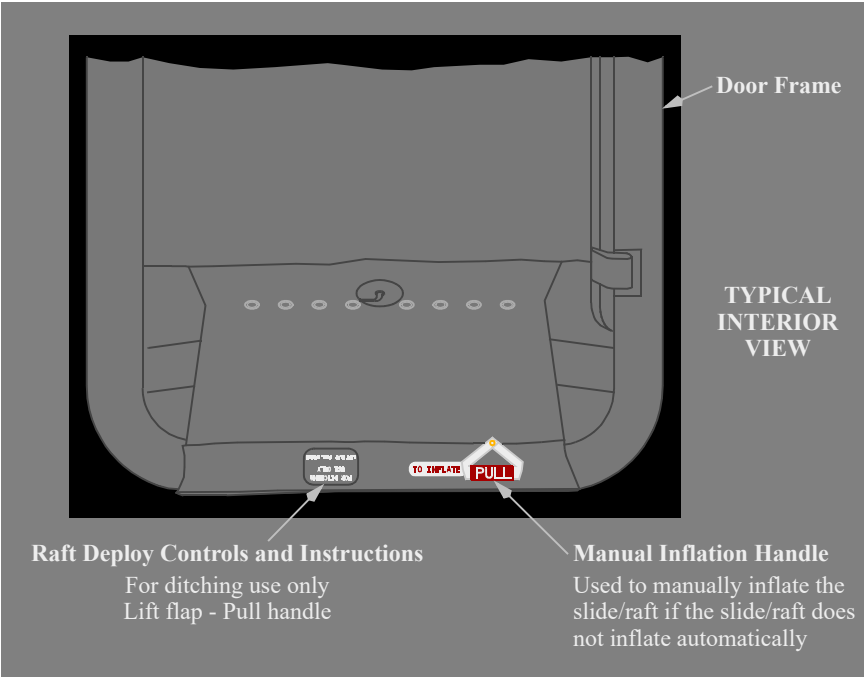
[\[Option - EICAS Door AUTO/MANUAL Memo Messages\]](#)

The following EICAS memo messages display the overall door mode select lever positions:

- DOORS AUTO (FLIGHT)
- DOORS MANUAL (PARK)
- DOORS AUTO/MANUAL (FLIGHT/PARK).

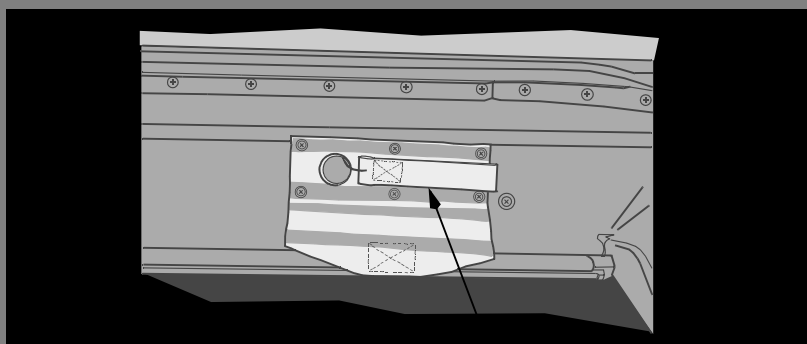
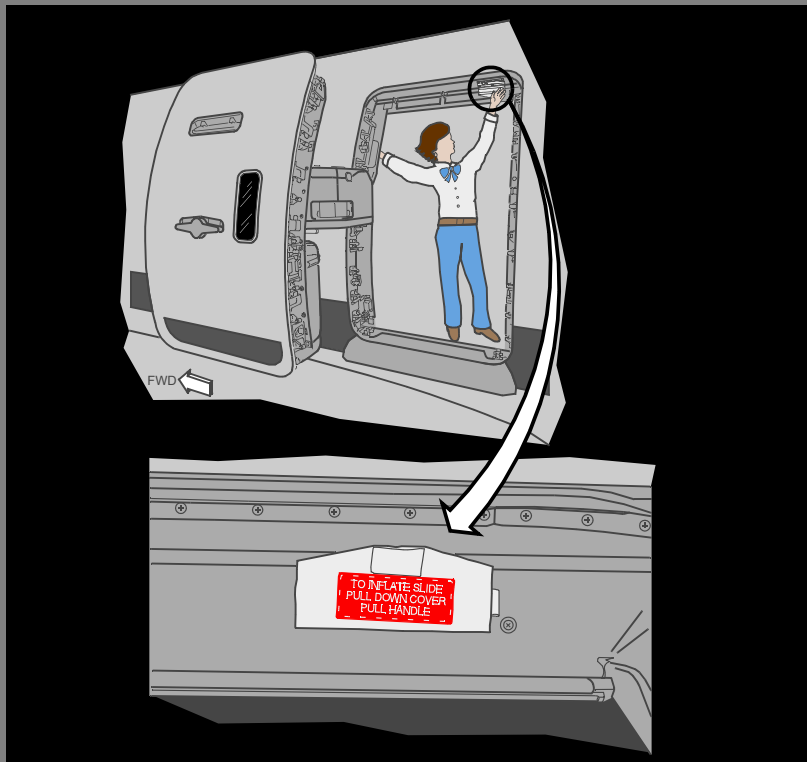
The DOORS AUTO/MANUAL message continues to be displayed for two seconds when it is being replaced by the DOORS AUTO or DOORS MANUAL message. During this time, both the DOORS AUTO/MANUAL message and the message replacing it can be displayed.

Slide/Raft Deployed



Door 3 Slide Manual Inflation Handle

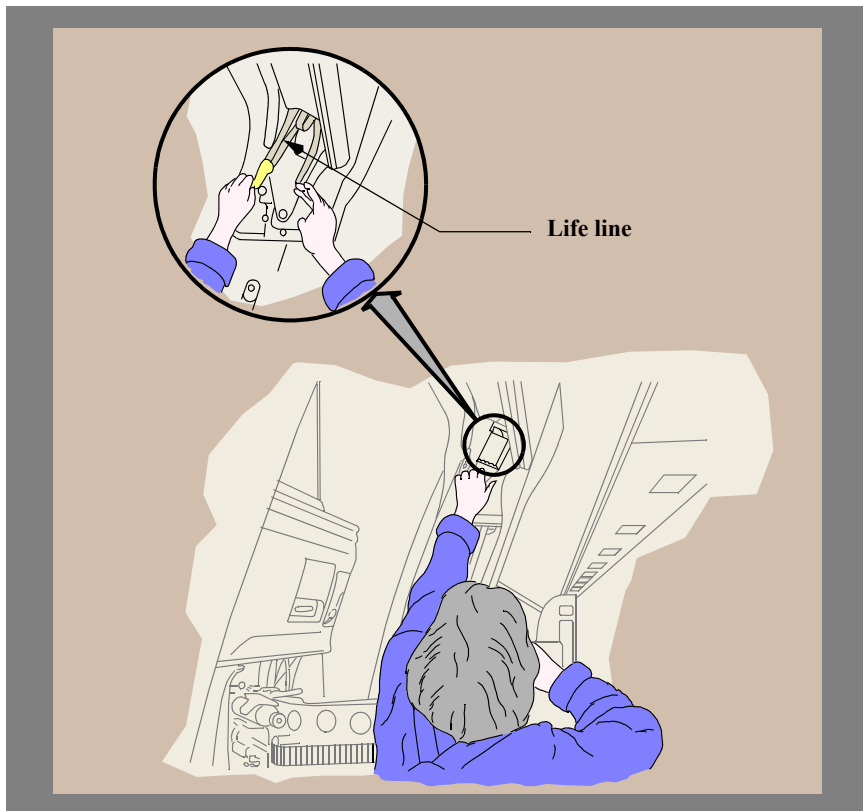
[777-300 and 777-300ER]

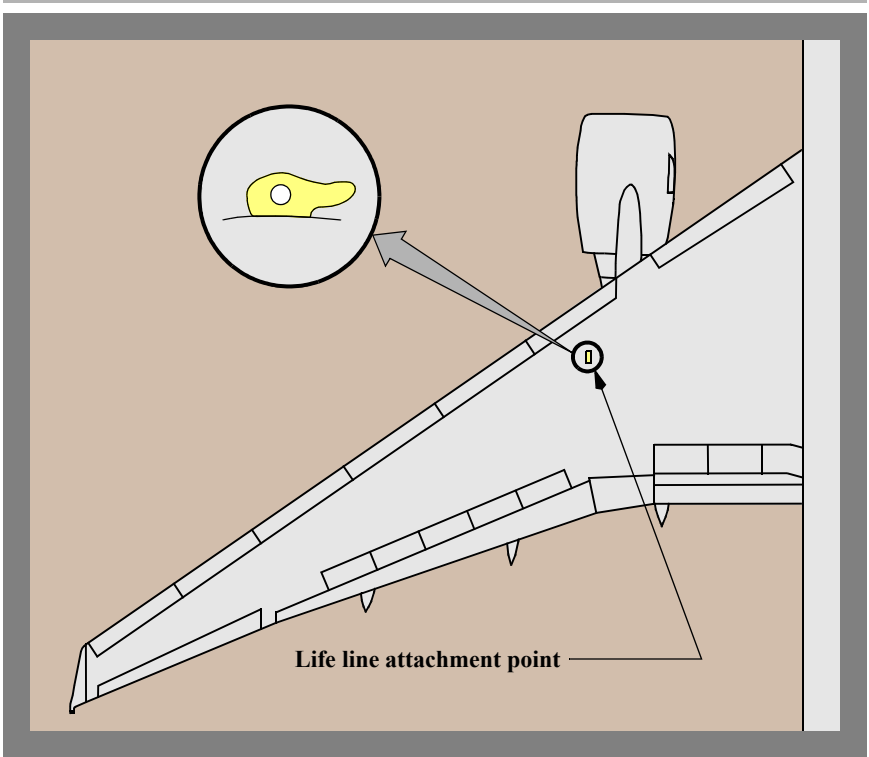


Manual Inflation Handle
Pull to manually inflate slide if
it does not inflate automatically

Door 3 Life Line

[777-300 and 777-300ER]

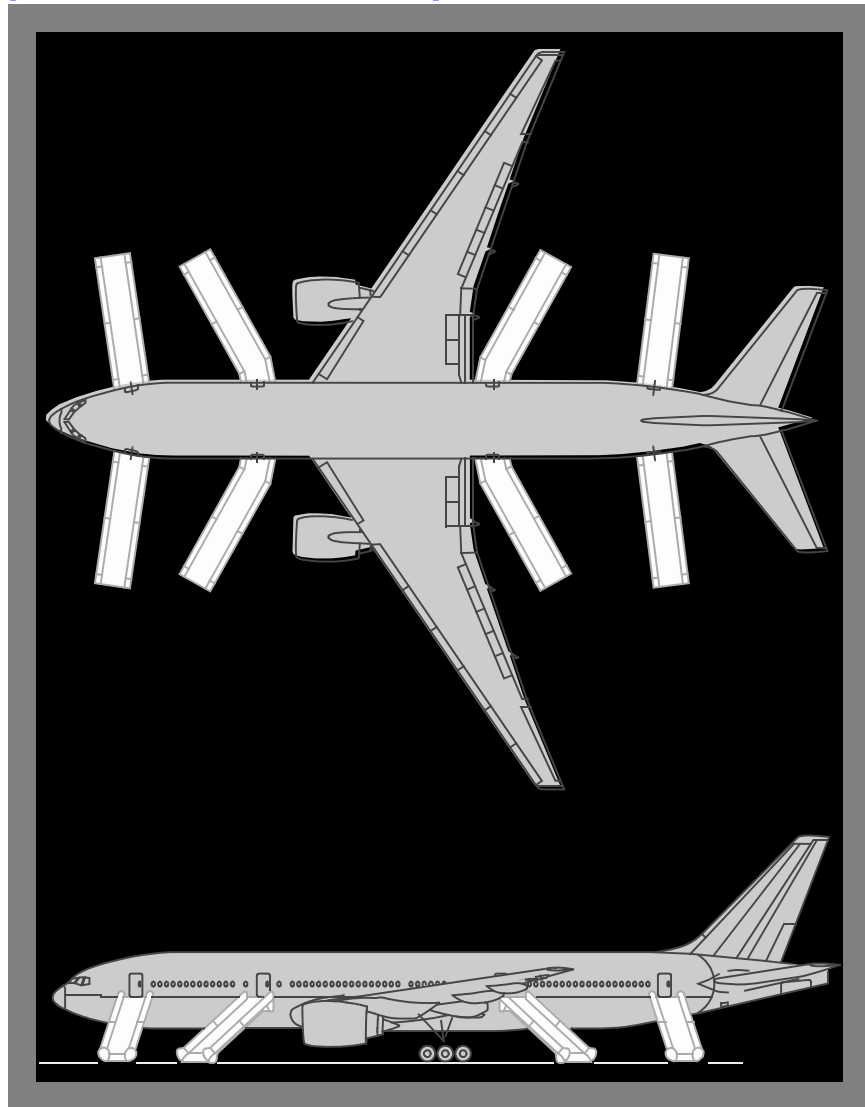




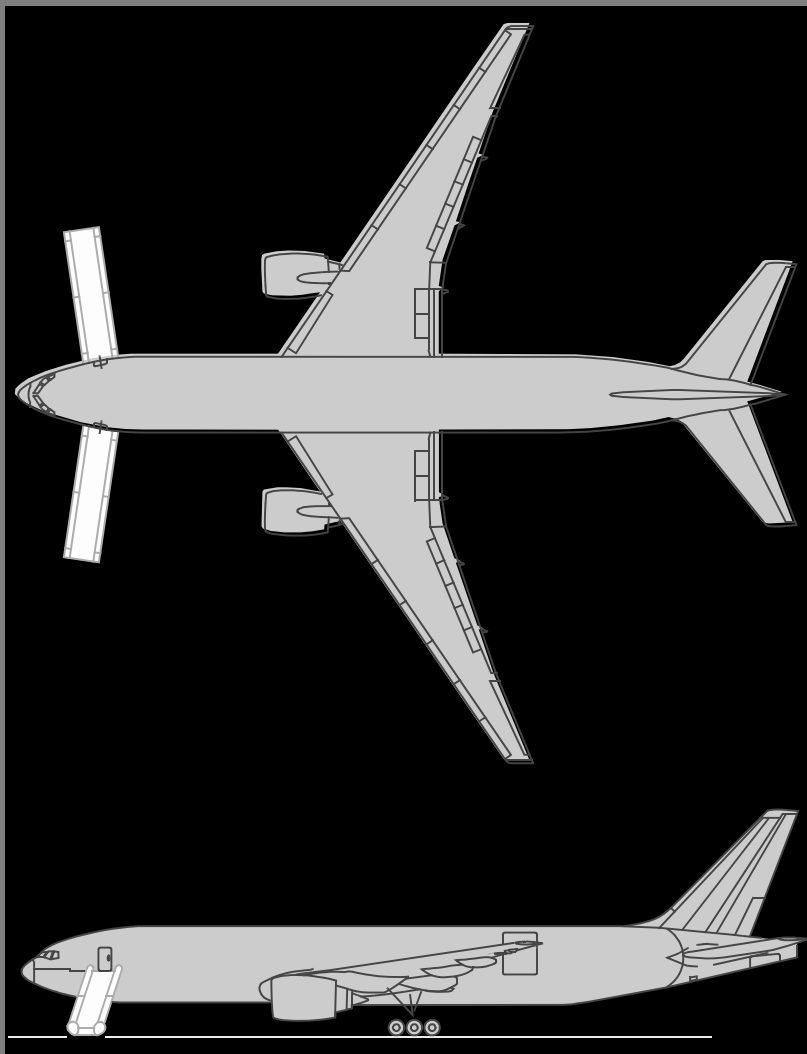
A life line is installed in the door 3 frame above each overwing exit. In a ditching emergency, the life line is attached to a hook on the wing leading edge, outboard of the engine. The life line is used as an attachment for the life raft mooring line and as a hand hold for passengers to walk out on the wing and into a life raft.

Evacuation Slide/Rafts

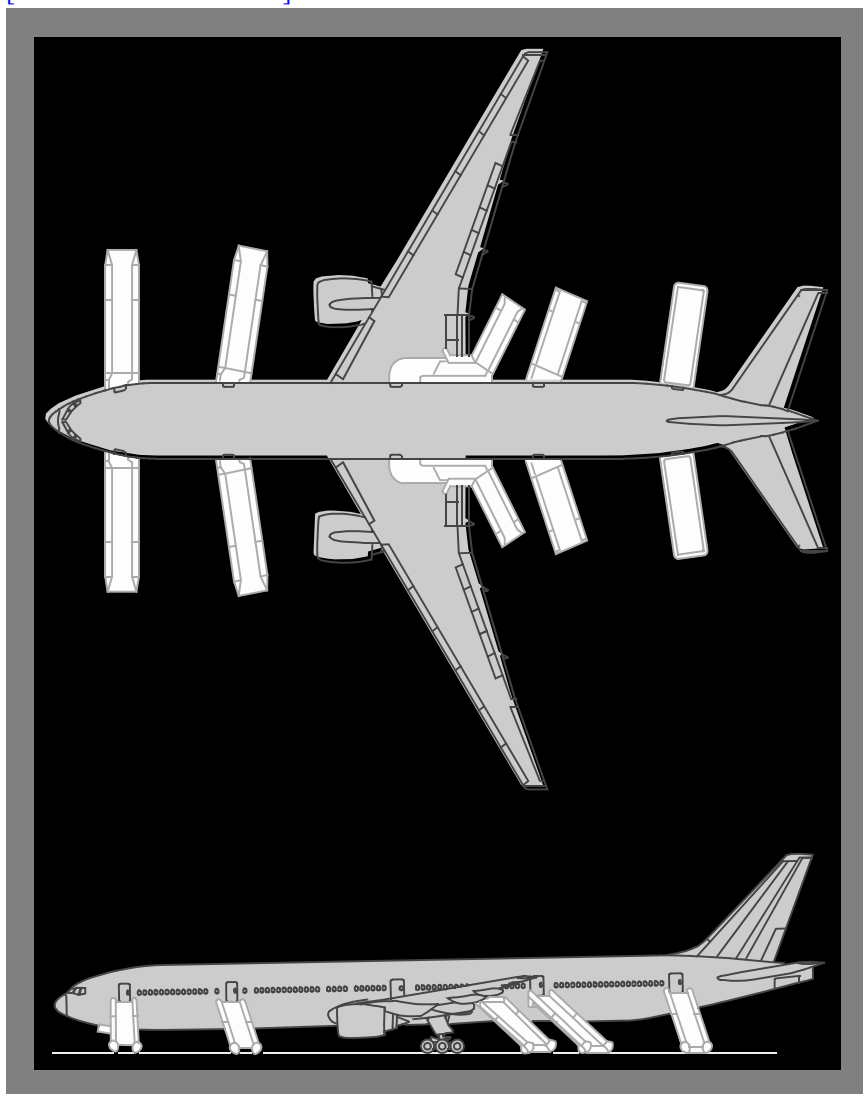
[777-200, 777-200ER, and 777-200LR]



[777F]



[777-300 and 777-300ER]



Cargo Doors

There are three lower cargo doors located on the right side of the airplane; one forward, one aft, and one bulk.

Both forward and aft cargo doors are normally operated electrically from an exterior or interior fuselage-mounted control panel located with each door. A control panel light indicates cargo door latching. Forward and aft cargo door locking is accomplished manually. If necessary, the forward and aft cargo doors may be operated manually.

The bulk cargo door is manually opened and closed, and is counterbalanced for ease of operation.

The aft small cargo door is a plug type. To open, it first moves up out of the plug position, then it opens outward and upward.

The large cargo door(s) are non-plug type of door. Door latches hold the door closed against cabin pressure loads. The door opens outward and upward.

Main Deck Cargo Door

[\[Freighter\]](#)

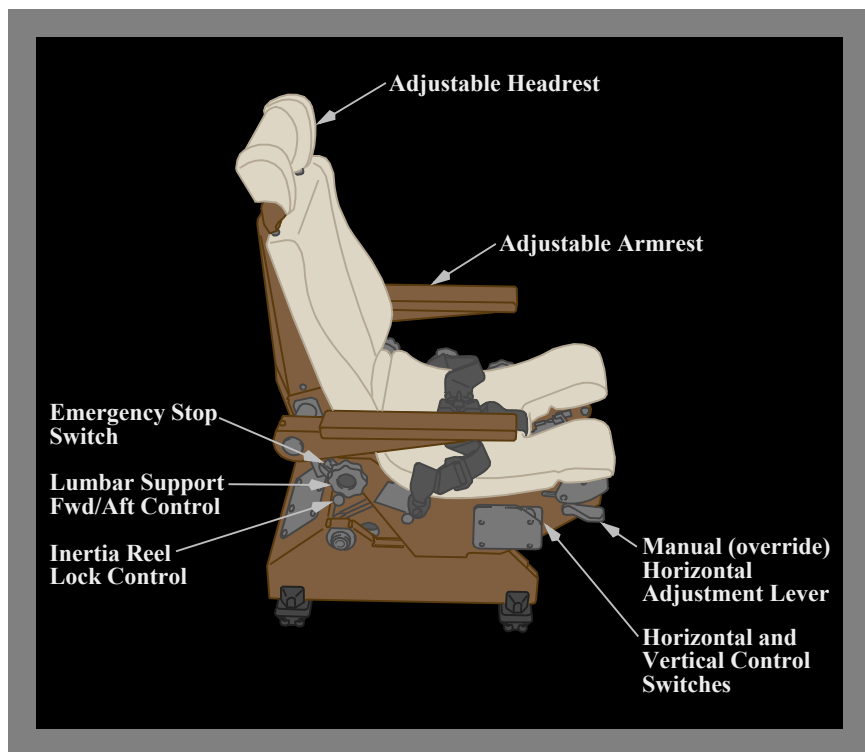
A main deck cargo door is located on the aft left side of the airplane. The door is operated from inside the airplane at either the forward or aft control panel. Each panel has lights that indicate the status of the door during opening and closing. Electric power to operate the door is supplied by the ground handling bus.

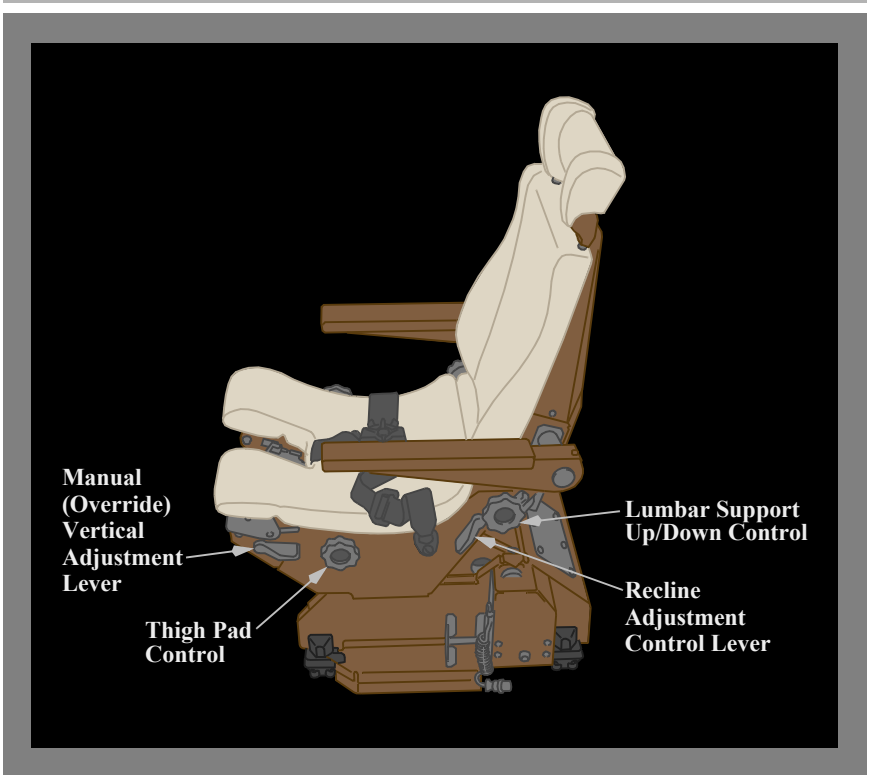
Flight Deck Seats

The flight deck has three seat types:

- pilot seats (captain and first officer)
- first observer seat
- second observer seat.

Pilot Seats





The pilot seats:

- recline
- adjust vertically
- adjust forward and aft
- adjust for thigh support
- adjust for lumbar support

The seats also have:

- adjustable armrests
- crotch straps
- inertial–reel shoulder harnesses with manual locks
- lap belts
- adjustable headrests

The seats move outboard during the last two inches of aft travel. Electric and manual controls provide forward, aft, and vertical adjustment. Manual levers provide other adjustments.

WARNING: Seat must be in FWD straight section of tracks during taxi, takeoff and landing.

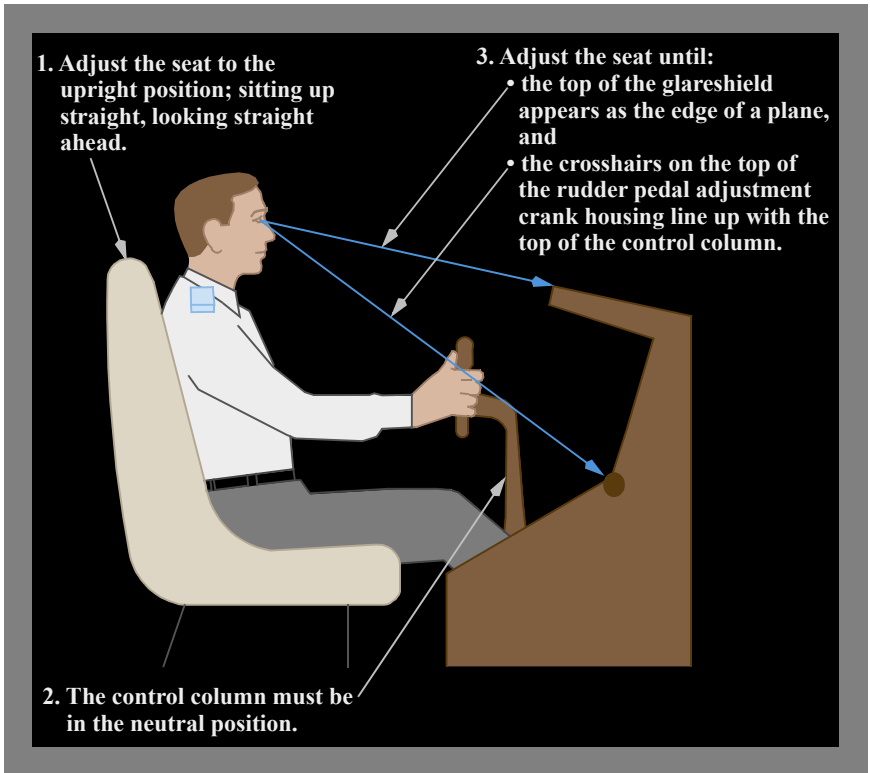
WARNING: When manually adjusting the vertical seat position, pilots should use their legs and/or the overhead hand-hold to unload their weight from the seat prior to releasing the manual lever. A weighted seat may rapidly fall to the full down position upon lever release and may result in personal injury.

WARNING: When using the Manual (override) Horizontal Adjustment Lever to move the seat, ensure the seat motion has stopped before releasing the lever. Releasing the Manual (override) Horizontal Adjustment Lever while the seat is still moving can damage the seat actuator. Manually moving the seat to the forward or aft stop is permissible as it does not impact the seat actuator.

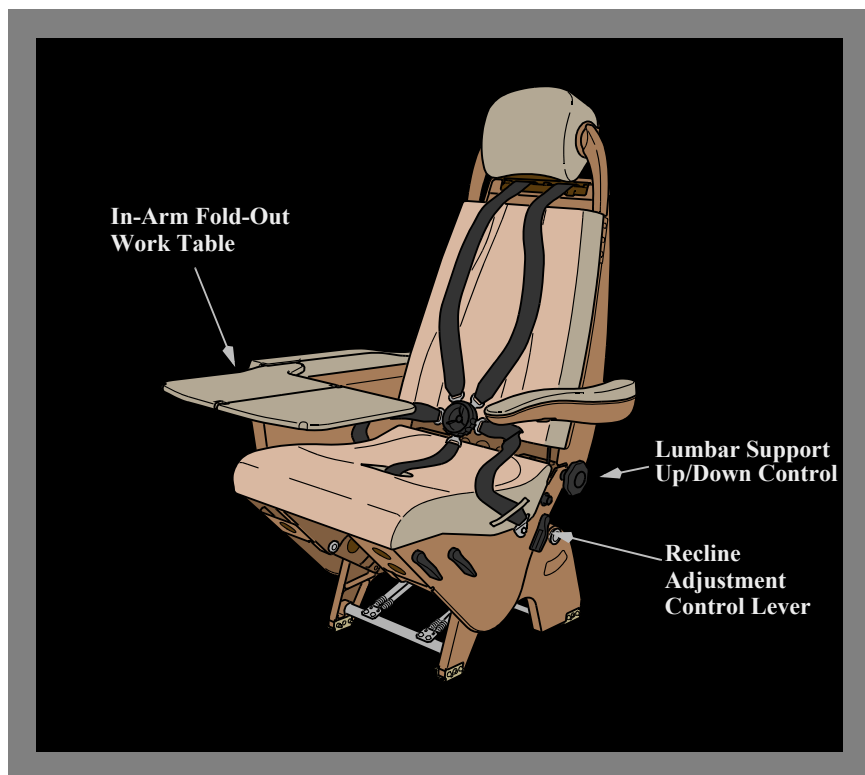
Lumbar and thigh pad support can be adjusted using the adjustment hand wheels. Armrest pitch can be adjusted using the control knob under the armrest. The armrests can be stowed vertically for easier seat access. The headrest angle can be adjusted by moving the cushion to the right and turning it. There are eight positions.

Adjust the seat to obtain the optimum eye position as shown on the following illustration.

Pilot Seat Adjustment



Observer Seats



The first observer seat is pedestal-mounted. It adjusts manually in the vertical, forward and aft directions. The seat has:

- a folding arm rest on the left side
- crotch strap
- inertial-reel shoulder harness with manual locks
- lap belt
- adjustable headrest.
- lumbar support
- fold-out work table.

The second observer seat is not adjustable. The seat has:

- folding arm rests
- crotch strap
- shoulder harness with manual locks
- lap belt
- adjustable headrest.

**Airplane General, Emergency
Equipment, Doors, Windows
EICAS Messages****Chapter 1****Section 60****Airplane General, Emergency Equipment, Doors, Windows
EICAS Messages**

The following EICAS messages can be displayed.

Message	Level	Aural	Message Logic
CREW OXYGEN LOW	Advisory		Crew oxygen pressure is low.

[Option - large aft cargo door]

DOOR AFT CARGO	Caution	Beeper	Cargo door is not closed and latched and locked.
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[Option - small aft cargo door]

DOOR AFT CARGO	Advisory		Cargo door is not closed and latched and locked.
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DOOR BULK CARGO	Advisory		Bulk cargo door is not closed and latched and locked.
DOOR E/E, FWD ACCESS	Advisory		Access door is not closed and latched and locked.

[777-200, 777-200ER, and 777-200LR]

DOOR ENTRY 1-4L, R	Advisory		Entry door is not closed and latched and locked.
-----------------------	----------	--	--

[777-300 and 777-300ER]

DOOR ENTRY 1-5L, R	Advisory		Entry door is not closed and latched and locked.
-----------------------	----------	--	--

[777F]

DOOR ENTRY 1L, 1R	Advisory		Entry door is not closed and latched and locked.
----------------------	----------	--	--

Message	Level	Aural	Message Logic
DOOR FWD CARGO	Caution	Beeper	Cargo door is not closed and latched and locked.

[777F]

DOOR MAIN DECK CARGO	Caution	Beeper	Main deck cargo door is not closed and latched and locked.
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[777-300 and 777-300ER]

DOOR WING SLIDE L, R	Advisory		The door for the unpressurized wing slide compartment is not closed and locked.
-------------------------	----------	--	---

DOORS	Advisory		Two or more doors are not closed and latched and locked.
-------	----------	--	--

[Option]

ELT ON	Advisory		Emergency locator transmitter is on.
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EMER LIGHTS	Advisory		Emergency lighting system has been manually activated or emergency lights switch is OFF.
-------------	----------	--	--

[Option]

PASS OXYGEN LOW	Advisory		Passenger oxygen pressure is low.
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[Passenger]

PASS OXYGEN ON	Advisory		Passenger oxygen system is activated.
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[Freighter]

SUPRNMRY OXYGEN LOW	Advisory		Supernumerary oxygen pressure is low.
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[Freighter]

SUPRNMRY OXYGEN ON	Advisory		Supernumerary oxygen system is activated.
-----------------------	----------	--	---

Message	Level	Aural	Message Logic
WINDOW FLT DECK L, R	Advisory		Side window is not closed and latched.
WINDOWS	Advisory		Left and right side windows are not closed and latched.

EICAS Memo Messages

Message	Level	Aural	Message Logic
---------	-------	-------	---------------

[Optional messages]

DOORS AUTO	Memo		All entry doors are in the automatic mode.
DOORS AUTO/MANUAL	Memo		Some entry doors are in the automatic mode and some are in the manual mode.
DOORS MANUAL	Memo		All entry doors are in the manual mode.

[Optional messages]

DOORS AUTO	Memo		All entry doors are in the armed mode.
DOORS AUTO/MANUAL	Memo		Some entry doors are in the armed mode and some are in the disarmed mode.
DOORS MANUAL	Memo		All entry doors are in the disarmed mode.

[Optional messages]

DOORS AUTO	Memo		All entry doors are in the flight mode.
DOORS AUTO/MANUAL	Memo		Some entry doors are in the flight mode and some are in the park mode.
DOORS MANUAL	Memo		All entry doors are in the park mode.

Message	Level	Aural	Message Logic
NO SMOKING ON	Memo		NO SMOKING switch is in the on position.
PASS SIGNS ON	Memo		The NO SMOKING and SEAT BELTS switches are in the on position.
SEATBELTS ON	Memo		The SEAT BELTS switch is in the on position.

[Option]

THERAPEUTIC OXY ON	Memo		Therapeutic oxygen is on.
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Air Systems**Chapter 2****Table of Contents****Section TOC**

Controls and Indicators	2.10
Air Conditioning System	2.10.1
Air Conditioning Panel	2.10.1
Cabin Temperature Control	2.10.6
Shoulder and Foot Heaters	2.10.7
Cargo Temperature Control	2.10.8
Lower Cargo Temperature Control	2.10.9
Pressurization System	2.10.11
Pressurization Panel	2.10.11
Bleed Air Control	2.10.12
Duct Pressure and Pressurization System Indications	2.10.13
Air Synoptic Display	2.10.15
Air Conditioning System Description	2.20
Introduction	2.20.1
Air Conditioning Packs	2.20.1
Pack Ground Operation	2.20.2
Pack Non-Normal Operation	2.20.2
Standby Cooling Mode	2.20.2
Air Distribution	2.20.2
Alternate Ventilation System	2.20.3
Temperature Control	2.20.3
Crew Rest Area Temperature Control	2.20.5
Temperature Control With Loss of Trim Air	2.20.5
Operation With Complete Loss of Zone Temperature Control	2.20.5
Shoulder and Foot Heaters	2.20.6
Flight Deck Humidification System	2.20.6
Gasper System	2.20.6
Main Deck Air Flow Rate System	2.20.6

Cargo Temperature Control System	2.20.7
Cargo Heat System	2.20.7
Forward Cargo Compartment Air Conditioning System	2.20.7
Lower Cargo Air Conditioning System	2.20.8
Air Conditioning System Schematic	2.20.9
Equipment Cooling, Equipment Ventilation, Lavatory and Galley Ventilation	2.20.12
Pressurization System Description	2.30
Introduction	2.30.1
Pressurization System Automatic Operation	2.30.1
Cabin Altitude Controller Automatic Operation With Loss of Landing Altitude	2.30.2
Cabin Altitude Controller Automatic Operation With Loss of Cabin Pressurization	2.30.2
Pressurization System Manual Operation	2.30.2
Operation With Loss of Cabin Pressurization	2.30.3
Bleed Air System Description	2.40
Introduction	2.40.1
Engine Bleed Air Supply	2.40.1
APU Bleed Air Supply	2.40.1
APU to Pack Takeoff	2.40.1
Ground Bleed Air Supply	2.40.2
Bleed Air Duct System	2.40.2
Duct Leak and Overheat Detection System	2.40.2
Bleed Air System Schematic	2.40.4
EICAS Messages	2.50
EICAS Alert Messages	2.50.1
EICAS Memo Messages	2.50.3

Air Systems

Controls and Indicators

Chapter 2

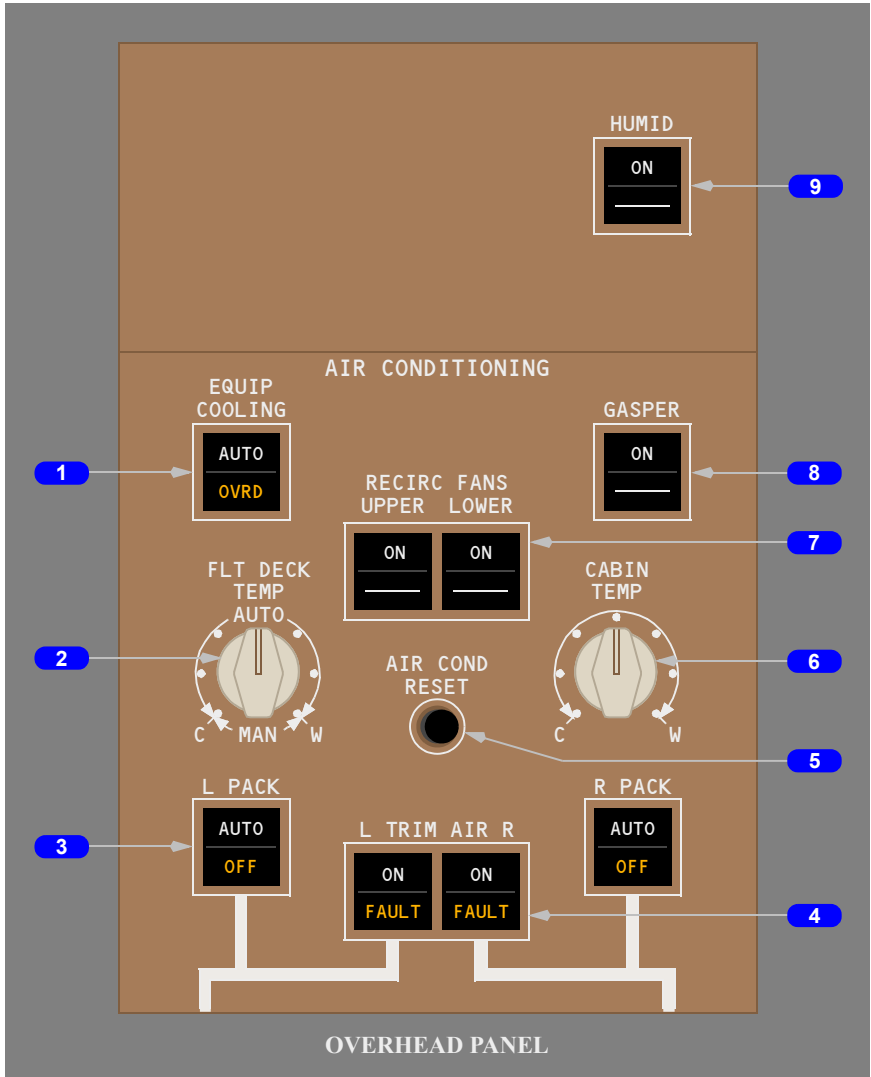
Section 10

Air Conditioning System

Air Conditioning Panel

[777-200/-300 Series]

[Options - Humidifier, Gasper]



1 Equipment Cooling (EQUIP COOLING) Switch

AUTO – equipment cooling is controlled automatically.

Off (AUTO not visible) –

- both equipment cooling supply fans are not operating
- the override valve is open
- the forward cargo heat valve is closed
- OVRD is illuminated

OVRD (override) illuminated (amber) – the equipment cooling override valve is open. The override valve opens and the equipment cooling system configures to override mode when:

- both equipment cooling supply fans are failed, or
- smoke is detected in the equipment cooling system, or
- the EQUIP COOLING switch is off, or
- the CARGO FIRE ARM FWD switch is in ARMED

2 Flight Deck Temperature (FLT DECK TEMP) Selector

AUTO – C to W sets the temperature from 65°F to 85°F (18°C to 29°C). Mid position (12 o'clock) sets approximately 75°F (24°C).

MAN (spring loaded to 6 o'clock position) –

- C (cool) - the flight deck trim air valve moves toward closed to supply cooler air
- W (warm) - the flight deck trim air valve moves toward open to supply warmer air

3 PACK Switches

AUTO – the pack is controlled automatically.

Off (AUTO not visible) – the pack flow control valve is commanded closed.

OFF illuminated (amber) – the pack flow control valve is closed. The valve is commanded closed and the OFF light is illuminated when:

- the pack valve is failed closed, or
- a pack or compressor outlet high temperature has occurred, or
- bleed air pressure is inadequate, or
- the R PACK valve is closed during APU to Pack Takeoff procedure, or
- the PACK switch is pushed off

4 TRIM AIR Switches

ON – the master trim air valve is commanded open and the zone trim air valves are controlled automatically.

Off (ON not visible) – the trim air valve is commanded closed

FAULT illuminated (amber) –

- the trim air valve is failed closed, or
- the trim air valve is commanded closed because a zone supply duct overheat has occurred, or
- the TRIM AIR switch is off
- if a single master trim air valve is failed closed or commanded closed, the other trim air valve continues to operate normally

5 Air Conditioning Reset (AIR COND RESET) Switch

Push –

- attempts to reset any closed pack flow control valve or trim air valve held closed because an overheat, control failure, or valve failure has occurred
- attempts to reset a failed recirculation fan
- resets fault protection

6 Cabin Temperature (CABIN TEMP) Selector

C to W – sets the temperature from 65°F to 85°F (18°C to 29°C). Mid position (12 o'clock) sets approximately 75°F (24°C).

7 Recirculation Fans (RECIRC FANS) Switches

ON – the recirculation fans are controlled automatically.

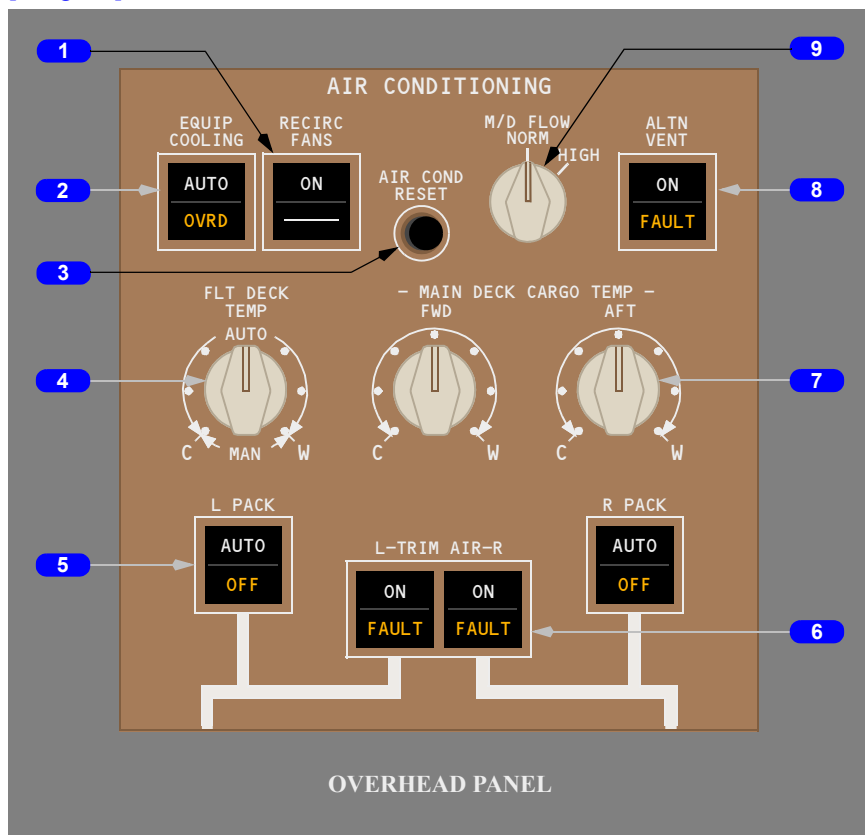
8 GASPER Switch

ON – the gasper fan operates.

9 Humidification (HUMID) Switch

ON – the humidifier is controlled automatically.

[Freighter]



1 Recirculation Fans (RECIRC FANS) Switch

ON – the recirculation fans are controlled automatically.

2 Equipment Cooling (EQUIP COOLING) Switch

AUTO – equipment cooling is controlled automatically.

Off (AUTO not visible) –

- both equipment cooling supply fans are not operating
- the override valve is open
- the forward cargo heat valve is closed
- the nitrogen generation system (NGS) is shut down
- OVRD is illuminated

OVRD (override) illuminated (amber) – equipment cooling override valve is open. The override valve opens and the equipment cooling system configures to override mode when:

- both equipment cooling supply fans are failed, or
- smoke is detected in the equipment cooling system, or
- the EQUIPMENT COOLING switch is off, or
- the CARGO FIRE ARM FWD switch is in ARMED

3 Air Conditioning Reset (AIR COND RESET) Switch

Push –

- attempts to reset any closed pack valve flow control valve or trim air valve held closed because an overheat, control failure, or valve failure has occurred
- attempts to reset a failed recirculation fan
- resets fault protection

4 Flight Deck Temperature (FLT DECK TEMP) Selector

AUTO – C to W sets the temperature from 65°F to 85°F (18°C to 29°C). Mid position (12 o'clock) sets approximately 75°F (24°C).

MAN (spring loaded to 6 o'clock position) –

- C (cool) - the flight trim air valve moves toward closed to supply cooler air
- W (warm) - the flight deck trim air valve moves toward open to supply warmer air

5 PACK Switch

AUTO – the pack is controlled automatically.

Off (AUTO not visible) – the pack flow control valve is commanded closed.

OFF illuminated (amber) – the pack flow control valve is closed. The valve is commanded closed and the OFF light is illuminated when:

- the pack valve is failed closed, or
- a pack or compressor outlet high temperature has occurred, or
- bleed air pressure is inadequate, or
- the R PACK valve is closed during APU to Pack Takeoff procedure, or
- the PACK switch is pushed off.

6 TRIM AIR Switch

ON – the master trim air valve is commanded open and the zone trim air valves operate automatically.

Off (ON not visible) – the trim air valve is commanded closed.

FAULT illuminated (amber) –

- the trim air valve is failed closed, or
- the trim air valve is commanded closed because a zone supply duct overheat has occurred, or
- the TRIM AIR switch is off.

7 Main Deck Cargo Temperature (MAIN DECK CARGO TEMP) Selector

C to W sets temperature between 40°F and 80°F (4°C and 27°C). Mid position (12 o'clock) sets approximately 60°F (16°C).

8 Alternate Ventilation (ALTN VENT) Switch

ON –

- the alternate ventilation system fan operates and the alternate ventilation system shutoff valves are open
- the lavatory galley vent fans are shut down and the lavatory galley shutoff valve are closed.

FAULT illuminated (amber) – a fault is occurring in the alternate ventilation system.

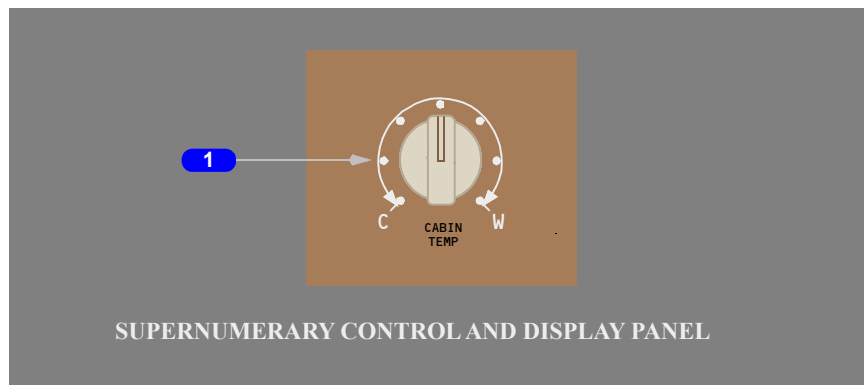
9 Main Deck Air Flow Rate (M/D FLOW) Selector

NORM – pack airflow is controlled automatically.

HIGH – all operating packs are configured to high flow.

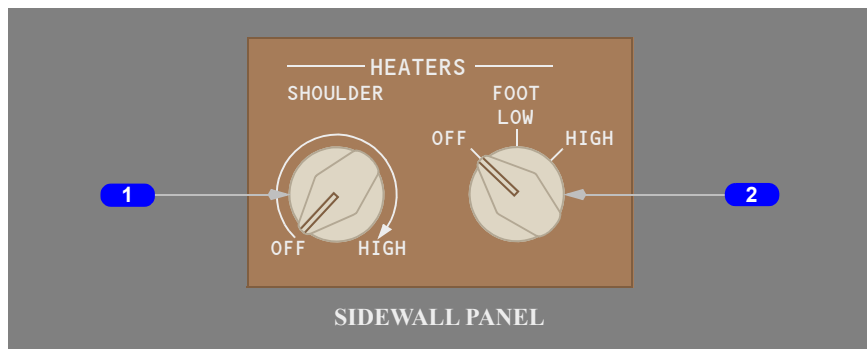
Cabin Temperature Control

[Freighter]



1 Cabin Temperature (CABIN TEMP) Selector

C to W sets the temperature from 65°F to 85°F (18°C to 29°C). Mid position (12 o'clock) sets approximately 75°F (24°C).

Shoulder and Foot Heaters**1 SHOULDER HEATER Control**

OFF to HIGH – the electric heater adds heat to the condition air supplied at shoulder level.

2 FOOT HEATER Selector

Heating rate varies based on HI and LO selection. Heater is inhibited when the temperature of the foot heater plate is above 65°F (18°C).

OFF – the under-floor electric heater is not operating.

LOW – the under-floor electric heater operates at a low heating rate.

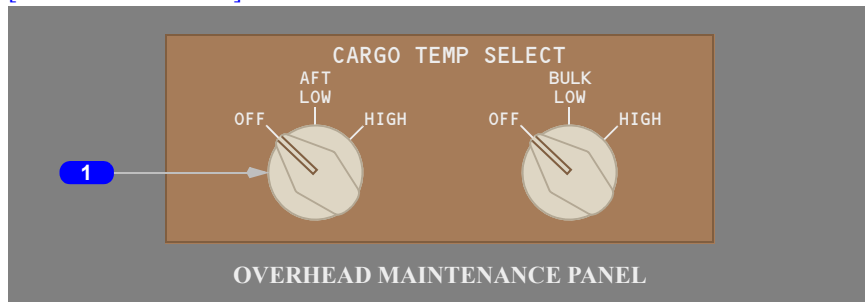
HIGH – the under-floor electric heater operates at a high heating rate.

Cargo Temperature Control

[Passenger]

Aft and Bulk Cargo Temperature Control

[777-200/-300 Series]



1 CARGO TEMPERATURE Selectors

OFF - shuts off bleed air to the associated compartment.

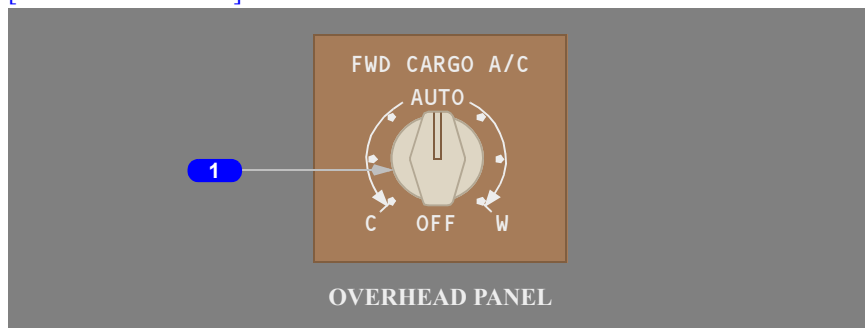
LOW – bleed air heating system maintains the compartment temperature between 40°F and 50°F (4°C to 10°C).

HIGH – bleed air heating system maintains the compartment temperature between 65°F and 75°F (18°C to 24°C). For the bulk compartment only, the bulk compartment ventilation fan operates continuously.

Forward Cargo Air Conditioning Control

[777 All Passenger Models- Option]

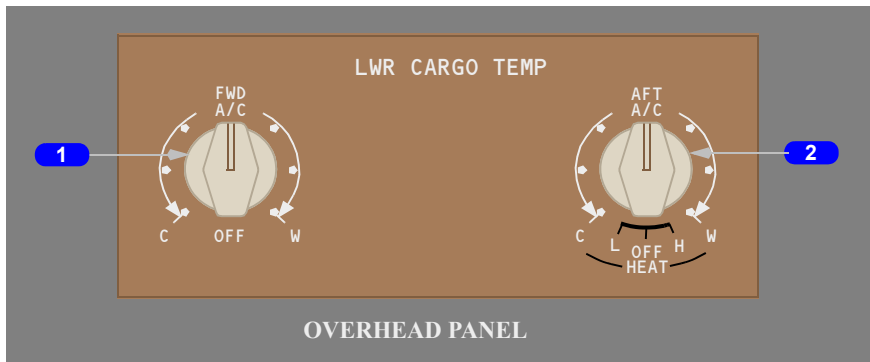
[777-200/-300 Series]



1 Forward Cargo Air Conditioning (FWD CARGO A/C) Selector

AUTO –

- C to W sets the temperature from 40°F to 80°F (4°C to 27°C). Mid position (12 o'clock) sets approximately 60°F (16°C)
- forward cargo compartment heating system does not operate

Lower Cargo Temperature Control[\[Freighter\]](#)**Lower Cargo Temperature Panel**[\[Option – Freighter - Lower Aft Cargo A/C\]](#)**1 Lower Cargo Temperature Forward (LWR CARGO TEMP FWD) Selector**

A/C – C to W sets the temperature from 40°F to 80°F (4°C to 27°C). Mid position (12 o'clock) sets approximately 60°F (16°C).

2 Lower Cargo Temperature Aft (LWR CARGO TEMP AFT) Selector

A/C –

- C to W sets the temperature from 40°F to 80°F (4°C to 27°C). Mid position (12 o'clock) sets approximately 60°F (16°C).
- lower aft cargo compartment bleed air heating system does not operate

Low (L) –

- bleed air heating system maintains compartment temperature between 40°F and 50°F (4°C and 10°C)
- lower aft cargo compartment air conditioning does not operate

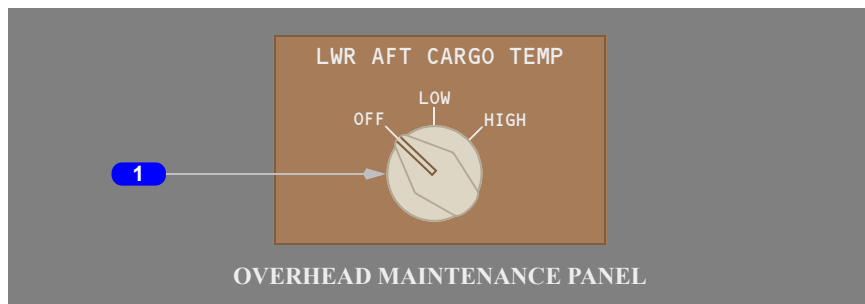
High (H) –

- bleed air heating system maintains the compartment temperature between 65°F and 75°F (18°C and 24°C)
- lower aft cargo compartment air conditioning does not operate

Lower Cargo Temperature Panels

[Option –Freighter - without Lower Aft Cargo A/C]

Lower Aft Cargo Temperature Panel



1 Lower Aft Cargo Temperature (LWR AFT CARGO TEMP) Selector

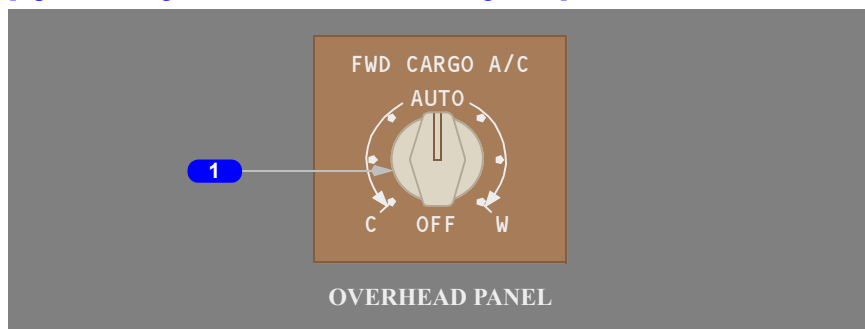
OFF – the bleed air heating system does not operate.

LOW – the bleed air heating system maintains the temperature between 40°F and 50°F (4°C and 10°C).

HIGH – the bleed air heating system maintains the temperature between 65°F and 75°F (18°C and 24°C).

Lower Forward Cargo Air Conditioning Panel

[Option – Freighter - without Lower Aft Cargo A/C]



1 Lower Forward Cargo Air Conditioning (FWD CARGO A/C) Selector

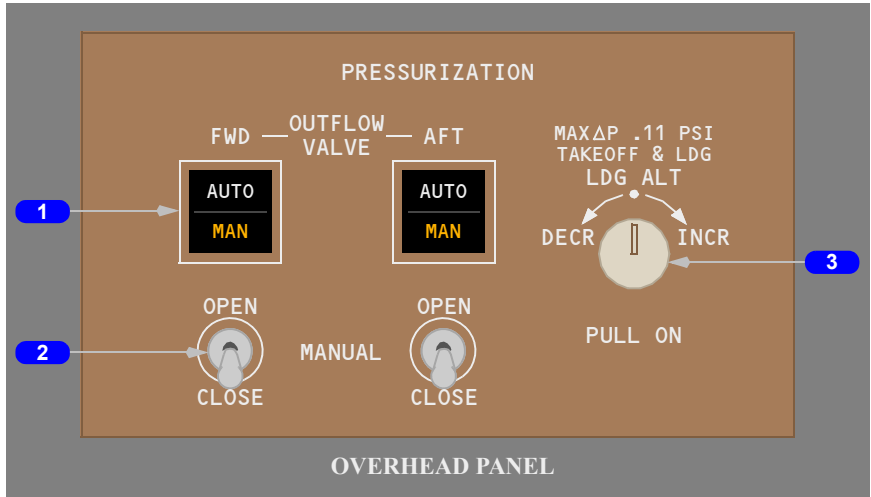
AUTO –

- lower forward cargo compartment conditioned air temperatures controlled automatically
- range C to W sets temperature between 40°F and 80°F (4°C and 27°C). Mid position (12 o'clock) sets approximately 60°F (16°C).

Pressurization System

Pressurization Panel

[777-200/-300 Series]



1 OUTFLOW VALVE Switches

AUTO – the outflow valve is controlled automatically.

MAN (manual) illuminated (amber) –

- outflow valve is controlled manually
- automatic outflow valve control and cabin altitude limiter is bypassed
- AUTO is extinguished

2 OUTFLOW VALVE MANUAL Switches

OPEN – moves the outflow valve toward open.

CLOSE – moves the outflow valve toward closed.

3 Landing Altitude (LDG ALT) Selector

Pull ON, then rotate –

- sets landing altitude manually
- landing altitude followed by MAN is displayed on EICAS

[777-200/-300 Series]

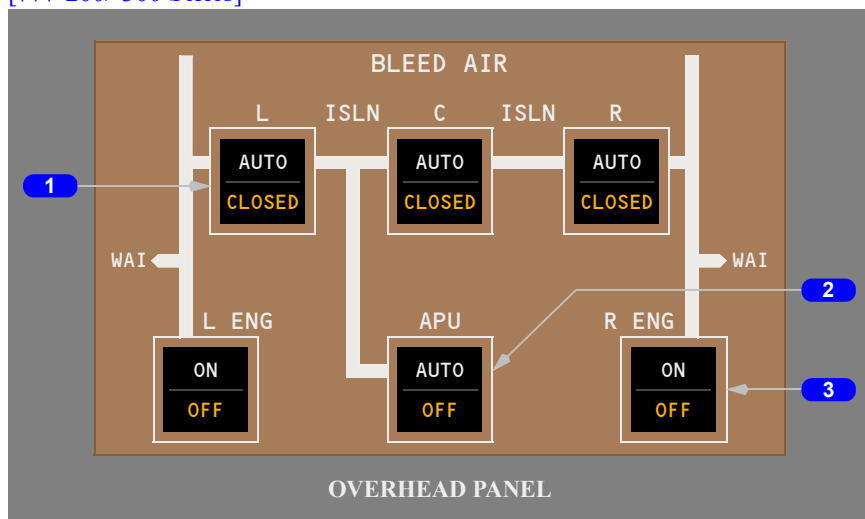
- landing altitude changes in 100 foot increments at first detent, 500 foot increments at second detent

Push –

- landing altitude is set automatically from FMS – Refer to Chapter 11, Flight Management Navigation – Approach
- landing altitude followed by AUTO is displayed on primary EICAS

Bleed Air Control

[777-200/-300 Series]



1 Bleed Isolation (ISLN) Switches

AUTO – the bleed isolation valve is controlled automatically.

Off (AUTO not visible) – the valve is commanded closed.

CLOSED illuminated (amber) –

- the valve is closed because a duct leak or bleed loss has occurred, or
- the valve is failed closed, or
- the switch is off

2 APU Bleed Switch

AUTO – the APU bleed air valve opens by system logic when bleed air pressure is available.

Off (AUTO not visible) – the valve is commanded closed.

OFF illuminated (amber) –

- the valve is closed because a duct leak has occurred
- the valve is failed closed, or
- the switch is off, or
- the APU fire switch is pulled out

3 Engine (ENG) Bleed Switches

ON – the engine bleed valve opens when engine bleed air is available.

Off (ON not visible) – the valve is commanded closed.

OFF illuminated (amber) – the engine bleed valve is closed. The engine bleed valve is commanded closed and the OFF light is illuminated when:

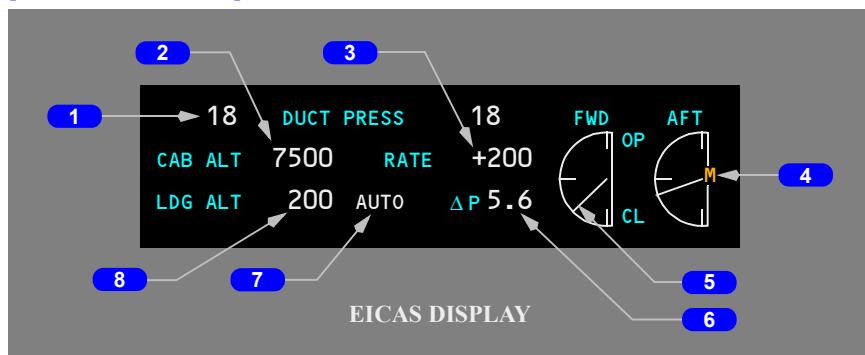
- the engine is not running, or
- a bleed air overheat, overpressure, or bleed control system failure has occurred, or
- the valve is failed closed, or
- the L ENG bleed valve is closed during APU to Pack Takeoff procedure, or
- the ENG fire switch is pulled out, or
- the switch is off

Duct Pressure and Pressurization System Indications

Pressurization system indications are displayed when:

- landing altitude MAN is displayed
- either OUTFLOW VALVE switch is in MAN
- cabin altitude is in amber above normal range or in red excessive range
- cabin differential pressure is in amber above normal range or in red excessive range
- duct pressure is in amber below normal range with the respective engine running
- the AIR synoptic switch is pushed
- any of the following EICAS messages are displayed:
 - CABIN ALTITUDE
 - CABIN ALTITUDE AUTO
 - LANDING ALTITUDE
 - OUTFLOW VALVE AFT
 - OUTFLOW VALVE FWD.

[777-200/-300 Series]



1 Duct Pressures

White – normal range.

Amber – below normal range.

2 Cabin Altitude

White – normal range.

Amber – above normal range.

Red – excessive cabin altitude.

3 Cabin Altitude Rate

+ (plus) – rate of climb.

– (minus) – rate of descent.

4 Outflow Valve Control Source

M (manual) (amber) – manual control.

Blank – automatic control.

5 Outflow Valves Position

OP – open.

CL – closed.

6 Cabin Differential Pressure

White – normal range.

Amber – above normal range.

Red – excessive cabin differential pressure.

7 Landing Altitude Selection

AUTO (white) – altitude is set automatically from the FMC.

MAN (amber) – altitude is set by the LANDING ALTITUDE selector.

8 Landing Altitude

Landing altitude is supplied by the FMC or is manually set using the LANDING ALTITUDE selector.

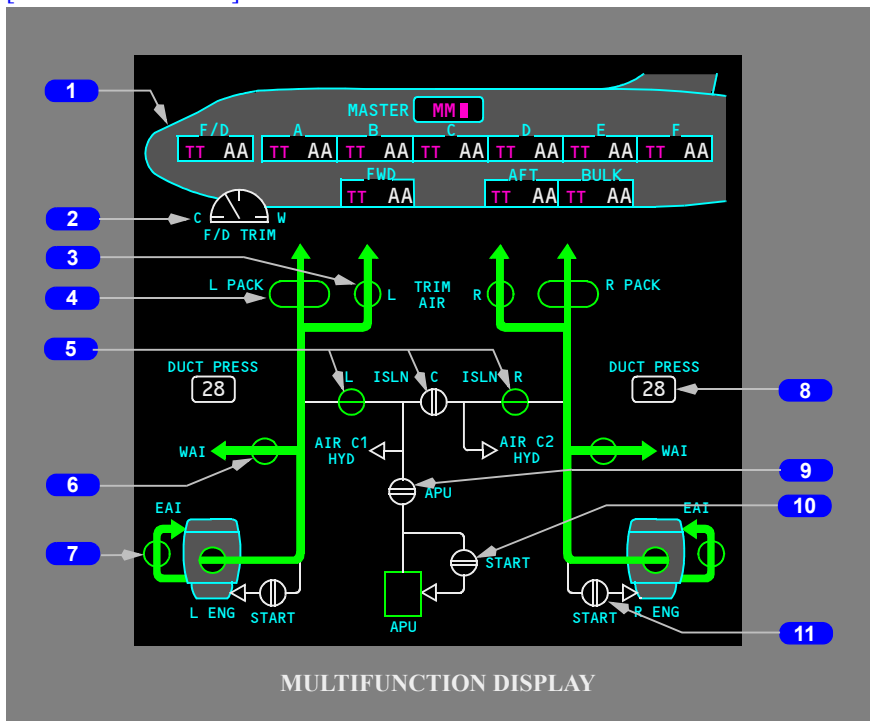
Blank – display is blank without a valid FMC landing altitude or a manually set landing altitude.

Air Synoptic Display

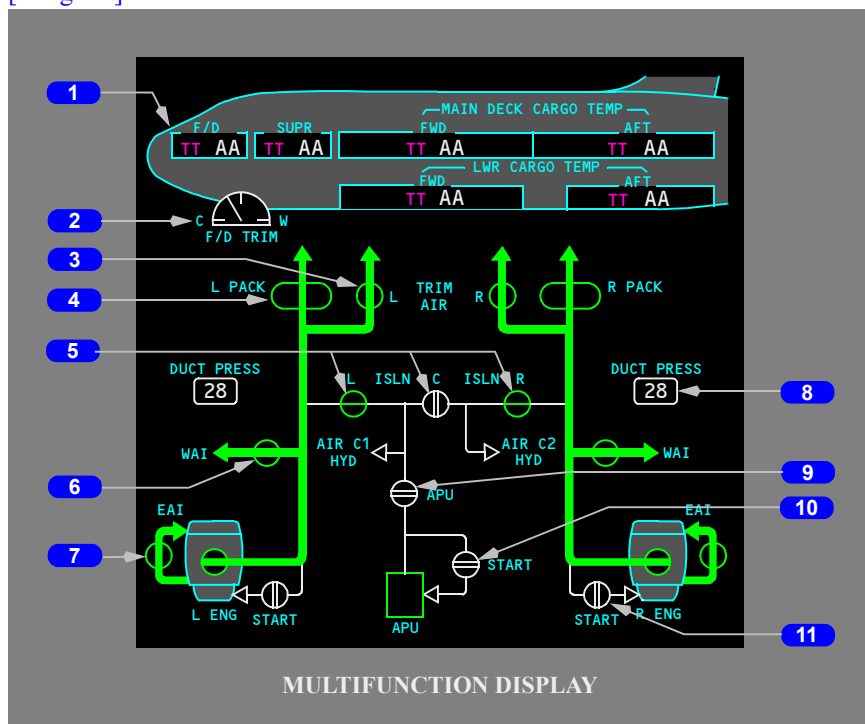
The air systems synoptic is displayed by pushing the AIR Synoptic switch on the Display Select panel. Display Select panel operation is described in Chapter 10, Flight Instruments, Displays.

Air flow displayed is generated by displayed valve positions, switch positions, and pack status. It does not display actual air flow, therefore the display may not represent actual system operation.

[777-200/-300 Series]



[Freighter]



[777 All Passenger Models]

1 Zone Temperature

MASTER - (MM) temperature setting of Passenger Temperature selector.

F/D -

- (TT) target temperature on left; displayed when:
 - at least one pack is operating, and
 - FLT DECK TEMP selector is in AUTO, and
 - temperature control is not in backup mode
- (AA) actual temperature on right

A, B, C, D, E, and F -

- (TT) target temperature on left; displayed when:
 - at least one pack is operating, and
 - temperature control is not in backup mode
- (AA) actual temperature on right

FWD, AFT, BULK -

- (TT) target temperature on left; displayed when:
 - at least one pack is operating, and
 - temperature selector is in A/C, and
 - temperature control is not in backup mode
- (AA) actual temperature on right

1 Zone Temperature

F/D, SUPR -

- (TT) target temperature on left; displayed when:
 - at least one pack is operating, and
 - the FLT DECK TEMP selector is in AUTO, and
 - temperature control is not in backup mode
- (AA) actual temperature on right

MAIN DECK CARGO FWD, MAIN DECK CARGO AFT -

- (TT) target temperature on left; displayed when:
 - at least one pack is operating, and
 - temperature control is not in backup mode
- (AA) actual temperature on right

LOWER CARGO TEMP FWD, LOWER CARGO TEMP AFT -

- (TT) target temperature on left; displayed when:
 - at least one pack is operating, and
 - the LOWER CARGO TEMP selector is in A/C, and
 - temperature control is not in backup mode
- (AA) actual temperature on right

2 Flight Deck Trim Air Valve position

Position of the flight deck trim air valve.

3 Trim Air Valve

Position of the trim air valve.

4 Pack Control

Pack is operating - green oval

Pack is not operating or pack status data is invalid - white oval

Pack failed - amber oval with amber X

5 Isolation Valve

Position of the isolation valve.

6 Wing Anti-Icing Valve

Position of the wing anti-icing valve.

7 Engine Anti-Icing Valve

Position of the engine anti-icing valve.

8 Bleed Air Duct Pressure

White - 11 psi or greater.

Amber - less than 11 psi.

9 APU Bleed Air Valve

Position of the APU bleed air valve.

10 APU Start Valve

Position of the APU start valve.

11 Engine Start Valve

Position of the engine start valve.

Positions of the trim air, wing anti-icing, engine anti-icing, engine start, isolation, APU bleed air, and APU start valves are displayed as:

- open - white circle with bars in-line with duct
- closed - white circle with bars across duct
- failed open - amber valve open symbol with amber X
- failed closed - amber valve closed symbol with amber X
- valve position data is not available - white circle with no bars
- for wing anti-icing valve not in commanded position - amber valve symbol with amber X
- for isolation and APU bleed air valves selected closed - amber valve closed symbol with amber X

Air Systems**Chapter 2****Air Conditioning System Description****Section 20****Introduction**

The air conditioning system supplies conditioned bleed air and recirculated cabin air at a controlled temperature throughout the airplane.

The system supplies conditioned air to the flight deck shoulder heaters.

[777 All Passenger Models]

The system supplies ventilation for the passenger cabin:

- lavatories
- galleys

[Option – Gasper]

- individual passenger seat gaspers

[777 All Passenger Models]**[Option – Crew Rest Compartments]**

- lower crew rest compartment
- overhead crew rest compartments
- flight deck crew rest compartment

[Freighter]

The system supplies ventilation for the crew rest, lavatory, and galley.

Pack control, zone temperature control, cabin air recirculation, fault detection, and overheat protection are all automatic. Backup system control modes operate automatically in the event of system failures.

[777 All Passenger Models]**[Option – Forward Cargo A/C]**

The airplane is divided into eight temperature zones: the flight deck, six passenger cabin zones, and the forward cargo compartment.

[Freighter]**[Option – Lower Aft Cargo A/C]**

The airplane is divided into six temperature zones: the flight deck, supernumerary cabin, forward and aft main deck cargo zones, and the forward and aft lower cargo compartments.

Air Conditioning Packs

Two identical air conditioning packs cool bleed air from the engines, APU, or high pressure air from a ground source. Bleed air is precooled before entering the pack. Each pack is controlled by two redundant channels in one of two separate controllers. If one channel fails in a controller, control of the respective pack is continued automatically by the redundant channel in that controller.

Pack Ground Operation

Both air conditioning packs are normally selected to AUTO for ground operations. Fuel consumption is about the same for single pack and two pack operation, and single pack operation causes higher flight line noise levels.

A ground source of conditioned air may be used to supply conditioned air directly to the cabin distribution system, eliminating the need for pack operation.

Pack Non–Normal Operation

Pack control, fault detection, and overheat protection are all automatic. If an overheat or other significant pack fault is detected, the pack shuts down automatically. An attempt to restore pack operation may be made by pressing the AIR COND RESET switch.

Standby Cooling Mode

For certain internal malfunctions, pack control automatically uses standby cooling mode as a backup to normal mode. In standby cooling mode, the EICAS advisory message PACK MODE (L, R) is displayed, and STBY COOLING is displayed in amber on the AIR synoptic.

If one pack is in standby cooling and the other pack is operating normally, the pack in standby cooling mode shuts down at lower altitudes and higher outside air temperatures when ambient conditions do not permit standby cooling. The pack restarts automatically when altitude and outside air temperatures are suitable for standby cooling.

If both packs are in standby cooling mode, or if one pack is inoperative and the other pack is in standby cooling mode, the packs or pack operates continuously to maintain cabin pressurization, regardless of altitude or outside air temperature.

In standby cooling mode, pack cooling capacity may be less than in normal mode and may result in warm flight deck or cabin temperatures at lower altitudes.

Air Distribution

[777 All Passenger Models]

The flight deck receives 100% fresh conditioned air from the left pack. The flight deck is maintained at a slightly higher pressure than the passenger cabin to prevent smoke and objectionable odors from entering the flight deck.

[Freighter]

The flight deck and supernumerary cabin receive 100% fresh conditioned air from the left pack. To prevent smoke and objectionable odors from entering the occupied compartments, the flight deck and supernumerary cabin are maintained at a slightly higher pressure than the main deck cargo and lower cargo compartments.

[\[777 All Passenger Models\]](#)

Recirculation fans assist the packs to maintain a constant ventilation rate through the cabin. The fans draw cabin air through filters, then reintroduce the air into the conditioned air distribution system.

[\[Freighter\]](#)

Recirculation fans assist the packs to maintain a constant ventilation rate through the cargo compartments. The fans draw cabin air through filters, then reintroduce the air into the cargo conditioned air distribution system.

[\[777 All Passenger Models\]](#)

Air exhausted from the passenger cabin flows into the upper recirculation system or to the lower deck, where it is either exhausted overboard through outflow valves or drawn into the lower recirculation system. Air from the recirculation fans is mixed with pack air before entering the distribution ducts.

[\[Freighter\]](#)

Air exhausted from the main deck cargo compartment flows into the lower deck, where it is either exhausted overboard through outflow valves or drawn into the recirculation system. Air from the recirculation fans is mixed with pack air before entering the cargo compartment distribution ducts.

Alternate Ventilation System

[\[Freighter\]](#)

The alternate ventilation system provides air flow into the flight deck and supernumerary cabin when both air conditioning packs are inoperative. If the airplane is not pressurized normally and the ALTN VENT switch is ON, air is drawn from the aft outflow valve and provided to the flight deck and supernumerary cabin. When the airplane is pressurized normally and the ALTN VENT switch is ON, there is no air flow through the alternate ventilation system.

Temperature Control

Zone temperatures are controlled by the cabin air conditioning and temperature control system (CACTCS). Hot trim air from the bleed air system is added through trim air valves in the conditioned air supply ducts. The CACTCS modulates the zone trim air valves to achieve the target temperature of the conditioned air in each zone.

[\[777 All Passenger Models\]](#)

[\[Option – Fwd Cargo A/C\]](#)

Trim air from the left engine bleed is added to conditioned air ducts for the flight deck and three passenger cabin zones. Trim air from the right engine is added to the conditioned air ducts for the other three passenger cabin zones and the forward cargo compartment.

[Freighter]

[Option – Lower Aft Cargo A/C]

Trim air from the left engine bleed is added to conditioned air ducts for the flight deck, supernumerary cabin, forward main deck cargo, and lower aft cargo compartments. Trim air from the right engine is added to the conditioned air ducts for the aft main deck cargo and lower forward cargo compartments, and the flight deck equipment cooling during flight.

[777 All Passenger Models]

The CABIN TEMP selector sets a master temperature between 65°F and 85°F (18°C and 29°C). The master reference temperature is increased or decreased automatically or manually to set target temperatures for each temperature zone.

[777 All Passenger Models]

For passenger comfort, the target temperature for each passenger cabin temperature zone increases automatically at a slow rate during the early part of cruise flight. This temperature increase is to compensate for a presumed decrease in passenger activity and humidity. During descent, the target temperatures decrease slowly until the comfort temperature corrections that were added are all removed. The target temperatures of each passenger cabin temperature zone may also be modified manually plus or minus 10°F (6°C), within the range of 65°F and 85°F (18°C and 29°C), using the cabin management system.

[777 All Passenger Models]

The FLT DECK TEMP selector sets the flight deck temperature to between 65°F and 85°F (18°C and 29°C). Flight deck temperature is controlled manually by setting the selector to MAN.

[Freighter]

The FLT DECK TEMP selector sets a temperature for the flight deck zone to between 65°F and 85°F (18°C and 29°C). Flight deck cabin temperature is controlled manually by setting the selector to MAN.

The CABIN TEMP Selector on the supernumerary control and display panel sets a temperature for the supernumerary cabin zone to between 65°F and 85°F (18°C and 29°C). Manual control is not available for the supernumerary cabin zone.

The temperature zone requiring the coolest temperature controls the pack outlet temperature.

[777 All Passenger Models]

If the flight deck or cabin temperature selector setting is unavailable to the pack temperature controller, the pack outlet temperature is regulated to achieve either the last temperature set or an average cabin temperature of 75°F (24°C).

[Freighter]

If the FLT DECK TEMP or MAIN DECK CARGO TEMP selector setting is unavailable to the pack temperature controller, the pack outlet temperature is regulated to achieve either the last temperature set or an average flight deck temperature of 75°F (24°C).

Crew Rest Area Temperature Control**[Option – Crew Rest Compartments]**

Crew rest area temperature may be controlled manually by the heater controls in the compartment.

Temperature Control With Loss of Trim Air**[777 All Passenger Models]**

If the left or right trim air system is off, the CACTCS attempts to maintain all zones at the average target temperature. Flight deck temperature will be maintained between 65°F and 85°F (18°C and 29°C).

[Freighter]

If the left or right trim air system is off, the CACTCS attempts to maintain all zones at the average selected temperature. Flight deck temperature will be maintained between 65°F and 85°F (18°C and 29°C).

[777 All Passenger Models]

The flight deck may become uncomfortably warm or cool. Setting the CABIN TEMP selector to a cooler or warmer master temperature may achieve a cooler or warmer flight deck temperature.

[Freighter]

The flight deck may become uncomfortably warm or cool. Setting the FWD or AFT MAIN DECK CARGO TEMP selector to a cooler or warmer temperature may achieve a cooler or warmer flight deck temperature.

**Operation With Complete Loss of Zone
Temperature Control****[777 All Passenger Models]**

If CACTCS control of cabin temperature zones fails, or all engine and APU electrical power fails, the air supply and cabin pressurization controllers control the pack flow control valves. Pack flow rate is modulated to achieve a pack outlet temperature between 40°F and 110°F (5°C and 43°C). All flight deck ECS controls are disabled except the PACK switches.

[Freighter]

If CACTCS control of cabin temperature zones fail, or all engine and APU electrical power fails, the air supply and cabin pressurization controllers control the pack flow control valves. Pack flow rate is modulated to achieve a pack outlet temperature between 40°F and 110°F (5°C and 43°C). All flight deck ECS controls are disabled except the PACK switches.

Shoulder and Foot Heaters

Flight crew shoulder heat is provided by electric elements in the side window air diffusers. The foot heaters have electric heating elements only, with no airflow. Both are available in flight only.

Flight Deck Humidification System

[Option]

The humidification system operates during cruise when the HUMID switch is ON. The system uses water from the potable water system to introduce moisture into the circulation air. Minerals in the potable water may precipitate as solids when the humidification system operates. These solids may circulate in the cabin as dust or haze.

Gasper System

[Option]

The gasper system fan supplies conditioned air from the aft cabin distribution duct to the passenger service unit air gasper outlets above each passenger seat.

Main Deck Air Flow Rate System

[Freighter]

Normal and High Main Deck Cargo flow modes can be selected by positioning the M/D FLOW switch on the ECS Control Module which is located in the overhead panel.

Normal flow mode is intended for most cargo types on the Main Deck Cargo compartment. During flight it schedules a lower airflow setting which conserves fuel. Additionally, the left recirculation fan does not operate during Normal flow mode.

High flow mode is intended for carrying live animals or perishable cargo. During High flow mode, all six shut-off valves are open. In High Flow mode the cruise fuel burn increase is expected to be an additional 0.2% to 0.5%.

During a "Class E" Main Deck Cargo fire fighting mode, all six shut-off valves close.

Cargo Temperature Control System

Cargo Heat System

[\[777-200/-300 Series Passenger\]](#)

The aft and bulk cargo compartments have independent bleed air heating systems. An insulated curtain separates the two compartments.

[\[777-200/-300 Series Passenger\]](#)

With the CARGO TEMP selector in LOW or HIGH, the respective cargo heat shutoff valve opens and the temperature control valve opens and closes to maintain the temperature in the compartment. The lavatory/galley vent fans draw air across temperature sensors in each compartment. If both vent fans fail, cargo heat is not provided.

[\[777-200/-300 Series Passenger\]](#)

With the CARGO TEMP selector in LOW and TAT less than 45°F (7°C), the respective temperature control valve opens. The compartment temperature is maintained between 40°F and 50°F (4°C and 10°C). With the CARGO TEMP selector in HIGH and TAT less than 70°F (21°C), the respective temperature control valve opens. The compartment temperature is maintained between 65°F and 75°F (18°C and 24°C).

[\[777-200/-300 Series Passenger\]](#)

With the BULK CARGO TEMP selector in HIGH the bulk ventilation fan operates. The fan is provided for animal carriage. The system has automatic overheat protection. When an automatic overheat shutdown occurs, cargo heat to the related compartment cannot be restored in flight.

[\[Freighter\]](#)

[\[Option – Lower Aft Cargo A/C\]](#)

With the LWR CARGO TEMP AFT selector in LOW and TAT less than 45°F (7°C) the temperature control valve opens. The compartment temperature is maintained between 40°F and 50°F (4°C and 10°C). With the selector in HIGH and TAT less than 70°F (21°C), compartment temperature is maintained between 65°F and 75°F (18°C and 24°C).

[\[777-200/-300 Series Passenger\]](#)

The lower forward cargo compartment is heated by warm air from the forward equipment ventilation system.

Forward Cargo Compartment Air Conditioning System

[\[Passenger\]](#)

[\[Option – Forward Cargo A/C\]](#)

With the FWD CARGO A/C selector in AUTO, the forward cargo heating system is shut off and a target temperature is displayed on the AIR synoptic.

Automatic ventilation ensures that smoke and objectionable odors do not enter the flight deck or passenger cabin.

If the selector setting is not available because of system failure, the packs maintain the last temperature set by the FWD CARGO A/C selector.

Lower Cargo Air Conditioning System

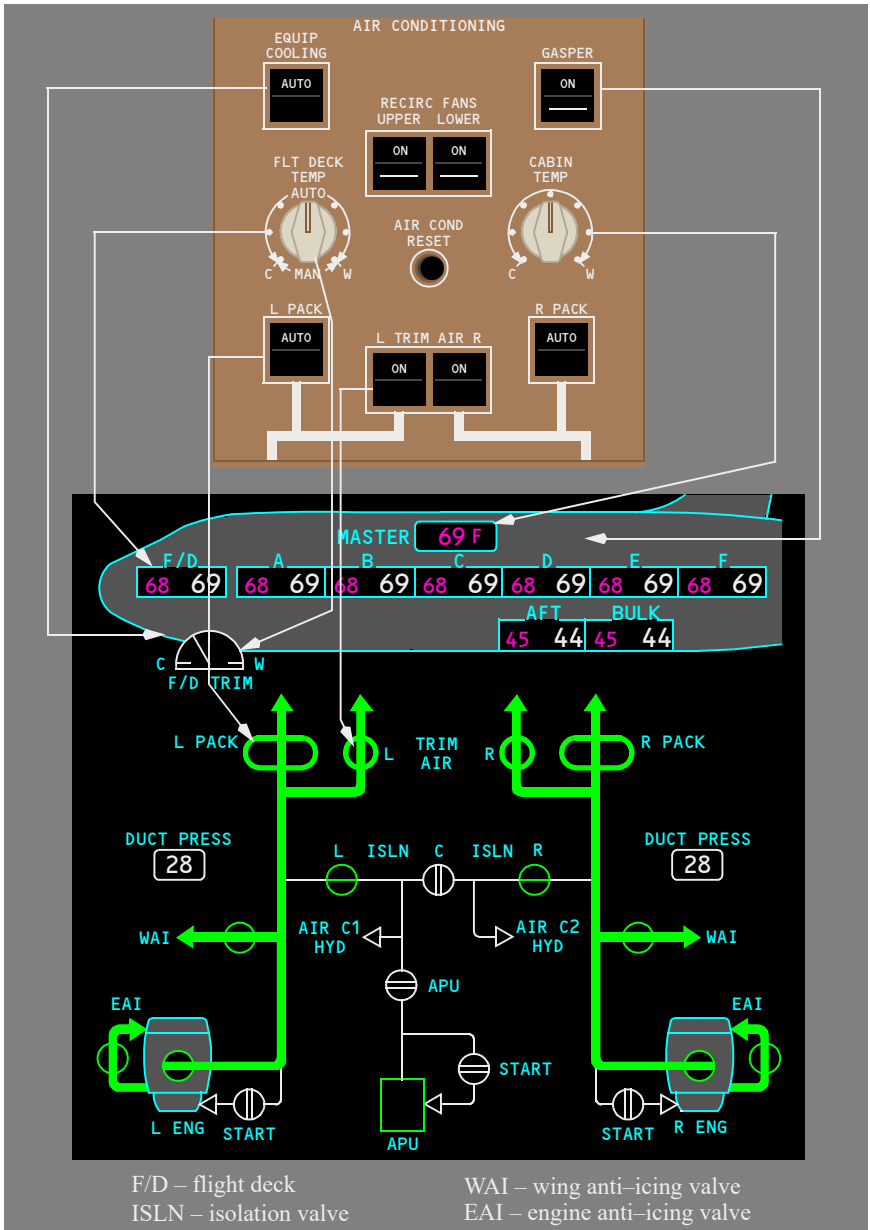
[Freighter]

[Option - Lower Aft Cargo A/C]

With the LWR CARGO TEMP FWD A/C selector or the LWR CARGO TEMP AFT A/C selector in AUTO, the respective cargo heating system is shut off and a target temperature for the compartment is displayed on the AIR synoptic.

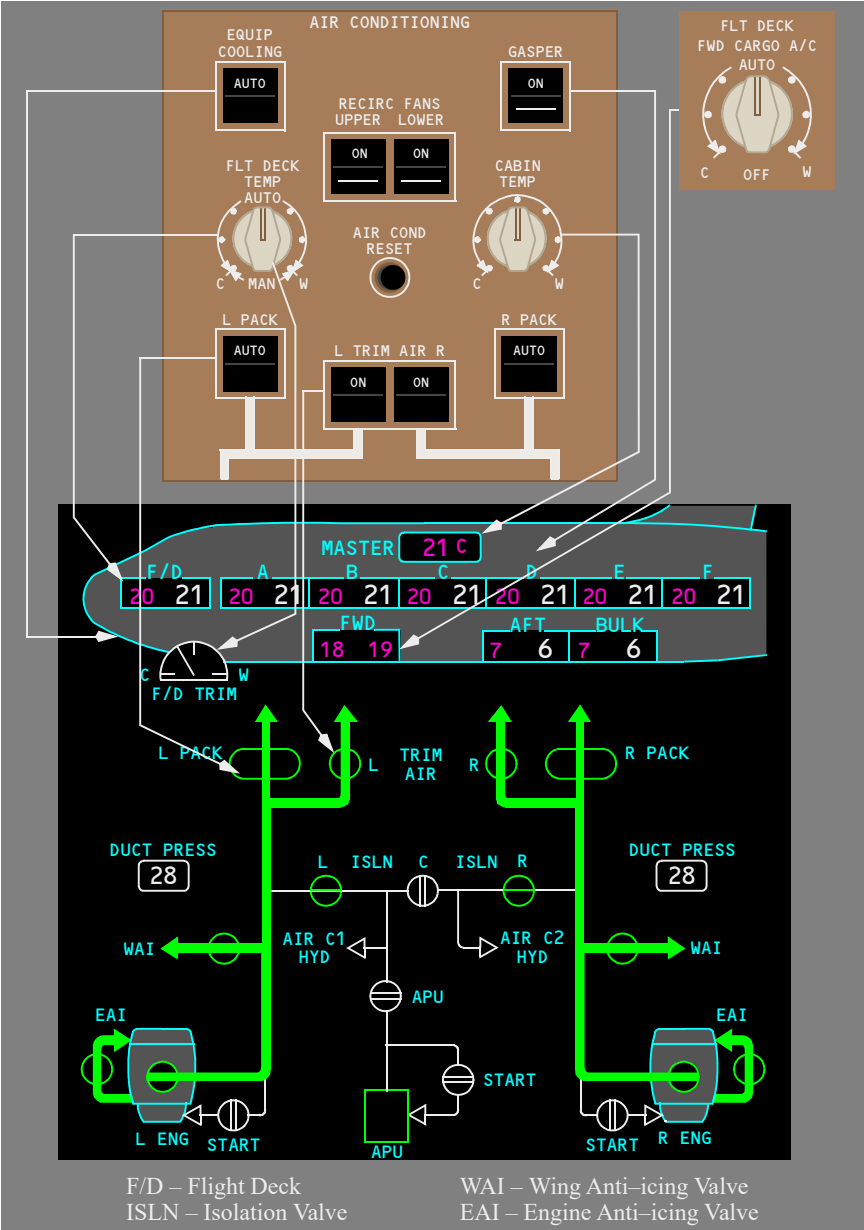
If a lower cargo temperature selector setting is not available because of system failure, the packs maintain the temperature of that compartment to the last temperature set by the respective forward or aft selector.

Air Conditioning System Schematic



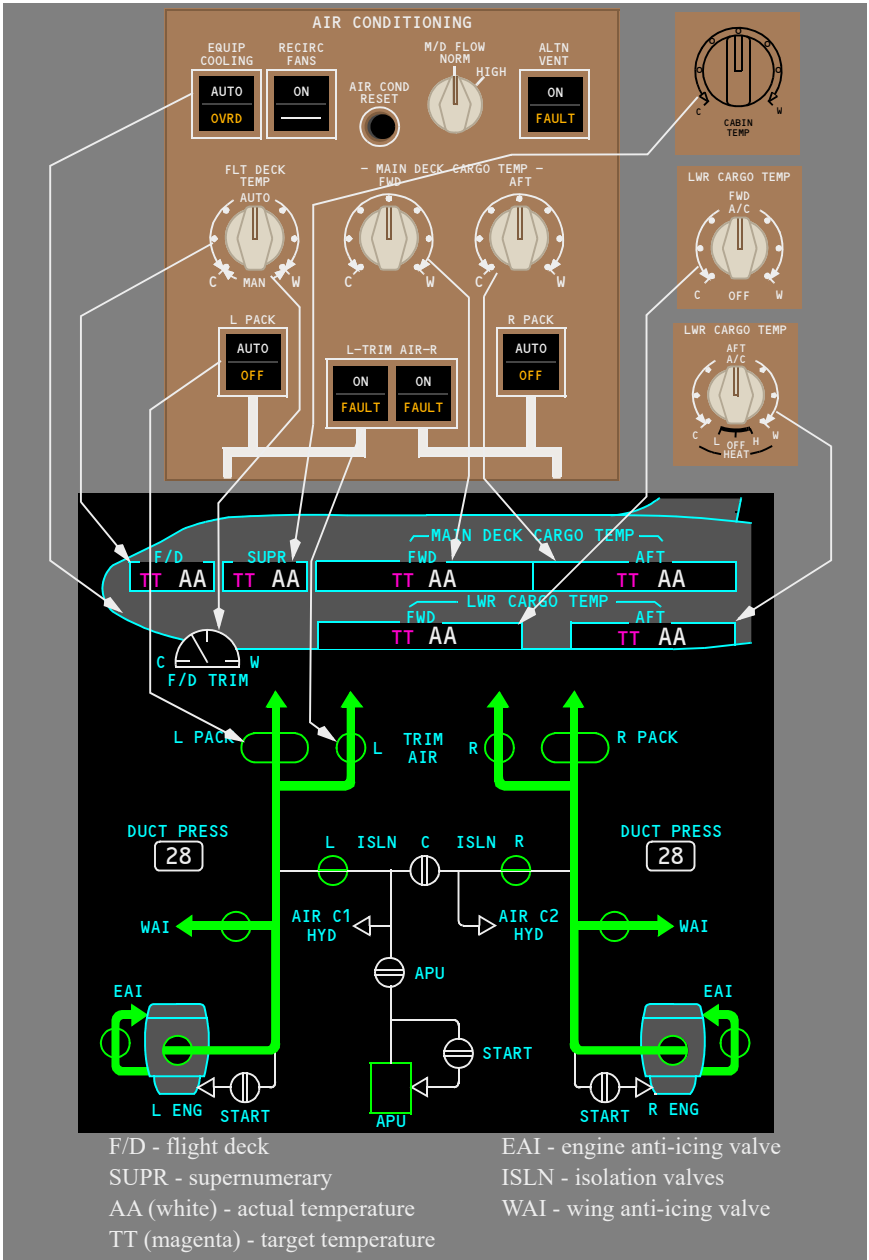
[777-200/-300 Series Passenger]

[Options – °C, Gasper, Fwd Cargo A/C]



[Freighter]

[Option - Lower Aft Cargo A/C]



Equipment Cooling, Equipment Ventilation, Lavatory and Galley Ventilation

[777-200/-300 Series]

The forward equipment cooling and ventilation provides cooling and ventilation for the electrical and electronic equipment on the flight deck and in the forward electrical and electronic (E & E) compartment equipment racks.

[777-200/-300 Series Passenger]

The forward systems use internal fans and valves to direct air drawn from the cabin to the equipment and ventilates the warm exhaust air into the forward outflow valve or the forward cargo compartment, if the compartment requires additional heat. There are two cooling system supply fans, a primary and a backup. If the primary supply fan fails, the backup supply fan operates automatically.

[Freighter]

The forward systems use internal fans and valves to direct conditioned pack air to the equipment and ventilates the warm exhaust air into the forward outflow valve or the lower forward cargo compartment if the compartment requires additional heat. There are two cooling system supply fans, a primary and a backup. If the primary supply fan fails, the backup supply fan operates automatically.

The forward system reconfigures automatically to an override mode when:

- in flight, both supply fans fail, or
- in flight, low airflow is detected, or
- smoke is detected in the forward equipment cooling system or the forward equipment ventilation system, or

[777-200/-300 Series Passenger]

- the FWD CARGO FIRE ARM switch is ARMED, or

[Freighter]

[Option – Lower Aft Cargo A/C]

- the LWR AFT CARGO FIRE ARM switch is ARMED, or

[Freighter]

- the LWR FWD CARGO FIRE ARM switch is ARMED
- the EQUIP COOLING switch is in OVRD

[Passenger]

In the override mode when the FWD CARGO FIRE ARM switch is not ARMED, the vent valve opens, both supply fans shut down, and the forward cargo heat valve closes. In the override mode when the FWD CARGO FIRE ARM switch is ARMED, the vent valve remains closed, both supply fans remain shut down, and the forward cargo heat valve is closed. Cabin differential pressure draws air through the flight deck panels and into the E & E equipment compartment to create a reverse flow of air across the equipment, then through the override valve to an overboard vent.

[Freighter]

In the override mode when the LWR FWD CARGO FIRE ARM switch is not ARMED, the vent valve opens, both supply fans shut down, and the lower forward cargo heat valve closes. In the override mode when the LWR FWD CARGO FIRE ARM switch is ARMED, the vent valve remains closed, both supply fans remain shut down, and the lower forward cargo heat valve is closed. Cabin differential pressure draws air through the flight deck panels and into the E & E equipment compartment to create a reverse flow of air across the equipment, then through the override valve to an overboard vent.

[Freighter]

When the MAIN DECK FIRE switch is ARMED, the system is configured to supply conditioned air to the flight deck and the air is exhausted through the ventilation system into the lower forward cargo compartment.

In flight, the EQUIP COOLING switch in OVRD aids smoke evacuation from the flight deck.

The override mode supplies adequate airflow for equipment cooling while the airplane is in cruise. During descent, the airflow decreases as the cabin pressure differential decreases.

On the ground, the EICAS advisory message EQUIP COOLING is displayed and the ground crew call horn in the wheel well sounds if the forward equipment cooling system is inoperative.

[777-200/-300 Series Passenger]

The aft equipment cooling and ventilating system provides cooling and ventilating air for the aft electronic equipment and ventilating air for the lavatories and galleys. Two aft ventilation fans, a primary and a backup, draw air through the aft electronic equipment and from the galleys and lavatories. The warm exhaust air is discharged through the aft outflow valve. Conditioned air is supplied to the galleys from the air distribution system.

[Freighter]

The aft equipment cooling and ventilating system provides cooling and ventilating air for the aft electronic equipment and ventilating air for the lavatory and galley. Two aft ventilation fans, a primary and a backup, draw air through the aft electronic equipment and from the galley and lavatory. The warm exhaust air is discharged through the aft outflow valve. Conditioned air is supplied to the galley from the air distribution system.

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Air Systems**Pressurization System Description****Chapter 2****Section 30**

Introduction

Cabin pressurization is controlled by regulating the discharge of conditioned cabin air through the outflow valves.

Two outflow valves are installed: one forward and one aft. Normally, most of the outflow is through the aft outflow valve. This improves ventilation and smoke removal. Cabin altitude and full ventilation rates can be maintained by either valve.

Positive and negative pressure relief valves protect the fuselage against excessive pressure differential.

The pressurization system has automatic and manual operating modes. Other than accomplishing normal procedures for entering FMC data, no specific flight crew action is required for fully automatic operation.

Pressurization System Automatic Operation

In flight, the cabin altitude controller operates in a climb mode, a cruise mode, or a descent mode.

The controller uses ambient pressure and flight plan data from the FMC to calculate a cabin pressurization schedule. The schedule provides a comfortable cabin climb to cruise altitude.

For takeoff, the system supplies a small positive pressurization prior to rotation to cause a smooth cabin altitude transition to the cabin altitude climb schedule.

In cabin altitude controller climb mode, cabin altitude increases on a schedule related to the airplane climb rate and flight plan cruise altitude. When the FMC climb path has a planned level segment, it is included in the total time required for the airplane to reach the top of climb. Cabin altitude continues to increase during the level segment. When the airplane climb flight path is above the FMC climb path and maximum cabin pressure differential is reached during the climb, cabin rate then becomes a function of airplane climb rate so maximum cabin differential pressure is not exceeded.

[777-200/-300 Series]

If cruise altitude is unavailable from the FMC in AUTO, the cabin altitude controllers assume a cruise altitude of 39,000 feet.

[777-200/-300 Series]

In cabin altitude controller cruise mode, maximum cabin altitude is 8,000 feet. When the takeoff field elevation is higher than 8,000 feet, the cabin descends to the cabin cruise altitude while the airplane is climbing.

[\[777-200/-300 Series\]](#)

When the destination airport elevation is greater than 8,000 feet, cabin altitude controller cruise mode maintains a cabin altitude of 8,000 feet.

The cabin altitude controllers enter cabin altitude controller descent mode at T/D or at initial descent of approximately 1,000 feet from cruise altitude, regardless of T/D.

In cabin altitude descent mode, cabin altitude decreases or increases to slightly below the FMC planned landing altitude in AUTO or the landing altitude set in MAN. The slight altitude difference ensures a small positive pressurization at touchdown. In MAN, FMC altitude information is bypassed and the cabin altitude controller uses internal rate schedules to control cabin altitude.

Landing elevation limits are 1,000 feet below sea level to 14,000 feet above sea level. The captain's altimeter setting provides landing altitude barometric pressure correction.

At touchdown, the outflow valves open to depressurize the cabin.

The cabin altitude limiter closes both outflow valves if cabin altitude exceeds 15,000 feet.

Full automatic operation of cabin altitude is possible with one outflow valve operating automatically and the other outflow valve not operating.

Cabin Altitude Controller Automatic Operation With Loss of Landing Altitude

[\[777-200/-300 Series\]](#)

If landing altitude is unavailable from the FMC, and not set in MAN, the EICAS advisory message LANDING ALT is displayed and the cabin altitude controller assumes a landing altitude of 2,000 feet.

Cabin Altitude Controller Automatic Operation With Loss of Cabin Pressurization

If a depressurization event occurs, the cabin altitude controller controls the outflow valves to preserve cabin pressure.

Pressurization System Manual Operation

If both OUTFLOW VALVE switches are in MAN, all automatic cabin altitude control functions are bypassed.

The pressurization system is in the manual mode when the OUTFLOW VALVE switches are set to MAN.

777 Flight Crew Operations Manual

The system is manually operated by:

- setting the OUTFLOW VALVE switches to MAN
- holding the related OUTFLOW VALVE MANUAL switch to OPEN or CLOSE.

Outflow valve position is displayed on the EICAS display. If the outflow valve position is not available on EICAS, holding the respective OUTFLOW VALVE MANUAL switch in the desired position for 30 seconds will move the valve from full open or close to the selected position.

Landing altitude (normally provided by the FMC) can be manually set using the LANDING ALTITUDE selector. Landing field selection limits are 2,000 feet below sea level to 14,000 feet above sea level. Pulling the selector out to the detent removes the FMC landing altitude and displays pressurization system indications on the EICAS display. The knob is rotated clockwise to increase or counterclockwise to decrease the landing altitude setting. Two rates of increase or decrease, low and high, are available in each direction from the spring-loaded center position.

Operation With Loss of Cabin Pressurization

With a sudden loss of cabin pressurization, the outflow valves will close immediately in an attempt to control the cabin pressure. After descent, when the airplane and cabin altitudes are approximately equal, the outflow valves open to protect the airplane against negative pressure differentials.

It is important that the flight crew not attempt to manually close the outflow valves during the descent.

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Air Systems**Chapter 2****Bleed Air System Description****Section 40****Introduction**

Bleed air can be supplied by the engines, APU, or a ground air source.

Bleed air is used for:

- air conditioning
- pressurization
- wing and engine anti-icing
- APU and engine start
- aft cargo heat
- air driven hydraulic pumps
- hydraulic reservoir pressurization
- potable water tank pressurization
- TAT probe aspiration.

Engine Bleed Air Supply

Engine bleed air is supplied from either the high stage or the low stage engine sections. Low stage air is used during high power setting operations. High stage air is used during descent and other low power setting operations.

The engine bleed valves close automatically:

- during start
- for bleed source loss
- for bleed air overtemperature
- for bleed air overpressure
- for a bleed air duct leak
- when an engine fire switch is pulled
- when a ground cart is supplying air.

APU Bleed Air Supply

APU bleed air is used primarily during ground operations for pack operation and engine starting. In flight, APU bleed air is available at and below 22,000 feet.

The check valve in the APU supply line prevents reverse flow of bleed air from the duct into the APU.

APU to Pack Takeoff

[\[777 All Passenger Models\]](#)

Before engine start, selecting APU from the FMC scratch pad to the SEL-APU field on the THRUST LIMIT PAGE arms the system for APU to pack takeoff. Approximately one minute after starting the second engine, the bleed air supply system configures for APU to pack takeoff.

When APU is selected to the SEL-APU field after both engines are running but before takeoff, the bleed air supply immediately configures for APU to pack takeoff.

In APU to pack takeoff configuration:

- the left engine bleed valve is closed,
- the L ENG OFF light is illuminated and remains illuminated,

[777-200/-300 Series]

- the APU provides air to air demand pump C1 and the left pack,
- the center bleed isolation valve is closed,
- the right engine provides air to air demand pump C2,
- the right pack valve is closed, and
- the R PACK OFF light is illuminated and remains illuminated.

The system reconfigures from APU to pack takeoff to normal operation when:

- thrust is reduced to climb thrust, or
- approximately 10 minutes after takeoff, or
- the airplane is above 11,400 feet altitude, or
- APU to pack configuration cannot be continued because of failures in other systems, or
- APU to pack mode is deleted manually.

Ground Bleed Air Supply

External connectors are provided to connect a ground source of high pressure air directly to the bleed air duct.

Check valves prevent reverse flow of bleed air from the bleed air duct to the connectors.

Bleed Air Duct System

The left, center, and right isolation valves separate the bleed air duct into isolated segments. The automatic system operates with the left and right isolation valves normally open. The center isolation valve is normally closed, except for engine start or single bleed source operation. When the center and respective isolation valves are open, air from the APU can be used for engine start.

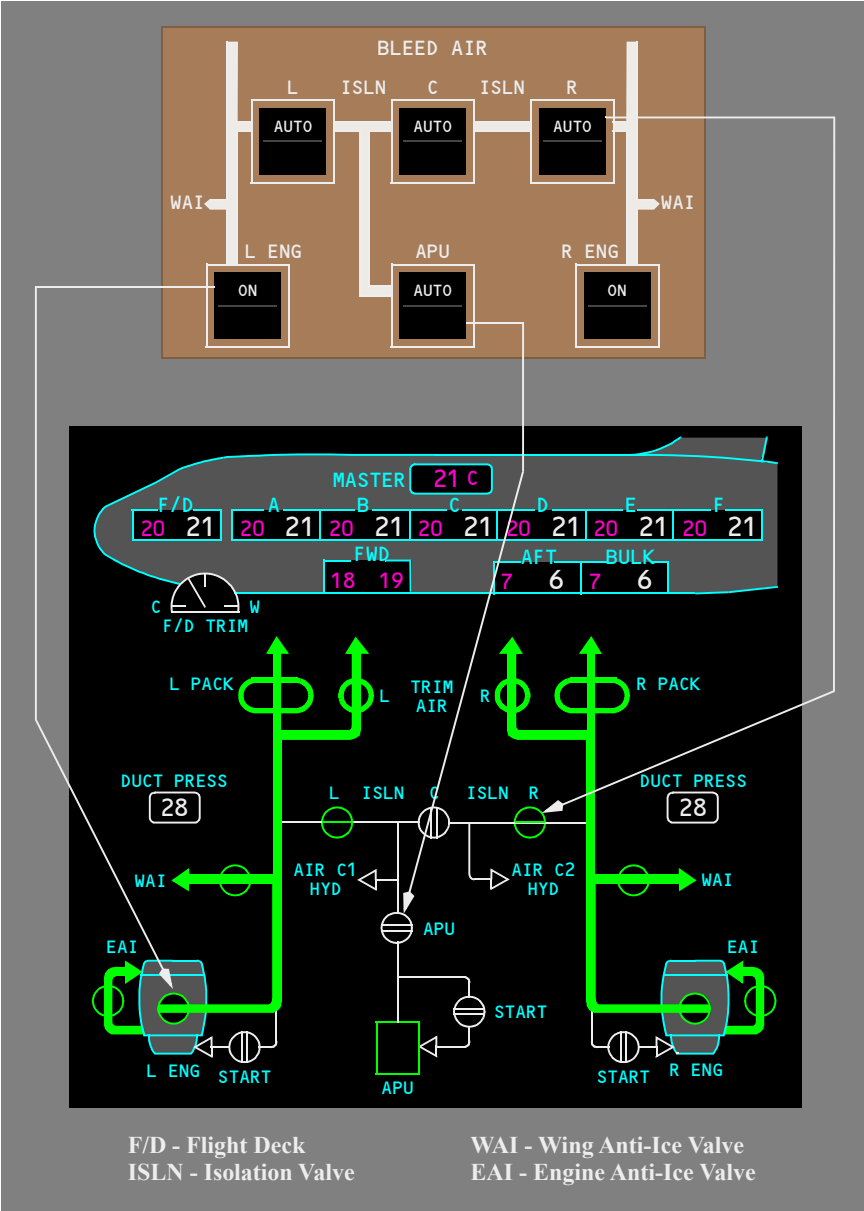
Duct Leak and Overheat Detection System

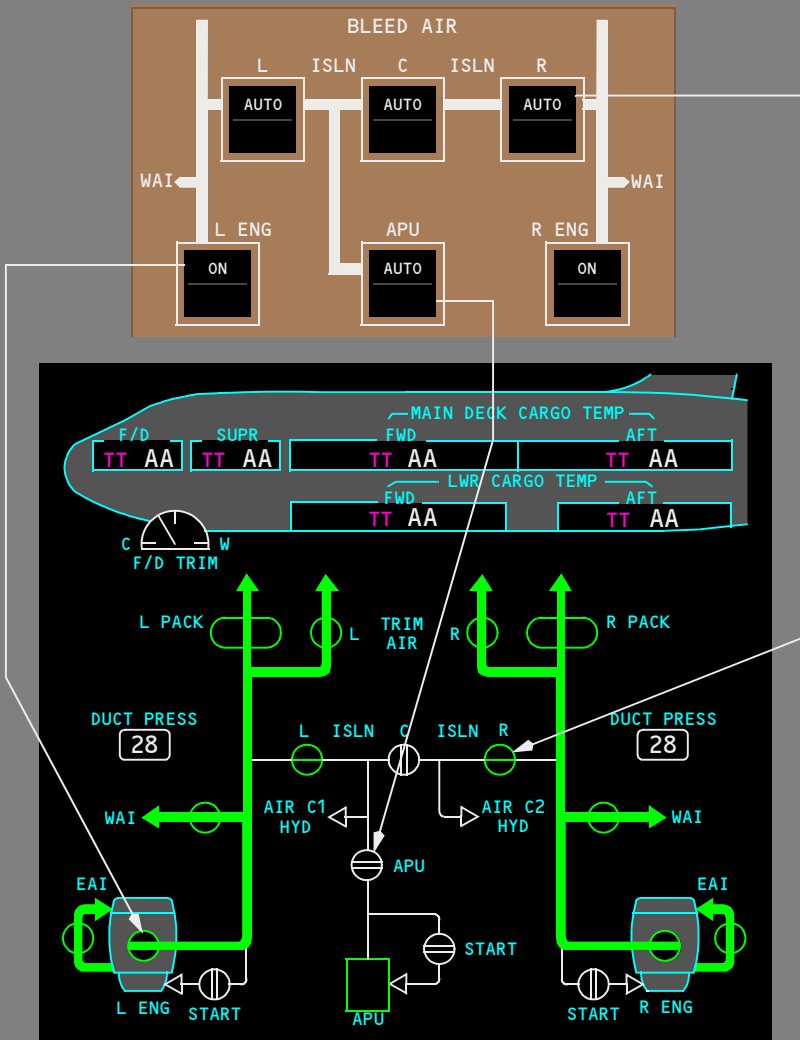
If a duct leak is detected, the system automatically isolates the leak. The EICAS caution message BLEED LEAK is displayed. The automatic isolation logic may include one, two, or three sequential steps. During isolation, the ENGINE and/or APU bleed switch OFF lights and the ISOLATION switch CLOSED lights illuminate and extinguish as the respective valves close and open.

When the temperature in the affected duct area cools, the BLEED LEAK EICAS message is no longer displayed. The valves isolating the leak remain closed and the appropriate EICAS message BLEED LOSS is displayed. The switch OFF or CLOSED lights are illuminated for the respective valves which remain closed to isolate the affected duct area.

CAUTION: Do not change the APU bleed, engine bleed, or bleed isolation switch positions after the system has automatically isolated the leak. Airplane damage can occur.

Bleed Air System Schematic





F/D - flight deck
 SUPER - Supernumerary
 AA (white) - actual temperature
 TT (magenta) - target temperature

EAI - engine anti-ice valve
 ISLN - isolation valves
 WAI - wing anti-ice valve

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Air Systems**Chapter 2****Air Systems EICAS Messages****Section 50****EICAS Alert Messages**

Message	Level	Aural	Message Logic
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[Freighter]

ALTN VENT SYS	Advisory		The alternate ventilation system is failed when commanded to operate.
---------------	----------	--	---

BLEED ISLN CLOSED C, L, R	Advisory		The isolation valve is failed closed when commanded open or the bleed isolation switch is OFF.
BLEED ISLN OPEN C, L, R	Advisory		The isolation valve is failed open when commanded closed.
BLEED LEAK BODY	Caution	Beeper	A bleed air leak is detected in the body area.
BLEED LEAK L, R	Caution	Beeper	A bleed air leak is detected in the wing or pack bay area.

[RR or Trent Engines]

BLEED LEAK STRUT L, R	Caution	Beeper	A bleed air leak is detected in the strut area.
--------------------------	---------	--------	---

[GE Engines]

BLEED LEAK STRUT L, R	Caution	Beeper	A bleed air leak or starter duct leak is detected in the strut area.
--------------------------	---------	--------	--

BLEED LOSS BODY	Advisory		Bleed air from the left and right body ducts is not available.
BLEED LOSS BODY L, R	Advisory		Bleed air from the body duct is not available.
BLEED LOSS WING L, R	Advisory		Bleed air from the wing duct is not available.
BLEED OFF APU	Advisory		The APU bleed valve is closed because of a system fault or the APU bleed switch is OFF.

Message	Level	Aural	Message Logic
BLEED OFF ENG L, R	Advisory		The engine bleed valve is closed because of a system fault or the engine bleed switch is OFF.
CABIN ALTITUDE	Warning	Siren	Cabin altitude is excessive.
CABIN ALTITUDE AUTO	Caution	Beeper	Automatic pressurization control is failed or both outflow valve switches are in manual.

[Freighter]

CABIN TEMPERATURE	Advisory		Flight deck or cabin temperature is excessively hot or cold. The temperature may cause incapacitation.
----------------------	----------	--	--

[777 All Models Passenger]

[Option - Forward Cargo Air Conditioning]

CARGO A/C FWD	Advisory		Forward lower cargo air conditioning is inoperative.
---------------	----------	--	--

[Freighter]

[Option - Lower Aft Cargo Air Conditioning]

CARGO A/C LWR AFT	Advisory		Aft lower cargo air conditioning is inoperative.
----------------------	----------	--	--

[Freighter]

CARGO A/C LWR FWD	Advisory		Forward lower cargo air conditioning is inoperative.
----------------------	----------	--	--

[Freighter]

CARGO HEAT AFT	Advisory		Cargo heat is inoperative or the cargo temperature selector is OFF.
-------------------	----------	--	---

[777 All Models Passenger]

CARGO HEAT AFT, BULK	Advisory		Cargo heat is inoperative or the cargo temperature selector is OFF.
-------------------------	----------	--	---

Message	Level	Aural	Message Logic
EQUIP COOLING	Advisory		The forward equipment cooling is failed.
EQUIP COOLING OVRD	Advisory		The equipment cooling system is in override mode.
LANDING ALTITUDE	Advisory		The FMC does not supply a landing altitude or the landing altitude selector is pulled.

[Freighter]

MAIN DECK A/C	Advisory		Main deck cargo air conditioning is inoperative.
---------------	----------	--	--

OUTFLOW VALVE AFT, FWD	Advisory		Automatic control of the outflow valve is inoperative or the outflow valve switch is in MAN.
PACK L, R	Advisory		Pack is inoperative.

[777-200/-300 Series]

[AIMS BP03 installed]

PACK L+R	Caution	Beeper	Both packs are inoperative.
----------	---------	--------	-----------------------------

PACK MODE L, R	Advisory		The pack is in the standby mode.
TRIM AIR L, R	Advisory		The trim air valve is closed.

EICAS Memo Messages

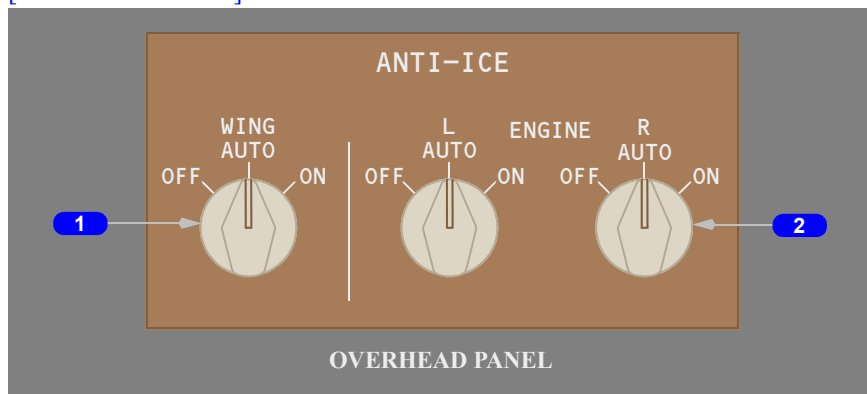
Message	Level	Aural	Message Logic
RECIRC FANS OFF	Memo		One or both recirculation fan switches are off.

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**Anti-Ice, Rain
Table of Contents****Chapter 3
Section TOC**

Controls and Indicators	3.10
Engine and Wing Anti Icing	3.10.1
Anti-Ice Panel	3.10.1
Anti-Icing Indications	3.10.2
Window Heat and Wiper Panels	3.10.2
Window Heat Panel	3.10.2
Wiper Panels	3.10.3
System Description	3.20
Introduction	3.20.1
Anti-Icing Systems	3.20.1
Icing Conditions Detection	3.20.1
Engine Anti-Icing	3.20.1
Wing Anti-Icing	3.20.2
Anti-Icing System Schematic	3.20.3
Flight Deck Windows	3.20.3
Windshield Wipers	3.20.4
Probe Heat	3.20.4
EICAS Messages	3.30
EICAS Alert Messages	3.30.1

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**Anti-Ice, Rain
Controls and Indicators****Chapter 3
Section 10****Engine and Wing Anti Icing
Anti-Ice Panel**[\[777-200/-300 Series\]](#)[\[777-200/-300 Series\]](#)**1 WING ANTI-ICE Selector**

OFF – the wing anti-icing valves are commanded closed.

AUTO – in flight, the wing anti-icing valves open when wing icing conditions exist and bleed air pressure is available.

ON – in flight, the wing anti-icing valves are commanded open.

[\[777-200/-300 Series\]](#)**2 ENGINE ANTI-ICE Selectors**

OFF – the engine anti-icing valve is commanded closed.

AUTO – in flight, the engine anti-icing operates when engine icing conditions exist.

ON – the engine anti-icing valve is commanded open.

Note: When the ENGINE ANTI-ICE selector is in AUTO and the anti-icing valve is commanded open or when the ENGINE ANTI-ICE selector is in ON, then:

[\[Options – PW Engines\]](#)

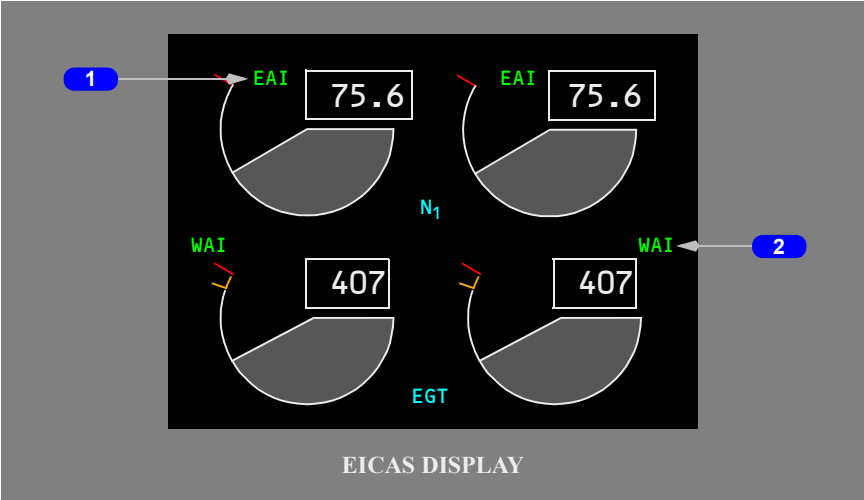
- approach idle and continuous ignition are commanded by the EEC

[\[Option – RR, GE Engines\]](#)

- approach idle is commanded by the EEC

Anti-Icing Indications

[777-200/-300 Series]



1 Engine Anti-icing Indication

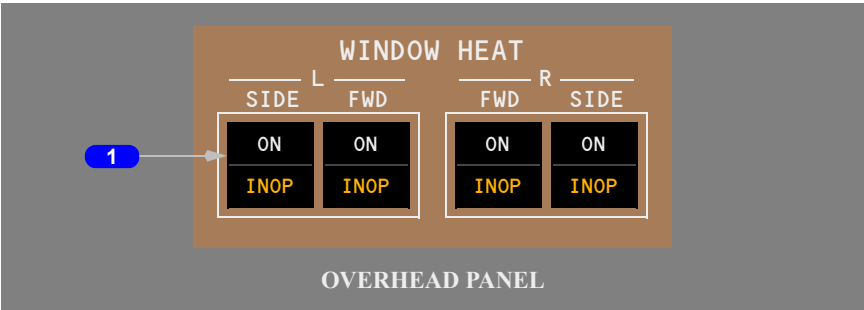
Displayed (green) – engine anti-icing valve is open.

2 Wing Anti-Icing Indication

Displayed (green) – wing anti-icing valve is open.

Window Heat and Wiper Panels
Window Heat Panel

[777-200/-300 Series]



1 WINDOW HEAT Switches

ON – controlled heat is applied to the respective windows.

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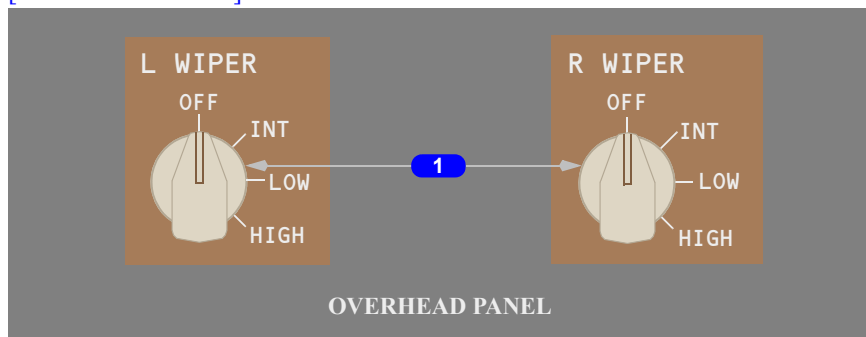
777 Flight Crew Operations Manual

INOP (inoperative) illuminated (amber) –

- the switch is OFF, or
- an overheat has occurred, or
- a system fault has occurred

Wiper Panels

[777-200/-300 Series]



1 WIPER Selectors

OFF – the wiper is off and is sequenced to stowed position.

INT (intermittent) – the wiper operates intermittently at low speed.

LOW – the wiper operates at low speed.

HIGH – the wiper operates at high speed.

Intentionally
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**Anti-Ice, Rain
System Description****Chapter 3
Section 20****Introduction**

The anti-icing and rain systems include:

- icing conditions detection
- engine anti-icing
- wing anti-icing
- flight deck window heat
- windshield wipers
- probe heat

Anti-Icing Systems

Engine and wing anti-icing is provided by distributing engine bleed air to the engine inlets and to the wing leading edges. Window anti-icing and anti-fogging is accomplished via embedded heaters. The air data probes are also anti-iced by electric heaters. The windshields are cleared of rain by windshield wipers and a hydrophobic coating.

Icing Conditions Detection

The icing conditions detection system detects engine nacelle inlet icing conditions and wing icing conditions in flight. Two probes on the forward fuselage and system logic:

- control the engine and wing anti-icing valves
- display anti-icing system operating indications on EICAS, and
- display EICAS alert messages

If ice is detected on the probes, they are automatically deiced. Each occurrence of ice build-up and subsequent deicing of the probes is counted by the system as one cycle.

When the deicing cycle threshold for engine anti-icing is exceeded, the system activates engine anti-icing. Similarly, when the deicing cycle threshold for wing anti-icing is exceeded, the system activates wing anti-icing.

When the icing condition detection system no longer detects icing, engine and wing anti-icing is deactivated.

Engine Anti-Icing

The engine anti-icing valves are opened by engine bleed air pressure. When an engine anti-icing valve is open, EAI is displayed on the primary EICAS display.

In flight, when an ENGINE ANTI-ICE selector is in AUTO and engine icing conditions exist, the respective engine anti-icing valve is commanded open.

When an ENGINE ANTI-ICE selector is ON, the respective engine anti-icing valve is commanded open.

Engine Anti-Icing System Leak Detection

Each engine has an anti-icing duct leak detection system. If an engine anti-icing duct leak is detected, the respective engine anti-icing valve closes.

Wing Anti-Icing

When a wing anti-icing valve is open, WAI is displayed on the primary EICAS display.

On the ground, wing anti-icing valves are automatically commanded closed regardless of the WING ANTI-ICE selector position.

In flight, when the WING ANTI-ICE selector is in AUTO and wing icing conditions exist, the wing anti-icing valves are commanded open.

In flight, when the WING ANTI-ICE selector is ON the wing anti-icing valves are commanded open.

When the WING ANTI-ICE selector is ON and TAT is above 10 degrees C, wing anti-icing is inhibited for five minutes after liftoff.

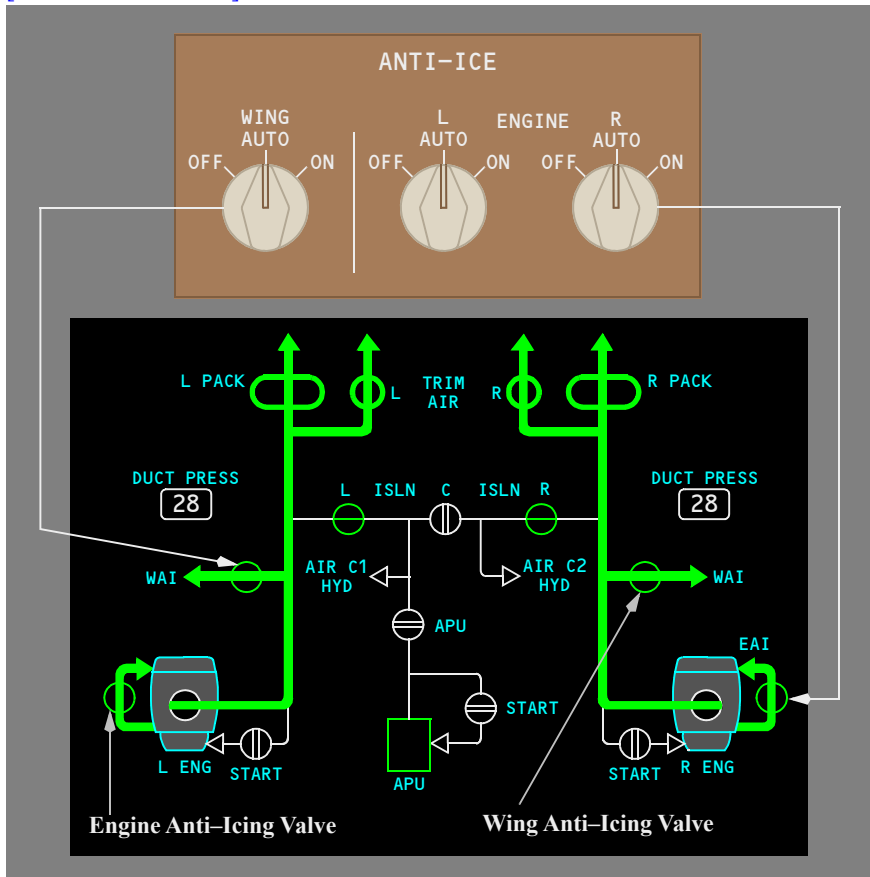
Automatic wing anti-icing operation is inhibited when:

- TAKEOFF mode is selected, and
- less than 10 minutes has elapsed after liftoff

If a bleed source is unavailable and bleed duct isolation has not occurred, the isolation valves open to maintain anti-icing to both wings. If a bleed air or wing anti-icing system fault occurs that would result in asymmetrical wing anti-icing, the wing anti-icing system deactivates to prevent asymmetrical anti-icing.

Anti-Icing System Schematic

[777-200/-300 Series]



Flight Deck Windows

Flight deck windows are electrically heated. The forward windshields have anti-icing protection on the exterior surfaces, and anti-fogging heating on the interior surfaces. The side windows have controlled anti-fogging heating on the interior surfaces.

The WINDOW HEAT switches control heating for all flight deck windows.

If a fault or overheat condition is sensed, power is disconnected from the respective window heat system. Selecting a WINDOW HEAT switch off for 10 seconds, then ON, resets a window heat controller fault.

A backup anti-fogging system for the forward windows operates automatically if the primary window heat system fails.

Windshield Wipers

The three speed windshield wipers are independently controlled. When a WIPER selector is OFF, the wiper is off and stowed.

Probe Heat

Three pitot-static probes and two angle of attack probes are electrically heated for anti-icing protection when either engine is operating.

The total air temperature probe is electrically heated for anti-icing protection in flight.

**Anti-Ice, Rain
EICAS Messages****Chapter 3
Section 30****EICAS Alert Messages**

Message	Level	Aural	Message Logic
ANTI-ICE ENG L, R	Advisory		The engine anti-icing valve is closed when commanded open.
ANTI-ICE LEAK ENG L, R	Caution	Beeper	A bleed air leak occurs in the engine anti-icing duct or starter duct.
ANTI-ICE LEAK ENG L, R	Caution	Beeper	A bleed air leak occurs in the engine anti-icing duct.
ANTI-ICE LOSS ENG L, R	Advisory		Anti-icing bleed air for the engine is not available.
ANTI-ICE ON	Advisory		The ANTI-ICE selector is ON, and TAT is more than 10 degrees C, and icing conditions do not exist.
ANTI-ICE WING	Advisory		One or both wing anti-icing valves are failed closed.
HEAT PITOT C	Advisory		The center pitot probe heat is failed.
HEAT PITOT L	Advisory		The left pitot probe heat is failed.
HEAT PITOT L+C+R	Advisory		The left, center, and right pitot probe heats are failed.
HEAT PITOT R	Advisory		The right pitot probe heat is failed.
ICE DETECTORS	Advisory		The ice detection system has failed.
ICING ENG	Caution	Beeper	Icing conditions exist and an engine ANTI-ICE selector is OFF.
ICING WING	Advisory		Icing conditions exist and the WING ANTI-ICE selector is OFF, or icing conditions exist and wing anti-icing is inhibited during takeoff.
WINDOW HEAT	Advisory		Two or more window heats are off.

Message	Level	Aural	Message Logic
WINDOW HEATL, R FWD	Advisory		Primary window heat for the forward window is inoperative.
WINDOW HEATL, R SIDE	Advisory		Window heat for the side window is inoperative.

Automatic Flight**Table of Contents****Chapter 4****Section TOC**

Controls and Indicators	4.10
Mode Control Panel (MCP)	4.10.1
Autopilot Flight Director System Controls	4.10.1
Autothrottle System Controls	4.10.4
Autopilot Flight Director IAS/Mach Controls	4.10.6
Autopilot Flight Director Roll and Pitch Controls	4.10.8
Autopilot Flight Director Heading, Track, and Bank Angle Controls	4.10.12
Autopilot Flight Director Vertical Speed (V/S) and Flight Path Angle (FPA) Controls	4.10.14
Autopilot Flight Director Altitude Controls	4.10.16
Autopilot Flight Director Approach Mode Controls	4.10.18
PFD Flight Mode Annunciations (FMAs)	4.10.20
Autopilot Disconnect Switch	4.10.22
Autothrottle Disconnect and TO/GA Switches	4.10.23
System Description	4.20
Introduction	4.20.1
Autopilot Flight Director System	4.20.1
MCP Mode Selection	4.20.1
Autopilot Engagement	4.20.2
Autopilot Disengagement	4.20.2
Autopilot and Flight Director Mode Degradations	4.20.2
Flight Director Display	4.20.3
Autopilot Flight Director System Schematic	4.20.4
AFDS Status Annunciation	4.20.4
AFDS Flight Mode Annunciations	4.20.5
Autothrottle System	4.20.10
Manual Flight	4.20.10
Automatic Activation	4.20.10
Autothrottle Thrust Lever Operation	4.20.13

Autothrottle Disconnect	4.20.13
Automatic Flight Operations	4.20.14
Automatic Flight - Takeoff and Climb	4.20.14
Automatic Flight Takeoff Profile	4.20.16
Automatic Flight - Cruise	4.20.16
Automatic Flight - Approach and Landing	4.20.17
Automatic Flight Approach Profile	4.20.19
Automatic Flight - Go-Around	4.20.20
Automatic Flight Go-Around Profile	4.20.22
Automatic Flight Windshear Recovery	4.20.23
Flight Envelope Protection	4.20.23
EICAS Messages	4.30
Automatic Flight EICAS Messages	4.30.1

Automatic Flight Controls and Indicators

Chapter 4 Section 10

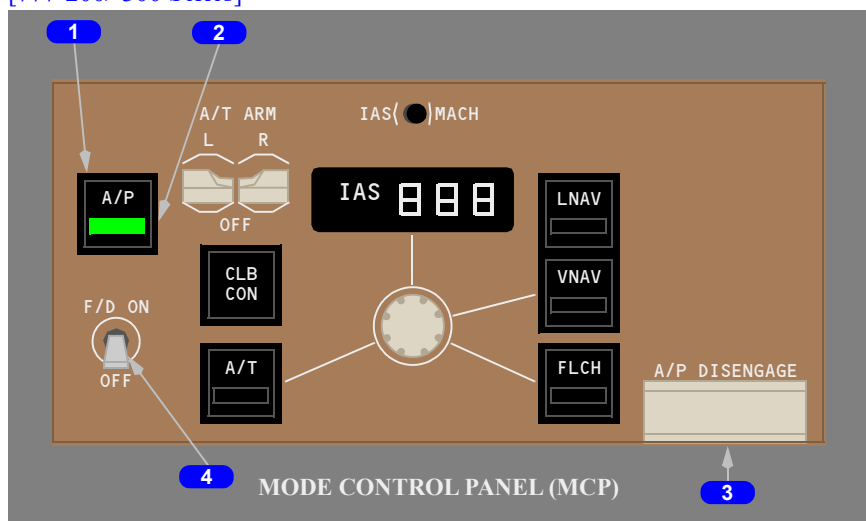
Mode Control Panel (MCP)

[777-200/-300 Series]



Autopilot Flight Director System Controls

[777-200/-300 Series]



1 Autopilot (A/P) Engage Switch

Push (either switch engages the autopilot) –

- inhibited on the ground with flaps out of UP
- when either Flight Director switch is ON, the autopilot engages in the selected flight director mode(s)

[Option – A/P ATT Hold Engage]

- when both Flight Director switches are OFF, the autopilot engages in:
 - heading hold (HDG HOLD) or track hold (TRK HOLD) as the roll mode; or, if bank angle is greater than five degrees, attitude hold (ATT)
- vertical speed (V/S) or flight path angle (FPA) as the pitch mode.

2 Autopilot Engaged Light

[777-200/-300 Series]

Illuminated (green) – autopilot is engaged.

3 Autopilot (A/P) DISENGAGE Bar

Push down –

- with autopilot engaged:
 - disengages autopilot
 - displays EICAS warning message AUTOPILOT DISC
 - sounds an aural warning
 - illuminates master warning lights
- prevents autopilot engagement
- displays EICAS advisory message NO AUTOLAND
- disables bank angle protection
- exposes amber and black stripes (as installed).

Lift up –

- enables autopilot engagement
- hides amber and black stripes (as installed)
- enables bank angle protection.

4 Flight Director (F/D) Switches

The left flight director switch activates the flight director steering indications on the left PFD. The right flight director switch activates the flight director steering indications on the right PFD.

ON –

[AFDS -506/-507/-508/-509 s/w allows ALT mode engagement on gnd]

- on the ground with both Flight Director switches OFF, the first Flight Director switch positioned ON arms the flight director in takeoff go-around (TO/GA) roll mode. In addition, the first switch arms the flight director in TO/GA pitch mode when MCP selected altitude differs more than 20 feet from displayed baro altitude, or activates the flight director in altitude (ALT) pitch mode when selected altitude is within 20 feet of displayed baro altitude. If ALT mode is active, selecting an altitude more than 20 feet from displayed baro altitude and recycling the first switch arms the flight director in TO/GA roll and pitch modes. The flight mode annunciation appears on both PFDs. Positioning the second switch ON displays the flight director steering indications on the second PFD

[Option – A/P ATT Hold Engage]

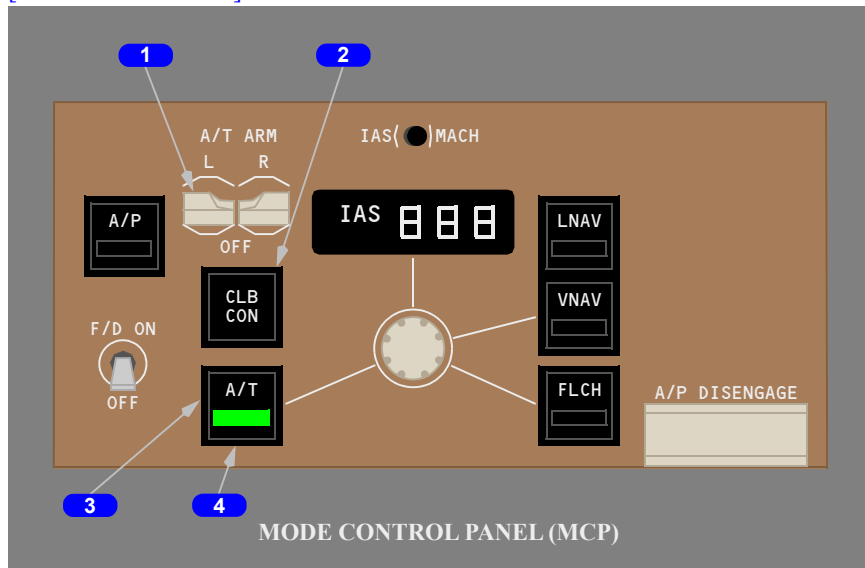
- in flight with the autopilot disengaged and both Flight Director switches OFF, the first Flight Director switch positioned to ON activates the flight director in:
 - heading hold (HDG HOLD) or track hold (TRK HOLD) as the roll mode; or, if bank angle is greater than 5°, attitude hold (ATT)
 - vertical speed (V/S) or flight path angle (FPA) as the pitch mode
- in flight with the autopilot engaged and both Flight Director switches OFF, the first Flight Director switch positioned to ON activates the flight director in the currently selected autopilot mode(s).

OFF –

- the flight director steering indications do not display, unless
- a TO/GA switch is pushed when airspeed is greater than 80 knots and flaps are out of up.

Autothrottle System Controls

[777-200/-300 Series]



1 Autothrottle (A/T) ARM Switches

The left Autothrottle Arm switch arms or disarms the left engine autothrottle. The right Autothrottle Arm switch arms or disarms the right engine autothrottle.

ARM -

- arms selected autothrottle for mode activation
- autothrottle activates when VNAV, FLCH, or TO/GA switch pushed
- autothrottle activates when autothrottle switch pushed in any pitch mode
- autothrottle automatically activates in certain low airspeed situations as described in the Automatic Activation section.

OFF -

- disconnects selected autothrottle
- prevents selected autothrottle activation.

2 Climb/Continuous (CLB/CON) Thrust Switch

On the ground and below 400 feet during takeoff, the switch is inoperative.

Push –

- with two engines operating, changes the engine thrust limit to the FMC selected climb thrust
- with one engine operating, changes the thrust limit to maximum continuous (CON).

3 Autothrottle Engage (A/T) Switch

Push –

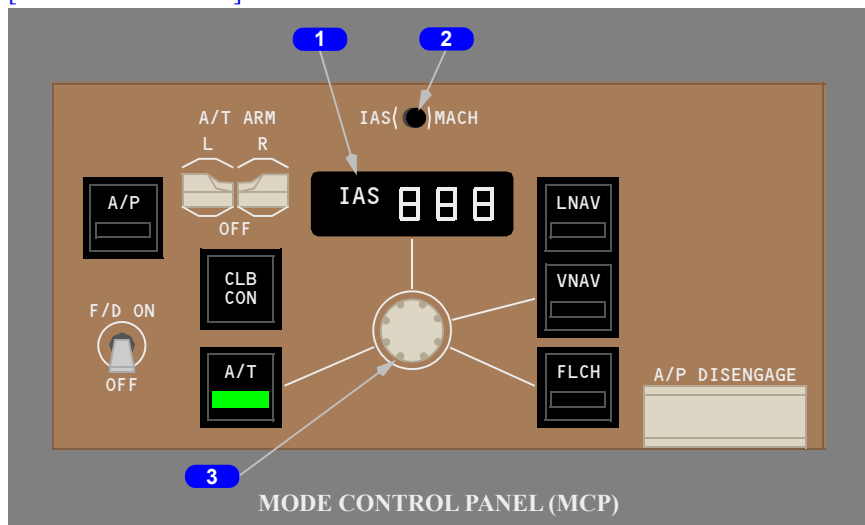
- above 400 feet with autothrottle armed, activates the appropriate autothrottle mode for the selected AFDS pitch mode, or if no pitch mode, in speed (SPD) mode.

4 Autothrottle Engage Light

Illuminated (green) – an autothrottle mode is active.

Autopilot Flight Director IAS/Mach Controls

[777-200/-300 Series]



1 IAS/MACH Window

Shows 200 knots when power first applied.

Shows the speed selected by the IAS/MACH selector.

Blanks when the FMC controls the speed. When changing from TO/GA to V/S, FPA, or ALT, the window shows:

- the flap placard speed minus 5 knots (flaps extended), or
- 250 knots (flaps up), or
- a speed value entered in the IAS/MACH window after TO/GA was pushed.

Shows range:

- 100 – 399 KIAS
- .40 – .95 Mach.

The selected speed shows as the PFD selected speed.

In climb, automatically changes from IAS to Mach at .84 Mach.

In descent, automatically changes from Mach to IAS at 310 knots.

2 IAS/MACH Reference Switch

Push –

- alternately changes IAS/MACH window between IAS and Mach displays (Mach must be 0.4 or greater to switch from IAS to Mach)
- inoperative when IAS/MACH window is blank.

3 IAS/MACH Selector

Rotate –

[HUD Option not selected]

- sets the speed in the IAS/MACH window as the selected speed on both the PFDs
- inoperative when IAS/MACH window is blank.

Push – with VNAV active, alternately activates or blanks the IAS/MACH window.

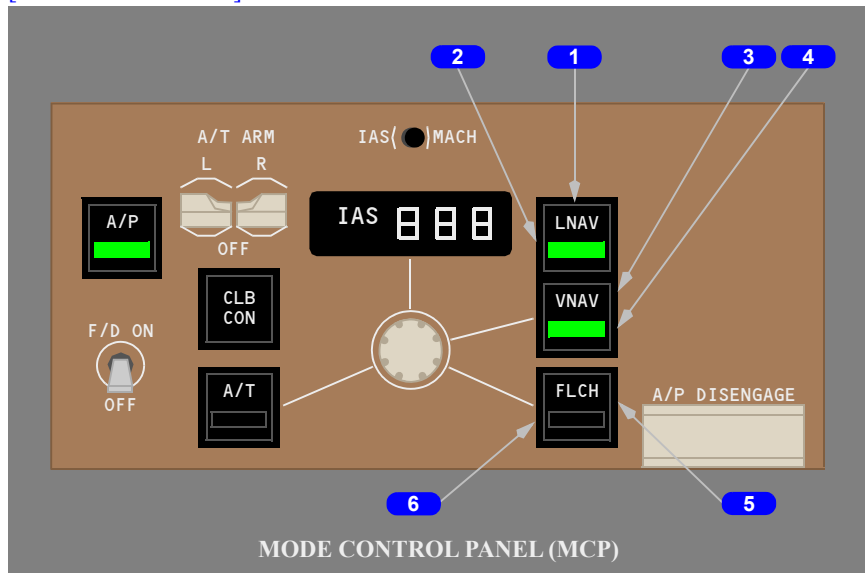
[HUD Option not selected]

When the window is blank, FMC computed target speed is active and shows on both PFDs.

When the window is open, FMC speed–intervention is active and IAS/MACH selector may be used to set the desired speed.

Autopilot Flight Director Roll and Pitch Controls

[777-200/-300 Series]



1 Lateral Navigation (LNAV) Switch

Push –

- arms, selects, or disarms LNAV as roll mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S

[No HUD option]

- shows LNAV in white (armed) on both PFDs roll flight mode annunciations when armed. The previous roll mode remains active
- LNAV activates when the airplane is above 50 feet radio altitude and:
 - within 2.5 NM of the active leg
 - when not within 2.5 NM of the active leg and on an intercept heading to the active leg, remains armed then activates when approaching the active leg
 - when active, shows LNAV in green on both PFDs roll flight mode annunciation
- selection of LNAV with the airplane not on a heading to intercept the active leg, displays NOT ON INTERCEPT HEADING in the CDU scratchpad
- selection of LNAV when an active FMC route is not available displays NO ACTIVE ROUTE in the CDU scratchpad

- LNAV maintains current heading when:
 - passing last active route waypoint
 - passing last waypoint prior to a route discontinuity
 - passing last route offset waypoint
 - activating the inactive route or activating an airway intercept and not within LNAV engagement criteria.

LNAV is deactivated:

- by selecting heading hold (HDG HOLD) or track hold (TRK HOLD)
- by selecting heading select (HDG SEL) or track select (TRK SEL)

[777-200/-300 Series]

- when localizer captures
- with dual FMC failure (LNAV may be re-activated if there is an active CDU ALTN NAV route available).

[777-200/-300 Series]

LNAV is disarmed by:

- pushing the LNAV switch a second time
- by arming LOC or APP
- when the TO/GA switch is pushed with flaps not up and no instrument approach procedure loaded into the FMC
- by disengaging the autopilot and turning both flight directors off.

2 LNAV Light

Illuminated (green) – the LNAV mode is armed or active.

3 Vertical Navigation (VNAV) Switch

Push –

- arms, selects, or disarms VNAV as the pitch mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S

[Option – GS capture not inhibited before LOC capture]

- inoperative when the armed roll mode is LOC and the active pitch mode is G/S
- shows VNAV as armed mode on both PFDs (in white) pitch flight mode annunciation below 400 feet
- VNAV activates 400 feet above runway elevation
- when VNAV selected and the FMC has insufficient data to provide VNAV guidance (such as the gross weight is invalid or there is no end-of-descent point in descent) displays PERF/VNAV UNAVAILABLE in the CDU scratchpad
- VNAV SPD, VNAV PTH, or VNAV ALT pitch mode shows in green (active) on both PFDs pitch flight mode annunciation

- in VNAV SPD pitch mode, AFDS commands pitch to hold target airspeed. The autothrottle operates in the THR REF, THR, IDLE, or HOLD mode, as required by phase of flight
- in VNAV PTH pitch mode, the AFDS commands pitch to maintain FMC target altitude or VNAV path
- in VNAV ALT pitch mode, the AFDS commands pitch to maintain MCP selected altitude; autothrottles operates in speed (SPD) mode
- when selecting VNAV and VNAV commands a descent with the MCP altitude window above the current airplane altitude, the autopilot maintains the altitude at which VNAV was selected. When on an instrument approach using VNAV, selecting the missed approach altitude does not interfere with the VNAV descent
- when selecting VNAV and VNAV commands a climb with the MCP altitude window below the current airplane altitude, the autopilot maintains the altitude at which VNAV is selected
- with the VNAV PTH pitch mode active, the autothrottle operates in the following modes:
 - for climb or cruise – operates in the speed (SPD) mode
 - for descent – operates in the IDLE, HOLD, or speed (SPD) mode
- VNAV pitch guidance is available with one engine inoperative.

VNAV is deactivated:

- by selecting TO/GA, FLCH SPD, V/S, FPA, ALT or G/S pitch mode
- if dual FMC failure
- by disengaging the autopilot and turning both flight directors off.

VNAV is disarmed by:

- pushing the VNAV switch a second time, or
- arming APP.

4 VNAV Light

Illuminated (green) – the VNAV mode is armed or active.

5 Flight Level Change (FLCH) Switch

Push –

- selects FLCH SPD pitch mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- FLCH SPD pitch mode shows in green (active) on both PFDs flight mode annunciation
- when IAS/MACH window is blank, it activates to the FMC target speed, if valid. If not valid, the IAS/MACH window activates to the current speed
- when IAS/MACH window is active, it shows command speed

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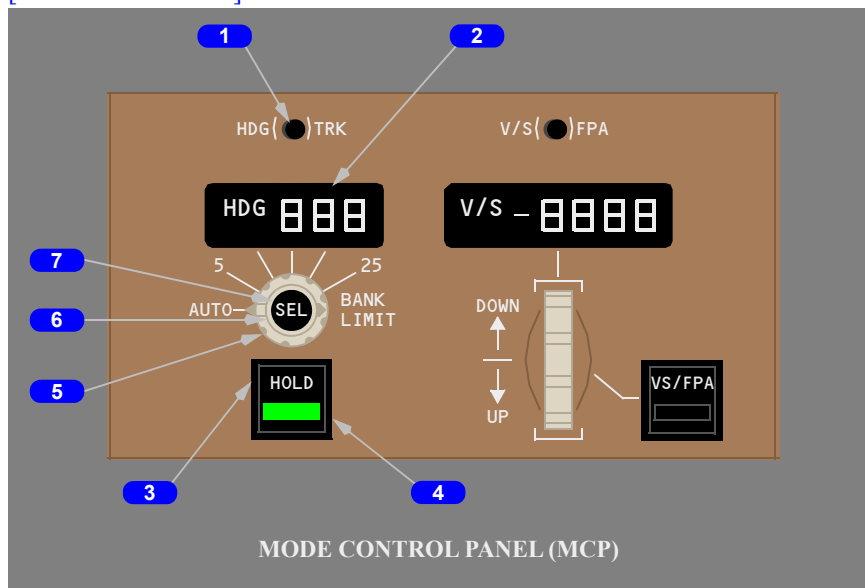
- when changing from TO/GA to FLCH, IAS/MACH window shows highest value of current speed or selected speed
- AFDS pitch holds MCP selected speed. When MCP selected altitude captured, pitch flight mode annunciation changes to ALT
- A/T operates in THR, followed by HOLD mode in descent. When selected altitude captured, A/T mode changes to SPD
- A/T advances or retards thrust levers to provide 500 FPM vertical speed for each 1000 feet altitude change
- AFDS attempts to reach the MCP selected altitude within two minutes if able with available thrust. Otherwise, A/T uses IDLE or CLB thrust to reach the MCP selected altitude
- with a higher altitude set in the altitude window, reference thrust limit changes to CLB when CRZ displayed or to CON with an engine inoperative.

6 Flight Level Change Light

Illuminated (green) – flight level change mode is active.

Autopilot Flight Director Heading, Track, and Bank Angle Controls

[777-200/-300 Series]



1 Heading/Track (HDG/TRK) Reference Switch

Push –

- alternately changes the heading/track window, PFD, and ND selected heading/track references between heading and track. Also changes both PFDs roll flight mode annunciations, when the HDG or TRK mode is active.

2 Heading/Track Window

Shows selected heading or track on both PFDs and NDs. When approach armed, changes to ILS front course at LOC capture. Shows 360 when power first applied.

3 Heading/Track Hold (HOLD) Switch

Push –

- selects heading hold (HDG HOLD) or track hold (TRK HOLD) roll mode
- inoperative when the active roll mode is either LOC or FAC and the active pitch mode is either G/S or G/P

777 Flight Crew Operations Manual

- shows HDG HOLD or TRK HOLD on both PFDs roll flight mode annunciation
- AFDS commands wings level and holds heading or track when wings level.

4 Heading/Track Hold Light

Illuminated (green) – heading/track HOLD mode is active.

5 BANK LIMIT Selector (outer)

Rotate –

[777-200/-300 Series]

- sets AFDS commanded bank limit when in the heading select (HDG SEL) or track select (TRK SEL) roll mode as follows:
- AUTO – varies between 15 – 25 degrees, depending on TAS
- 5, 10, 15, 20, or 25 – selected value is the maximum, regardless of airspeed.

6 Heading/Track Selector (middle)

Rotate –

- sets heading or track in the heading/track window and on both PFDs and NDs.

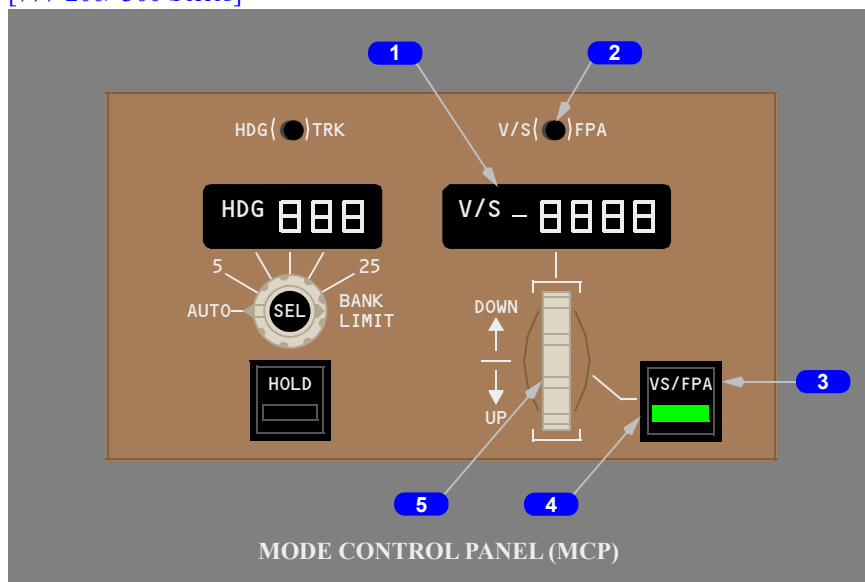
7 Heading/Track Select (SEL) Switch (inner)

Push –

- selects heading select (HDG SEL) or track select (TRK SEL) as roll mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- shows HDG SEL or TRK SEL on both PFDs roll flight mode annunciation
- AFDS controls roll to fly the selected heading or track
- bank is limited by bank limit selector.

Autopilot Flight Director Vertical Speed (V/S) and Flight Path Angle (FPA) Controls

[777-200/-300 Series]



1 Vertical Speed/Flight Path Angle (V/S – FPA) Window

Shows selected vertical speed in 100 fpm increments or the selected flight path angle in 0.1 degree increments.

Display range:

- V/S: -8000 to +6000 fpm
- FPA: -9.9 to +9.9 degrees

Blank when vertical speed (V/S) or flight path angle (FPA) pitch mode is not active; display state can be pre-selected by pushing the V/S - FPA Reference Switch.

Selected vertical speed shows on both PFDs vertical speed indication.

Selected flight path angle shows on both PFDs attitude indicator.

Flight path vector shows on both PFDs if not already shown.

2 V/S – FPA Reference Switch

Push –

- alternately changes vertical speed/flight path angle window on PFD references between vertical speed and flight path angle. Also changes both PFDs pitch flight mode annunciations, when the V/S or FPA mode is active.

3 V/S – FPA Switch

Push –

- selects V/S or FPA pitch mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- shows V/S or FPA on both PFDs pitch flight mode annunciation
- shows current vertical speed or flight path angle in the vertical speed/flight path angle window

[\[777-200/-300 Series\]](#)

- when selected altitude is reached, the pitch mode changes to ALT
- AFDS commands pitch to maintain the vertical speed or flight path angle displayed in the vertical speed/flight path angle window
- when V/S or FPA selected while in FLCH or VNAV, autothrottle activates in speed (SPD) mode when engaged.

4 V/S – FPA Light

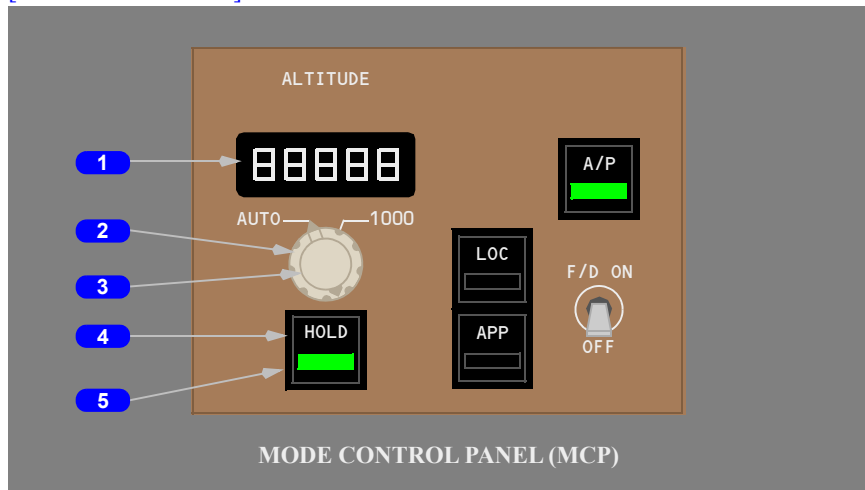
Illuminated (green) – the vertical speed/flight path angle mode is active.

5 V/S – FPA Selector

UP or DOWN – sets the vertical speed or flight path angle in the vertical speed/flight path angle window and on both PFDs.

Autopilot Flight Director Altitude Controls

[777-200/-300 Series]



1 Altitude Window

Shows selected altitude.

The altitude shown is the reference altitude for altitude alerting and level off.

The altitude range is 0 to 50,000 feet.

Shows 10,000 feet when power is first applied.

[No HUD option]

The selected altitude shows on both PFDs altitude tapes.

Shows altitude transmitted to ATC.

2 Altitude Increment Selector (outer)

AUTO –

- the altitude selector changes in 100 foot increments
- shows the selected BARO minimum as the altitude selector passes through that altitude. If the BARO minimum is not a 10 foot increment, shows the next highest 10 foot increment

1000 – the altitude selector changes in 1,000 foot increments.

3 Altitude Selector (inner)

[777-200/-300 Series]

Rotate –

- sets altitude in the altitude window and on both PFDs.

Push –

- in climb or descent with altitude constraints, each push deletes the next waypoint constraint between the airplane altitude and the altitude window setting
- in climb with no altitude constraints, and the altitude window set above the FMC cruise altitude, the cruise altitude is changed to the altitude window setting
- in cruise:
 - with the altitude window set above or below FMC cruise altitude, resets the FMC cruise altitude to the altitude window altitude
 - when in VNAV PTH or VNAV ALT pitch mode, initiates a climb or descent toward the altitude window altitude
 - within 50 NM of the top-of-descent (T/D) point with the altitude window set below cruise altitude, initiates descend now (DES NOW) feature.

4 Altitude HOLD Switch

Push –

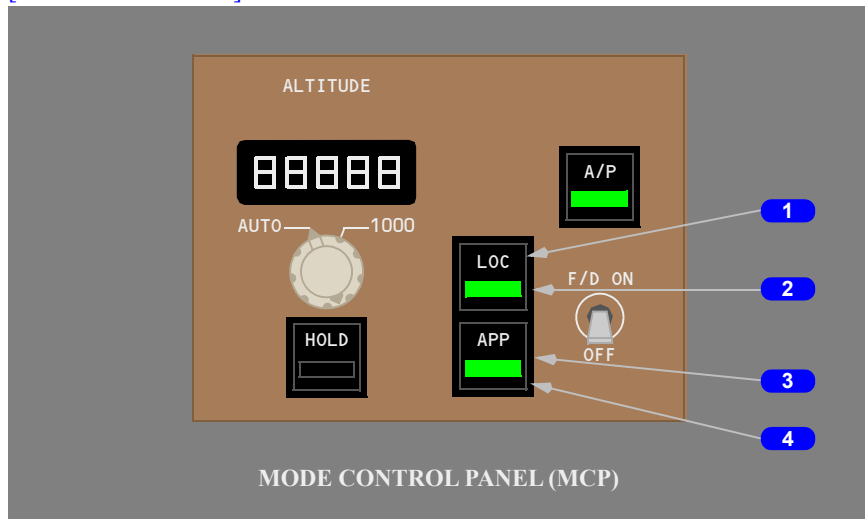
- selects altitude (ALT) pitch mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- ALT shows on both PFDs pitch flight mode annunciations
- AFDS commands pitch to maintain the altitude when the switch was pushed.

5 Altitude Hold Light

Illuminated (green) – the altitude hold mode is active.

Autopilot Flight Director Approach Mode Controls

[777-200/-300 Series]



[777-200/-300 Series]

1 Localizer (LOC) Switch

Push –

- arms, disarms, or captures localizer (LOC) as the roll mode
- shows LOC in white (armed) on both PFDs roll flight mode annunciations before localizer capture; current roll mode remains active until LOC capture
- shows LOC in green (active) on both PFDs roll flight mode annunciations after localizer capture
- arms AFDS to capture and track inbound on front course
- capture point varies based on range and intercept angle
- localizer capture can occur when intercept track angle is within 120 degrees of the localizer course.

The localizer mode can be disarmed before localizer capture by:

- pushing the localizer switch a second time, or
- arming or activating LNAV.

The localizer mode can be deactivated after localizer capture by:

- selecting a roll mode other than LNAV, or
- pushing a TO/GA switch, or

- disengaging the autopilot and turning both flight director switches off, or
- pushing the localizer switch a second time above 1,500 feet radio altitude (reverts to the default roll mode).

2 Localizer Light

Illuminated (green) – the localizer mode is armed or active.

3 Approach (APP) Switch

Push –

- arms, disarms, or captures localizer (LOC) as roll mode and glideslope (G/S) as pitch mode
- shows LOC and G/S in white (armed) on both PFDs roll and pitch flight mode annunciations prior to localizer and glideslope capture
- shows LOC and G/S in green (engaged) on both PFDs roll and pitch flight mode annunciations after each one is captured
- AFDS captures and tracks localizer and captures the glideslope upon interception
- localizer captures when intercept track angle is within 120 degrees of localizer course
- glideslope captures when intercept track angle is within 80 degrees of localizer course.

[Option – G/S capture inhibited before LOC capture]

Glideslope capture is inhibited before localizer capture.

The approach mode can be disarmed or deactivated for any status of localizer and/or glideslope by disengaging the autopilot and turning both Flight Director switches off.

When both localizer and glideslope are armed, the approach mode can be disarmed by selecting APP, LOC, LNAV, or VNAV.

The approach mode deselects:

- by pushing APP when above 1,500 feet radio altitude, or
- with localizer captured and glideslope armed, by selecting heading select (HDG SEL) or heading hold (HDG HOLD), or

[Option – G/S capture not inhibited before LOC capture]

- with localizer armed and glideslope captured, by selecting any other pitch mode except VNAV, or
- after localizer and glideslope are captured, by selecting TO/GA mode.

4 Approach Light

Illuminated (green) – the approach modes (LOC and G/S) are armed or active.

PFD Flight Mode Annunciations (FMAs)

Note: When first activated, Autothrottle, Roll Mode, Pitch Mode and Autoflight Status changes are emphasized for 10 seconds by a green box drawn around the mode.

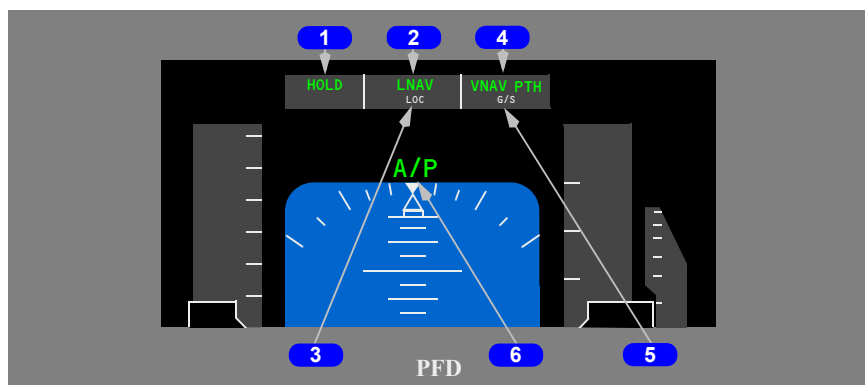
Note: An amber horizontal line displays through the affected active pitch or roll mode when a flight mode fault is detected.

[777-200/-300 Series]

Note: NO AUTOLAND shows on both PFDs if failures cause the system to degrade from multi-channel engage status (LAND 3 or LAND 2) to single channel status during an autoland. The mode change is emphasized for 10 seconds by an amber box.

[777-200/-300 Series]

Note: NO AUTOLAND also shows on both PFDs if multi-channel approach selected but multi-channel engage status (LAND 3 or LAND 2) has not been annunciated by 600 feet AGL. Under these conditions, flare and rollout modes are not armed.



1 Autothrottle Modes (Active)

Illuminated (green) –

- HOLD
- THR
- IDLE
- THR REF
- SPD

Note: When only one autothrottle is connected and armed, the autothrottle mode annunciator is augmented by a “L-” or “R-” preceding the mode.

2 AFDS Roll Modes (Active)

Illuminated (green) –

[Option - Bank Angle Hold at Engage]

- ATT
- HDG HOLD
- HDG SEL
- LNAV
- LOC
- ROLLOUT
- TO/GA
- TRK HOLD
- TRK SEL

3 AFDS Roll Modes (Armed)

Illuminated (white) –

- LOC
- LNAV
- ROLLOUT

4 AFDS Pitch Modes (Active)

Illuminated (green) –

- TO/GA
- ALT
- V/S
- VNAV PTH
- VNAV SPD
- VNAV ALT
- G/S
- FLARE
- FLCH SPD
- FPA

5 AFDS Pitch Modes (Armed)

Illuminated (white) –

- G/S
- FLARE
- VNAV

6 Autoflight Status Annunciation

Illuminated (green) –

- FLT DIR
- A/P
- LAND 3

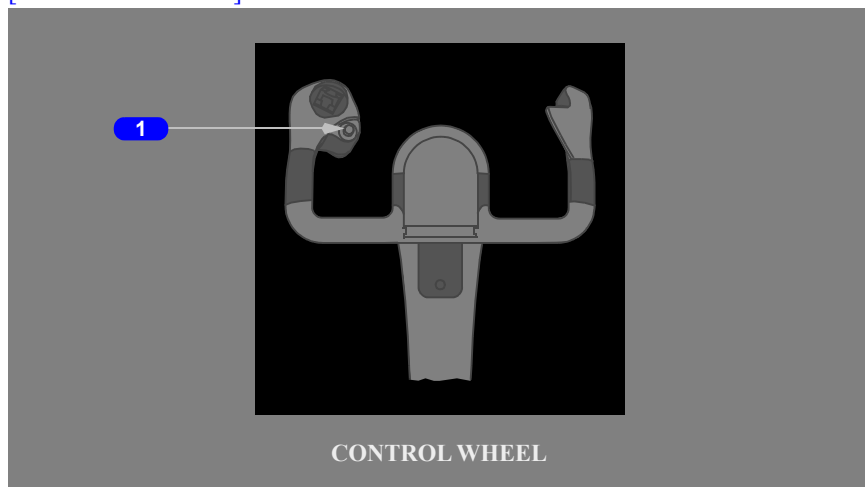
Illuminated (green with white triangles) – ▷LAND2◁

When newly selected, a green box shows around the A/P indication for ten seconds then the box blanks while the A/P stays shown.

Illuminated (amber) – NO AUTOLAND.

Autopilot Disconnect Switch

[777-200/-300 Series]



1 Autopilot Disconnect Switch

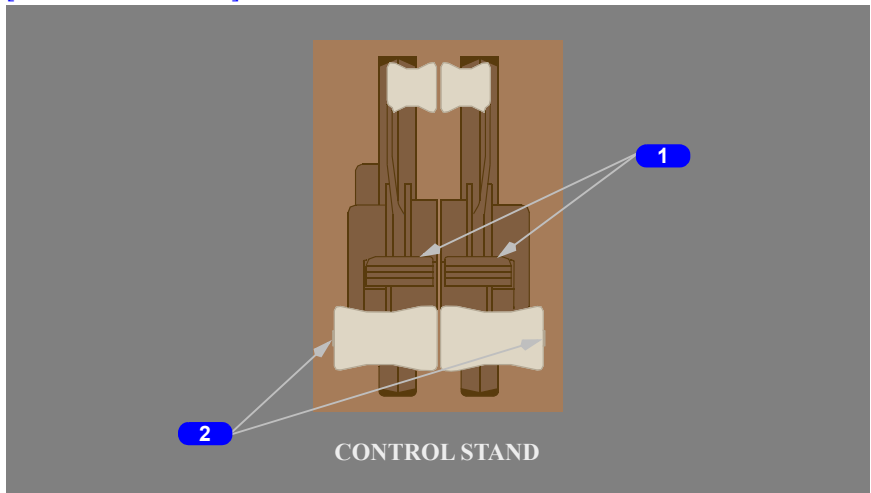
First push (either switch) –

- disengages all autopilots
- Master Warning lights illuminate
- shows the EICAS warning message AUTOPILOT DISC
- sounds an aural warning
- if the autopilot automatically disengages, first push resets the Master Warning lights, EICAS warning message, and the aural warning.

Second push – resets:

- Master Warning lights
- EICAS warning message
- aural warning.

Autothrottle Disconnect and TO/GA Switches

[\[777-200/-300 Series\]](#)**1 Takeoff/Go-around (TO/GA) Switches**

On the ground:

Push (below 50 knots and flaps out of up) –

[\[777-200/-300 Series\]](#)

- activates autothrottle in THR REF mode at reference thrust limit selected on THRUST LIMIT page. If not pushed below 50 knots, autothrottle operation is inhibited until reaching 400 feet altitude.

Push (above 80 knots, prior to lift off) –

- disarms LNAV and VNAV, if they were armed
- the Flight Directors are automatically shown, if they were not ON.

In flight:

Push (after lift-off with takeoff reference thrust limit displayed) –

- removes takeoff and climb derates and assumed temperature thrust reduction
- A/T in HOLD, activates A/T in THR REF mode
- disarms LNAV and VNAV, if armed
- between 50 feet and 400 feet, selects TO/GA roll mode
- above 400 feet, selects TO/GA roll and pitch modes

Push (on approach with flaps out of up or glideslope captured) –

- activates autothrottle in THR mode with GA reference thrust limit displayed. Thrust adjusts to provide 2000 feet per minute climb
- selects TO/GA roll and pitch modes
- arms or activates LNAV if an LNAV path is available
- disarms AFDS modes.

Note: During landing, the TO/GA switches are inhibited after touchdown or when below 2 feet radio altitude for 3 seconds or more. If the landing is discontinued, the TO/GA switches are enabled again above 5 feet radio altitude.

Second push (go-around active with flaps out of up, LNAV armed, TO/GA roll and pitch mode) -

- activates autothrottle in THR REF using GA reference thrust, or

Second push (go-around active with flaps out of up, LNAV active, TO/GA pitch mode) -

- activates autothrottle in THR REF using GA reference thrust, roll mode remains LNAV, or

Second push (go-around active with flaps out of up, HDG SEL or HDG HOLD active, TO/GA pitch mode) -

- activates autothrottle in THR REF using GA reference thrust, selects TO/GA roll and pitch modes.

2 Autothrottle Disconnect Switches

Push (either switch) –

- disconnects autothrottle (both left and right)
- illuminates Master Caution lights
- displays EICAS message AUTOTHROTTLE DISC
- if autothrottle automatically disconnects, resets Master Caution lights and EICAS message.

Second push –

- resets Master Caution lights and EICAS message
- autothrottle remains armed.

**Automatic Flight
System Description****Chapter 4
Section 20****Introduction**

The automatic flight control system consists of the autopilot flight director system (AFDS) and the autothrottle system (A/T). The mode control panel (MCP) and the flight management computer (FMC) control the AFDS and the autothrottle system to perform climb, cruise, descent, and approach.

Autopilot Flight Director System

The AFDS consists of three autopilot flight director computers (AFDCs) and the MCP.

The MCP provides control of the autopilot, flight director, altitude alert, and autothrottle systems. The MCP is used to select and activate AFDS modes, and establish altitudes, speeds, and climb/descent profiles.

[\[777-200/-300 Series\]](#)

The AFDCs provide control of the flight directors and autopilot. Flight director information displays on the primary flight displays (PFDs). The AFDS does not have direct control of the flight control surfaces. The autopilot controls the elevators, ailerons, flaperons, and spoilers through the fly-by-wire flight control system. Autopilot rudder commands are added only during an autopilot approach and landing. The autopilot controls nose wheel steering during rollout after an automatic landing.

MCP Mode Selection

MCP switches select automatic flight control and flight director modes. A light on the switch illuminates to indicate the mode is armed or active. Mode activation is indicated by the PFD roll and pitch flight mode annunciations. Autothrottle modes are discussed later in this section.

Most modes activate with a single push. These modes include:

- flight level change (FLCH SPD)
- heading hold (HDG HOLD)
- track hold (TRK HOLD)
- heading select (HDG SEL)
- track select (TRK SEL)
- vertical speed (V/S)
- flight path angle (FPA)
- altitude hold (ALT)

Other modes arm or activate with a single push. These modes are:

[\[777-200/-300 Series\]](#)

- lateral navigation (LNAV)
- vertical navigation (VNAV)
- localizer (LOC)
- approach (APP)

Desired target values can be selected on the MCP for:

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-
- | | |
|------------|---------------------|
| • airspeed | • vertical speed |
| • Mach | • flight path angle |
| • heading | • altitude |
| • track | |

All of these parameters except vertical speed and flight path angle can be preselected prior to autopilot and/or flight director activation.

Autopilot Engagement

The autopilot is engaged by pushing either of the two MCP autopilot engage switches.

Autopilot Disengagement

Normal autopilot disengagement is through either control wheel autopilot disconnect switch. The autopilots can also be disengaged by:

- the MCP autopilot disengage bar, or
- overriding with the control column, control wheel, or rudder pedals (pedals will only disengage the autopilots with LAND 2 or LAND 3 annunciated)

When an override force sufficient to move the control column, control wheel, or rudder pedals (LAND 2 or LAND 3 annunciated) is applied, the fly-by-wire flight control system detects a difference between the cockpit controls and its own estimate of the expected positions and forces disengagement of the autopilot. After the autopilot is disengaged, the control system transitions the control surface commands from those of the autopilot to those of the flight crew.

An automatic autopilot disengagement occurs for some failures detected by the autopilot. The EICAS warning message AUTOPILOT DISC displays if the autopilot is manually or automatically disengaged. Depending on the system failure, it may be possible to re-engage an autopilot by pushing the autopilot engage switch.

Autopilot and Flight Director Mode Degradations

Autopilot

The autopilot system can detect the degradation of a specific autopilot mode. When an engaged mode degrades, the autopilot remains engaged in an attitude stabilizing mode based on inertial data. If the degradation persists, the condition is annunciated on the PFD by an amber line through the affected flight mode annunciation. If the degradation continues, the EICAS caution message AUTOPILOT displays to indicate the autopilot is operating in a degraded mode. When the degradation is no longer present, the annunciations clear, the autopilot resumes using the mode, and a green box displays around the affected flight mode annunciation on the PFD for 10 seconds.

Flight Director

When a specific flight director mode degrades, the flight director provides an attitude stabilizing command based on inertial data. If the degradation persists, the condition is annunciated by removal of the affected (pitch or roll) flight director bar. When the degradation is no longer present, the flight director commands immediately return to view.

ILS Signal Interference Monitor

The autopilot flight director system (AFDS) can detect significant ILS signal interference due to service vehicles or aircraft. If localizer or glideslope signal interference is detected, the autopilot disregards the ILS signal and remains engaged in an attitude stabilizing mode based on inertial data. Most ILS signal interferences last only a short period of time, so there is no annunciation other than erratic movement of the ILS raw data during the time the interference is present. If the condition persists, the annunciations described above for Autopilot and Flight Director Mode Degradation are provided.

Flight Director Display

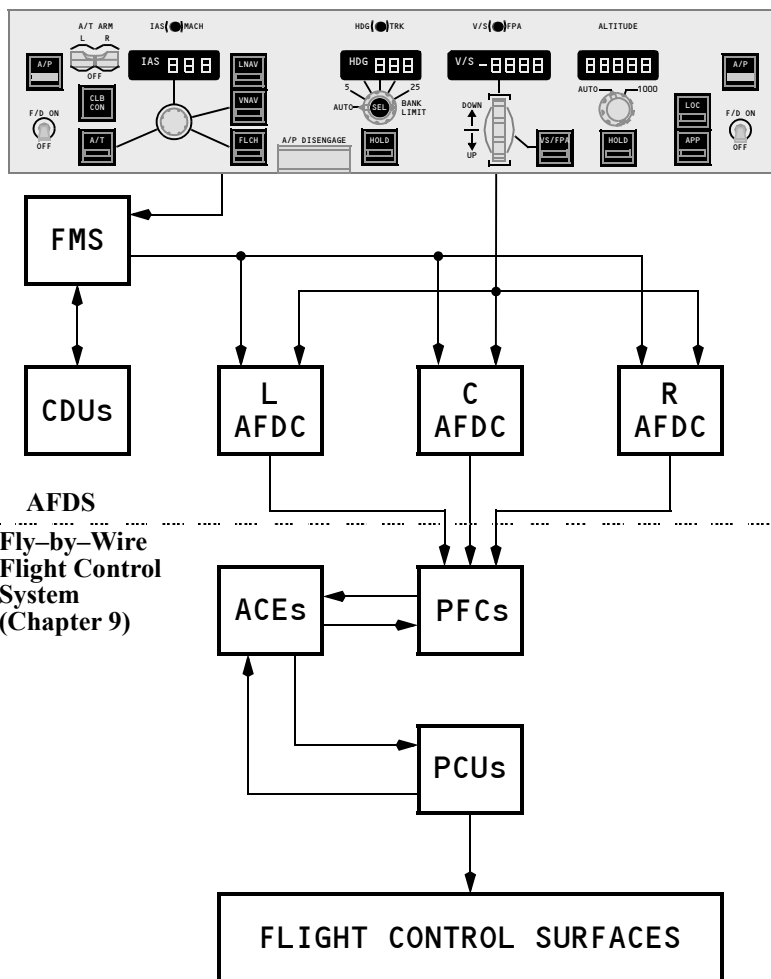
The flight director steering indications normally display any time the related flight director switch is ON.

The steering indications also display when the related flight director switch is OFF and a TO/GA switch is pushed, if airspeed is greater than 80 knots and the flaps are out of up. In this case, the flight director display can be removed by cycling the respective flight director switch on, then off.

A flight director mode failure, in either pitch or roll, causes the respective steering bars to disappear. The stall and overspeed protection functions also cause the pitch flight director bar to disappear.

Autopilot Flight Director System Schematic

[777-200/-300 Series]



AFDS Status Annunciation

The following AFDS status annunciations display just above the PFD attitude display:

- FLT DIR (flight director is ON and autopilots are not engaged)
- A/P (autopilots are engaged)

[777-200/-300 Series]

- LAND 3 (three autopilots are engaged and operating normally for an automatic landing)

[777-200/-300 Series]

- LAND 2 (AFDS redundancy is reduced; in some cases, only two autopilots are available)
- NO AUTOLAND (AFDS is unable to make an automatic landing).

With a LAND 3 indication, the autopilot system level of redundancy is such that a single fault cannot prevent the autopilot system from making an automatic landing (fail operational).

With a LAND 2 indication, the level of redundancy is such that a single fault cannot cause a significant deviation from the flight path (fail passive).

[777-200/-300 Series]

An EICAS message displays for any fault which limits the capability of the automatic landing system. Aural alerts for EICAS messages not affecting safety of flight are inhibited until after touchdown. Changes in autoland status below 200 feet, other than transition to NO AUTOLAND status, are inhibited.

AFDS Flight Mode Annunciations

The flight mode annunciations display just above the PFD AFDS status annunciations. The mode annunciations, from left to right, are:

- autothrottle
- roll
- pitch

Active or captured modes display at the top of the flight mode annunciation boxes in large green letters. Armed modes (except for TO/GA in the air) display in smaller white letters at the bottom of the flight mode annunciation boxes. Degradations of a specific mode while the autopilot is engaged annunciate by an amber line through the mode annunciations. A green box displays around the mode annunciation for 10 seconds when a mode first becomes active, and when the amber line through a degraded mode is removed.

Autothrottle Modes

Autothrottle annunciations are:

- THR – autothrottle applies thrust to maintain the climb/descent rate required by the pitch mode
- THR REF – thrust set to the reference thrust limit displayed on EICAS

[777-200/-300 Series]

- IDLE – displays while the autothrottle moves thrust levers to idle; IDLE mode is followed by HOLD mode

- HOLD – thrust lever autothrottle servos are inhibited. The pilot can set thrust levers manually
- SPD – autothrottle maintains command speed. Speed can be set using the MCP IAS/MACH selector or by the FMC, as displayed on the CDU CLIMB, CRUISE, or DESCENT page.

Note: In SPD mode, the autothrottle will not exceed the operating speed limits for the airplane configuration or the referenced thrust limits displayed on the EICAS.

[\[777-200/-300 Series\]](#)

Note: If only one thrust lever is active, “L” or “R” displays in front of SPD for the active thrust lever.

Roll Modes

Roll annunciations are:

LNAV –

- LNAV (armed) – LNAV is armed to activate when parameters are met
- LNAV (active) – LNAV activates when above 50 feet and in position to turn onto the active route leg. In flight, selection causes immediate activation if within 2 1/2 nm of the active leg.

HDG –

- HDG SEL (active) – airplane turns to or maintains the heading set in the MCP heading/track window
- HDG HOLD (active) – AFDS holds present heading. When turning, AFDS holds the heading reached after rolling wings level.

TRK –

- TRK SEL (active) – airplane turns to or maintains the track set in the MCP heading/track window
- TRK HOLD (active) – AFDS holds present track. When turning, AFDS holds the track reached after rolling wings level.

[\[Option – ATT Hold Engage\]](#)

ATT – (active) – when the autopilot is first engaged or the flight director is first turned on in flight, AFDS holds a bank angle between 5 and 30 degrees and will not roll to wings level. When the bank angle is less than 5 degrees, AFDS rolls to wings level (HDG HOLD or TRK HOLD). When the bank angle is greater than 30 degrees, AFDS rolls to 30 degrees of bank.

LOC –

- LOC (armed) – AFDS captures localizer when within range and within 120 degrees of localizer course
- LOC (active) – AFDS follows the localizer course.

TO/GA –

- On the ground, TO/GA annunciates by positioning either flight director switch ON when both flight directors are OFF; or, by pushing either TO/GA switch with airspeed greater than 80 KTS. TO/GA roll guidance becomes active at lift-off

[777-200/-300 Series]

- In flight, TO/GA is armed when flaps are out of up or glideslope is captured. There is no flight mode annunciation for TO/GA armed. TO/GA is activated in flight by pushing a TO/GA switch. The roll steering indication provides guidance to maintain the ground track present at mode engagement.

ROLLOUT –**[777-200/-300 Series]**

- ROLLOUT (armed) – displayed below 1500 feet radio altitude and activates below 2 feet
- ROLLOUT (active) – after touchdown, AFDS uses rudder and nosewheel steering to steer the airplane on the localizer centerline.

Pitch Modes

Pitch annunciations are:

TO/GA –

On the ground, TO/GA annunciates by positioning either flight director switch ON when both flight directors are OFF, or by pushing either TO/GA switch with airspeed greater than 80 knots. The flight director PFD pitch bar indicates an initial pitch of eight degrees up. TO/GA pitch guidance becomes active at lift-off.

After lift-off, the AFDS commands a pitch attitude to maintain:

- a target speed of V2 plus 15 knots or the airspeed at rotation (pitch attitude greater than two degrees) plus 15 knots, whichever is greater
- if current airspeed exceeds the target speed for 5 seconds, the target speed is reset to the lesser of the current airspeed or V2 plus 25 knots
- the IAS/MACH window speed when the window speed is changed to a speed greater than the target speed.

Note: AFDS uses the speed set in the IAS/MACH window for V2.

In flight, TO/GA is armed when flaps are out of up or glideslope is captured.

When a go-around is initiated, the command speed is the MCP IAS/MACH window or current airspeed, whichever is higher, to a maximum of the IAS/MACH window speed plus 25 knots. GA displays as the thrust limit on the primary EICAS engine display.

VNAV –

VNAV is armed by pushing the VNAV switch (the light illuminates and VNAV is annunciated on the PFD pitch mode annunciation in white characters below the current pitch mode).

VNAV activates at 400 feet and provides pitch commands to maintain the FMC computed airspeed/path:

- VNAV SPD (active) – AFDS maintains the FMC speed displayed on the PFD, and/or the CDU CLIMB or DESCENT pages. If speed intervention is selected, the MCP IAS/MACH selector is used to manually select the speed
- VNAV PTH (active) – AFDS maintains FMC altitude or descent path with pitch commands. If the MCP altitude window remains set to the current cruise altitude and the airplane is within two minutes of the top of descent, the CDU scratchpad message RESET MCP ALT displays
- VNAV ALT (active) – when a conflict occurs between the VNAV profile and the MCP altitude, the airplane levels and the pitch flight mode annunciation becomes VNAV ALT. The airplane maintains altitude. To continue the climb or descent, change the MCP altitude and push the altitude selector or change the pitch mode
- if an early descent is desired, FLCH, V/S, or FPA may be selected to descend below the VNAV descent path. If, during the descent, VNAV is armed and the airplane descent path subsequently intercepts the VNAV descent path, VNAV activates in VNAV PTH.

V/S (active) – pushing the MCP VS/FPA switch opens the vertical speed window to display the current vertical speed. Pitch commands maintain the rate of climb or descent set in the VS/FPA window.

FPA (active) – pushing the MCP VS/FPA switch opens the flight path angle window to display the current flight path angle. Pitch commands maintain the flight path angle set in the VS/FPA window.

FLCH SPD (active) – pushing the MCP FLCH switch opens IAS/MACH window (if blanked). Pitch commands maintain IAS/MACH window airspeed or Mach.

ALT (active) – altitude hold mode is activated by:

- pushing the MCP altitude HOLD switch, or
- [\[777-200/-300 Series\]](#)
- capturing the selected altitude from a V/S, FPA, or FLCH climb or descent

[\[777-200/-300 Series\]](#)

G/S (active) – AFDS follows the ILS glideslope.

FLARE (armed) – during autoland, FLARE displays below 1500 feet RA.

FLARE (active) – during autoland, flare activates between 60 and 40 feet RA.

FLARE deactivates at touchdown and smoothly lowers the nosewheel to the runway.

Autothrottle System

The autothrottle system provides thrust control from takeoff through landing. Autothrottle operation is controlled from the MCP and CDUs. The MCP provides mode and speed selection. The CDUs enable FMC reference thrust limit selection. When VNAV is active, the FMC selects autothrottle modes and target thrust values. Refer to Chapter 11, Flight Management, Navigation, for FMS and CDU operation. Refer to Chapter 10, Flight Instruments, Displays, for PFD indications.

The autothrottle is either OFF, ARMED, or active. The autothrottle is off when the A/T arm switches are OFF. The autothrottle is armed when the A/T switches are ON and the autothrottle mode is blank. The autothrottle is active when the A/T arm switches are ON and there is an autothrottle mode shown. The active autothrottle modes are: IDLE, HOLD, THR, THR REF, and SPD.

Manual Flight

The autothrottle can be operated with flight directors OFF and the autopilot not engaged. When the autopilot is not engaged, but one or both flight directors are ON and the autothrottle is active, turning off both flight directors transitions the autothrottle to SPD. The autothrottle maintains the IAS/MACH window speed.

[\[777-200/-300 Series Before AIMS V17B\]](#)

During a manual landing, when the active autothrottle mode is SPD, or the pitch mode is VNAV with the autothrottle active, thrust reduces to IDLE at 25 feet RA and the autothrottle mode transitions to IDLE.

[\[777-200/-300 Series After AIMS V17B\]](#)

During a manual landing, when the active autothrottle mode is SPD, or the pitch mode is VNAV or FLCH SPD with the autothrottle active, thrust reduces to IDLE at 25 feet RA and the autothrottle mode transitions to IDLE.

Automatic Activation

The autothrottle can automatically activate to provide stall protection when armed and not active (A/T mode is blank).

[\[777-200/-300 Series After AIMS V17B\]](#)

With the autothrottle armed and not active, the autothrottle automatically activates when the pitch mode is ALT, V/S, FPA, VNAV ALT, VNAV PTH, G/S, or there is no active pitch mode, and:

[777-200/-300 Series After AIMS V17B]

With the autothrottle armed and not active, the autothrottle automatically activates when the pitch mode is ALT, V/S, FPA, VNAV ALT, VNAV PTH, VNAV SPD, FLCH SPD, G/S, TOGA or there is no active pitch mode, and:

- speed is less than an FMC calculated value for one second, and
- thrust is below reference thrust limit, and
- airplane barometric altitude is 400 feet above the airport on takeoff or airplane altitude is above 100 feet RA on approach.

[777-200/-300 Series Before AIMS V17B]

If speed decreases to near stick shaker activation, the autothrottle automatically activates in SPD mode and advances thrust to maintain minimum maneuvering speed (approximately the top of the amber band) or the speed set in the IAS/MACH window, whichever is greater.

[777-200/-300 Series After AIMS V17B]

If the current pitch mode is no mode, ALT, V/S, FPA, G/S, or VNAV ALT, then autothrottle engages into SPD mode, and it will maintain minimum maneuvering speed (approximately the top of the amber band) or the speed set in the IAS/MACH window, whichever is greater.

Note: During a climb in VNAV SPD with the autothrottle armed and not active, the autothrottle automatically activates in THR REF mode and advances thrust to the current reference thrust limit.

[777-200/-300 Series After AIMS V17B]

Note: During a descent in VNAV SPD or FLCH SPD with the autothrottle armed and not active, the autothrottle automatically activates in THR mode and advances thrust to a throttle position corresponding to the relative distance speed has decreased into the amber band so that if speed continues to decrease, thrust will reach the CLB thrust limit as stick shaker is activated.

[777-200/-300 Series Before AIMS V17B]

Note: During a descent in VNAV SPD with the autothrottle armed and not active, the autothrottle can automatically activate in HOLD mode and will not advance thrust levers to support stall protection.

[777-200/-300 Series After AIMS V17B]

Note: During a climb in FLCH SPD, with the autothrottle armed and not active, the autothrottle automatically activates in THR mode and advances.

[777-200/-300 Series After AIMS V17B]

Note: During a climb in TOGA after a go-around, with the autothrottle armed and not active, the autothrottle automatically activates in THR mode and increases thrust towards the reference thrust limit.

[777-200/-300 Series Before AIMS V17B]

Note: The autothrottle will not automatically activate to support stall protection when the pitch mode is FLCH SPD or TO/GA.

[777-200/-300 Series Before AIMS V17B]

Note: The autothrottle will not support stall protection when the A/T mode is HOLD.

[777-200/-300 Series After AIMS V17B]

If the pitch mode is FLCH SPD, VNAV SPD, or VNAV PTH and A/T is in HOLD or THR mode, and speed decreases into the amber band, the A/T will change from HOLD to THR mode if necessary, and thrust will increase proportional to the amount speed has decreased into the amber band.

[777-200/-300 Series After AIMS V17B]

If the pitch mode is TOGA during takeoff, and the A/T is in HOLD mode, and thrust has been manually set below the TO thrust reference, and a low speed condition is encountered, then the A/T mode will change from HOLD to THR REF and will advance thrust towards the selected TO thrust reference while airspeed is within 10 kts of stick shaker speed.

When the respective autothrottle servo fails or the switch is selected off the AUTOTHROTTLE L or R EICAS advisory message shows. If the autothrottle is active and only one autothrottle is armed, the PFD autothrottle flight mode annunciation shows L or R preceding the mode. For example, L SPD indicates only the left autothrottle is active in speed mode.

Autothrottle Thrust Lever Operation

The autothrottle system moves either or both thrust levers to provide speed or thrust control, depending on the active mode.

Thrust levers can be manually positioned without disconnecting the autothrottle. After manual positioning, the autothrottle system repositions thrust levers to comply with the active mode. The autothrottle system does not reposition thrust levers while in HOLD mode.

[777-200/-300 Series]

Note: When the pitch flight mode annunciation is FLCH SPD, the autothrottle can enter the HOLD mode. This occurs if the pilot overrides thrust levers; or, in a descent, when thrust levers retard to IDLE. When in HOLD mode, thrust lever servos are inhibited and the autothrottle does not control thrust or speed. Thrust levers can be manually advanced.

Autothrottle Disconnect

The autothrottle system can be disconnected manually by pushing either autothrottle disconnect switch, except during conditions that cause the autothrottle to automatically activate. The autothrottle can also be disconnected manually by positioning both A/T ARM switches to OFF, or individually by positioning the left or right A/T ARM switch to OFF. Positioning one or both A/T ARM switches to OFF prevents activation of all autothrottle modes for the affected autothrottle.

Autothrottle disconnect occurs automatically:

- if a fault in the active autothrottle mode is detected
- when either reverse thrust lever is raised to reverse idle
- if the thrust levers are overridden during a manual landing, after the autothrottle has begun to retard the thrust levers to idle
- when both engines are shut down.

When the autothrottle is manually or automatically disconnected or failed the AUTOTHROTTLE DISC EICAS caution message shows and an aural alert sounds. The EICAS caution message and aural alert are inhibited if the disconnect occurs because of reverse thrust.

Automatic Flight Operations

Automatic Flight - Takeoff and Climb

Takeoff is a flight director only function of the takeoff/go-around (TO/GA) mode. The autopilot may be engaged after takeoff.

During preflight:

- with the autopilot disengaged and both flight director switches OFF, annunciation of TO/GA roll and pitch mode occurs when the first flight director switch is positioned ON
- PFD displays FLT DIR as AFDS status and TO/GA as the pitch and roll flight mode annunciations
- pitch command is set to approximately eight degrees up
- roll command is wings level.

During takeoff prior to lift-off:

- with speed less than 50 knots, pushing a TO/GA switch activates the autothrottle in thrust reference (THR REF) and advances thrust levers to the selected reference thrust limit. If the autothrottle is not active by 50 knots, it cannot be activated until above 400 feet
- at 80 knots, autothrottle annunciation changes to HOLD
- with speed greater than 80 knots, pushing a TO/GA switch disarms LNAV and VNAV

[777-200/-300 Series]

- during takeoff, the FMC records the barometric altitude as the airplane accelerates through 100 knots. This altitude is used to activate VNAV, enable autothrottle activation (if not active), command acceleration for flap retraction, and set climb thrust if an altitude has been selected. Radio altitude is used for activation of LNAV.

At lift-off:

[777-200/-300 Series]

- pitch command target speed is $V_2 + 15$. If current airspeed remains above target speed for 5 seconds, target airspeed is reset to current airspeed (limited to a maximum of $V_2 + 25$)
- if an engine failure occurs on the ground, the pitch command target speed at lift-off is V_2 or airspeed at lift-off, whichever is greater
- roll command maintains ground track.

After lift-off:

- if an engine failure occurs, the pitch command target speed is:
 - V_2 , if airspeed is below V_2
 - existing speed, if airspeed is between V_2 and $V_2 + 15$
 - $V_2 + 15$, if airspeed is above $V_2 + 15$.

- if a TO/GA switch is pushed:
 - removes takeoff and climb derates and assumed temperature thrust reduction
 - A/T in HOLD, A/T activates in THR REF
- at 50 feet radio altitude, LNAV activates, if armed. Roll commands bank to track the active route
- at 400 feet, VNAV activates, when armed. Pitch commands the current airspeed. The autothrottle sets the selected reference thrust and annunciates THR REF
- at acceleration height or altitude capture below acceleration height, pitch commands speed to 5 knots below takeoff flap placard speed. As flaps are retracted, pitch commands an acceleration to 5 knots below the placard speed of the commanded flap position

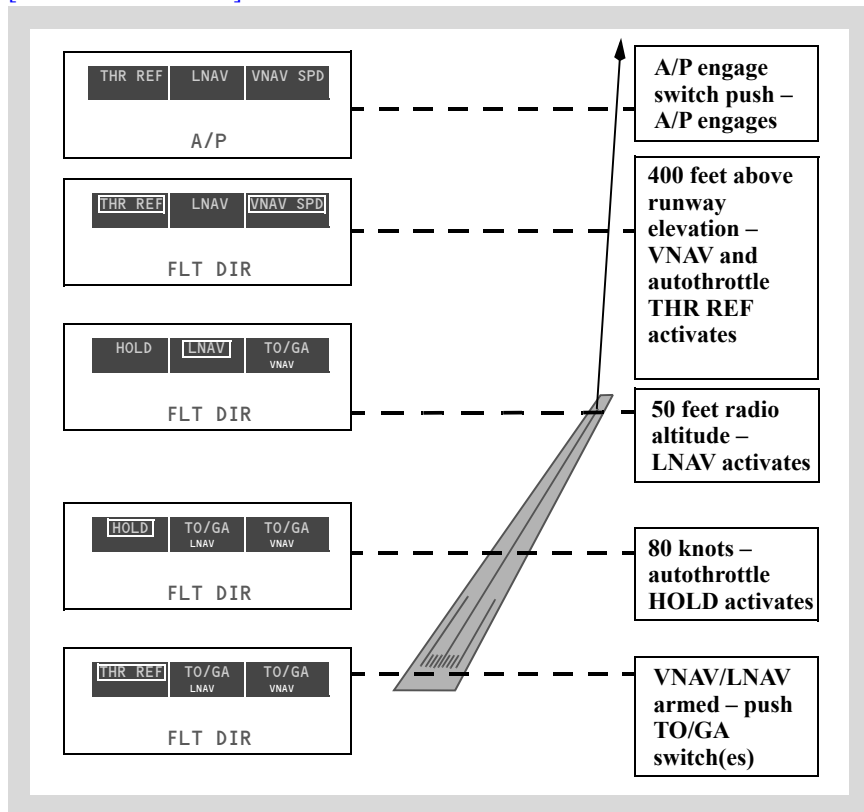
[777-200/-300 Series]

- when flaps are up, pitch commands an acceleration to VNAV climb speed. VNAV climb speed is the greater of:
 - VREF + 80 knots, or
 - speed transition associated with origin airport
- at thrust reduction point (either an altitude or a flap position), FMC changes reference thrust limit to armed climb limit (CLB, CLB 1, or CLB 2).

The TO/GA mode is terminated by selecting any other pitch and roll mode or by activation of LNAV/VNAV modes.

Automatic Flight Takeoff Profile

[777-200/-300 Series]



Automatic Flight - Cruise

The autopilot and/or flight director can be used after takeoff to fly a lateral navigation track (LNAV) and a vertical navigation track (VNAV) provided by the FMS. Using LNAV and VNAV ensures the most economical operation.

Other roll modes available are:

- heading hold (HDG HOLD)
- heading select (HDG SEL)
- track hold (TRK HOLD)
- track select (TRK SEL)

Other pitch modes available are:

- altitude hold (ALT)
- flight level change (FLCH SPD)
- vertical speed (V/S)
- flight path angle (FPA)

Profile illustrations show the use of LNAV and VNAV.

Automatic Flight - Approach and Landing

[777-200/-300 Series]

The AFDS provides autopilot guidance for ILS approaches.

[Option – GS capture not inhibited before LOC capture]

Pushing the APP switch arms localizer in roll mode and glideslope in pitch mode. Either localizer or glideslope can be captured first.

[Option – GS capture inhibited before LOC capture]

Pushing the APP switch arms localizer in roll mode and glideslope in pitch mode. Glideslope capture is inhibited until the localizer is captured.

Pushing the LOC switch arms the AFDS for localizer tracking. Descent on the localizer can be accomplished using VNAV, V/S, FLCH, or FPA pitch modes. The localizer mode cannot capture if the intercept angle exceeds 120 degrees. All other non-ILS approaches can be flown using LNAV and VNAV modes, or HDG SEL, TRK SEL, V/S, or FPA modes.

With a command speed of VREF+5 knots and landing flaps, there is sufficient wind and gust protection available with the autothrottle active. The autothrottle adjusts thrust quickly when airspeed decreases below command speed. The autothrottle decreases thrust slowly when airspeed is more than command speed. In turbulence, thrust may be somewhat higher than necessary to maintain command speed. Average speed may be somewhat higher than the command speed.

Runway Alignment

Runway alignment is a submode of the approach mode. With crosswinds, the crab angle is reduced at touchdown. Runway alignment also compensates for a single engine approach.

[777-200/-300 Series]

For crosswinds requiring more than 10 degrees of crab angle, runway alignment occurs at 500 feet AGL. A sideslip of 5 degrees is established to reduce the crab angle. This configuration is maintained until touchdown. The airplane lands with the upwind wing low.

For crosswinds requiring a crab angle of between 5 and 10 degrees, an initial alignment occurs at 500 feet AGL, followed by a second alignment at 200 feet AGL. The initial alignment initiates a sideslip to reduce the crab angle to 5 degrees. This configuration is maintained to 200 feet AGL, where a second sideslip alignment increases the sideslip to further reduce the touchdown crab angle.

For crosswinds requiring a crab angle of less than 5 degrees, no runway alignment occurs until 200 feet AGL, where a sideslip is introduced to align the airplane with the runway.

If an engine fails prior to the approach, the AFDS introduces a sideslip at 1,300 feet AGL. This establishes a wings level configuration. If an engine fails during the approach, the wings level configuration is established when the engine failure is detected.

In the event of moderate or strong crosswinds from the side opposite the failed engine, no wings level sideslip is commanded, since the airplane is already banked into the wind.

Flare

The flare mode brings the airplane to a smooth automatic landing touchdown. The flare mode is not intended for single autopilot or flight director only operation.

[\[777-200/-300 Series\]](#)

Flare is armed when LAND 3 or LAND 2 is annunciated on the PFDs. At approximately 50 feet radio altitude, the autopilots start the flare maneuver. FLARE replaces the G/S pitch flight mode annunciation.

During flare:

- between 25 and 50 feet radio altitude, the autothrottle begins retarding thrust levers to idle
- PFD autothrottle annunciation changes from SPD to IDLE
- at touchdown, the FLARE annunciation no longer displays and the nose wheel is lowered to the runway.

Rollout

Rollout provides localizer centerline rollout guidance. Rollout arms when LAND 3 or LAND 2 annunciates.

[\[777-200/-300 Series\]](#)

At less than two feet radio altitude, rollout activates. ROLLOUT replaces the LOC roll mode annunciation.

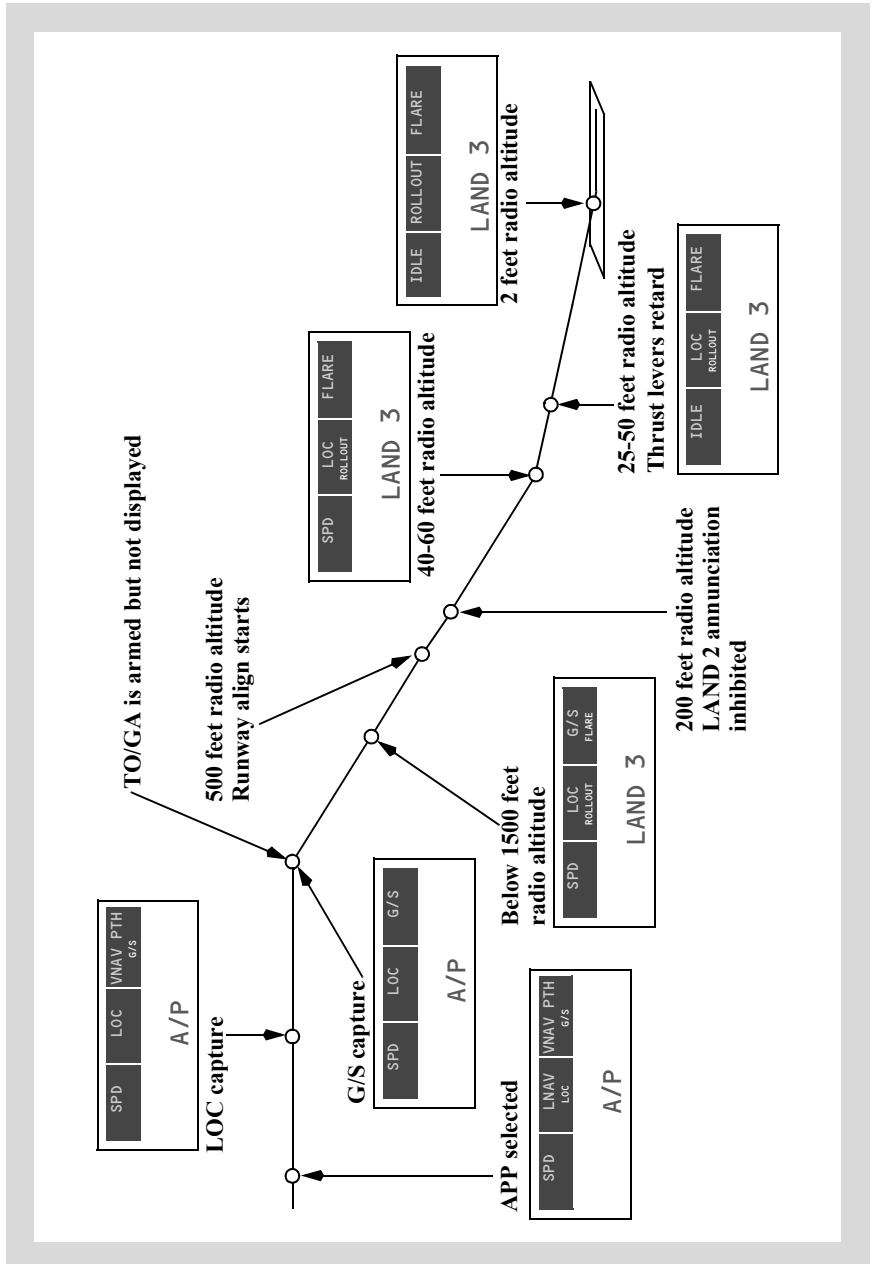
The autopilot controls rudder and nose wheel steering to track the localizer centerline.

During rollout, autothrottle IDLE mode remains active until the autothrottle disconnects with thrust levers in reverse.

Rollout guidance continues until the autopilots disengage.

Automatic Flight Approach Profile

[777-200/-300 Series]



Automatic Flight - Go-Around

TO/GA is armed when flaps are out of up or glideslope is captured. The reference thrust limit changes to GA when flaps are extended out of up, flaps are extended to landing position, or glideslope is captured. The reference thrust limit is locked in GA when flaps are in landing position or glideslope is captured.

With flaps out of up, but not in landing position, activation of VNAV in VNAV PTH changes the reference thrust limit to CRZ. However, pressing TO/GA changes the reference thrust limit to GA and GA thrust is available.

Pushing either TO/GA switch activates a go-around. The mode remains active even if the airplane touches down while executing the go-around.

Note: During landing, the TO/GA switches are inhibited after touchdown or when below 2 feet radio altitude for 3 seconds or more. If the landing is discontinued, the TO/GA switches are enabled again above 5 feet radio altitude.

[777-200/-300 Series]

When the flight director switches are off, pushing either TO/GA switch displays the flight director bars.

With the first push of either TO/GA switch:

- roll and pitch activate in TO/GA
- autothrottle activates in thrust (THR) to establish a minimum climb rate of 2,000 fpm
- the AFDS increases pitch to hold the selected speed as thrust increases
- if current airspeed remains above the target speed for 5 seconds, the target airspeed is reset to current airspeed (to a maximum of the IAS/MACH window speed plus 25 knots)

[LNAV auto-engage option - requires AIMS 05]

- with an LNAV path available, LNAV automatically activates:
 - above 50 feet radio altitude when autopilot is not engaged, or
 - above 200 feet radio altitude when autopilot is engaged.

Note: With an LNAV path available, LNAV arms until above minimum engagement altitude.

Note: During go-around from a LAND 2 or LAND 3 approach, automatic LNAV activation causes disengagement of autopilot rudder control. If executing an engine out missed approach with thrust asymmetry compensation inoperative, manual rudder control may be required to prevent large roll and yaw excursions.

With the second push of either TO/GA switch, autothrottle activates in thrust reference (THR REF) at full go-around thrust.

With an LNAV path available, LNAV remains active following a second TO/GA push.

TO/GA level-off:

- when reaching the altitude set in the Altitude window, AFDS pitch mode changes to altitude hold (ALT)
- when altitude is captured or V/S or FPA is active, MCP speed is automatically set to:
 - the flap placard speed minus 5 knots
 - 250 knots if flaps are up, or
 - a speed value entered in the IAS/Mach window after TO/GA was pushed

[no LNAV auto-engage]

[777-200/-300 Series]

- TO/GA remains the active roll mode until another roll mode is selected

[777-200/-300 Option - LNAV auto-engage - requires AIMS 05]

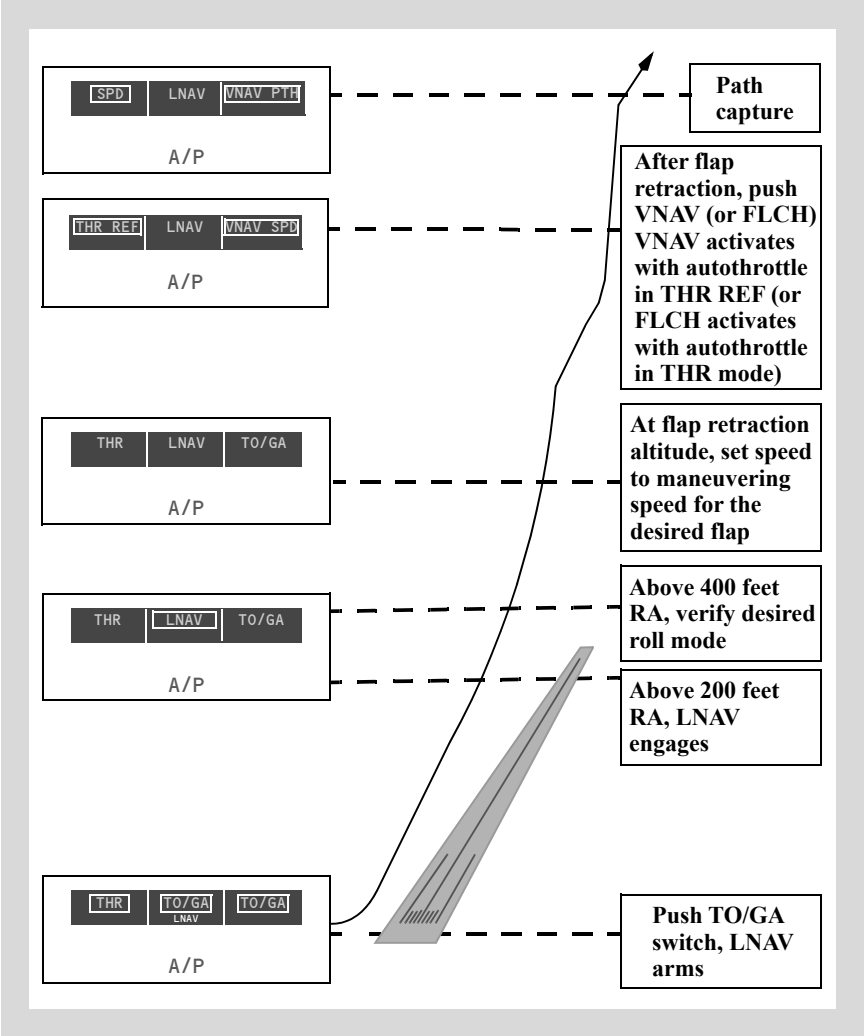
- TO/GA remains the active roll mode until LNAV automatically engages or another roll mode is selected.

TO/GA mode termination:

- below 400 feet radio altitude, disengage autopilot and turn off both flight directors, or automatic LNAV activation (after automatic LNAV activation, a different roll mode can be selected)
- above 400 feet radio altitude, select a different roll or pitch mode.

Automatic Flight Go-Around Profile

[777-200/-300 Option - LNAV auto-engage - requires AIMS 05]



Automatic Flight Windshear Recovery

The AFDS provides windshear recovery guidance by means of the normal go-around pitch and roll modes. With go-around armed, pushing a TO/GA switch commands a pitch-up of 15 degrees or slightly below the pitch limit, whichever is lower.

As rate of climb increases, the AFDS transitions from pitch to airspeed control. The target airspeed is IAS/MACH window airspeed or current airspeed, whichever is greater when TO/GA is activated. If current airspeed remains above the selected speed for 5 seconds, the selected airspeed is reset to current airspeed, (to a maximum of the IAS/MACH window speed plus 25 knots).

If the autopilot is not engaged when go-around is initiated, the pilot must fly the windshear recovery following the flight director commands. If the autothrottle is not armed, the thrust levers must be advanced manually.

Flight Envelope Protection

There are three forms of flight envelope protection in the autopilot:

- stall protection
- overspeed protection
- roll envelope bank angle protection

An AUTOPILOT caution message and roll or pitch mode failures alert the pilot if the envelope is exceeded, and the autopilot prevents further envelope violations.

Refer to Chapter 9, Flight Controls, for a description of flight envelope protection.

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**Automatic Flight
EICAS Messages****Chapter 4
Section 30****Automatic Flight EICAS Messages**

The following EICAS messages can be displayed.

Message	Level	Aural	Message Logic
AUTOPILOT	Caution	Beeper	Autopilot is operating in a degraded mode. Active roll and/or pitch mode may have failed, or the autopilot has entered envelope protection.

[\[Autopilot Disconnect Siren Option\]](#)

AUTOPILOT DISC	Warning	Siren	Autopilot has disengaged.
AUTOTHROTTLE DISC	Caution	Beeper	Both autothrottles have disconnected.
AUTOTHROTTLE L, R	Advisory		Affected autothrottle is OFF or has failed.
NO AUTOLAND	Caution	Beeper	Autoland is not available. Message is a caution if fault occurs after LAND 3 or LAND 2 is annunciated, or approach has been selected but does not engage by 600 feet AGL.
	Advisory		Message is an advisory if fault occurs before LAND 3 or LAND 2 is annunciated.
NO LAND 3	Caution	Beeper	Autoland system does not have redundancy for triple channel autoland.
	Advisory		Message is a caution if fault occurs after LAND 3 is annunciated. Message is an advisory if fault occurs before LAND 3 is annunciated.

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Communications**Chapter 5****Table of Contents****Section TOC**

Controls and Indicators	5.10
Audio Control Panel	5.10.1
Radio System	5.10.3
Radio Tuning Panel	5.10.3
Radio Tuning Panel Indications	5.10.5
Miscellaneous Communication Controls	5.10.6
Headphone/Boom Microphone [Typical]	5.10.6
Hand Microphone [Typical]	5.10.7
Oxygen Mask Microphone [Typical]	5.10.7
Control Wheel Microphone/Interphone Switch	5.10.8
Glareshield Microphone Switch	5.10.8
Service Interphone Switch	5.10.9
Handset	5.10.9
Flight Deck Speaker	5.10.11
Boom Microphone/Headphone Panel	5.10.11
Observer Audio Selector	5.10.12
Call Panel	5.10.12
Flight Deck Call Switch	5.10.14
Cargo Interphone Component Locations	5.10.15
Cargo Interphone Components	5.10.16
Data Link Accept/Cancel/Reject Switches	5.10.19
Cockpit Voice Recorder System	5.10.20
Cockpit Voice Recorder Panel	5.10.20
Cockpit Voice Recorder Microphone [Typical]	5.10.22
Cockpit Voice Recorder Switch	5.10.22
Printer Controls	5.10.23
System Description	5.20
Introduction	5.20.1
Audio Control Panels	5.20.1
Cockpit Voice Recorder System	5.20.2

Radio Tuning Panels	5.20.2
Radio Communication Systems	5.20.2
VHF Communication System	5.20.2
HF Communication System	5.20.3
Stuck Mic Protection	5.20.4
SELCAL System	5.20.4
SATCOM System	5.20.4
SATCOM Phone Pages [Typical]	5.20.5
SATCOM Directory Index Page [Typical]	5.20.7
SATCOM Directory Page [Typical]	5.20.7
Communication Crew Alerting System	5.20.8
Crew Alert Categories	5.20.8
Main Deck Alert System	5.20.9
Broadband Communication System	5.20.9
Interphone Systems	5.30
Interphone Communication System	5.30.1
Flight Interphone System	5.30.1
Service Interphone System	5.30.2
Passenger Address System	5.30.2
Personnel Address System	5.30.3
Cabin Interphone System	5.30.3
CDU Menu Page	5.30.4
Cabin Interphone CDU Controls	5.30.5
Cabin Interphone Main Menu	5.30.5
Cabin Interphone Main Menu Page [Typical]	5.30.6
Cabin Interphone Directory Page [Typical]	5.30.8
Cabin Interphone Subdirectory Page [Typical]	5.30.8
Cabin Interphone System	5.30.9
Cargo Interphone System	5.30.10
Cargo Intercom System	5.30.10

MFD Communications Functions	5.40
Introduction	5.40.1
Communications Menus	5.40.2
Communications Control and Input Functions	5.40.4
Command Key Locations	5.40.4
Command Key Functions	5.40.5
Text Entry	5.40.11
Menu Entry Fields	5.40.12
Invalid Entries	5.40.12
Message List	5.40.13
Message Display Format	5.40.14
Exclusive and Nonexclusive Select Keys	5.40.16
Information Messages	5.40.17
Communications Information Messages	5.40.17
Uplink Message	5.40.19
ATC Data Link	5.40.21
Crew Feedback	5.40.21
FMC Data Loading	5.40.21
Downlink Pages	5.40.22
ATC Menu	5.40.22
Altitude Request	5.40.24
Level Request	5.40.25
Altitude Request Reason Page	5.40.27
Level Request Reason Page	5.40.28
Route Request	5.40.30
Speed Request	5.40.33
Clearance Request	5.40.34
Combination Downlink Request	5.40.35
When Can We Expect	5.40.38
Voice Contact Request	5.40.40
ATC Logon/Status	5.40.41
ATC Connection Displays	5.40.45
Emergency Report	5.40.47

ATC Reports.	5.40.50
ATC Requested Report.	5.40.50
Armable Report.	5.40.52
Conditional Clearances.	5.40.54
Position Report.	5.40.55
Optional Position Report Items.	5.40.58
Free Text Message.	5.40.59
Flight Information.	5.40.59
Flight Information Menu.	5.40.59
Departure Clearance Request.	5.40.60
Oceanic Clearance Request.	5.40.61
ATIS Request.	5.40.63
TWIP Request.	5.40.64
Pushback Clearance Request.	5.40.65
Expected Taxi Clearance Request.	5.40.66
Company Menu.	5.40.68
Company Downlink Message Page.	5.40.69
Review Menu.	5.40.70
Review State Indicators.	5.40.71
Manager Functions.	5.40.72
Manager Menu.	5.40.72
ACARS Manager.	5.40.73
ACARS Manager Page 2/2.	5.40.76
VHF Manager.	5.40.77
HF Manager.	5.40.78
SATCOM Manager.	5.40.78
Automatic Dependent Surveillance Manager.	5.40.79
System Information Manager.	5.40.80
Printer Manager.	5.40.82
Automatic Messages Manager.	5.40.82
Master Manager.	5.40.83
Diagnostics Manager.	5.40.84
Manager Messages.	5.40.85

777 Flight Crew Operations Manual

New Messages	5.40.87
New Messages Menu	5.40.87
New Message – No Response Required.....	5.40.89
New Message – Response Required.....	5.40.90
EICAS Messages.....	5.50
Communications EICAS Alert Messages	5.50.1
EICAS Communication Messages.....	5.50.2

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Chapter 5

Section 10

The diagram shows the AFT AISLE STAND PANEL with the following components and callouts:

- 1**: Points to the top left corner of the panel.
- 2**: Points to the top left corner of the panel.
- 3**: Points to the top left corner of the panel.
- 4**: Points to the MIC INT switch.
- 5**: Points to the VOR L R switch.
- 6**: Points to the PA button.
- 7**: Points to the SPKR button.
- 8**: Points to the SPKR button.
- 9**: Points to the APP L R switch.
- 10**: Points to the bottom right corner of the panel.

The panel includes the following controls and labels:

- MIC CALL** (6 buttons)
- VHF** (3 buttons)
- FLT** (1 button)
- CAB** (1 button)
- PA** (1 button)
- MIC** (1 button)
- INT** (1 button)
- HF** (2 buttons)
- SAT** (2 buttons)
- SPKR** (1 button)
- VOR** (2 buttons)
- ADF** (2 buttons)
- V B R** (1 button)
- APP** (2 buttons)
- L C R** (1 button)
- MKR** (1 button)

3 CALL Lights

Illuminated (green) –

- indicates a call on SELCAL, the flight interphone (FLT), the cabin interphone (CAB), or SATCOM (SAT)
- resets when the respective transmitter select switch is pushed or, if already pushed, by pressing a MIC/INTERPHONE switch (the SATCOM CALL light remains illuminated until the call ends)
- PA does not have a CALL light

4 MIC/Interphone (INT) Switch

MIC – keys the boom microphone or oxygen mask on the selected radio transmitter or other system.

Center – off position (spring-loaded to center).

INT – keys the boom microphone or oxygen mask on the flight interphone.

5 VOR/ADF Receiver Selector

Selects the VOR or ADF receiver to be monitored:

- VOR L – left VOR
- VOR R – right VOR
- ADF L – left ADF
- ADF R – right ADF

6 Receiver Lights

Illuminated (green) – indicates the respective receiver volume control is manually selected on.

7 Receiver Volume Controls

Push – turns the respective receiver audio on or off.

Rotate – controls receiver volume.

8 Speaker (SPKR) Volume Control

Push – turns the respective flight deck speaker on or off.

Rotate – controls flight deck speaker volume.

9 Approach (APP) Receiver Selector

Selects the approach receiver to be monitored:

- APP L – left ILS
- APP C – center ILS

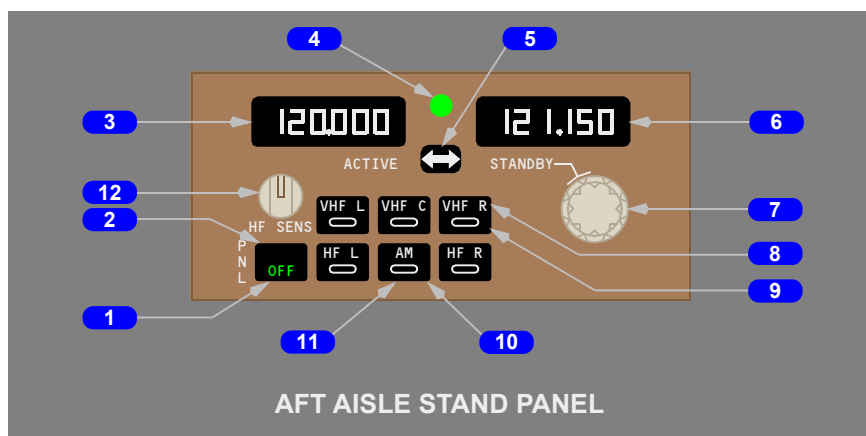
- APP R – right ILS
- MKR – marker beacon

10 Navigation Filter Selector

Filters VOR, ADF, ILS, or DME audio:

- V (voice) – only the voice audio is heard
- B (both) – both the voice and range audio are heard
- R (range) – range audio (navigation aid Morse code identifier) is heard

Note: Marker beacon audio is available in all positions.

Radio System**Radio Tuning Panel****1 Radio Tuning Panel OFF Light**

Illuminated (green) – the radio tuning panel is off.

2 Radio Tuning Panel OFF Switch

Push – disconnects the panel from the communication radios.

3 ACTIVE Frequency Window

Displays the tuned frequency of the selected radio.

Displays DATA if the selected radio is in the data mode (not applicable for VHF L).

4 Offside Tuning Light

Illuminated (green) –

- 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

Note: The left radio tuning panel is normally associated with VHF L and HF L.
The right radio tuning panel is normally associated with VHF R and HF R.
The center radio tuning panel is normally associated with VHF C.

5 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

6 STANDBY Frequency Window

Displays the preselected or previously tuned frequency of the selected radio.

With data link installed, displays DATA when selection of the frequency transfer switch would reconfigure the selected radio to the data mode (not applicable for VHF L).

7 Frequency Selector

Rotate –

- outer knob – selects the portion of the STANDBY frequency to the left of the decimal point
- inner knob – selects the portion of the STANDBY frequency to the right of the decimal point

8 Radio Tuning Switches

Push –

- selects the radio to be tuned
- the tuned frequency is displayed in the ACTIVE frequency window
- the standby frequency is displayed in the STANDBY frequency window

Push and hold – removes automatic squelch on selected VHF radio until switch is released.

9 Radio Tuning Lights

Illuminated – indicates the selected radio.

10 AM Switch

Push – sets the AM or USB mode for the selected HF.

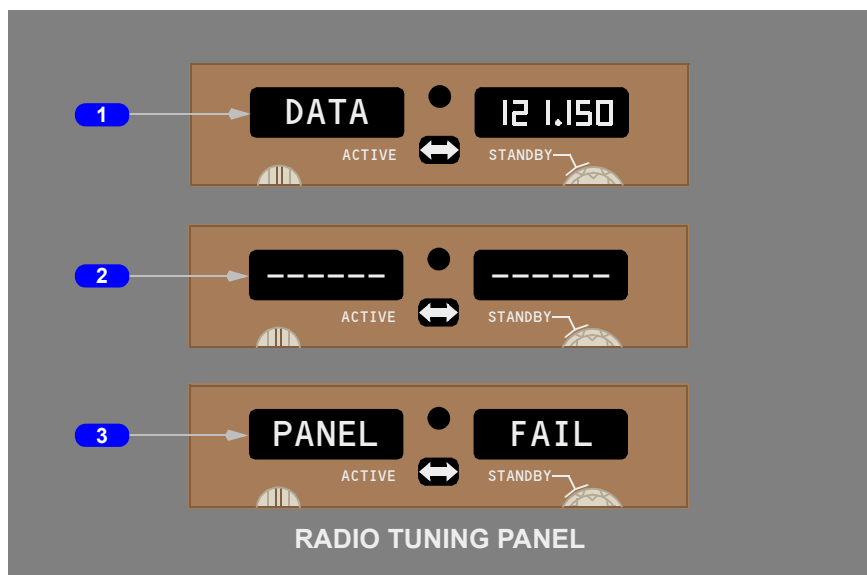
11 AM Light

Illuminated – HF AM is selected.

Extinguished – HF USB is selected.

12 HF Sensitivity Control

Rotate – adjusts the sensitivity of the on-side HF receiver.

Radio Tuning Panel Indications**1 DATA Mode**

Displays DATA in the ACTIVE frequency window when the selected radio is being used in the data mode.

2 Radio Fail

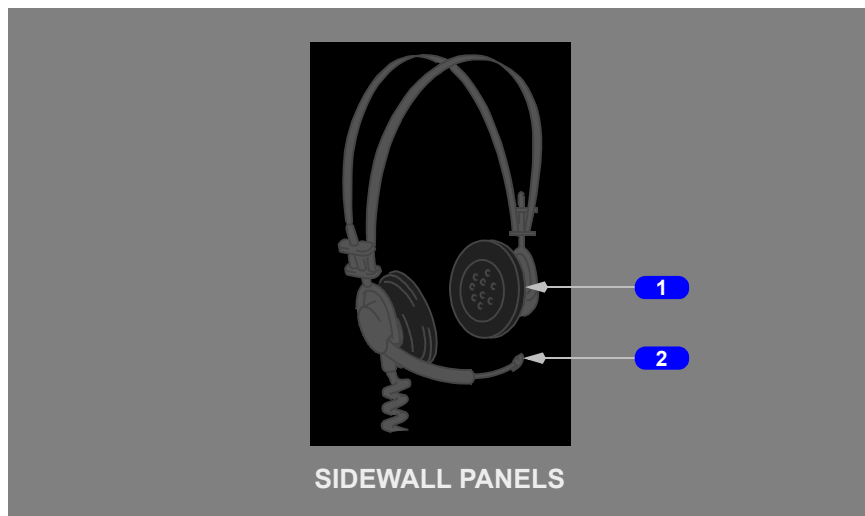
Displays dashes in both windows when the selected radio is failed or has been disconnected.

3 PANEL FAIL

The radio tuning panel is failed.

Miscellaneous Communication Controls

Headphone/Boom Microphone [Typical]



1 Headphone

Used to monitor audio from the respective audio control panel.

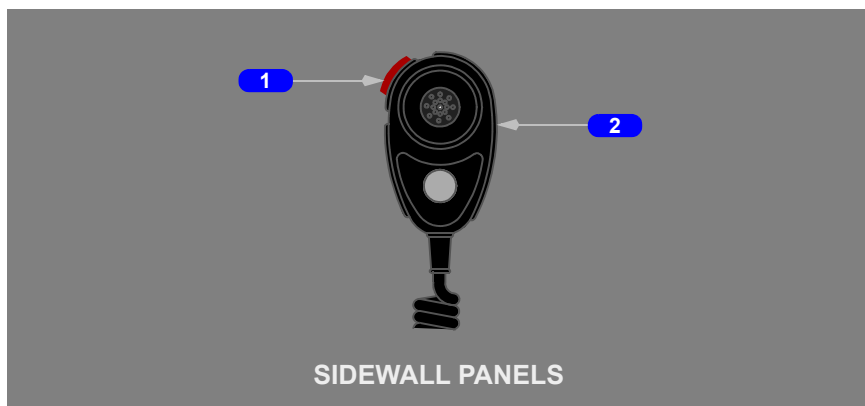
Audio volume is adjusted using audio control panel controls for the associated station.

Available at all flight deck stations.

2 Boom Mic

Activation of a control wheel, glareshield or audio control panel mic/interphone switch transmits on the system selected for use at that station.

Hand Microphone [Typical]



1 Hand Microphone Push-To-Talk Switch

Push – activates the hand microphone.

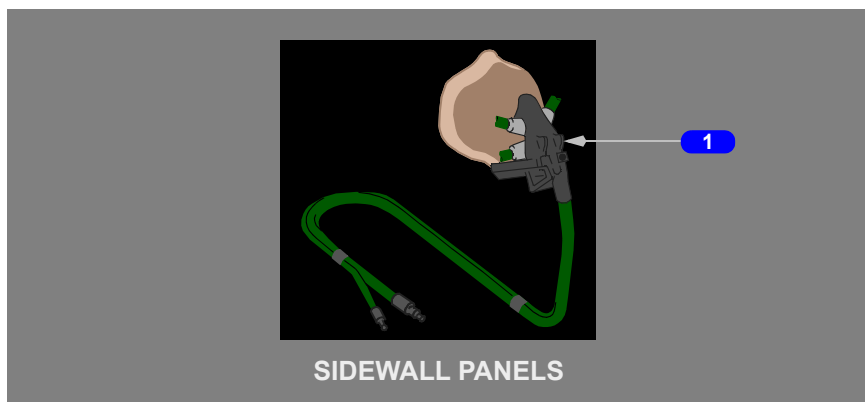
2 Hand Microphone

Transmits on the system selected by the audio control panel.

Available at the Captain and First Officer stations.

- Optional for the First and Second Observer stations.

Oxygen Mask Microphone [Typical]

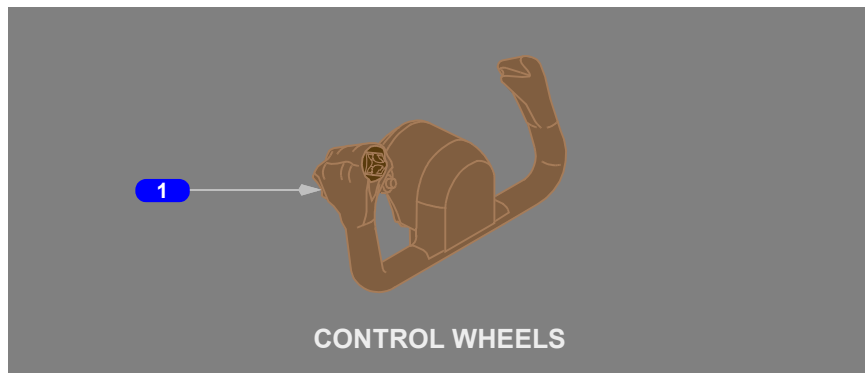


1 Oxygen Mask Microphone

Enabled when the oxygen mask doors are open. The boom microphone is disabled.

Activation of a control wheel, glareshield or audio control panel mic/interphone switch transmits on the system selected for use at that station.

Control Wheel Microphone/Interphone Switch



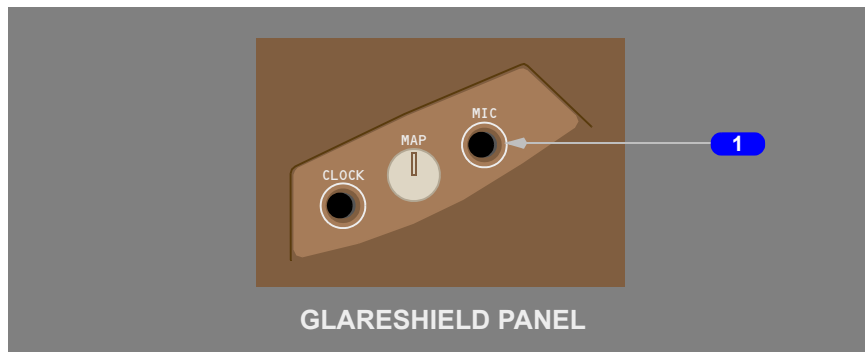
1 Control Wheel Mic/Interphone Switch

MIC – allows oxygen mask or boom microphone transmission on selected transmitter. Spring-loaded to center.

CENTER – off position.

INT – allows oxygen mask or boom microphone transmission on the flight interphone system. Spring-loaded to center.

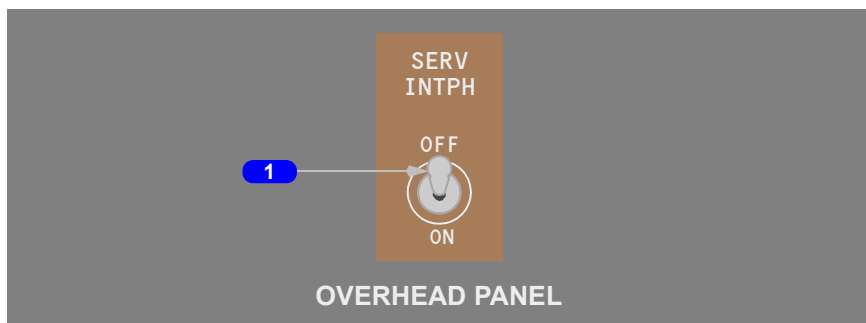
Glareshield Microphone Switch



1 Glareshield MIC Switch

Push – allows oxygen mask or boom microphone transmission on the selected transmitter.

Service Interphone Switch



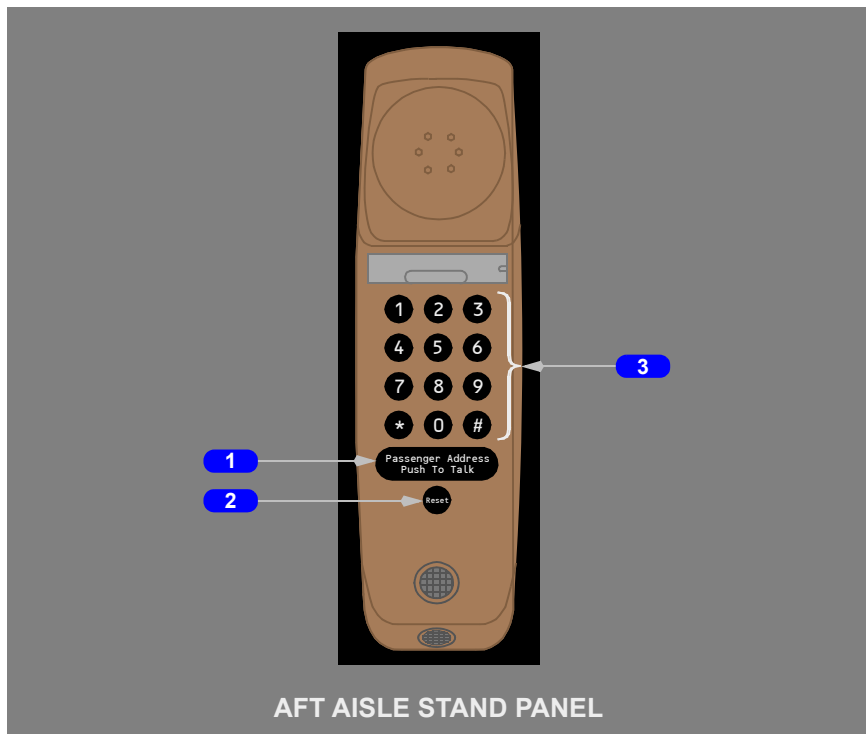
1 Service (SERV) Interphone (INTPH) Switch

OFF – allows independent operation of the service and flight interphone systems.

ON – connects the service and flight interphone systems.

Handset

[Passenger]



1 Passenger Address Push To Talk Switch

Push –

- connects the handset microphone to the selected PA area
- only used in the PA mode

2 Reset Switch

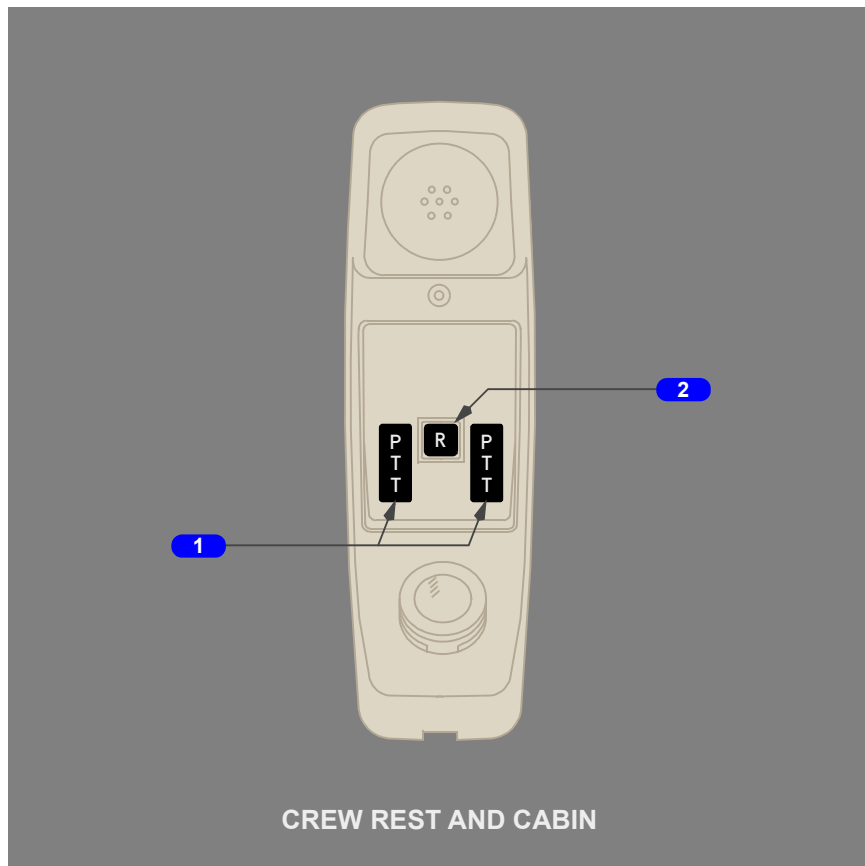
Push – cancels a call or incorrectly selected code.

3 Numeric Keys

Push – selecting a code calls the respective station or PA area.

Note: Dial codes entered using the handset are not displayed on the CDU cabin interphone pages.

[Freighter]

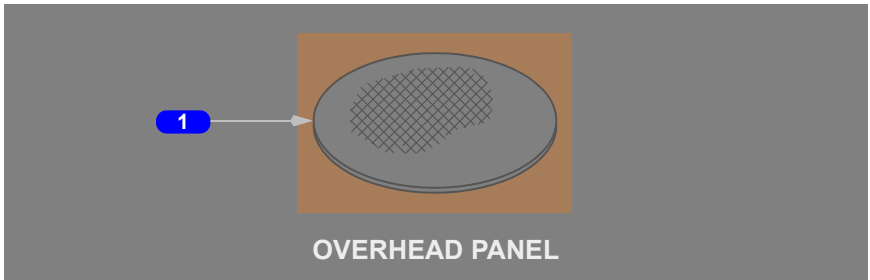


1 Push To Talk (PTT) Switches

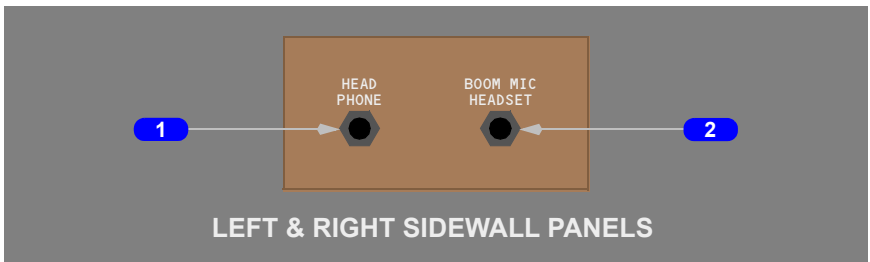
Push - extinguishes FLT DECK call switch light.

2 Reset (R) Switch

Push - cancels call.

Flight Deck Speaker**1 Flight Deck Speaker**

Controlled by the speaker volume control on the respective audio control panel.

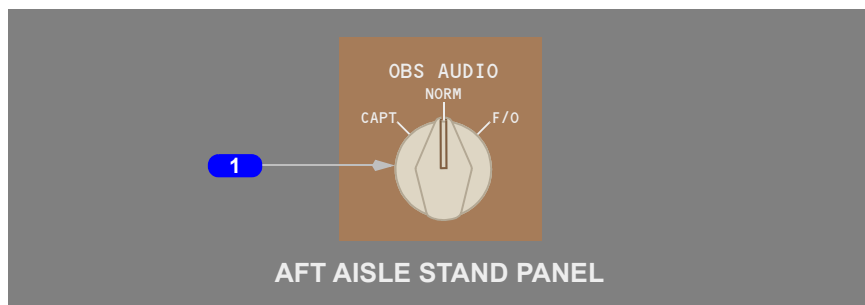
Boom Microphone/Headphone Panel**1 HEAD PHONE Jack**

Accepts a flight crew headphone plug.

2 BOOM MIC HEADSET Jack

Accepts a flight crew boom mic plug.

Observer Audio Selector



1 Observer (OBS) AUDIO Selector

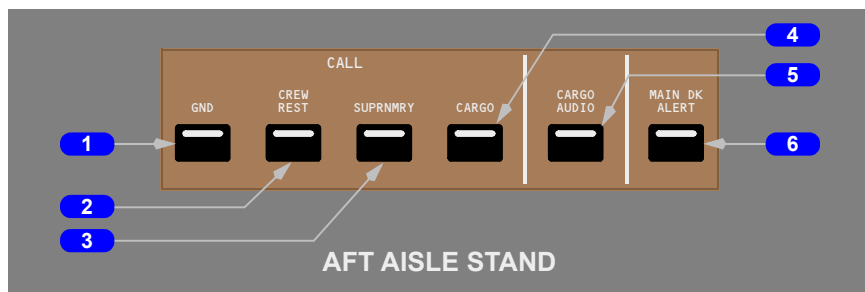
CAPT – connects the Captain's hand microphone, headphone, boom microphone/headset, oxygen mask microphone, speaker, and mic/interphone switches to the First Observer audio control panel.

NORM – the First Observer audio control panel is connected to the First Observer's hand microphone, headphone, boom microphone/headset and oxygen mask microphone.

F/O – connects the First Officer's hand microphone, headphone, boom microphone/headset, oxygen mask microphone, speaker, and mic/interphone switches to the First Observer audio control panel.

Call Panel

[Freighter]



1 Ground (GND) Call Switch

Illuminated (green) - indicates nose wheel well horn is sounding.

Push – sounds three second horn in nose wheel well.

2 CREW REST Call Switch

Illuminated (green) - indicates crew rest is being called. Light extinguishes when call is answered.

Push - illuminates Flight Deck switch on crew rest handset cradle and sounds chime in crew rest area.

Second push (light illuminated) - cancels call to crew rest.

3 Supernumerary (SUPRNMRY) Call Switch

Illuminated (green) - indicates supernumerary is being called. Light extinguishes when call is answered.

Push - illuminates Flight Deck switches on the two supernumerary handset cradles and sounds chime in supernumerary area.

Second push (illuminated) - cancels call to supernumerary area.

4 CARGO Call Switch

Illuminated (green) - indicates cargo area is being called. Light extinguishes when call is answered by any loadmaster amplifier panel or cargo area station.

Push - illuminates Flight Deck switch on loadmaster amplifier panels, wing inspection stations, and cargo speaker/mike stations.

Second push (illuminated) - cancels call to cargo area.

5 CARGO AUDIO Switch

Illuminated (green) - indicates cargo and cabin interphone systems are connected.

Push - disconnects cargo and cabin interphone systems. Cargo and cabin interphones automatically connect for incoming or outgoing calls. Disconnect following cargo call may eliminate circuit noise.

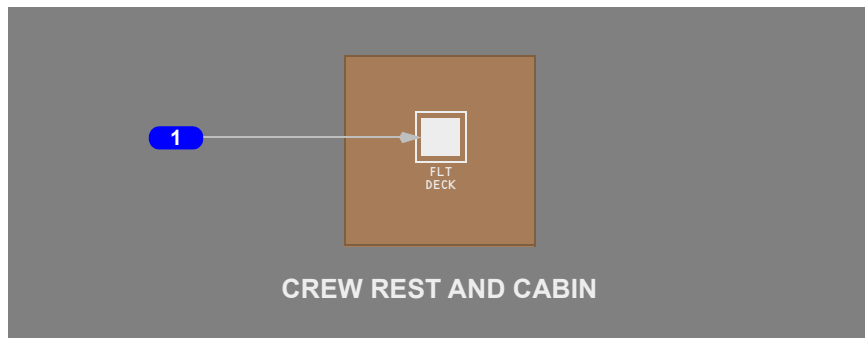
6 MAIN Deck (DK) ALERT Switch

Illuminated (green) - indicates system activation. Extinguishes after several seconds to indicate system reset.

Push - activates main deck aural warning and flashes main deck sidewall lights for several seconds.

Flight Deck Call Switch

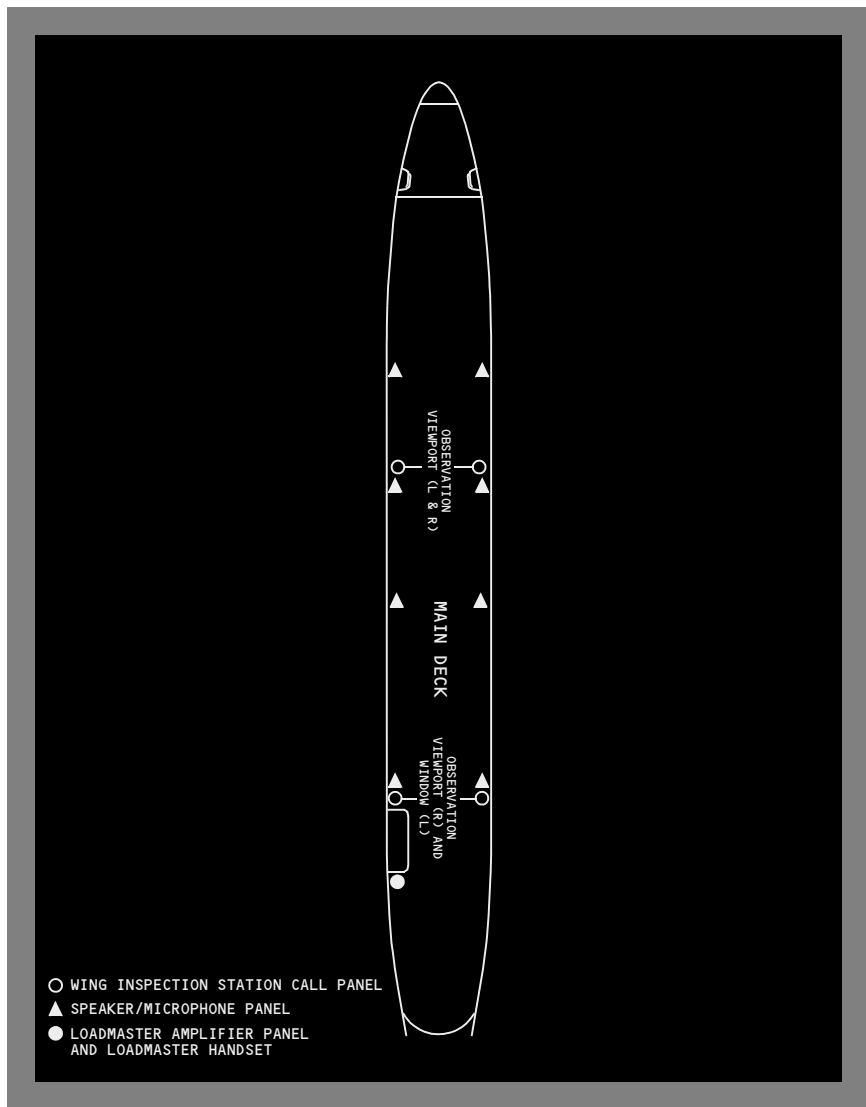
[Freighter]



1 Flight (FLT) DECK Call Switch

Illuminated (white) – interphone call from flight deck received, chime also sounds.

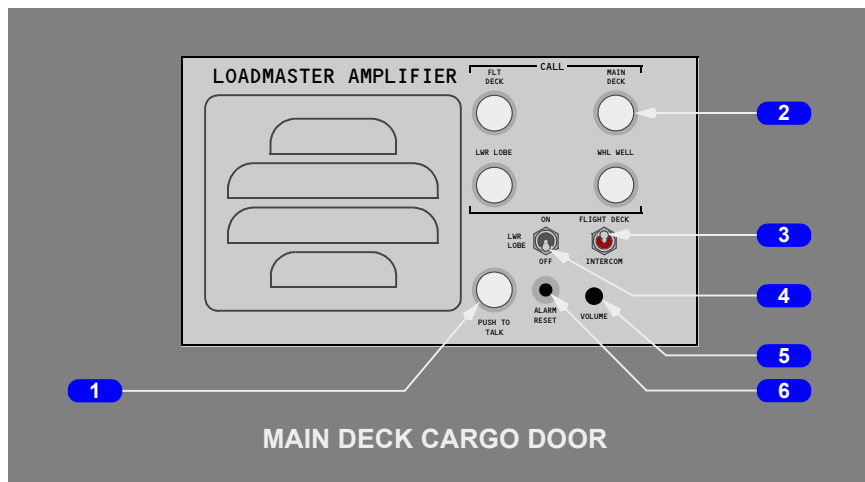
Push – sounds chime in flight deck, displays CREW REST CALL or SUPRNMY CALL on EICAS, and illuminates Cabin (CAB) CALL light on audio control panel.

Cargo Interphone Component Locations[\[Freighter\]](#)

Cargo Interphone Components

[Freighter]

Loadmaster Amplifier Panel



1 PUSH TO TALK Switch

Push - activates loadmaster amplifier panel microphone and connects to any selected area except flight deck.

2 CALL Switches

Illuminated (white) - indicates a call from the respective area. Extinguishes when pushed.

Push - sounds a chime in area being called.

3 FLIGHT DECK/INTERCOM Switch

FLIGHT DECK - connects loadmaster amplifier panel handset to flight deck interphone. Handset must be used for communication with flight deck.

INTERCOM - connects loadmaster panel to main cargo deck speaker/microphone panels.

4 LOWER LOBE Switch

ON - activates lower lobe speaker/microphone panels.

OFF - deactivates lower lobe speaker/microphone panels.

5 VOLUME Selector

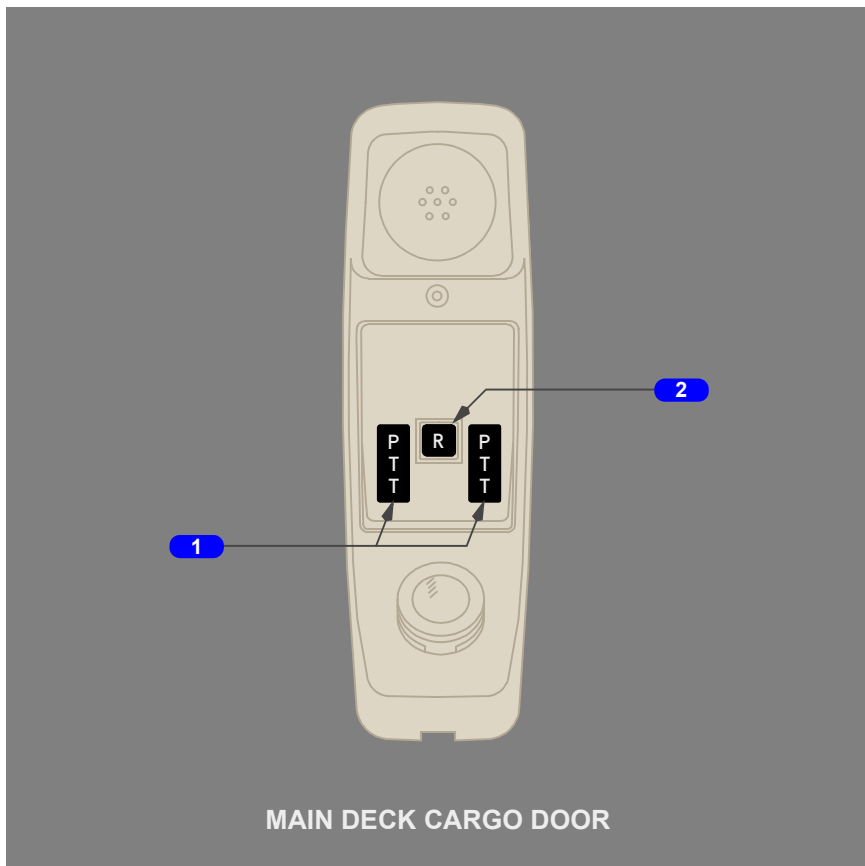
Rotate - adjusts loadmaster amplifier panel speaker volume.

6 ALARM RESET Switch

Push - resets aft CG audio alarm.

Loadmaster Handset

The loadmaster handset provides communications on cargo interphone and intercom systems.

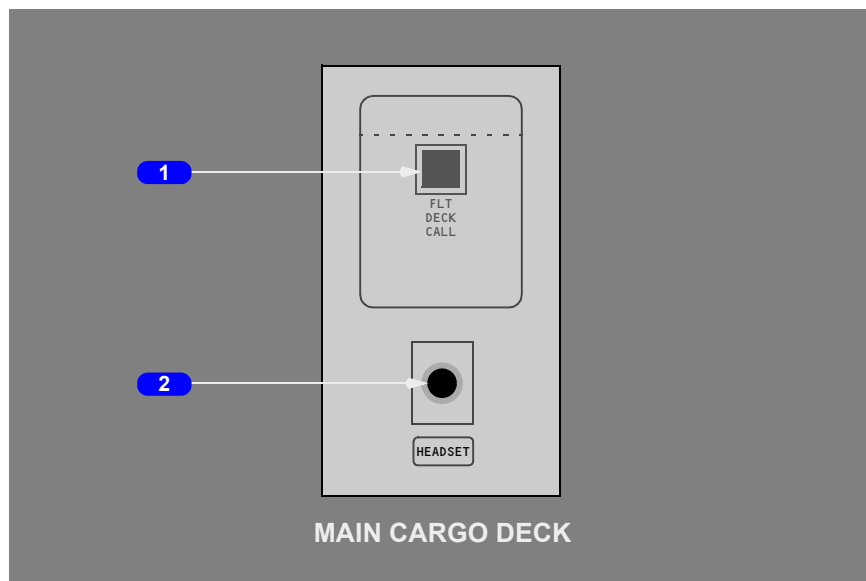
**1 Push To Talk (PTT) Switches**

Push - extinguishes Call switch lights.

2 Reset (R) Switch

Push - cancels call.

Wing Inspection Station Call Panel



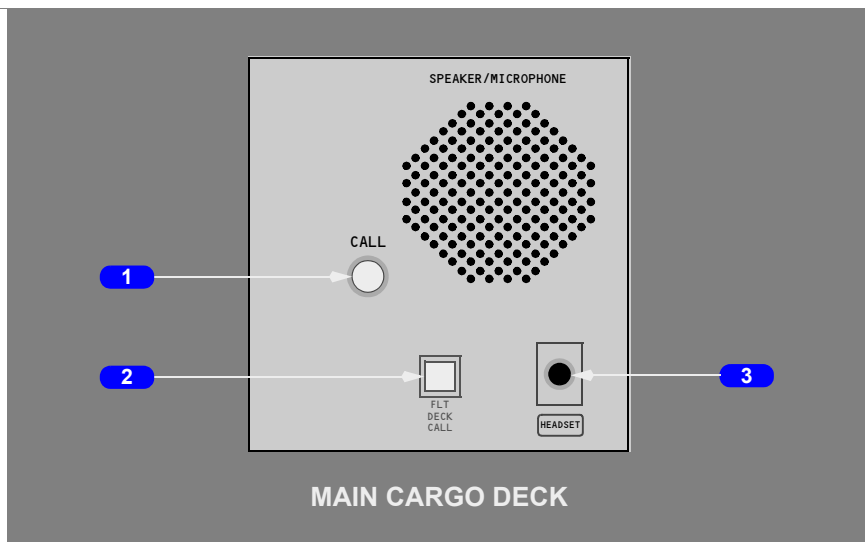
1 Flight (FLT) DECK CALL Switch

Illuminated (white) - interphone call from flight deck received. Extinguishes when pushed.

Push - sounds chime in flight deck, displays CARGO CALL on EICAS, and illuminates Cabin (CAB) CALL light on audio control panel.

2 HEADSET Jack

Receptacle for headset connection.

Main Cargo Deck Speaker/Microphone Panel**1 CALL Switch**

Push (on ground) - sounds a tone and illuminates Main Deck Call switch on loadmaster amplifier panel.

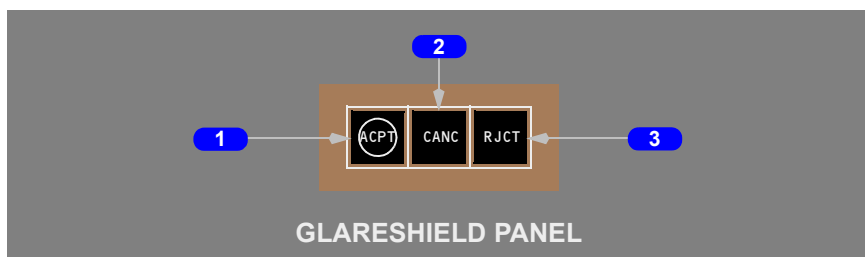
2 Flight (FLT) DECK CALL Switch

Illuminated (white) - interphone call from flight deck received. Extinguishes when pushed.

Push - sounds chime in flight deck, displays CARGO CALL on EICAS, and illuminates Cabin (CAB) CALL light on audio control panel.

3 HEADSET Jack

Receptacle for headset connection.

Data Link Accept/Cancel/Reject Switches

1 Accept (ACPT) Switch

Push –

- a positive response to a displayed message is downlinked to the origin of the displayed message
- functions the same as selecting an MFD communications display ACCEPT command key

2 Cancel (CANC) Switch

Push –

- the message is removed from the display
- functions the same as selecting an MFD communications display CANCEL command key

3 Reject (RJCT) Switch

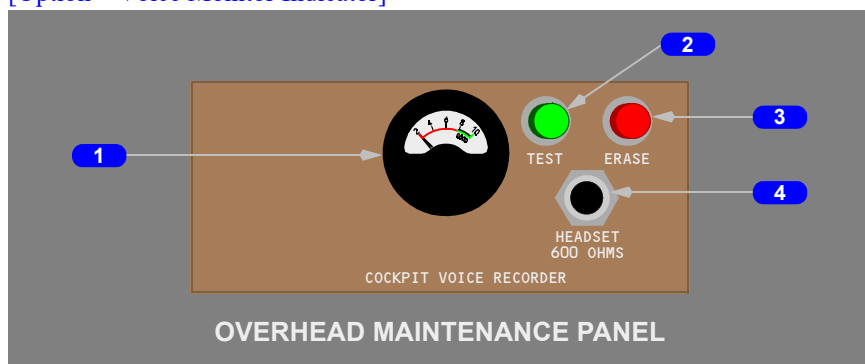
Push –

- a negative response to the displayed message is downlinked to the origin of the displayed message
- functions the same as selecting an MFD communications display REJECT command key

Cockpit Voice Recorder System

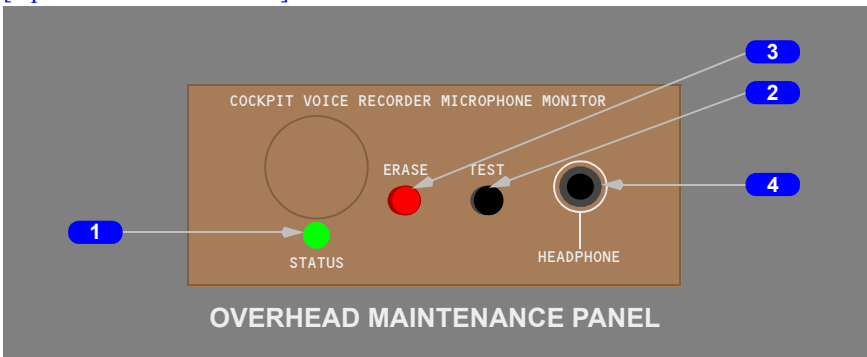
Cockpit Voice Recorder Panel

[Option – Voice Monitor Indicator]

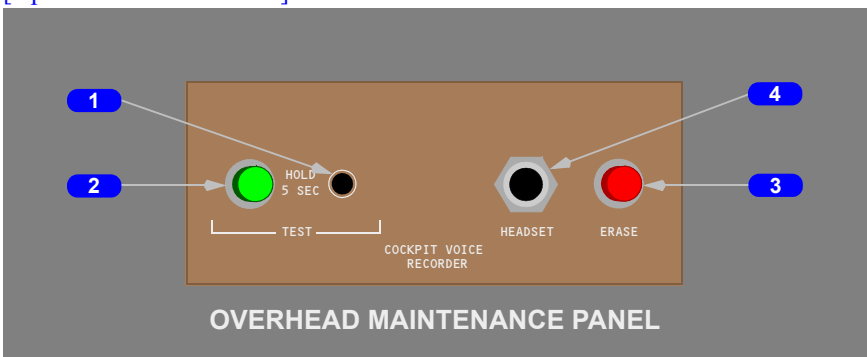


777 Flight Crew Operations Manual

[Option – Status Indicator]



[Option – Status Indicator]



[Option]

1 Cockpit Voice Monitor Indicator

Pointer deflection indicates recording or erasure on all channels.

During test, the pointer rises into the green band.

[Option]

1 STATUS Indicator

Illuminated – test completed successfully. Extinguished after one second.

[Option]

1 STATUS Indicator

Illuminated – test completed successfully. Extinguished after button is released.

2 Cockpit Voice Recorder TEST Switch

Push and hold for five seconds – tests all four cockpit voice recorder channels (1 per second).

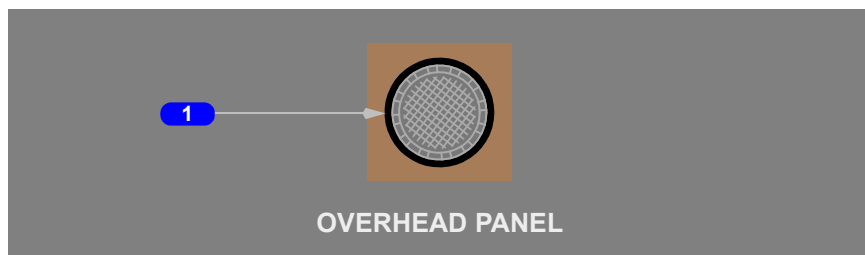
3 Cockpit Voice Recorder ERASE Switch

Push and hold for three seconds – erases voice recorder if on the ground, AC power on, and parking brake set.

4 Cockpit Voice Recorder Headset Jack

A headset may be plugged in to monitor playback of voice audio, or to monitor tone transmission during test.

Cockpit Voice Recorder Microphone [Typical]

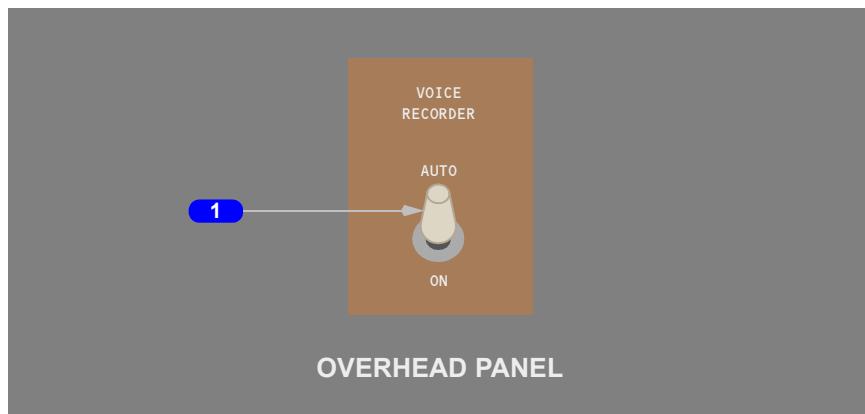


1 Cockpit Voice Recorder Microphone

Area microphone for the voice recorder.

Cockpit Voice Recorder Switch

[Option]



1 VOICE RECORDER Switch

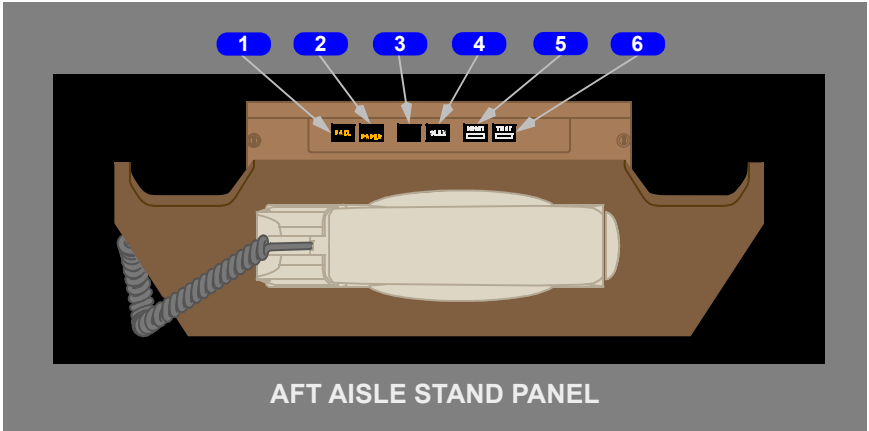
AUTO – The cockpit voice recorder runs from first engine start until 5 minutes after last engine shutdown (spring-loaded).

777 Flight Crew Operations Manual

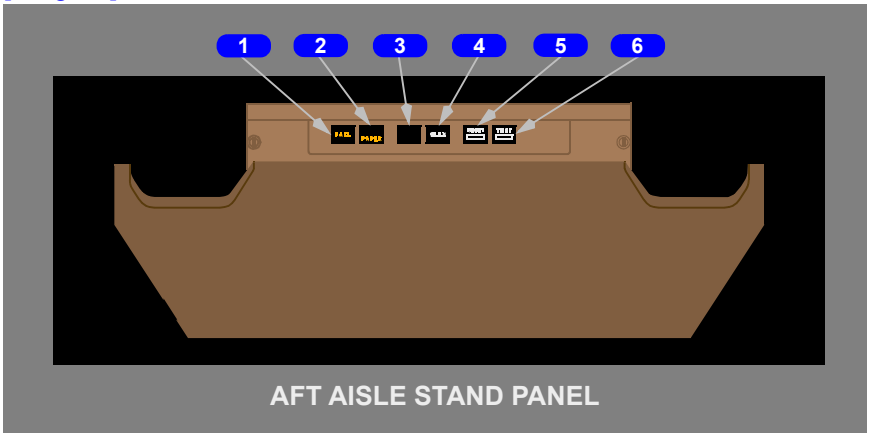
ON – The cockpit voice recorder runs until first engine start, then spring-loaded to AUTO.

Printer Controls

[Passenger]



[Freighter]

**1 Printer FAIL Light**

Illuminated amber - printer failed

2 Printer PAPER Light

Illuminated (amber):

- printer is out of paper, or
- paper is jammed

3 Switch is not functional

4 Printer SLEW Switch

Push and hold – advances the printer paper

5 Printer RESET Switch

Push – illuminated

- clears out current print job
- resets printer

6 Printer TEST Switch

Push – illuminated

- tests printer and printer lights
- prints test page

**Communications
System Description****Chapter 5
Section 20****Introduction**

The communication systems include:

- cockpit voice recorder system
- radio communication system
- SELCAL system
- SATCOM system
- communication crew alerting system
- interphone communication system (refer to Section 30 of this chapter)

[Freighter]

- main deck alert system
- data communication system (refer to Section 40 of this chapter).

[Passenger]

- broadband communication system

The communication systems are controlled using the:

- audio control panels
- radio tuning panels

[Passenger]

- CDU communications pages (refer to Section 30 of this chapter)

[Freighter]

- call panel
- MFD communications pages (refer to Section 40 of this chapter)

Audio Control Panels

The audio control panels are used to manage the radio and interphone communication systems. Navigation receiver audio can also be monitored. The Captain, First Officer, and First Observer audio control panels are installed on the aft aisle stand.

Microphones are keyed by pushing the desired audio control panel transmitter select switch and using the MIC position of a control wheel or audio control panel microphone/interphone switch, a glareshield MIC switch, or a hand microphone push-to-talk switch. Systems are monitored using headphones or speakers. An oxygen mask microphone is enabled and the boom microphone is disabled when the oxygen mask stowage doors are open. The oxygen mask microphone is disabled and the boom microphone is enabled when the left oxygen mask stowage box door is closed and the RESET/TEST switch is pushed.

Cockpit Voice Recorder System

The cockpit voice recorder records any transmitted or received flight deck audio as selected on the audio control panels. It also records flight deck area conversations using an area microphone and crewmember boom, oxygen mask, and hand microphones, independent of microphone/interphone switch positions. All inputs are recorded continuously.

[Option]

Recording continues for 5 minutes after last engine shutdown.

Radio Tuning Panels

The radio tuning panels are used to tune the VHF and HF radios. The panels are designated left, center, and right, and are normally associated with the respective VHF and HF radios.

Radio Communication Systems

The radio communication systems consist of the VHF communication system, the HF communication system, the SATCOM system, and the SELCAL system.

VHF Communication System

Three independent VHF voice/data radios, designated VHF L, VHF C, and VHF R are installed. Any VHF radio can be controlled by any radio tuning panel. The audio control panels are used to control voice transmission and receiver monitoring.

[Option]

When a VHF radio is tuned to frequency 121.5, all flight crew automatically monitor the radio. The receiver lights on all audio control panels illuminate.

VHF L is configured for voice communication only. VHF C and VHF R can be configured for data or voice communication. However, only one VHF radio can operate in the data mode at a time. Data communication is normally selected on VHF C.

Data Mode

The data mode can be selected and deselected on the MFD COMM display or by pushing the frequency transfer switch on the radio tuning panel. If the selected VHF radio is the default data radio (selected on the MFD COMM display), then the word DATA is displayed in the radio tuning panel active frequency window. When a standby frequency is transferred to the active window, DATA is displayed in the standby window. If a new frequency is selected in the standby window when DATA is displayed, DATA is replaced by the new frequency. Data can be returned to the standby window by selecting a frequency higher or lower than the allowable VHF frequency range.

When a VHF radio is in the data mode, it is not available for voice communications. A VHF radio can be returned to the voice communication mode by transferring a voice frequency into the ACTIVE frequency window.

HF Communication System

There are two independent HF communication radios, designated HF L and HF R. Each HF radio can be tuned by any radio tuning panel. HF radio sensitivity can only be set on the on-side radio tuning panel.

The audio control panels are used to control voice transmission and receiver monitoring.

[Option]

When a HF transmitter is keyed after a frequency change, the antenna tunes while a continuous tone can be heard through the audio system. A tone lasting longer than 7 seconds indicates failure of the system to tune.

[Option]

When a HF transmitter is keyed after a frequency change, the antenna tunes while a continuous or intermittent tone may be heard through the audio system. A tone lasting longer than 7 seconds indicates failure of the system to tune. Data is stored in memory for the last 100 tuned frequencies. Stored frequencies may tune quickly and a tone may not be noticeable.

Both HF radios use a common antenna. When either HF radio is transmitting, the antenna is disconnected from the other HF radio, and it cannot be used to transmit or receive. However, both HF radios can receive simultaneously if neither is being used for transmitting.

HF L and HF R can be configured for data or voice communication. However, only one HF radio can operate in the data mode at a time.

Data Mode

The data mode can be selected and deselected on the MFD COMM display or by pushing the frequency transfer switch on the radio tuning panel. If the selected HF radio is the default data radio (selected on the MFD COMM display), then the word DATA is displayed in the radio tuning panel active frequency window. When a standby frequency is transferred to the active window, DATA is displayed in the standby window. If a new frequency is selected in the standby window when DATA is displayed, DATA is replaced by the new frequency. Data can be returned to the standby window by selecting a frequency higher or lower than the allowable HF frequency range.

HF datalink operation is inhibited on the ground. When a HF radio is in the data mode, it is not available for voice communications. A HF radio can be returned to the voice communication mode by transferring a voice frequency into the ACTIVE frequency window.

Stuck Mic Protection

In the event a VHF or HF radio transmits for more than 30 seconds, the EICAS advisory message RADIO TRANSMIT is displayed. The message is removed when the transmission stops.

On the ground with both engines shut down, any VHF radio that transmits for more than 35 seconds is automatically disabled. That radio is enabled when the microphone switch for that radio is released.

SELCAL System

The SELCAL system monitors the three VHF radios and the two HF radios. When the system receives a call from a ground station, the crew is alerted through the communication crew alerting system.

SATCOM System

The SATCOM system provides both data and voice communications. The system is managed by the satellite data unit. Flight deck voice calls are controlled using the CDUs and audio control panels.

The SATCOM control pages are displayed by selecting SAT on the CDU menu page. Directories of airline-defined numbers are line-selectable or numbers may be manually entered if function is enabled by the operator.

Incoming SATCOM calls are annunciated by a SELCAL chime and illumination of a CALL light on the audio control panel. Pressing the respective transmitter select switch connects the call to the pilot headset/hand mic.

SATCOM calls are terminated when the CALL light extinguishes (ground party hang-up or pilot ends call).

The EICAS communication message SATCOM MESSAGE displays when a SATCOM message requires flight crew attention. Servicing the message clears the EICAS message.

SATCOM Phone Pages [Typical]

[Option]

The SATCOM phone pages allow the flight crew to initiate, answer and terminate calls, monitor call status, and access lower-level pages. Control functions are active when displayed with a caret.

SATCOM Phone Page 1/2



1 Channel 1 Control Field

Push – selects active control function, priority level, or manual phone number entry from scratchpad. Call status information displays in small font.

2 Channel 2 Control Field

Push – selects active control function, priority level, or manual phone number entry from scratchpad. Call status information displays in small font.

3 DIRECTORY INDEX

Push – displays SATCOM directory index page.

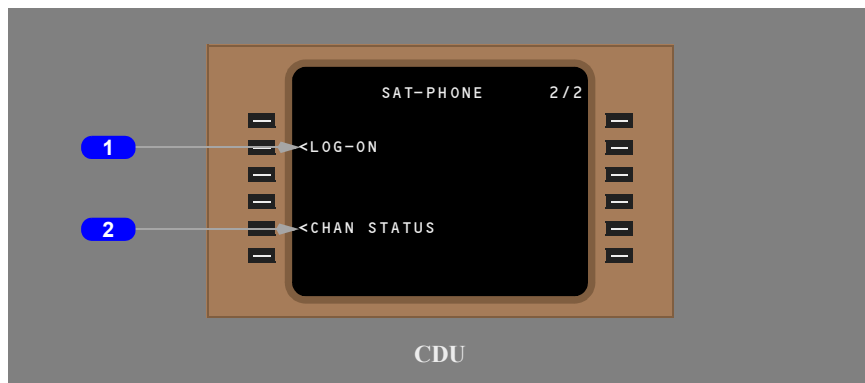
4 Priority (PRI)

The following call priority levels can display:

- EME (Emergency) - emergency and distress calls (activates ground station alarm)
- HGH (High) - regulatory and flight safety calls
- LOW - non-safety related service calls

Push – toggles between levels for selecting call priority.

SATCOM Phone Page 2/2



1 LOG-ON

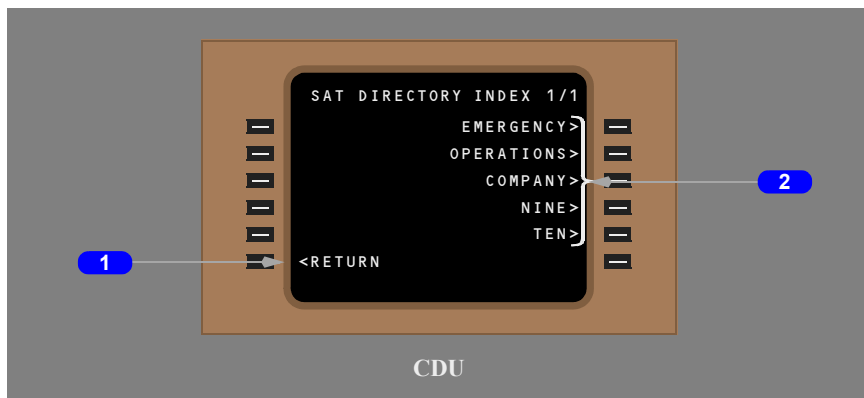
Push – displays SATCOM log-on page for manual selection and control of log-on process.

2 Channel (CHAN) STATUS

Push – displays SATCOM channel status page.

SATCOM Directory Index Page [Typical][\[Option\]](#)

The SATCOM directory index page is used to access directory pages.

**1 RETURN**

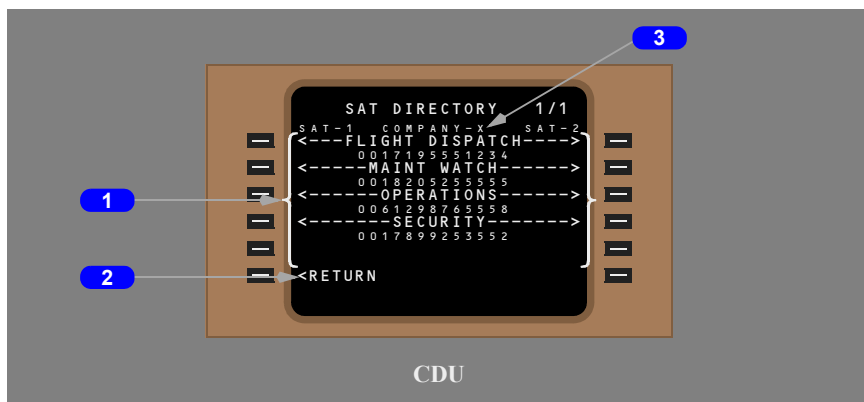
Push – display returns to SATCOM phone page 1/2.

2 Index Labels

Push – displays SATCOM directory page associated with selected index label. Index labels are defined by the operator.

SATCOM Directory Page [Typical][\[Option\]](#)

The SATCOM directory page contains a list of phone numbers used for making line-selectable calls.



1 Phone Number List

Push – preselects phone number for making call, selects voice channel via left (SAT-1) or right (SAT-2) line select key, and returns display to SATCOM phone page 1/2. Phone number labels and content are defined by the operator.

2 RETURN

Push – display returns to SATCOM directory index page.

3 Index Label

Displays index label associated with selected SATCOM directory page.

Communication Crew Alerting System

The communication crew alerting system provides aural and visual alerts for normal operations requiring crew awareness that may require crew action. Visual alerts are presented as EICAS messages preceded by a bullet symbol (•). The aural alert is a high–low chime. The following table shows communication crew alert categories and the respective aural and visual alerts for each category. Refer to section 50 of this chapter for a list of possible messages.

Crew Alert Categories

Communication Crew Alert Category	Aural Alert	Visual Alert	Comments
High	High–low chime	EICAS communication message	None currently implemented. Reserved for future use.
Medium	High–low chime	EICAS communication message	Message awareness required. Crew action may be required.
Low	None	EICAS communication message	Crew action may be required.

Main Deck Alert System

[Freighter]

The main deck alert system activates an aural warning and flashes the cargo area sidewall lights for several seconds to alert crewmembers in the main deck cargo compartment to return to the cabin. The system activates automatically upon main cargo deck smoke detection or cabin depressurization, or manually by pushing the MAIN DK ALERT switch on the flight deck call panel. The switch light illuminates to indicate system activation and extinguishes to indicate reset.

Broadband Communication System

[Passenger]

A dedicated broadband communications system provides passengers and crew with real-time, high-speed internet connectivity in flight. Passengers and crew access the system with compatible personal electronic devices (PEDs) using the cabin wireless access points (CWAPs).

The BROADBAND COM switch allows the flight crew to remove power from the Power Supply Unit and the Broadband Antenna to support Gate to Gate operations. The IFE/PASS SEAT switch on the overhead panel removes power to the entire Broadband and IFE system (See Chapter 6.10 for additional information).

WARNING: Prior to de-icing / anti-icing on the ground, turn BROADBAND COM switch OFF to avoid RF hazard to personnel near Broadband Antenna. When de-icing / anti-icing is complete, place BROADBAND COM switch to ON or OFF position as desired, with guard closed.

Intentionally
Blank

**Communications
Interphone Systems****Chapter 5
Section 30**

Interphone Communication System

The interphone communication system includes the:

[Passenger]

- flight interphone system
- cabin interphone system
- service interphone system
- passenger address (PA) system

[Freighter]

- flight interphone system
- cabin interphone system
- service interphone system
- personnel address (PA) system
- cargo interphone system
- cargo intercom system

The flight interphone, service interphone, and PA systems are normally operated through the audio control panel.

[Passenger]

The cabin interphone system is operated through the audio control panel, CDU, and flight deck handset.

[Freighter]

The cabin and cargo interphone systems are operated through the audio control panel and flight deck call panel.

Flight Interphone System

The flight interphone system provides communications between flight deck crew members. The flight interphone system also provides communications between the flight deck and ground crew through a flight interphone jack on the nose landing gear.

The system is used by selecting the INT (interphone) position of a control wheel or audio control panel mic/interphone switch. The interphone can also be used by selecting the FLT transmitter selector on an audio control panel and then selecting one of the following microphone switches:

- MIC position of a control wheel switch
- MIC position of an audio control panel mic/interphone switch

- a hand microphone push to talk switch
- a glareshield MIC switch

Note: Voice level from both flight deck speakers decreases significantly when selecting the MIC/INT switch on the ACP or control wheel, the PTT switch on the hand microphone, or the MIC switch on the glareshield.

Crew alerting of a ground crew initiated call is provided by an aural alert chime, the GROUND CALL EICAS communication message, and a CALL light illuminated on the audio control panel transmitter select switch.

[\[Passenger\]](#)

The ground crew is called by selecting the GND CREW dial code from the center CDU.

[\[Freighter\]](#)

The ground crew is called by pushing the GND call switch on the call panel.

Service Interphone System

The service interphone system provides voice communications between ground crew stations at various locations around the airplane. The system can be connected to the flight interphone system through the service interphone switch on the overhead panel.

Passenger Address System

[\[Passenger\]](#)

The PA system is used by the flight crew to make cabin announcements. Pushing a PA transmitter select switch on an audio control panel and activation of a microphone switch provides direct access to all PA areas.

The system is monitored by pushing the PA receiver volume control on an audio control panel. The PA system can also be selected through the cabin interphone system or the flight deck handset.

Cabin PA announcement priorities are:

- flight deck announcements from an audio control panel
- cabin handset direct access announcements
- priority (all area) announcements
- normal announcements from flight attendant or flight deck handsets

Personnel Address System

[Freighter]

The PA system is used by the flight crew to make announcements to the supernumerary and crew rest areas. Pushing a PA transmitter select switch on an audio control panel and activation of a microphone switch provides direct access to all PA areas.

Cabin Interphone System

[Passenger]

The cabin interphone system provides voice communications between the flight deck and the flight attendant stations. Boom microphones, oxygen mask microphones, and hand microphones are used by selecting the CAB transmitter select switch on an audio control panel and pushing the mic/interphone switch to the MIC position. A cabin interphone station(s) must be selected and a call initiated from the center CDU to alert the desired station to pick up the call.

EICAS communications alert messages and chimes alert the pilots to incoming cabin calls. Normal priority calls from the cabin display the CABIN CALL EICAS message. Normal priority calls made to the flight deck while another call is in progress will result in a busy signal at the handset, the calling station being displayed in the call queue, and the CABIN CALL memo message being set in EICAS. The call queue and memo messages will be cleared when communication is established between that calling station and the flight deck. Priority calls from the cabin display the CABIN ALERT EICAS message. Priority calls automatically disconnect lower priority cabin interphone calls. Priority calls placed while a priority call is in progress are automatically connected as a conference call.

The cabin interphone call queue, speed dial numbers, and directories are accessed from the center CDU cabin interphone menu.

Calls are initiated by:

- line selecting the call location on the CDU display, or
- entering the appropriate call code in the CDU scratchpad and selecting SEND

Pushing the audio control panel CAB transmitter select switch twice within one second places a priority call to an airline-designated call location.

A station which is in use will be disconnected from the call in progress and connected to the flight deck.

Note: Flight deck initiated calls will not interrupt a current PA announcement from the dialed station.

Calls can be answered by selecting an audio control panel CAB transmitter select switch or, if a CAB transmitter select switch is already pushed in, by pressing a mic/interphone switch to the MIC position.

Calls can be ended by selecting the CDU prompt END CALL or de-selecting the CAB transmitter selector on the audio control panel. The call also ends if the other party terminates the call.

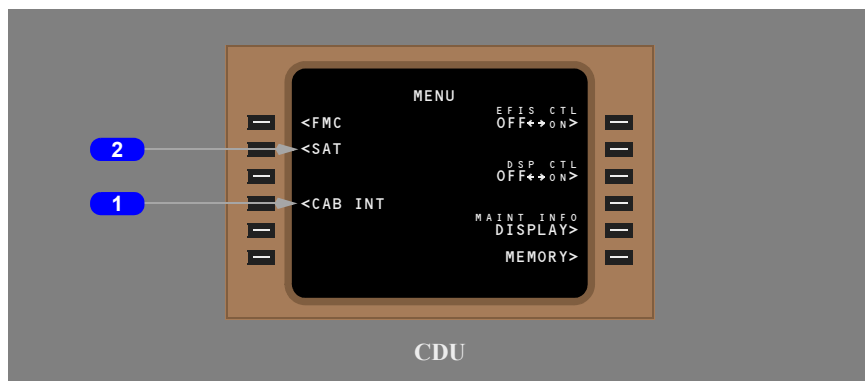
Calls can also be answered or placed using the flight deck handset. Desired call locations are entered using the numeric keys on the handset. Pressing the handset reset switch or placing the handset back on the cradle terminates the call.

Note: The handset PA push-to-talk switch is not required to operate the handset except for PA announcements.

CDU Menu Page

Pushing the CDU MENU key displays the CDU menu page.

Normally, the cabin interphone (CAB INT) and SATCOM (SAT) displays are viewed on the center CDU. The SATCOM prompt is available on all CDUs.



1 CAB INT

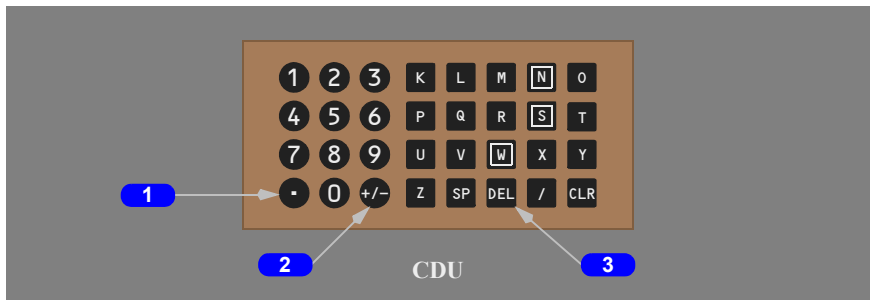
Push – displays the CDU cabin interphone pages.

Note: Available only on the center CDU.

2 SAT

Push – displays the CDU SATCOM pages.

Cabin Interphone CDU Controls



1 Period (.) key

Push – displays an asterisk (*) in the scratchpad.

2 Plus/Minus (+/-) Key

Push – displays a pound sign (#) in the cabin interphone scratchpad.

3 Delete Key

Push –

- displays DELETE in the cabin interphone scratchpad
- used to delete calls from the call queue

Cabin Interphone Main Menu

The cabin interphone menu allows the pilots to send or end calls. Calls are sent by selecting a station from the speed dial page or the directory. Two digit station codes can be manually entered into the scratchpad and the call sent using the SEND prompt. A list of the two digit station codes is located on the handset.

The directory of stations is created by the customer airline and is not shown here. The following depict typical main menu pages and selected options.

Speed Dial

The speed dial menu provides a quick means to call up to five predefined stations or groups of stations. A single push initiates the selected call.

Call Queue

When the flight deck is involved in a call, additional incoming calls are displayed in the queue. Up to four calls can be displayed in order of the priority assigned as follows:

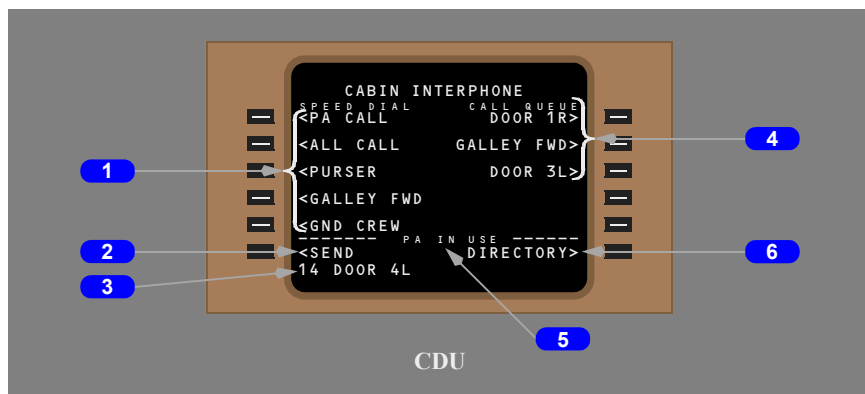
- PILOT ALERT
- conference calls

- cabin calls
- other calls

The PILOT ALERT queue entry is displayed only when the flight deck is using the PA and an incoming call is received.

When there are four calls in the queue and a new, higher priority call is received, the lowest priority call is removed from the queue and the new call is displayed in the proper priority.

Cabin Interphone Main Menu Page [Typical]



1 SPEED DIAL Labels

Lists the dial code labels of predefined stations, station groups, or functions:

- PA CALL – selects the passenger address system
- ALL CALL – selects all cabin interphone stations
- PURSER – selects the purser station
- GALLEY FWD – selects the forward galley station
- GND CREW – activates an alert horn in the nose wheel well. When selected, the horn sounds briefly to alert the ground crew for communications with the flight crew

Push – directly dials the selected station, station group or enables the selected call function.

2 SEND

A two-digit dial code may be manually entered with the CDU keyboard. If the dial code is valid, the dial code, dial code label, and SEND are displayed. If the dial code is invalid, INVALID CODE is displayed in the scratchpad.

Push – initiates a call to the selected station.

2 END CALL

Displayed during a connect call.

Push – disconnects all existing call connections.

3 CURRENT CALL

Displays the most recently selected dial code and label when a call is being connected. Dial code is removed when call is established.

Note: XX BUSY appears in the scratchpad when a cabin interphone call is attempted from the CDU to a handset that is off the hook. Line selecting <END CALL will remove the XX BUSY annunciation.

4 CALL QUEUE Labels

Lists the dial code labels of unanswered calls to the flight deck.

Push –

- initiates a call back to the displayed station(s)
- adds station(s) to the existing call (if the flight deck is currently connected in a call)

5 IN USE Status

PA IN USE –

- a portion of the airplane PA system is in use by/from the cabin crew, or
- both the PA and video entertainment systems are in use by/from the cabin crew

VIDEO IN USE – a portion of the video entertainment system is in use.

Blank (dashes) – neither the PA nor video system is in use.

6 DIRECTORY

Push – displays the cabin interphone DIRECTORY page.

Cabin Interphone Directory Page [Typical]

The cabin interphone directory pages are used to access subdirectory pages. CDU cabin interphone directory pages and individual directory entries are predefined by the airline. Each directory label is the name of a subdirectory where the dial code labels of the individual stations or functions are listed.

Selection of the specific location(s) is accomplished on the subdirectory page.



1 Directories

Up to 20 subdirectories can be predefined.

Push – displays the appropriate subdirectory page

2 CAB INT

Push – returns the display to the cabin interphone main menu page.

Cabin Interphone Subdirectory Page [Typical]

Selecting a dial code label on the subdirectory page initiates a call to that station or station group.

The cabin interphone subdirectory pages are used to view and select individual locations through their dial code labels.

Typical stations or station groups are:

- individual cabin station
- two or more cabin stations for conference calls
- PA call to all cabin areas
- PA call to individual cabin areas
- PA priority call to all cabin areas
- ground crew alert
- gate station (on the ground)



1 Dial Code Labels

Push – initiates a call to the appropriate station(s).

2 CAB INT

Push – returns the display to the cabin interphone main menu page.

Cabin Interphone System

[Freighter]

The cabin interphone system provides voice communications between flight deck, crew rest, and supernumerary stations. Boom microphones, oxygen mask microphones, and hand microphones are used by selecting the CAB transmitter select switch on an audio control panel and pushing the mic/interphone switch to the MIC position. A call is initiated from the call panel to alert the desired station to pick up the call.

The cabin interphone can be connected to the cargo interphone with the CARGO AUDIO switch on the call panel. An incoming cargo call or pushing the CARGO call switch on the call panel automatically selects cargo audio. The CARGO AUDIO switch should be disconnected following a cargo call to eliminate residual circuit noise on the cabin interphone.

EICAS communication messages and chimes alert the pilots to incoming cabin/cargo calls. Calls made to the flight deck from any crew rest, supernumerary, or cargo area illuminate the CALL light on the CAB transmitter select switch and display the associated EICAS communication message. The communication message clears from EICAS when communication is established between the calling station and the flight deck. Any additional incoming calls are added to the call already in progress.

Calls are initiated by selecting the call location on the call panel. Multiple calls can be initiated simultaneously or while other calls are already in progress.

Cargo Interphone System

[Freighter]

The cargo interphone system is used for ground and in-flight communications between cargo area stations over handsets/headsets. The cargo interphone is accessed through the Loadmaster Amplifier panel handset, headset jacks at four wing inspection station call panels, and headset jacks at eight main cargo deck speaker/microphone panels. The cargo interphone system is independent of the cargo intercom speaker/microphone panels. The cargo interphone system can be connected to the cabin interphone system for communications with the flight deck, crew rest, and supernumerary areas by selecting the CARGO AUDIO switch on the flight deck call panel.

Cargo Intercom System

[Freighter]

The cargo intercom system has speaker/microphone panels located throughout the main cargo deck. The cargo intercom speaker/microphone panels are controlled by the Loadmaster Amplifier panel and are active only on the ground.

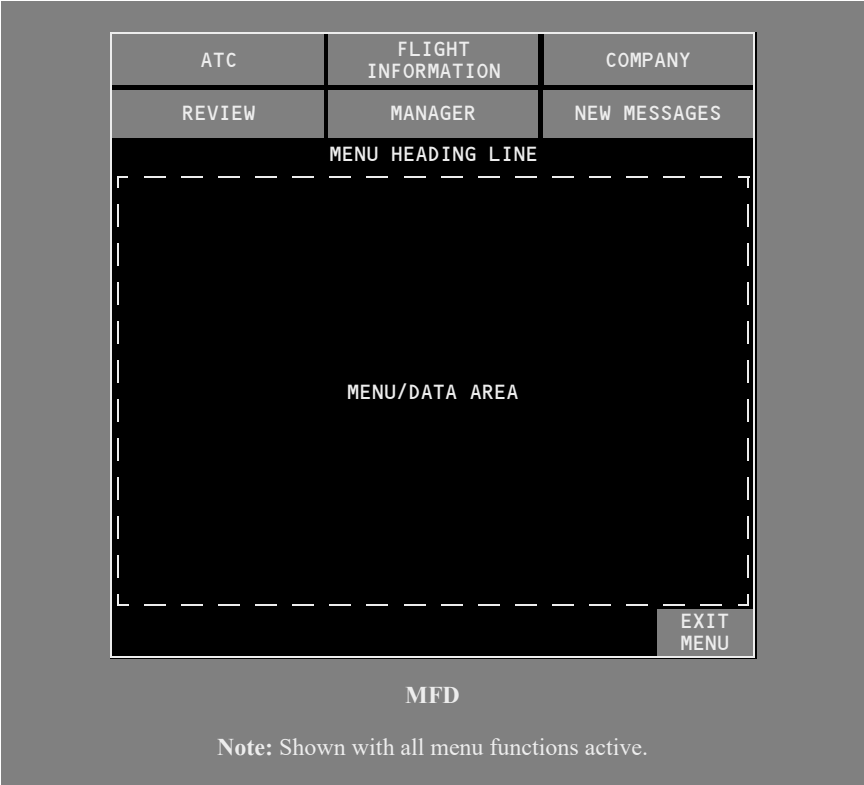
Communications**Chapter 5****MFD Communications Functions****Section 40****Introduction**

The MFD communications functions are used to control data link features. Data link messages not processed by the FMC are received, accepted, rejected, reviewed, composed, sent, and printed using communications functions on the MFD. Data link communications can be established with participating ATC and company locations. ACARS and data link radio management functions are provided through communications management menus.

The COMM display switch, located on the display select panel, displays the communications main menu on the selected MFD. Communications functions are selected using the cursor control device. Message text entry is accomplished by entering data into the CDU scratchpad and transferring it to the appropriate area. Messages can be printed on the flight deck printer. Incoming message traffic is annunciated by EICAS communications messages.

Illustrations shown in this section depict the COMM menu with all features enabled. ATC data link requires appropriate airplane and ATC capability.

Communications Menus



Company communications functions can be customized by airlines. Descriptions and illustrations provided in this section are examples of a typical installation with all communications functions active (depending on airline configuration or function availability, some functions may be inhibited).

Selectable menu items (active functions) have white text on a gray background. Inhibited items have cyan text on a black background with a cyan border. Inhibited items cannot be selected. The background color for a selected top level function is green.

Selecting ATC, FLIGHT INFORMATION, COMPANY, REVIEW, MANAGER, or NEW MESSAGES selection:

- places the appropriate title in the menu heading line
- displays the subordinate menu selections for that function in the menu/data area

Subordinate menu items which lead to subsequent subordinate menu(s) are followed by three dots (...). Making a selection from the subordinate menu places the title of that function in the menu heading and displays a new subordinate menu or data below. Making a selection from the subordinate menu displays the appropriate title, the menu heading, and the data below.

ATC provides downlink messages to ATC, where available.

[\[Option - Flight Information\]](#)

FLIGHT INFORMATION provides for downlink messages that allow request of Pushback Clearance, Taxi Clearance, Departure Clearance, Oceanic Clearance, Automatic Terminal Information Service (ATIS) information, or Terminal Weather Information for Pilots (TWIP).

COMPANY provides for downlink messages to airline facilities.

REVIEW displays a list of all transmitted messages, received messages not requiring a response, or received messages with the response already sent. REVIEW is inhibited if there are no listed messages.

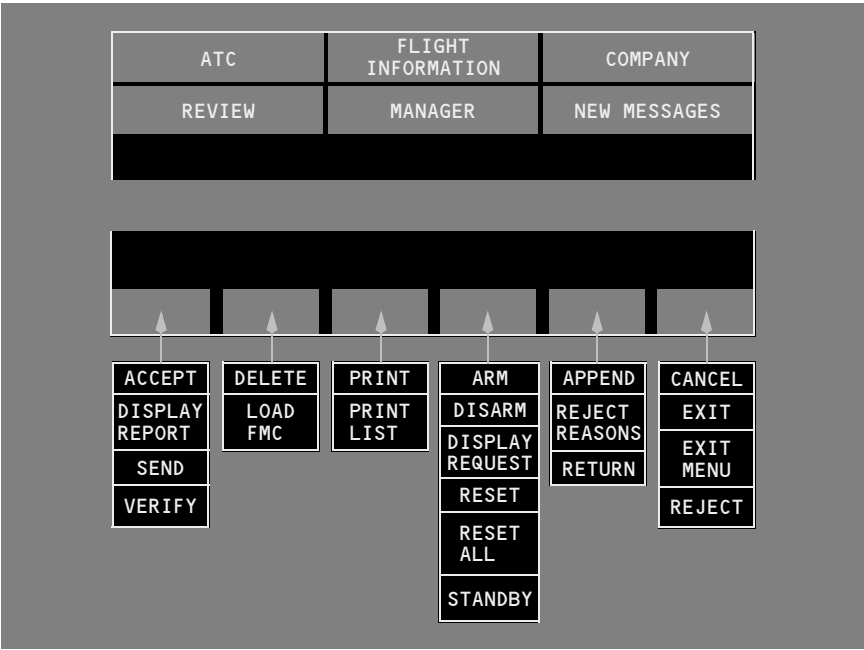
MANAGER provides the controls for data link and communications systems in general.

NEW MESSAGES displays a list of uplinked messages that have not been displayed or responded to. NEW MESSAGES is inhibited when there are no new messages.

Communications Control and Input Functions

Communications menus, controls, and data input methods are similar for ATC, FLIGHT INFORMATION, and COMPANY functions. Basic functions are explained here.

Command Key Locations



Communications command keys are displayed at the bottom of communications pages. Command keys change as appropriate for pages displayed. Each key has a label which changes based on the page displayed and the possible action. Only one label is displayed in a single location for a specific condition on the page.

Command Key Functions

The following table describes the key functions and labels for all ATC, FLIGHT INFORMATION, and COMPANY functions.

Command key label	Displayed/Inhibited	Key function
ACCEPT (uplink messages)	Displayed when: <ul style="list-style-type: none">message requires an accept/reject response, andall message pages have been displayed Inhibited for first 2 seconds of message display	Select: <ul style="list-style-type: none">message acceptance downlinked to message senderACCEPT & REJECT keys removedmessage status displayed in info boxCANCEL command key displayed
APPEND (company downlink accept/reject response)	Displayed when: <ul style="list-style-type: none">all pages of the uplinked message have been displayed, andcompany data link capability is operational Inhibited when: <ul style="list-style-type: none">for first 2 seconds of uplink display, orwhen company data link capability is not operational	Select: <ul style="list-style-type: none">uplink message is removed, anddownlinked message page is displayed
ARM (ATC downlink reports)	Displayed when an armable report is open: <ul style="list-style-type: none">REPORT LEAVINGREPORT LEVELREPORT PASSINGREPORT REACHING.	Select: <ul style="list-style-type: none">arms the report for automatic downlink to ATC when report conditions are metkey function changes to DISARMreport status changes from OPEN to ARMED

Command key label	Displayed/Inhibited	Key function
CANCEL	<p>Displayed when:</p> <ul style="list-style-type: none"> • uplink message is displayed which does not require an accept or reject response, or • an uplink message is displayed which has been accepted, rejected, or • review message is displayed <p>Inhibited for first 2 seconds of message display.</p>	Message is removed.
DELETE (ATC reports)	Displayed when a downlink report page is open for entry.	<p>Select:</p> <ul style="list-style-type: none"> • deletes the report without sending. • displays the COMM menu
DISARM (ATC reports)	<p>Displayed when an armable report is ARMED:</p> <ul style="list-style-type: none"> • REPORT LEAVING • REPORT LEVEL • REPORT PASSING • REPORT REACHING 	<p>Select:</p> <ul style="list-style-type: none"> • disarms automatic report downlink to ATC • key function changes to ARM • Report status changes from ARMED to OPEN
DISPLAY REPORT	Displayed after accepting an uplink message which contains a report.	Displays the downlink report attached to an uplinked message.
DISPLAY REQUEST	Displayed after accepting an ATC uplink message which contains a request.	Downlink request which required an ATC response is displayed,

777 Flight Crew Operations Manual

Command key label	Displayed/Inhibited	Key function
EXIT	Displayed when: <ul style="list-style-type: none">• a downlink message is displayed, or• a manager page is displayed	COMM main menu is displayed
EXIT MENU	Displayed when menu is displayed.	COMM main menu is displayed.
LOAD FMC (ATC uplink)	Displayed when uplinked ATC message contains data which can be loaded into the FMC. Inhibited when active route is in a MOD condition.	Select: <ul style="list-style-type: none">• FMC data is transferred into the active route, and• FMC modification is started.
PRINT	Displayed when: <ul style="list-style-type: none">• displayed message can be printed, and• printer is available Inhibited when printer is not available.	Message is sequenced for printing.
PRINT LIST	Displayed when: <ul style="list-style-type: none">• new message list page is displayed, or• review list page is displayed Inhibited when printer is not available.	All messages in the list are sequenced for printing.

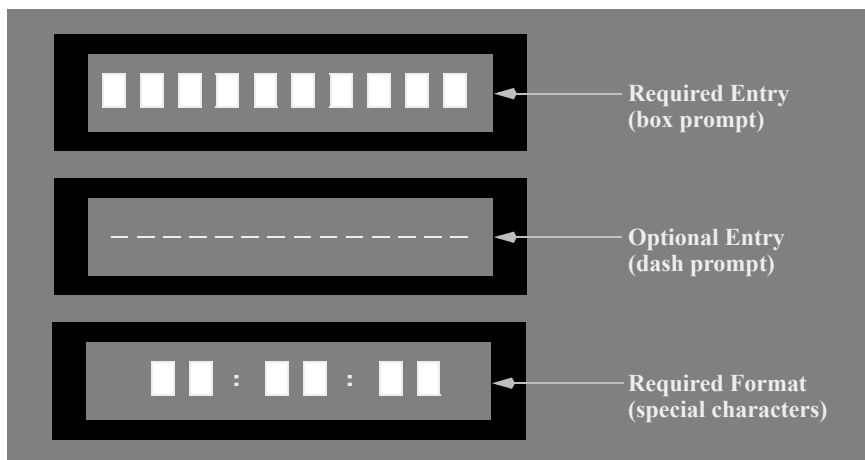
Command key label	Displayed/Inhibited	Key function
REJECT (uplink messages)	<p>Displayed when:</p> <ul style="list-style-type: none"> message requires an accept/reject response, and all message pages have been displayed <p>Inhibited for first 2 seconds of message display.</p>	<p>Select:</p> <ul style="list-style-type: none"> message rejection downlinked to message sender ACCEPT and REJECT command keys removed CANCEL command key displayed message status displayed in info box, and message cleared from the display 5 seconds after status changes to REJECTED
REJECT REASONS (ATC reject downlink)	Displayed when an uplink message requires an accept or reject response.	Displays REJECT REASON page.
RESET (downlink pages)	Displayed when downlink page is displayed.	Message parameters are reset to their default values.
RESET ALL (ATC downlink pages)	Displayed when ATC VERIFY REQUEST page is displayed.	<p>Select:</p> <ul style="list-style-type: none"> all request parameters on the VERIFY REQUEST are set to reset/default values ATC combined request pages are reset, or COMM main menu is displayed

777 Flight Crew Operations Manual

Command key label	Displayed/Inhibited	Key function
RETURN	Displayed when: <ul style="list-style-type: none">• a review message is displayed, or• a downlink message is displayed, or• a VERIFY REQUEST page is displayed, or• a manager page is displayed	Previous list page, request page, or menu is displayed.
SEND (downlink messages)	Displayed when: <ul style="list-style-type: none">• required data complete, and• all company message pages have been displayed Inhibited when transmission queue is full.	Select: <ul style="list-style-type: none">• message transmission initiated• message status displayed in info box, and• message cleared from the display 5 seconds after status changes to SENT
STANDBY (ATC uplink messages)	Displayed when: <ul style="list-style-type: none">• uplinked message is received which requires an accept/reject response, and• STANDBY has not been previously selected for this message	Standby response is sent.

Command key label	Displayed/Inhibited	Key function
VERIFY	<p>Displayed when data is entered on more than one of the following ATC pages:</p> <p>[Not AIMS V17]</p> <ul style="list-style-type: none">• ALTITUDE REQUEST <p>[AIMS V17]</p> <ul style="list-style-type: none">• LEVEL REQUEST• ROUTE REQUEST• SPEED REQUEST	Displays VERIFY REQUEST page.

Text Entry



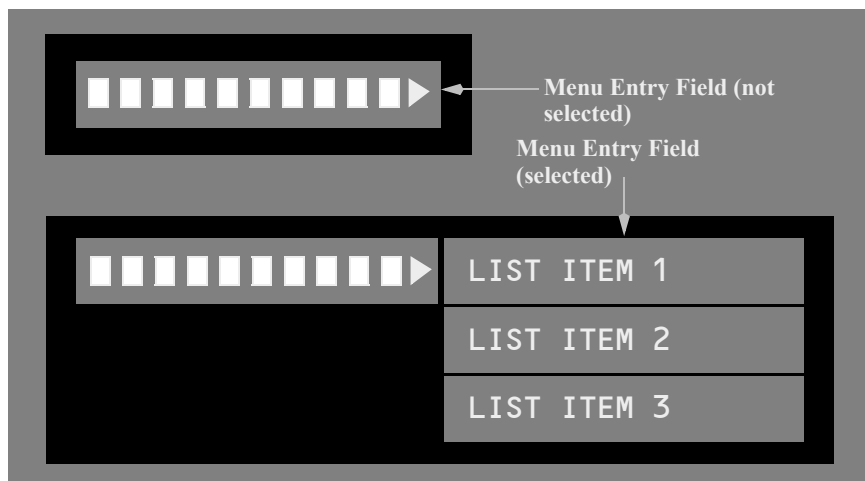
Downlink message pages provide text entry fields. Scratchpad entries transfer to selected entry fields when a cursor select switch is pushed. Scratchpad entries blank when successfully transferred. Scratchpad entries remain and an INVALID ENTRY message is displayed on the MFD when the entry is not valid.

An entry field resets to a default value when a blank scratchpad is transferred. An entry field resets to the default entry prompt when DELETE is transferred.

Box and dash prompts indicate the maximum number of characters allowed.

Some entry fields have format requirements. Entry prompts display the required entry format, with special characters separating entry boxes. The required data is entered without the special characters or spaces. Scratchpad data is transferred to entry boxes after being checked for proper format. Invalid data or format prevents transfer and displays an INVALID ENTRY message.

Menu Entry Fields



Menu entry fields are used to make text entry selections from a list. Menu entry fields distinguish mandatory versus optional entry in the same manner as CDU entry field.

The menu entry field is distinguished from other entry fields by the pointer to the right of the field.

When initially selected, a list of menu items is displayed to the side of the pointer. If an item from the list is then selected using the cursor and cursor select switch, that item is transferred to the entry field. If the menu prompt is selected again and the CDU contains a valid value, that CDU value is transferred to the entry field. Actions for invalid values, an empty scratchpad, space characters, and the delete key are the same as for the CDU entry field. When the entry field is selected with text already inserted, the menu list is removed from the display.

Invalid Entries

When the scratchpad contains invalid data for the entry field, the INVALID ENTRY message is displayed in the INFO BOX. Re-entering valid data clears the INVALID ENTRY message on an ATC downlink page. Selecting the EXIT INFO key also clears the INVALID ENTRY message and removes the info box.

INVALID ENTRY messages on a company downlink page must be individually cleared by selecting the EXIT INFO key before valid data is re-entered into the field.

Message List

Message titles and related information can be displayed in a list. The illustration shows the REVIEW message list. A similar list is available for NEW MESSAGES.

The NEW MESSAGE list is sorted by the time of receipt, the most current message at the top. ATC uplink messages have an ATC label to the right of the message block. The message remains in the list until it is accepted, rejected, or displayed. Messages requiring an accept/reject remain in the list until the accept/reject response is accomplished.

Selecting an item from the list with the cursor and pushing the cursor select switch displays the message page. Lists are also used to view new messages.

[Not AIMS V17]

ATC		FLIGHT INFORMATION	COMPANY
REVIEW		MANAGER	NEW MESSAGES
1	1848Z	RECEIVED	
	1842Z	VHF-VOICE CONTACT	ACCEPTED
2	1832Z	WEATHER	DISPLAYED
	1820Z	ATIS	DISPLAYED

Diagram illustrating the Message List interface. The list is sorted by time of receipt. The interface shows a table with columns for ATC, Flight Information, and Company. The 'REVIEW' tab is selected. The list contains messages with timestamps and descriptions. Callouts 1, 2, 3, and 4 indicate specific elements: 1 points to the first message (1848Z), 2 points to the second message (1832Z), 3 points to the 'ACCEPTED' status, and 4 points to the 'DISPLAYED' status.

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1848Z	RECEIVED	
1842Z	VHF-VOICE CONTACT	KOAK ACCEPTED
1832Z	WEATHER	DISPLAYED
1820Z	ATIS	DISPLAYED

1 Current Time

Displays current time.

2 Message Time

For new messages – time the message is received.

For review messages – time the message is received or sent.

3 Message Title

Displays message title information.

4 Message Status

Only displayed for review list boxes.

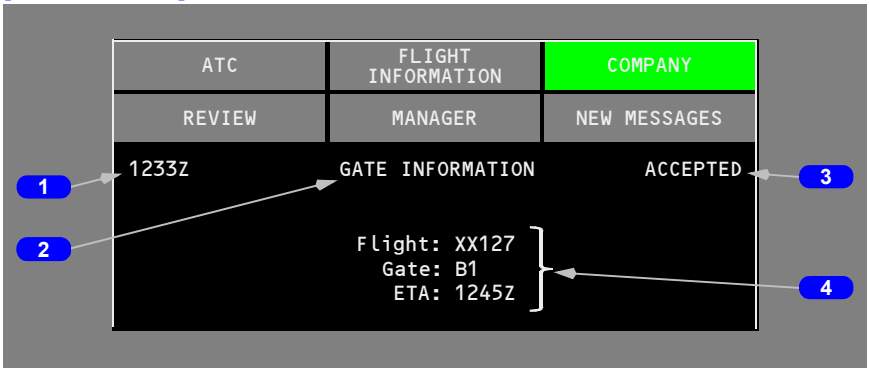
The appropriate status indicator is displayed.

Message Display Format

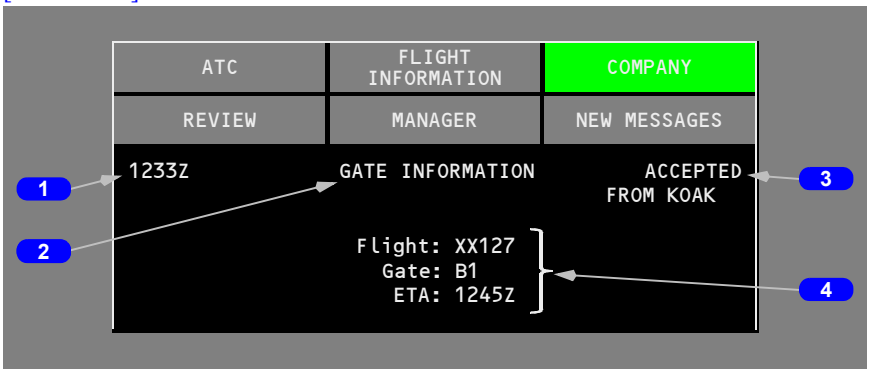
A typical message display format is shown. Messages selected from a list are displayed in this format.

Note: Selection of a main menu item exits the message page.

[Not AIMS V17]



[AIMS V17]



1 Message Time

For downlink messages – current time.

For new messages – time the message is received.

For review messages – time the message is received or sent.

2 Message Title

Displays message title information.

3 Review State

Only displayed for review messages.

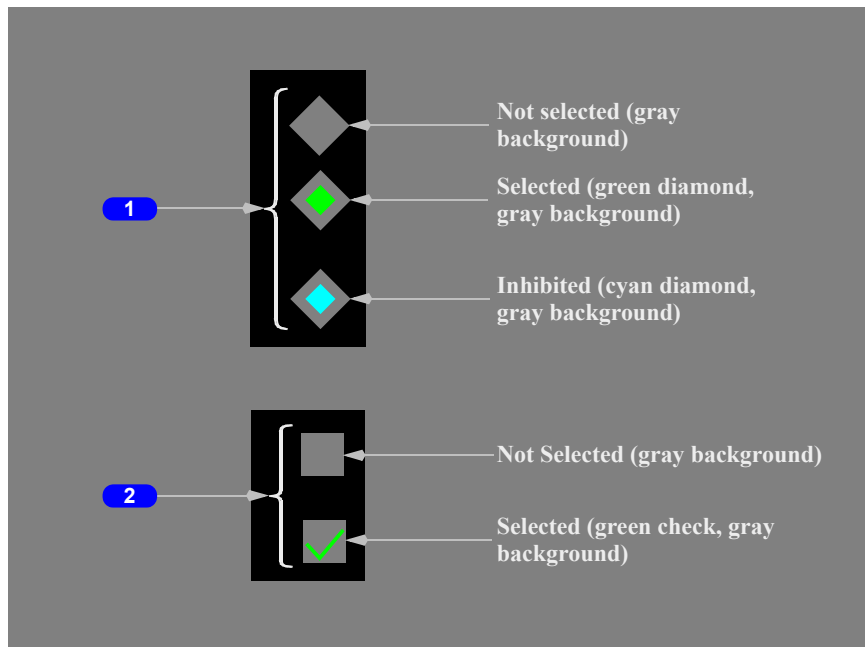
The appropriate state indicator is displayed.

4 Message Content

Located between the title and the keys.

Exclusive and Nonexclusive Select Keys

Manager and new message pages can contain select keys to activate features. Pushing the cursor select switch when the key is highlighted makes the selection. A second selection of a nonexclusive key toggles to the deselected state.



1 Exclusive Select Key

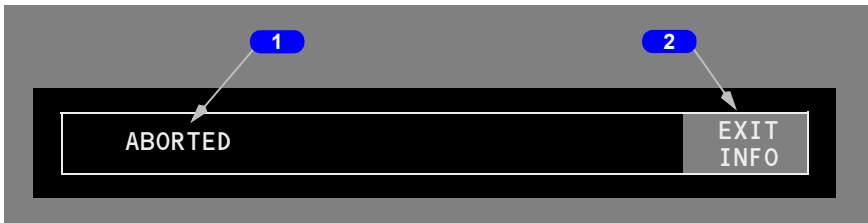
The diamond-shaped exclusive select keys are used to select a single feature from a group. Selecting a key activates the feature and all other exclusive select keys in that group are deselected. The keys are displayed in their selected or default condition. If selection is required, the SEND key is not displayed until a selection is made.

2 Nonexclusive Select Key

The square-shaped nonexclusive select keys are used to select multiple features. Selecting a key activates the feature. The keys are displayed in their previously selected or default condition. If selection is required, the SEND key is not displayed until a selection is made.

Information Messages

Messages are displayed in an information box at the bottom of the MFD. The information box covers command keys. Information messages, such as INVALID ENTRY, are cleared by selecting EXIT INFO. Some information messages automatically disappear.



1 Information Message Text

The text starts at the left of the box.

2 EXIT INFO Key

Select – removes the information box for the displayed message from the display.

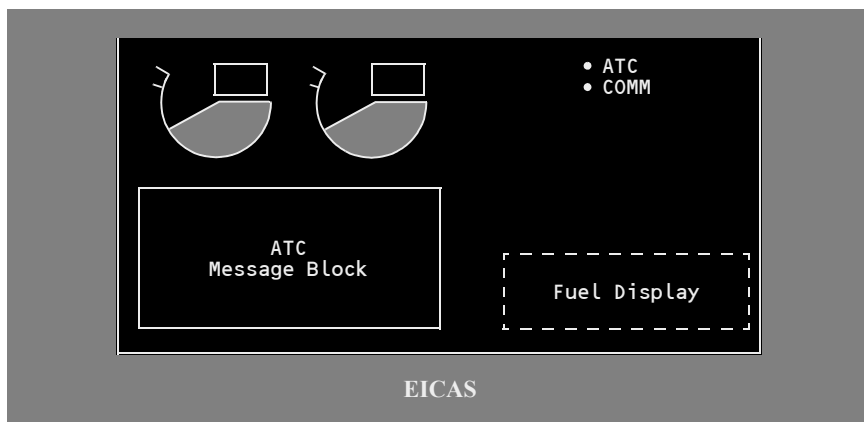
Communications Information Messages

Communications information messages are described in the following table.

Information Message	Condition
ABORTED	ATC connection not established, lost, or loss of handoff to a new active center, while a message is transmitting, or before acceptance.
ACCEPTED	ACCEPT response received.
ACCEPTING	ACCEPT response sent.
DISPLAYED	All pages of a message not requiring an ACCEPT or REJECT response have been displayed.
COMM CONTROL TRANSITION – COMPANY MESSAGES LOST	Airplane data link system switched to a new AIMS master. Company datalink information may be lost. Incomplete company downlink messages are lost and must be created/transmitted again. If previously received Company messages are required, they must be requested again. ATC connections, data, and messages are not affected.
CONNECTING	Logon request sent, network acknowledgment received, and connect or start request not received.

Information Message	Condition
INCOMPLETE MESSAGE	Only part of the displayed message is received.
INVALID ENTRY	An entry box is selected and the CDU scratchpad value is not valid.
LOADED	ATC uplink route modification is successfully loaded into the FMC.
LOAD ABORTED	Loading of ATC uplink route modification into the FMC is aborted.
LOADING	ATC uplink route modification is loading into the FMC.
MESSAGE TO PRINTER	Selected message(s) sent to printer.
MESSAGE LIMIT EXCEEDED	Maximum number of characters that can be transmitted in ATC downlink message is exceeded.
NO ACCEPT (company)	ACCEPT response is not successfully transmitted or an ACCEPT response is not required.
NO PRINT	An attempt to send a message(s) to the printer is unsuccessful.
NO REJECT (company)	REJECT response is not successfully transmitted or a REJECT response is not required by the message.
NO SEND	An attempt to send a downlink message is unsuccessful.
PARTIAL LOAD	ATC uplink route modification was partially loaded into the FMC.
PRINTING	ATC message is printing.
REJECTED	REJECT response received.
REJECTING	REJECT response transmitting.
SENDING	The downlink message is sent.
SENT	The downlink message is received.
UNABLE TO LOAD	ATC uplink route modification can not be loaded into the FMC.

Uplink Message



ATC Uplinks

Arriving ATC uplink messages are annunciated by an •ATC communications message, an aural chime, and the display of the EICAS ATC message block. The message text is displayed below the normal EICAS engine display. Uplink messages too large to fit in the message area display the message LARGE ATC MESSAGE. The message text is displayed using the NEW MESSAGE menu selection.

Flight Information Uplinks

[\[Option - Flight Information\]](#)

Arriving flight information uplink messages are annunciated by a •COMM communications message and an aural chime. The message text is displayed using the NEW MESSAGE menu selection.

Company Uplinks

Arriving company uplink messages are annunciated by a •COMM communications message and an optional aural chime.

Accept/Reject Uplinks

ATC messages requiring an accept or reject response display those options on the EICAS display. The MFD message page displays ACCEPT, STANDBY, REJECT REASONS, and REJECT keys at the bottom. Select ACCEPT or REJECT to respond to the uplink message. The REJECT REASONS key can be selected to inform ATC why the message is being rejected.

Company messages can also be accepted or rejected on the message page.

After making a selection, the status changes to ACCEPTING/REJECTING while the response is transmitting. When the communications network sends a response indicating that the message was received, the message status changes to ACCEPTED/REJECTED. After a message has been accepted or rejected, a CANCEL key is displayed at the bottom of the page. Selecting CANCEL will clear the message from the display. Rejected messages are automatically removed 5 seconds after the message status changes to REJECTED.

The ACCEPT, CANCEL, and REJECT buttons on the glareshield perform the same function as the same keys on the MFD.

Reject Reasons Page

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES

1234Z

REJECT REASONS

☐

DUE TO AIRCRAFT PERFORMANCE

☐

DUE TO WEATHER

☐

NOT CONSISTENT, PLEASE RE-SEND

FREE TEXT:

RESET

RETURN

REJECT

If the response to an ATC uplink message is to reject the message, the REJECT REASONS key can be selected to inform ATC why the clearance message is being rejected. Up to three lines of text can be included. Select REJECT to send the reject message with the applicable reasons.

Standby Response

When more time is required to respond to an ATC uplink, use the STANDBY key to send a delay notification.

ATC Sidelinks

ATC sidelinks are system generated ATC communication messages. They are annunciated by an •ATC communications message, aural chime, and display of the EICAS ATC message block. The message text is displayed below the normal EICAS engine display. Selecting CANCEL with the cursor control device or glareshield button will clear the message from the display.

ATC Data Link

ATC data link communicates with participating air traffic control centers, reducing the need for VHF voice communications. Airplane situation reports, route changes, speed and vertical clearances, and voice contact requests can be sent or received as appropriate. The COMM display ATC menu selection allows display of downlink message pages.

Uplink and downlink messages are stored. All messages are assigned the time of receipt/transmission and are printable.

ATC data link requires manual logon to a participating ATC facility. Once logged on, transfer to adjacent ATC facilities is normally automatic.

Crew Feedback

ATC uplinks containing clearance data that the crew can set on the MCP or EFIS control panel have a crew feedback display function. When the message is displayed on EICAS or the message page, the data values change from white to green when properly set by the crew. Data which provides feedback is:

- MCP speed
- MCP heading
- MCP altitude
- barometer setting
- transponder code
- VHF frequency
- HF frequency

FMC Data Loading

Some ATC uplinks contain data for loading into the FMC. Display of the LOAD FMC command key indicates that FMC data is available for loading. Selecting LOAD FMC transfers data to the FMC and creates an FMC modification.

Both MFD information messages and FMC scratchpad messages provide indications of loading progress.

Downlink Pages
ATC Menu

[Not AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC		
ALTITUDE REQUEST	WHEN CAN WE EXPECT	EMERGENCY REPORT
ROUTE REQUEST	VOICE CONTACT REQUEST	ATC REQUESTED REPORTS...
SPEED REQUEST	LOGON / STATUS	POSITION REPORT
CLEARANCE REQUEST		FREE TEXT MESSAGE

ATC Menu

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC		
LEVEL REQUEST	WHEN CAN WE EXPECT	EMERGENCY REPORT
ROUTE REQUEST	VOICE CONTACT REQUEST	ATC REQUESTED REPORTS...
SPEED REQUEST	FREE TEXT MESSAGE	CONDITIONAL CLEARANCES
CLEARANCE REQUEST	LOGON / STATUS	POSITION REPORT

ATC Menu

[\[AIMS V17 and Option - ATN\]](#)

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC		
LEVEL REQUEST	WHEN CAN WE EXPECT	EMERGENCY REPORT
ROUTE REQUEST	VOICE CONTACT REQUEST	ATC REQUESTED REPORTS...
SPEED REQUEST	FREE TEXT MESSAGE	CONDITIONAL CLEARANCES
CLEARANCE REQUEST	LOGON / STATUS	POSITION REPORT

ATC Menu - ATN Connection Established

The ATC menu provides access to ATC downlink pages.

The ATC REQUESTED REPORTS menu selection is inhibited (cyan) when no reports are requested by ATC.

[\[AIMS V17\]](#)

The CONDITIONAL CLEARANCES menu selection is inhibited (cyan) unless a conditional clearance is accepted by the flight crew.

[\[AIMS V17 and Option - ATN\]](#)

Some ATC menu selections and request messages are inhibited (cyan) when an ATN (Aeronautical Telecommunication Network) data link connection is established.

Note: This menu is not repeated when describing individual pages.

Altitude Request

[Not AIMS V17]

The ALTITUDE REQUEST page allows selection of an altitude, an altitude block, or a VMC descent. A second request page allows selection of a reason for the request.

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES

1234Z ALTITUDE REQUEST

1 ALTITUDE: ----

STEP AT: ----

CRUISE CLIMB

2 BLOCK: ----

TO: ----

3 REQUEST VMC DESCENT

1

2

SEND PRINT RESET RETURN EXIT

1 ALTITUDE

The requested altitude is entered into the dash prompt and the SEND key becomes active.

Pushing the SEND key requests a normal climb at climb power unless otherwise requested, or a normal descent.

Additional climb or descent options are:

- STEP AT – allows entering a time or position for the start of the climb or descent
- CRUISE CLIMB – begin a cruise climb from present position

STEP AT is inhibited when the ALTITUDE value is less than 150 feet from current airplane altitude. Altitude entries are any valid FMC altitude. Time entries are in four digit, hours and minutes, optionally followed by a Z. Position entries are any valid FMC position.

2 BLOCK

BLOCK is the beginning of a block altitude. TO is the end of the altitude block. Altitude entries are any valid FMC altitude.

The SEND key becomes active with an entry.

3 REQUEST VMC DESCENT

A VMC descent is begun from present position.

The SEND key becomes active with this selection.

Level Request

[AIMS V17]

The LEVEL REQUEST page allows selection of an altitude, an altitude block, or a VMC descent. A second request page allows selection of a reason for the request.

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES

1234Z LEVEL REQUEST

1 [] LEVEL: []

[] STEP AT: []

[] CRUISE CLIMB

2 [] BLOCK: []

[] TO: []

3 [] REQUEST VMC DESCENT

1 []

2 []

[]

SEND PRINT RESET RETURN EXIT

[AIMS V17 and Option - ATN]

ATC FLIGHT INFORMATION COMPANY

REVIEW MANAGER NEW MESSAGES

1234Z LEVEL REQUEST

1 LEVEL:

STEP AT:

CRUISE CLIMB

2 BLOCK:

TO:

REQUEST VMC DESCENT

SEND PRINT RESET RETURN EXIT

ATN Connection Established

1 LEVEL

The requested flight level is entered into the dash prompt and the SEND key becomes active.

Pushing the SEND key requests a normal climb at climb power unless otherwise requested, or a normal descent.

Additional climb or descent options are:

- STEP AT – allows entering a time or position for the start of the climb or descent
- CRUISE CLIMB – begin a cruise climb from present position

STEP AT is inhibited when the LEVEL value is less than 150 feet from current airplane altitude. Flight level entries are any valid FMC altitude. Time entries are in four digit, hours and minutes, optionally followed by a Z. Position entries are any valid FMC position.

2 BLOCK

BLOCK is the beginning of a block altitude. TO is the end of the altitude block. Altitude entries are any valid FMC altitude.

The SEND key becomes active with an entry.

3 REQUEST VMC DESCENT

A VMC descent is begun from present position.

The SEND key becomes active with this selection.

Altitude Request Reason Page

[Not AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z ALTITUDE REQUEST		
<input type="checkbox"/> AT PILOTS DISCRETION		
<input type="checkbox"/> DUE TO WEATHER		
<input type="checkbox"/> DUE TO AIRCRAFT PERFORMANCE		
<input type="checkbox"/> MAINTAIN OWN SEPARATION AND VMC		
FREE TEXT: <input type="text"/>		
SEND	PRINT	RESET
RETURN	EXIT	

The page scroll bar selects a second ALTITUDE REQUEST page. Reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

Level Request Reason Page

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z LEVEL REQUEST		
<div><input type="checkbox"/> AT PILOTS DISCRETION</div> <div><input type="checkbox"/> DUE TO WEATHER</div> <div><input type="checkbox"/> DUE TO AIRCRAFT PERFORMANCE</div> <div><input type="checkbox"/> MAINTAIN OWN SEPARATION AND VMC</div> <div>FREE TEXT: <div></div></div>		
<div>SEND PRINT RESET RETURN EXIT</div>		

777 Flight Crew Operations Manual

[AIMS V17 and Option - ATN]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
<div>1234Z LEVEL REQUEST</div> <div> <input type="checkbox"/> AT PILOTS DISCRETION <input type="checkbox"/> DUE TO WEATHER <input type="checkbox"/> DUE TO AIRCRAFT PERFORMANCE <input type="checkbox"/> MAINTAIN OWN SEPARATION AND VMC </div> <div> FREE TEXT: <div></div> </div> <div> <div>SEND</div> <div>PRINT</div> <div>RESET</div> <div>RETURN</div> <div>EXIT</div> </div>		

ATN Connection Established

The page scroll bar selects a second LEVEL REQUEST page. Reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

Route Request

The ROUTE REQUEST page allows selection of a direct to waypoint, new route, heading or track, departure and transition, arrival and transition, weather deviation, or a route offset. A second request page allows selection of a reason for the request.

1

2

3

4

5

6

7

8

ATC

FLIGHT INFORMATION

COMPANY

REVIEW

MANAGER

NEW MESSAGES

1234Z

ROUTE REQUEST

DIRECT TO:

ROUTE 1

ROUTE 2

HEADING:

TRACK:

DEP/ARR:

WEATHER DEVIATION

UP TO:

OFFSET: NM

OFFSET AT:

SEND

PRINT

RESET

RETURN

EXIT

1

2

[AIMS V17 and Option - ATN]

ATC		FLIGHT INFORMATION		COMPANY	
REVIEW		MANAGER		NEW MESSAGES	
1234Z		ROUTE REQUEST			
1	◆ DIRECT TO: [-----]	◆ ROUTE 1		◆ ROUTE 2	1
	◆ HEADING: [---]				
	◆ TRACK: [---]				
	◆ DEP/ARR: [-----]				
6	◆ WEATHER DEVIATION UP TO: [---] NM				2
	◆ OFFSET: [---] NM				
	<input type="checkbox"/> OFFSET AT: [-----]				
SEND		PRINT		RESET	RETURN EXIT

ATN Connection Established

1 DIRECT TO

Enter any valid FMC waypoint. The SEND key becomes active with this selection.

2 ROUTE

Selects FMC route 1 or 2. Sends the selected route, including any modifications. The SEND key becomes active with this selection.

3 HEADING

Enter desired heading. When displays are referenced to true north, a TRU label is displayed right of the heading. The SEND key becomes active with this selection.

4 TRACK

Enter desired ground track. When displays are referenced to true north, a TRU label is displayed right of the ground track. The SEND key becomes active with this selection.

5 Departure (DEP)/Arrival (ARR)

Enter one of the following:

- departure
- arrival
- departure and transition
- arrival and transition

Default entries are:

- departure procedure/transition selected for the selected route
- the approach procedure/transition selected for the active route when the airplane is in the air and an arrival procedure/transition is not selected

The SEND key becomes active when one of the check boxes is selected.

6 WEATHER DEVIATION UP TO

[\[AIMS V14 or later\]](#)

Enter desired offset in nautical miles. Valid entries are L (left) or R (right) NNN (NNN is any number from 1 to 128). Entries can be made without L or R to allow for offsets to either side of the route. The SEND key becomes active with this selection.

7 OFFSET

Enter desired FMC route offset in nautical miles. Valid entries are L or R XX (XX is any number from 1 to 99). The SEND key becomes active with this selection.

8 OFFSET AT

Enter a time or position to begin the offset. Time entries are in four digit, hours and minutes, optionally followed by a Z. Position entries are any valid FMC position.

Route Request Reason Page

[\[Not AIMS V17\]](#)

The page scroll bar selects a second ROUTE REQUEST page similar to the ALTITUDE REQUEST page previously described. The reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

[\[AIMS V17\]](#)

The page scroll bar selects a second ROUTE REQUEST page similar to the LEVEL REQUEST page previously described. The reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

Speed Request

The SPEED REQUEST page allows selection of speed. A second request page allows selection of a reason for the request.

1 SPEED

Enter any valid FMC speed or mach number. IAS entries are rounded to the nearest 10 knots. The SEND key becomes active with this entry.

Speed Request Reason Page

[Not AIMS V17]

The page scroll bar selects a second SPEED REQUEST page similar to the ALTITUDE REQUEST page previously described. The reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

[AIMS V17]

The page scroll bar selects a second SPEED REQUEST page similar to the LEVEL REQUEST page previously described. The reasons for a request are optionally entered on this page. Up to three lines of free text can be included.






Clearance Request

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z CLEARANCE REQUEST		
<input type="checkbox"/> REQUEST CLEARANCE		
FREE TEXT: <div>----- ----- -----</div>		
SEND	PRINT	RESET
	RETURN	EXIT

Selecting REQUEST CLEARANCE informs ATC that the crew is ready for a clearance, such as predeparture or pushback. Up to three lines of free text can be included. The SEND key becomes active with this selection.

Combination Downlink Request

[Not AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z ALTITUDE REQUEST		
 ALTITUDE: FL330		
 STEP AT: -----		
 CRUISE CLIMB		
 1		
SEND PRINT RESET RETURN EXIT		
1234Z SPEED REQUEST		
SPEED: .84		
 1		
VERIFY PRINT RESET RETURN EXIT		
1234Z VERIFY REQUEST		
REQUEST CRUISE CLIMB TO FL 330, REQUEST SPEED .84		
SEND PRINT RESET RETURN EXIT		

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES

1234Z

LEVEL REQUEST

LEVEL: FL330

STEP AT:

CRUISE CLIMB

1

SEND

PRINT

RESET

RETURN

EXIT

1234Z

SPEED REQUEST

SPEED: .84

1

VERIFY

PRINT

RESET

RETURN

EXIT

1234Z

VERIFY REQUEST

REQUEST CRUISE CLIMB TO FL 330,
REQUEST SPEED .84

SEND

PRINT

RESET

RETURN

EXIT

[Not AIMS V17]

Requests from the altitude, speed, and route pages can be combined into one downlink request. Each request is individually selected and filled out. Select subsequent request pages by selecting RETURN, and selecting additional downlink pages from the ATC main menu. When data is entered into the second request page, the SEND key changes to VERIFY.

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[AIMS V17]

Requests from the level, speed, and route pages can be combined into one downlink request. Each request is individually selected and filled out. Select subsequent request pages by selecting RETURN, and selecting additional downlink pages from the ATC main menu. When data is entered into the second request page, the SEND key changes to VERIFY.

The SEND key is active on the VERIFY REQUEST page. A combined request is limited to five elements. Selecting a sixth request element displays the MESSAGE LIMIT EXCEEDED information message.

The verify page provides a display of the combined request elements. Each element is displayed on separate lines. Elements requiring revision before sending are revised on their respective request page. Selecting SEND transmits the combined downlink message to ATC.

[Not AIMS V17]

The example shows a combined altitude and speed request. The altitude request is created first.

[AIMS V17]

The example shows a combined level and speed request. The level request is created first.

When Can We Expect

[Not AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z WHEN CAN WE EXPECT		
<div><div>◆ ALTITUDE: <input type="text"/></div><div><input type="checkbox"/> CRUISE CLIMB</div><div>◆ HIGHER ALT</div><div>◆ LOWER ALT:</div><div><input type="checkbox"/> SPEED: <input type="text"/></div><div><input type="checkbox"/> BACK ON ROUTE</div><div>FREE TEXT: <div><div></div><div></div><div></div></div></div></div>		
SEND	PRINT	RESET
	RETURN	EXIT

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES

1234Z
WHEN CAN WE EXPECT

☒

LEVEL:

☐

CRUISE CLIMB

☒

HIGHER LEVEL:

☒

LOWER LEVEL:

☐

SPEED:

☐

BACK ON ROUTE

FREE TEXT:

SEND
PRINT
RESET
RETURN
EXIT

[Not AIMS V17]

Making selections asks ATC the time or location the crew can expect clearance for the requested items. Altitude, speed, and cruise climb entry rules are the same as on the ALTITUDE REQUEST and SPEED REQUEST pages. Up to three lines of free text can be included. The SEND key becomes active when a check box is selected.

[AIMS V17]

Making selections asks ATC the time or location the crew can expect clearance for the requested items. Altitude, speed, and cruise climb entry rules are the same as on the LEVEL REQUEST and SPEED REQUEST pages. Up to three lines of free text can be included. The SEND key becomes active when a check box is selected.

Voice Contact Request

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z VOICE CONTACT REQUEST		
<input type="checkbox"/> REQUEST VOICE CONTACT		
FREE TEXT: <div></div>		
SEND	PRINT	RESET
	RETURN	EXIT

Making selection asks ATC for a voice contact. Up to three lines of free text can be included. The SEND key becomes active when the request for voice contact box is selected.

ATC Logon/Status

The ATC LOGON/STATUS page allows entry of the desired ATC facility for establishment of a data link connection.

The SEND key is displayed after all logon entries are completed. Selecting the SEND key displays SENDING status during logon transmission. Five seconds after the logon status changes to SENT, the page is exited.

[AIMS V14 or V15 or V16]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES

1234Z	ATC LOGON/STATUS
1 → ACTIVE CENTER:	
2 → NEXT CENTER:	
3 →	ATC CONNECTION: NOT ESTABLISHED
4 →	MAX UPLINK DELAY: 360 SEC
5 →	LOGON TO: KOAK
6 →	FLIGHT NUMBER: BOE456
7 →	TAIL NUMBER: N7771

SEND	RESET	RETURN	EXIT
------	-------	--------	------

[AIMS V17 and Option - ATN]

ATC		FLIGHT INFORMATION		COMPANY	
REVIEW		MANAGER		NEW MESSAGES	
1234Z		ATC LOGON/STATUS			
1	ACTIVE CENTER:				
2	NEXT CENTER:				
3	ATC CONNECTION: NOT ESTABLISHED				
4	MAX UPLINK DELAY: 040 SEC				
5	LOGON TO: KOAK	NETWORK READY			
6	FLIGHT NUMBER: BOE456		FANS	9	
7	ORIGIN: KSEA				
8	DESTINATION: KLAX				
SEND		RETURN		EXIT	

1 ACTIVE CENTER

Displays the ATC facility identifier where a connection is established.

2 NEXT CENTER

Displays the ATC facility identifier to which an automatic handoff transfers the connection.

3 ATC CONNECTION

Displays the status of the ATC connection, ESTABLISHED or NOT ESTABLISHED.

[AIMS 2005 or later]

4 MAX UPLINK DELAY

Elapsed time from transmission to receipt of an ATC uplink message that triggers a late annunciation. The words “UPLINK DELAY EXCEEDED” precede any late ATC uplink message. Valid entries are from 1 to 999. Resets to off and displays dashes at:

- power-up
- datalink system reset
- ATC connection terminated
- “DELETE” entry

[AIMS V17 and Option - ATN]

- non-ATN identifier entry into the LOGON TO field

[AIMS V17 and Option - ATN]

When an ATN data link connection is established, displays 040 in cyan and manual entry is inhibited. Uplink messages having an elapsed transmission time of 40 seconds or more do not display to the flight crew and an error message is sent to ATC.

5 LOGON TO

Box prompts are initially displayed. Enter the ICAO four letter identifier for the desired ATC center. The display changes to dashed prompts after establishing an ATC connection.

[AIMS V17 and Option - ATN]

When an ATN identifier is entered, network status displays as:

- NETWORK READY -
 - VHF data link mode 2 available, or
 - FANS select key selected and data communication radio available
- NETWORK NOT READY -
 - VHF data link mode 2 not available, or
 - FANS select key selected and data communication radio not available

When a non-ATN identifier is entered, network status displays as:

- NETWORK READY - data communication radio available
- NETWORK NOT READY - data communication radio not available

6 FLIGHT NUMBER

Normally displays the flight number entered on the FMC route page. When the flight number is not available, box prompts are displayed. Flight number entry on this page is copied to the FMC route page. Changing this entry after establishing an ATC connection cancels the ATC connection.

[Not AIMS V17]

7 TAIL NUMBER

Normally supplied by the airplane system. When the airplane tail number (registry number) is not available from the system, box prompts are displayed and a value can be entered. A manual entry will remain until power to AIMS is interrupted. Changing this entry after establishing an ATC connection cancels the ATC connection. Tail number is provided on the SELCAL placard.

[AIMS V17]

7 ORIGIN

Displays flight number airport of origin.

[AIMS V17]

8 DESTINATION

Displays flight number destination airport.

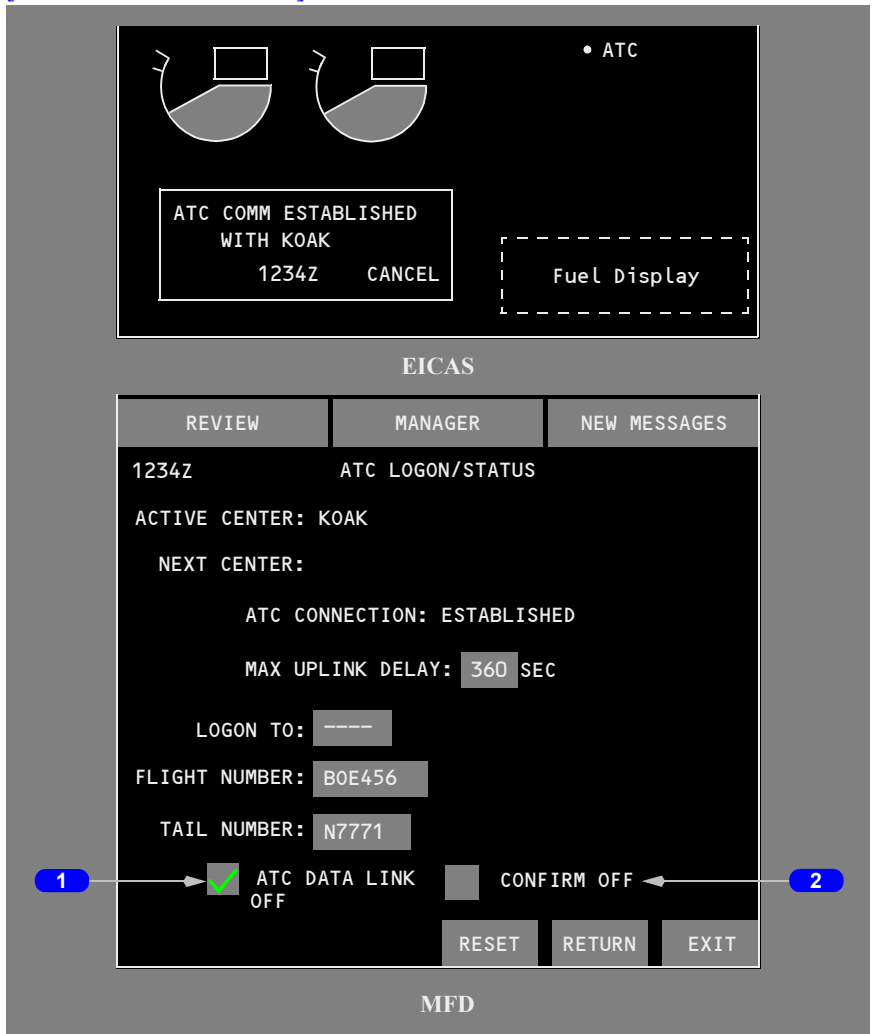
[AIMS V17 and Option - ATN]

9 FANS Select Key

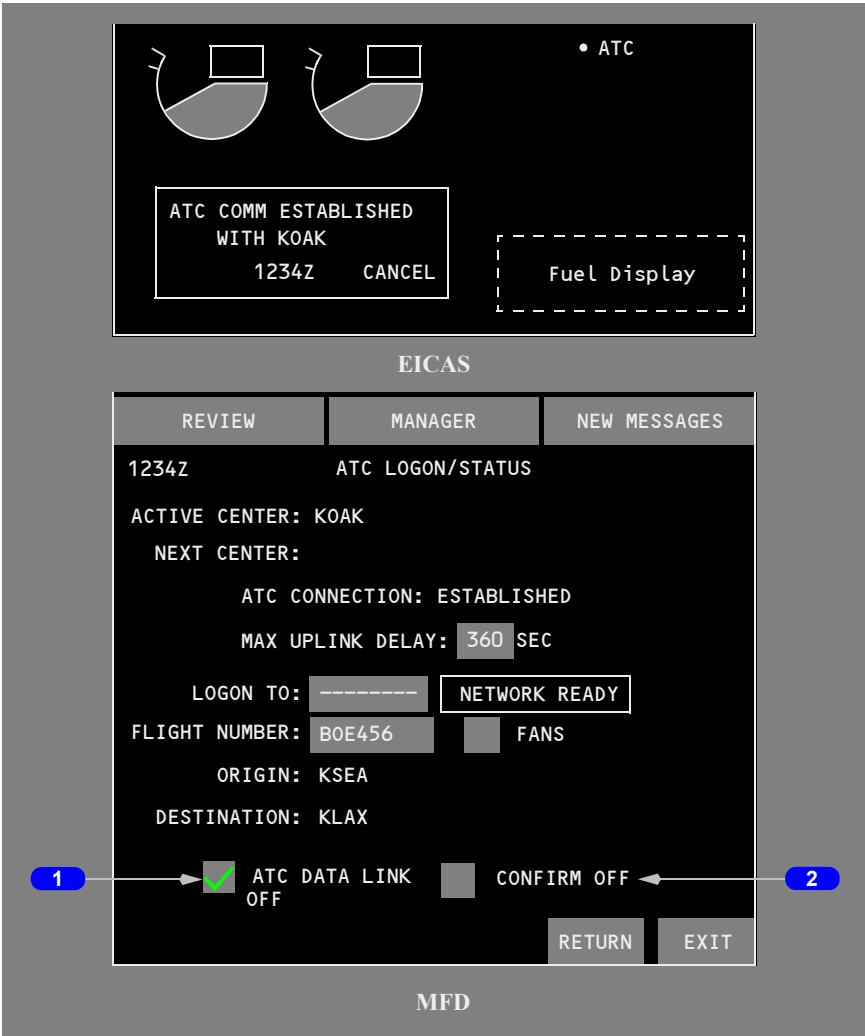
Displays when a four character ATN identifier is entered into the LOGON TO field. Selection allows the flight crew to send a FANS logon request.

ATC Connection Displays

[AIMS V14 or V15 or V16]



[AIMS V17 and Option - ATN]



1 ATC DATA LINK OFF

Displayed when an ATC connection is established.

Selecting ATC DATA LINK OFF displays the CONFIRM OFF selection.

2 CONFIRM OFF

Selecting CONFIRM OFF sends the termination request.

[AIMS V14 or later]

The EICAS communication message •ATC is displayed when the connection is terminated.

Loss of ATC Connection

[AIMS V14 or later]

If the EICAS alert message DATALINK LOST is displayed for 16 minutes, the ATC connection is automatically lost and the EICAS communication message •ATC is displayed

Once an ATC connection is terminated or lost, the logon entries revert to the default values.

Emergency Report

This page informs ATC of an emergency. Sending this report with MAYDAY selected places automatic dependent surveillance (ADS) into the emergency mode.

[Not AIMS V17]

ATC		FLIGHT INFORMATION		COMPANY	
REVIEW		MANAGER		NEW MESSAGES	
1234Z		EMERGENCY REPORT			
1	◆ MAYDAY	◆ PAN	◆ CANCEL EMERGENCY		
2	■ DIVERTING TO: _____	VIA ROUTE X			
3	■ FUEL REMAINING [_ _ _ _ _]				
4	→ _____	HOURS+MINUTES			
5	SOULS ON BOARD: _____				
6	DESCENDING TO: _____				
7	→ OFFSETTING: _____				
8	→ FREE TEXT: _____				
SEND		PRINT		RESET RETURN EXIT	

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z	EMERGENCY REPORT	
1 MAYDAY	PAN	CANCEL EMERGENCY
2 DIVERTING TO: []	VIA ROUTE X	
3 FUEL REMAINING [- - - -]		
4 [] HOURS+MINUTES		
5 PERSONS ON BOARD: []		
6 DESCENDING TO: []		
7 OFFSETTING: []		
8 FREE TEXT: []		
SEND	PRINT	RESET RETURN EXIT

1 MAYDAY, PAN, CANCEL EMERGENCY

Select MAYDAY or PAN emergency. The SEND key becomes active. CANCEL EMERGENCY informs ATC that a previous emergency is now canceled and returns ADS to the normal mode. CANCEL EMERGENCY is inhibited until MAYDAY or PAN downlink is sent.

2 DIVERTING TO

Defaults to the destination airport from the active route. The default route number is displayed. Enter any valid FMC position.

3 FUEL REMAINING

Displays the FMC fuel remaining from the PROGRESS page.

4 FUEL REMAINING – HOURS + MINUTES

Defaults to time provided from the FMC. Manually enter fuel remaining in hours and minutes. Use two numeric characters for hours followed by two numeric characters for minutes.

[Not AIMS V17]

5 SOULS ON BOARD

Manual entry of number of souls on board is required. Enter up to three numeric characters.

[AIMS V17]

5 PERSONS ON BOARD

Manual entry of number of persons on board is required. Enter up to three numeric characters.

6 DESCENDING TO

Enter the altitude for an immediate descent. The default value is the MCP altitude when it is more than 150 feet below current altitude.

7 OFFSETTING

Enter any valid FMC route offset value.

8 FREE TEXT

24 characters of free text can be included.

Note: When data is entered in all fields above OFFSETTING, the system will not accept data entry for the OFFSETTING and FREE TEXT fields. Entering data in one of these two fields displays the MESSAGE LIMIT EXCEEDED information message.

ATC Reports

ATC Requested Report

[Not AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1230Z ATC UPLINK		
CLIMB TO AND MAINTAIN FL330, REPORT REACHING FL330.		

DISPLAY REPORT	CANCEL
-------------------	--------

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC REPORT		
REACHING FL330		

SEND	DELETE	PRINT	ARM	RETURN	CANCEL
------	--------	-------	-----	--------	--------

777 Flight Crew Operations Manual

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1230Z ATC UPLINK FROM KOAK CLIMB TO AND MAINTAIN FL330, REPORT REACHING FL330.		

DISPLAY REPORT	CANCEL
-------------------	--------

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC REPORT FROM KOAK REACHING FL330		

SEND	DELETE	PRINT	ARM	RETURN	CANCEL
------	--------	-------	-----	--------	--------

ATC uplink messages can contain a request for a report. When the uplink is accepted, the DISPLAY REPORT key is displayed. Selecting DISPLAY REPORT displays the ATC requested report. A displayed report can be sent. Some reports can be armed for automatic transmission when conditions are met.

Armable Report

[Not AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC		
ALTITUDE REQUEST	WHEN CAN WE EXPECT	EMERGENCY REPORT
ROUTE REQUEST	VOICE CONTACT REQUEST	ATC REQUESTED REPORTS...
SPEED REQUEST	LOGON / STATUS	POSITION REPORT
CLEARANCE REQUEST		FREE TEXT MESSAGE

ATC REPORTARMED

LEAVING FL330

ATC REPORTARMED

LEVEL FL330

ATC REPORTARMED

PASSING SEA

ATC REPORTARMED

REACHING FL330

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC		
LEVEL REQUEST	WHEN CAN WE EXPECT	EMERGENCY REPORT
ROUTE REQUEST	VOICE CONTACT REQUEST	ATC REQUESTED REPORTS...
SPEED REQUEST	FREE TEXT MESSAGE	CONDITIONAL CLEARANCES
CLEARANCE REQUEST	LOGON / STATUS	POSITION REPORT

ATC REPORT
ARMED

FROM KOAK

LEAVING FL330

ATC REPORT
ARMED

FROM KOAK

LEVEL FL330

ATC REPORT
ARMED

FROM KOAK

PASSING SEA

ATC REPORT
ARMED

FROM KOAK

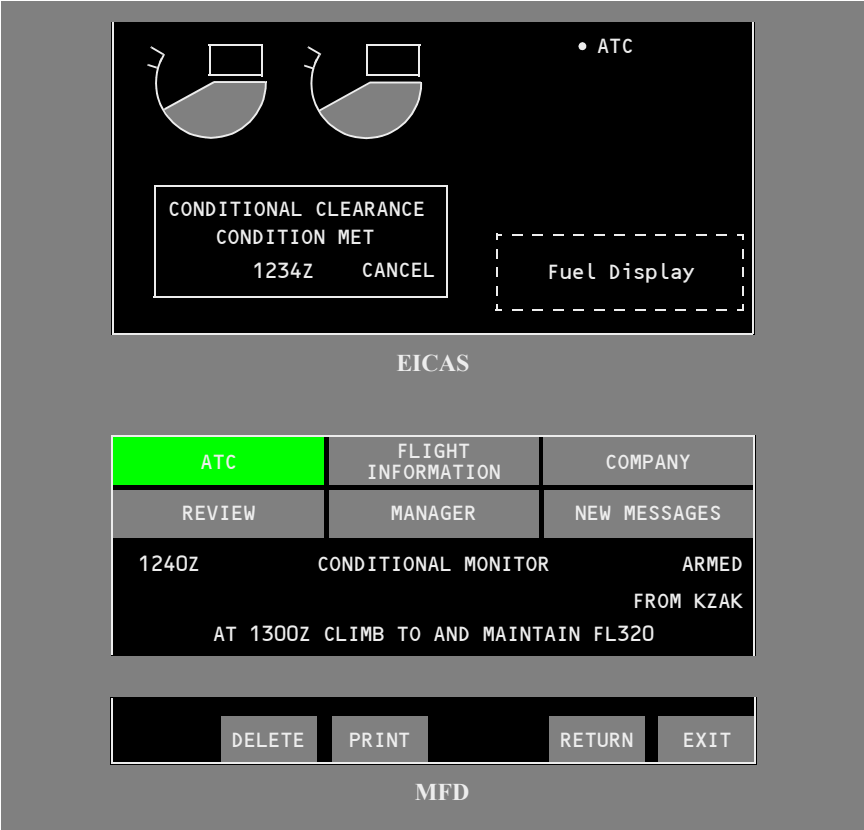
REACHING FL330

All reports requested by ATC can be displayed using the ATC REQUESTED REPORT menu selection. The LEAVING, LEVEL, PASSING, and REACHING reports can be armed for automatic transmission. Selecting the ARM key for a report displays ARMED for the report status. When a report is armed, the ARM key changes to DISARM. When a report is automatically transmitted, an ATC uplink message confirms the report was sent.

Conditional Clearances

[AIMS V17]

Conditional clearances are ATC directions for route modification at some future location, time or altitude. The CONDITIONAL CLEARANCES item on the ATC menu is normally non-selectable. It becomes selectable when a conditional clearance is accepted by the flight crew. The communications management system then monitors the clearance parameters and notifies the flight crew with an ATC sidelink when each condition is either met or not met.



When a conditional clearance must be canceled (e.g. a new clearance is received by voice that supersedes the conditional clearance) the crew can select CONDITIONAL CLEARANCES from the ATC menu and then choose DELETE on the CONDITIONAL MONITOR page.

Note: Deleting a conditional clearance does not disarm or delete any other ATC requested reports contained in the clearance. Each individual ATC report must be disarmed or deleted manually.

Position Report

Use the POSITION REPORT page to manually send a position report.

Note: Current position is also reported to ATC when sending the POSITION REPORT, but is not displayed.

[Not AIMS V17]

ATC		FLIGHT INFORMATION		COMPANY	
REVIEW		MANAGER		NEW MESSAGES	
POSITION REPORT					
1	→ POS: 4038.2N12045.1E	ATA: 1234Z	←	7	
2	→ ALTITUDE: FL320				1
3	→ EST: 4038.4N13045.3E	ETA: 1314Z	←	8	
4	→ NEXT: 4038.6N14045.8E				
		DEST ETA: 2200Z	←	9	2
5	→ SPEED: .89	TEMP: -52C	←	10	
6	→ POS FUEL: xxx.xx X 1000	WIND: 145/030 KT	←	11	
SEND		PRINT		RESET	RETURN EXIT

[AIMS V17]

ATC		FLIGHT INFORMATION		COMPANY	
REVIEW		MANAGER		NEW MESSAGES	
POSITION REPORT					
1	→ POS: 4038.2N12045.1E	ATA: 1234Z	←	7	
2	→ LEVEL: FL320			8	1
3	→ EST: 4038.4N13045.3E	ETA: 1314Z	←	9	
4	→ NEXT: 4038.6N14045.8E			10	
		DEST ETA: 2200Z	←	11	2
5	→ SPEED: .89	TEMP: -52C	←		
6	→ POS FUEL: xxx.xx X 1000	WIND: 145/030 KT	←		
SEND		PRINT	RESET	RETURN	EXIT

1 Position (POS)

Displays the last sequenced waypoint. Displays all asterisks (*) when no FMC data is available.

Latitude and longitude are displayed in the same order as the FMC position report page. Degree and minute values precede the compass letter, just as the crew uses in a voice report.

[Not AIMS V17]

2 ALTITUDE

Displays current altitude. Displays all asterisks (*) when no FMC data is available.

[AIMS V17]

2 LEVEL

Displays current flight level. Displays all asterisks (*) when no FMC data is available.

3 EST

Displays the active waypoint. Accepts any valid FMC active route waypoint entry. Entry of a waypoint not in the active route results in the INVALID ENTRY message.

4 NEXT

Displays the next waypoint following the EST waypoint. Accepts any valid FMC active route waypoint entry. Entry of a waypoint not in the active route results in the INVALID ENTRY message.

5 SPEED

Displays FMC speed. Accepts valid speed entry.

6 Position (POS) FUEL

Displays FMC calculated fuel remaining at the POS waypoint. Displays all asterisks (*) when no FMC data is available.

7 ATA

Displays actual time of arrival at the last sequenced waypoint. Displays all asterisks (*) when no FMC data is available.

8 ETA

Displays estimated time of arrival for the EST waypoint. Accepts valid time entry.

9 Destination (DEST) ETA

Displays estimated time of arrival for the destination airport. Accepts a valid time entry. Displays all asterisks (*) when no FMC data is available.

10 Temperature (TEMP)

Displays air temperature. Displays all asterisks (*) when no FMC data is available.

11 WIND

Displays wind bearing and speed. Displays all asterisks (*) when no FMC data is available.

Optional Position Report Items

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
<p>POSITION REPORT</p> <p>TURBULENCE: ICING:</p> <p> <input type="radio"/> LIGHT <input type="radio"/> TRACE </p> <p> <input type="radio"/> MODERATE <input type="radio"/> LIGHT </p> <p> <input type="radio"/> SEVERE <input type="radio"/> MODERATE </p> <p> <input type="radio"/> <input type="radio"/> SEVERE </p>		
<p>SEND PRINT RESET RETURN EXIT</p>		

A report of current turbulence and icing conditions can be included with the position report.

Free Text Message

ATC	FLIGHT INFORMATION	COMPANY		
REVIEW	MANAGER	NEW MESSAGES		
FREE TEXT MESSAGE <div style="border: 1px solid black; width: 80%; margin: 10px auto; height: 100px; position: relative;"><div style="position: absolute; top: 0; left: 0; right: 0; border-bottom: 1px solid black; height: 10px;"></div><div style="position: absolute; top: 10px; left: 10px; right: 10px; border-bottom: 1px solid black; height: 15px;"></div><div style="position: absolute; top: 20px; left: 10px; right: 10px; border-bottom: 1px solid black; height: 15px;"></div><div style="position: absolute; top: 30px; left: 10px; right: 10px; border-bottom: 1px solid black; height: 15px;"></div><div style="position: absolute; top: 40px; left: 10px; right: 10px; border-bottom: 1px solid black; height: 15px;"></div><div style="position: absolute; top: 50px; left: 10px; right: 10px; border-bottom: 1px solid black; height: 15px;"></div><div style="position: absolute; top: 60px; left: 10px; right: 10px; border-bottom: 1px solid black; height: 15px;"></div><div style="position: absolute; top: 70px; left: 10px; right: 10px; border-bottom: 1px solid black; height: 15px;"></div><div style="position: absolute; top: 80px; left: 10px; right: 10px; border-bottom: 1px solid black; height: 15px;"></div><div style="position: absolute; top: 90px; left: 10px; right: 10px; border-bottom: 1px solid black; height: 15px;"></div></div>				
SEND	PRINT	RESET	RETURN	EXIT

Nine lines of text can be transmitted.

Flight Information Flight Information Menu

[\[Option - Flight Information\]](#)

ATC	FLIGHT INFORMATION	
	MANAGER	
FLIGHT INFORMATION		
DEPARTURE CLEARANCE REQ		TWIP REQUEST
OCEANIC CLEARANCE REQ		PUSHBACK REQUEST
ATIS REQUEST		EXPECTED TAXI REQUEST
FLIGHT INFORMATION Menu		

The Flight Information menu provides access to FLIGHT INFORMATION downlink pages.

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z DEPARTURE CLEARANCE REQUEST		
1 →	FLT NUMBER: <input type="text"/>	FACILITY: <input type="text"/> ← 4
2 →	DEPARTURE: <input type="text"/>	DESTINATION: <input type="text"/> ← 5
3 →	ATIS: <input type="text"/>	GATE: <input type="text"/> ← 6
FREE TEXT: <input type="text"/>		
<input type="text"/>		
<input type="text"/>		
SEND	PRINT	RESET
RETURN EXIT		

When boxes display, valid entry is flight number up to 7 characters.

Valid entry is a valid ICAO identifier.

Valid entry is any character A through Z.

4 FACILITY

Valid entry is a 4 character ATC facility identifier.

5 DESTINATION

Destination airport defaults to FMC destination.

Valid entry is a valid ICAO identifier.

6 GATE

Valid entry is a gate number at the reference airport, POS INIT page.

Oceanic Clearance Request

The OCEANIC CLEARANCE REQUEST page allows request downlinks to obtain clearance via datalink in a more timely manner with reduced risk of incorrect voice transmission. The clearance may be viewed on the MFD or printed.

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z OCEANIC CLEARANCE REQUEST		
1 → FLT NUMBER: ■■■■■■	ATC FACILITY: ■■■■ ← 4	
2 → ENTRY POINT: ■■■■■■■■■■	FLIGHT LEVEL: ■■■ ← 5	
3 → ETA: ■■■■ z	MACH: ■■■ ← 6	
FREE TEXT: <div style="border: 1px solid black; height: 20px; margin-bottom: 5px;"></div> <div style="border: 1px solid black; height: 20px; margin-bottom: 5px;"></div> <div style="border: 1px solid black; height: 20px;"></div>		
SEND	PRINT	RESET RETURN EXIT

1 FLIGHT NUMBER

Flight number defaults to FMC flight number, if entered. If previously entered and flight number is more than 7 characters, only the first 7 characters display.

When boxes display, valid entry is flight number up to 7 characters.

2 ENTRY POINT

Valid entry is up to 15 characters; tenths of a minute of latitude or longitude may not display. A valid entry must be at least 3 characters. Entries of 7 or more characters are decoded as a latitude/longitude.

3 ETA

If an ENTRY POINT has been entered, it is a waypoint in the active route, and an ETA has not been entered; the ETA box defaults to the predicted ETA at the waypoint.

Valid entry is any time in the range 0000 to 2359.

4 ATC FACILITY

Valid entry is a 4 character ATC facility identifier.

5 FLIGHT LEVEL

Valid entry is a 3 character flight level; for example, 350.

6 MACH

Valid entry is any Mach number between 0.4 and 0.92. Entry of leading zero and decimal point is not required.

ATIS Request

The ATIS REQUEST page allows request downlinks for digital ATIS information without using voice radio. ATIS information may be viewed on the MFD or printed.

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES

1234Z
ATIS REQUEST

1 → AIRPORT:

2 → { DEPARTURE

ENROUTE

ARRIVAL

4 → TERMINATE

3 ← AUTO

SEND
PRINT
RESET
RETURN
EXIT

1 AIRPORT

If a departure airport exists in the active route and the airplane is on the ground, the default entry is the departure airport. If the destination airport exists in the active route and the airplane is in flight, the default entry is the destination airport.

Valid entry is a four character ICAO identifier.

2 ATIS SELECTOR GROUP

The default is none selected. Only one selection can be made at a time. The SEND key becomes active with selection. Pushing the SEND key requests the selected information.

3 AUTOMATIC UPDATE

If ARRIVAL selected, the AUTO update selection box displays. Selection provides automatic updating. If ENROUTE selected, updating is automatic; AUTO does not display.

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4 TERMINATE

Displays when an ENROUTE or ARRIVAL AUTO update has been selected. Selection cancels automatic updating and sets ATIS SELECTOR to none selected. The SEND key becomes active with this selection.

TWIP Request

[AIMS V14 or later]

The Terminal Weather Information for Pilots (TWIP) REQUEST page allows request downlinks for digital TWIP information without using voice radio. TWIP information may be viewed on the MFD or printed.



1 AIRPORT

Valid entry is a four character ICAO identifier.

2 TWIP SELECTOR

The default is none selected. Only one selection can be made at a time. The SEND key becomes active with selection. Pushing the SEND key requests the selected information.

3 TERMINATE AUTOMATIC UPDATE

Displays when AUTOMATIC UPDATE has been selected. Selection cancels automatic updating and sets TWIP SELECTOR to none selected.

The SEND key becomes active with this selection.

Pushback Clearance Request

[AIMS V14 or later]

The PUSHBACK CLEARANCE REQUEST page allows request downlinks to obtain clearance via datalink in a more timely manner with reduced risk of incorrect voice transmission. The clearance may be viewed on the MFD or printed.

1 FLIGHT NUMBER

Flight number defaults to FMC flight number, if entered. If previously entered and flight number is more than 7 characters, only the first 7 characters display.

When boxes display, valid entry is flight number up to 7 characters.

2 DEPARTURE DATE

Valid entry is scheduled departure date.

3 DEPARTURE

Departure airport defaults to FMC origin.

Valid entry is a valid ICAO identifier.

4 GATE

Valid entry is a gate number at the reference airport, POS INIT page.

5 DEPARTURE TIME

Valid entry is scheduled departure time.

6 DESTINATION

Destination airport defaults to FMC destination.

Valid entry is a valid ICAO identifier.

Expected Taxi Clearance Request

The EXPECTED TAXI CLEARANCE REQUEST page allows request downlinks to obtain clearance via datalink in a more timely manner with reduced risk of incorrect voice transmission. The clearance may be viewed on the MFD or printed.

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES

1234Z EXPECTED TAXI CLEARANCE REQUEST

1 →	FLT NUMBER: ■■■■■■	GATE: ■■■■ ←	4
2 →	DEPARTURE DATE: ■■	DEPARTURE TIME: ■■■■ ←	5
3 →	DEPARTURE: ■■■■	DESTINATION: ■■■■ ←	6

FREE TEXT:

SEND	PRINT	RESET	RETURN	EXIT
------	-------	-------	--------	------

1 FLIGHT NUMBER

Flight number defaults to FMC flight number, if entered. If previously entered and flight number is more than 7 characters, only the first 7 characters display.

When boxes display, valid entry is flight number up to 7 characters.

2 DEPARTURE DATE

Valid entry is scheduled departure date.

3 DEPARTURE

Departure airport defaults to FMC origin.

Valid entry is a valid ICAO identifier.

4 GATE

Valid entry is a gate number at the reference airport, POS INIT page.

5 DEPARTURE TIME

Valid entry is scheduled departure time.

6 DESTINATION

Destination airport defaults to FMC destination.

Valid entry is a valid ICAO identifier.

Company Menu

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
COMPANY		
FLIGHT INITIALIZATION	DEPARTURE REPORT	WEATHER REQUESTS
REQUEST AUTO-INITIALIZATION	POSITION REPORT	CREW REQUESTS...
DELAY REPORTS	ARRIVAL REPORT	MAINTENANCE REPORT
DIVERSION	MESSAGE TO GROUND	MISCELLANEOUS CODES
ETA REPORT	VOICE CONTACT REQUEST	SITUATION
FLIGHT TIMES	CREW REMINDERS	

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
CREW REQUESTS		
WEIGHT & BALANCE	CLEARANCE	RE-CLEARANCE
FLIGHT PLAN	FLIGHT RELEASE	GATE ASSIGNMENT
ATIS	NOTAMS	

Typical COMPANY Menu

Company downlink menus are accessed by selecting the COMPANY function. Actual menu and page layout is determined by the airline. An example of a typical menu and report page are provided to show common features.

Company Downlink Message Page

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES

1234Z
DELAY/DIVERT

PLANNING TO
DIVERT

ACTUAL
DIVERT

DIVERT
STATION:

KGEK

EXPECTED
ON TIME:

REASON:

▶

MEDICAL EMERGENCY

MEDICAL EMERGENCY

WEATHER

SEND

PRINT

RESET

RETURN

EXIT

Typical COMPANY Page

This COMPANY report page shows both exclusive and nonexclusive selections, a required entry, and optional menu selections.

Review Menu

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
REVIEW		
ATC UPLINK...	FLIGHT INFORMATION	SENT...
ATC DOWNLINK...		RECEIVED...
		WEATHER...

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1420Z	ATC DOWNLINKS	
1350Z	ALTITUDE REQUEST	SENT
1315Z	SPEED ALTITUDE ROUTE REQUEST	RESP RCVD
1240Z	WHEN CAN WE EXPECT	RESP RCVD
1234Z	CLEARANCE REQUEST	ABORTED

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1420Z	VERIFY REQUEST	RESPONSE RCVD
REQUEST .82, REQUEST CRUISE CLIMB TO FL410 DUE TO WEATHER, REQUEST DIRECT GANDER.		
FREE TEXT: ROUGH RIDE HERE AT FL350		

Typical REVIEW Menu

Review messages are accessed by selecting the REVIEW menu. Both uplink and downlink messages are displayed in review lists. The review menu is inhibited (cyan) if there are no review messages in that category.

Review State Indicators

Each review message list field and each review message displays the last state of the referenced message. Only one state can apply to a message at a time.

State Indicator	Condition
ABORTED	ATC data link connection lost before sending response to uplink message or completing a downlink message.
ACCEPTING	The received message was displayed and an ACCEPT response was initiated.
ACCEPTED	The received message was displayed, an ACCEPT response was initiated, and the service provider has acknowledged receipt of the response.
DISPLAYED	The received message was displayed (no accept/reject response was required).
NO ACCEPT	The received message was displayed, an ACCEPT response was initiated, but the service provider did not acknowledge receipt of the response.
NO REJECT	The received message was displayed, a REJECT response was initiated, but the message destination did not acknowledge receipt of the response.
NO SEND	The downlink message was initiated to be sent and the service provider did not acknowledge receipt of the message.
REJECTING	The received message was displayed and a REJECT response was initiated.
REJECTED	The received message was displayed, a REJECT response was initiated, and the message destination has acknowledged receipt of the response.
RESPONSE RCVD	ATC uplink message received in response to a downlink request.
SENDING	The downlink message was initiated to be sent.
SENT	The downlink message was initiated to be sent and the service provider has acknowledged receipt of the message.

Manager Functions
Manager Menu

[AIMS V17]











ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
MANAGER		
ACARS		SYSTEM INFO
VHF		PRINTER
SATCOM		AUTOMATIC MESSAGES
ADS		MASTER
HF		DIAGNOSTICS

Typical MANAGER Menu

The MANAGER menu page provides access to the manager functions.

ACARS Manager

[AIMS V14 and AIMS 2 Hardware]

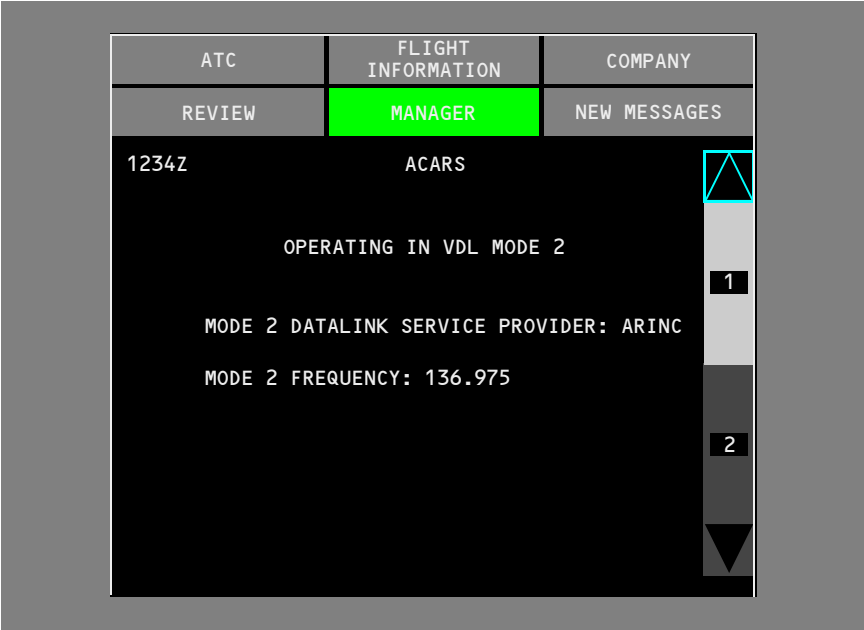
ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z	ACARS	
 131.725	 131.825	
 131.550		1
 131.450		
 136.850		
 132.750		2
 AUTOTUNE FREQUENCY	136.975	
	 AUTOMATIC	

The ACARS manager page provides selection of ACARS frequencies. Manager messages related to ACARS are on ACARS page two.

[AIMS V14 and AIMS 2 Hardware]

The AUTOMATIC key is selected by default and frequency selection is controlled by ACARS. Manually selecting a frequency or deselecting the AUTOMATIC key places ACARS in manual mode and disables automatic frequency scanning. If the AUTOMATIC key is subsequently selected, the system returns to automatic mode and frequency selection is controlled by ACARS. If the service provider uplinks a request to change frequency, the AUTOTUNE FREQUENCY key displays and ACARS tunes to the requested frequency.

[AIMS V14 or V15 or V16]



[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z	ACARS	
OPERATING IN VDL MODE 2		1
MODE 2 DATALINK SERVICE PROVIDER: ARINC		
MODE 2 FREQUENCY: 136.975		2
 AUTOMATIC		

[AIMS V14 or V15 or V16 and Option - VDLM2]

When operating in VHF datalink (VDL) mode 2, only the service provider and active frequency are displayed.

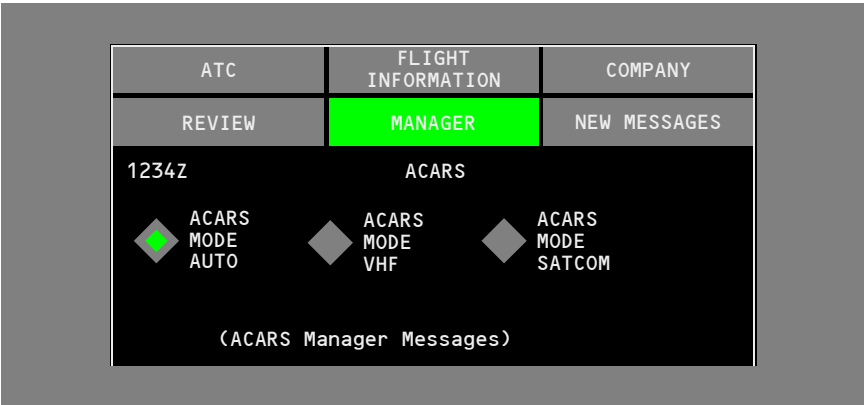
[AIMS V17 and Option - VDLM2]

When operating in VHF datalink (VDL) mode 2, only the service provider, active frequency, and AUTOMATIC key are displayed. Deselecting the AUTOMATIC key places ACARS in manual mode and returns to the previous page format with highest priority frequency for current position selected.

ACARS Manager Page 2/2

[Not AIMS 2003]

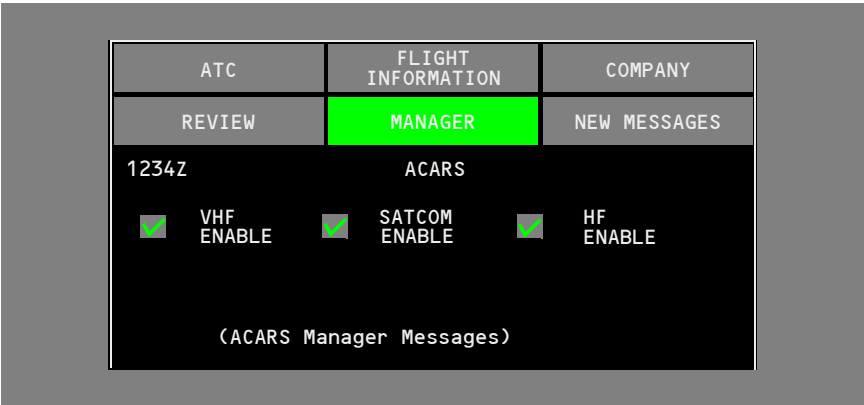
ACARS MODE AUTO is the normal ACARS mode. This permits the ACARS system to automatically select the VHF or SATCOM (if VHF is unavailable) mode. If ACARS MODE VHF is selected, ACARS changes to VHF. If ACARS MODE SATCOM is selected, ACARS changes to SATCOM.







[AIMS 2003 and SATCOM and HF Datalink]

This page allows the operator to select/deselect VHF, SATCOM, or HF transmission of data. ACARS is set to auto mode (all boxes selected) at power-up or during a manual data communication system reset. Normally, this permits ACARS to automatically use VHF, SATCOM (if VHF is unavailable), or HF (if VHF and SATCOM are unavailable). If all boxes are deselected, ACARS loses the capability to send downlink messages, but can receive and display uplink messages.

[AIMS 2003 and SATCOM and HF Datalink]



VHF Manager

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
<div style="display: flex; justify-content: space-between;"> 1234Z VHF </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">  DEFAULT RADIO CENTER </div> <div style="text-align: center;">  DEFAULT RADIO RIGHT </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">  DEFAULT RADIO MODE: DATA </div> <div style="text-align: center;">  DEFAULT RADIO MODE: VOICE </div> </div> <p style="text-align: center; margin-top: 10px;">(VHF Manager Messages)</p>		

The VHF manager page provides the capability to select the default radio and to configure the default radio to the voice or data mode. Manager messages related to the VHF system are also presented on this page.

If the DEFAULT RADIO CENTER key is selected, the center VHF radio becomes the default radio. If the DEFAULT RADIO RIGHT key is selected, the right VHF radio becomes the default radio.

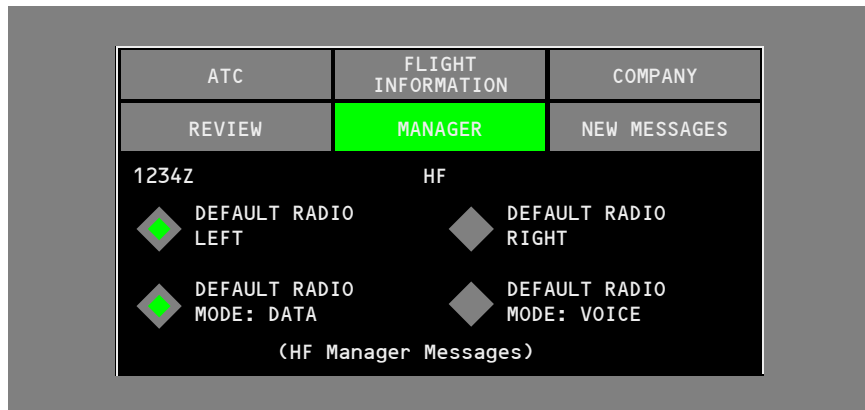
Note: To select another VHF default radio, the SATCOM ENABLE and HF ENABLE keys must be deselected on ACARS manager page 2.

If the DEFAULT RADIO MODE DATA key is selected, the default radio is set to data mode. If the DEFAULT RADIO MODE VOICE key is selected, the default radio is set to voice mode.

Note: The default radio can also be set to data or voice mode using the Radio Tuning Panel.

HF Manager

[AIMS 2003 and HF Datalink]

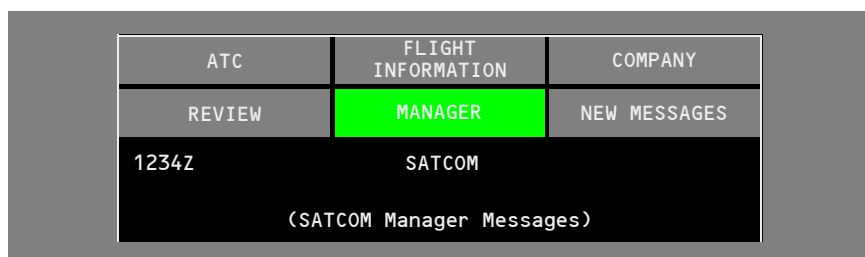


If the DEFAULT RADIO LEFT is selected, the left HF radio becomes the default radio. If the DEFAULT RADIO RIGHT is selected, the right HF radio becomes the default radio.

If the DEFAULT RADIO MODE: DATA is selected, the default HF radio is set to data mode. If the DEFAULT RADIO MODE: VOICE is selected, the default HF radio is set to voice mode.





Note: The default HF radio can also be set to the data or voice mode via the Radio Tuning Panel.

SATCOM Manager



The SATCOM manager page displays manager messages related to the SATCOM system.

Automatic Dependent Surveillance Manager

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z	ADS	
 ADS ARM	 ADS OFF	
 ADS EMERGENCY	 ADS EMERGENCY OFF	
1225Z ADS CONNECTION NOT ESTABLISHED -OAKXGXA		
1120Z ADS CONNECTION ESTABLISHED -OAKXGXA		
1020Z ADS CONNECTION ESTABLISHED -SEAXGXA		

When ADS is armed, AUTOMATIC position report messages are sent to ATC and COMPANY.

The ADS page controls the following airplane ADS functions:

- ADS ARM – allows airplane ADS functions
- ADS OFF – inhibits airplane ADS functions
- ADS EMERGENCY – sends an alert to ATC indicating an emergency situation (resets to ADS EMERGENCY OFF at power-up)
- ADS EMERGENCY OFF – cancels emergency indication to ATC

A list of ADS connection status is displayed on the ADS page.

System Information Manager

The system information manager page displays manager messages for all applicable systems.

[Not AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z SYSTEM INFORMATION		
1 → TAIL NUMBER:	N7771	AIRLINE: B0 ← 2
(All Manager Messages)		

[AIMS V17 and Option - ATN]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z SYSTEM INFORMATION		
1 → TAIL NUMBER:	N7771	AIRLINE: B0 ← 2
3 → VER:	41	ADM: 454144 ← 4
(All Manager Messages)		

[Not AIMS V17]

1 TAIL NUMBER

Normally supplied by the airplane system. When the airplane tail number (registry number) is not available from the system, box prompts are displayed and a value can be entered. A manual entry will remain until power to AIMS is interrupted. Changing this entry after establishing an ATC connection cancels the ATC connection. Tail number is provided on the SELCAL placard.

[AIMS V17]

1 TAIL NUMBER

Normally supplied by the airplane system. When the airplane tail number (registry number) is not available from the system or a hot battery power cycle has occurred, box prompts are displayed and a value can be entered. If a hot battery power cycle has occurred, manually entering the tail number will validate the tail number provided by the system. The tail number then becomes a non-modifiable field. If the tail number was not available from the system, a manual entry will remain until power to AIMS is interrupted. Changing this entry after establishing an ATC connection cancels the ATC connection. Tail number is provided on the SELCAL placard. Manual entry is inhibited after engine start.

[AIMS V14 or later]

2 AIRLINE

Normally supplied by the airplane system, but can be manually entered or overwritten. When the airline identifier is not available from the system, box prompts are displayed. A valid entry is two alphanumeric characters and will remain until power to AIMS is interrupted. Changing this entry after establishing an ATC connection cancels the ATC connection.

[AIMS V17 and Option - ATN]

3 VER

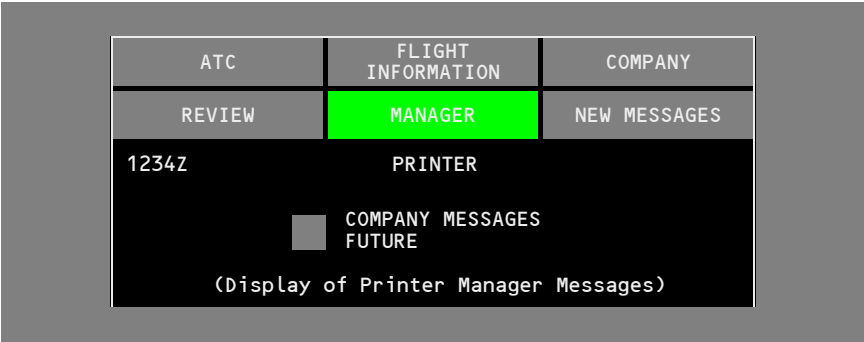
The VER field is used in ATN CPDLC addressing. Normally supplied by the airplane system, but can be manually entered or overwritten. When the VER field is not available from the system, box prompts are displayed. A valid entry is two hexadecimal characters and will remain until power to AIMS is interrupted. The only valid entry is 41. Other than an entry made when box prompts are displayed, changing the value causes ACARS to reset to voice mode.

[AIMS V17 and Option - ATN]

4 ADM

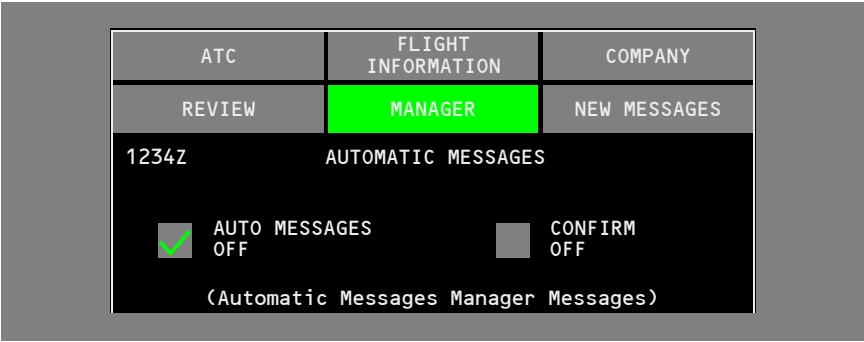
The ADM field is used in ATN CPDLC addressing. Normally supplied by the airplane system, but can be manually entered or overwritten. When the ADM field is not available from the system, box prompts are displayed. A valid entry is six hexadecimal characters and will remain until power to AIMS is interrupted. The value of this field is the airline ICAO three character identifier in hexadecimal. Other than an entry made when box prompts are displayed, changing the value causes ACARS to reset to voice mode.

Printer Manager



The printer manager page can be set to send messages directly to the printer. Manager messages related to the printer system are also presented on this page. If the COMPANY MESSAGES FUTURE key is selected, company messages that normally display on the MFD are sent directly to the printer and the •PRINTER EICAS message is displayed. Future messages are not included in the new messages or review categories.

Automatic Messages Manager



The AUTO MESSAGES OFF selection inhibits automatic sending, display, or printing of company messages. Manager messages related to the automatic messages capability are also presented on this page. When the AUTOMATIC MESSAGES OFF key is selected, the CONFIRM OFF key is displayed. Selecting the CONFIRM OFF key turns off the capability to automatically send, display, or print company messages.

Master Manager

[Not AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z MASTER		
<input checked="" type="checkbox"/> DATA LINK SYSTEM RESET		<input type="checkbox"/> CONFIRM RESET
(Master Manager Messages)		

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z MASTER		
<input checked="" type="checkbox"/> DATA LINK SYSTEM RESET		<input type="checkbox"/> CONFIRM RESET
<input type="checkbox"/> DCMF RESET		
(Master Manager Messages)		

The master manager page provides the capability to reset the data communication system. Manager messages related to the master features are also presented on this page.

Data Link System Reset

If the DATA LINK SYSTEM RESET key is selected, the CONFIRM RESET key is displayed. If the CONFIRM RESET key is selected, the following occurs.

On the ground:

- all new messages are deleted
- all messages queued for downlink are deleted
- all review messages are deleted
- ATC reports are deleted

In flight:

- flight information and company new messages are deleted
- flight information and company messages queued for downlink are deleted
- flight information and company review messages are deleted
- ATC displays reset to default values

On the ground or in flight:

- flight information and company displays reset to default values
- center VHF radio is selected as the default and set to data mode on the ground or voice mode in flight
- right HF radio is selected as the default and set to voice mode
- AUTO MESSAGES OFF is deselected
- COMPANY MESSAGES FUTURE is deselected
- ADS OFF is selected
- ADS EMERGENCY OFF is selected
- all manager status messages are deleted
- two seconds after selection, the CONFIRM RESET key is removed from the display and the DATA LINK SYSTEM RESET key is displayed as not selected

This reset does not occur at power-up.

[\[Option – Automatic Reset\]](#)

Except for configuration of ACARS data radios, the data link system is automatically reset after each flight. Reset occurs approximately 10 minutes after the last engine is shut down, and with any entry door open.

Data link capability for the flight management system, OMS, and EICAS related maintenance functions, and cabin functions are not reset with this feature.

Data Communication Management Function (DCMF) Reset

[\[AIMS V17\]](#)

If the DCMF RESET key is selected, the CONFIRM RESET key is displayed. If the CONFIRM RESET key is selected, the following occurs:

- ACARS data communication management function is reset
- center VHF radio is selected as the default and set to data mode

Diagnostics Manager

[\[AIMS V17\]](#)

The diagnostics manager page is for maintenance use only.

Manager Messages

Manager messages are displayed in reverse chronological order (the newest message is nearest the top of the display). The time of occurrence is displayed with each message. The manager messages are listed in the following table.

Function	Manager Message
----------	-----------------

[AIMS V17 and HF Datalink and ATN]

ACARS	ACARS CONNECTION ESTABLISHED
	NO ACARS CONNECTION
	VHF - ENABLE
	VHF - NOT ENABLE
	SATCOM - ENABLE
	SATCOM - NOT ENABLE
	HF - ENABLE
	HF - NOT ENABLE
	VDLM2 CAPABLE
	VDLM2 NOT CAPABLE
	ATN CAPABLE
	ATN NOT CAPABLE

ADS	ADS CONNECTION ESTABLISHED – ATC facility
	ADS CONNECTION LOST – ATC facility
	ALL ADS CONNECTIONS LOST

Function	Manager Message
----------	-----------------

[AIMS V17 and Option - ATN]

VHF	VHF LINK ESTABLISHED
	NO VHF LINK
	VHF DATA MODE RADIO FAILURE
	VHF DATA MODE RADIO NORMAL
	VDLM2 ESTABLISHED
	NO VDLM2 LINK
	ATN ESTABLISHED
	NO ATN LINK

SATCOM	SATCOM LINK ESTABLISHED
	NO SATCOM LINK
	SATCOM DATA MODE FAILED
	SATCOM DATA MODE NORMAL
PRINTER	PRINTER OPERABLE
	PRINTER NOT OPERABLE
	COMPANY FUTURE MESSAGES TO PRINTER – ON
	COMPANY FUTURE MESSAGES TO PRINTER – OFF
AUTOMATIC MESSAGES	AUTOMATIC MESSAGES – ON
	AUTOMATIC MESSAGES – OFF

[AIMS V17]

MASTER	DATA LINK SYSTEM – RESET
	DCMF – RESET
	DCMF – RESET FAILED

Function	Manager Message
HF	HF LINK ESTABLISHED
	NO HF LINK
	HF DATA MODE RADIO FAILURE
	HF DATA MODE RADIO NORMAL

New Messages New Messages Menu

[Not AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
1234Z	NEW MESSAGES	
1228Z	CLIMB AND MAINTAIN FL330	ATC
1233Z	PASSENGER INFORMATION - CONNECTING FLIGHTS	
1220Z	WEATHER INFORMATION FOR KPDX, KSFO, KLAX	
1215Z	CONTACT DISPATCH	

Typical NEW MESSAGE List

[AIMS V17]

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
NEW MESSAGES		
1234Z	CLIMB AND MAINTAIN FL330	
1228Z	EDYY	
1233Z	PASSENGER INFORMATION - CONNECTING FLIGHTS	
1220Z	WEATHER INFORMATION FOR KPDX, KSFO, KLAX	
1215Z	CONTACT DISPATCH	

Typical NEW MESSAGE List

New uplink messages are displayed with ATC messages displayed above flight information messages which are displayed above company messages. Within ATC, flight information and company, messages are listed by the time they are received. The newest message is at the top of the group. Messages are removed from the list when displayed or an accept/reject response is sent.

New messages can also be accessed by selecting the NEW MESSAGES menu, which displays list boxes for all pending messages. A message is displayed by selecting the appropriate message line.

New ATC uplinks which respond to downlink requests display a key which displays the original downlink request.

New Message – No Response Required

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
<div style="display: flex; justify-content: space-between;"> 1233Z GATE INFORMATION </div> <div style="text-align: center; margin-top: 20px;"> <p>Flight: XX127</p> <p>Gate: B1</p> <p>ETA: 1245Z</p> </div> <div style="display: flex; justify-content: space-between; margin-top: 100px;"> <div style="background-color: #808080; color: white; padding: 5px 10px;">PRINT</div> <div style="background-color: #808080; color: white; padding: 5px 10px;">CANCEL</div> </div>		

Received messages remain in the new messages list until after they are displayed. If an ACCEPT or REJECT response is required, the message remains in the list until accepted or rejected.

The display above shows a received message that does not require a response. The ACCEPT and REJECT keys are not displayed for this message. The message can be cleared by selecting the CANCEL key on the MFD or pushing the CANCEL switch on the glareshield.

New Message – Response Required



The display above shows a message that requires an ACCEPT or REJECT response. The ACCEPT and REJECT keys are displayed.

An APPEND capability is provided for certain received messages which require an accept or reject response. In this case, the APPEND key is displayed.

Communications**EICAS Messages****Chapter 5****Section 50****Communications EICAS Alert Messages**

The following EICAS alert messages can be displayed.

Message	Level	Aural	Message Logic
DATALINK LOST	Advisory		Datalink is temporarily lost.
DATALINK SYS	Advisory		Datalink system has failed.

[\[AIMS 2003 and HF Datalink\]](#)

HF DATALINK	Advisory		HF datalink has failed.
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RADIO TRANSMIT	Advisory		A VHF or HF radio is keyed for 30 seconds or more.
SATCOM	Advisory		SATCOM system has failed.
SATCOM DATALINK	Advisory		SATCOM datalink has failed.
SATCOM VOICE	Advisory		SATCOM voice communication has failed.
SATVOICE LOST	Advisory		SATCOM voice communication is temporarily lost.
VHF DATALINK	Advisory		VHF datalink has failed.

EICAS Communication Messages

The following EICAS communication messages can be displayed.

Message	Level	Message Logic	Crew Action
•ATC	Medium	An ATC data link message has been received or an armed report has been sent.	Respond to message displayed on EICAS or select the MFD communications display.

[Passenger]

•CABIN ALERT	Medium	Pilot alert received over cabin interphone.	Respond to the alert.
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[Passenger]

•CABIN CALL	Medium	Pilot call received over cabin interphone.	Respond to the call.
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[Passenger]

•CABIN READY	Medium	CABIN READY received over cabin interphone.	Crew awareness. Automatically removed after one minute.
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[Freighter]

•CARGO CALL	Medium	Pilot call received over cabin interphone from loadmaster amplifier panel or wing inspection station.	Respond to the call.
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•COMM	Medium/ low	A data link message has been received.	Select COMM display on the MFD.
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777 Flight Crew Operations Manual

Message	Level	Message Logic	Crew Action
•COMM BUSY	Medium	Communications system pending data link message queue is full.	Respond to current pending data link messages.

[Freighter]

•CREW REST CALL	Medium	Pilot call received over cabin interphone from crew rest.	Respond to the call.
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•FMC	Medium	An FMC related data link message has been received.	Select FMC from the CDU MENU page if not already in the FMC mode. View the message title in the CDU scratchpad. View the message on the appropriate CDU page.
•GROUND CALL	Medium	Pilot call received over flight interphone from nose wheel well.	Respond to the call.
•PRINTER (with data link installed)	Medium/low	A data link message has been received and sent to the printer.	Review the printed message.
•SATCOM MESSAGE	Medium/low	SATCOM voice system information available if SATCOM system is selected on a CDU.	View the SATCOM CDU message.
•SELCAL	Medium	SELCAL received or any SATCOM voice call received.	Respond to the call.

Message	Level	Message Logic	Crew Action
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[Freighter]

•SUPRNMRY CALL	Medium	Pilot call received over cabin interphone from supernumerary seating area.	Respond to the call.
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Electrical**Chapter 6****Table of Contents****Section TOC**

Controls and Indicators	6.10
Overhead Panel	6.10.1
Electrical Panel	6.10.1
Overhead Maintenance Panel	6.10.6
Standby Power Switch	6.10.6
Towing Power Switch	6.10.7
Medical Outlet Power Control	6.10.7
Electrical Synoptic Display	6.10.8
System Description	6.20
AC Electrical System	6.20.1
Electrical Load Management System (ELMS)	6.20.1
AC Electrical System Power Sources	6.20.1
AC Electrical Power Distribution	6.20.4
AC Electrical System Schematic	6.20.6
Backup AC Electrical System	6.20.7
Backup Generators	6.20.7
Backup AC Electrical System Schematic	6.20.8
DC Electrical System	6.20.9
Main DC Electrical System	6.20.9
Batteries	6.20.9
Towing Power	6.20.10
DC and Flight Control Electrical Systems Schematic	6.20.11
Flight Control DC Electrical System	6.20.12
Standby Electrical System	6.20.12
Standby Electrical System Schematic	6.20.13
Main Battery	6.20.13
Standby Inverter	6.20.14
Ram Air Turbine (RAT) Generator	6.20.14
Cabin Systems and Utility Power	6.20.14
IFE/PASS SEATS and CABIN/UTILITY Power Switches. .	6.20.15

IFE and Passenger Seats	6.20.15
Cabin and Utility Systems.....	6.20.15
Cabin and Utility Systems.....	6.20.16
EICAS Messages	6.30
EICAS Alert Messages.....	6.30.1

Electrical Controls and Indicators

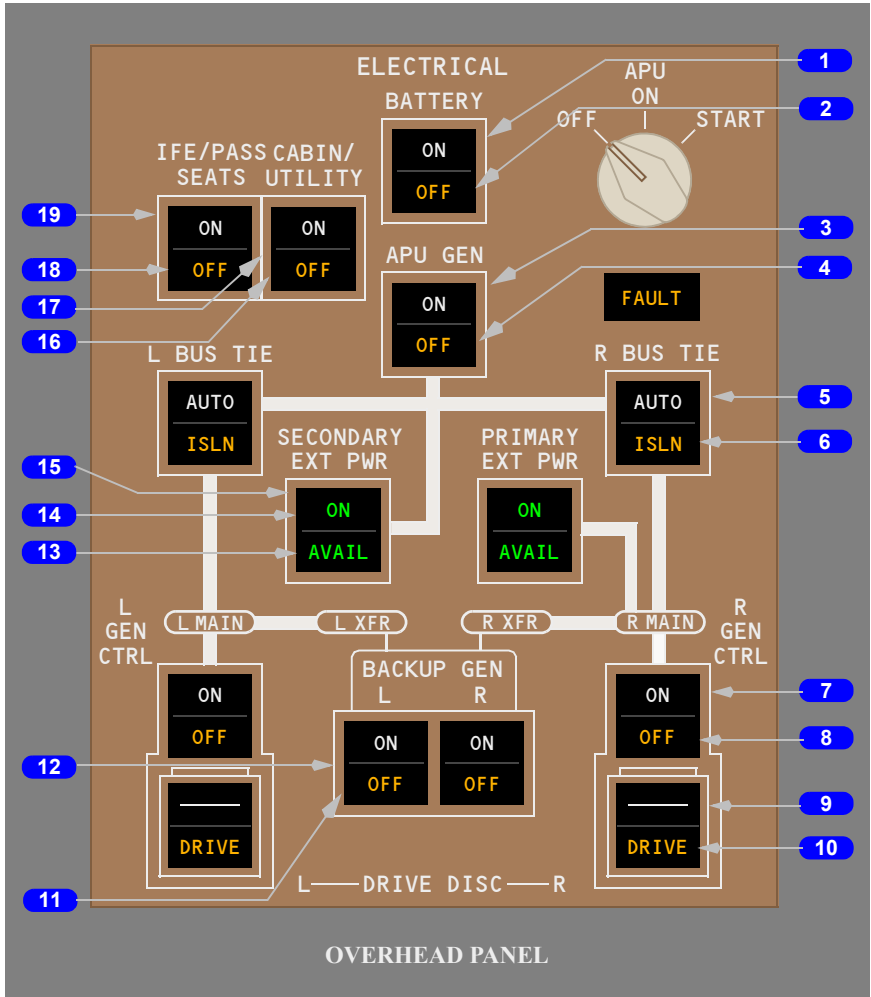
Chapter 6 Section 10

Overhead Panel Electrical Panel

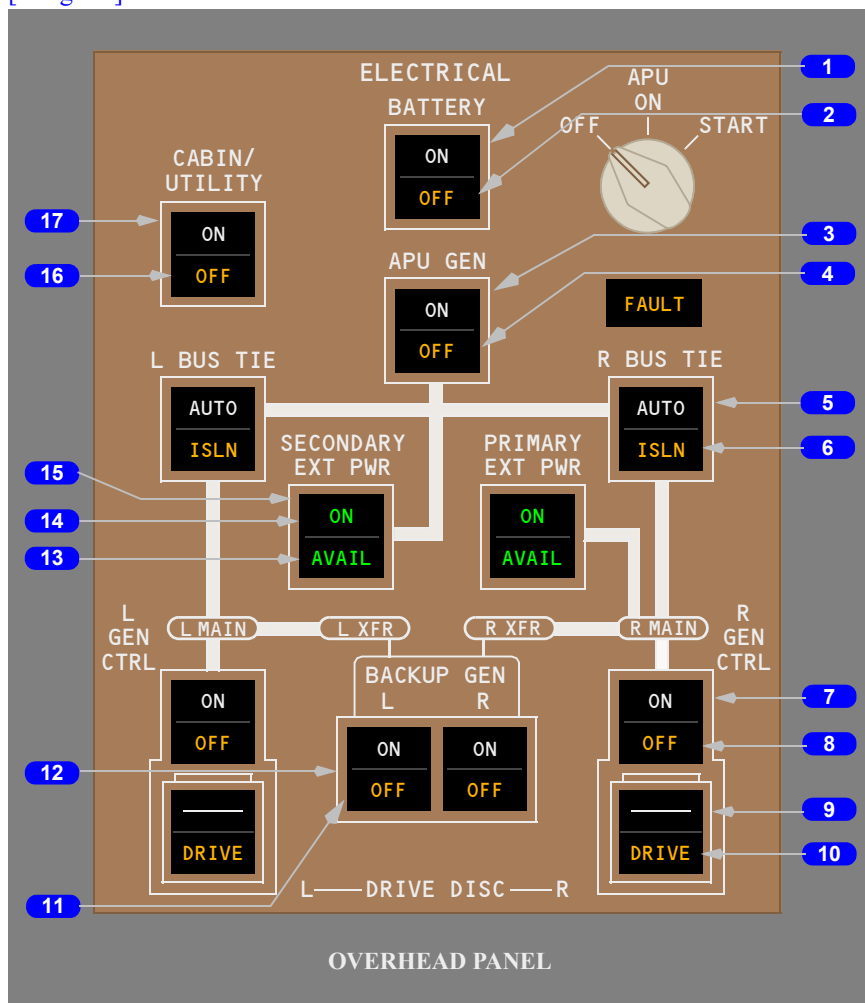
[777-200/-300 Series - Passenger]

[IFE/PASS SEATS and CABIN/UTILITY switches basic with C/L 350]

[Passenger]



[Freighter]



1 BATTERY Switch

ON –

- on the ground and the airplane does not have AC power:
 - some switch annunciator lights are illuminated
 - allows the APU to be started

777 Flight Crew Operations Manual

- on the ground after AC power is disconnected or lost:
 - standby busses and emergency lighting are powered
- [777-200/-300 Series - Passenger]
- the left inboard, outboard, and upper center displays, and the left CDU are powered

Off – on the ground, battery bus is not powered.

2 Battery OFF Light

Illuminated (amber) – the battery switch is off and the airplane has AC power.

3 APU Generator (APU GEN) Switch

ON – APU generator breaker is armed.

Off – APU generator breaker open.

4 APU Generator OFF Light

Illuminated (amber) –

- the APU GEN switch is off, or
- with the APU running, secondary external power not connected, and the auxiliary power breaker open

5 BUS TIE Switches

AUTO – bus tie breaker is armed.

Off – bus tie open.

6 Bus Isolation (ISLN) Lights

Illuminated (amber) – bus tie breaker is open because:

- BUS TIE switch is off, or
- BUS TIE switch is in AUTO and a fault has occurred

7 Generator Control (GEN CTRL) Switches

ON – generator breaker is armed.

Off –

- generator breaker open
- resets fault trip circuitry

8 Generator OFF Lights

Illuminated (amber) – generator breaker open.

9 Drive Disconnect Switches

Push –

- disconnects the integrated drive generator (IDG) from the engine
- requires maintenance action on the ground to reconnect the IDG

10 Generator DRIVE Lights

Illuminated (amber) – IDG oil pressure is low.

11 Backup Generator OFF Lights

Illuminated (amber) –

- backup generator switch is off, or
- a fault occurred, or
- engine is shut down, or
- engine fire switch is out

12 Backup Generator (BACKUP GEN) Switches

ON – backup generator converter armed.

Off –

- backup generator control relay open
- resets the fault circuitry

13 External Power AVAIL Lights

[777-200/-300 Series - Passenger]

Illuminated (green) – external power is plugged in and power quality is acceptable

14 External Power ON Lights

[777-200/-300 Series - Passenger]

Illuminated (green) – external power is connected to the bus

15 External Power (EXT PWR) Switches

Push –

- when AVAIL light is illuminated, connects external AC power
- when ON light is illuminated, disconnects external AC power

[Freighter or Passenger with switch and light installed]

16 CABIN/UTILITY Power OFF Light

Illuminated (amber) – CABIN/UTILITY power switch is off and the airplane has AC power.

[Freighter or Passenger with switch and light installed]

17 Cabin/Utility (CABIN/UTILITY) Power Switch

ON – powers cabin and utility systems.

Off –

- disconnects power from cabin and utility systems
- powers some cabin lighting

[Passenger with switch and light installed]

18 IFE/PASS SEATS OFF Light

Illuminated (amber) – IFE/PASS SEATS power switch is off and the airplane has AC power.

[Passenger with switch and light installed]

19 In-Flight Entertainment System/Passenger Seats (IFE/PASS SEATS) Power Switch

ON – powers:

- IFE and passenger seat systems
- broadband communication system

[Option - Power PASS Window Shades]

- cabin power window shades
- flight deck entry video surveillance systems

[Option - 777-300, 777-300ER]

- ground maneuvering camera system

Off – disconnects power from:

- IFE and passenger seat systems
- broadband communication system

[Option - Power PASS Window Shades]

- cabin power window shades
- flight deck entry video surveillance systems

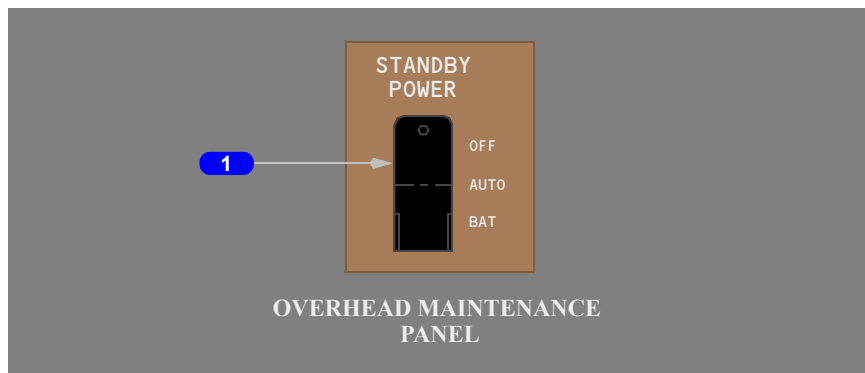
[Option - 777-300, 777-300ER]

- ground maneuvering camera system

Overhead Maintenance Panel

Standby Power Switch

[777-200/-300 Series - Passenger]



1 STANDBY POWER Switch

Note: Ground operation only.

OFF – the AC standby bus is not powered.

AUTO (guarded) – the standby busses transfer to battery power if normal AC power is lost.

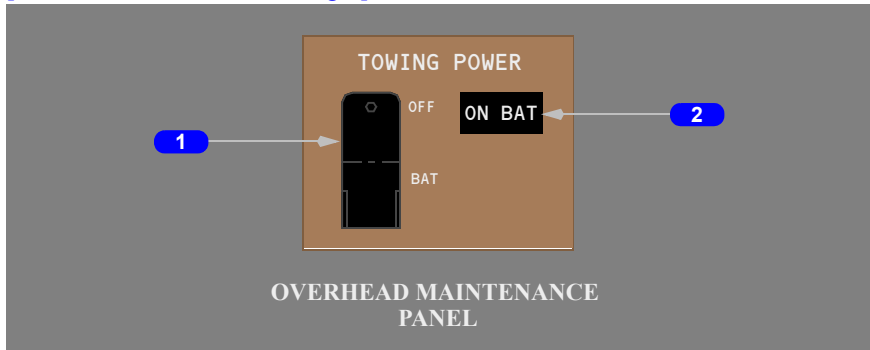
BAT (momentary) –

- with AC power not available and Battery switch ON, powers the standby AC bus from the battery through the standby static inverter
- initiates a DC/standby self-test in the inverter when AC power is available

Towing Power Switch

[Option]

[777-200/-300 Series - Passenger]



[777-200/-300 Series - Passenger]

1 TOWING POWER Switch (Ground Operation Only)

OFF – main battery disconnected from towing bus.

BAT – with BAT switch in OFF and ground handling bus not powered, main battery powers:

- position lights
- flight interphone
- Captain instrument panel flood lights
- brake accumulator pressure indicator
- brake source light

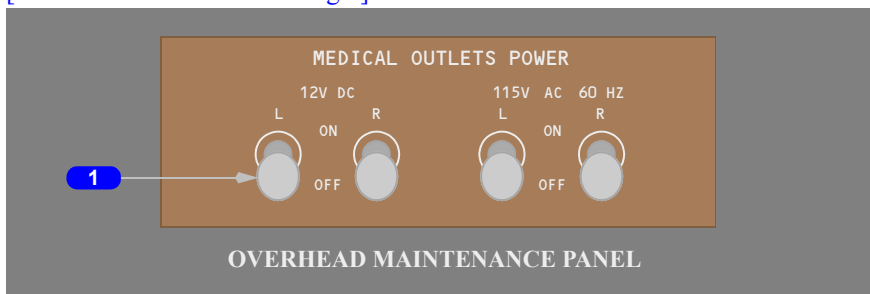
2 Towing Power ON BAT Light

Illuminated (white) – towing bus powered by main battery.

Medical Outlet Power Control

[Option - other switch configurations are available]

[777-200/-300 Series - Passenger]



1 MEDICAL OUTLETS POWER Switches

ON – powers medical outlets.

Electrical Synoptic Display

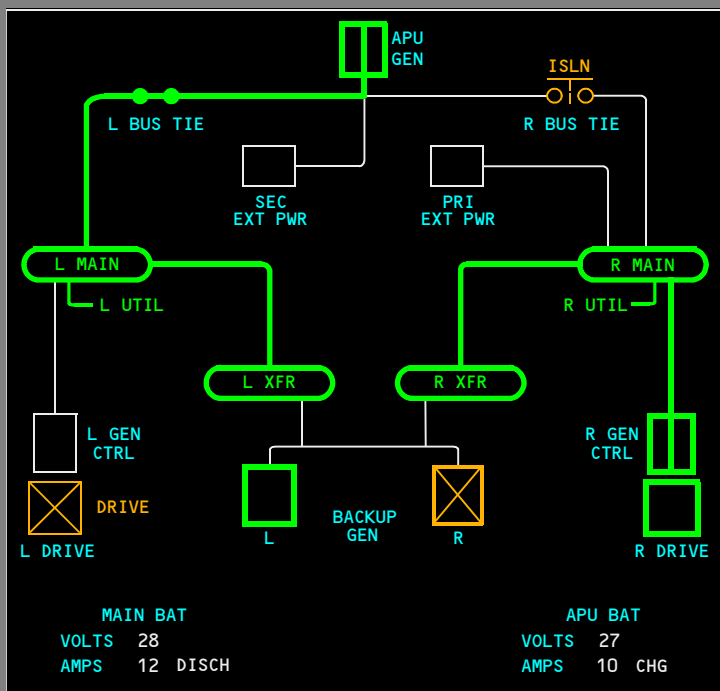
The electrical synoptic is displayed by pushing the ELEC synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

777 Flight Crew Operations Manual

The electrical power flow display is created from the displayed switch and contactor positions and by the displayed status of electrical equipment. Actual electrical flow is not displayed, therefore the electrical flow bars do not represent actual system operation.

The electrical synoptic display of switch, contactor, and flow bar position and status are not included in the MMEL or DDG. The electrical synoptic display of switch, contactor, and flow bar position and status is not required for flight crew to accomplish any normal or non-normal procedure.

[777-200/-300 Series - Passenger]



MULTIFUNCTION DISPLAY

Status of the electrical generators, drives, breakers, and power flow are displayed as:

- power flowing - wide green line
- power not flowing - thin white line
- generator on or available - green
- generator off - white

- generator not supplying electrical power or failed - amber X in amber box
- drive oil pressure low - amber DRIVE
- drive disconnected with engine running - amber X in amber box
- bus tie open due to electrical fault or BUS TIE switch Off - amber ISLN

**Electrical
System Description****Chapter 6
Section 20****AC Electrical System**

The AC electrical system is the main source for airplane electrical power.

Electrical Load Management System (ELMS)

The ELMS provides load management and protection to ensure power is available to critical and essential equipment.

If the electrical loads exceed the power available (airplane or external), ELMS automatically sheds AC loads by priority until the loads are within the capacity of the airplane or ground power generators. The load shedding is galleys first, then utility busses. Utility busses are followed by individual equipment items powered by the main AC busses. When an additional power source becomes available or the loads decrease, ELMS restores power to shed systems (in the reverse order). The message LOAD SHED displays on the electrical synoptic when load shed conditions exist.

The ELMS also provides inputs for display of EICAS messages for manual center tank fuel pump shut off during climb/cruise, and automatic shut off to prevent unintentional dry fuel pump operation when the center fuel tank is empty.

AC Electrical System Power Sources

The entire airplane AC electrical load can be supplied by any two main AC power sources.

The main AC electrical power sources are:

- left and right engine integrated drive generators (IDGs)
- APU generator
- primary and secondary external power.

The power sources normally operate isolated from one another. During power source transfers on the ground (such as switching from the APU generator to an engine generator) operating sources are momentarily paralleled to prevent power interruption.

Integrated Drive Generators (IDGs)

Each engine has an IDG. Each IDG has automatic control and system protection functions.

When an engine starts, with the GENERATOR CONTROL switch selected ON, the IDG automatically powers the respective main bus. The previous power source is disconnected from that bus.

The IDG can be electrically disconnected from the busses by pushing the GENERATOR CONTROL switch to OFF. The IDG can also be electrically disconnected from its respective bus by selecting an available external power source prior to engine shutdown. (See Primary External Power and Secondary External Power in this section.)

The DRIVE light illuminates and the EICAS message ELEC GEN DRIVE L or R displays when low oil pressure is detected in an IDG. The IDG drive can be disconnected from the engine by pushing the respective DRIVE DISCONNECT switch. The IDG cannot be reconnected by the flight crew.

High drive oil temperature causes the IDG to disconnect automatically.

APU Generator

The APU generator is electrically identical to the IDG generators. The APU generator can power either or both main busses, and may be used in flight as a replacement to an IDG source.

If no other power source is available when the APU generator becomes available, the APU generator automatically connects to both main AC busses. If the primary external source is powering both main busses, the APU powers the left main bus, and the primary external source continues to power the right main bus. If the primary external source is powering the right main bus, and the secondary external source is powering the left main bus, the APU then powers the left main bus and the primary external source continues to power the right main bus. If the secondary external source is powering both main busses, the APU then powers both main busses.

The APU generator OFF light illuminates when the APU is operating and the APU generator breaker is open because of a fault or the APU GENERATOR switch is selected OFF. When the APU GENERATOR switch is ON and a fault is detected, the APU generator cannot connect to the busses.

In flight, when both transfer busses are unpowered, the APU starts automatically, regardless of APU selector position. Refer to Chapter 7, Engines, APU for APU starter operation.

Primary External Power

Primary external power can power the left and right main busses. When the primary power source voltage and frequency are within limits, the primary external power AVAIL (available) light illuminates. If no AC power is applied, either external power source will power the airplane if the BATTERY switch is ON.

If no other source is powering the main busses, with the BATTERY switch ON, pushing the PRIMARY EXT PWR switch ON connects primary external power to both main busses. When primary external power is connected to a main bus, the PRIMARY EXT PWR ON light illuminates and the AVAIL light extinguishes.

If a single IDG powers both busses, pushing the PRIMARY EXT PWR switch ON connects primary external power to both busses and removes the IDG source.

If both IDGs are powering their respective busses, the APU generator is NOT running and secondary external power is NOT available, pushing the PRIMARY EXT PWR switch ON connects primary external power to both busses and removes the IDG sources.

If both IDGs are powering their respective busses, and secondary external power is available, pushing the PRIMARY EXT PWR switch to ON connects primary external power to the right main bus, leaving the left main bus powered from the left IDG.

If the APU generator is running, pushing the PRIMARY EXT PWR switch ON connects primary external power to the right main bus, leaving the previous source connected to the left main bus.

If both busses are powered from secondary external power, pushing the PRIMARY EXT PWR switch ON connects primary external power to the right main bus, leaving secondary external power connected to the left main bus.

Pushing the PRIMARY EXT PWR switch while primary external power is ON, disconnects primary external power. The previously connected power source is reconnected, if available.

Secondary External Power

Secondary external power can power the left and right main busses. When the secondary external power source voltage and frequency are within limits, the secondary external power AVAIL (available) light illuminates.

If no AC power is applied, the BATTERY switch must be ON or primary external power must be available for secondary external power to power the airplane. If the BATTERY switch is ON and no other source is powering the main busses, pushing the SECONDARY EXT PWR switch ON connects secondary external power to both main busses. When secondary external power is connected to a main bus, the SECONDARY EXT PWR ON light illuminates and the AVAIL light extinguishes.

If a single IDG powers both main busses, pushing the SECONDARY EXT PWR switch ON connects secondary external power to both busses and removes the IDG source. Similarly, if only secondary external power is available and both IDGs are powering their respective busses, pushing the SECONDARY EXT PWR switch ON connects secondary external power to the left main bus. When the right engine is shut down, there is a no-break transfer of power of secondary external power to the right main bus.

If both IDGs are powering their respective busses, and both secondary and primary external power are available, pushing the SECONDARY EXT PWR switch ON connects secondary external power to the left main bus, leaving the right main bus powered from the right IDG.

If the APU generator is running, pushing the SECONDARY EXT PWR switch ON connects secondary external power to the left main bus, leaving the right IDG or primary external power connected to the right main bus.

If both busses are powered from primary external power, pushing the SECONDARY EXT PWR switch ON connects secondary external power to the left main bus, leaving primary external power connected to the right main bus. If no other source is available, secondary external power is connected to both main busses.

Pushing the SECONDARY EXT PWR switch while secondary external power is ON disconnects secondary external power. The previously connected power source is reconnected, if available.

AC Electrical Power Distribution

AC power is distributed through the left and right main busses and the ground service bus.

AC Main Busses

The right IDG normally powers the right main bus and the left IDG normally powers the left main bus. The APU normally powers both main busses when they are not powered by any other source.

When external power is connected:

- primary external power normally powers the right main bus
- secondary external power normally powers the left main bus.

Bus tie relays, controlled by BUS TIE switches, isolate or parallel the right and left main busses. When both BUS TIE switches are set to AUTO, the bus tie system operates automatically to maintain power to both main busses.

Power transfers are made without interruption when the airplane is on the ground, except when switching between primary and secondary external power sources.

777 Flight Crew Operations Manual

The source order for powering left and right main busses in flight is the:

- respective IDG
- APU generator
- opposite IDG.

The main busses power individual equipment items such as:

- cooling vent fan
- electric hydraulic pumps
- recirculation fans
- IFE
- lavatory/galley fans

Each main bus also powers its associated busses (typical loads are shown in parentheses):

- transfer bus (DC system transformer–rectifiers, AC standby bus)
- utility bus (forward galley heater, chiller boost fan, gasper fan, captain's and first officer's foot and shoulder heaters, door area heaters, lavatory water heaters and shavers)
- galley busses.

Ground Service Bus

The ground service bus is normally powered by the right main bus. Alternate sources of power for the ground service bus are:

- the APU generator
- primary external power.

The ground service bus powers:

- the main battery charger
- miscellaneous cabin and system loads.

Ground Handling Bus

(777-200/-300 Series)

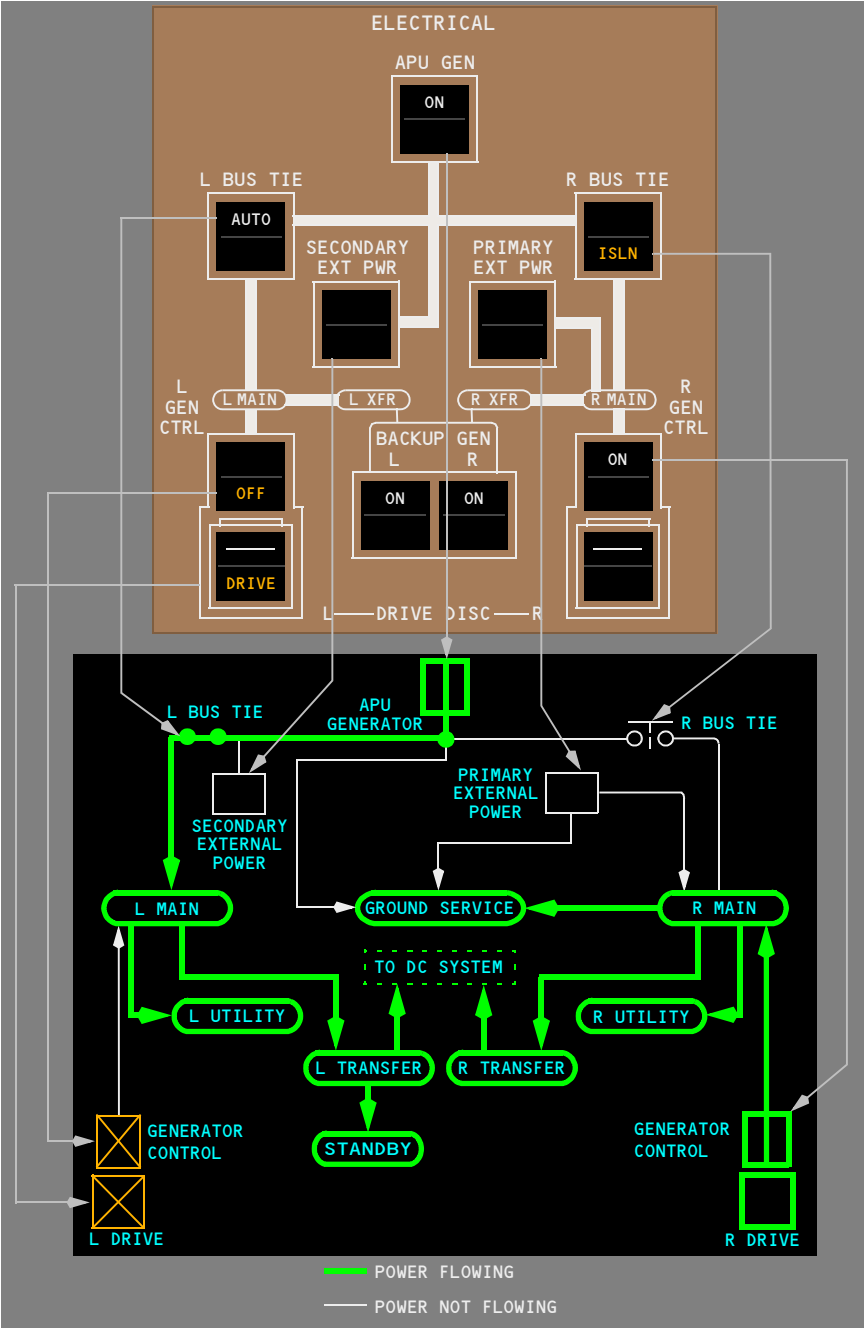
The ground handling bus can be powered on the ground only from the APU generator or from the primary external power source. It is provided for loads such as cargo handling, fueling/defueling operations, and other equipment energized only during ground operations.

Autoland

During autoland, the busses isolate to allow three independent sources to power the three autopilots:

- the left IDG powers the left AC transfer bus, the left main DC bus, and the captain's flight instrument bus
- the right IDG powers the battery bus and AC standby bus through the main battery charger
- the backup system powers the right AC transfer bus, the right main DC bus, and the first officer's flight instrument bus.

AC Electrical System Schematic



Backup AC Electrical System

The backup electrical system is designed to automatically provide power to selected airplane systems. The backup electrical system automatically powers one or both transfer busses when:

- only one main AC generator (includes APU) is available
- power to one or both of the main AC busses is lost

[\[777-200/-300 Series - Passenger\]](#)

- approach (APP) mode is selected for autoland

The system is automatically tested after engine starts and transfers power without interruption.

Backup Generators

Backup power is provided by one variable speed, variable frequency generator mounted on each engine. A frequency converter converts the generator frequency to a constant 400 Hz. Only one backup generator can power the converter at a time.

Each backup generator contains two permanent magnet generators (PMGs) that supply power to the flight control DC electrical system (refer to DC Electrical System).

If both IDGs and the APU generator are inoperative, a backup generator powers essential airplane equipment. To reduce electrical loading on the backup generator, the following systems are inoperative:

- TCAS
- SATCOM
- Right HF radio

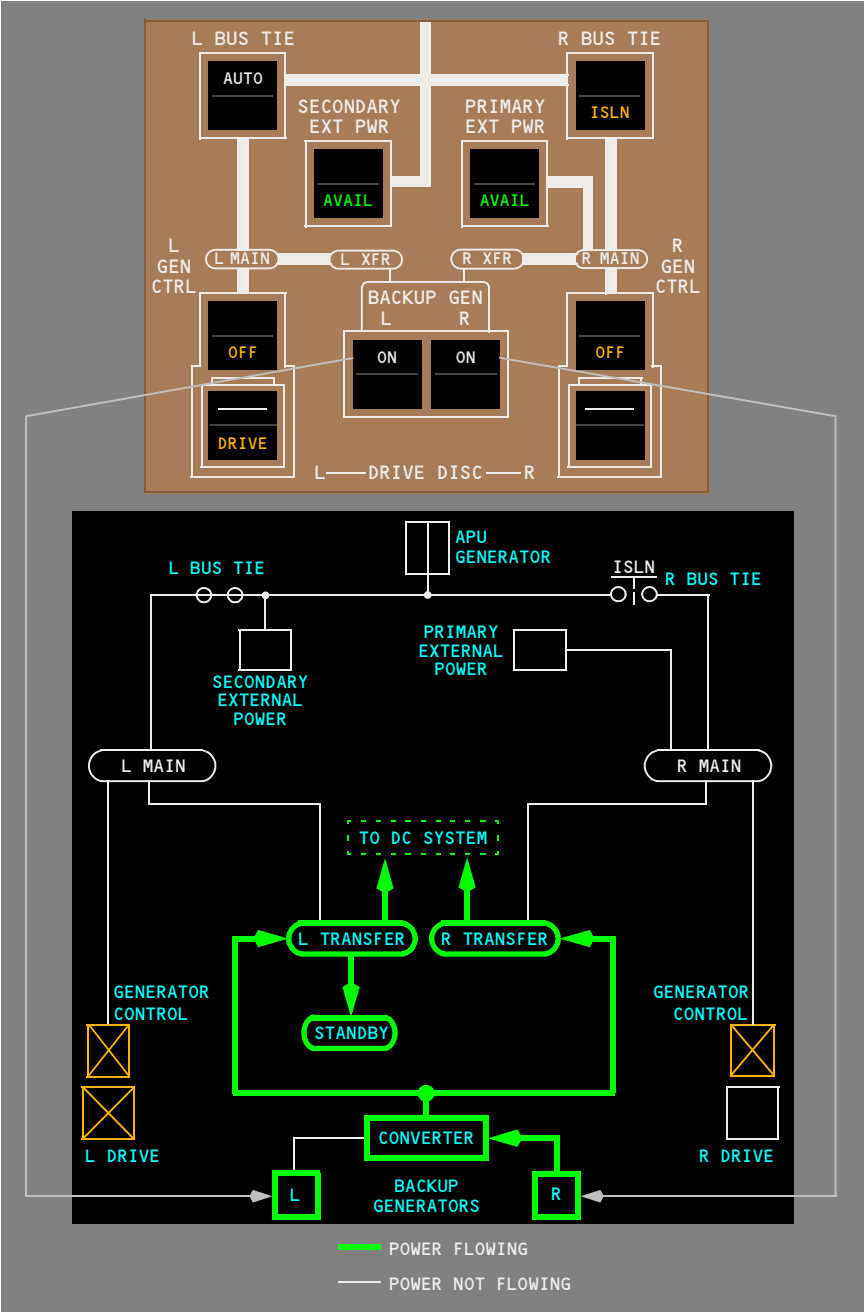
[\[HF Datalink installed\]](#)

- Right HF radio and associated datalink
- Center tank override/jettison pumps (center tank fuel is unusable and cannot be jettisoned)

[\[AUX Fuel installed\]](#)

- Center tank override/jettison pumps (center tank and auxiliary fuel is unusable and cannot be jettisoned)
- Position and other exterior lights (except nose gear landing lights)
- All non-essential cabin equipment (galleys, entertainment systems, etc.)
- Passenger cabin lighting (except night, galley and cross-aisle lights)
- Supernumerary cabin lighting (except night, galley and cross-aisle lights)
- Cabin temperature control (remains operative, but in degraded mode)

Backup AC Electrical System Schematic



DC Electrical System

The DC electrical system includes:

- main DC electrical system
- batteries
- [Option - Towing Power Switch]
- towing power
- flight control DC electrical system

Main DC Electrical System

The main DC electrical system uses four transformer–rectifier units (TRUs) to produce DC power. The TRUs are powered by the AC transfer busses.

Main DC Power Distribution

TRU DC electrical power is distributed to various DC busses as follows:

The left TRU powers the left main DC bus, which provides a second DC power source for:

- left flight control power supply assembly (PSA)
- right main DC bus.

The right TRU powers the right main DC bus, which provides a second DC power source for:

- right flight control PSA
- left main DC bus.

The C1 TRU powers the captain's flight instrument bus and the battery bus. The captain's flight instrument bus provides a second DC power source for:

- center flight control PSA
- first officer's flight instrument bus

The C2 TRU powers the first officer's flight instrument bus, which provides a second DC power source for the captain's instrument bus.

Batteries

The main battery is connected directly to the hot battery bus and provides standby power to other busses (See Standby Electrical System). The main battery charger normally powers the hot battery bus and maintains the main battery fully charged.

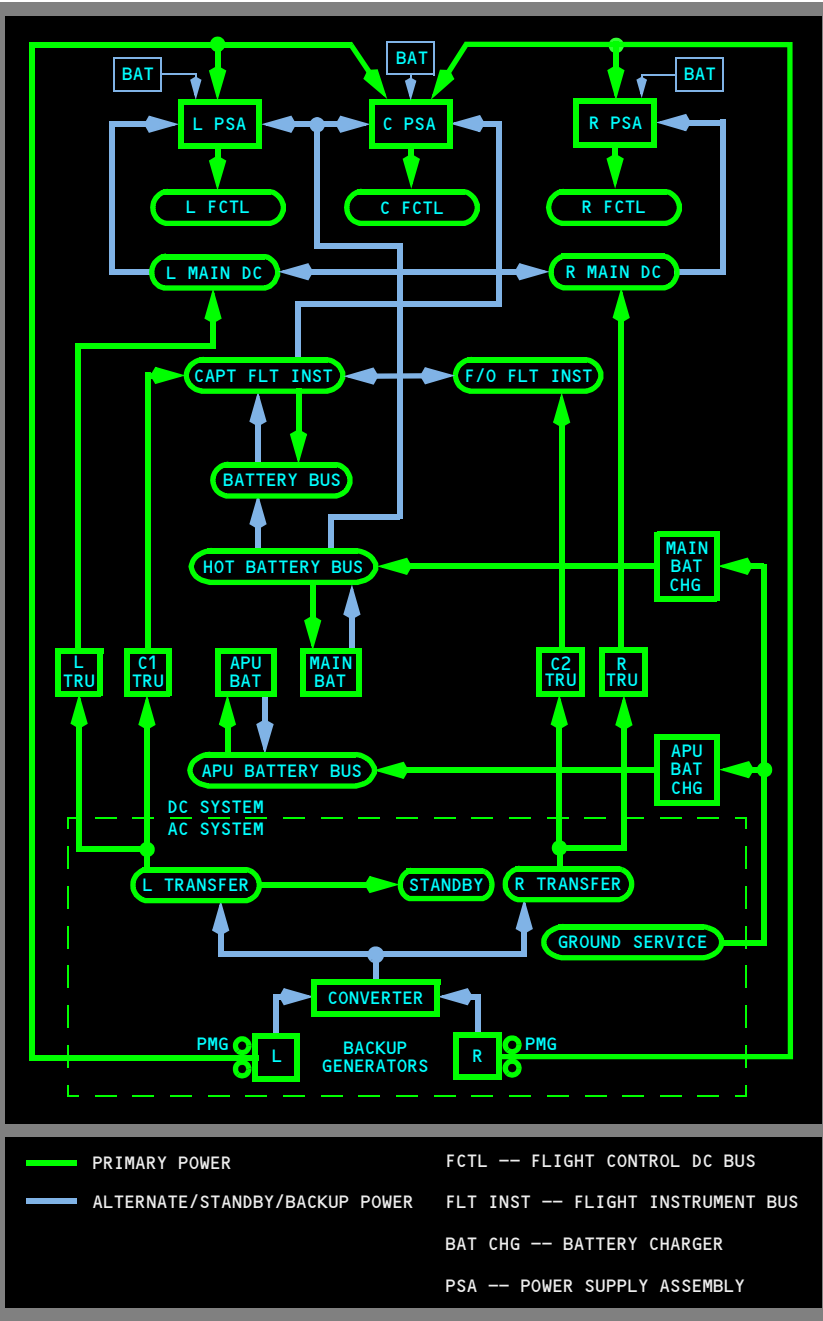
The APU battery is connected directly to the APU battery bus and provides dedicated power to the APU electric starter, which is used when sufficient bleed air duct pressure is unavailable for the APU air turbine starter. The APU battery charger normally powers the APU battery bus and maintains the APU battery fully charged.

Towing Power

[Option]

Permits towing operations without AC power. With the TOWING POWER switch selected to BAT position, main battery power is provided through the hot battery bus to systems required for towing. When AC power is applied to the airplane and the TOWING POWER switch is in BAT, the main battery provides back-up if AC power is lost during towing.

DC and Flight Control Electrical Systems Schematic



Flight Control DC Electrical System

[\[777-200/-300 Series - Passenger\]](#)

The flight control DC electrical system is a dedicated power source for the primary flight control system.

Primary power for the flight control DC electrical system comes from permanent magnet generators (PMGs) housed within each backup generator. Variable frequency PMG AC power is used by individual power supply assemblies (PSAs) to provide DC power to the three flight control DC busses.

To ensure a high level of system reliability, each PSA also has multiple DC power sources. If primary PMG AC power is not available, secondary power for the left and right PSAs is provided by the related main DC bus. Secondary power for the center PSA is provided by the captain's flight instrument bus. The hot battery bus provides additional backup power for the left and center PSAs only.

Each PSA also uses a dedicated battery to prevent power interruptions to the related flight control DC bus. The batteries have limited capacity and are incorporated to supply power for brief periods during PSA power source transfers.

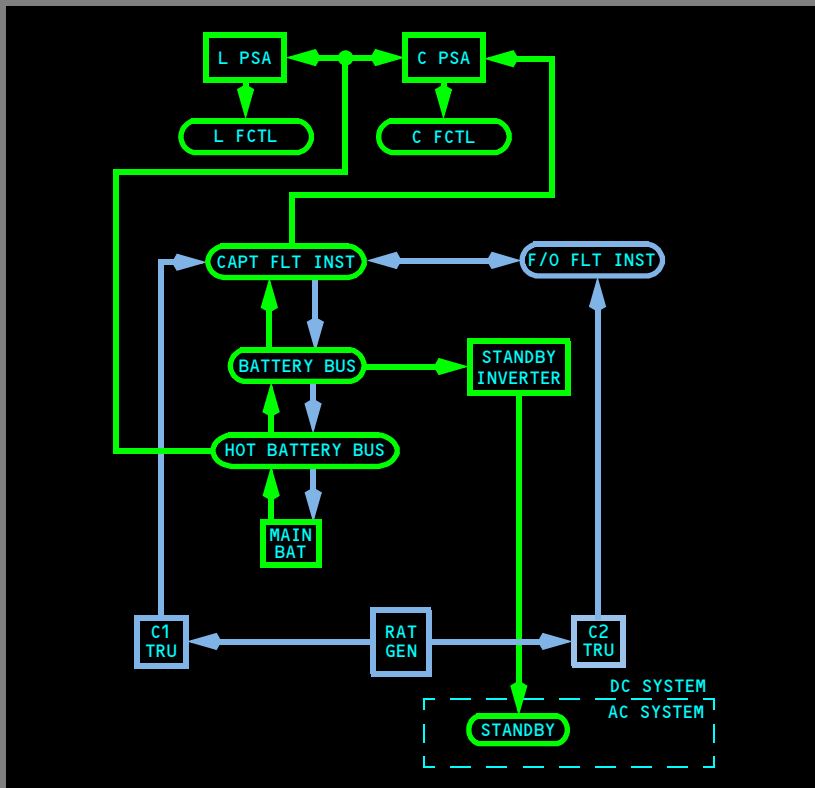
Standby Electrical System

The standby electrical system can supply AC and DC power to selected flight instruments, communications and navigation systems, and the flight control system, if there are primary electrical power system failures.

The standby electrical system consists of:

- the main battery
- the standby inverter
- the RAT generator and its associated generator control unit
- the C1 and C2 TRUs.

Standby Electrical System Schematic



STANDBY POWER (BATTERY ONLY AVAILABLE).

ADDITIONAL STANDBY POWER (RAT GEN AVAILABLE).

RAT GEN -- RAM AIR TURBINE GENERATOR

FCTL -- FLIGHT CONTROL DC BUS

FLT INST -- FLIGHT INSTRUMENT BUS

PSA -- POWER SUPPLY ASSEMBLY

Main Battery

The main battery provides standby power to the:

- hot battery bus
- battery bus
- captain's flight instrument bus

[777-200/-300 Series - Passenger]

- left and center flight control PSAs
- standby inverter.

[777-200/-300 Series - Passenger]

Note: The main battery can power the standby system for a minimum of 10 minutes.

Standby Inverter

The standby inverter converts DC power to AC power. The inverter powers the AC standby bus if the left transfer bus is not powered.

Ram Air Turbine (RAT) Generator

The RAT generator provides standby power to the C1 and C2 TRUs. The RAT generator has no operating time limits, and operates at all airspeeds and altitudes.

The RAT can supply electrical and hydraulic power simultaneously. If the RAT is unable to maintain RPM, the RAT generator electrical load is shed until RPM is satisfactory. Power for standby electrical loads is provided by the main battery during deployment of the RAT and when RAT generator loads are shed.

The RAT is deployed automatically if both AC transfer busses lose power in flight. The RAT can be manually deployed by pushing the RAM AIR TURBINE switch on the overhead panel.

RAT deployment and operation are described in Chapter 13, Hydraulics.

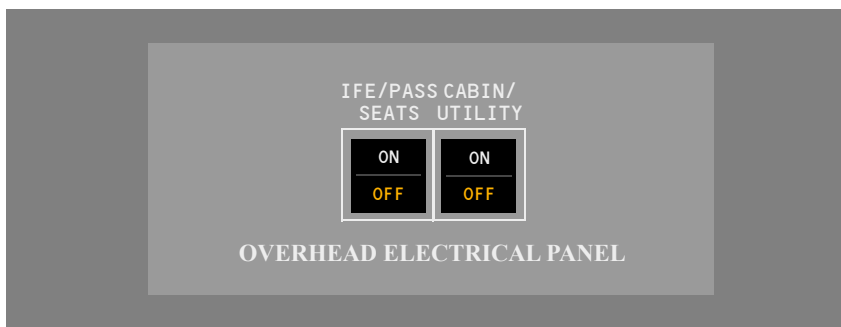
Cabin Systems and Utility Power

[IFE/PASS SEATS and CABIN/UTILITY switches basic with C/L 350]

Electrical power to some cabin and utility systems are controlled from the flight deck.

IFE/PASS SEATS and CABIN/UTILITY Power Switches

Electrical power to some non-essential loads can be controlled from the flight deck overhead electrical panel. Two switches are provided for de-energizing these loads if necessary. The IFE/PASS SEATS switch controls In-Flight Entertainment (IFE) system, passenger seat systems, video surveillance cameras, and flight deck personal electronic device (PED) power outlets. The CABIN/UTILITY switch controls galleys, most cabin lights, and other non-essential cabin utility loads.



IFE and Passenger Seats

The IFE/PASS SEATS Power switch controls power to the IFE and passenger seats. Pushing the switch OFF removes power from:

- all IFE components
- passenger seats, including:
 - seat motor power
 - personal computer power outlets
 - telephones

[Option - Broadband Comm]

- broadband communication

Cabin and Utility Systems

The CABIN/UTILITY Power switch controls power to cabin and utility systems. When the switch is OFF power is removed from:

- ground service bus, except:
 - main and APU battery chargers
 - left forward fuel pump
- utility busses
- galleys

[Option]

- gasper fan

- fluorescent cabin lighting
- beacon, logo, and wing lights

Additionally, when the CABIN/UTILITY Power switch is OFF, power is provided to:

- night lights
- reading lights
- attendant work lights
- some galley and crew rest lights.

Cabin and Utility Systems

The CABIN/UTILITY Power switch controls power to cabin and utility systems. When the switch is OFF power is removed from:

- ground service bus, except:
 - main and APU battery chargers
 - left forward fuel pump
- utility busses
- galley
- gasper fan
- beacon, logo, and wing lights
- main deck cargo, lower forward cargo, lower aft cargo compartment electrical power outlets
- supernumerary general lights
- main deck alert system, and
- in flight, main deck cargo lights.

Additionally, when the CABIN/UTILITY Power switch is OFF, power is provided to:

- night and supplemental night lights
- reading lights
- some galley and crew rest lights.

Power is removed from the main deck cargo, lower forward cargo, lower aft cargo compartment electrical power outlets when the respective compartment CARGO FIRE ARM switch is in ARMED.

**Electrical
EICAS Messages****Chapter 6
Section 30****EICAS Alert Messages**

Message	Level	Aural	Message Logic
ELEC AC BUS L, R	Caution	Beeper	AC bus is unpowered.
ELEC BACKUP GEN L, R	Advisory		Backup generator has failed.
ELEC BACKUP SYS	Advisory		Backup power system has failed.
ELEC BATTERY OFF	Advisory		Battery switch is OFF.
ELEC BUS ISLN L, R	Advisory		Bus tie breaker is open due to an AC electrical system fault or Bus Tie switch is OFF.
ELEC CABIN/UTIL OFF	Advisory		Cabin/utility power switch is OFF.
ELEC CABIN/UTIL OFF	Advisory		Cabin/utility power switch is OFF.
ELEC GEN DRIVE L, R	Advisory		Generator drive oil pressure is low.
ELEC GEN OFF APU	Advisory		APU generator control breaker is open.
ELEC GEN OFF L, R	Advisory		Generator control breaker is open.
ELEC GND HDLG BUS	Advisory		Ground handling bus relay has failed.
ELEC IFE/SEATS OFF	Advisory		In-Flight Entertainment System/Passenger Seats Power switch is OFF.

ELEC IFE/SEATS OFF	Advisory		In-Flight Entertainment System/Passenger Seats Power switch is OFF.
ELEC STANDBY SYS	Advisory		A fault is detected in the standby power system.
MAIN BATTERY DISCH	Advisory		Main battery is discharging or hot battery bus is unpowered.

**Engines, APU
Table of Contents****Chapter 7
Section TOC**

Controls and Indicators	7.10
EICAS Display	7.10.1
Mode Indications	7.10.3
EPR Indications	7.10.4
EPR Indications (Alternate Mode)	7.10.5
N1 Indications	7.10.6
N1 Indications (Hard Alternate Mode)	7.10.6
N1 Indications (All Modes)	7.10.7
EGT Indications	7.10.9
In-Flight Start Envelope	7.10.10
Crossbleed Start Indications	7.10.12
Secondary Engine Indications	7.10.13
Secondary Engine Display	7.10.13
N2 Indications	7.10.15
N3 Indications	7.10.16
Fuel Flow Indications	7.10.17
Oil Pressure Indications	7.10.17
Oil Temperature Indications	7.10.19
Oil Quantity Indications	7.10.20
Engine Vibration Indications	7.10.21
Compact Engine Indications	7.10.22
Engine Controls	7.10.25
Thrust Levers	7.10.25
Fuel Control Switches	7.10.26
Engine Control Panel	7.10.27
Auxiliary Power Unit (APU)	7.10.29
APU Controls	7.10.29
APU Indications	7.10.30
Engine System Description	7.20
Introduction	7.20.1

Engine Intermix	7.20.2
Takeoff Bump Thrust Reference Mode	7.20.2
Engine Indications	7.20.2
Primary Engine Indications	7.20.2
Secondary Engine Indications	7.20.3
Normal Display Format	7.20.4
Compact Display Format	7.20.6
Electronic Engine Control (EEC)	7.20.7
EEC Normal Mode	7.20.7
EEC Alternate Mode	7.20.8
Overspeed Protection	7.20.9
Engine Idle	7.20.9
Thrust Control Malfunction Protection	7.20.10
Engine Start and Ignition System	7.20.10
Autostart	7.20.11
Autostart	7.20.12
Autostart	7.20.14
Manual Start	7.20.15
In-Flight Start	7.20.15
In-Flight Start	7.20.16
Engine Ignition	7.20.16
Auto-Relight	7.20.17
Engine Start and Ignition System Schematic	7.20.19
Engine Fuel System	7.20.20
Engine Fuel System Schematic	7.20.21
Engine Oil System	7.20.23
Engine Oil System Schematic	7.20.24
Thrust Reverser System	7.20.25
Thrust Reverser Schematic	7.20.27
Airborne Vibration Monitoring System	7.20.28
Engine Failure Alert System	7.20.29

APU System Description	7.30
Introduction	7.30.1
APU Operation	7.30.1
APU Start	7.30.1
APU Automatic Start	7.30.2
APU Run.	7.30.2
APU Shutdown	7.30.2
APU Operating Modes	7.30.2
EICAS Messages.....	7.40
EICAS Alert Messages	7.40.1
EICAS Memo Messages	7.40.3

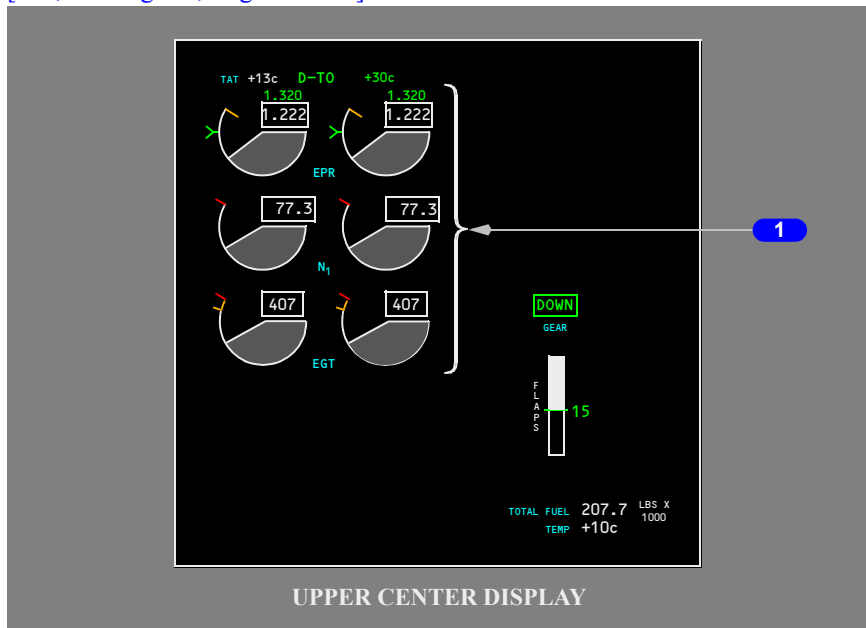
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**Engines, APU
Controls and Indicators**

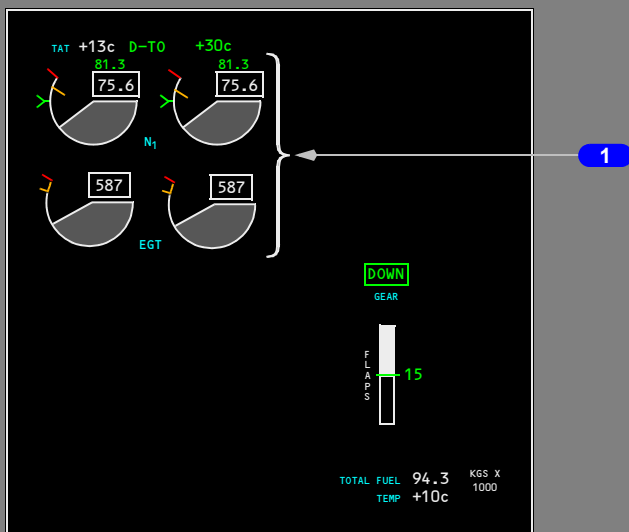
**Chapter 7
Section 10**

EICAS Display

[PW, RR Engines, English Units]



[GE90 Engines, Metric Units]



UPPER CENTER DISPLAY

[GE Engines]

1 Primary Engine Indications

Displayed full time on the EICAS display:

- N1
- EGT.

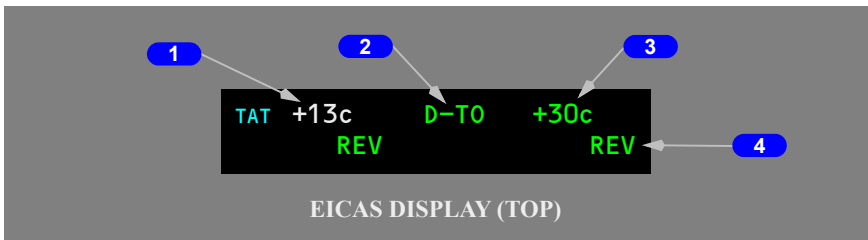
[PW, RR Engines]

1 Primary Engine Indications

Displayed full time on the EICAS display:

- EPR
- N1
- EGT.

Mode Indications



1 Total Air Temperature (TAT)

Displayed (white) – TAT (degrees C).

[\[777-200/300 Series Takeoff Derates\]](#)

2 Thrust Reference Mode

Displayed (green) – selected FMS thrust reference mode:

- TO – maximum rated takeoff thrust
- TO 1 – derate one takeoff thrust
- TO 2 – derate two takeoff thrust
- D-TO – assumed temperature derated takeoff thrust
- D-TO 1 – derate one assumed temperature derated takeoff thrust
- D-TO 2 – derate two assumed temperature derated takeoff thrust
- CLB – maximum rated climb thrust
- CLB 1 – derate one climb thrust
- CLB 2 – derate two climb thrust
- CON – maximum rated continuous thrust
- CRZ – maximum rated cruise thrust
- G/A – maximum go-around thrust.

[\[Option\]](#)

- TO B – provides additional takeoff thrust. Refer to the Airplane Flight Manual (AFM) for the performance limitations and data required to use this feature.

[\[Option\]](#)

- A-TO, A-TO 1, A-TO 2, A-TO B – APU-to-Pack or APU-to-Pack derated or APU-to-Pack takeoff bump thrust

3 Assumed Temperature

Displayed (green) – selected assumed temperature (degrees C) for reduced thrust takeoff.

4 Thrust Reverser Indication

Displayed REV (amber) – reverser in transit.

Displayed REV (green) – reverser fully deployed.

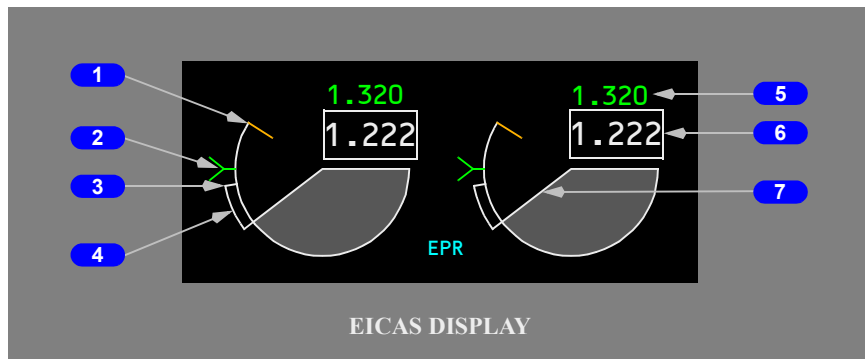
EPR Indications

[PW, RR Engines]

Note: During tailwind conditions, slight EPR fluctuations may occur prior to 5 knots forward airspeed.

Note: When reverse thrust is activated, the following indications are not displayed:

- maximum EPR line
- commanded EPR
- reference/target EPR indication
- reference EPR.



1 Maximum EPR Line

Displayed (amber).

2 Reference/Target EPR Indication

Displayed (green) – reference EPR limit.

Displayed (magenta) – target FMC commanded EPR when VNAV is engaged and:

- the autothrottle is engaged in THR or THR REF mode, or
- the autothrottle is not engaged.

3 Commanded EPR

Displayed (white).

4 Commanded EPR Sector

Displays momentary difference between engine EPR and EPR commanded by thrust lever position.

5 Reference EPR

Displayed (green).

6 Actual EPR

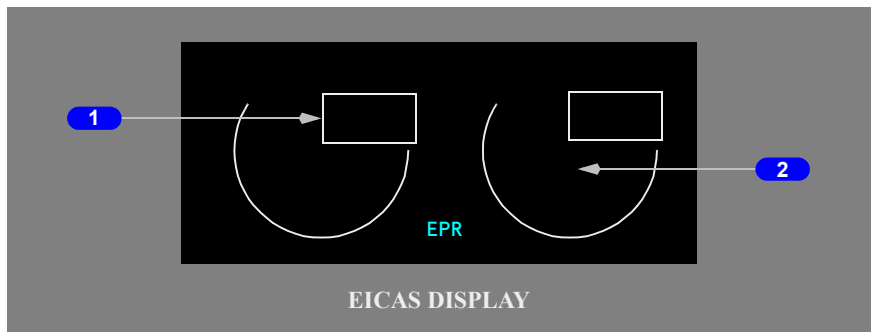
Displayed (white).

7 Actual EPR Indication

Displayed (white).

EPR Indications (Alternate Mode)

[PW, RR Engines]

**1 Actual EPR**

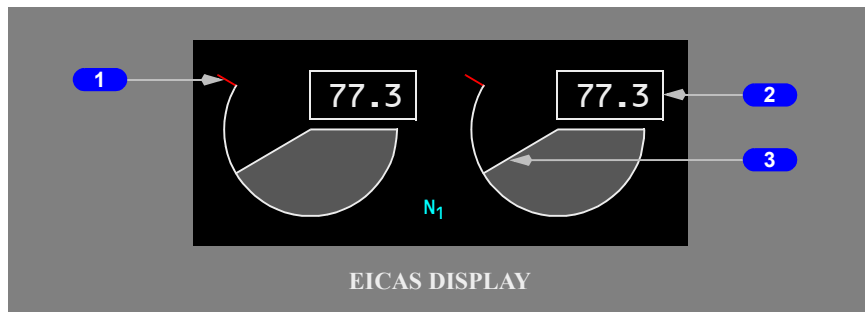
Displayed (blank).

2 Actual EPR Indication

Displayed (blank).

N1 Indications

[PW, RR Engines]



1 N1 Red Line

Displayed (red) – N1 RPM operating limit.

2 N1

Digital N1 RPM (%), displayed:

- (white) – normal operating range
- displayed (red) – operating limit reached.

3 N1 Indication

N1 RPM, displayed:

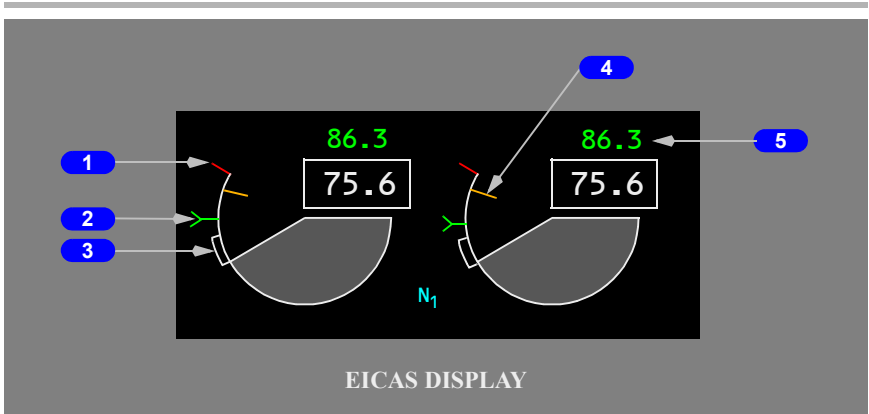
- (white) – normal operating range
- displayed (red) – operating limit reached.

N1 Indications (Hard Alternate Mode)

[PW, RR Engines]

Note: When reverse thrust is activated, the following indications are not displayed:

- maximum N1 line
- commanded N1
- reference/target N1 indication
- reference N1.



1 N1 Red Line

Displayed (red).

2 Reference/Target N1 Indication

Displayed (green) – reference N1 limit.

Displayed (magenta) – target FMC commanded N1 when VNAV is engaged and:

- the autothrottle is engaged in THR or THR REF mode, or
- the autothrottle is not engaged.

3 Commanded N1 Sector

Displays momentary difference between engine N1 and N1 commanded by thrust lever position.

4 Maximum N1 Line

Displayed (amber).

5 Reference N1

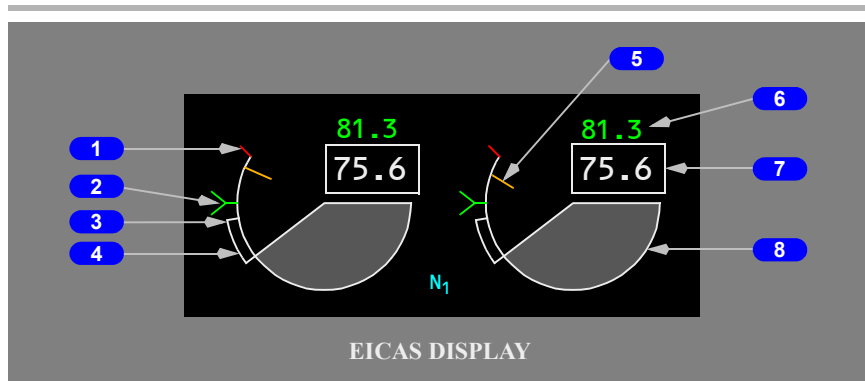
Displayed (green) – thrust reference calibrated for N1.

N1 Indications (All Modes)

[\[GE Engines\]](#)

Note: When reverse thrust is activated, the following indications are not displayed:

- maximum N1 line
- commanded N1
- reference/target N1 indication
- reference N1.



1 N1 Red Line

Displayed (red) – N1 RPM operating limit.

2 Reference/Target N1

Displayed (green) – reference N1 limit.

Displayed (magenta) – target FMC commanded N1 when VNAV is engaged and:

- the autothrottle is engaged in THR or THR REF mode, or
- the autothrottle is not engaged.

3 Commanded N1

Displayed (white).

4 Commanded N1 Sector

Displays momentary difference between engine N1 and N1 commanded by thrust lever position.

5 Maximum N1 Line

Displayed (amber).

6 Reference N1

Displayed (digital, green).

7 N1

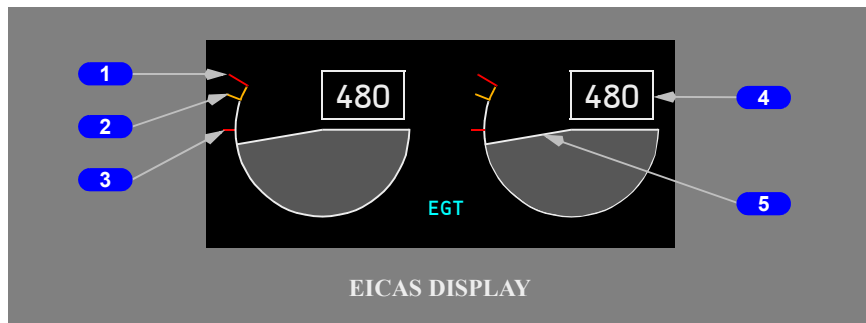
Digital N1% RPM, displayed:

- (white) – normal operating range
- displayed (red) – operating limit reached.

8 N1 Indication

N1 RPM, displayed:

- (white) – normal operating range
- displayed (red) – operating limit reached.

EGT Indications

[GE, RR Engines]

1 EGT Red Line

Displayed (red) – maximum takeoff EGT limit.

[PW Engines]

1 EGT Red Line

Displayed (red) – maximum takeoff/in-flight start EGT limit.

2 EGT Amber Band

Displayed (amber) – maximum continuous EGT limit.

[GE, RR Engines]

3 EGT Start Limit Line

Displayed (red):

- with the FUEL CONTROL switch in CUTOFF, or

[GE, PW Engines]

- with the N2 RPM below idle.

[RR Engines]

- with the N3 RPM below idle.

[PW Engines]

3 EGT Start Limit Line

Displayed (red):

- on the ground
- with the FUEL CONTROL switch in CUTOFF, or
- with the N2 RPM below idle.

4 EGT

EGT (degrees C), displayed:

- (white) – normal operating range
- (amber) – maximum continuous limit reached
- (red) – maximum start or takeoff limit reached.

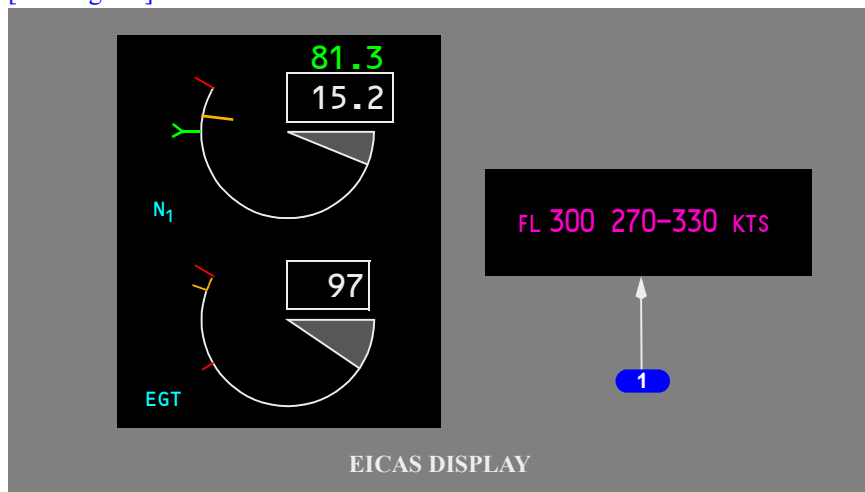
5 EGT Indication

Displayed:

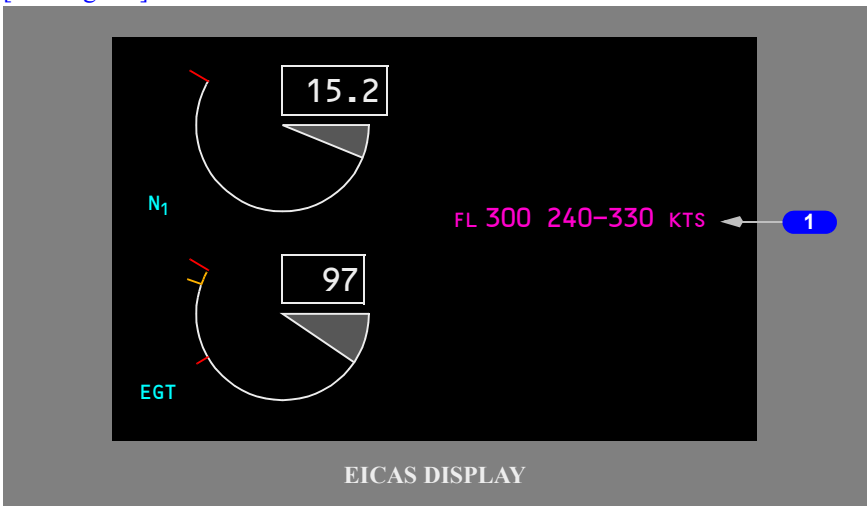
- (white) – normal operating range
- (amber) – maximum continuous limit reached
- (red) – maximum start or takeoff limit reached.

In-Flight Start Envelope

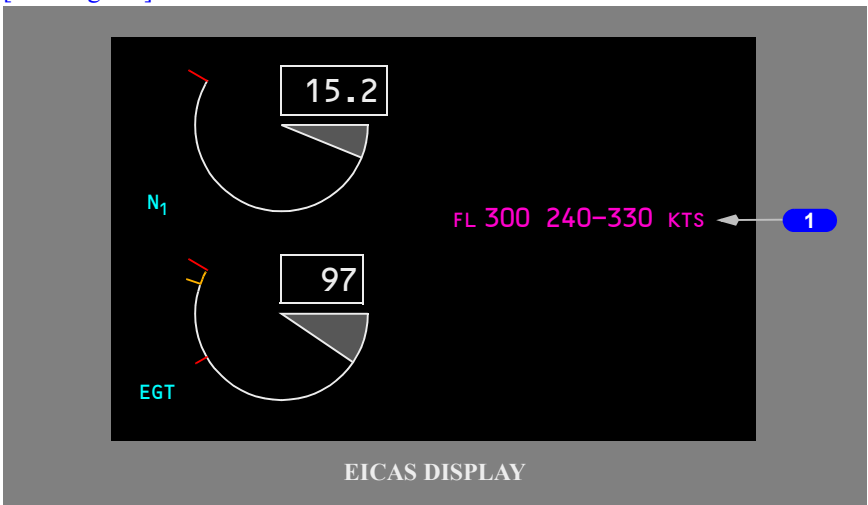
[GE Engines]



[RR Engines]



[PW Engines]

**1 In-Flight Start Envelope**

Displayed (magenta) – airspeed range for an in-flight start at the current flight level or maximum flight level (whichever is less) when the respective engine fire switch is in and:

- a FUEL CONTROL switch is in CUTOFF, or

[GE, PW Engines]

- engine N_2 RPM is below idle.

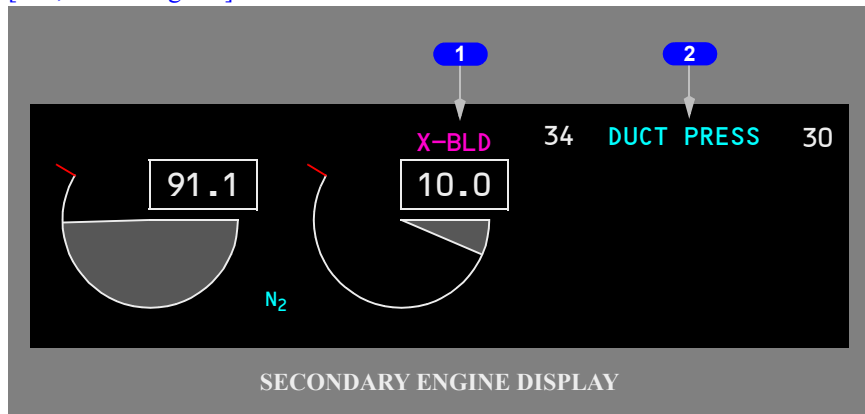
Boeing Proprietary. Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details.

[RR Engines]

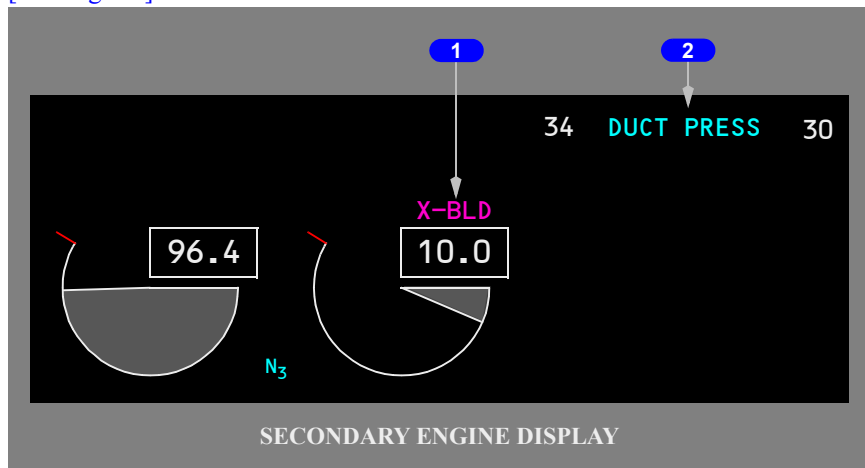
- engine N3 RPM is below idle.

Crossbleed Start Indications

[PW, GE90 Engines]



[RR Engines]



1 Crossbleed (X-BLD) Start Indication

Indicates crossbleed air is recommended for an in-flight start.

Displayed (magenta):

- the in-flight start envelope is displayed, and
- the respective engine fire switch is in, and
- airspeed is lower than that for a windmilling start.

2 DUCT Pressure (PRESS)

Displayed (white numbers) – pressure in the left and right bleed air ducts in psi when the respective engine fire switch is in and:

- a FUEL CONTROL switch is in CUTOFF, and

[PW, GE Engines]

- engine N2 RPM is below idle.

[RR Engines]

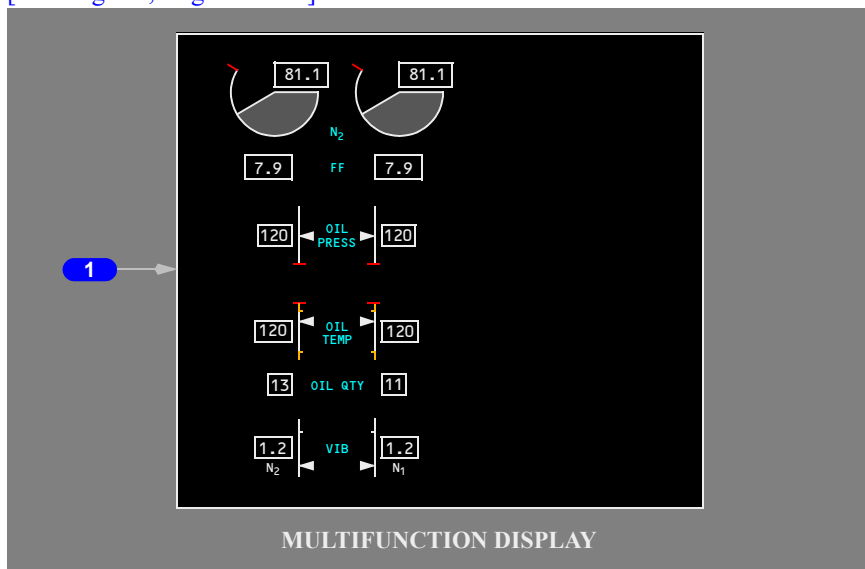
- engine N3 RPM is below idle.

Secondary Engine Indications

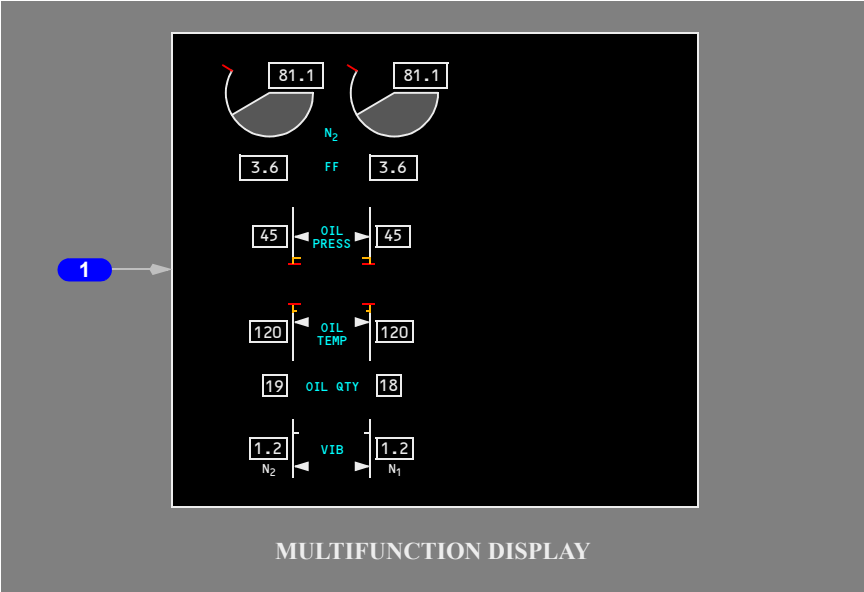
See Chapter 10, Flight Instruments, Displays, for display selection of Secondary Engine indications.

Secondary Engine Display

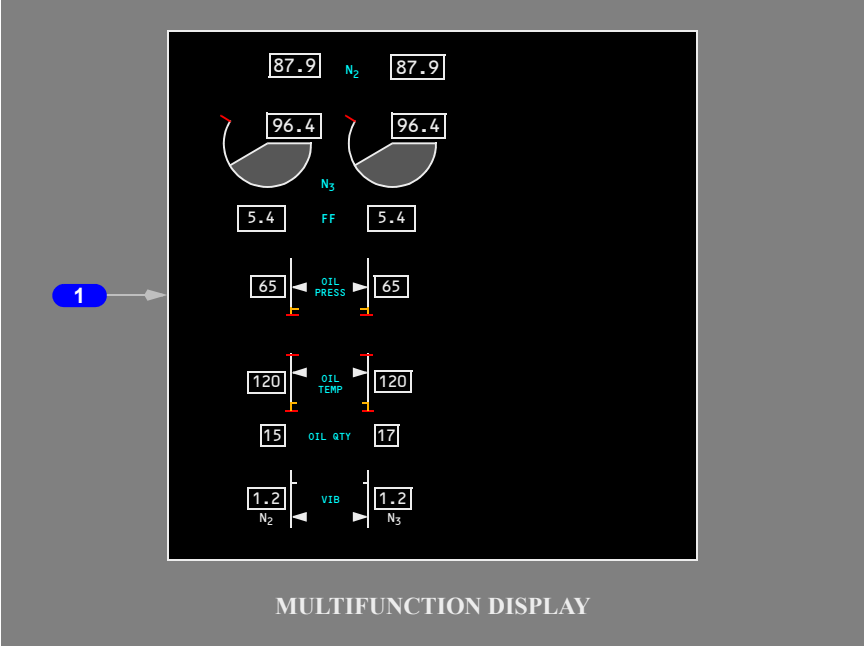
[PW Engines, English Units]



[GE90 Engines, Metric Units]



[RR Engine, Metric Units]



[GE, PW Engines]

1 Secondary Engine Display

Displays:

- N2 RPM
- fuel flow (FF)
- oil pressure
- oil temperature
- oil quantity
- vibration.

[RR Engines]

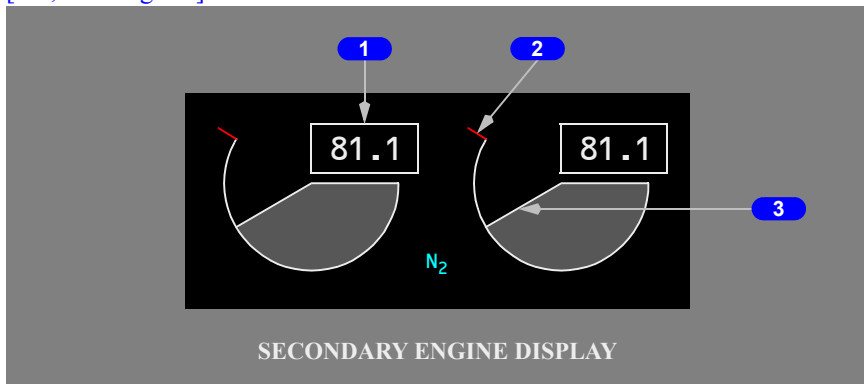
1 Secondary Engine Display

Displays:

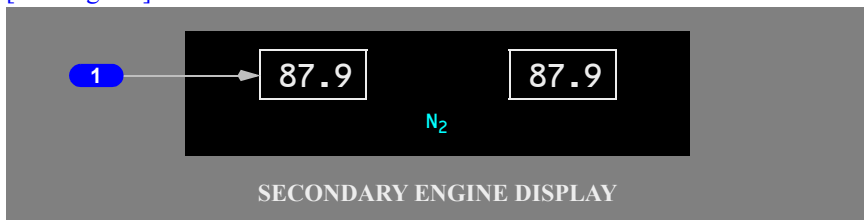
- N2 RPM
- N3 RPM
- fuel flow (FF)
- oil pressure
- oil temperature
- oil quantity
- vibration.

N2 Indications

[GE, PW Engines]



[RR Engines]



1 N2

N2 RPM (%), displayed:

- (white) – normal operating range
- (red) – operating limit reached.

[GE, PW Engines]

2 N2 Red Line

N2 RPM operating limit, displayed (red).

[GE, PW Engines]

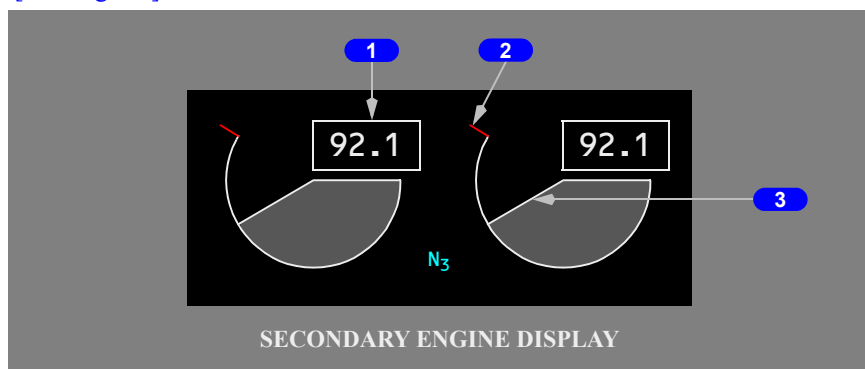
3 N2 Indication

N2 RPM, displayed:

- (white) – normal operating range
- (red) – operating limit reached.

N3 Indications

[RR Engines]



1 N3

N3 RPM (%), displayed:

- (white) – normal operating range
- (red) – operating limit reached.

2 N3 Red Line

N3 RPM operating limit, displayed (red).

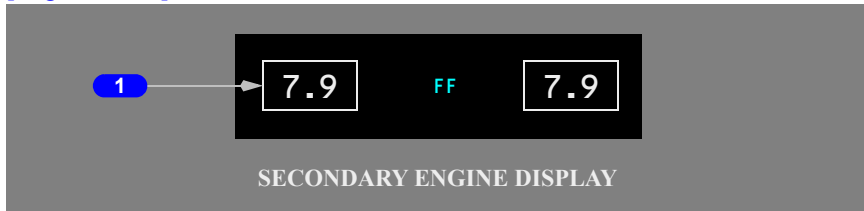
3 N3 Indication

N3 RPM, displayed:

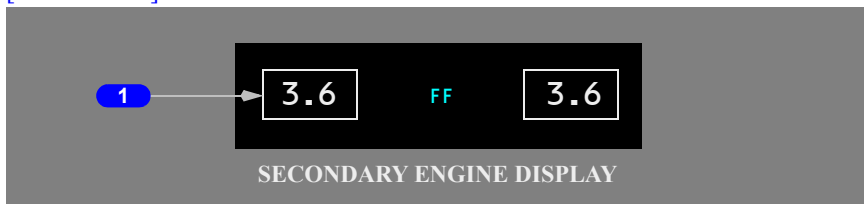
- (white) – normal operating range
- (red) – operating limit reached.

Fuel Flow Indications

[English Units]



[Metric Units]



1 Fuel Flow

[English Units]

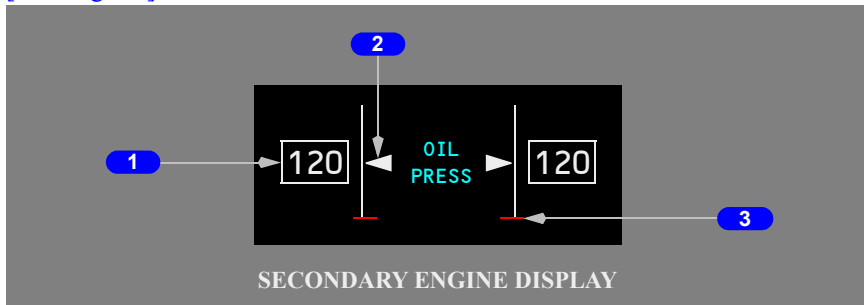
Displayed (white) – fuel flow to the engine (pounds per hour x 1000).

[Metric Units]

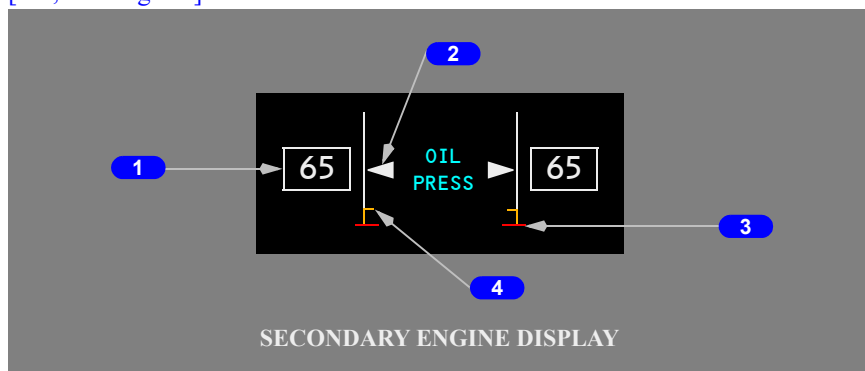
Displayed (white) – fuel flow to the engine (kilograms per hour x 1000).

Oil Pressure Indications

[PW Engines]



[GE, RR Engines]



[PW Engines]

1 Oil Pressure

Engine oil pressure (psi), displayed:

- (white) – normal operating range
- (red) – operating limit reached.

[GE, RR Engines]

1 Oil Pressure

Engine oil pressure (psi), displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached.

[PW Engines]

2 Oil Pressure Pointer

Engine oil pressure, displayed:

- (white) – normal operating range
- (red) – operating limit reached.

[GE, RR Engines]

2 Oil Pressure Pointer

Engine oil pressure, displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached.

3 Oil Pressure Red Line

Displayed (red) – oil pressure operating limit.

Vertical position of oil pressure red line will vary with N2 RPM.

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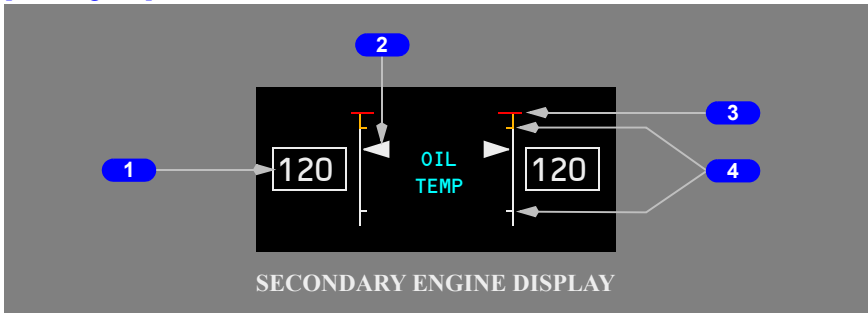
[GE, RR Engines]

4 Oil Pressure Amber Band

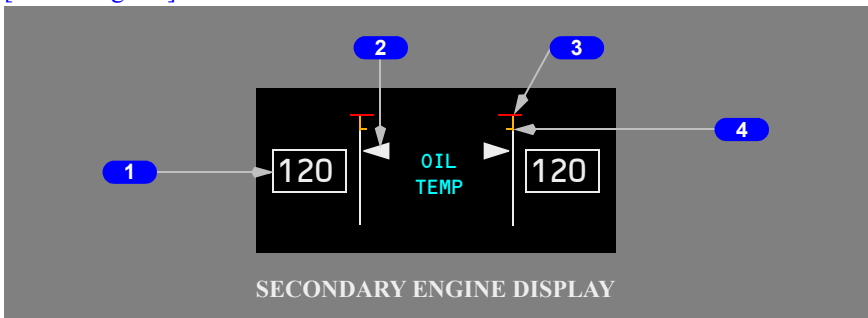
Displayed (amber) – oil pressure caution range.

Oil Temperature Indications

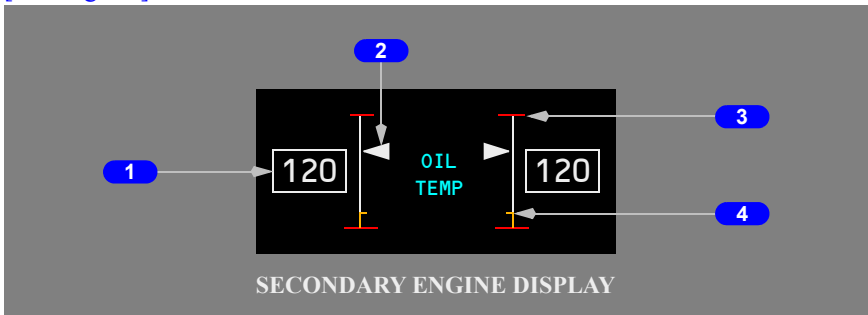
[PW Engines]



[GE90 Engines]



[RR Engines]



1 Oil Temperature

Engine oil temperature (degrees C), displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached.

2 Oil Temperature Pointer

Engine oil temperature, displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached.

3 Oil Temperature Red Line

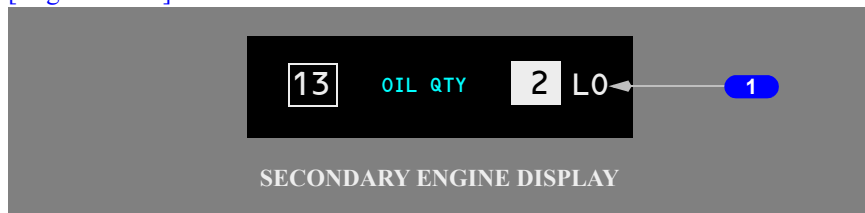
Displayed (red) – oil temperature operating limit.

4 Oil Temperature Amber Band

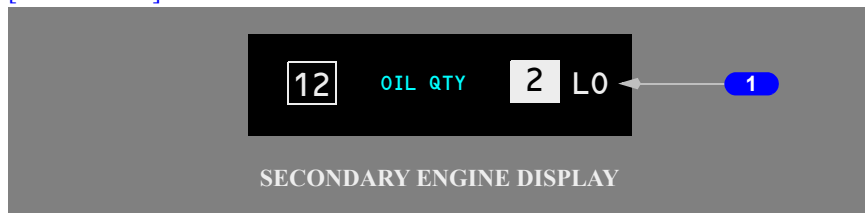
Displayed (amber) – oil temperature caution range.

Oil Quantity Indications

[\[English Units\]](#)



[\[Metric Units\]](#)



1 Oil Quantity

[\[English Units\]](#)

Usable oil quantity (quarts).

[\[Metric Units\]](#)

Usable oil quantity (liters).

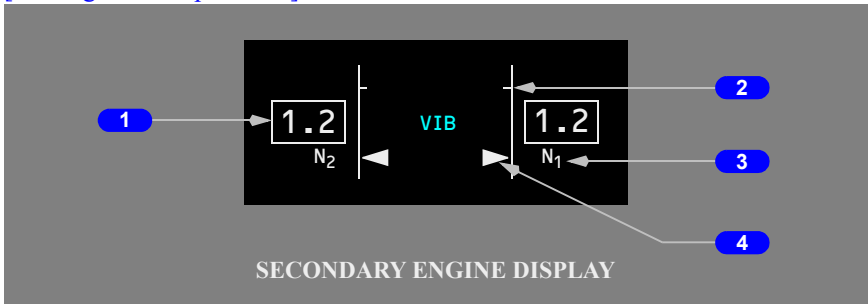
Displayed:

- (white) – normal quantity
- (reverses the display to show black numbers on white background) – low quantity.

Note: LO – displayed (white) when quantity is low.

Engine Vibration Indications

[\[All Engines except GE9X\]](#)



1 Engine Vibration

Engine vibration, displayed:

- (white) – normal operating range
- (black numbers, white background) – high vibration.

2 Engine Vibration High Band

Displayed (white) – vibration level at which automatic display of secondary engine indications occurs.

3 Vibration Source

Identifies the vibration source being displayed.

Displayed (white) – vibration source with the highest vibration:

- N1 rotor vibration
- N2 rotor vibration.

[\[RR Engines\]](#)

- N3 rotor vibration.

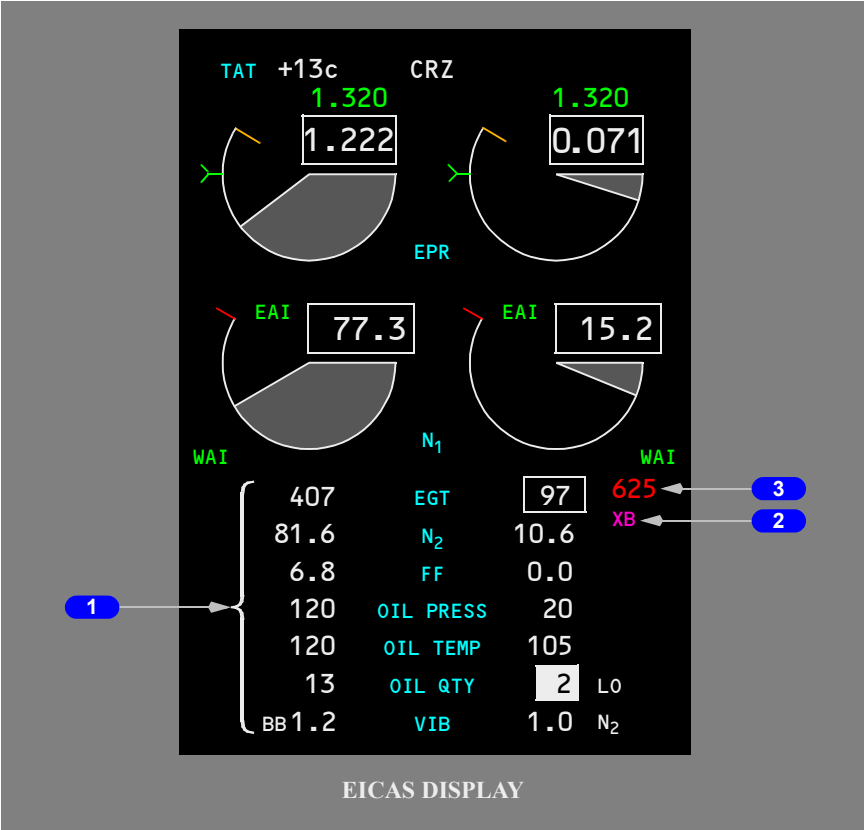
If the vibration source BB (broad band vibration) is displayed, the source is unknown and average vibration is displayed.

4 Engine Vibration Pointer

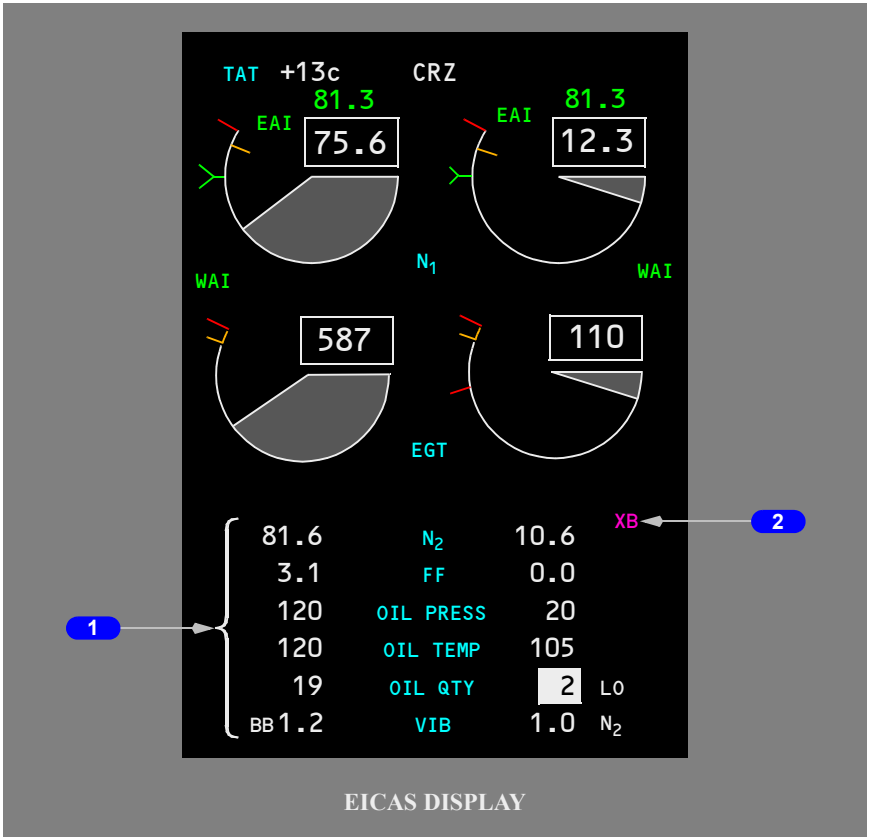
Displayed (white) – engine vibration.

Compact Engine Indications

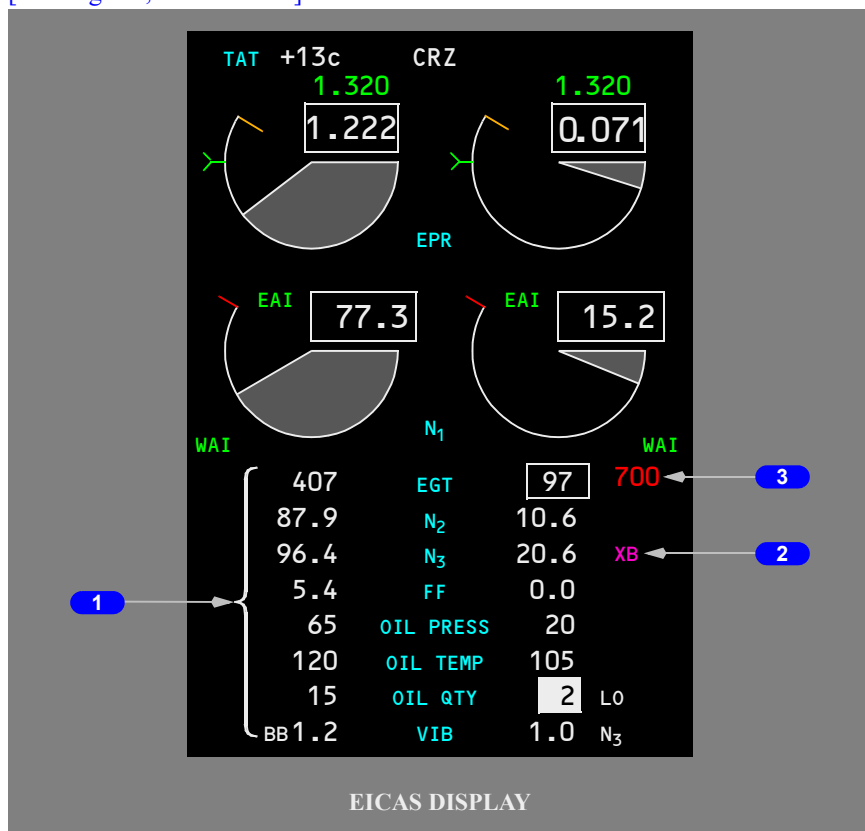
[PW Engines, English Units]



[GE Engines, Metric Units]



[RR Engines, Metric Units]



1 Compact Engine Indications

The following changes to EICAS and the normal secondary engine display occur:

[GE Engines]

- N2 changes from round dial displays to a digital display. The digital display is framed by an amber or red box if limits are exceeded.

[PW Engines]

- EGT and N2 change from round dial displays to digital displays. The digital displays are framed by an amber or red box if limits are exceeded.

[RR Engines]

- EGT and N3 change from round dial displays to digital displays. The digital displays are framed by an amber or red box if limits are exceeded.

777 Flight Crew Operations Manual

- FF, OIL PRESS, OIL TEMP are displayed as digital readouts only. The digital displays turn amber or red if limits are exceeded.
- OIL QTY and VIB are displayed as digital readouts only. Low oil quantity and high vibrations are displayed the same as in the normal format.

2 Crossbleed (XB) Start Indication

Displayed (magenta).

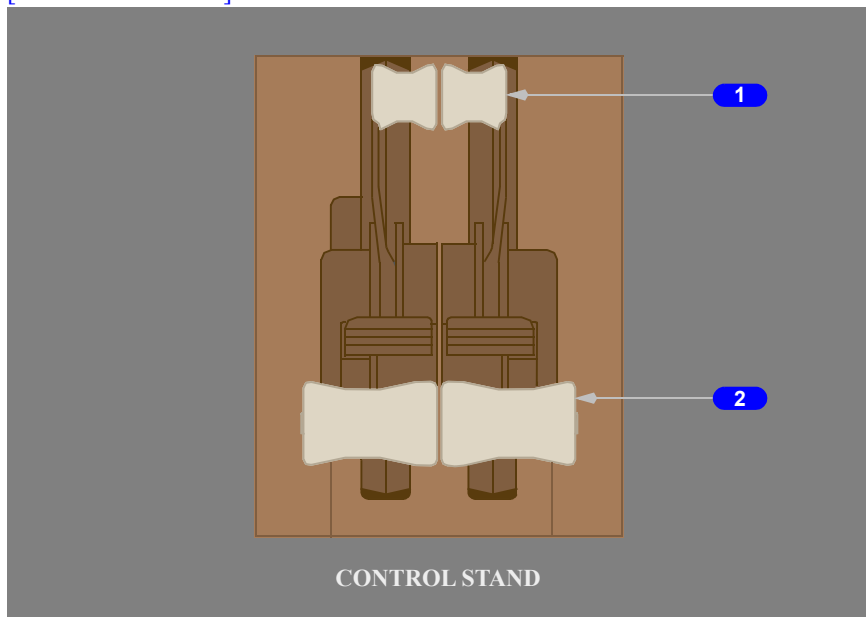
[PW, RR Engines]

3 EGT start limit

Displayed (red).

**Engine Controls
Thrust Levers**

[777-200/300 Series]

**1 Reverse Thrust Levers**

Control engine reverse thrust.

Reverse thrust can only be selected when the forward thrust levers are closed.

Actuates automatic speedbrakes (refer to Chapter 9, Flight Controls).

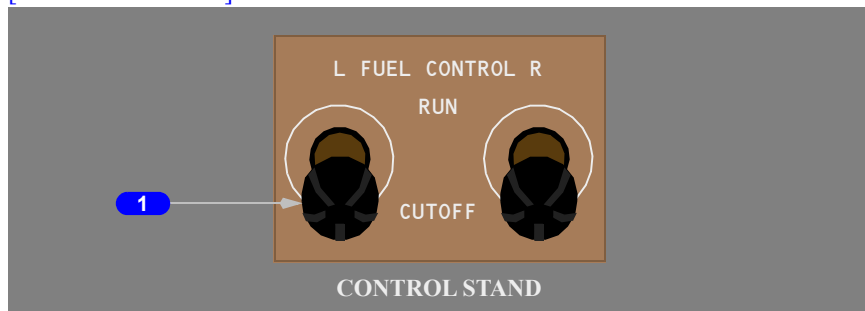
2 Forward Thrust Levers

Controls engine forward thrust.

The thrust levers can only be advanced if the reverse thrust levers are down.

Fuel Control Switches

[777-200/300 Series]



[777-200/300 Series]

1 FUEL CONTROL Switch

RUN (AUTOSTART ON) –

- Opens the spar fuel valve
- arms the engine fuel valve (the EEC opens the valve when required)
- arms the selected igniters (the EEC turns the igniters on when required).

RUN (AUTOSTART OFF) –

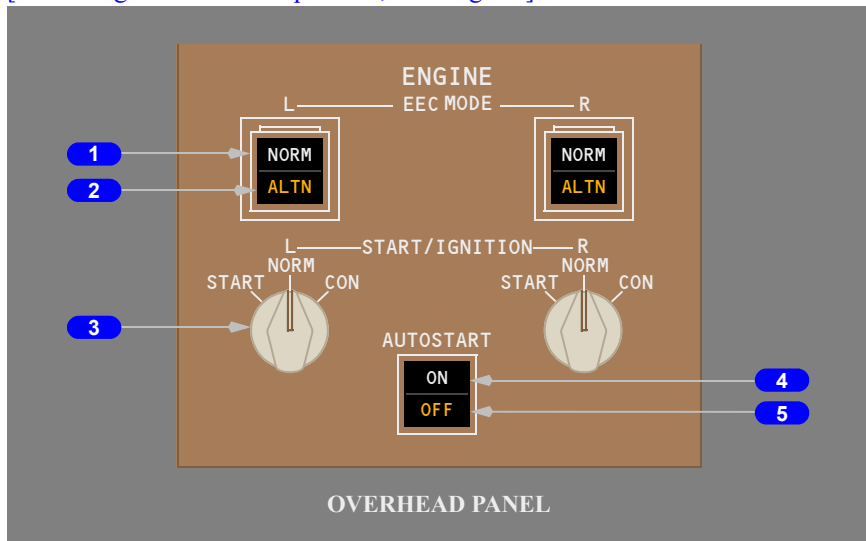
- opens the spar fuel valve
- opens the engine fuel valve
- turns igniters on.

CUTOFF –

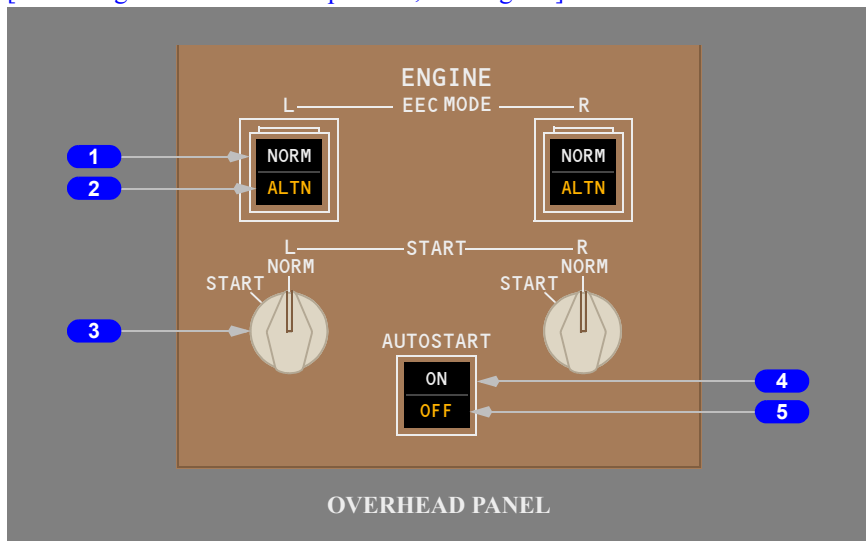
- closes the fuel valves
- removes igniter power
- unlocks the engine fire switch.

Engine Control Panel

[GE90 Engines with CON position, PW Engines]



[GE90 Engines without CON position, RR Engines]



1 Electronic Engine Control (EEC) Mode Switch

NORM –

- selects the normal engine control mode for engine control
- [\[GE Engines\]](#)
- the EEC sets thrust using N1 RPM as the controlling parameter.
- [\[PW, RR Engines\]](#)
- the EEC sets thrust using EPR as the controlling parameter.

Off (ALTN visible) –

- selects the alternate engine control mode for engine control
- thrust is set using N1 RPM as the controlling parameter.

2 Electronic Engine Control (EEC) Alternate (ALTN) Light

Illuminated (amber) – the alternate engine control mode is either automatically or manually selected.

[\[PW Engines\]](#)

3 START/IGNITION Selector

START –

- initiates engine start by opening the start valve
- releases to NORM at start valve cutout.

NORM –

- the start valve closes
- automatic ignition is provided for both igniters (if the FUEL CONTROL switch is in RUN)
- automatic ignition operates both igniters continuously for the following conditions:
 - the flap lever is out of the up position, or
 - engine anti-ice is on.

CON – both igniters operate continuously (if the FUEL CONTROL switch is in RUN).

[\[GE90 Engines with CON IGN position\]](#)

3 START/IGNITION Selector

START –

- initiates engine start by opening the start valve
- releases to NORM at start valve cutout.

NORM –

- the start valve closes
- ignition is automatically provided during engine start-up or if engine flameout occurs (if the FUEL CONTROL switch is in RUN).

777 Flight Crew Operations Manual

CON – both igniters operate continuously (if the FUEL CONTROL switch is in RUN) when:

- on ground above approximately 55% N1 with takeoff flaps set, or
- in flight.

[RR Engines]

3 START Selector

START –

- initiates engine start by opening the start valve
- releases to NORM at start valve cutout.

NORM – the start valve closes.

[777-200/300 Series]

4 AUTOSTART Switch

ON – arms the autostart system.

OFF –

- the autostart system is disabled
- the start is manually controlled.

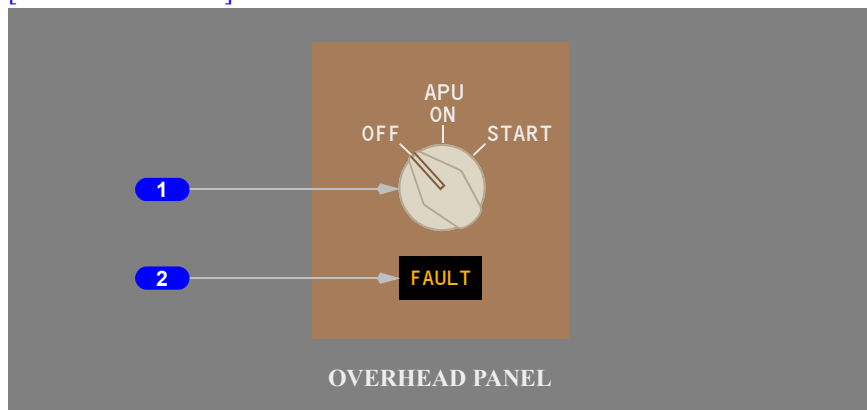
[777-200/300 Series]

5 AUTOSTART OFF Light

Illuminated (amber) – the AUTOSTART switch is OFF.

Auxiliary Power Unit (APU)**APU Controls**

[777-200/300 Series]



1 APU Selector

OFF –

- closes the APU bleed air isolation valve
- initiates normal shutdown
- resets auto shutdown fault logic.

ON (APU operating position) –

- opens the APU fuel valve and inlet door
- activates AC or DC fuel pump
- powers the APU controller.

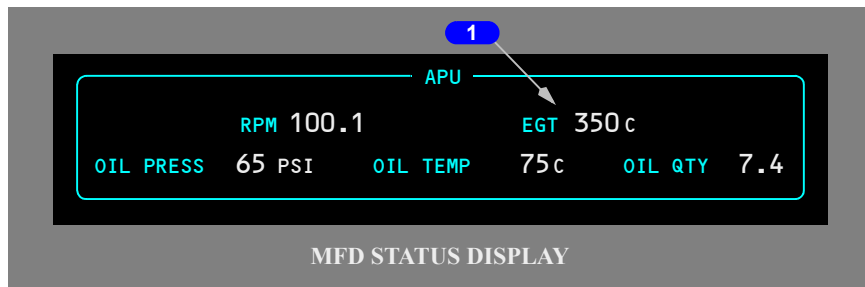
START (momentary position, spring-loaded to ON) – initiates automatic start sequence.

2 APU FAULT Light

Illuminated (amber):

- APU fault and/or fire is detected
- APU shutdown due to fault and/or fire
- momentarily during APU controller self-test.

APU Indications



1 APU Status Display

RPM – APU rotation speed in percent RPM.

EGT – APU exhaust gas temperature.

OIL PRESS – APU oil pressure in PSI.

OIL TEMP – APU oil temperature.

[\[English Units\]](#)

OIL QTY – APU oil quantity (quarts).

[\[Metric Units\]](#)

OIL QTY – APU oil quantity (liters).

Engines, APU
Engine System Description**Chapter 7**
Section 20**Introduction****[777-200/300 Series]**

The following optional engines may be installed on 777-200/300 Series airplanes. General Electric (GE), Pratt and Whitney (PW), and Rolls Royce Trent (RR) model engines are shown. The rated takeoff thrust in pounds for each engine is shown in (parentheses).

- PW4074 (77,440)
- PW4077 (79,960)
- PW4084 (86,760)
- PW4090 (91,790)
- PW4098 (99,040)
- GE90-76B (81,070)
- GE90-77B (81,700)
- GE90-85B (88,870)
- GE90-90B (94,000)
- GE90-94B (97,300)
- GE90-110B1L (110,760)
- GE90-115B (115,540)
- RR Trent 875 (76,580)
- RR Trent 877 (78,910)
- RR Trent 884 (85,430)
- RR Trent 892 (91,450)
- RR Trent 895 (92,940)

[GE, PW Engines]

The engines are dual rotor axial flow turbofans of high compression and bypass ratio. The N1 rotor consists of a fan, a low pressure compressor section, and a low pressure turbine section on a common shaft. The N2 rotor consists of a high pressure compressor section and a high pressure turbine section on a common shaft. The N1 and N2 rotors are mechanically independent. The N2 rotor drives the engine accessory gearbox.

[RR Engines]

The engines are three-rotor axial flow turbofans of high compression and bypass ratio. The N1 rotor consists of the fan and a low pressure turbine section on a common shaft. The N2 rotor consists of an intermediate pressure compressor section and an intermediate pressure turbine section on a common shaft. The N3 rotor consists of a high pressure compressor section and a high pressure turbine section on common shaft. The N1, N2, and N3 rotors are mechanically independent. The N3 rotor drives the engine accessory gearbox.

Each engine is controlled by an EEC. The EECs monitor autothrottle and flight crew inputs through the thrust levers to automatically control the engines.

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. See Chapter 11, Flight Management, Navigation, for a description of FMC thrust management functions.

Engine indications are displayed on the EICAS display.

Engine Intermix

[GE Engines]

Both engines are set to operate at the same thrust rating. Replacement engine thrust rating is increased or decreased to match the thrust rating of the installed engine configuration. An EGT amber band (maximum continuous limit) difference between engines may be indicated, but these indications are normal.

[PW Engines]

Both engines are set to operate at the same thrust rating. Replacement engine thrust rating is increased or decreased to match the thrust rating of the installed engine configuration. An EGT red line (maximum takeoff EGT limit) difference between the engines may be indicated, but these indications are normal.

Takeoff Bump Thrust Reference Mode

[Option]

Takeoff bump (when use is approved) can be selected on the CDU THRUST LIM page. When selected, TO B is displayed as the EICAS thrust reference mode.

Takeoff bump thrust is also available whenever the airplane is in the takeoff bump region (altitude and ambient temperature range). If the thrust levers are manually positioned full forward while in the takeoff bump region, the EECs will allow thrust to increase up to the takeoff bump rating even though another thrust limit is selected on the CDU THRUST LIM page.

Engine Indications

[777-200/300 Series]

Primary and secondary engine indications are provided. Engine indications are displayed on the EICAS display and any selected MFD.

Primary Engine Indications

[PW, RR Engines]

EPR, N1, and EGT are the primary engine indications. The primary engine indications are always displayed on the EICAS display. Normally the EICAS is on the upper center display unit. If that unit fails the EICAS display automatically moves to the lower center display unit.

[GE90 Engines]

N1 and EGT are the primary engine indications. The primary engine indications are always displayed on the EICAS display. Normally the EICAS is on the upper center display unit. If that unit fails, the EICAS display automatically moves to the lower center display unit.

Secondary Engine Indications

[GE90, PW Engines]

N2, fuel flow, oil pressure, oil temperature, oil quantity, and engine vibration are secondary engine indications. Secondary engine indications are displayed on the selected MFD to provide timely indication of a change to engine parameters. The secondary engine indications can be displayed by pushing the secondary engine display switch (the ENG switch on the display select panel). The secondary engine indications are automatically displayed when the display initially receives electrical power, or:

- a FUEL CONTROL switch is moved to CUTOFF in flight

[777-200/300 Series]

- an engine fire switch is pulled in flight

[777-200/300 Series]

[Option - AIMS V16 or later installed]

- the FUEL FLOW ENG L, R alert message is displayed
- a secondary engine parameter is exceeded, or
- engine N2 RPM is below idle in flight.

[RR Engines]

N2, N3, fuel flow, oil pressure, oil temperature, oil quantity, and engine vibration are secondary engine indications. Secondary engine indications are displayed on the selected MFD to provide timely indication of a change to engine parameters. The secondary engine indications can be displayed by pushing the secondary engine display switch (the ENG switch on the display select panel). The secondary engine indications are automatically displayed when the display initially receives electrical power, or:

- a FUEL CONTROL switch is moved to CUTOFF in flight
- an engine fire switch is pulled in flight
- a secondary engine parameter is exceeded, or
- engine N3 RPM is below idle in flight.

The secondary engine display:

[777-200/300 Series]

- Shows on the lower MFD, if available
- Shows and latches any time the secondary engine indications are automatically displayed
- Shows again, if latched, after any other display page is selected then blanked
- Can be cleared by pushing the secondary engine display switch, if the display is not latched

Automatic display of secondary engine indications is for crew awareness and does not require pilot action.

Only parameters with published operating limits generate EICAS messages. In general, procedures are written so that flight crews are not required to analyze or troubleshoot engine indications to diagnose problems or initiate procedures. EICAS monitors designated engine parameters and displays an EICAS alert message to notify the crew to take an action when published limits are exceeded. Flight crew procedures are accomplished in response to these alerts.

Normal Display Format

[GE, PW Engines]

Primary engine indications and the N2 indications are both digital readouts and round dial/moving pointer indications. The digital readouts display numerical values while the moving pointers indicate relative value.

[RR Engines]

Primary engine indications and the N3 indication are digital readouts and round dial/moving pointer indications. The digital readouts display numerical values while the moving pointers indicate relative value.

[GE, PW Engines]

Oil pressure, oil temperature, and 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 dial and vertical indications display the normal operating range, caution range, and operating limits (as applicable).

[RR Engines]

Oil pressure, oil temperature, and vibration indications are both digital readouts and vertical indication/moving pointers. Fuel flow, N2, and oil quantity are digital readouts only. All digital readouts are enclosed by boxes. The dial and vertical indications display the normal operating range, caution range, and operating limits (as applicable).

Normal operating range is displayed on a dial or vertical indication in white.

[PW Engines]

The oil temperature vertical indication has caution ranges displayed by amber bands. If oil temperature reaches the caution range, the digital readout, digital readout box, and pointer all change color to amber.

[GE90, RR Engines]

The oil temperature and oil pressure vertical indication has caution ranges displayed by amber bands. If oil temperature or oil pressure reaches the caution range, the digital readout, digital readout box, and pointer all change color to amber.

[GE, PW Engines]

N1, N2, EGT, oil pressure, and oil temperature indications have operating limits indicated by red lines. If one of these indications reaches the red line, the digital readout, box, and pointer change color to red for that indication.

[RR Engines]

N1, EGT, N3, oil pressure, and oil temperature indications have operating limits indicated by red lines. If one of these indications reaches the red line, the digital readout, box, and pointer change color to red for that indication.

[Option – 5 Minute Takeoff Inhibit]

The EGT indication has a maximum continuous limit represented by an amber band. The maximum continuous limit does not apply during takeoff or go-around. If EGT reaches the maximum continuous limit, the digital indication, box, pointer, and dial all change color to amber. EGT indications are inhibited from changing to amber during takeoff or go-around for five minutes. The EGT indication is often in the amber band during takeoff; this is acceptable. The EGT indication has a maximum takeoff limit displayed by a red line. If EGT reaches the maximum takeoff limit, the digital indication, box, pointer and dial, all change color to red.

[Option – 10 Minute Takeoff Inhibit]

The EGT indication has a maximum continuous limit represented by an amber band. The maximum continuous limit does not apply during takeoff or go-around. If EGT reaches the maximum continuous limit, the digital indication, box, pointer, and dial all change color to amber. EGT indications are inhibited from changing to amber during takeoff or go-around for five minutes. The EGT indication is often in the amber band during takeoff; this is acceptable. The inhibit is extended to ten minutes for single-engine operation. The EGT indication has a maximum takeoff limit displayed by a red line. If EGT reaches the maximum takeoff limit, the digital indication, box, pointer and dial, all change color to red.

[GE, PW Engines]

If an N1, N2, or EGT red line is exceeded, the box enclosing the digital readout remains red after the exceeded limit returns to the normal range. The red box color can be canceled to white or recalled to red by pushing the cancel/recall switch on the display select panel. An indication changes color back to white when it returns to the normal operating range.

[RR Engines]

If an N1, N3, or EGT red line is exceeded, the box enclosing the digital readout remains red after the exceeded limit returns to the normal range. The red box color can be canceled to white or recalled to red by pushing the cancel/recall switch on the display select panel. An indication changes color back to white when it returns to the normal operating range.

For low oil quantity, the oil quantity digital readout changes to black text on a white background. The white text LO is displayed adjacent to the readout.

For high engine vibration, the vibration digital readout changes to black text on a white background.

[PW, RR Engines]

The maximum EPR limit is indicated by an amber line at the top of the EPR dial. The EPR indication does not change color when maximum EPR is reached. The reference/target EPR indication displays the FMS reference or target EPR. The commanded EPR indication displays the EEC calculated EPR commanded by thrust lever position.

Compact Display Format

[PW Engines]

In compact format, primary and secondary engine indications are combined on the same display. The EPR and N1 displays are the same as the normal displays. All other indications change to digital readouts only. If an amber or red line parameter for a digital indication is exceeded, the digital indication changes color to amber or red (as does the box that appears around an EGT, or N2 indication for a red line exceedance). If the EGT or N2 red line is exceeded, the red color of the box around the digital indication can be returned to white (if the exceeded parameter has returned to normal) by pushing the display select panel CANCEL/RECALL switch.

[GE90 Engines]

In compact format, primary and secondary engine indications are combined on the same display. The N1 and EGT indications are displayed as they are normally (moving pointer/round dial and digital indications). All other indications change to digital readouts only, with the exception that the N2 digital readout is boxed if a parameter is exceeded. If an amber or red line parameter for a digital indication is exceeded, the digital indication changes color to amber or red (as does the box that appears around the N2 indication for a red line exceedance). If the N2 red line is exceeded, the red color of the box around the digital indication can be returned to white (if the exceeded parameter has returned to normal) by pushing the display select panel CANCEL/RECALL switch.

[RR Engines]

In compact format, primary and secondary engine indications are combined on the same display. The EPR and N1 displays are the same as the normal displays. All other indications change to digital readouts only. If an amber or red line parameter for a digital indication is exceeded, the digital indication changes color to amber or red (as does the box that appears around an EGT, N2, or N3 indication). If the N1, N2, N3, or EGT red line is exceeded, the red color of the box around the digital indication can be returned to white (if the exceeded parameter has returned to normal) by pushing the display select panel CANCEL/RECALL switch.

Primary and secondary engine indications are displayed on EICAS in compact format whenever:

- secondary engine display is automatically selected, and the lower multifunction display is failed, unpowered, or is occupied, or
- secondary engine display is manually selected to the lower center MFD and the lower MFD is failed, unpowered, or occupied with EICAS.

Electronic Engine Control (EEC)

[PW, RR Engines]

Each EEC has full authority over engine operation. The EEC uses thrust lever inputs to automatically control forward thrust and reverse thrust. The EEC has two control modes: normal and alternate. In the normal mode, the EEC uses EPR as the parameter for setting thrust. In the alternate mode, the EEC uses N1 RPM as the controlling parameter.

[PW Engines]

At altitudes of 17,000 feet and above, compressor stall protection logic causes the engines to accelerate slowly if the acceleration is initiated shortly after a deceleration. The engines may accelerate at slightly different rates. Thrust asymmetry compensation (TAC) may activate.

[GE Engines]

Each EEC has full authority over engine operation. The EEC uses thrust lever inputs to automatically control forward thrust and reverse thrust. The EEC has two control modes: normal and alternate. In both normal and alternate modes, the EEC uses N1 RPM as the parameter for setting thrust.

EEC Normal Mode

[PW, RR Engines]

In the normal mode, the EEC sets thrust by controlling EPR based on thrust lever position. EPR is commanded by positioning the thrust levers either automatically with the autothrottles, or manually by the flight crew.

[GE Engines]

In the normal mode, the EEC sets thrust by controlling N1 based on thrust lever position. N1 is commanded by positioning the thrust levers either automatically with the autothrottles, or manually by the flight crew.

[PW, RR Engines]

Maximum EPR represents the maximum rated thrust available from the engine. The EEC continuously computes maximum EPR.

[GE Engines]

Maximum N1 represents the maximum rated thrust available from the engine. The EEC continuously computes maximum N1.

Maximum rated thrust is available in any phase of flight by moving the thrust levers to the full forward positions.

EEC Alternate Mode

If the required signals are not available to operate in the normal mode, the EEC automatically uses the alternate mode. In the alternate mode, the EEC schedules N1 as a function of thrust lever position. The alternate mode provides soft and hard levels of control:

- Soft – When the EEC automatically switches an engine to the alternate mode and the EEC mode switch remains in NORM, the EEC is in the soft alternate mode (the switch position is NORM, the EEC mode is alternate). At a fixed thrust lever position, thrust does not change.
- Hard – When ALTN is manually selected on an EEC mode switch, that engine is switched to the hard alternate mode (the switch position is ALTN, the EEC mode is alternate). Reference and target N1, and maximum and commanded N1 values are displayed on the N1 indication during the hard alternate mode. Thrust may change to set the commanded N1 when ALTN is manually selected.

[PW, RR Engines]

EEC mode switch – NORM EEC mode – Normal	EEC mode switch – NORM EEC mode – Soft Alternate	EEC mode switch – ALTN EEC mode – Hard Alternate
<ul style="list-style-type: none">• EPR: actual, command, reference/target , maximum• N1: actual, red line.	<ul style="list-style-type: none">• EPR: blank• N1: actual, red line.	<ul style="list-style-type: none">• EPR: blank• N1: actual, command, reference/target , maximum, red line.

[GE Engines]

For the normal, soft alternate, and hard alternate modes, actual, command, reference/target, maximum, and red line N1 information is displayed.

Automatic reversion or manual selection to the alternate mode is indicated by the EICAS advisory message ENG EEC MODE (L, R) and illumination of the EEC ALTN light on the associated EEC mode switch. Selecting the alternate mode on both engines eliminates thrust lever stagger at equal thrust settings, or asymmetric thrust when the thrust levers are operated together.

The autothrottles remain engaged whenever the EEC automatically switches to the alternate mode. The alternate mode N1 reference/target values are computed by the FMC.

Note: The autothrottles remains connected whenever the EEC is in the alternate mode.

The alternate mode schedule (N1 schedule) provides equal or greater thrust than the normal mode for the same thrust lever position.

Thrust protection is not provided in the alternate mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions. The EICAS caution message ENG LIMIT PROT (L, R) is displayed if the thrust lever position commands an N1 greater than the maximum rated thrust (maximum N1).

[\[Option GE, PW Engines\]](#)

N1 and N2 red line protection is provided in the alternate control mode.

[\[Option RR Engines\]](#)

N1, N2, and N3 red line protection is provided in the alternate control mode.

Overspeed Protection

[\[Option GE, PW Engines\]](#)

The EEC also provides N1 and N2 red line overspeed protection. If N1 or N2 approaches overspeed, the EEC commands reduced fuel flow. The EICAS advisory message ENG RPM LIMITED (L or R) is provided when overspeed protection is provided.

[\[Option RR Engines\]](#)

The EEC also provides N1, N2, and N3 red line overspeed protection. If N1, N2, or N3 approaches overspeed, the EEC commands reduced fuel flow. The EICAS advisory message ENG RPM LIMITED (L or R) is provided when overspeed protection is provided.

If the EECs are in alternate mode, advancing the thrust levers full forward provides some overboost and should be considered only during emergency situations when all other available actions have been taken and terrain contact is imminent.

Engine Idle

[\[GE, PW Engines\]](#)

The EEC selects minimum idle or approach idle. Minimum idle is a lower thrust than approach idle.

[\[RR Engines\]](#)

The EEC selects minimum idle, intermediate idle, or approach idle. Minimum idle is a lower thrust than approach idle or intermediate idle. Intermediate idle is selected when the Landing Gear lever DN.

Approach idle is selected in flight when:

- engine anti-icing is operating
- the flaps are commanded to 25 or greater
- one hydraulic system air-driven demand pump is inoperative, and the flaps are out of the UP position
- the opposite engine bleed air valve is closed

Approach idle decreases acceleration time for go-around. Approach idle is maintained until after touchdown, when minimum idle is selected.

Thrust Control Malfunction Protection

[\[GE Engines 90-110/115B\]](#)

The EEC provides protection against an uncontrolled high thrust malfunction during ground operation. The EEC shuts down the affected engine when:

- airplane is on ground,
- thrust lever is at idle, and
- engine is above idle speed and not decelerating normally.

The EICAS caution message ENG FAIL (L or R) is displayed when the engine falls below idle speed.

Engine Start and Ignition System

[\[777-200/300 Series\]](#)

The engines can be started using the autostart system or manually. Autostart is the normal starting mode. Selecting OFF on the AUTOSTART switch disables autostart and allows manual, pilot-monitored, starting.

[\[GE, PW Engines\]](#)

Bleed air powers the starter motor, which is connected to the N2 rotor. The starter air source is normally the APU, but air from ground carts or another running engine can be used.

[\[RR Engines\]](#)

Bleed air powers the starter motor, which is connected to the N3 rotor. The starter air source is normally the APU, but air from ground carts or another running engine can be used.

[\[Option - GE90, PW Engines with CON IGN position\]](#)

The START/IGNITION selectors control the starter air valves and provide continuous ignition capability. Ignition and fuel flow are controlled through the FUEL CONTROL switches.

[Option - RR Engines, GE90 Engines without CON IGN position]

The START selectors control the starter air valves. Ignition and fuel flow are controlled through the FUEL CONTROL switches.

[GE90 Engines with CON IGN position]

At approximately idle N2 RPM, the EEC commands starter cutout, and the START/IGNITION selector releases to the NORM position.

[RR Engines]

The EEC monitors the start and commands starter cutout at 50 percent N3 RPM. The START selector releases to the NORM position.

[PW Engines]

The EEC monitors the start to determine the optimum N2 RPM for starter cutout. At that RPM, the EEC commands starter cutout, and the START/IGNITION selector releases to the NORM position.

[GE, PW Engines]

A maximum start limit line (red) is displayed on the EGT indication when the FUEL CONTROL switch is moved to CUTOFF or engine N2 RPM is below idle. It remains displayed after the FUEL CONTROL switch is moved to RUN until the engine is stabilized at idle. The EGT indication changes color to red if the EGT start limit is reached during starting.

[RR Engines]

A maximum start limit line (red) is displayed on the EGT indication when the FUEL CONTROL switch is moved to CUTOFF or engine N3 RPM is below idle. It remains displayed after the FUEL CONTROL switch is moved to RUN until the engine is stabilized at idle. The EGT indication changes color to red if the EGT start limit is reached during starting.

Autostart**[PW Engines]**

Autostart allows the EEC to control fuel and ignition. With the AUTOSTART switch ON, the autostart sequence is initiated by rotating the START/IGNITION selector to START and moving the FUEL CONTROL switch to RUN. For in-flight windmill starts the autostart sequence is initiated by moving the FUEL CONTROL switch to RUN.

The START/IGNITION selector opens the starter air valve to begin dry motoring the engine. Moving the FUEL CONTROL switch to RUN opens the spar fuel valve, but not the engine fuel valve. The proper sequencing of fuel and ignition is controlled by the autostart system. With the FUEL CONTROL switch positioned to RUN, the EEC opens engine fuel valve and energizes the igniter(s) at the appropriate N2 RPM.

During autostart, the EEC monitors EGT, N2 RPM, and other engine parameters until the engine reaches idle. During ground start, the autostart system monitors engine parameters and will abort the start for any of the following:

- hot start
- hung start
- no EGT rise
- compressor stall
- starter shaft failure
- no N1 rotation
- insufficient air pressure for starter operation
- start time exceeds the starter duty cycle timer.

Note: The autostart system does not monitor oil pressure and temperature.

If a hot start, hung start, no EGT rise, or compressor stall is detected, and N2 RPM is less than the starter cutout speed, the EEC turns off fuel and ignition and motors the engine for approximately 30 seconds before making a second attempt. The second attempt uses both igniters. On the ground, if the second attempt fails, the EEC aborts the start. Fuel and ignition are shut off, and the engine is motored for 30 seconds to clear residual fuel. The starter air valve then closes and the START/IGNITION selector releases to the NORM position. The EICAS caution message ENG AUTOSTART (L or R) is displayed.

On the ground, autostart does not attempt a second start if there is no N1 rotation, insufficient air pressure, the starter shaft fails, the start time exceeds the starter duty cycle, or the start is aborted above starter cutout speed and the EICAS caution message ENG AUTOSTART (L or R) is displayed.

Note: For some conditions, the EEC may rapidly cycle fuel off and on in an attempt to clear the condition.

Note: For in-flight starts, the autostart system temporarily discontinues the start if the takeoff EGT limit is exceeded. Autostart takes corrective action if some start problems are detected, but does not abort the start.

Whenever the AUTOSTART switch is selected OFF, the EICAS advisory message ENG AUTOSTART OFF is displayed and the AUTOSTART switch OFF light illuminates.

Autostart

[GE90 Engines with CON IGN position]

Autostart allows the EEC to control fuel and ignition. With the AUTOSTART switch ON, the autostart sequence is initiated by rotating the START/IGNITION selector to START and moving the FUEL CONTROL switch to RUN. For in-flight windmill starts the autostart sequence is initiated by moving the FUEL CONTROL switch to RUN.

The START/IGNITION selector opens the starter air valve to begin dry motoring the engine. Moving the FUEL CONTROL switch to RUN opens the spar fuel valve, but not the engine fuel valve. The proper sequencing of fuel and ignition is controlled by the autostart system. With the FUEL CONTROL switch positioned to RUN, the EEC opens engine fuel valve and energizes the igniter(s) at the appropriate N2 RPM.

During autostart, the EEC monitors EGT, N2 RPM, and other engine parameters until the engine reaches idle. During ground start, the autostart system monitors engine parameters and will abort the start for any of the following:

- hot start
- hung start
- no EGT rise
- compressor stall
- starter shaft failure
- no N1 rotation
- insufficient air pressure for starter operation
- start time exceeds the starter duty cycle timer.

Note: The autostart system does not monitor oil pressure and temperature.

If a hot start, hung start, no EGT rise, or compressor stall is detected, and N2 RPM is less than starter cutout speed, the EEC turns off fuel and ignition and motors the engine for 4 seconds before making a second or third attempt. The second attempt uses both igniters. If the second attempt fails, a third attempt is made by adjusting the starting fuel flow. If N2 RPM is greater than starter cutout speed, the EEC turns off fuel and ignition, closes the starter air valve and allows the engine to spool down below 30 percent N2 RPM. It then reopens the starter air valve and motors the engine before re-introducing fuel and ignition for subsequent attempt(s).

On the ground, if all attempts fail, the EEC aborts the start. Fuel and ignition are shut off and the engine is motored for 30 seconds to clear residual fuel. The starter air valve then closes and the START/IGNITION selector releases to the NORM position. The EICAS caution message ENG AUTOSTART (L or R) is displayed.

On the ground, autostart does not attempt a second or third start if there is no N1 rotation, insufficient air pressure, the starter shaft fails, or the start time exceeds the starter duty cycle. The EICAS caution message ENG AUTOSTART (L or R) is displayed.

Note: For in-flight starts, the autostart system temporarily discontinues the start if a preset EGT between the start and takeoff EGT red line limits is reached, or a hung start is detected. Autostart takes corrective action if some start problems are detected, but does not abort the start.

Whenever the AUTOSTART switch is selected OFF, the EICAS advisory message ENG AUTOSTART OFF is displayed and the AUTOSTART switch OFF light illuminates.

Autostart

[RR Engines]

Autostart allows the EEC to control fuel and ignition. With the AUTOSTART switch ON, the autostart sequence is initiated by rotating the START selector to START and moving the FUEL CONTROL switch to RUN. For in-flight windmill starts the autostart sequence is initiated by moving the FUEL CONTROL switch to RUN.

The START selector opens the starter air valve to begin dry motoring the engine. Moving the FUEL CONTROL switch to RUN opens the spar fuel valve, but not the engine fuel valve. The proper sequencing of fuel and ignition is controlled by the autostart system. With the FUEL CONTROL switch positioned to RUN, the EEC opens engine fuel valve and energizes the igniter(s) above the appropriate N2 and N3 RPM.

During autostart, the EEC monitors EGT, N3 RPM, and other engine parameters until idle N3 RPM is achieved. During ground start, the autostart system monitors engine parameters and will abort the start for any of the following:

- hot start
- hung start
- no EGT rise
- compressor stall
- starter shaft failure
- no N1 rotation
- insufficient air pressure for starter operation
- start time exceeds the starter duty cycle timer.

Note: The autostart system does not monitor oil pressure and temperature.

If a hot start, hung start, no EGT rise, or compressor stall is detected and N3 RPM is less than starter cutout speed, the EEC turns off fuel and ignition and motors the engine for 20 to 30 seconds (depending on the detected condition). Following motoring and after EGT falls below 100 degrees C, the EEC re-introduces fuel and ignition using both igniters. If the second attempt fails and N3 RPM is less than starter cutout speed, the EEC turns off fuel and ignition and motors the engine for 30 seconds and until the EGT is below 100 degrees C. The starter air valve then closes and the START selector releases to the NORM position. The EICAS caution message ENG AUTOSTART (L or R) is displayed.

On the ground, if no N1 rotation, low starter air pressure, starter shaft failed condition is detected, if the starter duty cycle timer expires, or the start is aborted above starter cutout speed, the EEC aborts the autostart sequence without motoring and will not make a second attempt. The starter air valve then closes and the START selector releases to the NORM position. The EICAS caution message ENG AUTOSTART (L or R) is displayed.

Note: For in-flight starts, the autostart system temporarily discontinues the start if the takeoff EGT red line limit is reached, or if a no light-off or a hung start is detected. If one of these conditions is detected, autostart will windmill the engine for 30 seconds before making another attempt. For starter assisted in-flight starts, autostart does not motor the engine with the starter between attempts. Instead, windmill motoring is used and the starter is re-engaged on the following start attempt. Autostart takes corrective action if some start problems are detected, but does not abort the start. During the second or subsequent start attempts autostart re-introduces fuel and ignition when the EGT falls below 200 degrees C.

Whenever the AUTOSTART switch is selected OFF, the EICAS advisory message ENG AUTOSTART OFF is displayed and the AUTOSTART switch OFF light illuminates.

Manual Start

[\[777-200/300 Series\]](#)

The AUTOSTART switch must be OFF to accomplish a manual start. The start is accomplished in accordance with the Manual Engine Start procedure (refer to Chapter SNP.7). Ignition and fuel are provided as soon as the FUEL CONTROL switch is positioned to RUN. The start must be monitored until the engine stabilizes at idle.

[\[RR Engines\]](#)

For ground starts, the FUEL CONTROL switch should not be moved to RUN until EGT is below 100 degrees C.

In-Flight Start

[\[GE, PW Engines\]](#)

In-flight start envelope information is displayed on the EICAS display when an engine is not running in flight (N2 RPM below idle RPM) or when an engine is shut down in flight and the respective engine fire switch is not pulled. The in-flight start envelope indicates the airspeed range necessary to ensure an in-flight start at the current flight level. If the current flight level is above the maximum start altitude, the maximum start altitude and respective airspeed range are displayed.

Secondary engine indications are displayed automatically when a FUEL CONTROL switch is moved to CUTOFF in flight or if N2 RPM goes below idle RPM while in flight. A crossbleed start indication is displayed next to the N2 indication if airspeed is below that recommended for a windmilling start, the in-flight start envelope is displayed, and the respective engine fire switch is in.

Refer to Engine In-Flight Start, Chapter NNC.7 for the in-flight start procedure.

For in-flight starts, autostart makes continuous start attempts until the engine either starts or the pilot aborts the start attempt by positioning the FUEL CONTROL switch to CUTOFF (and positioning the start switch to NORM if it was a starter assisted attempt).

In-Flight Start

[\[RR Engines\]](#)

In-flight start envelope information is displayed on the EICAS display when an engine is not running in flight (N3 RPM below idle RPM) or when an engine is shut down in flight and the respective engine fire switch is not pulled. The in-flight start envelope indicates the airspeed range necessary to ensure an in-flight start at the current flight level. If the current flight level is above the maximum start altitude, the maximum start altitude and respective airspeed range are displayed.

Secondary engine indications are displayed automatically when a FUEL CONTROL switch is moved to CUTOFF in flight or if N3 RPM goes below idle RPM while in flight. A crossbleed start indication is displayed next to the N3 indication if airspeed is below that recommended for a windmilling start.

Refer to Engine In-Flight Start, Chapter NNC.7 for the in-flight start procedure.

For in-flight starts, autostart makes continuous start attempts until the engine either starts or the pilot aborts the start attempt by positioning the FUEL CONTROL switch to CUTOFF (and positioning the START switch to NORM if it was a starter assisted attempt).

During a windmilling in-flight start, the EEC monitors engine parameters to provide the best fuel schedule to ensure the shortest possible start time.

Engine Ignition

Each engine has two igniters. The EEC automatically selects the appropriate igniter(s). The EEC alternates igniters for successive engine ground starts. Dual igniters are always used for in-flight starts.

Main AC power is the normal power source for ignition. Standby AC power provides a backup source.

[PW Engines]

By positioning the START/IGNITION selector to CON, continuous ignition is selected. Both igniters operate continuously when the respective FUEL CONTROL switch is placed to RUN. The igniters are turned off when the FUEL CONTROL switch is placed to CUTOFF. When the START/IGNITION selector is in the NORM position, continuous ignition is automatically provided whenever:

- the flap lever is out of the UP position, or
- engine anti-ice is on.

[GE90 Engines with CON IGN position]

By positioning the START/IGNITION selector to CON with the FUEL CONTROL switch in RUN, continuous ignition is selected. In flight, both igniters operate continuously. On the ground, both igniters operate continuously if the flaps are set for takeoff and N1 is above approximately 55%. The igniters are turned off when the FUEL CONTROL switch is placed to CUTOFF.

[GE90 Engines with CON IGN position]

When the START/IGNITION selector is in the NORM position and a flameout is detected, continuous ignition is automatically provided until three seconds after the flameout condition is cleared whenever:

- the flap lever is out of the UP position, or
- engine anti-ice is on.

[GE90 Engines]

On the ground, continuous ignition is inhibited when N1 is below approximately 55%.

Auto-Relight**[PW Engines]**

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 a rapid decrease in N2 occurs, or N2 is less than idle RPM.

[GE Engines except GE9X]

An auto-relight capability is provided for flameout protection and sub-idle stall recovery. If the EEC detects an engine flameout, both igniters activate. A flameout is detected when a rapid decrease in N2 occurs, or N2 is less than idle RPM. If a sub-idle stall is detected, fuel is shut off for one second in an attempt to clear the stall.

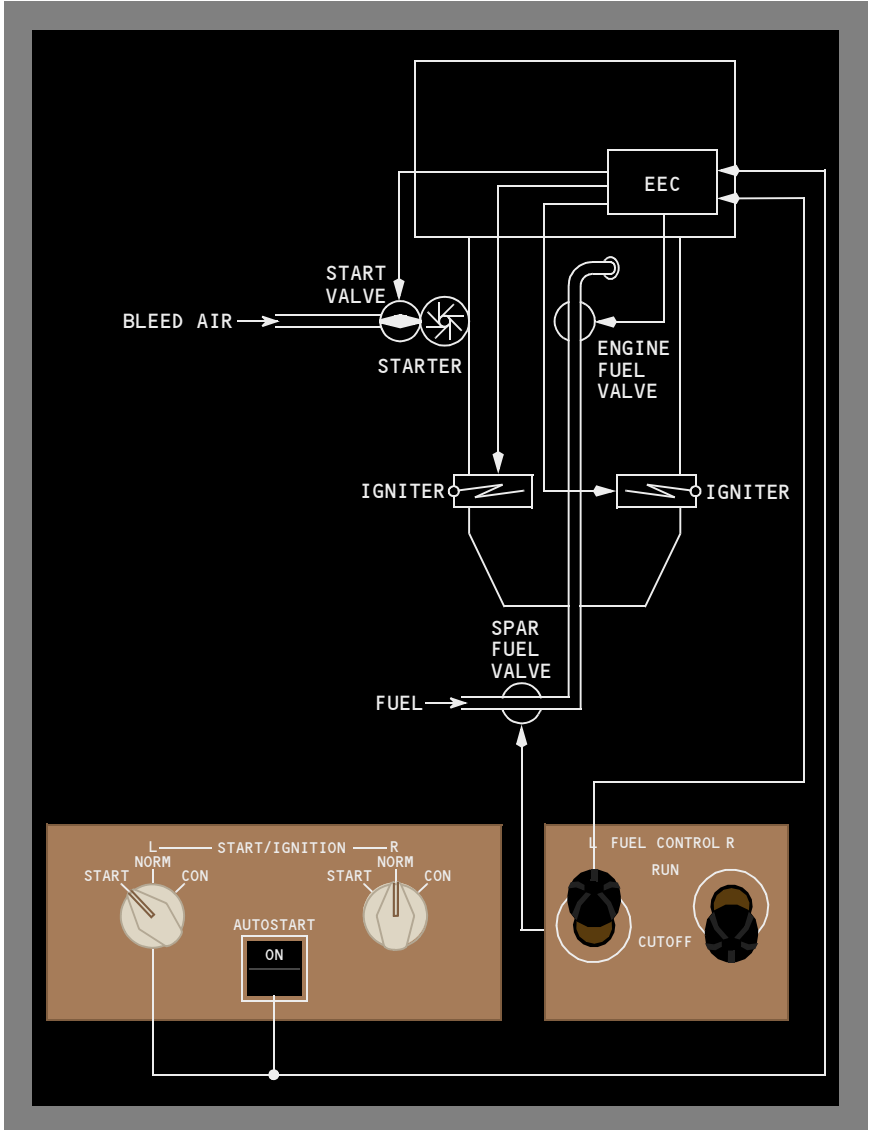
[\[RR Engines\]](#)

There is no manual continuous ignition selection or automatic continuous ignition function. Engine flameout protection is provided for an auto-relight and rain/hail ingestion. The auto-relight function is activated whenever an engine is at or below idle with the FUEL CONTROL switch in RUN. When the EEC detects an engine flameout, the respective engine igniters are activated. If the engine does not recover and continues to run down below 35% N3, the EEC shuts off fuel and ignition and disables the auto-relight function.

The EEC also provides protection against flameout during periods of excessive rain/hail ingestion. When a flameout is detected, the EEC energizes both igniters.

Engine Start and Ignition System Schematic

[777-200/300 Series]



Engine Fuel System

[PW, RR Engines]

Fuel is supplied by fuel pumps located in the fuel tanks. The fuel flows through a spar fuel valve located in the main tank. It then passes through the first stage engine fuel pump where additional pressure is added. It flows through a fuel/oil heat exchanger where it is preheated. A fuel filter removes contaminants. The second stage of the engine fuel pump adds more pressure before the fuel reaches the fuel metering unit. The fuel metering unit adjusts fuel flow to meet thrust requirements. The fuel then flows through the engine fuel valve into the engine.

[GE Engines]

Fuel is supplied by fuel pumps located in the fuel tanks. The fuel flows through a spar fuel valve located in the main tank. It then passes through the first stage engine fuel pump where additional pressure is added. The second stage of the engine fuel pump adds more pressure. It flows through a fuel/oil heat exchanger where it is preheated. A fuel filter removes contaminants. The fuel then reaches the fuel metering unit. The fuel metering unit adjusts fuel flow to meet thrust requirements. The fuel then flows through the engine fuel valve into the engine.

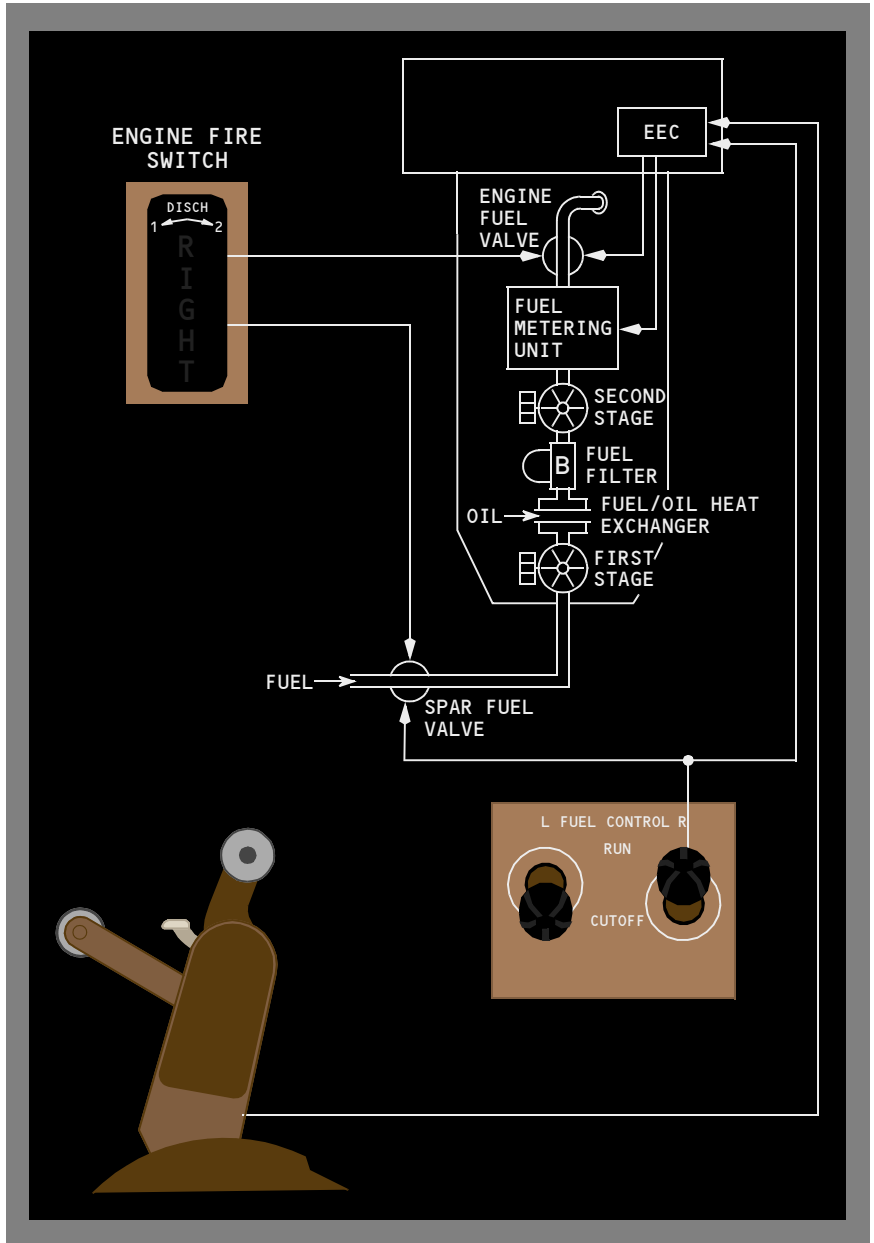
[777-200/300 Series]

The spar and engine fuel valves allow fuel flow to the engine when both valves are open. The valves open when the engine fire switch is IN and the FUEL CONTROL switch is in RUN. Both valves close when either the FUEL CONTROL switch is in CUTOFF or the engine fire switch is OUT.

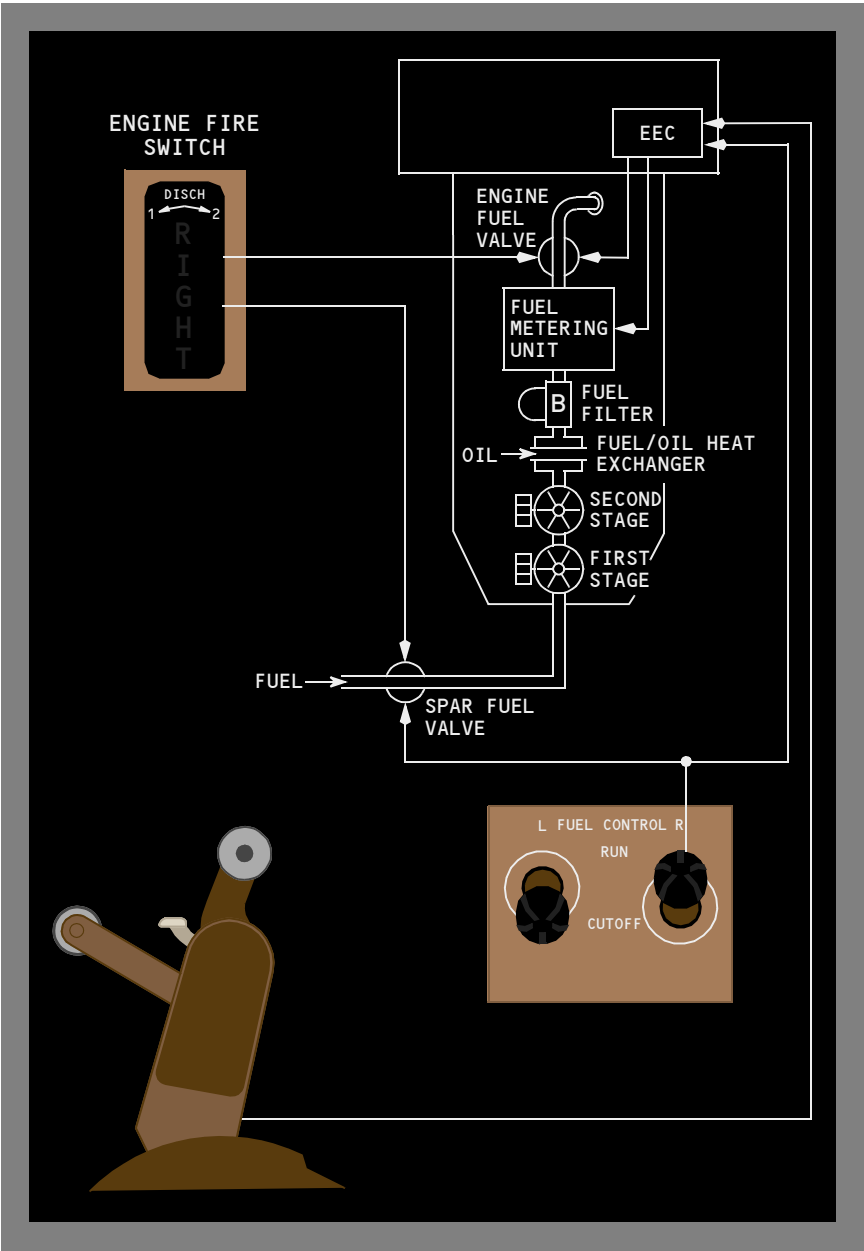
Fuel flow is measured after passing through the engine fuel valve. Fuel flow is displayed on the secondary engine display. Fuel flow information is also provided to the FMS.

Engine Fuel System Schematic

[PW, RR Engines]



[GE90 Engines]



Engine Oil System

The oil system provides pressurized oil to lubricate and cool the engine main bearings, gears and accessory drives. The oil system also provides automatic fuel heating for fuel system icing protection.

[PW Engines]

Oil is pressurized by an engine-driven oil pump. From the pump, the oil flows through a dual oil filter. The oil flows through the air/oil heat exchanger, and fuel/oil heat exchangers and is then delivered to the engine main bearings, gears, and accessory drives. A scavenge pump returns the oil to the reservoir.

[GE Engines]

Oil is pressurized by an engine-driven oil pump. From the pump, the oil flows through the oil filter. If the oil filter becomes clogged, then oil bypasses the oil filter and the EICAS advisory message ENG OIL FILTER (L, R) is displayed. The oil flows through the fuel/oil heat exchangers and then through the backup generator oil/oil heat exchanger, and is then delivered to the engine main bearings, gears, and accessory drives. A scavenge pump returns the oil to the reservoir.

[RR Engines]

Oil is pressurized by an engine-driven oil pump. From the pump, the oil flows through the high pressure oil filter. The oil flows through the air/oil heat exchanger, and fuel/oil heat exchangers and is then delivered to the engine main bearings, gears, and accessory drives. A scavenge pump returns the oil to the reservoir. Prior to the reservoir, the oil flows through a scavenge oil filter. If the scavenge oil filter becomes clogged, then oil bypasses the filter.

[GE Engines]

Oil pressure, temperature, and quantity are displayed on the secondary engine display. Oil pressure and oil temperature are measured prior to entering the engine.

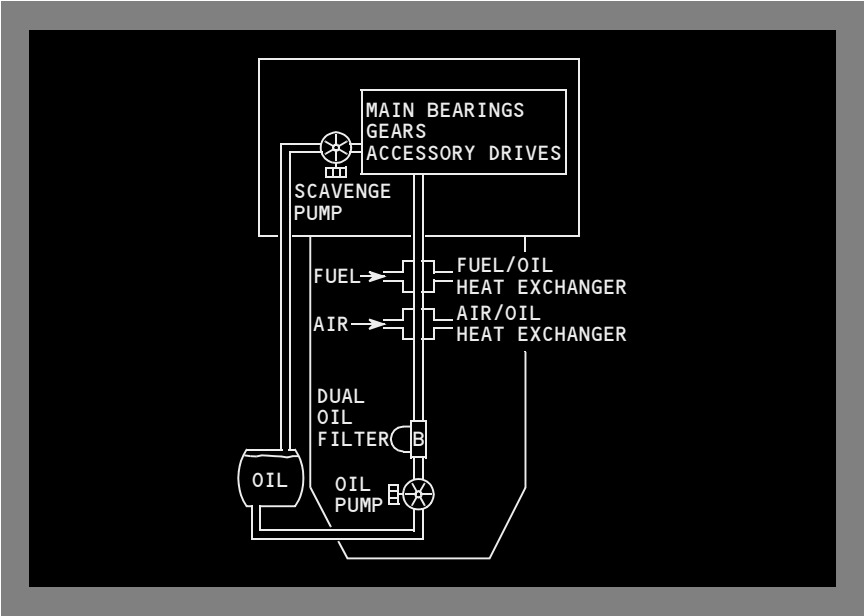
[PW, RR Engines]

Oil pressure, temperature, and quantity are displayed on the secondary engine display. Oil pressure is measured prior to entering the engine. Oil temperature is measured after leaving the engine, prior to entering the reservoir.

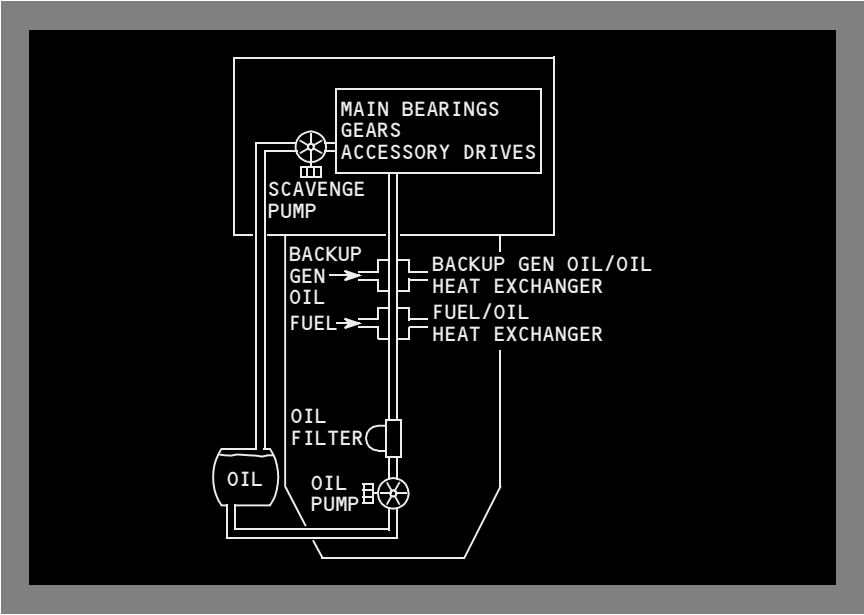
There is no minimum oil quantity limit (no amber or start limit line); however, a low oil quantity causes automatic display of the secondary engine display and reverses the display indication to show black numbers on a white background. There are no operating limitations for the engine oil quantity; therefore, there are no flight crew procedures based solely on a response to low oil quantity.

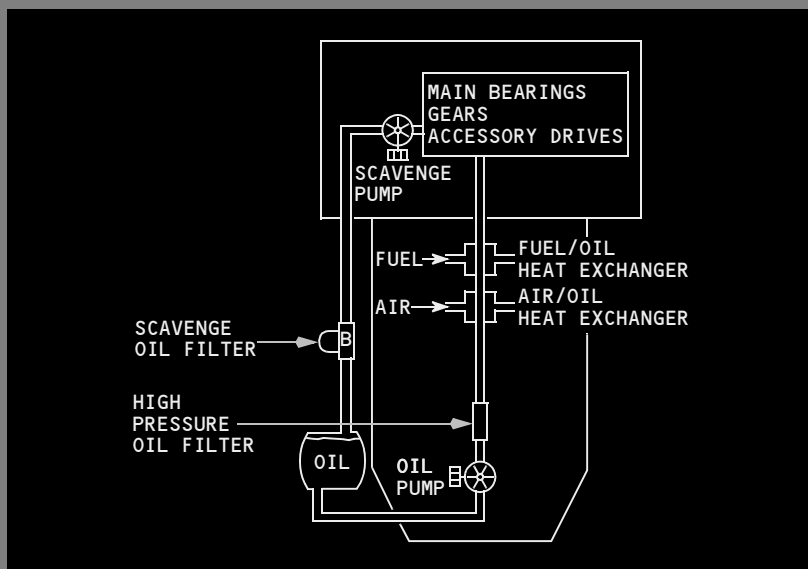
Engine Oil System Schematic

[PW Engines]



[GE Engines]



[\[RR Engines\]](#)

Thrust Reverser System

Each engine has a hydraulically actuated fan air thrust reverser. Reverse thrust is available only on the ground.

The reverse thrust levers can be raised only when the forward thrust levers are in the idle position. When the reverse thrust levers are raised, the EEC opens the reverser isolation valve. The EEC inhibits reverser isolation valve actuation and reverser deployment unless the airplane is on the ground with the engine running. The EECs also control thrust limits during reverser operation. This requirement supports asymmetric thrust airplane controllability when a thrust reverser fails to deploy.

When the reverse thrust levers are pulled aft to the interlock position:

- the autofluid disengages
- the auto speedbrakes deploy.

[PW, RR Engines]

When the reverser system is activated:

- the reverser translating sleeves hydraulically move aft
- the fan flow blocker doors rotate into place to direct fan air through stationary cascade guide vanes
- the reverser indication (REV) is displayed above each digital EPR indication (REV is displayed in amber when the reverser is in transit).

[GE Engines]

When the reverser system is activated:

- the reverser translating sleeves hydraulically move aft
- the fan flow blocker doors rotate into place to direct fan air through stationary cascade guide vanes
- the reverser indication (REV) is displayed above each digital N1 indication (REV is displayed in amber when the reverser is in transit).

When the interlock releases:

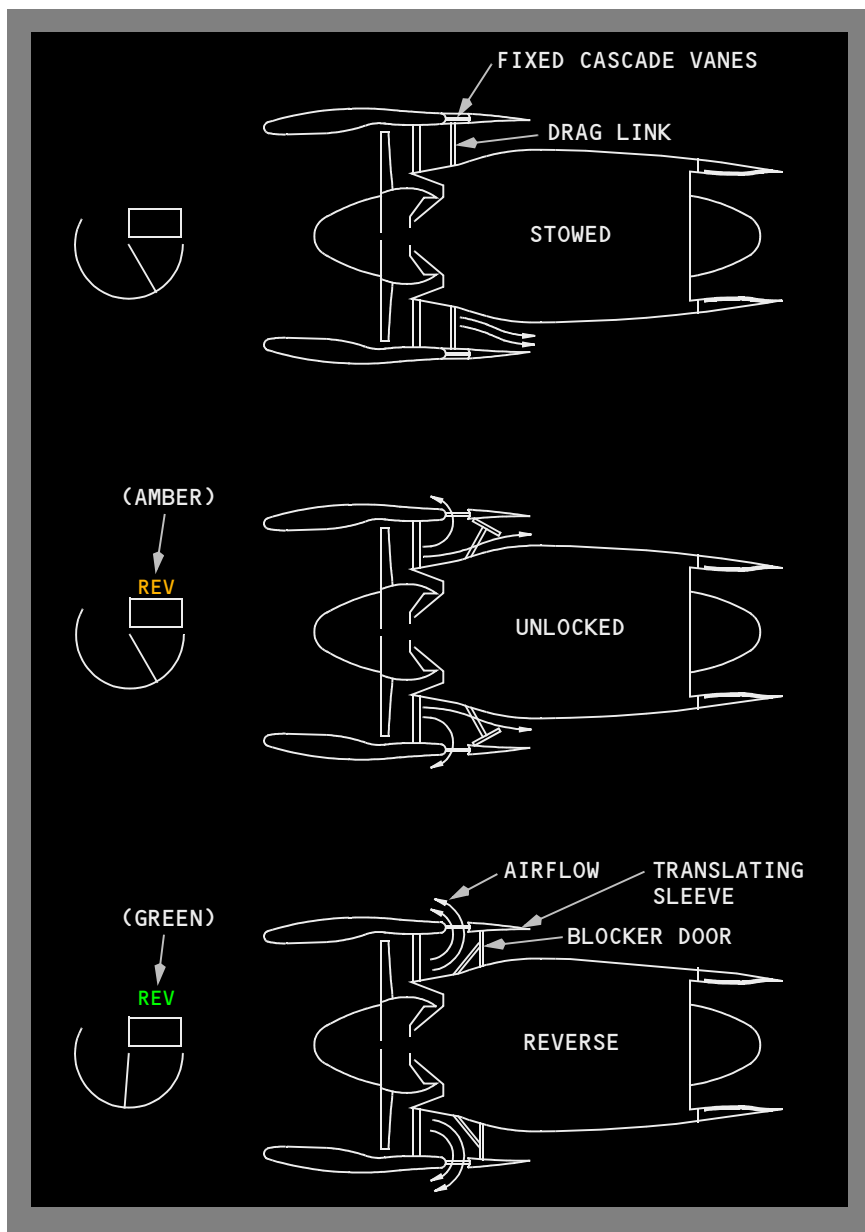
- the reverse thrust levers can be raised to the maximum reverse thrust position
- the REV indication changes to green when the reverser is fully deployed.

Pushing the reverse thrust levers to the full down position retracts the reversers to the stowed and locked position. The thrust levers cannot be moved forward until the reverse thrust levers are fully down.

The EICAS advisory message ENG REV LIMITED (L or R) is displayed if the reverser cannot deploy when commanded, or can deploy only with reverse thrust limited to idle. Not all conditions limiting or preventing reverse thrust can be detected before reverse thrust selection. For these conditions, the reverse thrust levers cannot be moved beyond the interlock position.

The EICAS advisory message ENG REVERSER (L or R) is displayed on the ground to indicate a reverser system fault.

Thrust Reverser Schematic



Airborne Vibration Monitoring System

[GE, PW Engines]

The airborne vibration monitoring system monitors engine vibration levels. The vibration indications are displayed on the secondary engine display. The vibration source indication is also displayed. If the vibration monitoring system cannot determine the source (N1 or N2), broadband (BB) is displayed for the affected engine. Broadband vibration is the average vibration detected.

[GE, PW Engines]

The airborne vibration monitoring system is primarily intended for engine condition monitoring, but it is also a useful tool for isolating and determining corrective action for engine anomalies. There is no certified vibration limit, but when a high vibration level is reached, the secondary engine parameters are automatically displayed. High N1 vibration indication would most likely be accompanied by tactile vibration. This is not the case with high N2 vibration indication. Both N1 and N2 high vibrations may be accompanied by anomalies in other engine parameters and will usually respond to thrust lever adjustment.

[RR Engines]

The airborne vibration monitoring system monitors engine vibration levels. The vibration indications are displayed on the secondary engine display. The vibration source indication is also displayed. If the vibration monitoring system cannot determine the source (N1, N2 or N3), broadband (BB) is displayed for the affected engine. Broadband vibration is the average vibration detected.

[RR Engines]

The airborne vibration monitoring system is primarily intended for engine condition monitoring, but it is also a useful tool for isolating and determining corrective action for engine anomalies. There is no certified vibration limit, but when a high vibration level is reached, the secondary engine parameters are automatically displayed. High N1 vibration indication would most likely be accompanied by tactile vibration. This is not the case with high N2 or N3 vibration indication. N1, N2, and N3 high vibrations may be accompanied by anomalies in other engine parameters and will usually respond to thrust lever adjustment.

[All Engines]

Certain engine malfunctions can result in airframe vibrations from the windmilling engine. As the airplane transitions from cruise to landing, there can be multiple, narrow regions of altitudes and airspeeds where the vibration level can become severe. In general, airframe vibrations can best be reduced by descending and reducing airspeed. However, if after descending and reducing airspeed, the existing vibration level is unacceptable, and if it is impractical to further reduce airspeed, the vibration level may be reduced to a previous, lower level by a slight increase in airspeed.

Engine Failure Alert System

The engine failure alert system provides alerts when actual engine performance is less than commanded engine performance during a part of the takeoff and for other phases of flight.

A red ENG FAIL is displayed on the PFD if actual thrust is less than commanded thrust during takeoff with airspeed between 65 knots and 6 knots prior to V₁. The PFD display is accompanied by the voice annunciation ENGINE FAIL and the Master WARNING lights illuminating.

The EICAS caution message ENG FAIL (L or R) is displayed if an engine unexpectedly decelerates to less than idle speed. The message remains displayed until the engine recovers or the fuel control switch is moved to CUTOFF.

The EICAS caution message ENG THRUST (L or R) is displayed if:

- actual thrust is significantly less than commanded thrust, or
- actual thrust is not increasing to commanded thrust, and
- airspeed is V₁ - 6 knots or greater.

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Engines, APU
APU System Description**Chapter 7**
Section 30

Introduction

The auxiliary power unit (APU) is a self-contained gas turbine engine located in the airplane tail cone.

The APU can be started and operated to the airplane maximum certified altitude.

[\[777-200/300 Series\]](#)

The APU supplies bleed air and electrical power. Electrical power has priority over bleed air. Electrical power is available throughout the airplane operating envelope. Bleed air is available at or below 22,000 feet.

Refer to the following chapters for additional information:

- Chapter 2, Air Systems, for a description of APU bleed air operation
- Chapter 6, Electrical, for a description of APU electrical operation
- Chapter 8, Fire Protection, for a description of the APU fire protection system
- Chapter 12, Fuel, for a description of the APU fuel system.

APU Operation**APU Start**

The APU is started either by an electric start motor or an air turbine starter.

The electric starter is powered by the APU battery. The main airplane battery powers the inlet door, fuel valve, and fire detection system.

The air turbine starter uses engine bleed air or ground cart air to start the APU.

Starter selection is automatic. The air turbine starter has priority over the electric start motor when there is sufficient bleed air duct pressure.

Rotating the APU selector to START begins the automatic start sequence.

APU fuel is supplied from the left fuel manifold by any operating AC fuel pump or the DC fuel pump. With AC power available and the APU selector in the ON position, the left forward fuel pump operates automatically.

If AC power is not available or no AC pump pressurizes the left fuel manifold, the DC pump in the left main tank provides APU fuel. On the ground, the APU can be started with no pumps operating.

When the APU air inlet door reaches the full open position the starter engages. After the APU reaches the proper speed, ignition and fuel are provided. When the APU reaches approximately 50 percent, the starter disengages and ignition is turned off.

If the start fails, the APU shuts down automatically. The EICAS message APU SHUTDOWN is displayed.

The APU's starter motors duty cycle for the electric starter motor and air turbine starter is 3 start attempts in a 60 minute period each.

APU Automatic Start

In flight, if both AC transfer busses lose power, the APU automatically starts, regardless of APU selector position. The APU can be shut down by positioning the selector to ON, then OFF.

APU Run

The EICAS memo message APU RUNNING is displayed when the APU is operating normally.

APU Shutdown

Rotating the APU selector to OFF begins the shutdown cycle by closing the APU bleed air valve. The APU continues running for a cooldown period. The EICAS memo message APU COOLDOWN is displayed during the cooldown period. When the cooldown period finishes, the APU shuts down.

APU Operating Modes

The APU has attended and unattended operating modes. The attended mode operates when either engine is running or starting, or when the airplane is in flight. The unattended mode operates at all other times on the ground.

APU Attended Mode

[\[777-200/300 Series\]](#)

In the attended mode, any of the following faults cause the APU to shut down immediately:

- APU fire/inlet over temperature
- overspeed/loss of overspeed protection
- APU controller failure
- speed droop.

There is no cool down period. The EICAS advisory message, APU SHUTDOWN, displays.

For the following faults, the APU continues to operate and the EICAS message APU LIMIT displays:

- high EGT
- high oil temperature
- low oil pressure.

There is no cooldown period when the APU is shut down after the APU LIMIT message is displayed.

APU Unattended Mode

In the unattended mode, in addition to all critical system faults the APU will shutdown for the following faults:

[777-200/300 Series]

- APU fire/inlet overtemperature
- overspeed/loss of overspeed protection
- high EGT
- low oil pressure
- high oil temperature
- generator oil filter approaching bypass
- intake door failure
- APU controller failure
- speed droop
- no combustion on start
- no acceleration on start.

There is no cooldown period.

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**Engines, APU
EICAS Messages****Chapter 7
Section 40****EICAS Alert Messages**

Message	Level	Aural	Message Logic
APU LIMIT	Caution	Beeper	APU operation has exceeded a limit.
APU SHUTDOWN	Advisory		APU has shut down.

[GE90-76B, -85B, -90B or -94B Engines]

ENG ANTI-ICE AIR L, R	Advisory		Engine anti-icing capability is reduced.
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[GE90, PW, RR Engines]

ENG AUTOSTART L, R	Caution	Beeper	On the ground during a start: <ul style="list-style-type: none"> autostart did not start the engine, or the AUTOSTART switch is off, the FUEL CONTROL switch is in RUN, and the engine RPM is low
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[GE90, PW, RR Engines]

ENG AUTOSTART OFF	Advisory		The AUTOSTART switch is off.
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ENG CONTROL L, R	Advisory		Fault has occurred in the EEC system.
ENG EEC MODE L, R	Advisory		The EEC is operating in the alternate mode.
ENG FAIL L, R	Caution	Beeper	Engine speed is below idle.
ENG FUEL FILTER L, R	Advisory		An impending fuel filter bypass condition exists.
ENG FUEL VALVE L, R	Advisory		Engine fuel or fuel spar valve position is not in the commanded position.

Message	Level	Aural	Message Logic
ENG IDLE DISAGREE	Advisory		One engine is at approach idle and the other engine is at minimum idle.
ENG LIMIT PROT L, R	Caution	Beeper	The EEC is operating in the alternate mode and commanded N1 exceeds maximum N1 limit.

[GE Engines]

ENG OIL FILTER L, R	Advisory		Engine oil filter contamination has caused oil to bypass the oil filter.
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[PW Engines - Option]

ENG OIL FILTER L, R	Advisory		The engine primary oil filter contamination is approaching a bypass condition. Oil will be filtered through the secondary filter.
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ENG OIL PRESS L, R	Caution	Beeper	The engine oil pressure is low.
ENG OIL TEMP L, R	Advisory		The engine oil temperature is high.
ENG REV LIMITED L, R	Advisory		The engine thrust reverser will not deploy or reverse thrust will be limited to idle on landing.
ENG REVERSER L, R	Advisory		A fault is detected in the engine reverser system.

[GE Engines, PW Engines]

ENG RPM LIMITED L, R	Advisory		The EEC is limiting engine thrust to prevent N1 or N2 from exceeding the RPM operating limit.
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[RR Engines]

ENG RPM LIMITED L, R	Advisory		The EEC is limiting engine thrust to prevent N1, N2, or N3 from exceeding the RPM operating limit.
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777 Flight Crew Operations Manual

Message	Level	Aural	Message Logic
ENG SHUTDOWN, L R	Caution		The engine is shutdown by the FUEL CONTROL switch or the Engine Fire switch.
ENG START VALVE L, R	Advisory		The engine start valve is not in commanded position.

[GE90 Engines with CON position, RR Engines with CON position, PW Engines]

ENG STARTER CUTOFF L, R	Caution	Beeper	The engine start valve is open when commanded to close, or the START/IGNITION selector remains in START.
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[GE90 Engines without CON position, RR Engines]

ENG STARTER CUTOFF L, R	Caution	Beeper	The engine start valve is open when commanded to close, or the START selector remains in START.
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ENG THRUST L, R	Caution	Beeper	The engine thrust is less than the thrust commanded.
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EICAS Memo Messages

Message	Level	Aural	Message Logic
APU COOLDOWN	Memo		The APU is in the cool down mode.
APU RUNNING	Memo		The APU is running, and is not in the cool down mode.

[GE90 Engines with CON position, PW Engines]

CON IGNITION ON L, L+R, R	Memo		Engine START/IGNITION selector CON position selected.
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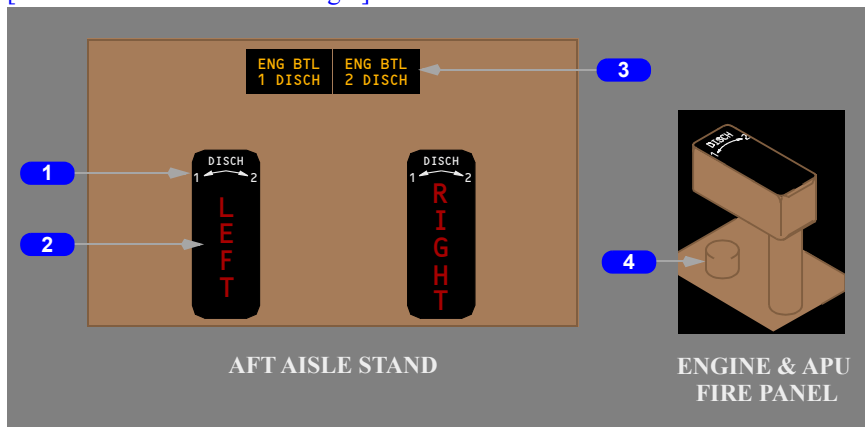
Fire Protection
Table of Contents**Chapter 8**
Section TOC

Controls and Indicators	8.10
Engine Fire Protection	8.10.1
Engine Fire Panel	8.10.1
Fuel Control Switches	8.10.2
APU and Cargo Fire Panel	8.10.3
APU Ground Control Fire Protection Panel	8.10.8
System Description	8.20
Introduction	8.20.1
Engine Fire Protection	8.20.1
Engine Fire and Overheat Detection	8.20.2
Engine Fire Extinguishing	8.20.3
APU Fire Protection	8.20.3
APU Fire Detection	8.20.4
APU Fire Extinguishing	8.20.4
Main Wheel Well Fire Protection	8.20.4
Main Wheel Well Fire Detection	8.20.4
Main Wheel Well Fire Warning	8.20.5
Cargo Compartment Fire Protection	8.20.5
Cargo Compartment Smoke Detection	8.20.5
Cargo Compartment Fire Warning	8.20.5
Cargo Compartment Fire Extinguishing	8.20.5
Cargo Compartment Fire Protection	8.20.6
Cargo Compartment Smoke Detection	8.20.6
Cargo Compartment Fire Warning	8.20.7
Lower Cargo Compartment Fire Extinguishing	8.20.7
Main Deck Cargo Compartment Fire Suppression	8.20.7
Crew Rest Compartment Fire Protection	8.20.8
Door 1 Upper Crew Rest Compartment Smoke Detection . . .	8.20.8
Door 3 Upper Crew Rest Compartment Smoke Detection . . .	8.20.8
Door 4 Upper Crew Rest Compartment Smoke Detection . . .	8.20.8

Door 5 Upper Crew Rest Compartment Smoke Detection . . .	8.20.8
Flight Deck Crew Rest Compartment Smoke Detection	8.20.8
Lower Crew Rest Compartment Smoke Detection	8.20.8
Lower Crew Rest Compartment Fire Extinguishing	8.20.8
Equipment Cooling System Fire Protection	8.20.9
Lavatory Fire Protection	8.20.9
Lavatory Fire Detection	8.20.9
Lavatory Fire Extinguishing	8.20.9
Cabin Area Compartment Fire Protection	8.20.10
Fire and Overheat Detection System Fault Test	8.20.10
Fire and Overheat Detection System Automatic Fault Test . .	8.20.10
Fire and Overheat Detection System Manual Fault Test . . .	8.20.10
EICAS Messages	8.30
Fire Protection EICAS Messages	8.30.1
Airplane System EICAS Messages	8.30.1
Cabin System EICAS Messages	8.30.3
System Test Messages	8.30.3

Fire Protection
Controls and Indicators**Chapter 8**
Section 10**Engine Fire Protection****Engine Fire Panel**

[777-200/-300 Series - Passenger]

**1 Engine Fire Switches**

In (normal position, mechanically locked) – unlocks automatically for a fire warning, or when the FUEL CONTROL switch is in CUTOFF.

Out –

- arms both engine fire extinguishers
- closes the associated engine and spar fuel valves
- closes the associated engine bleed air valves
- trips the associated engine generators off
- shuts off hydraulic fluid to the associated engine-driven hydraulic pump
- depressurizes the associated engine-driven hydraulic pump
- removes power to the thrust reverser isolation valve.

Rotate to position 1 or 2 – discharges the selected fire extinguisher into the engine.

2 Engine Fire Warning Lights

Illuminated (red) –

- an engine fire is detected, or
- the FIRE/OVERHEAT TEST switch is pushed.

3 Engine Bottle Discharged (ENG BTL DISCH) Lights

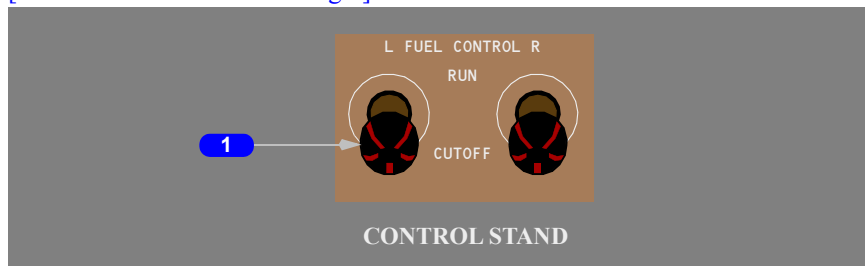
Illuminated (amber) – the extinguisher bottle is discharged or has low pressure.

4 Engine and APU Fire Override Switches

Push – unlocks the fire switch.

Fuel Control Switches

[777-200/-300 Series - Passenger]



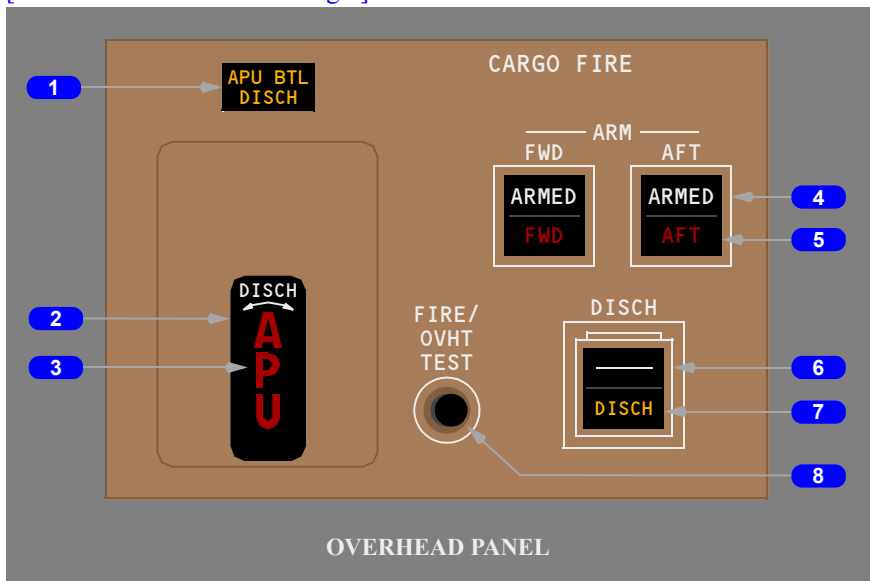
1 FUEL CONTROL Switch Fire Warning Lights

Illuminated (red) –

- an associated engine fire is detected, or
- the FIRE/OVERHEAT TEST switch is pushed.

APU and Cargo Fire Panel

[777-200/-300 Series - Passenger]



1 APU Bottle Discharge (APU BTL DISCH) Light

Illuminated (amber) – the extinguisher bottle is discharged or has low pressure.

2 APU Fire Switch

In – normal position, mechanically locked; unlocks automatically for a fire warning.

Out –

- arms the APU fire extinguisher bottle
- closes the APU fuel valve
- closes the APU bleed air valves
- closes the APU air inlet door
- trips the APU generator field and generator breaker
- shuts down the APU (if automatic shutdown does not occur).

Rotate – either direction discharges the APU fire extinguisher into the APU compartment.

3 APU Fire Warning Light

Illuminated (red) –

- an APU fire is detected, or
- the FIRE/OVERHEAT TEST switch is pushed.

The APU automatically shuts down for a detected fire.

4 CARGO FIRE ARM Switches

ARMED –

- arms all cargo fire extinguisher bottles
- arms the selected compartment extinguisher valve
- turns off both lower recirculation fans
- shuts down cargo heat
- shuts down In-Flight Entertainment (IFE) System

[777-200/-300]

- commands the packs to provide the minimum air flow required to provide pressurization
- shuts down the bulk cargo compartment ventilation system operation (aft cargo fire only)
- puts the equipment cooling system into the override mode (forward cargo fire only)
- activates lower crew rest evacuation system (aft cargo fire only)

Off (blank) – normal position.

5 CARGO FIRE Warning Lights

Illuminated (red) – the FIRE/OVERHEAT TEST switch is pushed, or associated cargo compartment smoke is detected and aircraft systems are commanded to shut down –

- AFT or FWD illuminated –
 - both lower recirculation fans
 - lavatory/galley vent fans
 - cargo heat in respective compartment
- FWD illuminated –
 - equipment cooling system in the override mode

6 CARGO FIRE Discharge (DISCH) Switch

Push – discharges the fire extinguisher bottles into the ARMED cargo compartment.

Note: The bulk cargo compartment is included in the AFT cargo fire extinguishing system.

7 CARGO FIRE Discharge (DISCH) Light

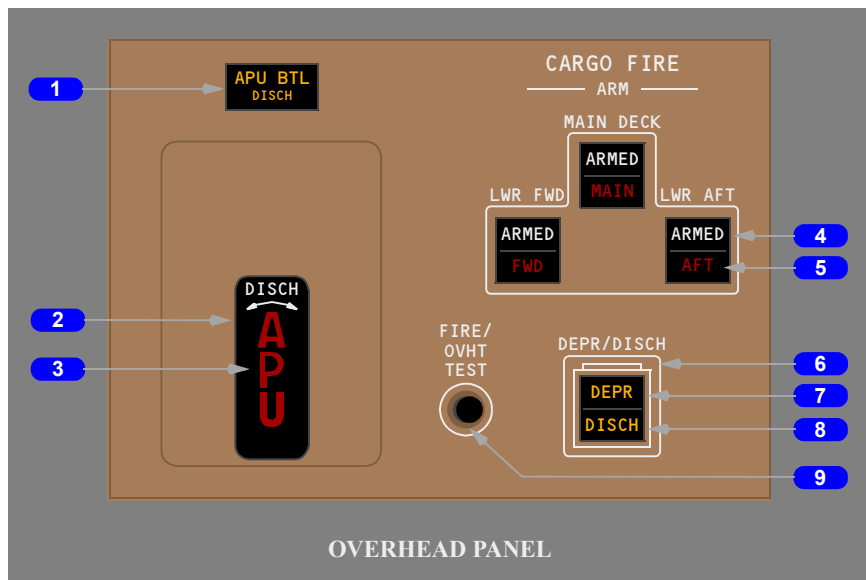
Illuminated (amber) – the fire extinguishers have discharged.

8 FIRE/OVERHEAT TEST Switch

Push and hold –

- sends fire/overheat test signals to the engine, APU, wheel well, and cargo compartment fire detector systems
- tests flight deck fire and overheat indications (see Fire and Overheat Detection System Manual Fault Test, Section 20).

[Freighter Airplane]

**1 APU Bottle Discharge (APU BTL DISCH) Light**

Illuminated (amber) – the extinguisher bottle is discharged or has low pressure.

2 APU Fire Switch

In – normal position, mechanically locked; unlocks automatically for a fire warning.

Out –

- arms the APU fire extinguisher bottle
- closes the APU fuel valve
- closes the APU bleed air valves
- closes the APU air inlet door

- trips the APU generator field and generator breaker
- shuts down the APU (if automatic shutdown does not occur).

Rotate – either direction discharges the APU fire extinguisher into the APU compartment.

3 APU Fire Warning Light

Illuminated (red) –

- an APU fire is detected, or
- the FIRE/OVERHEAT TEST switch is pushed.

The APU automatically shuts down for a detected fire.

4 CARGO FIRE ARM Switches

- LWR AFT or LWR FWD or MAIN DECK – ARMED –
 - turns off both recirculation fans
 - turns off the lavatory/galley vent fans
 - turns off cargo heat in respective compartment
 - turns off electrical power outlets in respective compartment
 - commands pack to supply air to flight deck and supernumerary areas only
 - turns off the Nitrogen Generation System
- LWR AFT or LWR FWD – ARMED –
 - arms all cargo fire extinguisher bottles
 - arms the selected compartment extinguisher valve
 - puts the equipment cooling system into the override mode
 - turns off cargo air conditioning in respective compartment
- MAIN DECK – ARMED –
 - commands EE cooling to provide pack air to flight deck equipment
 - turns off main deck cargo compartment air in-flow
 - turns off aft cargo air conditioning supply and exhaust

Off (blank) – normal position.

5 CARGO FIRE Warning Lights

Illuminated (red) – the FIRE/OVERHEAT TEST switch is pushed, or associated cargo compartment smoke is detected and aircraft systems are commanded to shut down –

- AFT, or FWD, or MAIN illuminated –
 - both recirculation fans
 - lavatory/galley vent fans
 - cargo heat in respective compartment

- AFT or FWD illuminated –
 - cargo air conditioning in respective compartment
 - equipment cooling system in the override mode
- MAIN illuminated –
 - Main Deck Alerting System activated
 - EE cooling provides pack air to flight deck equipment
 - main deck cargo compartment air in-flow
 - aft cargo air conditioning supply and exhaust

6 CARGO FIRE Depressurization/Discharge (DEPR/DISCH) Switch

Push –

MAIN DECK – ARMED – initiates airplane depressurization to a cabin altitude of approximately 21,000 feet with the airplane altitude at 23,000 feet.

LWR AFT or LWR FWD – ARMED – discharges the fire extinguisher bottles into the ARMED cargo compartment.

Note: The bulk cargo compartment is included in the LWR AFT cargo fire extinguishing system.

7 CARGO FIRE Depressurization (DEPR) Light

Illuminated (amber) – airplane depressurization initiated.

8 CARGO FIRE Discharge (DISCH) Light

Illuminated (amber) – the fire extinguishers have discharged.

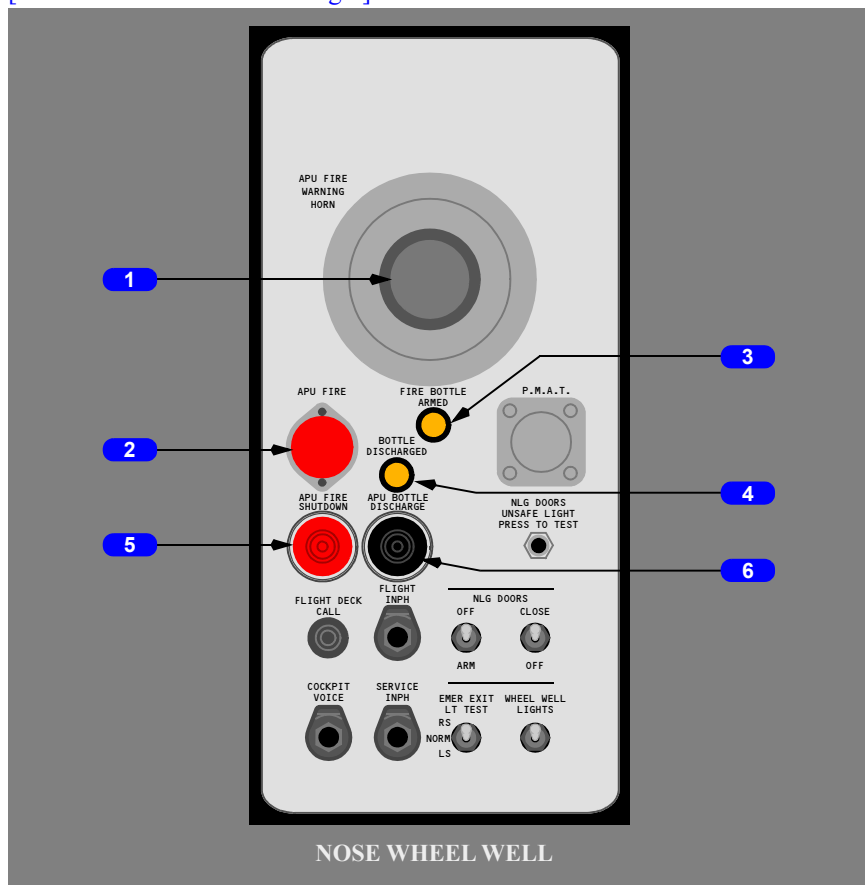
9 FIRE/OVERHEAT TEST Switch

Push and hold –

- sends fire/overheat test signals to the engine, APU, wheel well, and cargo compartment fire detector systems
- tests flight deck fire and overheat indications (see Fire and Overheat Detection System Manual Fault Test, Section 20).

APU Ground Control Fire Protection Panel

[777-200/-300 Series - Passenger]



1 APU FIRE WARNING HORN

Sounds intermittently during ground operation for an APU fire or fire test.

2 APU FIRE Light

Illuminated (red) –

- an APU fire is detected, or
- a fire/overheat test is in progress.

The APU automatically shuts down for a detected fire.

3 APU FIRE BOTTLE ARMED Light

Illuminated (amber) – the APU fire extinguisher is armed.

4 APU BOTTLE DISCHARGED Light

Illuminated (amber) – the extinguisher bottle pressure is low.

5 APU FIRE SHUTDOWN Switch

Push (red) –

- shuts down the APU
- arms the APU fire extinguisher.

6 APU BOTTLE DISCHARGE Switch

Push – discharges the APU fire extinguisher into the APU compartment.

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**Fire Protection
System Description****Chapter 8
Section 20****Introduction**

There are fire detection and extinguishing systems for the:

- APU
- cargo compartments
- engines
- lavatories.

[Option – Crew Rest Compartments]

The flight deck crew rest compartment has a fire detection system, but no fire extinguishing system.

The lower crew rest compartment has a fire detection system and a manually activated fire extinguishing system.

The door 1 upper crew rest compartment has a fire detection system, but no fire extinguishing system.

The door 2 upper enclosed compartment has a fire detection system, but no fire extinguishing system.

The door 3 upper crew rest compartment has a fire detection system, but no fire extinguishing system.

The door 4 upper crew rest compartment has a fire detection system, but no fire extinguishing system.

The door 5 upper crew rest compartment has a fire detection system, but no fire extinguishing system.

The engines also have overheat detection systems.

The main gear wheel wells have a fire detection system, but no fire extinguishing system.

Refer to the following chapters for additional information:

- Chapter 2 – Air Systems, for descriptions of equipment smoke evacuation, and bleed duct leak and overheat detection.
- Chapter 3 – Anti-Ice, Rain, for a description of engine anti-ice system leak protection.

Engine Fire Protection

Engine fire protection consists of these systems:

- engine fire and overheat detection
- engine fire extinguishing.

Engine Fire and Overheat Detection

There are two detector loops in each engine nacelle. Each detector loop provides both fire and overheat detection. Normally, both loops must detect a fire or overheat condition to cause an engine fire warning or overheat caution.

If a fault is detected in one loop, the system automatically switches to single loop operation. If the operating loop senses a fire or overheat, the system provides the appropriate fire warning or overheat caution.

If there are faults in both detector loops in an engine nacelle, no fire or overheat detection is provided. The EICAS advisory message DET FIRE ENG (L or R) is displayed if the engine fire detection system fails.

Engine Fire Warning

The indications of an engine fire are:

- the fire bell sounds
- the master WARNING lights illuminate
- the EICAS warning message FIRE ENG (L or R) is displayed
- the engine fire switch LEFT or RIGHT fire warning light illuminates
- the engine fire switch unlocks
- the engine FUEL CONTROL (L or R) switch fire warning light illuminates.

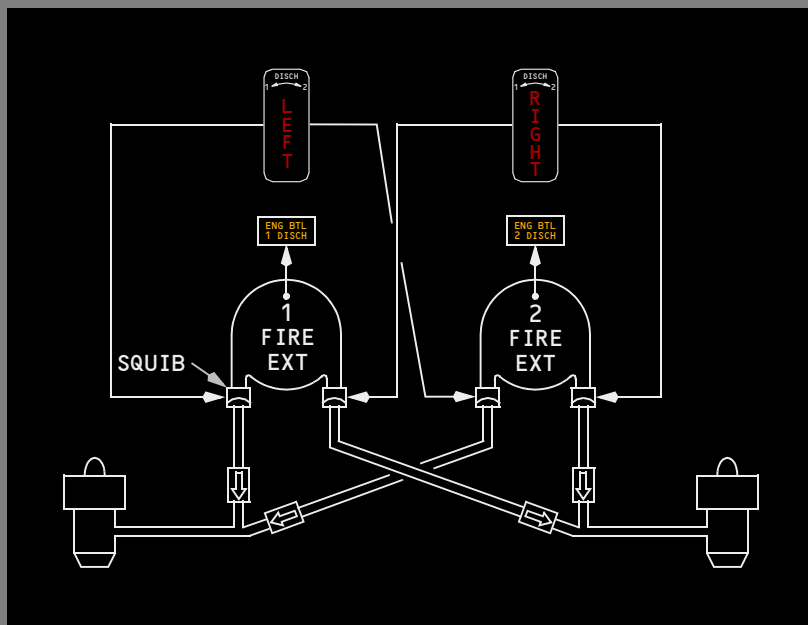
Engine Overheat Caution

The indications of an engine overheat are:

- the caution beeper sounds
- the master CAUTION lights illuminate
- the EICAS caution message OVERHEAT ENG (L or R) is displayed.

Engine Fire Extinguishing

[777-200/-300 Series - Passenger]



ENGINE FIRE EXTINGUISHING DIAGRAM

There are two engine fire extinguisher bottles. Either or both bottles can be discharged into either engine.

When the engine fire switch is pulled out, rotating the fire switch in either direction discharges a single extinguisher bottle into the associated engine. Rotating the engine fire switch in the other direction discharges the remaining extinguisher bottle into the same engine.

If an extinguisher bottle is discharged or has low pressure:

- the ENG BTL (1 or 2) DISCH light illuminates
- the EICAS advisory message BOTTLE (1 or 2) DISCH ENG is displayed.

APU Fire Protection

APU fire protection consists of these systems:

- APU fire detection
- APU fire extinguishing.

APU Fire Detection

The APU compartment has dual fire detector loops. There is no APU overheat detection.

Normally, both loops must detect a fire to produce a fire warning. An APU fire warning automatically shuts down the APU.

If a fault is detected in one loop, the system automatically switches to single loop operation. If the operating loop detects a fire, an APU fire warning occurs and the APU shuts down.

The EICAS advisory message DET FIRE APU is displayed if the APU fire detection system fails.

APU Fire Warning

The indications of an APU fire warning are:

- the fire bell sounds
- the master WARNING lights illuminate
- the EICAS warning message FIRE APU is displayed
- the APU fire switch fire warning light illuminates
- the APU fire switch unlocks.

APU Fire Extinguishing

There is one APU fire extinguisher bottle. When the APU fire switch is pulled out, rotating the switch in either direction discharges the extinguisher bottle into the APU compartment. If the bottle is discharged or has low pressure:

- the APU BTL DISCH light illuminates
- the EICAS advisory message BOTTLE DISCH APU is displayed.

On the ground with both engines off an APU fire signal from either APU fire detector loop causes APU shutdown and extinguisher bottle discharge.

Main Wheel Well Fire Protection

The main wheel well has fire detection only. There is no fire extinguishing system. The nose wheel well does not have a fire detection system.

Main Wheel Well Fire Detection

The main wheel well fire detection system consists of dual fire detector loops.

Main Wheel Well Fire Warning

The indications for a main wheel well fire are:

- the fire bell sounds
- the EICAS warning message FIRE WHEEL WELL is displayed
- the master WARNING lights illuminate.

Cargo Compartment Fire Protection

[\[Passenger airplane\]](#)

Cargo compartment fire protection consists of these systems:

- cargo compartment smoke detection
- cargo compartment fire extinguishing.

Note: The bulk cargo compartment is included in the aft cargo smoke detection and fire extinguishing systems.

Cargo Compartment Smoke Detection

[\[777-200, 777-200ER, 777-200LR\]](#)

The forward and aft cargo compartments each have smoke detectors. Each compartment is divided into three detection zones. If smoke is detected in any zone, a fire warning occurs.

[\[777-300, 777-300ER\]](#)

The forward and aft cargo compartments each have smoke detectors. Each compartment is divided into four detection zones. If smoke is detected in any zone, a fire warning occurs.

[\[777-200/-300 Series - Passenger\]](#)

Whenever cargo compartment smoke detection is inoperative, the EICAS advisory message DET FIRE CARGO (FWD or AFT) is displayed.

Cargo Compartment Fire Warning

[\[777-200/-300 Series - Passenger\]](#)

The indications of a cargo compartment fire are:

- the fire bell sounds
- the master WARNING lights illuminate
- the EICAS warning message FIRE CARGO (FWD or AFT) is displayed
- the CARGO FIRE (FWD or AFT) fire warning light illuminates.

Cargo Compartment Fire Extinguishing

Five fire extinguisher bottles are installed for cargo compartment fire extinguishing. Pushing the FWD or AFT CARGO FIRE ARM switch (ARMED visible) arms the extinguishers.

In flight, pushing the CARGO FIRE DISCHARGE switch causes the immediate total discharge of two extinguisher bottles into the selected compartment. After a time delay, the remaining three extinguisher bottles discharge at a reduced flow rate into the selected compartment. If the airplane lands before all of the bottles discharge, one of the remaining bottles discharges at the reduced rate on touchdown.

[777-200/-300 Series - Passenger]

On the ground, if a CARGO FIRE DISCHARGE switch is pushed, two extinguisher bottles discharge into the selected compartment, but only one of the remaining extinguisher bottles discharges after the time delay.

When cargo fire extinguisher bottle discharge is initiated:

- The CARGO FIRE DISCHARGE switch light illuminates when the first two extinguisher bottles begin to discharge.
- The EICAS advisory message BOTTLE DISCH CARGO is displayed when the first two extinguisher bottles have completely discharged.

[Option - Lower Crew Rest Compartment]

The SMOKE CREW REST LWR message may be displayed during descent following an aft cargo fire. Pressure differences between the aft cargo compartment and the lower crew rest compartment can cause smoke to enter the compartment.

Cargo Compartment Fire Protection

[Freighter]

Cargo compartment fire protection consists of these systems:

- cargo compartment smoke detection
- cargo compartment fire extinguishing or suppression.

Note: The bulk cargo compartment is included in the aft cargo fire detection and extinguishing systems.

Cargo Compartment Smoke Detection

[777-200/-300 Series - Passenger]

The main deck, forward, and aft cargo compartments each have smoke detectors. Each compartment is divided into multiple detection zones, three for each lower compartment and eight for the main deck. If smoke is detected in any zone, a fire warning occurs.

Whenever cargo compartment smoke detection is inoperative, the EICAS advisory message DET FIRE CARGO (AFT, FWD, or MAIN) is displayed.

Cargo Compartment Fire Warning

The indications of a cargo compartment fire are:

- the fire bell sounds
- the master WARNING lights illuminate
- the EICAS warning message FIRE CARGO AFT, or FIRE CARGO FWD, or FIRE MAIN DECK is displayed
- the CARGO FIRE (AFT, FWD, or MAIN) fire warning light illuminates.

Lower Cargo Compartment Fire Extinguishing

Five fire extinguisher bottles are installed for lower cargo compartment fire extinguishing. Pushing the LWR FWD or LWR AFT CARGO FIRE ARM switch (ARMED visible) arms the extinguishers.

In flight, pushing the CARGO FIRE DEPR/DISCH switch causes the immediate total discharge of two extinguisher bottles into the selected compartment. After a time delay, the remaining three extinguisher bottles discharge at a reduced flow rate into the selected compartment. If the airplane lands before all of the bottles discharge, one of the remaining bottles discharges at the reduced rate on touchdown.

On the ground, if the CARGO FIRE DEPR/DISCH switch is pushed, two extinguisher bottles discharge into the selected compartment, but only one of the remaining extinguisher bottles discharges after the time delay.

When cargo fire extinguisher bottle discharge is initiated:

- The CARGO FIRE DEPR/DISCH switch DISCH light illuminates when the first two extinguisher bottles begin to discharge.
- The EICAS advisory message BOTTLE DISCH CARGO is displayed when the first two extinguisher bottles have completely discharged.

Main Deck Cargo Compartment Fire Suppression

The main deck cargo compartment is a Class E compartment. Pushing the MAIN DECK CARGO FIRE ARM switch configures one pack off and the other to a low flow mode. Subsequently pushing the CARGO DEPR/DISCH switch initiates a controlled depressurization to a cabin altitude of approximately 21,000 feet with the airplane altitude at 23,000 feet.

Crew Rest Compartment Fire Protection

[Option – Flight Deck, Upper, and/or Lower Crew Rest Compartment]

Door 1 Upper Crew Rest Compartment Smoke Detection

Smoke detectors are installed in the door 1 upper crew rest compartment. If smoke is detected, an aural alert sounds in the door 1 crew rest compartment. The EICAS caution message SMOKE REST UPR DR 1 indicates smoke in the compartment.

Door 3 Upper Crew Rest Compartment Smoke Detection

Smoke detectors are installed in the door 3 upper crew rest compartment. If smoke is detected, an aural alert sounds in the door 3 upper crew rest compartment. The EICAS caution message SMOKE REST UPR DR 3 indicates smoke in the compartment.

Door 4 Upper Crew Rest Compartment Smoke Detection

Smoke detectors are installed in the door 4 upper crew rest compartment. If smoke is detected, an aural alert sounds in the door 4 crew rest compartment. The EICAS caution message SMOKE REST UPR DR 4 indicates smoke in the compartment.

Door 5 Upper Crew Rest Compartment Smoke Detection

Smoke detectors are installed in the door 5 upper crew rest compartment. If smoke is detected, an aural alert sounds in the door 5 crew rest compartment. The EICAS caution message SMOKE REST UPR DR 5 indicates smoke in the compartment.

Flight Deck Crew Rest Compartment Smoke Detection

Smoke detectors are installed in the flight deck crew rest compartment. If smoke is detected, an aural alert sounds in the flight deck crew rest compartment. The EICAS caution message SMOKE CREW REST F/D indicates smoke in the flight deck crew rest compartment.

Lower Crew Rest Compartment Smoke Detection

Smoke detectors are installed in the lower crew rest compartment. If smoke is detected, an aural alert sounds in the lower crew rest compartment. The EICAS caution message SMOKE CREW REST LWR indicates smoke in the lower crew rest compartment.

Lower Crew Rest Compartment Fire Extinguishing

The lower crew rest compartment contains a manually activated fire extinguishing system. Portable fire extinguisher bottles augment this system. There is no flight deck indication of fire extinguishing system activation.

Equipment Cooling System Fire Protection

[Freighter]

The equipment cooling system contains a smoke detector, but no fire extinguishing system. When smoke is detected in the equipment cooling system the EICAS caution message SMOKE EQUIP COOLING is displayed.

Refer to Chapter 2, Air Systems, for a description of the equipment cooling system.

Lavatory Fire Protection

Lavatory fire protection consists of these systems:

- lavatory fire detection
- lavatory waste container fire extinguishing.

Lavatory Fire Detection

[Option – SMOKE LAVATORY Message (may also display for other enclosed compartments, such as purser or communications compartments)]

Each lavatory has a single smoke detector. If smoke is detected, an aural alert sounds in the lavatory and in the cabin. In addition, the lavatory call light flashes and the master call light at the associated attendant station flashes. The EICAS advisory message SMOKE LAVATORY is displayed.

[Option – SMOKE LAV/COMPT Message (may also display for other enclosed compartments, such as purser or communications compartments)]

Each lavatory has a single smoke detector. If smoke is detected, an aural alert sounds in the lavatory and in the cabin. In addition, the lavatory call light flashes and the master call light at the associated attendant station flashes. The EICAS advisory message SMOKE LAV/COMPT is displayed.

[Freighter]

The lavatory has a single smoke detector. If smoke is detected, an aural alert sounds in the lavatory and in the supernumerary area. The EICAS caution message SMOKE LAVATORY is shown.

Lavatory Fire Extinguishing

[Passenger airplane]

[777-200/-300 Series - Passenger]

Each lavatory has a fire extinguisher located in the waste container cabinet. Fire extinguisher operation is automatic. There is no flight deck indication.

[Freighter]

The lavatory has a fire extinguisher located in the waste container cabinet. Fire extinguisher operation is automatic. There is no flight deck indication.

Cabin Area Compartment Fire Protection

[Passenger airplane]

A smoke detector is installed in the door 2 upper enclosed compartment. If smoke is detected, an aural alert sounds in the cabin. The EICAS caution message SMOKE COMPT UPR DR 2 indicates smoke in the compartment and power is automatically removed from the In-Flight Entertainment system.

Fire and Overheat Detection System Fault Test

The fire and overheat detection system has automatic and manual fault testing.

Fire and Overheat Detection System Automatic Fault Test

Fire and overheat detection system testing is automatic. The engine and APU systems continuously monitor the fire/overheat detector loops for faults. The cargo and wheel well systems continuously monitor for any system faults.

If a fault is detected, the system automatically reconfigures for single loop operation. Complete system failures are indicated by an EICAS advisory message for the failed system:

- DET FIRE ENG (L or R)
- DET FIRE APU
- DET FIRE CARGO (FWD or AFT)

[Freighter]

- DET FIRE CARGO MAIN.

Fire and Overheat Detection System Manual Fault Test

The fire and overheat detection systems can be tested manually by pushing and holding the FIRE/OVERHEAT TEST switch.

The indications for a manual fire and overheat detection system test are:

- the fire bell sounds
- the nose wheel well APU fire warning horn sounds (on the ground)
- the EICAS warning message FIRE TEST IN PROG is displayed
- these lights illuminate:
 - the master WARNING lights
 - the LEFT and RIGHT engine fire warning lights
 - the APU fire warning light
 - the nose wheel well APU fire warning light
 - the LEFT and RIGHT FUEL CONTROL switch fire warning lights
 - the FWD and AFT CARGO FIRE warning lights

[Freighter]

- the MAIN CARGO FIRE warning light.

777 Flight Crew Operations Manual

When the test is complete, the EICAS warning message FIRE TEST PASS or FIRE TEST FAIL replaces the FIRE TEST IN PROG message; the switch can be released. The appropriate system EICAS messages are displayed with the FIRE TEST FAIL message:

- DET FIRE APU
 - DET FIRE CARGO (FWD or AFT)
 - DET FIRE ENG (L or R)
 - DET FIRE WHEEL WELL
 - DET OVERHEAT ENG (L or R).
- [Freighter]
- DET FIRE CARGO MAIN

All test messages clear when the test switch is released. If the switch is released with the FIRE TEST IN PROG message displayed, the test ends without completing.

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**Fire Protection
EICAS Messages****Chapter 8
Section 30****Fire Protection EICAS Messages**

The following EICAS messages can be displayed.

Airplane System EICAS Messages

Message	Level	Aural	Message Logic
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[777-200/-300 Series - Passenger]

BOTTLE 1, 2 DISCH ENG	Advisory		Engine fire extinguisher bottle 1 or bottle 2 pressure is low.
BOTTLE DISCH APU	Advisory		APU fire extinguisher bottle pressure is low.
BOTTLE DISCH CARGO	Advisory		Both rapid discharge cargo fire extinguisher bottle pressures are low.
DET FIRE APU	Advisory		APU fire detection is inoperative.
DET FIRE CARGO AFT, FWD	Advisory		Affected cargo compartment smoke detection is inoperative.

[Freighter]

DET FIRE CARGO MAIN	Advisory		Affected cargo compartment smoke detection is inoperative.
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DET FIRE ENG L, R	Advisory		Affected engine fire detection and overheat are inoperative.
FIRE APU	Warning	Fire Bell	Fire is detected in the APU.
FIRE CARGO AFT, FWD	Warning	Fire Bell	Smoke is detected in the affected cargo compartment.
FIRE ENG L, R	Warning	Fire Bell	Fire is detected in the engine.

[Freighter]

FIRE CARGO MAIN DECK	Warning	Fire Bell	Smoke is detected in the affected cargo compartment.
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Message	Level	Aural	Message Logic
FIRE WHEEL WELL	Warning	Fire Bell	Fire is detected in a main wheel well.
OVERHEAT ENG L, R	Caution	Beeper	Engine overheat detected.

[Freighter]

SMOKE EQUIP COOLING	Caution	Beeper	Smoke is detected in the equipment cooling system.
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Cabin System EICAS Messages

[Options – Flight Deck Crew Rest Compartment, Lower Crew Rest Compartment, Lavatory Smoke Detection, Door 1 Upper Crew Rest Compartment, Door 3 Upper Crew Rest Compartment, Door 5 Upper Crew Rest Compartment, Door 2 Overhead Cabin Equipment Center, Connexion by Boeing]

Cabin Area

Message	Level	Aural	Message Logic
SMOKE COMPT UPR DR 2	Caution	Beeper	Smoke is detected in door 2 upper enclosed compartment.

[Passenger airplane]

SMOKE LAVATORY	Advisory		Smoke is detected in one or more lavatories.
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[Freighter]

SMOKE LAVATORY	Caution	Beeper	Smoke is detected in the lavatory.
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Crew Rest Area

Message	Level	Aural	Message Logic
SMOKE CREW REST F/D	Caution	Beeper	Smoke is detected in flight deck crew rest compartment.
SMOKE CREW REST LWR	Caution	Beeper	Smoke is detected in lower crew rest compartment.
SMOKE REST UPR DR 1	Caution	Beeper	Smoke is detected in door 1 upper crew rest compartment.
SMOKE REST UPR DR 3	Caution	Beeper	Smoke is detected in door 3 upper crew rest compartment.
SMOKE REST UPR DR 4	Caution	Beeper	Smoke is detected in door 4 upper crew rest compartment.
SMOKE REST UPR DR 5	Caution	Beeper	Smoke is detected in door 5 upper crew rest compartment.

System Test Messages

The following messages are associated only with the manually-initiated fire test.

Message	Level	Aural	Message Logic
DET FIRE WHEEL WELL	Advisory		Wheel well fire detection system is failed.
DET OVERHEAT ENG L, R	Advisory		Affected engine overheat detection system is failed.
FIRE TEST FAIL	Warning		One or more fire/overheat detection systems have failed to successfully complete the manually initiated fire/overheat test.
FIRE TEST IN PROG	Warning		A manually initiated fire/overheat detection system test is in progress.
FIRE TEST PASS	Warning		A manually initiated test of the fire/overheat detection system has been completed.

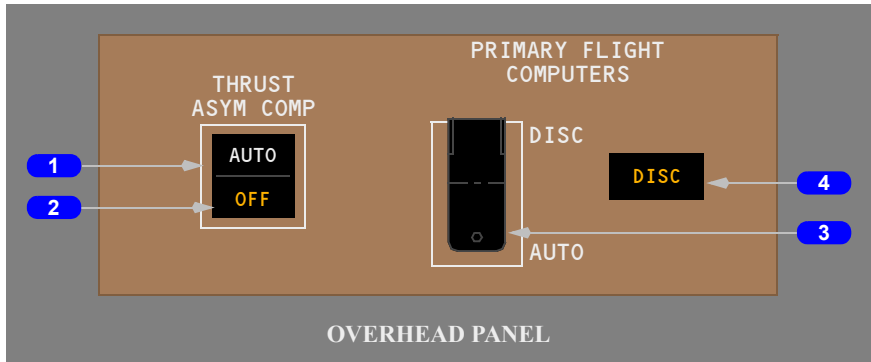
Flight Controls**Table of Contents****Chapter 9****Section TOC**

Controls and Indicators	9.10
Thrust Asymmetry Compensation and Primary Flight Computers Controls.	9.10.1
Pitch and Stabilizer Trim Systems	9.10.3
Control Wheel and Column	9.10.3
Stabilizer Trim System	9.10.4
Aileron and Rudder Trim Controls	9.10.6
Rudder/Brake Pedals	9.10.8
Speedbrake Lever.	9.10.9
Flap System	9.10.10
Flap Controls	9.10.10
Flap Limit Placard	9.10.11
Normal Flap Position Indication.	9.10.13
Flap Load Relief Indication	9.10.14
Non-Normal Flap and Slat Position Indication	9.10.15
Flight Control Synoptic Displays.	9.10.17
Normal Flight Control Synoptic	9.10.17
Non-Normal Flight Control Synoptic	9.10.19
System Description	9.20
Introduction	9.20.1
Pilot Controls	9.20.2
Flight Control Surfaces	9.20.3
Flight Control Surface Locations	9.20.4
Actuator Control Electronics/Hydraulic Power Distribution	9.20.5
Primary Flight Control System Modes	9.20.6
Flight Control System Normal Mode	9.20.6
Flight Envelope Protection	9.20.8
Flight Control System Secondary Mode.	9.20.8
Flight Control System Direct Mode	9.20.10

Normal Mode Pitch Control	9.20.12
Primary Pitch Trim Control	9.20.12
Alternate Pitch Trim	9.20.13
Pitch Envelope Protection	9.20.13
Elevator Variable Feel	9.20.14
Tail Strike Protection	9.20.14
Secondary and Direct Mode Pitch Control	9.20.15
Stabilizer Hydraulic Power and Non-Normal Operation	9.20.15
Stabilizer Shutdown	9.20.15
Stabilizer Position Indication and Green Band	9.20.16
Normal Mode Roll Control	9.20.17
Aileron Trim	9.20.17
Bank Angle Protection	9.20.17
Secondary and Direct Mode Roll Control	9.20.18
Normal Mode Yaw Control	9.20.19
Thrust Asymmetry Compensation	9.20.19
Wheel to Rudder Cross-Tie	9.20.20
Yaw Damping	9.20.20
Gust Suppression	9.20.20
Rudder Trim	9.20.20
Secondary and Direct Mode Yaw Control	9.20.21
Spoilers	9.20.22
Spoiler Speedbrake Operation	9.20.22
Landing Attitude Modifier (LAM)	9.20.23
Flaps and Slats	9.20.24
Flap and Slat Sequencing	9.20.24
Flap and Slat Modes	9.20.25
Flap/Slat Load Relief	9.20.27
Autoslats	9.20.28
Flap and Slat Asymmetry Detection	9.20.28
Uncommanded Flap or Slat Motion	9.20.28
Flap Indications	9.20.28

EICAS Messages.....	9.30
Flight Control System EICAS Messages.	9.30.1

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Flight Controls
Controls and Indicators**Chapter 9**
Section 10**Thrust Asymmetry Compensation and Primary Flight Computers Controls**[\[777-200/-300 Series\]](#)**1 Thrust Asymmetry Compensation (THRUST ASYM COMP) Switch**

AUTO – the thrust asymmetry compensation system operates automatically if a thrust asymmetry condition is detected.

OFF – disconnects the thrust asymmetry compensation system from the flight control system.

2 Thrust Asymmetry Compensation OFF Light

Illuminated (amber) – the thrust asymmetry compensation system has been automatically or manually disconnected.

3 PRIMARY FLIGHT COMPUTERS Disconnect Switch

DISC –

- disconnects the primary flight computers (PFCs) from the flight control system
- puts the flight control system in the direct mode
- **AUTO** can be reselected to attempt restoration of secondary or normal mode operation.

AUTO –

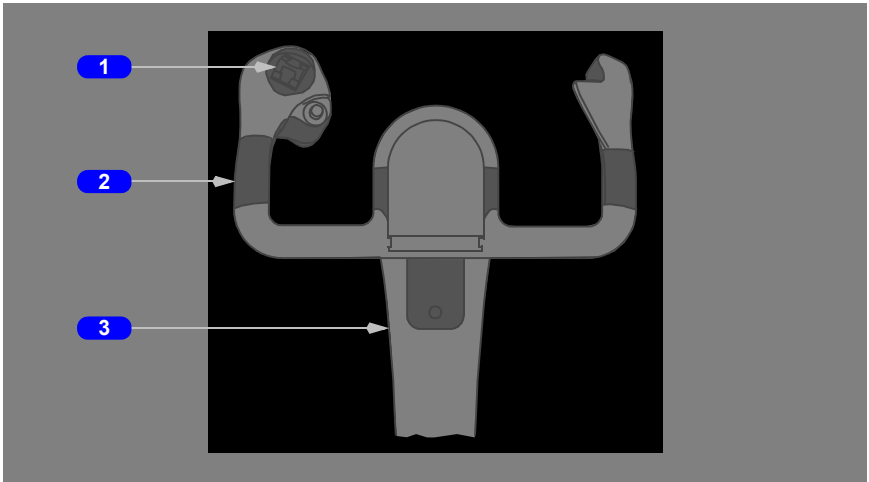
- the flight control system operates in the normal mode
- system faults automatically cause the system to switch to the secondary or direct modes.

4 PRIMARY FLIGHT COMPUTERS Disconnect (DISC) Light

Illuminated (amber) – the primary flight computers are disconnected automatically or manually and the system is in the direct mode.

Pitch and Stabilizer Trim Systems Control Wheel and Column

[777-200/-300 Series]



1 Pitch Trim Switches

Spring-loaded to neutral.

Push (both switches) –

- in the normal mode in flight, changes the trim reference airspeed
- in the normal mode on the ground, moves the stabilizer
- in the secondary and direct modes, moves the stabilizer.

2 Control Wheel

Rotate – deflects the ailerons, flaperons, and spoilers in the desired direction.

[777-200/-300 Series]

Moves and remains displaced with aileron trim.

3 Control Column

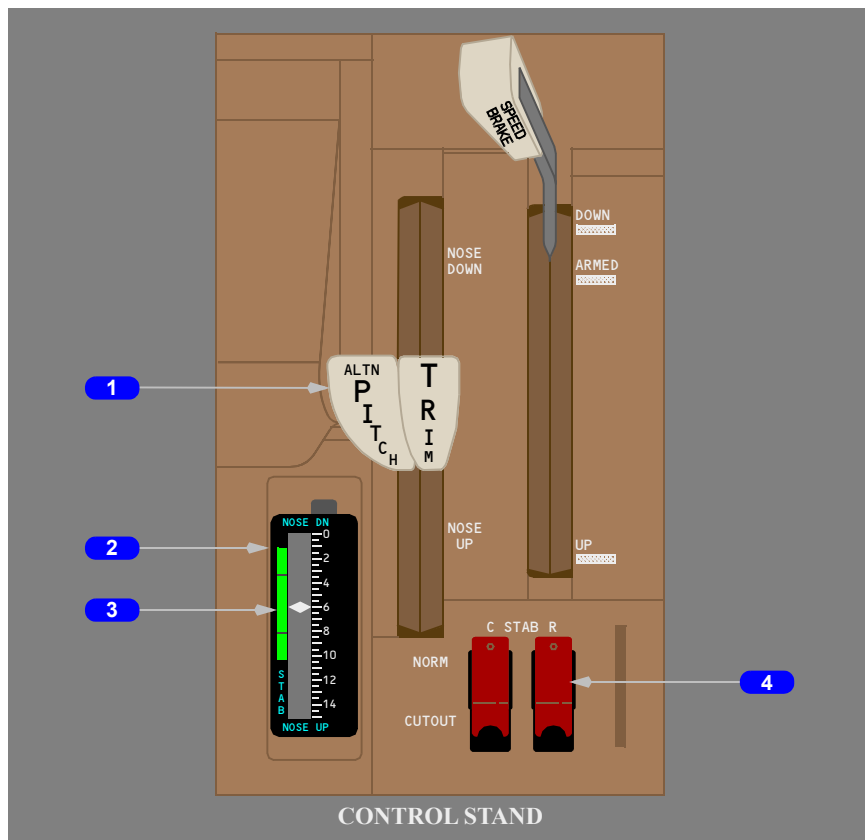
Push/pull – commands the airplane to pitch in the desired direction:

- in the normal mode, deflects the elevator and horizontal stabilizer
- in the secondary and direct modes, deflects the elevator.

Does not move with pitch trim operation.

Stabilizer Trim System

[777-200/-300 Series]



1 Alternate (ALTN) PITCH TRIM Levers

Spring-loaded to neutral.

Push/pull (both levers) –

- in the normal mode, changes trim reference airspeed and moves the stabilizer directly
- in the secondary and direct modes, moves the stabilizer directly.

2 Stabilizer (STAB) Position Indicator

Indicates stabilizer position in units of trim.

3 Takeoff Trim Green Band

The green band indicates the allowable takeoff trim range, based on gross weight, takeoff thrust, and CG information from the FMC. When no information is available, the green band defaults to midrange.

If the stabilizer signal is not present or is invalid, the green band and the pointer are not displayed.

4 Stabilizer (STAB) Cutout Switches

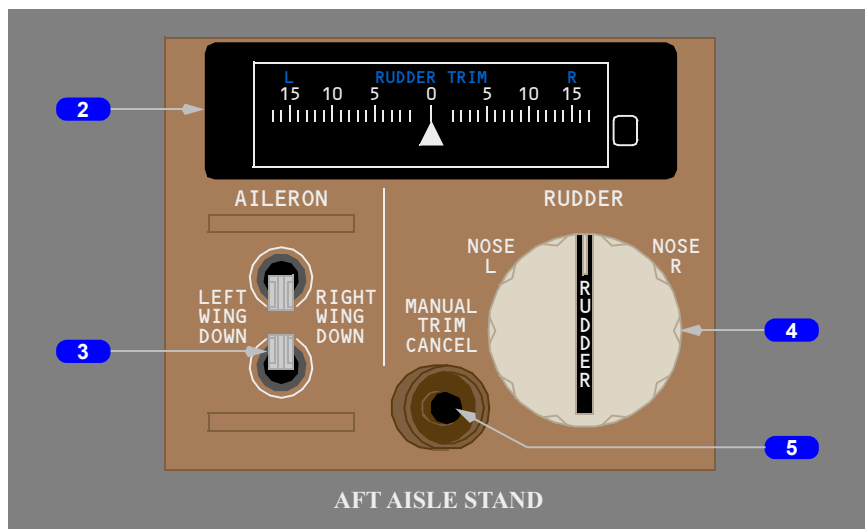
NORM –

- hydraulic power is supplied to the related stabilizer trim control module
- if unscheduled stabilizer motion is detected, center and/or right system hydraulic power to the related stabilizer trim control module is automatically shut off.

CUTOUT – shuts off the respective center or right hydraulic system power to the related stabilizer trim control module.

Aileron and Rudder Trim Controls

[777-200/-300 Series]



1 AILERON TRIM Indicator

Indicates units of aileron trim.

2 RUDDER TRIM Indicator

Indicates units of rudder trim.

3 AILERON Trim Switches

Push (both switches) – moves the control wheel, ailerons, flaperons, and spoilers in the desired direction (spring-loaded to neutral).

4 RUDDER Trim Selector

Spring-loaded to neutral.

Rotate –

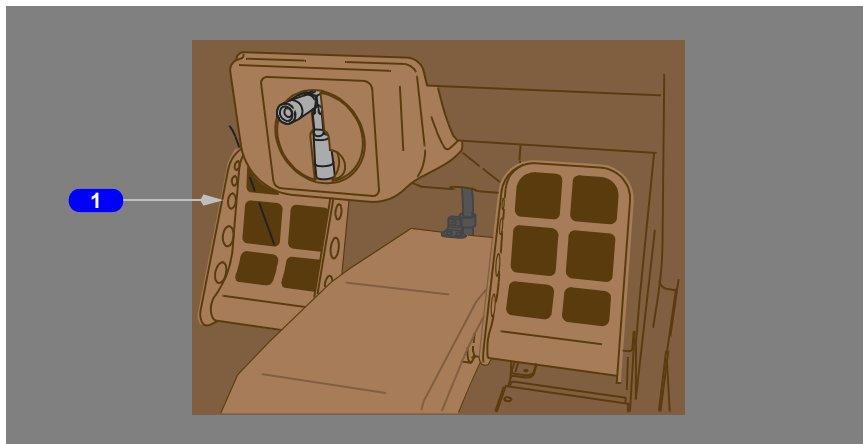
- trims the rudder in the desired direction
- the trim runs at high speed with the knob rotated past the first left or right detent
- the rudder pedals move with rudder trim operation.

5 MANUAL TRIM CANCEL Switch

Push – cancels manual rudder trim in the normal and secondary flight control system modes.

Rudder/Brake Pedals

[777-200/-300 Series]



1 Rudder Pedals

Push – deflects the rudder in the desired direction.

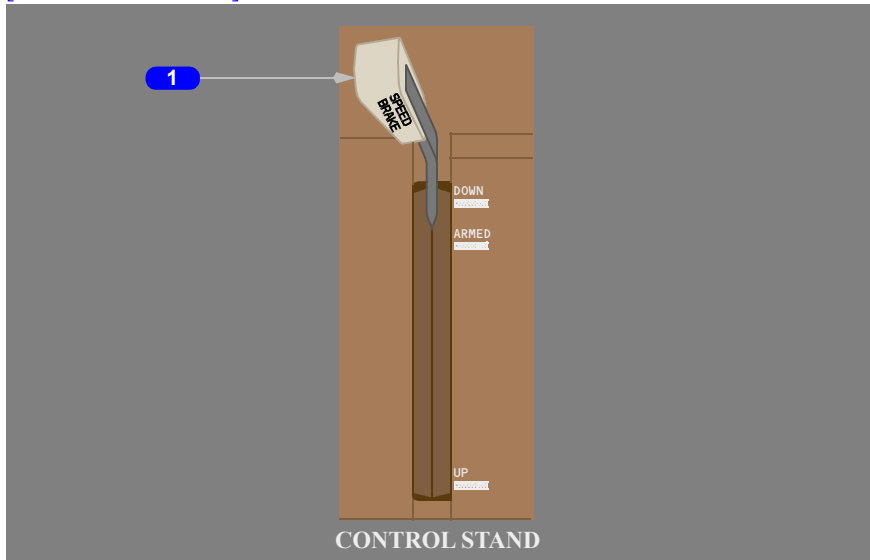
Refer to Chapter 14, Landing Gear, for brakes and nose-wheel steering description.

Speedbrake Lever

On the ground:

- the speedbrake lever moves to DOWN and all spoiler panels retract if either thrust lever is advanced to the takeoff thrust position
- the speedbrake lever moves to UP and all spoiler panels extend if either reverse thrust lever is raised to the reverse idle detent.

[777-200/-300 Series]



1 Speedbrake Lever

DOWN (detent) – all spoiler panels are retracted.

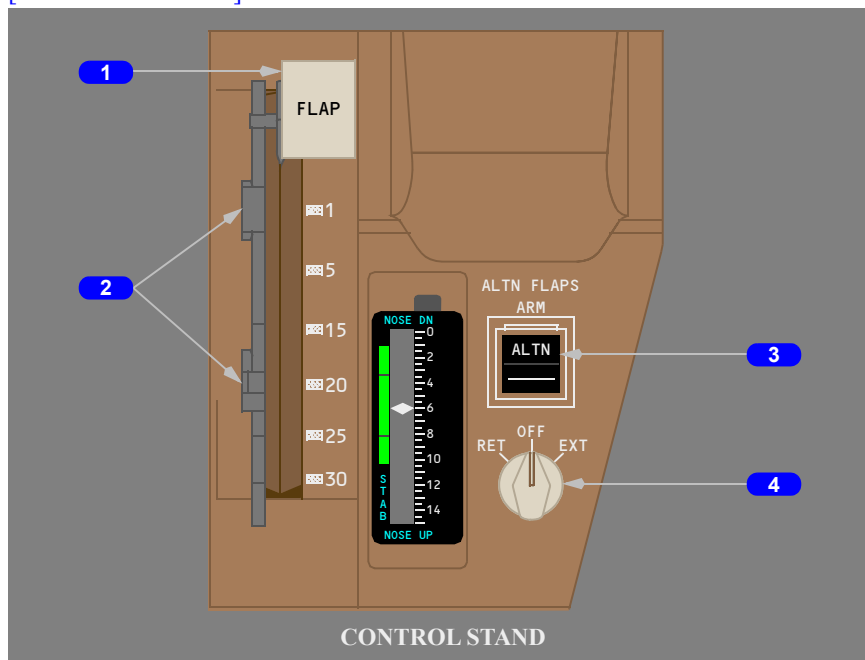
ARMED –

- the auto speedbrake system is armed
- after landing, the speedbrake lever automatically moves to UP and the spoiler panels extend.

UP – the required spoiler panels extend to their maximum in-flight or on-ground position (intermediate positions can be selected).

Flap System Flap Controls

[777-200/-300 Series]



1 Flap Lever

Primary mode – positions the slats and flaps hydraulically.

Secondary mode – positions the slats and/or flaps electrically if hydraulic operation fails.

2 Flap Gates

1 – prevents inadvertent retraction of the slats.

20 – prevents inadvertent retraction of the flaps past the go-around position.

3 Alternate Flaps Arm (ALTN FLAPS ARM) Switch

Push (ALTN displayed) –

- arms the alternate flap control mode
- arms the alternate flaps selector
- disables primary and secondary flap/slat mode operation

777 Flight Crew Operations Manual

- asymmetry/skew and uncommanded motion protection, autoslat, and flap/slat load relief are not available
- the flap lever is inoperative.

4 Alternate Flaps Selector

RET – the slats and flaps are electrically retracted.

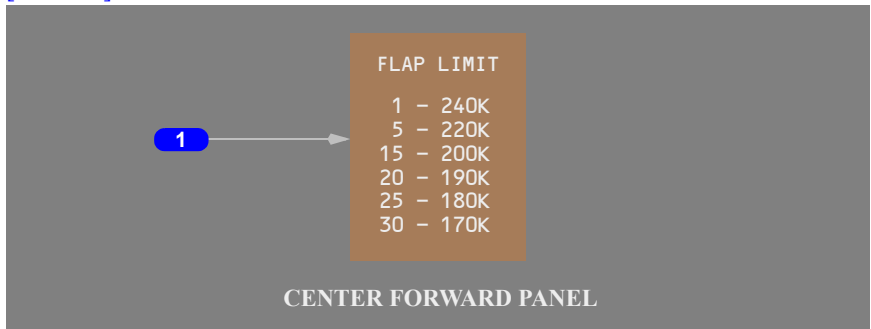
OFF – alternate flaps are deactivated.

EXT –

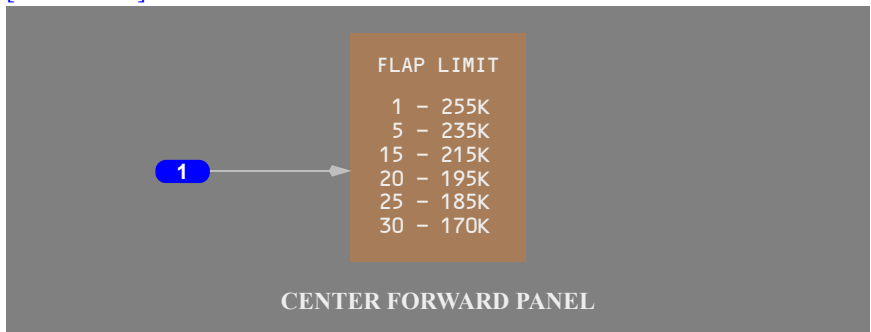
- the slats and flaps are electrically extended
- maximum extension is flaps 20, with the slats at the midrange position.

Flap Limit Placard

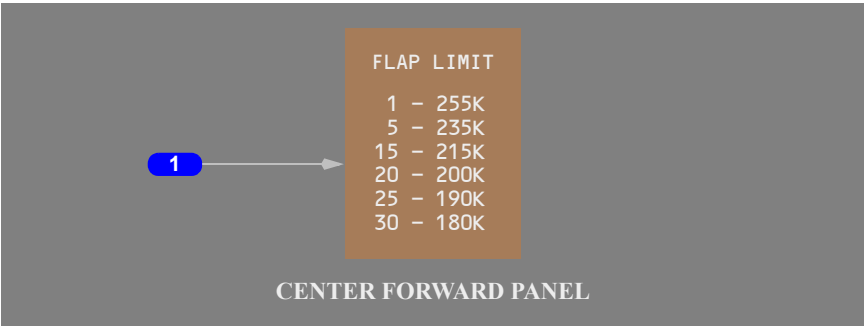
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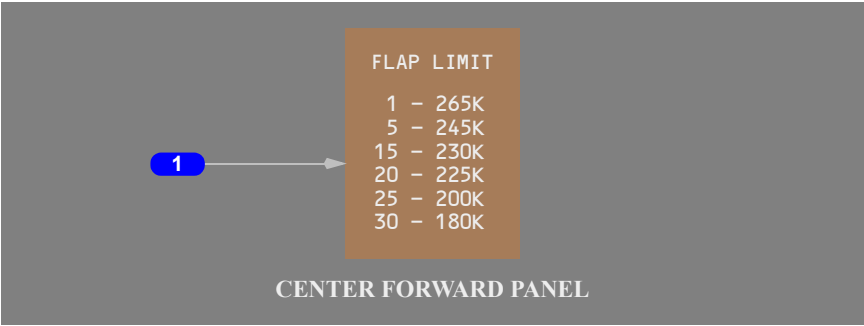
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[777-300]



[777-200LR, 777F, and 777-300ER]



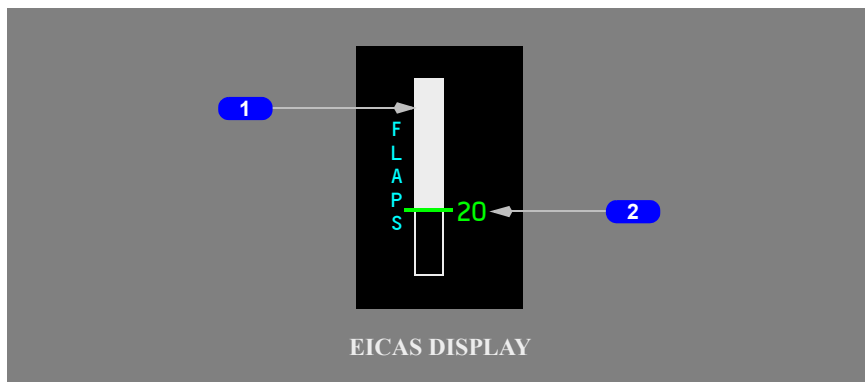
1 Flap Limit Placard

Flaps extended speed limits.

Normal Flap Position Indication

Displays combined flap and slat positions when all surfaces are operating normally and control is in the primary (hydraulic) mode. The indicator shows continuous motion.

The indication is no longer displayed 10 seconds after slat retraction.



[777-200/-300 Series]

1 Flap Position (white)

UP – the slats and flaps are retracted.

1 – the slats extend to the midrange position.

5, 15, and 20 –

- the slats remain in the midrange position
- the flaps extend to the commanded position.

25 – the slats extend to the fully extended position. The flaps extend to 25.

30 – the flaps extend to 30.

Loss of position information is displayed as a white outline with no tape fill and no flap lever position indications.

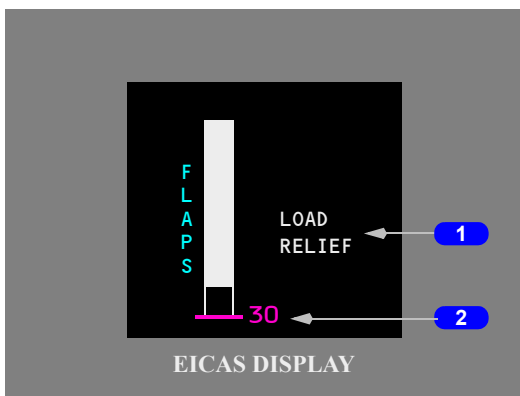
2 Flap Lever Position (line and number)

Magenta – the slats or flaps are in transit to the commanded position.

Green – the slats and flaps are in the commanded position.

The line and number change color.

Flap Load Relief Indication



1 Flap LOAD RELIEF Indication

Displayed (white) –

- flap load relief is retracting the flaps, or inhibiting extension, as required to prevent air load damage due to excessive airspeed
- extension from UP is being inhibited due to either excessive airspeed or altitude.

2 Flap Lever Position

Magenta – the slats or flaps are in transit to the commanded position.

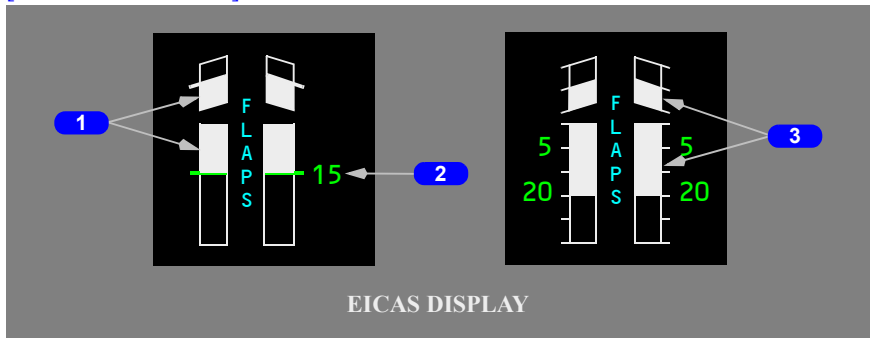
Non-Normal Flap and Slat Position Indication

[777-200/-300 Series]

If any flap/slat is non-normal or if control is in the secondary mode, slat and flap positions are shown independently. Each wing is also shown separately.

Indicator motion is continuous between flap detents.

[777-200/-300 Series]



[777-200/-300 Series]

1 Expanded Flap and Slat Position Indications

The slat indication fills up (forward) for extension.

The flap indication fills down (aft) for extension.

Indication colors of outline and fill are:

- white when operating in secondary mode
- amber when the respective FLAPS DRIVE or SLATS DRIVE EICAS message is displayed.

Loss of position information is displayed as a white outline with no tape fill and no flap lever position indications.

2 Flap Lever Position (line and number)

Magenta – the slats or flaps are in transit to the commanded position.

Green – the slats or flaps are in the commanded position.

The numbers are shown next to the flap position indicator only.

3 Alternate Flap and Slat Position Indications (white)

Slat and flap extension is limited to slats midrange and flaps 20.

Displayed automatically when the alternate control mode is armed.

Slats – displays the position of the slats.

Flaps – displays the position of the flaps.

Flap position index marks – reference flaps 5 and 20.

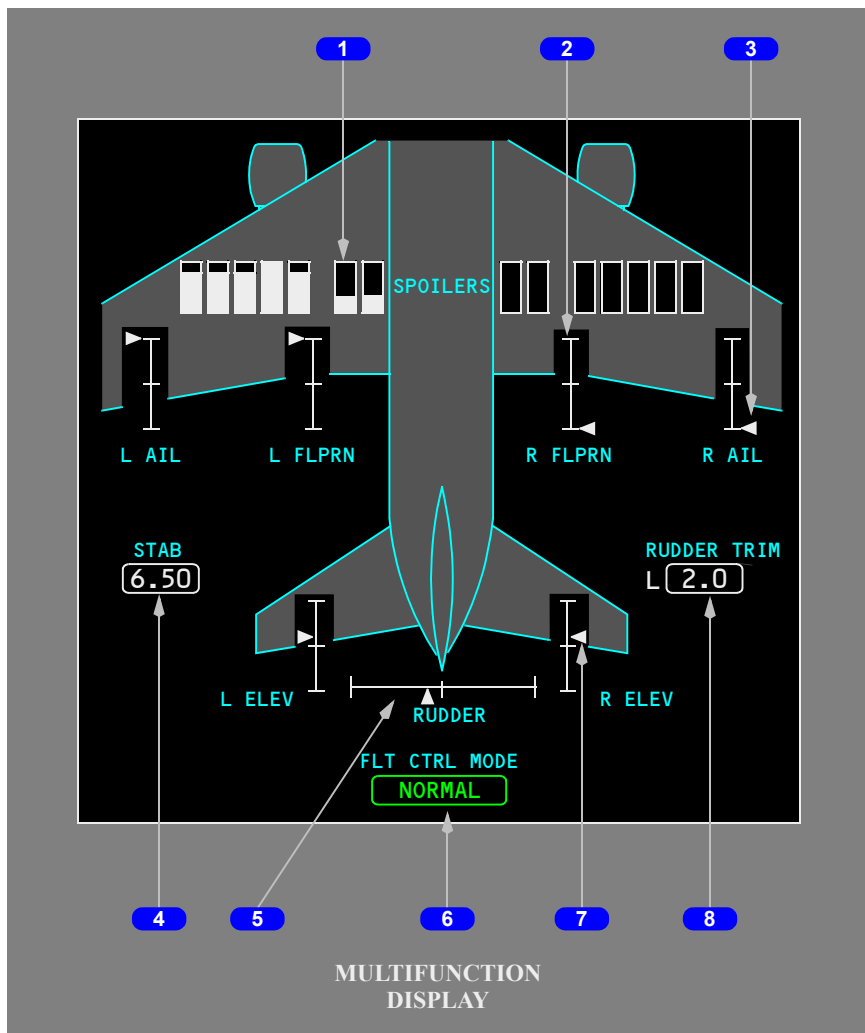
Loss of position information is displayed as a white outline with no tape fill and no position index marks or numbers.

Flight Control Synoptic Displays

[777-200/-300 Series]

The flight control synoptic is displayed by pushing the FCTL synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

Normal Flight Control Synoptic

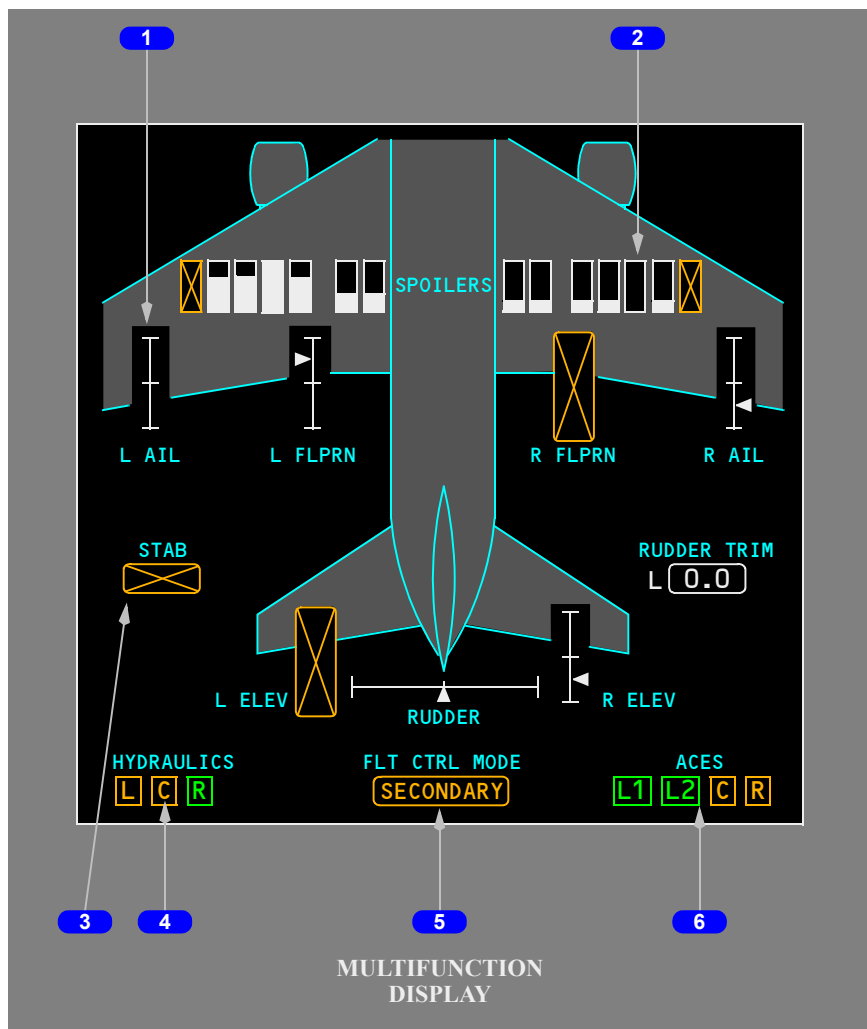


1 Spoiler Position

- 2 Flaperon Position**
- 3 Aileron Position**
- 4 Stabilizer Position**
- 5 Rudder Position**
- 6 Primary Flight Control System Mode**
- 7 Elevator Position**
- 8 Rudder Trim Position and Direction**

L – Left

R – Right

Non-Normal Flight Control Synoptic

- 1** Unknown Aileron Position
- 2** Unknown Spoiler Condition
- 3** Failed Control Surface or Trim Function (amber)
- 4** Hydraulic System Failure Indications

Green – the hydraulic system is functioning normally.

Amber – the failed hydraulic system.

5 Flight Control Mode SECONDARY or DIRECT Indication (amber)

6 Actuator Control Electronic Failure Indications

Green – the ACE is functioning normally.

Amber – the failed ACE.

**Flight Controls
System Description****Chapter 9
Section 20****Introduction**

The primary flight control system uses conventional control wheel, column, and pedal inputs from the pilot to electronically command the flight control surfaces. The system provides conventional control feel and pitch responses to speed and trim changes. The system electronic components provide enhanced handling qualities and reduce pilot workload.

The primary flight control system is highly redundant, with three operating modes: normal mode, secondary mode, and direct mode. The primary flight controls are powered by redundant hydraulic sources. The secondary flight controls, high lift devices consisting of flaps and slats, are hydraulically powered with an electrically powered backup system.

Pilot Controls

The pilot controls consist of:

- two control columns
- two control wheels
- two pairs of rudder pedals
- control wheel pitch trim switches
- the speedbrake lever
- the flap lever
- [\[777-200/-300 Series\]](#)
- aileron trim switches
- rudder trim selector
- [\[777-200/-300 Series\]](#)
- alternate pitch trim levers
- [\[777-200/-300 Series\]](#)
- manual rudder trim cancel switch.

The columns and wheels are connected through jam override mechanisms. If a jam occurs in a column or wheel, the pilots can maintain control by applying force to the other column or wheel to overcome the jam.

The rudder pedals are rigidly connected between the two sides.

The speedbrake lever allows manual or automatic symmetric actuation of the spoilers.

The pilot controls command these system electronic components:

- four actuator control electronics (ACEs)
- three primary flight computers (PFCs).

The ACEs receive input signals from all pilot controls. The ACEs send control signals to the primary flight control surfaces. Each ACE is assigned to different actuators on the control surfaces. No single ACE controls more than one actuator on a control surface. Some ACEs are not assigned to all control surfaces.

The EICAS caution message FLIGHT CONTROLS is displayed if:

- multiple ACE and/or hydraulic system failures cause the loss of a significant number of control surfaces, or
- other flight control system faults are detected.

The ACEs can transmit pilot control inputs directly to the control surfaces, or they can send the pilot inputs to the PFCs. When the ACEs are sending pilot inputs to the PFCs, the ACEs receive control commands back from the PFCs and use the commands to position the flight control surfaces.

The PFCs use information from other airplane systems (such as air data, inertial data, flap and slat position, engine thrust, and radio altitude) to compute control surface commands for enhanced handling qualities. See Primary Flight Control System Modes in this Section for a description of these handling quality enhancements.

The autopilot also sends commands to the PFCs, which then produce control surface commands. See Chapter 4, Automatic Flight.

Flight Control Surfaces

Pitch control is provided by:

- two elevators
- a movable horizontal stabilizer.

Roll control is provided by:

- two flaperons
- two ailerons

[\[777-200/-300 Series\]](#)

- fourteen spoilers.

Yaw control is provided by:

- single rudder
- partial span tab.

The two elevators and horizontal stabilizer work together to provide pitch control. A detailed description of pitch control is given in a separate section later in this chapter.

The flaperons and ailerons provide roll control, assisted by asymmetric spoilers.

The flaperons are located between the inboard and outboard flaps on both wings. In the normal mode, they are used for roll control with the flaps either retracted or extended. For increased lift, the flaperons move down and aft in proportion to trailing edge flap extension.

[\[777-200/-300 Series\]](#)

The ailerons are located outboard of the outboard flaps on each wing. For increased lift, the ailerons move down for flaps 5, 15, and 20, to improve takeoff performance.

In the normal mode, the ailerons and spoilers 5 and 10 are locked out during high-speed flight; the flaperons and remaining spoilers provide sufficient roll control. During low speed flight, these panels augment roll control.

[\[777-200/-300 Series\]](#)

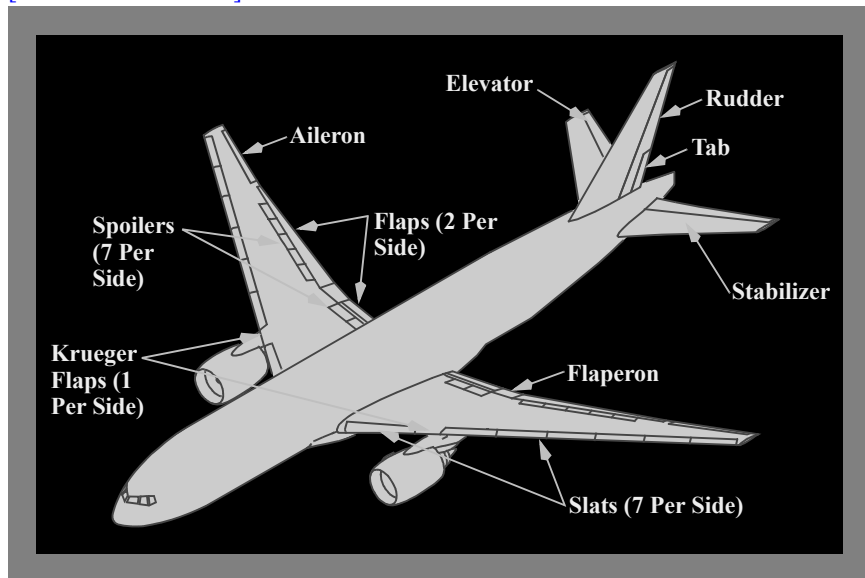
Yaw control is provided by a single rudder, which is almost the same height as the vertical tail. The lower portion of the rudder has a hinged section (tab) that deflects twice as far as the main rudder surface to provide additional yaw control authority. During takeoff, the rudder becomes aerodynamically effective at approximately 60 knots.

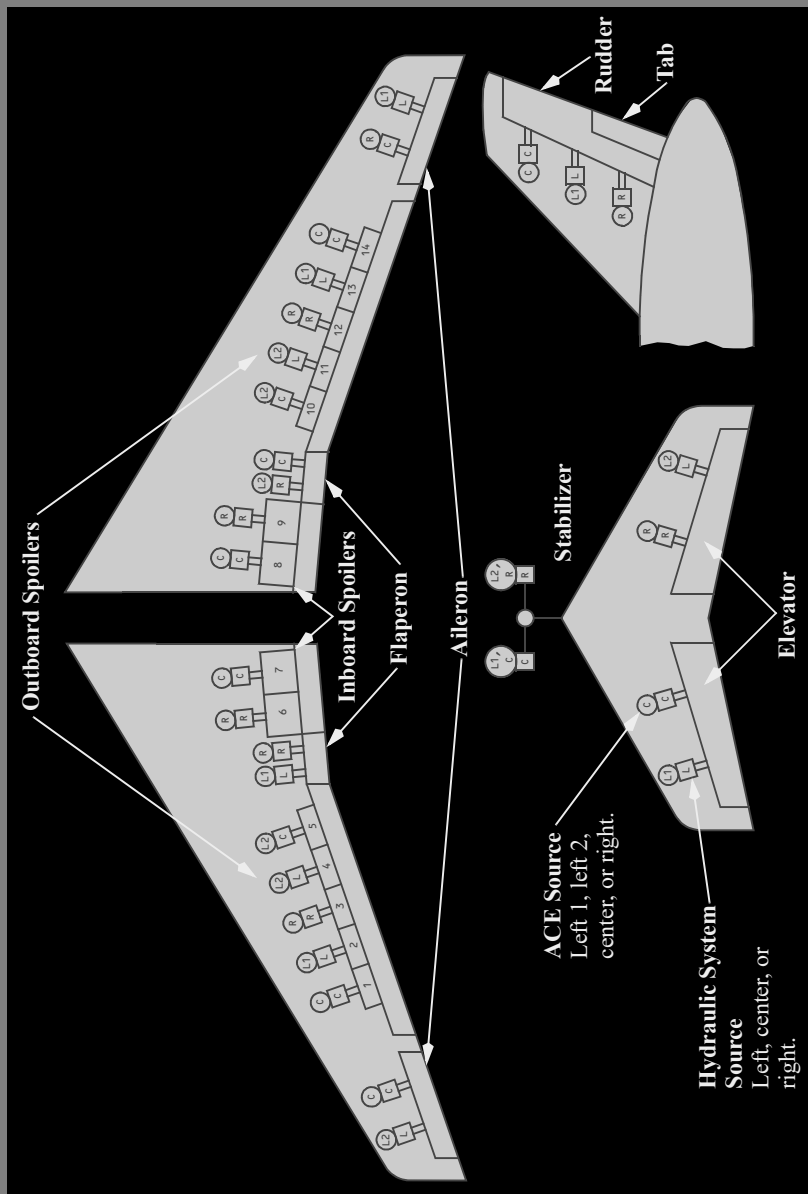
Flaps and slats provide high lift for takeoff, approach, and landing.

Symmetric spoilers are used as speedbrakes.

Flight Control Surface Locations

[777-200/-300 Series]



Actuator Control Electronics/Hydraulic Power Distribution[\[777-200/-300 Series\]](#)

Primary Flight Control System Modes

There are three primary flight control system modes (flap and slat system modes are described later in this section):

- normal
- secondary
- direct.

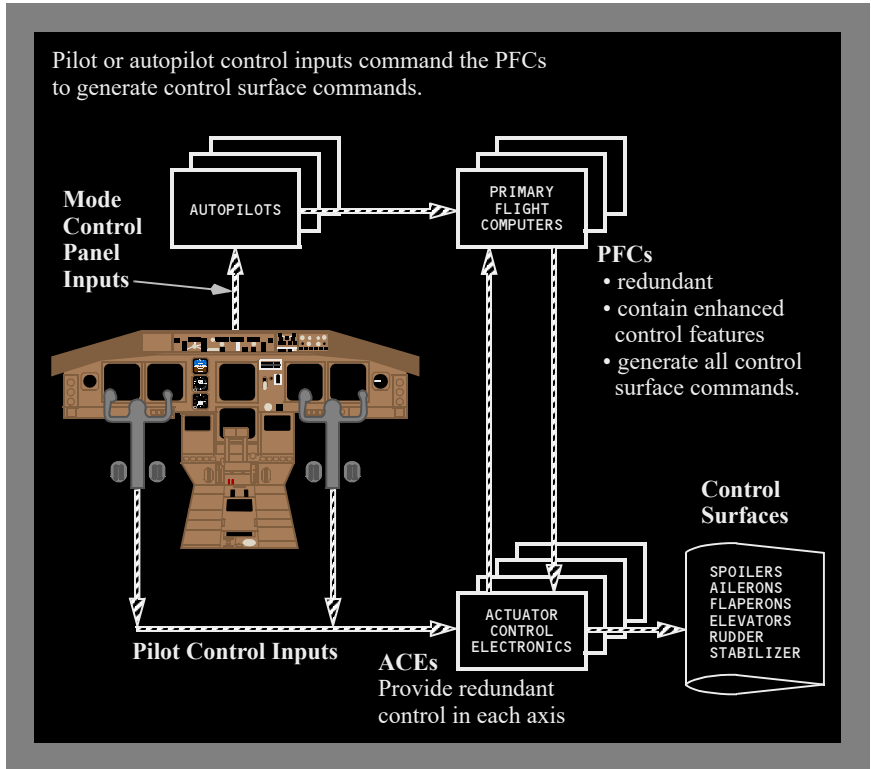
All the modes use the same pilot controls and flight control surfaces.

Flight Control System Normal Mode

In normal mode during manual flight, four ACEs receive pilot control inputs and send these signals to the three PFCs. The PFCs verify these signals and information from other airplane systems in order to compute control surface commands. These commands are then sent back to the ACEs. The ACEs send enhanced signals to the flight control surface actuators.

When the autopilot is engaged, the autopilot system sends commands to the PFCs. The PFCs generate control surface commands, which are then sent to the ACEs in the same manner as pilot control inputs. The autopilot commands move the pilot controls to provide indications of what the autopilot is doing. If the pilot overrides the autopilot with control inputs, the PFCs disconnect the autopilot and use the pilot control inputs. The autopilot is only available during normal mode operation. Refer to Chapter 4, Automatic Flight, for autopilot operation.

After the hydraulic systems are shut down, the PFCs self-test. During the test, various EICAS alert and status messages display, trim indicator information blinks, and various failure indications display on the flight controls synoptic. When the self-test is complete, the EICAS messages disappear, and the trim indicator and synoptic display return to normal. This happens about two minutes after the EICAS caution message HYD PRESS SYS L+C+R is displayed.

Normal Mode[\[777-200/-300 Series\]](#)

Flight Envelope Protection

The primary flight control system provides flight envelope protection when operating in normal mode. Flight envelope protection reduces the possibility of inadvertently exceeding the flight envelope by providing crew awareness of envelope margins through tactile, aural, and visual cues. Envelope protection does not reduce pilot control authority.

The envelope protection functions are described later in this section and include:

- stall protection
- overspeed protection
- bank angle protection.

Refer to Chapter 4, Automatic Flight, for a description of PFD flight mode annunciations, mode control panel operation, autothrottle operation, and flight envelope protection.

Refer to Chapter 10, Flight Instruments, Displays, for a description of PFD indications.

Refer to Chapter 15, Warning Systems, for a description of aural and visual cues.

Flight Control System Secondary Mode

When the PFCs can no longer support the normal mode due to internal faults or lack of required information from other airplane systems, they automatically revert to the secondary mode. The ACEs continue to receive pilot control inputs and send these signals to the three PFCs. However, the PFCs use simplified computations to generate flight control surfaces commands. These simplified commands are sent back to the ACEs, where they are sent to the control surface actuators the same way as in the normal mode.

The simplified PFC control laws used in the secondary mode affect airplane handling qualities. All flight control surfaces remain operable. The elevator and rudder are more sensitive at some airspeeds.

The following functions are not available in the secondary mode:

[777-200/-300 Series]

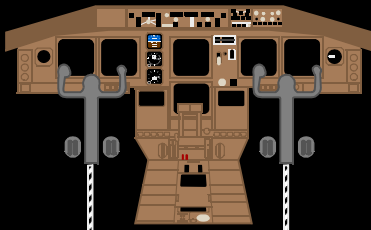
- autopilot
- auto speedbrakes
- envelope protection
- gust suppression
- tail strike protection
- thrust asymmetry compensation
- yaw damping (may be degraded or inoperative).

The EICAS caution message FLIGHT CONTROL MODE is displayed when the primary flight control system is in the secondary mode. The secondary mode cannot be manually selected.

Secondary Mode

[777-200/-300 Series]

Pilot control inputs command the PFCs to generate control surface commands. The autopilot is not available.



Pilot Control Inputs

PRIMARY
FLIGHT
COMPUTERS

PFCs
Generate all control
surface commands.

ACTUATOR
CONTROL
ELECTRONICS

Control
Surfaces

SPOILERS
AILERONS
FLAPERONS
ELEVATORS
RUDDER
STABILIZER

Flight Control System Direct Mode

The ACEs automatically transition to the direct mode when they detect the failure of all three PFCs or lose communication with the PFCs. The direct mode can also be manually selected by moving the PRIMARY FLIGHT COMPUTERS DISCONNECT switch to DISC.

In the direct mode, the PFCs no longer generate control surface commands. Pilot inputs received by the ACEs are sent directly to the control surface actuators.

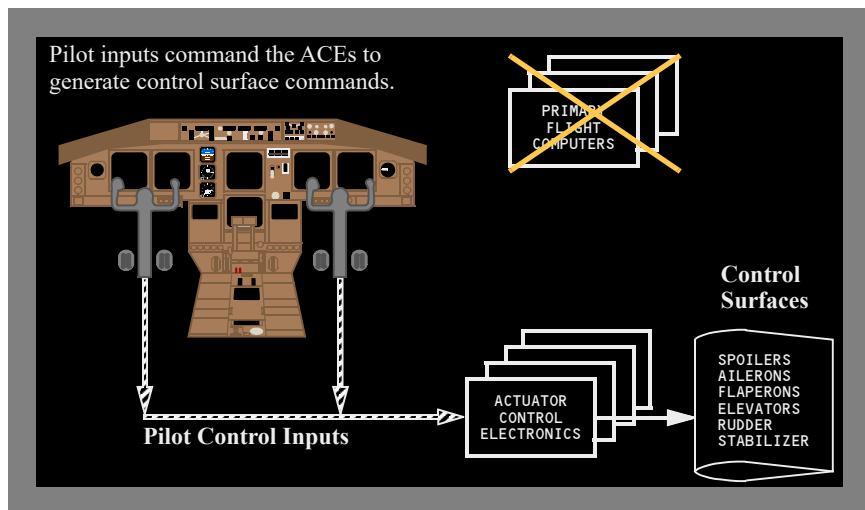
The direct mode provides full airplane control for continued safe flight and landing. Airplane handling qualities are approximately the same as in the secondary mode. The EICAS caution message PRI FLIGHT COMPUTERS is displayed when the system is in the direct mode.

In the direct mode, the following functions are not available:

- autopilot
 - auto speedbrakes
 - envelope protection
 - gust suppression
 - tail strike protection
- [777-200/-300 Series]
- manual rudder trim cancel switch
 - thrust asymmetry compensation
 - yaw damping.

Direct Mode

[777-200/-300 Series]



Mechanical Backup[\[777-200/-300 Series\]](#)

In the unlikely event of a complete electrical system shut-down, cables from the flight deck to the stabilizer and selected spoilers allow the pilot to fly straight and level until the electrical system is restarted.

Normal Mode Pitch Control

In the normal mode, airplane pitch control characteristics are like conventional airplanes, with improved handling qualities. Unlike conventional airplanes, the control column does not directly position the elevator in flight. The control column commands the PFCs to generate a pitch maneuver. The PFCs automatically position the elevator and the stabilizer to generate the commanded maneuver. The PFCs constantly monitor airplane response to pilot commands and reposition the elevator and stabilizer to carry out these commands. Airplane pitch responses to thrust changes, gear configuration changes, and turbulence are automatically minimized by PFC control surface commands.

The PFCs also provide compensation for flap and speedbrake configuration changes, and turns up to 30° of bank. The PFCs automatically control pitch to maintain a relatively constant flight path. This eliminates the need for the pilot to make control column inputs to compensate for these factors. For turns up to 30° of bank, the pilot does not need to add additional column back pressure to maintain altitude. For turns of more than 30° of bank, the pilot does need to add column back pressure.

As airspeed changes, the PFCs provide conventional pitch control characteristics by requiring the pilot to make control column inputs or trim changes to maintain a constant flight path.

Primary Pitch Trim Control

Primary pitch trim is controlled by the dual pitch trim switches on each control wheel. Both switches must be moved to command trim changes. The primary pitch trim switches are inhibited when the autopilot is engaged. Pitch trim does not move the control column.

In the normal mode, primary pitch trim operates differently on the ground than it does in flight. On the ground, the stabilizer is directly positioned when the pilot uses the pitch trim switches. In flight, the pitch trim switches do not position the stabilizer directly, but make inputs to the PFCs to change the trim reference speed. The trim reference speed is the speed at which the airplane would eventually stabilize if there were no control column inputs. Once the control column forces are trimmed to zero, the airplane maintains a constant speed with no column inputs. Thrust changes result in a relatively constant indicated airspeed climb or descent, with no trim inputs needed unless airspeed changes.

When pilot trim inputs are made, the PFCs automatically move the elevators to achieve the trim change, then move the stabilizer to streamline the elevator. Stabilizer motion may also automatically occur to streamline the stabilizer and elevator for thrust and configuration changes.

Alternate Pitch Trim

[777-200/-300 Series]

Alternate pitch trim is controlled by the dual alternate pitch trim levers on the control stand. Both levers must be moved to command trim changes. These levers move the trim reference airspeed (normal mode) and also move the stabilizer (all modes). The alternate pitch trim levers are linked to the stabilizer trim control modules (STCM) via control cables, and then mechanically to the stabilizer. Alternate pitch trim commands have priority over wheel pitch trim commands in all flight control modes.

Moving the alternate pitch trim levers with the autopilot engaged does not disconnect the autopilot, but does move the stabilizer. Moving the alternate pitch trim levers during stall or overspeed protection does move the stabilizer, but does not remove column forces.

Note: The alternate pitch trim levers should not be used with the autopilot engaged, or during stall or overspeed protection.

Pitch Envelope Protection

The pitch envelope protection functions include:

- stall protection
- overspeed protection.

Stall Protection

Stall protection reduces the likelihood of inadvertently exceeding the stall angle of attack by providing enhanced crew awareness of the approach to a stall or to a stalled condition.

Stall protection limits the speed to which the airplane can be trimmed. The trim reference speed is limited by inhibiting trim in the nose up direction when the airplane slows to a speed where maneuver margin is limited. This trim inhibit speed is approximately the minimum maneuvering speed (top of the amber band) at lower altitudes, and can be 10 to 20 knots lower than the top of the amber band at higher altitudes. The pilot must apply continuous aft column pressure, at higher than normal force, to maintain airspeed below trim inhibit speed.

Overspeed Protection

Overspeed protection limits the speed to which the airplane can be trimmed. At VMO/MMO, overspeed protection limits the trim reference speed so that trim is inhibited in the nose down direction. The pilot must apply continuous forward column force to maintain airspeed above VMO/MMO. Use of the alternate pitch trim levers does not reduce column forces.

Elevator Variable Feel

The PFCs calculate feel commands based on airspeed. In general, control column forces increase:

- as airspeed increases for a given column displacement, or
- as column displacement increases.

Tail Strike Protection

[777-200LR, 777-300ER]

During takeoff or landing, the PFCs calculate if a tail strike is imminent and decrease elevator deflection, if required, to reduce the potential for tail strike. Activation of tail strike protection does not provide feedback to the control column.

Secondary and Direct Mode Pitch Control

Airplane pitch control is different in the secondary and direct flight control modes. The control columns now command a proportional elevator deflection instead of a maneuver command. Secondary and direct modes do not provide automatic pitch compensation for:

- thrust changes
- gear configuration changes
- turbulence
- flap and speedbrake configuration changes
- turns to 30° bank angle.

In secondary and direct modes, the elevator variable feel system provides two feel force levels instead of a continuous variation with airspeed. The force levels change with flap position. With the flaps up, the feel forces provide maneuver force levels that discourage overcontrol in the pitch axis at high speeds. With flaps out of up, the feel forces decrease to provide force levels appropriate for approach and landing.

[\[777-200/-300 Series\]](#)

In the secondary and direct modes, both the primary pitch trim switches and the alternate pitch trim levers move the stabilizer directly. There is no trim reference speed.

Stabilizer Hydraulic Power and Non-Normal Operation

[\[777-200/-300 Series\]](#)

The stabilizer is powered by the center and right hydraulic systems. Stabilizer position commands from the PFCs and alternate pitch trim levers are sent to the stabilizer trim control modules, which control hydraulic power to the stabilizer. There are two modules, one for each stabilizer hydraulic source.

Stabilizer Shutdown

If uncommanded stabilizer motion is sensed, hydraulic power to the stabilizer trim control module that caused the motion is automatically shut off. If a module is inoperative due to an automatic shutdown or another failure, the EICAS advisory message STABILIZER C or STABILIZER R is displayed. The stabilizer remains operative through the remaining stabilizer trim control module.

If both stabilizer trim control modules automatically shut down or fail, the EICAS warning message STABILIZER is displayed. The STABILIZER warning is also displayed if automatic shutdown fails to stop uncommanded motion.

The center and right stabilizer cutout switches, located on the aisle stand, control hydraulic power to the respective stabilizer trim control module. Placing both switches in the CUTOOUT position removes all hydraulic power from the stabilizer. The EICAS advisory message STABILIZER CUTOOUT is displayed when both stabilizer cutout switches are in the CUTOOUT position. The STABILIZER warning message is no longer displayed.

In the normal flight control mode, when the stabilizer is manually shut down or failed, pitch trim is still available. Pilot pitch trim inputs change the PFC trim reference speed. The PFCs then reposition the elevators to trim the airplane.

The control column can be used to interrupt pitch trim commands from the wheel pitch trim switches. This feature allows the pilot to quickly stop uncommanded trim changes due to stuck pitch trim switches. The pitch trim commands are interrupted if the control column is displaced in the opposing direction.

Stabilizer Position Indication and Green Band

[777-200/-300 Series]

Stabilizer position is displayed on two stabilizer position indicators located on the aisle stand. Stabilizer position is also displayed on the flight controls synoptic.

The stabilizer position indicators also display the takeoff green band indication. The green band automatically displays the acceptable range for takeoff stabilizer positions. There are three green band segments that can be illuminated for takeoff:

- the mid-band
- the nose down band (which includes the mid-band)
- the nose up band (which includes the mid-band).

The green band is calculated using the FMC inputs of CG, gross weight, and takeoff thrust.

A nose gear oleo pressure switch provides an automatic cross-check of the CG to ensure that the correct green band has been selected. When either the nose up or nose down band is selected, the pressure switch position is compared to the computed green band. The EICAS advisory message STAB GREENBAND is displayed if the pressure switch and the green band disagree. If the stabilizer signal is not present or is invalid, the green band and the pointer are not displayed.

Normal Mode Roll Control

Roll control is similar to conventional airplanes. Aileron and flaperon surface deflections are proportional to control wheel displacement. Spoilers begin to extend to augment roll control after several degrees of control wheel rotation. Control wheel forces increase as control displacement increases. Control wheel forces do not change with airspeed changes. The ailerons are locked out at high speeds.

[\[777-200/-300 Series\]](#)

Spoilers 4 and 11 are mechanically controlled through a cable from the control wheel. These spoilers are available for roll control until the speedbrake lever is moved to near the UP position, when they function as speedbrakes only. Spoilers 5 and 10 are locked out at high speed.

A maneuver load alleviation function can move spoilers and ailerons to reduce wing loads caused by pilot column inputs. This function can activate when in normal flight control mode with flaps up.

Aileron Trim

[\[777-200/-300 Series\]](#)

Dual aileron trim switches located on the aisle stand must be pushed simultaneously to command trim changes. Use of aileron trim causes control wheel rotation.

[\[777-200/-300 Series\]](#)

The amount of aileron trim is indicated on a scale on the top of each control column.

Bank Angle Protection

Bank angle protection reduces the likelihood of exceeding the bank angle boundary due to external disturbances, system failures, or inappropriate pilot action.

Bank angle protection provides roll control wheel inputs when airplane bank angle exceeds the bank angle protection boundary of approximately 35°. If the boundary is exceeded, the control wheel force rolls the airplane back within 30° of bank. This roll command can be overridden by the pilot. Maximum control wheel deflection always commands maximum control surface deflection. The autopilot disengage bar disables bank angle protection.

Excessive bank angles are indicated on the PFD bank indicator. The indicator changes color to amber at bank angles exceeding 35°.

Secondary and Direct Mode Roll Control

[\[777-200/-300 Series\]](#)

Roll control in the secondary and direct modes is very similar to roll control in the normal mode. Bank angle protection is not available in either the secondary or direct mode. Spoilers 5 and 10 are always locked out.

Normal Mode Yaw Control

[\[777-200/-300 Series\]](#)

Yaw control operation is similar to a conventional airplane. Rudder surface deflections are proportional to rudder pedal movements.

Pedal forces increase as pedal displacement increases. Pedal forces do not change with airspeed changes.

The rudder ratio changer automatically reduces rudder deflection (for a given pedal input) as airspeed increases. This protects the vertical tail structure from stresses resulting from large rudder surface deflections at high airspeeds. Sufficient rudder authority is provided at all airspeeds to maintain airplane control in engine-out conditions, as well as during takeoffs and landings in crosswinds.

Thrust Asymmetry Compensation

[\[777-200/-300 Series\]](#)

The thrust asymmetry compensation (TAC) system significantly reduces uncommanded flight path changes associated with an engine failure. TAC continually monitors engine data to determine the thrust level from each engine. If the thrust level on one engine differs by 10 percent or more from the other engine, TAC automatically adds rudder to minimize yaw.

Before liftoff, TAC does not fully compensate for the failed engine so the pilot can recognize engine failure through roll/yaw cues. These roll/yaw cues are greatly reduced when compared to an airplane operating without TAC. After liftoff, TAC attempts to fully compensate for the failed engine.

The amount of rudder used is proportional to the engine thrust difference. Rudder movement is back-driven through the rudder pedals and displayed on the rudder trim indicator. Following engine failure, the pilot can trim the airplane using additional rudder trim, control wheel input, aileron trim, or autopilot engagement.

TAC is available except:

- when airspeed is below 70 knots on the ground, or
- when reverse thrust is applied, or
- when automatically disengaged due to system malfunction or loss of engine thrust data.

TAC automatically disengages if engine thrust data is lost. TAC may also disengage following severe engine damage or surge if it is unable to determine an accurate thrust level. TAC may still cause some rudder deflection in the appropriate direction just before automatically disengaging.

TAC can be manually overridden by making manual rudder pedal inputs. TAC is only available in the normal flight control mode. To manually disarm TAC, push the THRUST ASYM COMP switch on the overhead panel. If TAC is automatically or manually disconnected, the EICAS advisory message THRUST ASYM COMP displays.

Wheel to Rudder Cross-Tie

[\[777-200/-300 Series\]](#)

A wheel to rudder cross-tie function provides the capability of being able to control the initial effects of an engine failure using control wheel inputs only. Control wheel inputs can deflect the rudder up to 8 degrees.

[\[777-200/-300 Series\]](#)

Wheel to rudder cross-tie is operative in flight below 210 knots in the normal mode.

Yaw Damping

In the normal mode, the yaw damping function provides turn coordination and Dutch roll damping.

Gust Suppression

A gust suppression function reduces the effects of lateral gusts and improves lateral ride quality through a combination of yaw and roll commands. Operation does not result in either rudder pedal or control wheel movement.

Rudder Trim

[\[777-200/-300 Series\]](#)

The rudder trim control can be used to command manual rudder trim in all three flight control modes. Two rudder trim speeds are available. Low rate rudder trim is commanded by rotating the control to the detent. High rate rudder trim is commanded by rotating the control past the detent. Manual Trim Cancel switch actuation causes manually set rudder trim to move to the zero units position at the high speed trim rate. The zero position achieved by actuating the switch is not as accurate as manually trimming to zero units. The switch has no effect on rudder trim inputs from TAC.

Secondary and Direct Mode Yaw Control

[\[777-200/-300 Series\]](#)

Secondary and direct mode yaw control is similar to normal mode yaw control. Pedal feel forces are unchanged from normal mode; however, rudder response is slightly different.

In secondary and direct modes, the rudder ratio changer is degraded to two fixed ratios determined by flap position. With flaps up, the rudder response to pedal inputs is less than with the flaps down.

[\[777-200/-300 Series\]](#)

In the secondary mode:

- gust suppression is inoperative
- yaw damping is degraded (for some failures, it may be inoperative)
- thrust asymmetry compensation is inoperative.

[\[777-200/-300 Series\]](#)

In the direct mode the following are inoperative:

- gust suppression
- yaw damping
- the manual rudder trim cancel switch
- thrust asymmetry compensation.

Spoilers

[777-200/-300 Series]

There are 7 sets of spoilers, 5 outboard and 2 inboard of the flaperons, on the upper surface of each wing. The spoilers are numbered from left to right, 1 through 14. Spoilers on opposing wings are symmetrically paired.

Spoiler panels are used as speedbrakes to increase drag and reduce lift, both in flight and on the ground. The spoilers also supplement roll control in response to control wheel commands. Spoiler panels 5 and 10 are locked out during cruise, depending on altitude and airspeed.

[777-200/-300 Series]

All three hydraulic systems supply the spoilers. Each hydraulic system is dedicated to a different set of spoiler pairs to provide isolation and maintain symmetric operation in the event of hydraulic system failure. If a single spoiler fails, the corresponding spoiler on the other wing retracts. Failure of a single or multiple spoiler pairs causes the EICAS advisory message SPOILERS to display.

Spoiler Speedbrake Operation

[777-200/-300 Series]

The 14 spoiler panels are used as speedbrakes. In the normal mode, when used as speedbrakes, spoilers 5 and 10 are available as ground speedbrakes only. In the secondary and direct modes, spoilers 4, 5, 10, and 11 are locked out.

The speedbrake spoilers are controlled by the speedbrake lever located on the control stand. The speedbrake lever has three marked positions:

- DOWN
- ARMED
- UP.

The speedbrake lever can be placed in intermediate positions between ARMED and UP.

In the ARMED position, the speedbrake lever is driven aft to the UP position when the landing gear is fully on the ground (not tilted) and the thrust levers are at idle.

On the ground when either reverse thrust lever is moved to the reverse idle detent, the speedbrakes automatically extend. The speedbrake lever does not need to be in the ARMED position. A mechanical link between the speedbrake lever and the reverse thrust levers raises the speedbrake lever out of the DOWN detent. The speedbrake lever is then driven aft and the speedbrakes extend. If either thrust lever is advanced to a takeoff position, the speedbrake lever is driven to the down position.

Automatic speedbrakes are not available in the secondary and direct modes.

There is no limitation for extension of speedbrakes in a landing configuration.

Landing Attitude Modifier (LAM)

Landing Attitude Modifier (LAM) is an automatic function used to increase pitch attitude and increase the nose gear height when landing flaps are selected at higher speeds. LAM increases pitch attitude by partially raising selected lateral control surfaces. This reduces the lift produced by the wing, requiring the airplane to fly at a higher pitch attitude. When LAM is active, some airframe buffet may occur. There are no crew procedures or monitoring requirements for this system and no alert messages specific to this function for any failure mode.

Flaps and Slats

The flaps and slats are high lift devices that increase wing lift and decrease stall speed during takeoff, approach, and landing.

The airplane has an inboard and an outboard flap on the trailing edge of each wing, and one inboard and six outboard slats on the leading edge. A two-position Krueger flap provides a seal between the inboard slat and engine nacelle on each wing.

[777-200/-300 Series]

In the flaps 1 position, only the slats move. Flaps 5, 15, and 20 are takeoff flap positions. Flaps 25 and 30 are landing flaps positions. Flaps 20 is used for some non-normal landing conditions.

[777-200]

To protect against inadvertent deployment during cruise, flap and slat extension from the UP position is inhibited when speed is more than 250 knots or altitude is above approximately 20,000 feet.

[777-200ER and 777-300]

To protect against inadvertent deployment during cruise, flap and slat extension from the UP position is inhibited when speed is more than 265 knots or altitude is above approximately 20,000 feet.

[777-200LR, 777F, and 777-300ER]

To protect against inadvertent deployment during cruise, flap and slat extension from the UP position is inhibited when speed is more than 275 knots or altitude is above approximately 20,000 feet.

If the flap handle is moved out of UP while the flaps are inhibited, LOAD RELIEF displays.

Flap and Slat Sequencing

[777-200/-300 Series]

When the flap lever is in the UP detent, all flaps and slats are commanded retracted. Moving the flap lever aft allows selection of flap detent positions 1, 5, 15, 20, 25 and 30. The flaps and slats sequence so that the slats extend first and retract last.

Starting from flaps UP, selection of flaps 1 commands the slats to move to the midrange position. The flaps remain retracted.

[777-200/-300 Series]

Selection of the flaps 5, 15, and 20 positions commands the flaps to move to the position selected. The slats remain in the midrange position.

Selection of flaps 25 commands both the flaps and slats to move to landing positions. First the slats extend to the fully extended position, then the flaps extend to the landing flaps 25 position.

Selection of flaps 30 commands the flaps to extend to the primary landing position.

During retraction, flap and slat sequencing is reversed.

The mechanical gate at the flaps 20 detent prevents inadvertent retraction of the flaps past the go-around flap setting. The mechanical gate at flaps 1 prevents inadvertent retraction of the slats past the midrange position.

Flap and Slat Modes

Three modes of flap and slat operation are possible:

- primary (hydraulic)
- secondary (electric)
- alternate (electric).

The flaps and slats can operate independently in either the primary or secondary mode. However, independent flap and slat operation in the alternate mode is not possible.

Primary mode hydraulic power is supplied by the center hydraulic system. Secondary and alternate mode electrical power is supplied by the left and right AC busses.

The secondary mode is automatically engaged whenever the primary mode fails to move the flaps or slats to the selected position. Once engaged, the secondary mode remains engaged until the affected system surfaces are fully retracted or center hydraulic system pressure is restored.

[777-200]

In the secondary mode, the flaps and slats are positioned by electric motors. Because autoslats are unavailable, the slats are fully extended at all flap positions (if airspeed is less than 215 knots) to improve stall handling characteristics. If airspeed exceeds 215 knots, the slats retract to the midrange position (the midrange index on the slat position indicator), or will not extend beyond the midrange position.

[777-200ER]

In the secondary mode, the flaps and slats are positioned by electric motors. Because autoslats are unavailable, the slats are fully extended at all flap positions (if airspeed is less than 239 knots) to improve stall handling characteristics. If airspeed exceeds 239 knots, the slats retract to the midrange position (the midrange index on the slat position indicator), or will not extend beyond the midrange position.

[777-300]

In the secondary mode, the flaps and slats are positioned by electric motors. Because autoslats are unavailable, the slats are fully extended at all flap positions (if airspeed is less than 246 knots) to improve stall handling characteristics. If airspeed exceeds 246 knots, the slats retract to the midrange position (the midrange index on the slat position indicator), or will not extend beyond the midrange position.

[777-200LR, 777F, and 777-300ER]

In the secondary mode, the flaps and slats are positioned by electric motors. Because autoslats are unavailable, the slats are fully extended at all flap positions (if airspeed is less than 256 knots) to improve stall handling characteristics. If airspeed exceeds 256 knots, the slats retract to the midrange position (the midrange index on the slat position indicator), or will not extend beyond the midrange position.

If the slats are in the midrange position (flaps 1 through 20) when the secondary mode is engaged, they remain in that position until the flaps are retracted to UP, or extended beyond 20.

On the ground, secondary electric mode extension or retraction is inhibited when groundspeed is less than 40 knots, center hydraulic system pressure is low, and two of the following three items are true:

[GE, PW Engines]

- left engine N2 is less than 50 percent,
- right engine N2 is less than 50 percent,
- primary external power is available.

[RR Engines]

- left engine N3 is less than 50 percent,
- right engine N3 is less than 50 percent,
- primary external power is available.

The alternate mode allows direct manual operation of the flaps and slats through the secondary drive electric motors. The alternate flaps ARM switch:

- disables normal control
- engages the electric motors
- arms the alternate mode
- the flap lever no longer controls flaps/slats.

The three-position alternate flaps selector extends and retracts the flaps and slats. The flaps and slats extend simultaneously, but slat retraction is inhibited until the flaps are up. Alternate mode flap and slat extension is limited to slats midrange and flaps 20. Asymmetry protection, uncommanded motion protection, autoslats, and flap/slat load relief are not available in the alternate mode.

The alternate mode must be manually selected. Slat and flap operation time in the secondary and alternate modes is greatly increased.

Flap/Slat Load Relief

[777-200/-300 Series]

In the primary mode, the flap load relief system protects the flaps from excessive air loads. If flap airspeed placard limits are exceeded with the flaps in the 15 through 30 position, LOAD RELIEF is displayed and the flaps automatically retract to a position appropriate to the airspeed. Flaps start to retract when airspeed is 1 knot higher than the flap placard airspeed. Load relief retraction is limited to flaps 5.

When airspeed is 5 knots below the flap placard airspeed for the commanded flap position, the flaps automatically re-extend. Re-extension is limited to the commanded flap position.

[777-200/-300 Series]

If a flap overspeed exists, load relief prevents flap extension beyond the 5, 15, 20, or 25 positions until airspeed is sufficiently reduced. Flap load relief is available only in the primary mode. The EICAS flap display indicates an in-transit flap condition and shows actual flap position. The flap lever does not move during flap load relief operation. Load relief for slats is not required in the primary or alternate modes.

[777-200]

Slat load relief is available in the secondary mode. If airspeed exceeds 215 knots with the slats fully extended, they retract to midrange and LOAD RELIEF is displayed.

[777-200ER]

Slat load relief is available in the secondary mode. If airspeed exceeds 239 knots with the slats fully extended, they retract to midrange and LOAD RELIEF is displayed.

[777-300]

Slat load relief is available in the secondary mode. If airspeed exceeds 246 knots with the slats fully extended, they retract to midrange and LOAD RELIEF is displayed.

[777-200LR, 777F, and 777-300ER]

Slat load relief is available in the secondary mode. If airspeed exceeds 256 knots with the slats fully extended, they retract to midrange and LOAD RELIEF is displayed.

Autoslats

The autoslat system enhances airplane stall characteristics. Upon receiving a signal from the stall warning system, the slats automatically extend from the midrange position to the fully extended landing position. The slats retract a few seconds after the signal is removed. Slats are fully extended to improve stall handling characteristics.

Autoslat operation is armed at flaps 1, 5, 15 and 20 and is available only in the primary slat mode.

Flap and Slat Asymmetry Detection

[\[777-200/-300 Series\]](#)

A detection system detects asymmetrical extension or retraction of an individual flap. After detection, the flap drive shuts down and the EICAS message FLAPS DRIVE is displayed.

A detection system detects slat asymmetry. Loss of all but the most outboard slats on each wing is also detected. When slat loss or asymmetry occurs, the system shuts down the slat drive and displays the SLATS DRIVE EICAS message.

Uncommanded Flap or Slat Motion

Uncommanded motion is detected when the slats or flaps:

- move away from the commanded position
- continue to move after reaching a commanded position
- or move in a direction opposite to that commanded.

[\[777-200/-300 Series\]](#)

If the flap or slat is operating in the primary mode, uncommanded motion first causes an automatic transfer to the secondary mode. The EICAS message FLAPS PRIMARY FAIL or SLATS PRIMARY FAIL is displayed. If motion continues, the system shuts down. The EICAS message FLAPS DRIVE or SLATS DRIVE is displayed.

Flap Indications

Flap position indications are displayed on the primary EICAS display. A single vertical indicator displays combined flap and slat position. The position commanded by the flap lever is also displayed. Ten seconds after all flaps and slats are up, the entire indication is no longer displayed.

If flap/slat control is in the secondary or alternate mode, or if any non-normal condition is detected, an expanded flap indication is displayed automatically. The position of the left and right flaps and slats are separately indicated. In the alternate mode, the position commanded by the flap lever is replaced by flap position index marks at all flap and slat positions, and numbers at flaps 5 and flaps 20. The index marks are used as a guide to position the flaps to the desired setting.

Intentionally
Blank

Flight Controls
EICAS Messages**Chapter 9**
Section 30**Flight Control System EICAS Messages**

Note: Configuration (CONFIG) warning messages are described in Chapter 15, Warning Systems.

The following EICAS messages can be displayed.

Message	Level	Aural	Message Logic
AUTO SPEEDBRAKE	Advisory		A fault is detected in the automatic speedbrake system.

[777-200/-300 Series]

FLAPS DRIVE	Caution	Beeper	Flap drive mechanism has failed.
FLAPS PRIMARY FAIL	Caution	Beeper	Flaps are operating in the secondary mode.
FLAP/SLAT CONTROL	Caution	Beeper	Flap/slat electronics units are inoperative.
FLIGHT CONTROL MODE	Caution	Beeper	Flight control system is operating in the secondary mode.
FLIGHT CONTROLS	Caution	Beeper	Multiple flight control surfaces are inoperative or other flight control system faults are detected.
FLT CONTROL VALVE	Advisory		One or more flight control valves are failed closed or one or more flight control shutoff switches are in SHUTOFF.
PITCH DOWN AUTHORITY	Caution	Beeper	Pitch down authority is limited.
PITCH UP AUTHORITY	Caution	Beeper	Pitch up and flare authority is limited.
PRI FLIGHT COMPUTERS	Caution	Beeper	Flight control system is operating in the direct mode.
SLATS DRIVE	Caution	Beeper	Slat drive mechanism has failed.

Message	Level	Aural	Message Logic
SLATS PRIMARY FAIL	Caution	Beeper	Slats are operating in the secondary mode.
SPEEDBRAKE ARMED	Memo		Speedbrakes are armed.
SPEEDBRAKE EXTENDED	Caution	Beeper	Speedbrake is extended when radio altitude is between 15 and 800 feet, or when the flap lever is in a landing position, or when either thrust lever is not closed.

[777-200/-300 Series]

SPOILERS	Advisory		One or more spoiler pairs are inoperative.
STAB GREENBAND	Advisory		Nose gear pressure switch disagrees with computed stabilizer green band.
STABILIZER	Warning	Siren	Uncommanded stabilizer motion is detected or stabilizer is inoperative.
STABILIZER C	Advisory		Center stabilizer control path is inoperative.
STABILIZER CUTOUT	Advisory		Both stabilizer cutout switches are in CUTOUT.
STABILIZER R	Advisory		Right stabilizer control path is inoperative.
THRUST ASYM COMP	Advisory		Thrust asymmetry compensation is inoperative.

Flight Instruments, Displays**Chapter 10****Table of Contents****Section TOC**

Controls and Indicators	10.10
Primary Flight Display (PFD)	10.10.1
PFD Indications	10.10.1
PFD Airspeed Indications	10.10.3
PFD Reference Speeds	10.10.5
PFD VNAV Speed Band	10.10.7
PFD Angle of Attack (AOA) Indications	10.10.8
PFD Attitude Indications	10.10.9
PFD Steering Indications	10.10.11
PFD Radio Altitude Indications	10.10.13
PFD Navigation Performance Indications	10.10.14
PFD Instrument Landing System Indications	10.10.16
PFD Expanded Localizer Indications	10.10.17
PFD Rising Runway Indications	10.10.18
PFD Altitude Indications	10.10.19
PFD Landing Altitude/Minimums Indications	10.10.20
PFD Barometric Indications	10.10.21
PFD Vertical Speed Indications	10.10.23
PFD Heading/Track Indications	10.10.23
PFD Failure Flags	10.10.25
Navigation Display (ND)	10.10.26
ND Map Mode	10.10.26
Centered Map Mode	10.10.28
ND Grid Heading Display	10.10.30
ND Navigation Performance Indications	10.10.31
ND Weather Radar System Display Indications	10.10.32
ND Approach Mode	10.10.34
ND VOR Mode	10.10.35
ND Plan Mode	10.10.36
ND Failure Indications and Flags	10.10.36
ND Failure Messages	10.10.36

ND Failure Flags	10.10.37
Ground Maneuver Camera System	10.10.38
EFIS Control Panels	10.10.40
EFIS Control Panel PFD Controls	10.10.40
EFIS Control Panel ND Controls	10.10.41
Instrument Source Select Panels	10.10.44
Heading Reference and Inboard Displays	10.10.45
Inboard Display Controls	10.10.45
Heading Reference Controls	10.10.46
Display Select Panel (DSP)	10.10.47
Flight Deck Entry Video Surveillance System (FDEVSS)	10.10.48
Flight Deck Entry Video Panel	10.10.48
Cursor Control Device (CCD)	10.10.49
Display Brightness Controls	10.10.51
Forward Panel Brightness Controls	10.10.51
Side Display Brightness Controls	10.10.52
Center Panel Brightness Controls	10.10.52
Standby Flight Instruments	10.10.53
Integrated Standby Flight Display (ISFD)	10.10.54
Standby Magnetic Compass	10.10.57
Standby Attitude Indicator	10.10.59
Standby Airspeed Indicator	10.10.61
Standby Altimeter	10.10.63
Clock	10.10.64
EFIS Control Panels and Display Select Panel (DSP) –	
CDU Alternate Control	10.10.66
CDU EFIS/DSP Control Selection	10.10.66
EFIS Control CDU Pages	10.10.67
Display Select CDU Pages	10.10.71
System Description	10.20
Introduction	10.20.1

777 Flight Crew Operations Manual

Display Selection and Control	10.20.1
Inboard Display Selectors.	10.20.1
EFIS Control Panels	10.20.2
Display Select Panel	10.20.2
Display Brightness Control	10.20.4
Instrument Display Source Selection	10.20.4
Display Selection and Control Examples	10.20.4
Ground Maneuver Camera System	10.20.10
Flight Deck Entry Video Surveillance System (FDEVSS)	10.20.10
Control and Operation	10.20.11
Cursor Control Devices (CCD)	10.20.11
CCD Touch Pad	10.20.11
CCD Cursor Location Control	10.20.12
Standby Flight Instruments	10.20.12
Integrated Standby Flight Display (ISFD)	10.20.13
Standby Attitude Indicator	10.20.13
Standby Airspeed Indicator	10.20.14
Standby Altimeter.	10.20.14
Standby Magnetic Compass	10.20.14
Radio Altimeter (RA)	10.20.14
Clock	10.20.14
Display System Information Sources	10.20.15
Air Data Inertial Reference System (ADIRS)	10.20.15
Primary Flight Displays (PFDs)	10.30
Introduction	10.30.1
Airspeed.	10.30.1
Ground Speed	10.30.2
Altitude	10.30.2
Vertical Speed	10.30.3
Attitude	10.30.3
Steering Indications	10.30.3
Radio Altitude	10.30.4

Angle of Attack	10.30.4
Instrument Landing System Indications	10.30.4
Approach Minimums	10.30.4
Heading/Track Indications	10.30.5
Engine Fail, GPWS, and PWS Alerts	10.30.5
Typical PFD Displays	10.30.5
PFD Takeoff Display	10.30.6
PFD Climb Display	10.30.8
PFD Cruise Display	10.30.10
PFD Descent Display	10.30.12
PFD Approach Display	10.30.13
PFD Landing Display	10.30.16
Navigation Displays	10.40
Introduction	10.40.1
Map Mode	10.40.1
Navigation Data Points	10.40.1
VOR and Approach Modes	10.40.1
Plan Mode	10.40.2
ND Information	10.40.2
Heading	10.40.2
Track	10.40.2
Traffic	10.40.2
Weather Radar	10.40.2
Failure Flags and Messages	10.40.2
Typical ND Map Displays	10.40.3
ND Expanded Map Displays	10.40.3
ND Symbolology	10.40.11
Electronic Checklist Displays	10.50
Normal Checklist	10.50.1
Non-Normal Checklist Queue	10.50.3
Non-Normal Checklist	10.50.4

777 Flight Crew Operations Manual

Checklist Timer	10.50.5
Operational Note	10.50.6
Conditional Line Item	10.50.8
Deferred Line Item.	10.50.10
Inhibit Checklist Line Item	10.50.12
Checklist Override	10.50.13
Checklists Menu Page	10.50.14
Resets Page	10.50.16
Electronic Checklist Description.....	10.60
Introduction	10.60.1
Electronic Checklist Operation	10.60.1
Checklist Pages.....	10.60.1
Checklist Status	10.60.2
Checklist Line Items	10.60.2
Action Items	10.60.3
Closed Loop Action Items	10.60.3
Open Loop Action Items	10.60.3
Operational Notes.....	10.60.3
Conditional Line Items.....	10.60.4
Open Loop Conditional Line Items	10.60.4
Closed Loop Conditional Line Items	10.60.4
Inhibit Checklist Line Items.....	10.60.5
Deferred Line Items	10.60.5
Timers.....	10.60.6
Checklist Menu Operation.....	10.60.6
Normal Menu	10.60.6
Non-Normal Menu	10.60.6
Resets Page.....	10.60.7
Dual Database.....	10.60.7
Checklist Priority.....	10.60.7
Normal Checklists	10.60.8
Normal Checklist Access	10.60.8

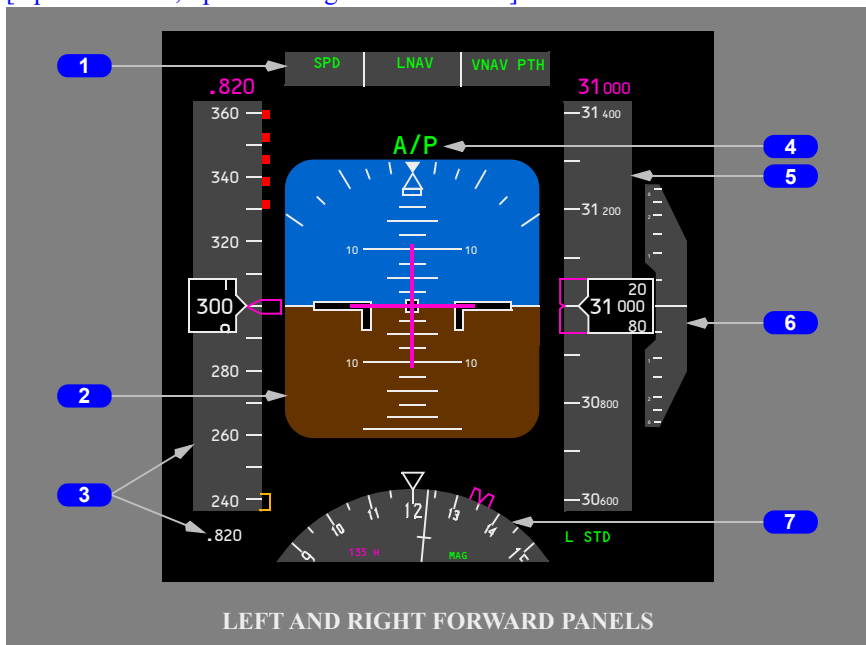
Normal Checklist Completion.	10.60.8
Incomplete Normal Checklist Alerting.	10.60.8
Non-Normal Checklists	10.60.9
Non-Normal Checklist Access and Checklist Icon.	10.60.9
Non-Normal Unannunciated Checklists	10.60.10
Non-Normal Checklist Completion	10.60.10
Hidden Non-Normal Checklist Alerting.	10.60.10
Checklist Resets	10.60.11
Normal Checklist Automatic Reset Conditions	10.60.11
Normal Checklist Manual Resets	10.60.11
Non-Normal Checklist Manual Resets	10.60.11
Manual Reset All.	10.60.12
Overrides	10.60.12
Item Override	10.60.12
Checklist Override	10.60.12
Electronic Checklist System Inoperative	10.60.12
Electronic Flight Bag (EFB).	10.65
Introduction	10.65.1
Display Unit	10.65.2
Display Description.	10.65.4
Main Menu (Typical)	10.65.7
Airport Maps (Typical)	10.65.12
IDENT page (Typical)	10.65.19
SYSTEM page (Typical).	10.65.21
Documents (Typical).	10.65.23
Performance (Typical)	10.65.26
Video Surveillance (Typical)	10.65.32
Logbook (Typical)	10.65.36
EICAS Messages	10.70
Flight Instruments, Displays EICAS Messages	10.70.1

Flight Instruments, Displays
Controls and Indicators

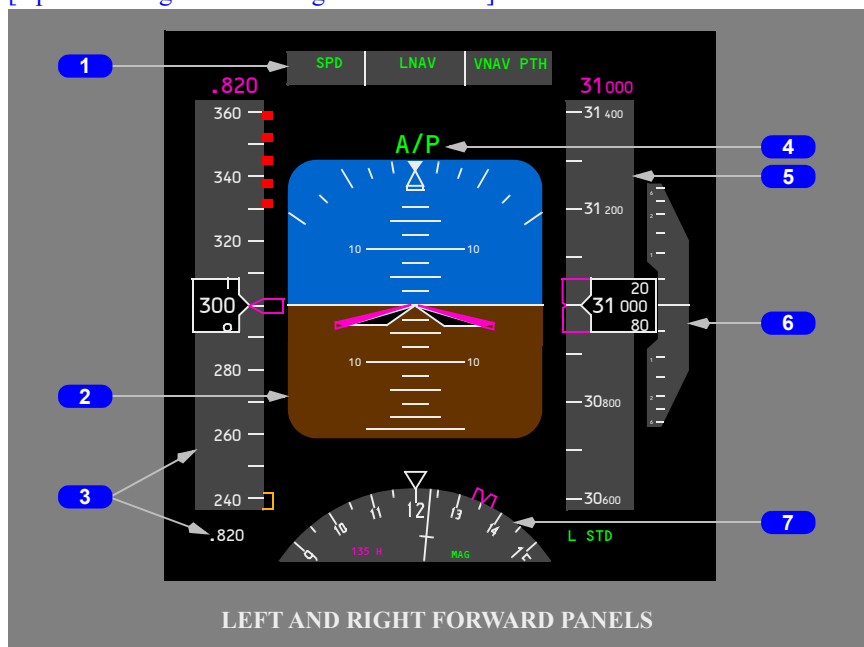
Chapter 10
Section 10

Primary Flight Display (PFD)
PFD Indications

[Option – Basic, Split Cue Flight Director Bars]



[Option – Integrated Cue Flight Director Bar]



1 Flight Mode Annunciations

Refer to Chapter 4, Automatic Flight.

2 Attitude, Steering, and Miscellaneous Indications

Displays Air Data Inertial Reference System (ADIRS) attitude information.

3 Airspeed/Mach Indications

Displays ADIRS airspeed information and other airspeed related information.

4 Autopilot, Flight Director System Status

Refer to Chapter 4, Automatic Flight.

5 Altitude Indications

Displays ADIRS altitude and other altitude-related information.

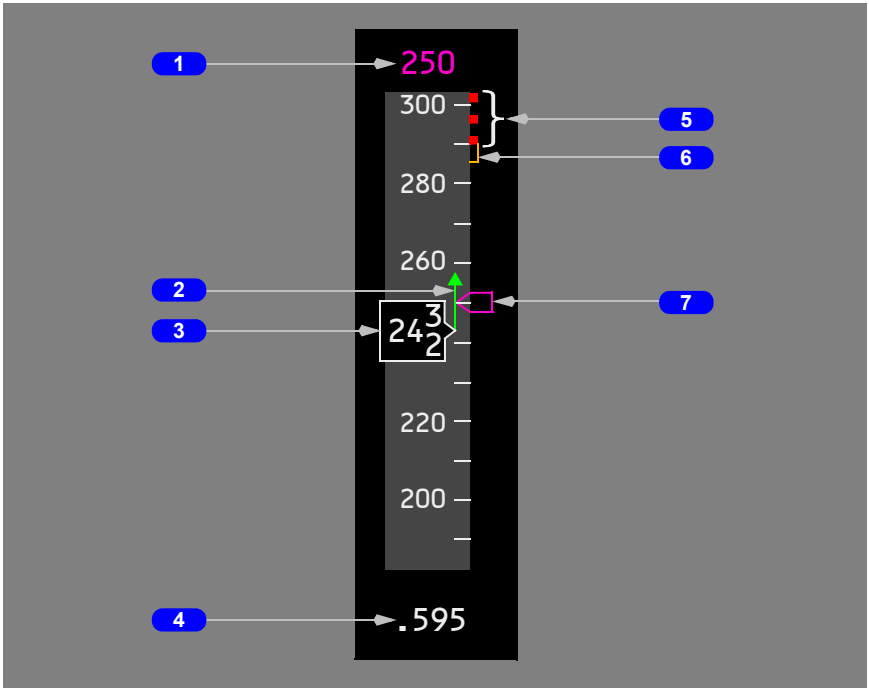
6 Vertical Speed Indication

Displays ADIRS vertical speed and other vertical speed information.

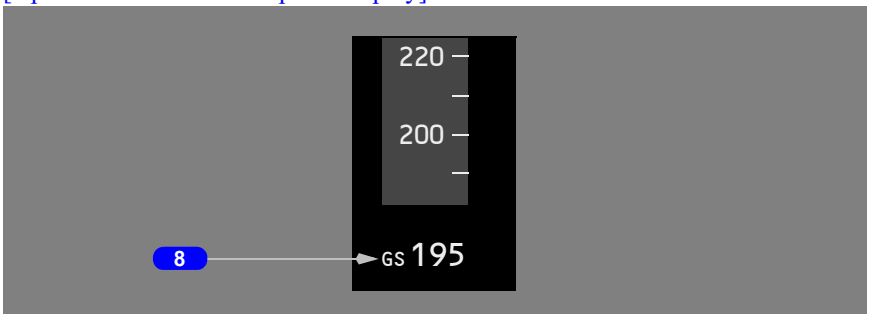
7 Heading and Track Indications

Displays current ADIRS heading, track and other heading information.

PFD Airspeed Indications



[Option - Mach/Ground Speed Display]



1 Selected Speed

Displays the airspeed/Mach selected in the mode control panel MCP IAS/MACH window (refer to Chapter 4, Automatic Flight).

Displays the FMC-computed airspeed/Mach when the MCP IAS/MACH window is blank.

2 Speed Trend Vector

Indicates predicted airspeed in ten seconds based on current acceleration or deceleration.

3 Current Airspeed

Indicates current ADIRS airspeed.

The box around the current airspeed indication turns amber when airspeed is below minimum maneuvering speed.

4 Current Mach

Displays current ADIRS Mach at or above 0.40.

5 Maximum Speed

Indicates maximum permissible airspeed as limited by the lowest of the following:

- V_{mo}/M_{mo}
- landing gear placard speed, or
- flap placard speed.

6 Maximum Maneuvering Speed

When displayed, indicates maneuver margin to high speed buffet. Bottom of the bar is the airspeed that provides 1.3 g maneuver capability (or an alternative approved maneuver capability as preset by maintenance). Bar may be displayed when operating at high altitude at relatively high gross weights.

Note: 1.3 g maneuver capability occurs at 40 degrees of bank in level flight.

7 Speed Bug

Points to the airspeed/Mach selected in the MCP IAS/MACH window.

Points to FMC-computed airspeed when the MCP IAS/MACH window is blank.

The bug is five knots in height.

When the selected speed is off scale, the bug is parked at the top or bottom of the tape, with only one half the bug visible.

[Option - Mach/Ground Speed Display]

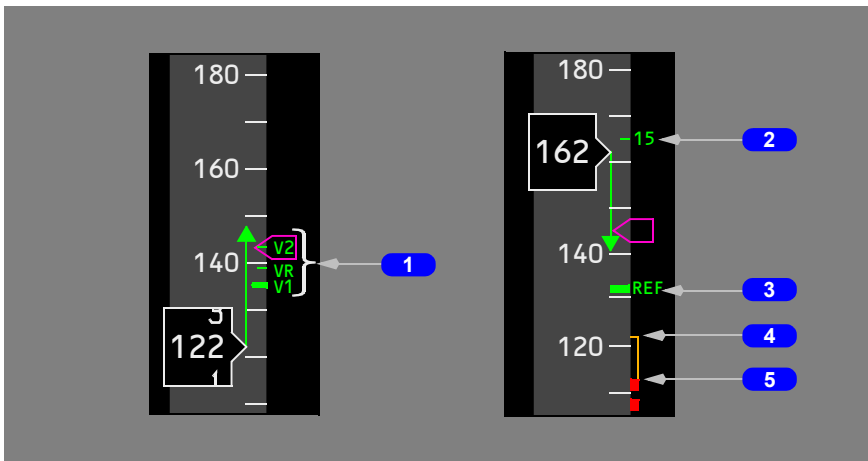
8 Current Ground Speed

Displays ground speed when Mach number is less than 0.40.

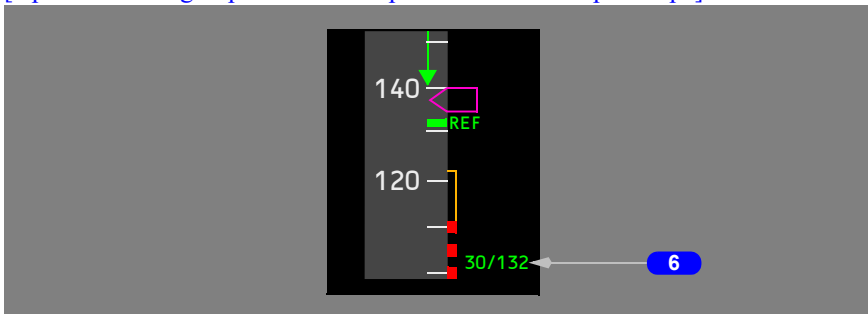
When a transition occurs between the display of ground speed and Mach number, the new display is highlighted with a white box for 10 seconds.

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PFD Reference Speeds



[Option – landing flaps and VREF speed at bottom of speed tape]



1 Takeoff Reference Speeds

Displays the takeoff reference speeds V1, VR (displays R if VR is within 4 knots of V1 or V2), and V2, selected on the CDU (refer to Chapter 11, Flight Management, Navigation):

- displayed for takeoff
- NO V SPD is displayed if V speeds are not selected on the CDU
- V1 is displayed at the top of the airspeed indication when selected and if the value is off the scale
- V1 and VR are removed at lift-off
- V2 is removed on climb-out:
 - when flap retraction begins, or
 - after 10 minutes have passed without flap lever movement, or
 - after VREF has been selected (for a turn-back).

2 Flap Maneuvering Speeds

Indicates flap maneuvering speed for flap retraction or extension.

Not displayed above approximately 20,000 feet altitude.

3 Landing Reference Speed

Displays the VREF speed as selected on the CDU (refer to Chapter 11, Flight Management, Navigation).

4 Minimum Maneuvering Speed

Indicates maneuver speed margin to stick shaker or low speed buffet. Top of the bar is the airspeed that provides:

- 1.3 g maneuver capability to stick shaker with flaps down.
- 1.3 g maneuver capability to stick shaker or VREF + 80, whichever is less, with flaps up at or below 20,200 FT.
- 1.3 g maneuver capability to low speed buffet (or an alternative approved maneuver capability as preset by maintenance), with flaps up above 20,200 FT.

Displayed with first flap retraction after takeoff.

Note: 1.3 g maneuver capability occurs at 40 degrees of bank in level flight.

5 Minimum Speed

Indicates the airspeed where stick shaker activates.

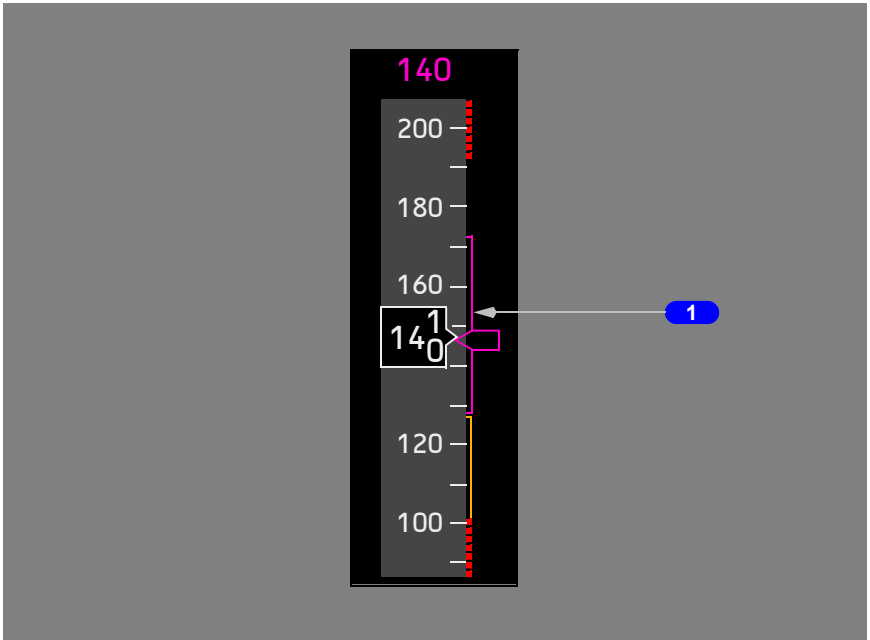
[Option – Landing Flaps and VREF Speed at Bottom of Speed Tape]

6 Selected Landing Flap and VREF Speed

Landing flap and VREF speed are displayed at the bottom of the airspeed indication.

PFD VNAV Speed Band

[Option - VNAV Speed Band]

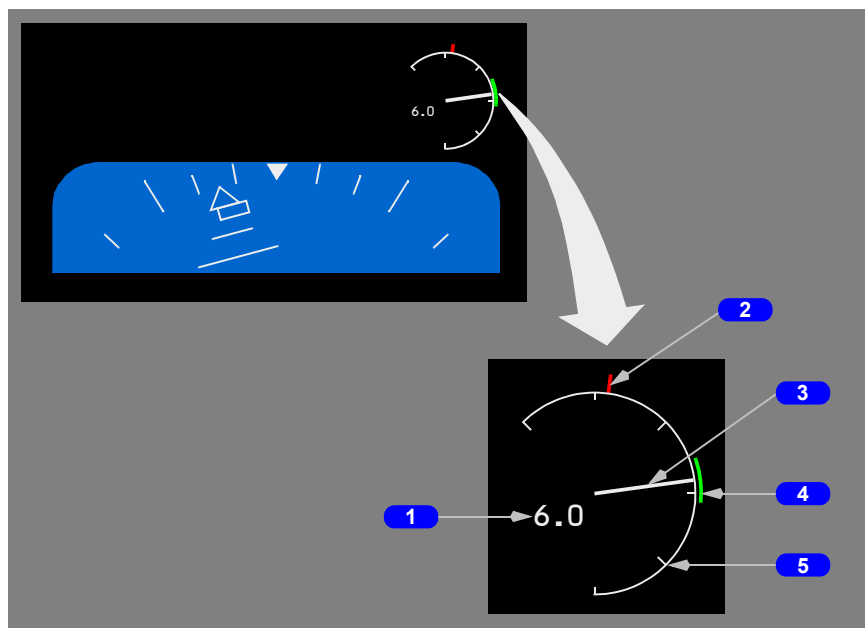
**1 VNAV Speed Band**

Indicates acceptable airspeed range for VNAV path (VNAV PTH) pitch mode.
Available with flaps up.

PFD Angle of Attack (AOA) Indications

[Option - AOA Indication]

The angle of attack indications display ADIRU aircraft body angle of attack.



1 Digital AOA Readout

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. Captain and first officer values can differ by 0.2 degrees.

2 Stick Shaker Indicator

Indicates point at which stick shaker activation occurs for existing flight conditions, blank if AOA signal is invalid.

3 Analog Needle

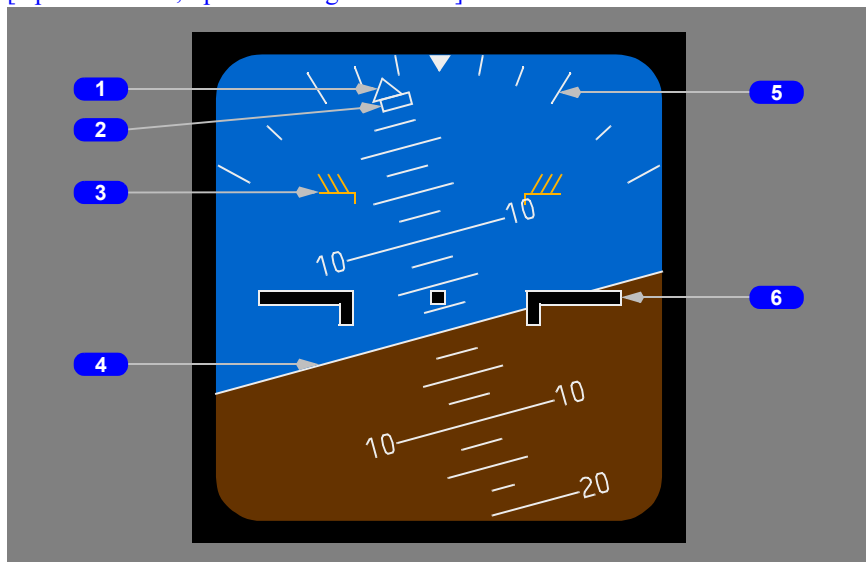
Indicates analog AOA value.

- 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.

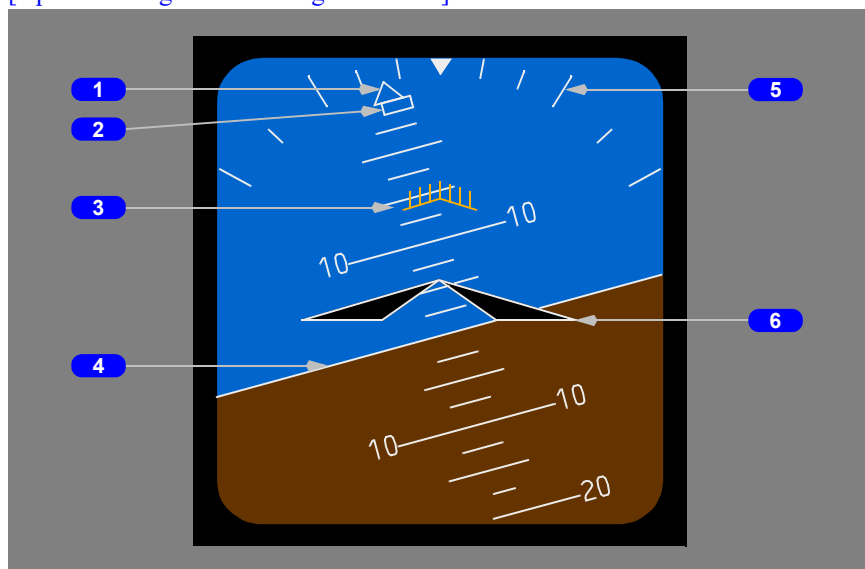
- displayed when in normal or single engine landing flaps (20, 25, 30)
- moves with flap position
- inhibited on takeoff and initial climb.

Indicates zero degrees angle of attack. Reference lines are displayed every 5 degrees from -5 degrees to +20 degrees.

[Option – Basic, Split Cue Flight Director]



[Option – Integrated Cue Flight Director]



1 Bank Pointer

Indicates:

- ADIRS bank in reference to the bank scale
- direction towards wings level

Fills and turns amber if bank angle is 35 degrees or more.

2 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 deflection.

3 Pitch Limit Indication

Indicates pitch limit (stick shaker activation point for existing flight conditions). Limited to a maximum of +30 degrees.

Displayed when the flaps are not retracted, or at slow speeds with the flaps retracted.

4 Horizon Line and Pitch Scale

Indicates the ADIRS horizon relative to the airplane symbol.

Fixed reference for the bank pointer.

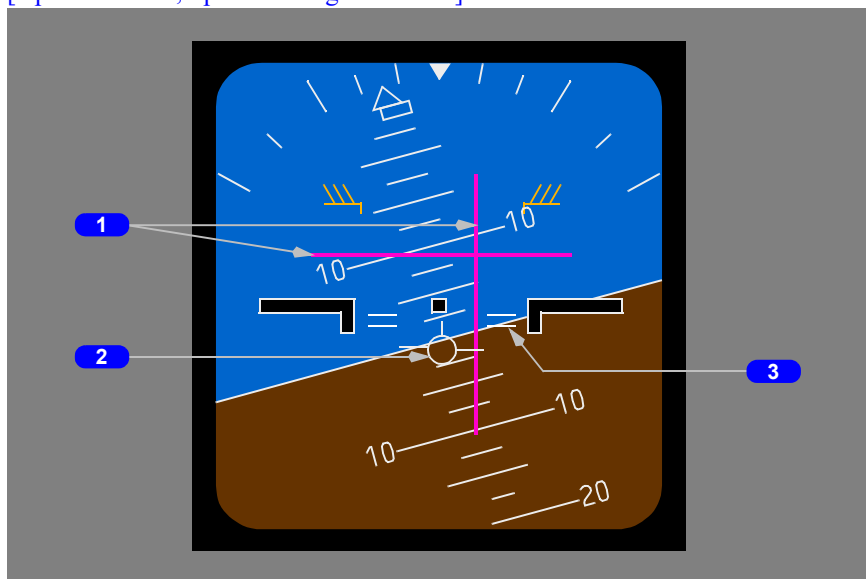
Scale marks are at 0, 10, 20, 30, 45, and 60 degrees.

Indicates airplane attitude with reference to the ADIRS horizon.

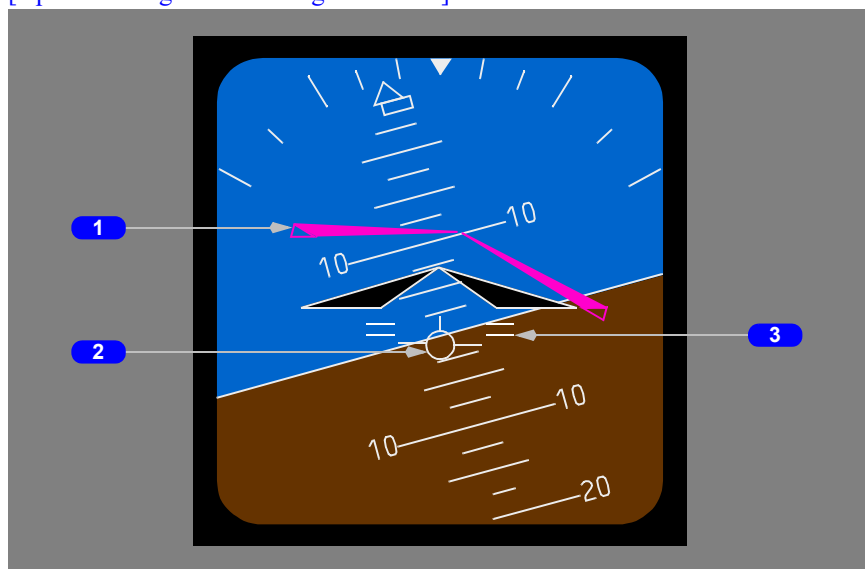
PFD Steering Indications

Note: Refer to Chapter 15, Warning Systems, for TCAS Steering Indications and Time Critical Warnings.

[Option – Basic, Split Cue Flight Director]



[Option – Integrated Cue Flight Director]



[Option – Split Cue Flight Director]

1 Flight Director Pitch and Roll Bars

Indicates flight director pitch and roll steering commands.

Refer to Chapter 4, Automatic Flight.

[Option – Integrated Cue Flight Director]

1 Flight Director Bar

Indicates flight director pitch and roll steering commands.

Refer to Chapter 4, Automatic Flight.

2 Flight Path Vector (FPV)

Displays flight path angle and drift angle if:

- FPV is selected on the EFIS control panel, or
- FPA (flight path angle) is selected on the MCP.

Flight path angle is displayed relative to the horizon line.

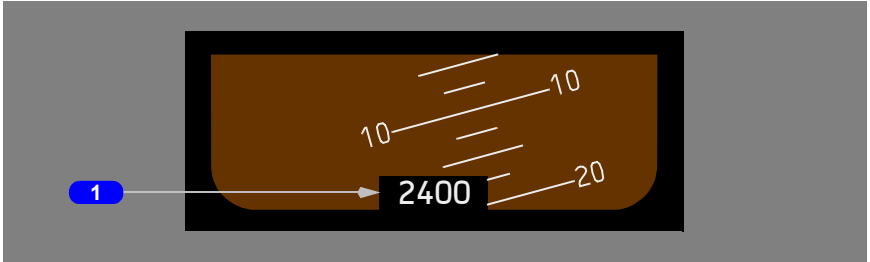
Drift angle is represented by the perpendicular distance from the centerline of the pitch scale to the FPV symbol.

3 Selected Flight Path Angle (FPA)

Indicates the selected flight path angle when FPA is selected on the MCP.

PFD Radio Altitude Indications

[Option – Basic Numeric RA Display]



1 Radio Altitude

Displays radio altitude below 2500 feet AGL.

[Option – Basic Numeric RA Display]

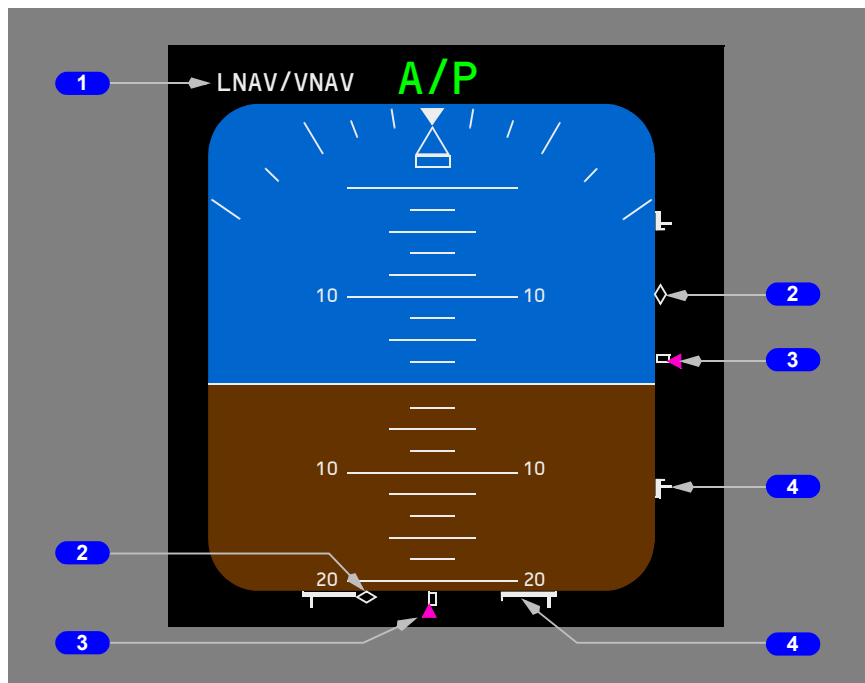
The display box is highlighted in white for 10 seconds when passing below 2500 feet.

Turns amber when below radio altitude minimums.

PFD Navigation Performance Indications

[Option – Enhanced RNP]

Navigation Performance Scales display when LNAV, VNAV, or TO/GA are active modes or when LNAV is armed. Vertical scales do not display during cruise with VNAV PTH active.



1 Navigation Source Reference

Displays the source of navigation performance for the navigation scales.

The lateral scale source is shown first, followed by the vertical scale source. Possible combinations are:

- ILS
- LOC/VNAV – Localizer with VNAV deviation
- LNAV/ G/S – LNAV deviation with glideslope
- LNAV/VNAV – LNAV and VNAV deviation

2 Anticipation Cue

Represents the relative position of the path for the selected and activated approach.

3 Deviation Pointer

Indicates the position of the FMC course relative to the airplane.

Pointer:

- unfilled magenta symbol when parked at deflection limit
- filled magenta when not parked at deflection limit
- indicates relative position from the annunciated navigation source
- flashes for ten seconds if pointer migrates into bar area for more than five seconds

4 Deviation Scale

Indicates RNP for the active phase of flight.

Deviation:

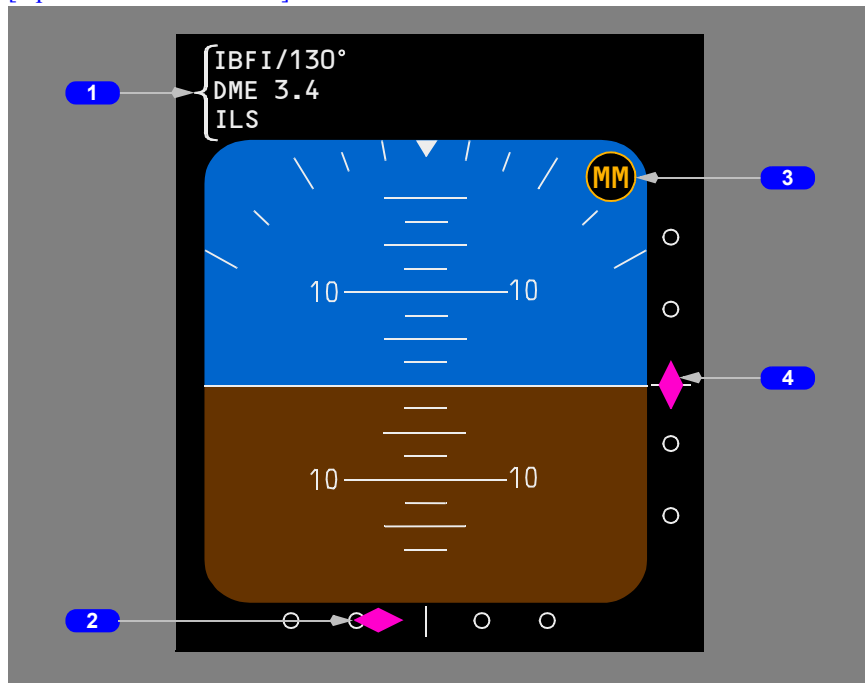
- bars represent Actual Navigation Performance (ANP)
- area between bars indicates margin available to remain within Required Navigation Performance (RNP) criteria
- ANP bars and scale turn amber if pointer migrates into bar area for more than five seconds.
- ANP bars and scale turn amber when LNAV is in the armed mode and the NAV UNABLE RNP message is displayed.

If ANP equals RNP the:

- bars meet in the middle
- bars turn amber
- NAV UNABLE RNP EICAS message displays

PFD Instrument Landing System Indications

[Option – Enhanced RNP]



1 Approach Reference

[Option – Enhanced RNP]

Displays the selected ILS identifier or frequency, approach front course, ILS DME distance, and source annunciation.

If the tuned ILS frequencies disagree, the frequency turns amber with an amber horizontal line through it.

If the approach courses in the ILS receivers disagree, the course turns amber with an amber horizontal line through it.

2 Localizer Pointer and Scale

The localizer pointer:

- indicates localizer position relative to the airplane
- is in view when the localizer signal is received
- fills in solid when within 2 1/2 dots from the center.

The scale is in view after the frequency is tuned.

At low radio altitudes, with the autopilot or flight director engaged, the scale turns amber and the pointer flashes to indicate excessive localizer deviation.

At low altitudes, with LNAV engaged and LOC armed, the localizer scale turns amber and the pointer flashes if the localizer is not captured.

3 Marker Beacon Indication

The marker beacon indication appears flashing when over one of the marker beacon transmitters:

- IM – an airway or inner marker beacon
- MM – a middle marker beacon
- OM – an outer marker beacon.

The indication flashes in cadence with the beacon identifier.

4 Glideslope Pointer and Scale

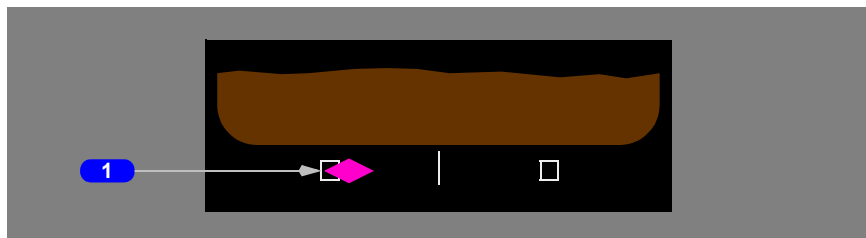
The glideslope pointer:

- indicates glideslope position relative to the airplane, and:
 - is in view when the glideslope signal is received
 - fills in solid when within 2 1/2 dots from the scale center.

The scale is in view after the frequency is tuned.

At low radio altitudes, with the autopilot or flight director engaged, the scale turns amber and the pointer flashes to indicate excessive glideslope deviation.

PFD Expanded Localizer Indications



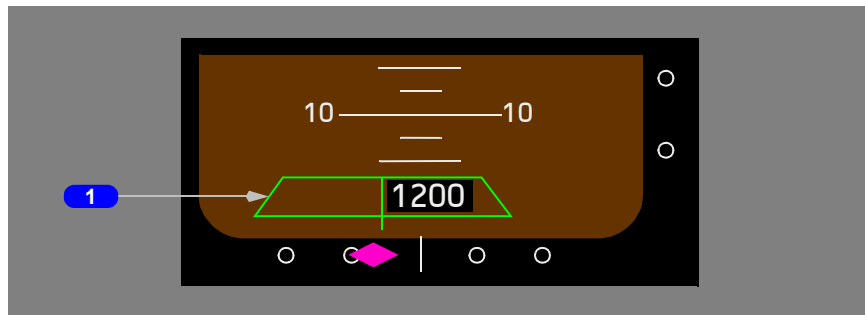
1 Expanded Localizer Scale

Displays when the autopilot or flight director is in LOC mode and the airplane is close to the runway center line. Provides a more sensitive display.

A rectangle equals 1/2 dot deviation.

PFD Rising Runway Indications

[Option – Rising Runway]



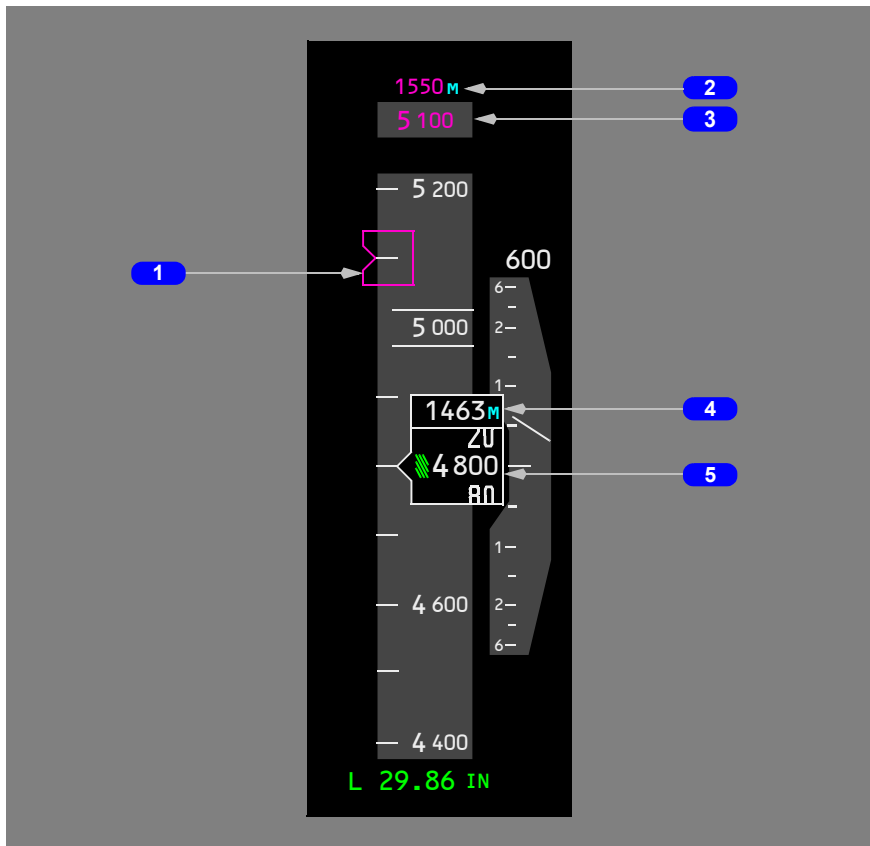
1 Rising Runway

Displayed below 2500 feet radio altitude when the localizer pointer is in view for both front and back courses.

Moves toward the airplane symbol below 200 feet radio altitude.

The stem of the rising runway symbol flashes when localizer deviations cause the diamond to flash.

PFD Altitude Indications



1 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 of the tape, with only one half the bug visible.

2 Selected Altitude – Meters

Displayed when MTRS is selected on the EFIS control panel MTRS switch.

Indicates selected altitude in meters (selected in feet in the MCP altitude window).

Displays in 10 meter increments.

3 Selected Altitude

Displays the altitude set in the MCP altitude window.

4 Current Altitude – Meters

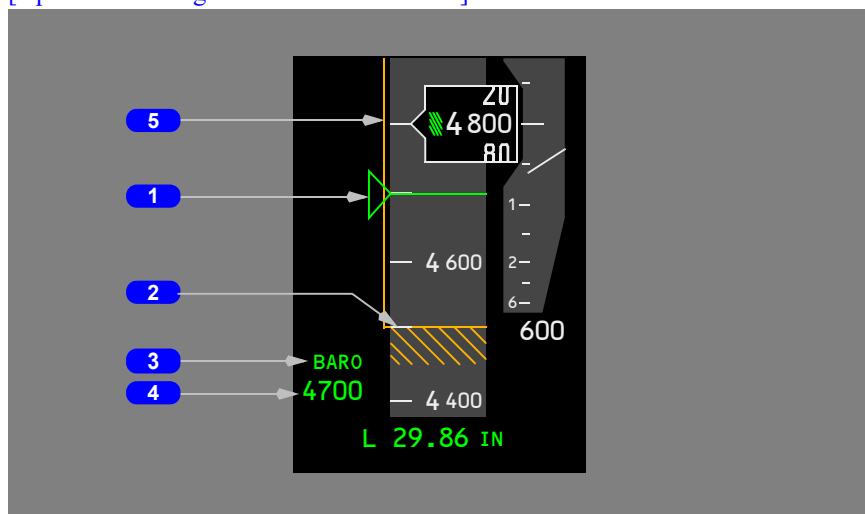
Displays altitude in meters.

5 Current Altitude

Indicates current ADIRS altitude.

PFD Landing Altitude/Minimums Indications

[Option – Landing Altitude Reference Bar]



1 BARO Minimums Pointer

When BARO minimums are displayed, the number is also represented as a pointer and line on the altitude scale.

Turns steady amber when the airplane descends below baro minimums.

2 Landing Altitude Indication

The crosshatched area indicates the FMC landing altitude for the destination runway or airport.

Indicates the landing altitude for the departure runway or airport until 400 NM or one-half the distance to the destination, whichever occurs first.

3 Minimums Reference

Displays BARO when the EFIS control panel MINS reference selector is set to BARO.

[Option – RA versions except round dial and upper right displays. Round dial and upper right displays do not show RADIO here]

Displays RADIO when the EFIS control panel MINS reference selector is set to RADIO (no corresponding line on the altitude scale).

Turns amber and flashes for 3 seconds when the airplane descends below selected minimum altitude.

4 Minimums

Displays the approach minimums altitude set using the EFIS control panel MINS selector:

- BARO minimums are feet MSL

[Option – RA versions except round dial and upper right displays. Round dial and upper right displays do not show RADIO here]

- RADIO minimums are radio altitude feet AGL.

Turns amber and flashes for 3 seconds when the airplane descends below selected minimum altitude.

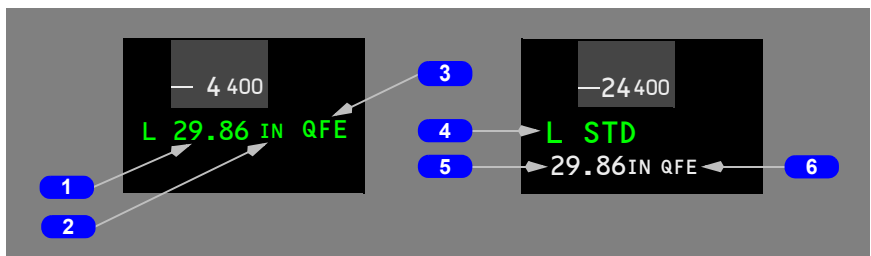
[Option]

5 Landing Altitude Reference Bar

Indicates the height above touchdown.

White bar – 500 to 1000 feet above landing altitude.

Amber bar – 0 to 500 feet above landing altitude.

PFD Barometric Indications**1 Barometric Setting**

Indicates the barometric setting selected on the EFIS control panel barometric selector.

STD is displayed when STD is selected on the EFIS control panel barometric STD switch.

Display is boxed and changes to amber if a barometric setting is selected, MCP altitude is above transition altitude, and airplane climbs more than 300 feet above transition altitude; or if STD is selected, MCP altitude is below transition flight level, and airplane descends more than 300 feet below transition flight level.

2 Barometric Reference

Indicates the barometric setting units selected on the EFIS control panel barometric reference selector:

- IN is inches of mercury
- HPA is Hectopascals.

3 QFE Altitude Reference

Indicates QFE altitude reference selected on the CDU APPROACH REF page.

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.

4 Autopilot/Flight Director Barometric Source

L or R indicates that the left or right EFIS control panel is the barometric setting reference for the autopilot or flight director (the same indication is displayed on both PFDs).

Displayed when a flight director switch is ON or the autopilot is engaged.

- F/D – one turned on and one not on determines L or R
- F/D – both on – L is displayed
- A/P – first one pushed on determines L or R.

5 Preselected Barometric Setting

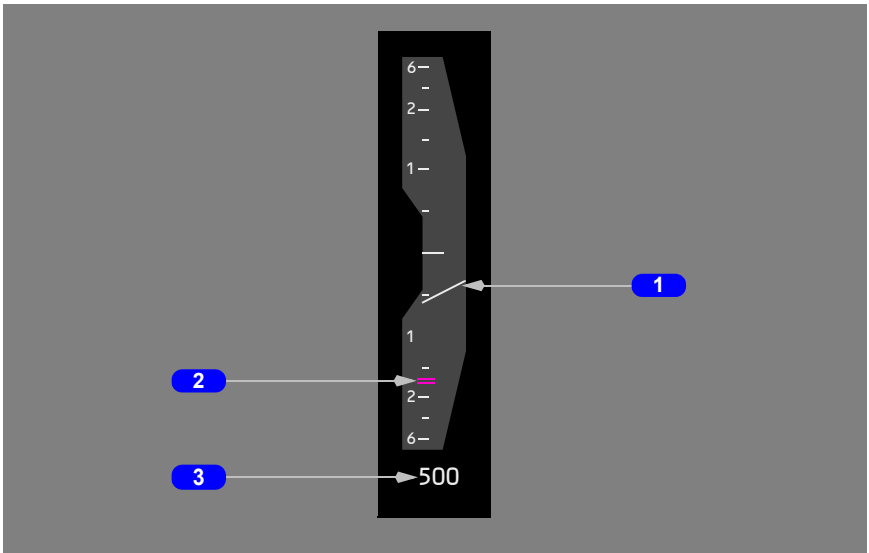
A barometric setting can be preselected when STD is displayed.

The preset barometric setting is selected on the EFIS control panel barometric selector and is displayed below STD.

6 QFE

When STD is selected, a small QFE appears when QFE is selected.

PFD Vertical Speed Indications



1 Vertical Speed Pointer

Indicates current vertical speed.

2 Selected Vertical Speed Bug

Indicates the speed selected in the MCP vertical speed window with the V/S pitch mode engaged.

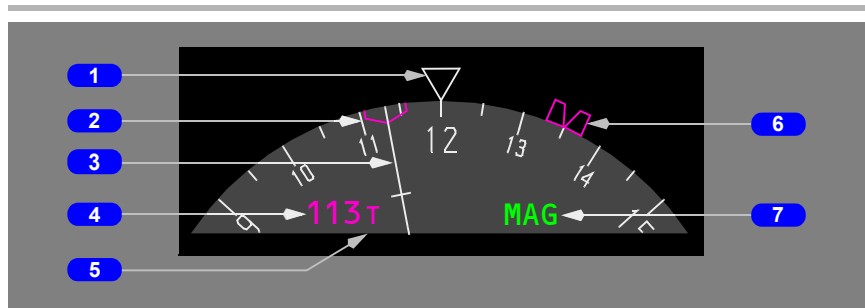
3 Vertical Speed

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.

PFD Heading/Track Indications

Note: The selected track bug and selected heading bug are not displayed at the same time.



1 Current Heading Pointer

Indicates current heading.

2 Selected Track Bug (MCP Selection)

The selected track bug is displayed on the inside of the compass rose.

If selected track exceeds display range, the bug parks on the side of the compass rose in the direction of the shorter turn to the track.

3 Track Line

Indicates the current track.

4 Selected Heading/Track (MCP Selection)

Digital display of the selected heading or track bug.

5 Selected Heading/Track Reference (MCP Selection)

When HDG (heading) is selected, an H is displayed.

When TRK (track) is selected, a T is displayed.

6 Selected Heading Bug (MCP Selection)

The selected heading bug is displayed on the outside of the compass rose.

If selected heading exceeds display range, the bug parks on the side of the compass rose in the direction of the shorter turn to the heading.

7 Heading/Track Reference

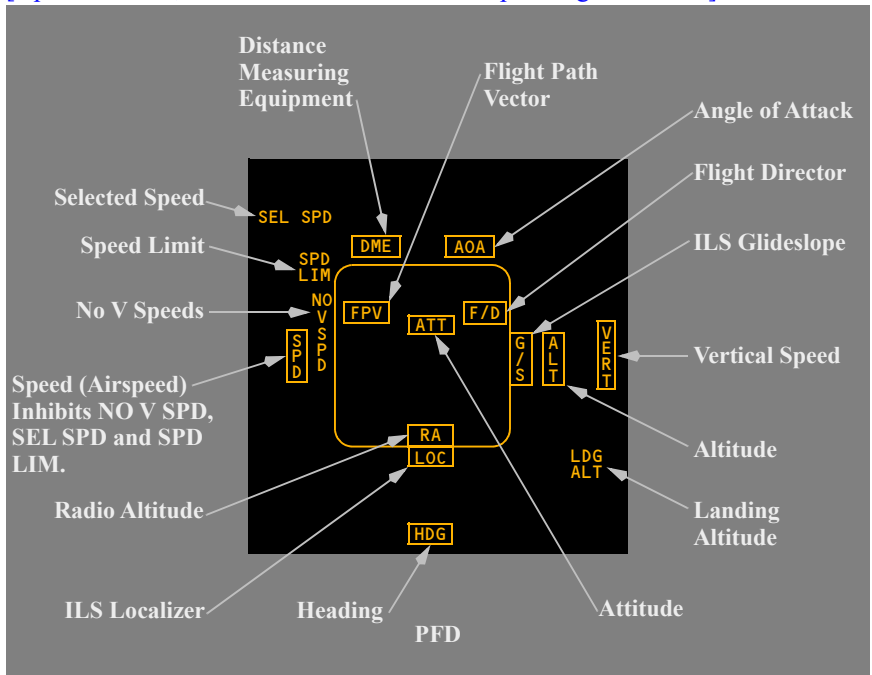
Displays the automatic or manually selected heading/track reference:

- MAG (magnetic north)
- TRU (true north).

PFD Failure Flags

Note: PFD failure flags replace the appropriate display to indicate source system failure, or lack of computed information.

[Option – Basic, Lower Center RA Indication plus angle of attack]



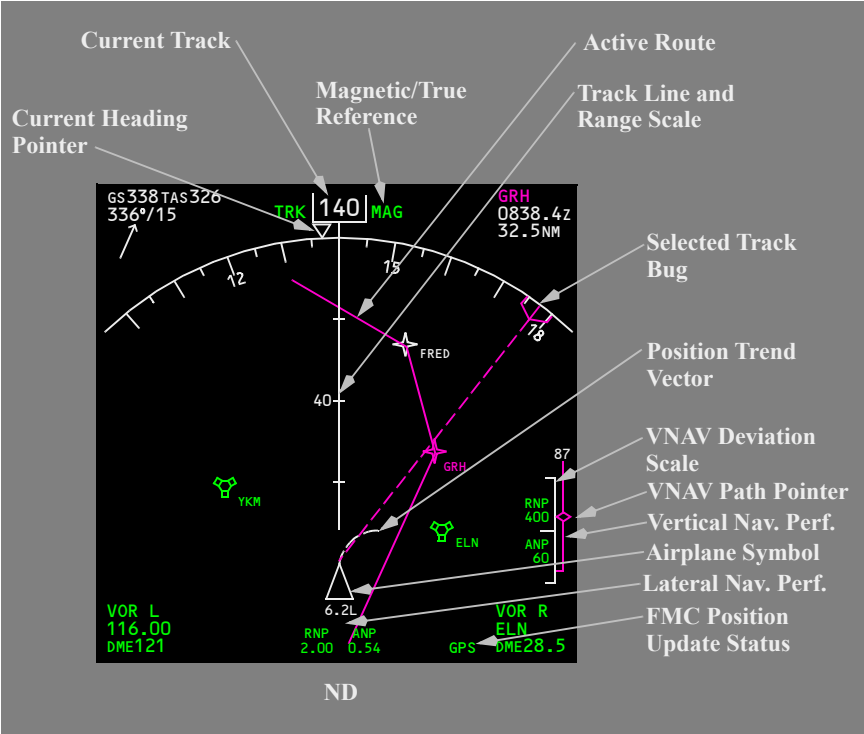
Navigation Display (ND)

Note: Refer to the Navigation Display section of this chapter for a detailed explanation of the ND symbology shown on the following pages.

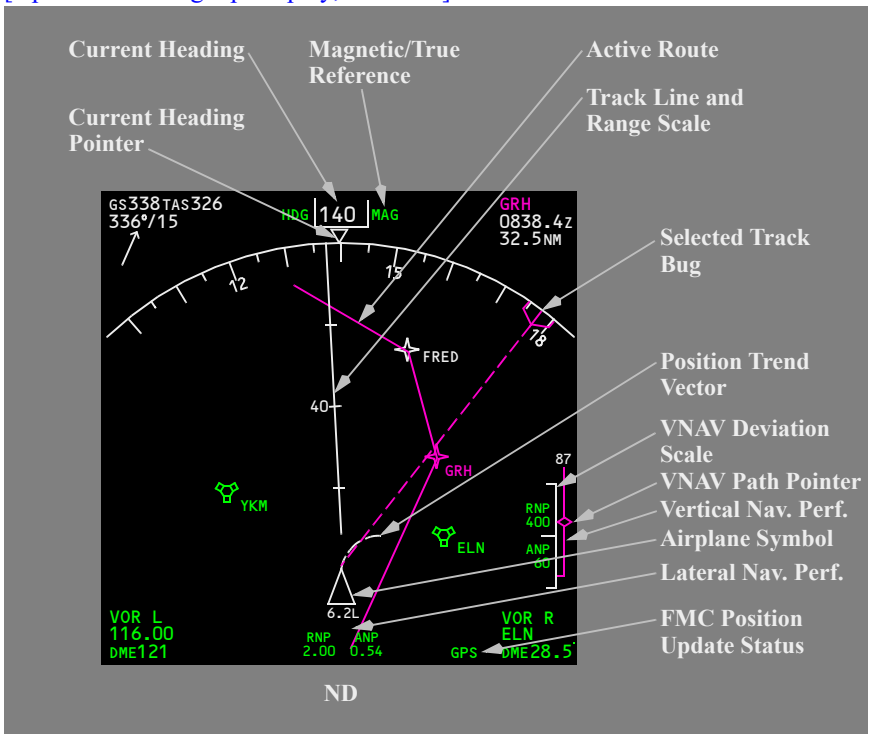
ND Map Mode

Expanded Map Mode

[Option – Track–Up Display, Nav Perf]

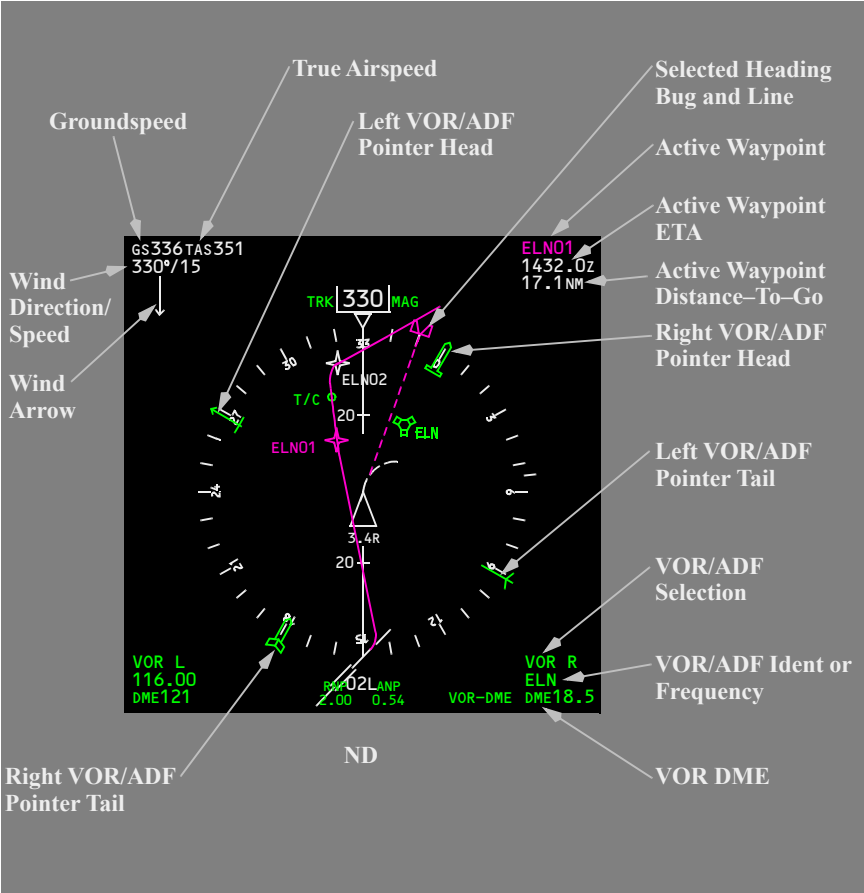


[Option – Heading-up Display, Nav Perf]

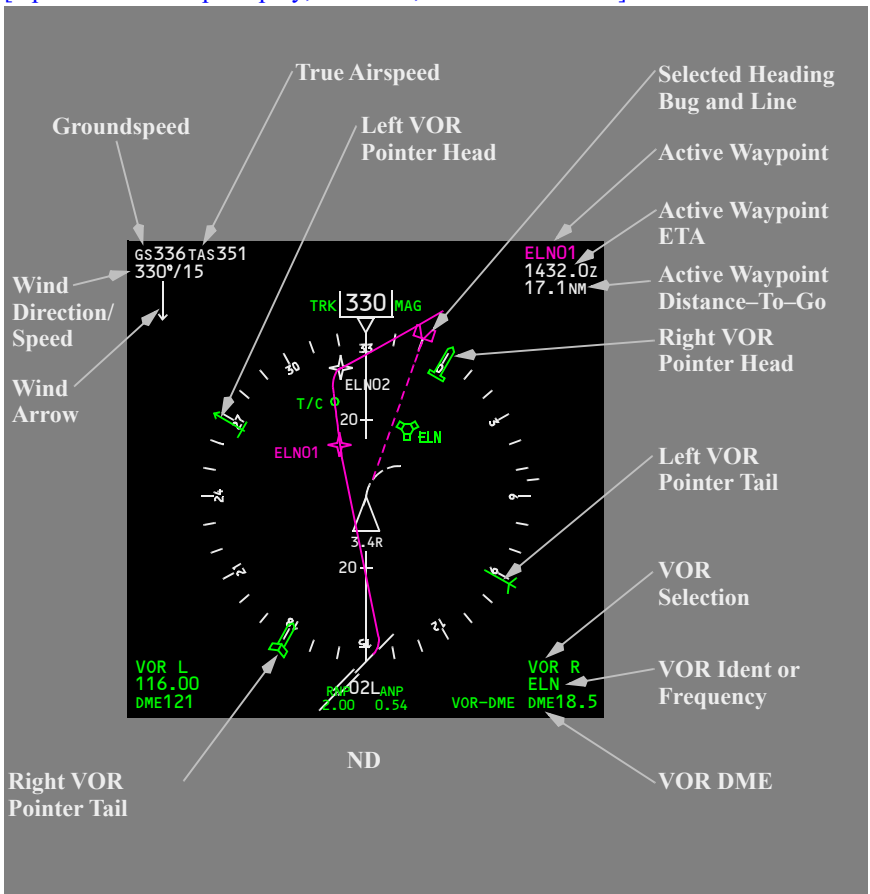


Centered Map Mode

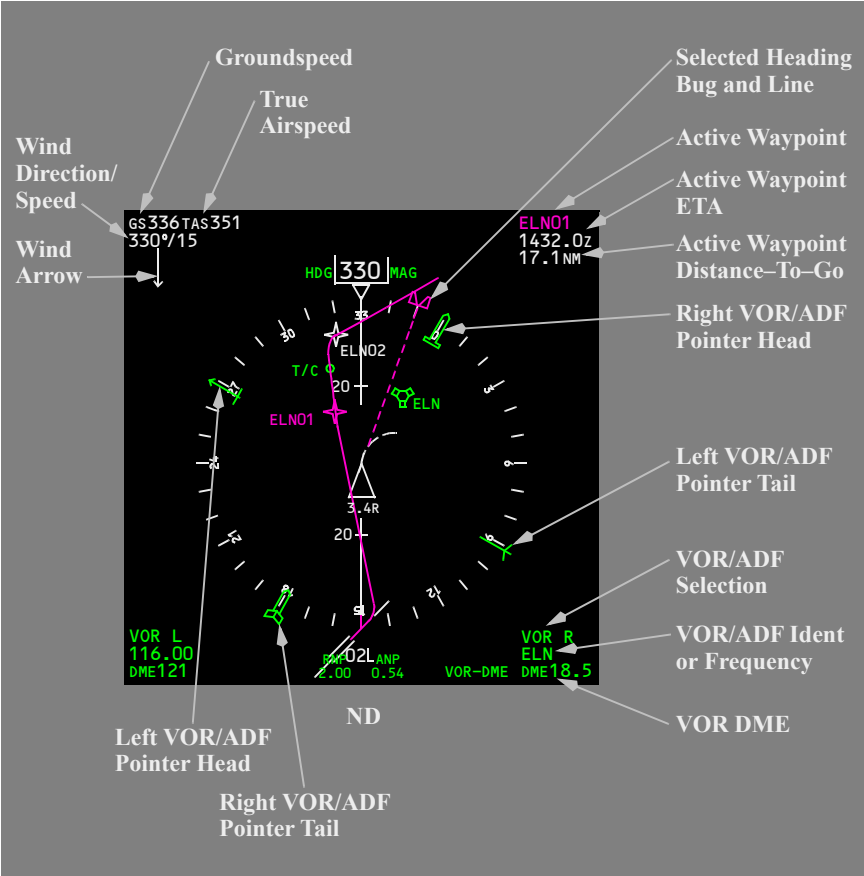
[Option – Track-up Display, Nav Perf]



[Option – Track-up Display, Nav Perf, ADF not installed]

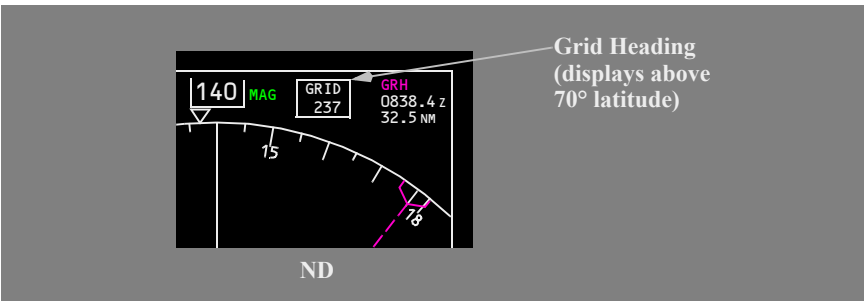


[Option – Heading-up Display, Nav Perf]



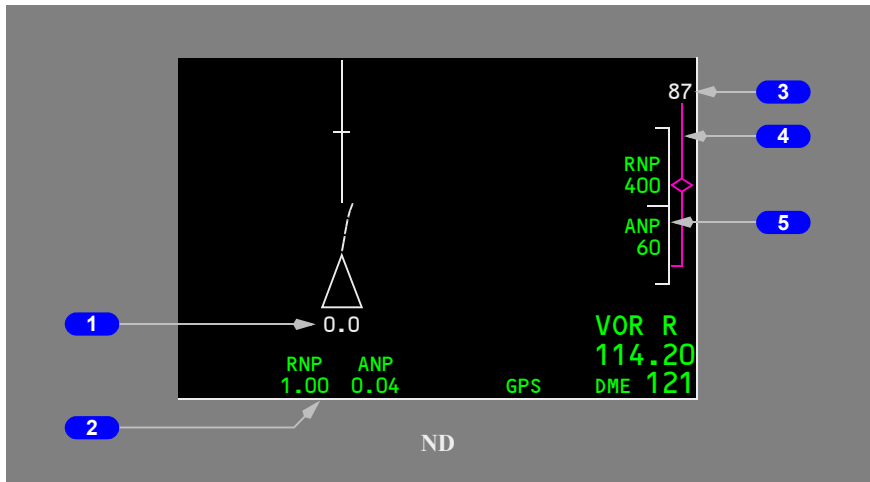
ND Grid Heading Display

[Option – Grid Heading]



ND Navigation Performance Indications

[Option – Enhanced RNP / ANP]

**1 Lateral Path Deviation**

A digital value is displayed below the airplane symbol to show the lateral deviation (in NM) when an active path is defined. The numeric value is followed by an R or L to indicate the airplane position relative to the path.

If map range is greater than 10NM or deviation is 10NM or greater, the lateral deviation is rounded to the nearest 0.1NM.

If map range is 10NM and deviation is less than 10NM, the lateral deviation is rounded to the nearest 0.01NM.

2 Lateral RNP / ANP

Digital display (in NM) of the RNP and ANP. The RNP can be changed on the CDU RNP PROGRESS page 4.

Normally green, changes to amber when ANP exceeds RNP.

3 Vertical Path Deviation

Digital vertical path deviation (in feet) displays when value exceeds 20 feet.

4 Vertical Path Deviation Band

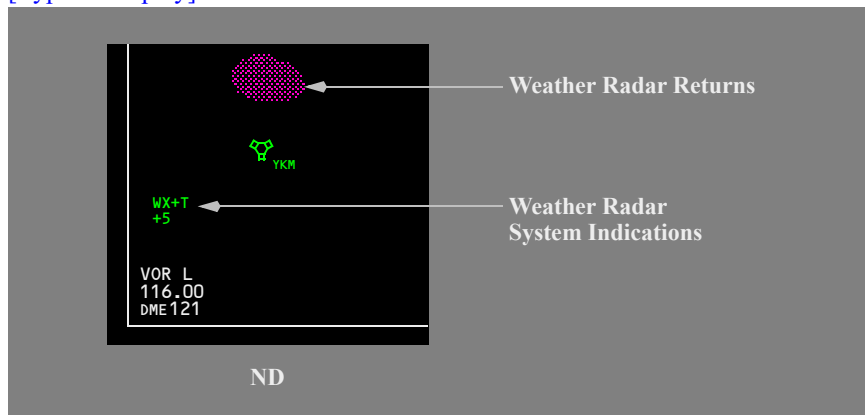
Band is centered on VNAV path pointer and represents current vertical RNP.

5 Vertical RNP /ANP

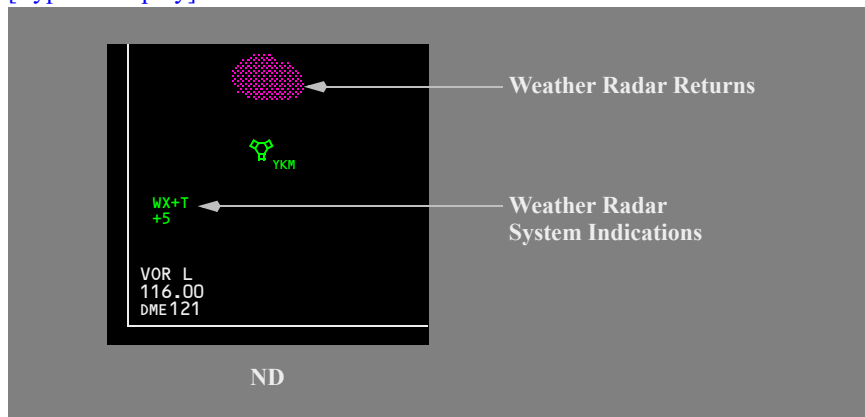
Digital vertical deviation values (in feet). RNP can be changed on the CDU RNP PROGRESS page 4.

ND Weather Radar System Display Indications

[Typical Display]



[Typical Display]



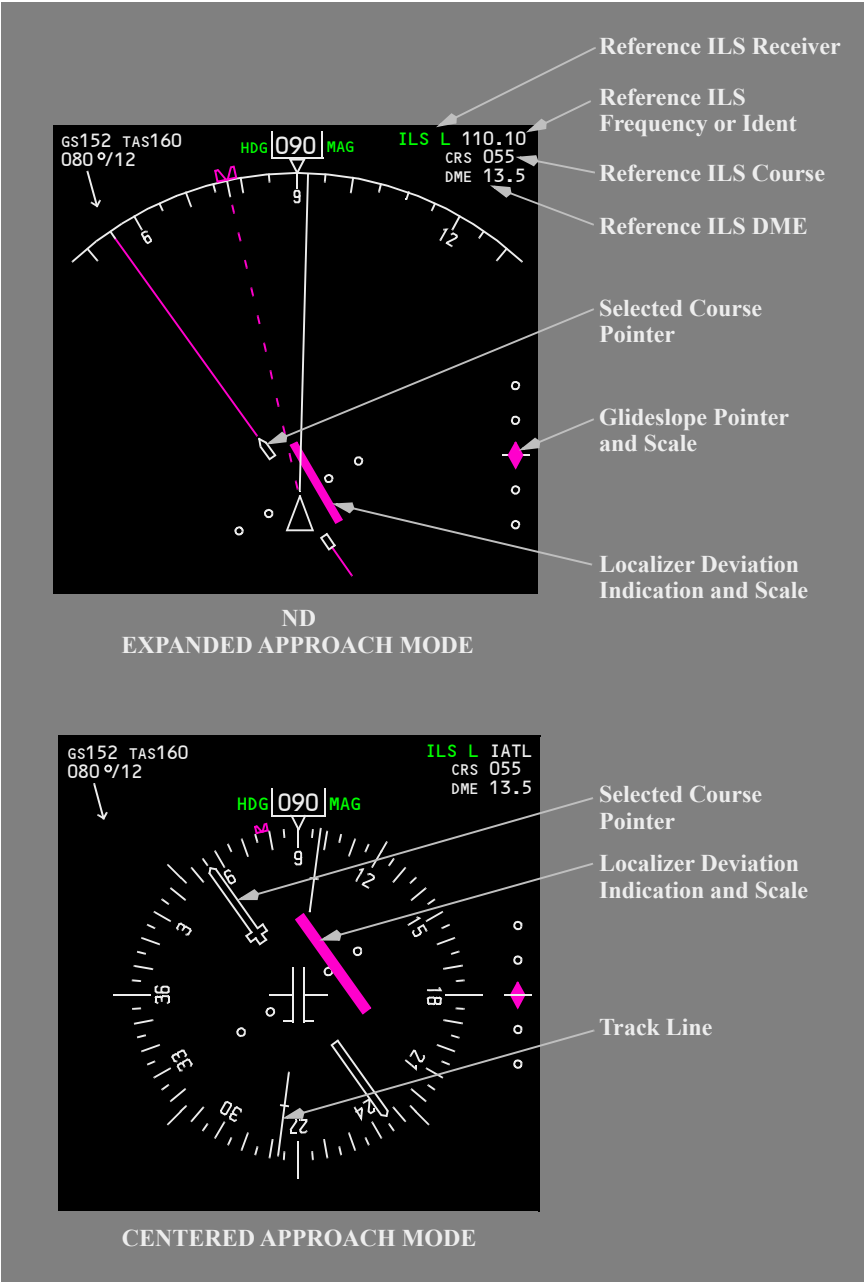
[Option – Range Arcs]



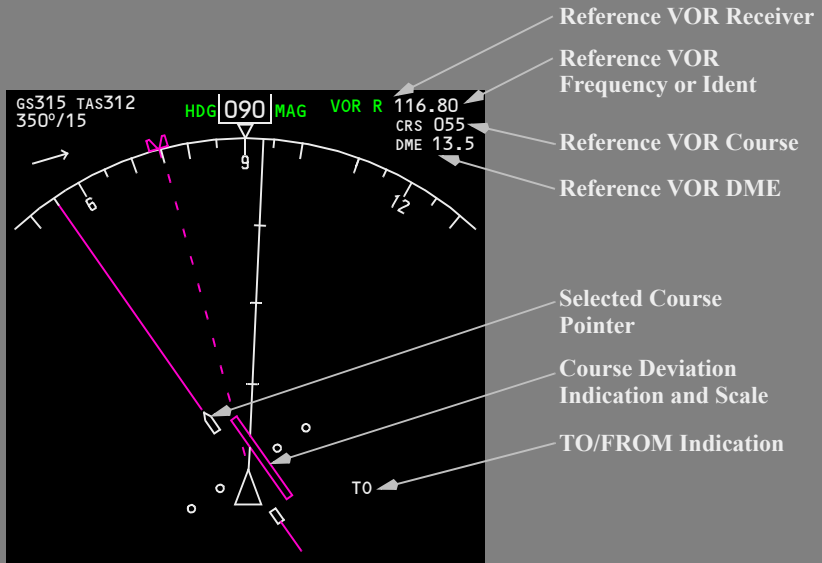
1 TCAS/Weather Radar Range Arcs

Three range arcs in place of the range scale tics on map when TCAS, weather radar, or terrain is selected.

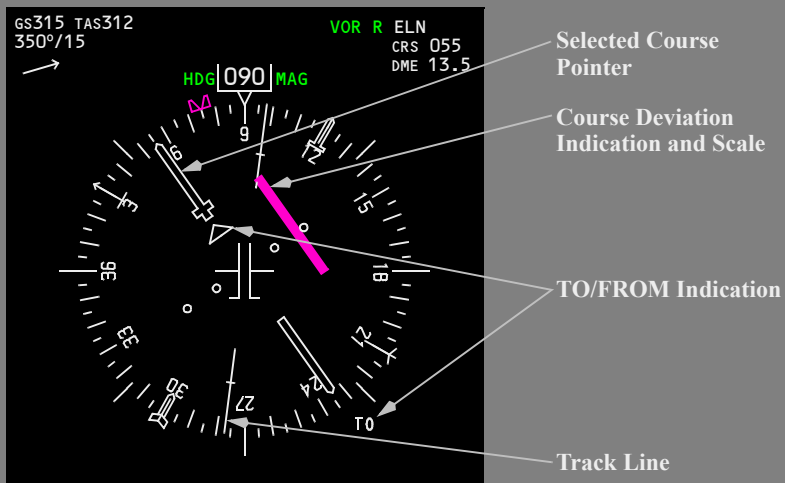
ND Approach Mode



ND VOR Mode

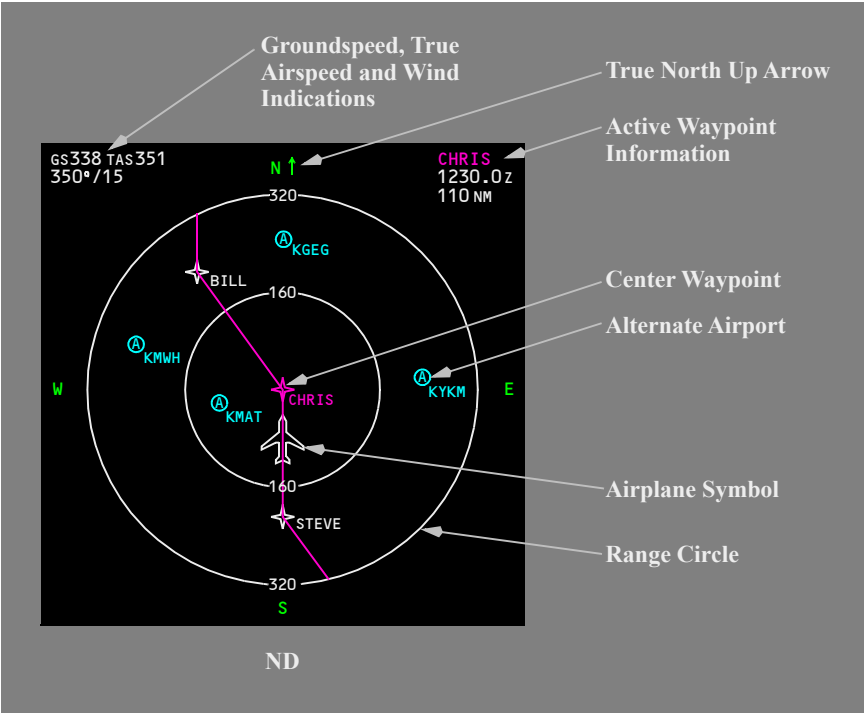


ND
EXPANDED VOR MODE



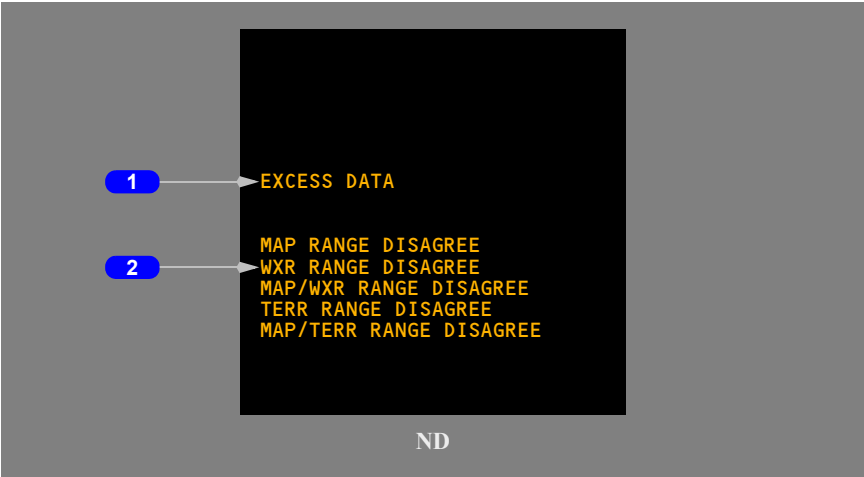
CENTERED VOR MODE

ND Plan Mode



ND Failure Indications and Flags

ND Failure Messages



1 Excess Data

The amount of map information sent to the primary display system is too great to display.

2 MAP/WXR Range Disagree

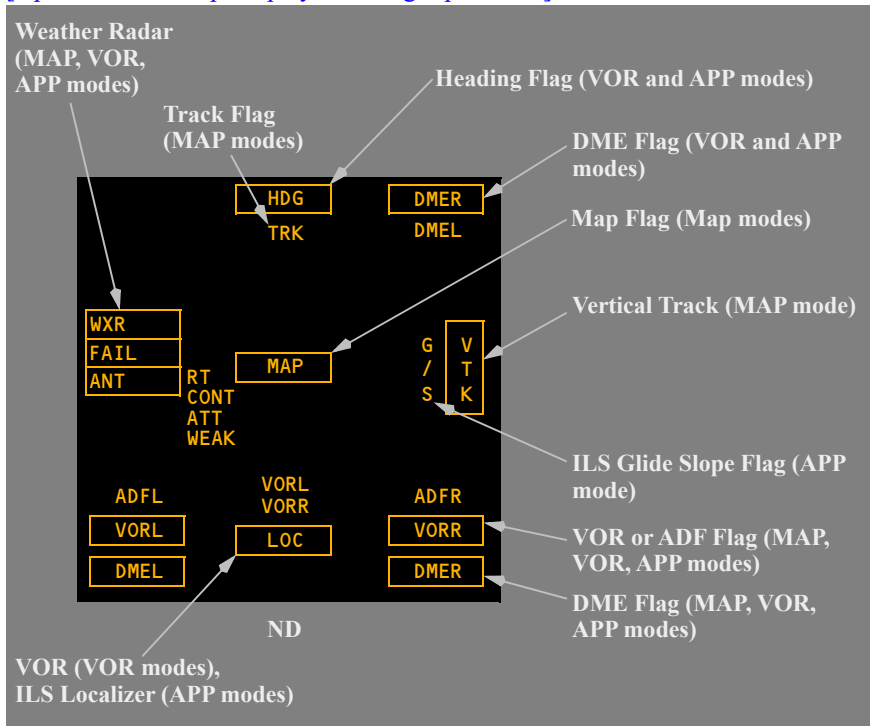
The selected range and range of display information disagree.

Map information is removed.

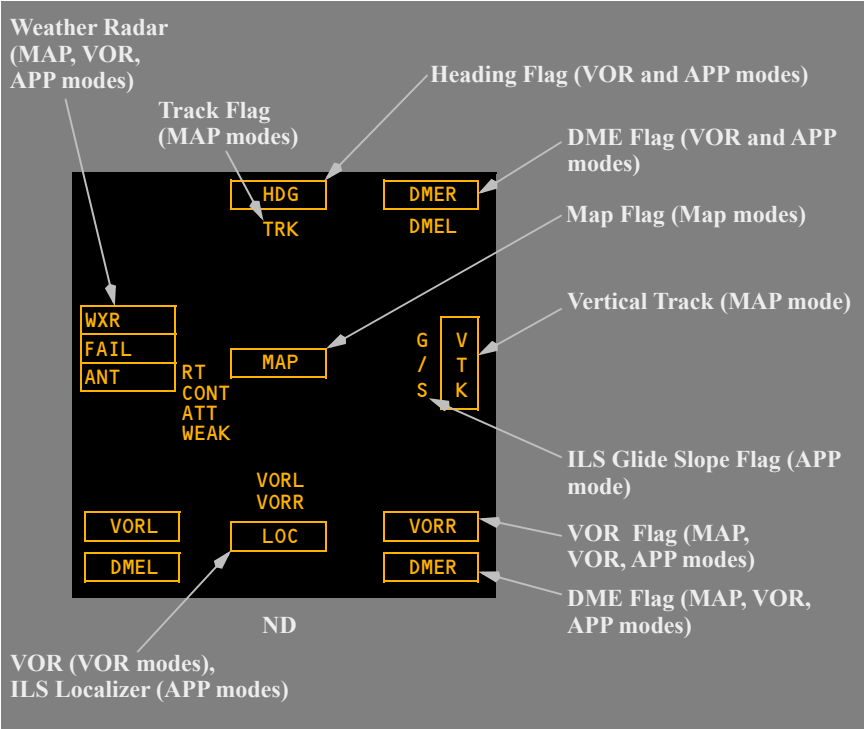
ND Failure Flags

Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate. Flag location varies, depending on the ND mode selected.

[Option – Track-Up Display, Heading-Up Similar]

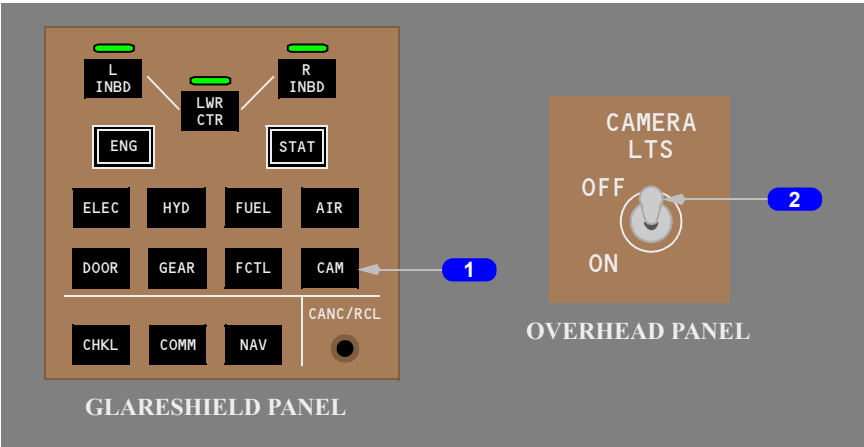


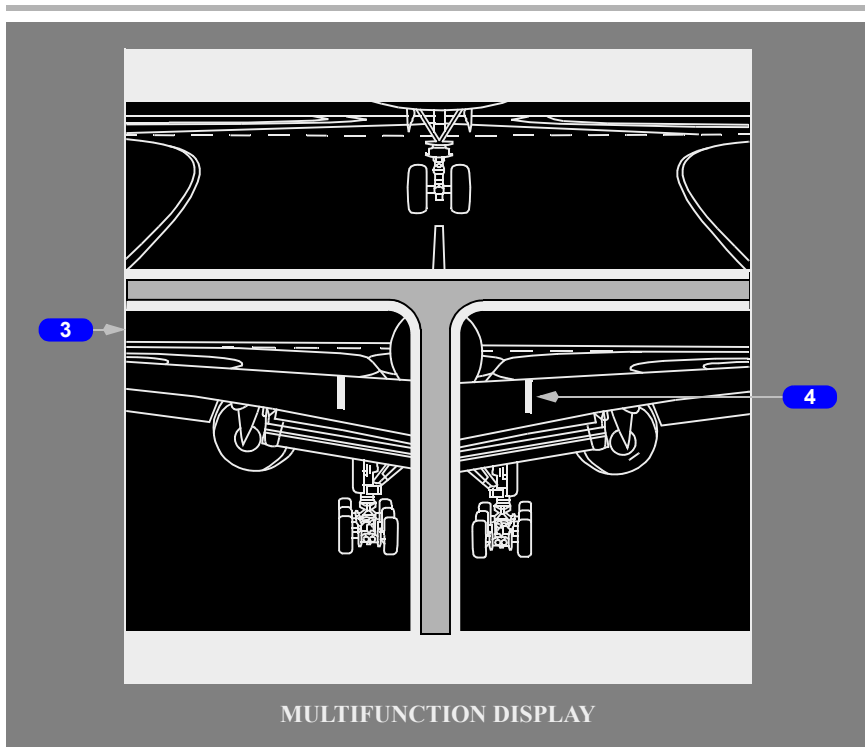
[Option – Track-Up Display, Heading-Up Similar]



Ground Maneuver Camera System

[777-300, 777-300ER]





1 Camera (CAM) Display Switch

Push – displays the main and nose landing gear on the selected MFD.

2 CAMERA LTS Switch

ON – turns on lights to illuminate the main and nose landing gear. The nose gear must be down and locked, and the BEACON light switch must be ON for the camera lights to operate.

3 Ground Maneuver Camera System Display

The main and nose landing gear are displayed on the selected MFD when the CAM display switch is pushed.

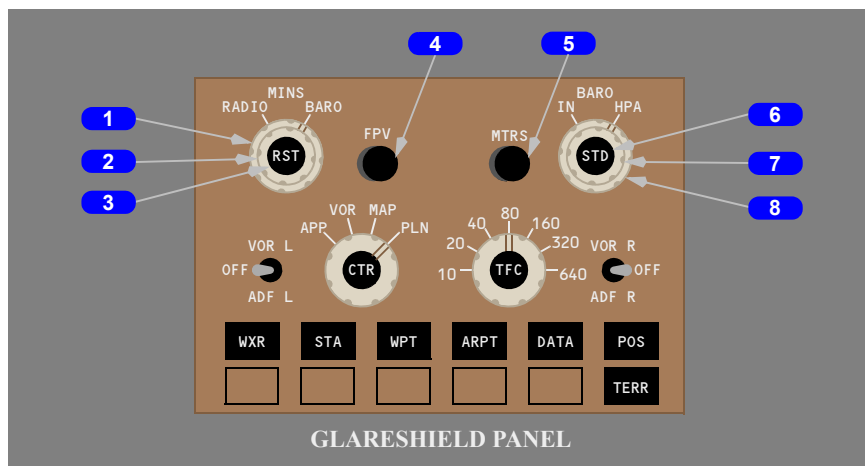
4 Main Landing Gear Location Stripes

The main landing gear location stripes, located on the tops of the wings, are directly above the outside of the main gear wheels. The stripes assist the pilot in locating the main gear wheels in adverse lighting conditions.

EFIS Control Panels

The left EFIS control panel controls the left PFD and ND. The right EFIS control panel controls the right PFD and ND.

EFIS Control Panel PFD Controls



1 Minimums (MINS) Reference Selector (outer)

RADIO – selects radio altitude as the PFD minimums reference.

BARO – selects barometric altitude as the PFD minimums reference.

2 Minimums (MINS) Selector (middle)

Rotate (slew)– adjusts the PFD radio or baro minimums altitude.

3 Minimums Reset (MINS RST) Switch (inner)

Push –

- resets the PFD minimums alert display
- blanks the minimums display when green.

4 Flight Path Vector (FPV) Switch

Push – displays the PFD flight path vector.

5 Meters (MTRS) Switch

Push – displays PFD altitude meters indications.

6 Barometric Standard (BARO STD) Switch (inner)

Push –

- selects the standard barometric setting (29.92 inches Hg/1013 HPA) for the PFD barometric reference
- if STD is displayed, selects the preselected barometric setting
- if no preselected barometric setting is displayed, displays the last value before STD was selected.

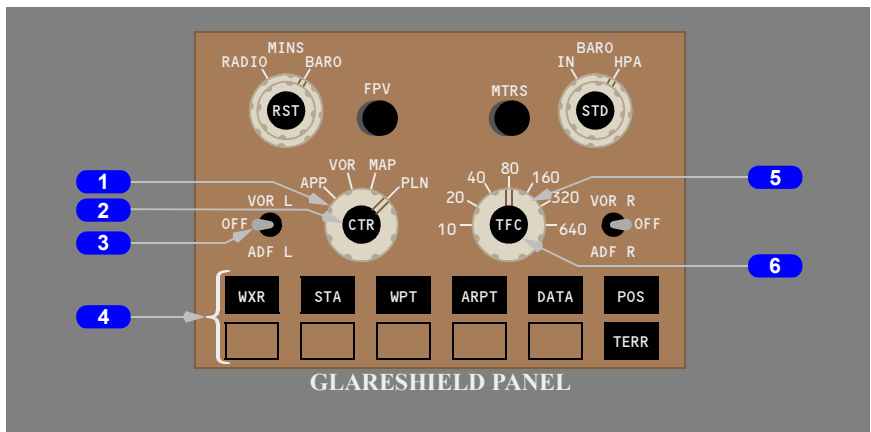
7 Barometric (BARO) Selector (middle)

Rotate (slew) – adjusts the PFD barometric reference.

8 Barometric (BARO) Reference Selector (outer)

IN – selects inches of mercury as the PFD barometric reference.

HPA – selects Hectopascals as the PFD barometric reference.

EFIS Control Panel ND Controls**1 ND Mode Selector (outer)**

Selects the desired ND map display.

APP –

- displays localizer and glideslope information in heading-up format
- displays reference ILS receiver, ILS frequency or identification, course, and DME
- weather radar, TCAS, and terrain are not displayed in CTR APP mode.

VOR –

- displays VOR navigation information in heading–up format
- displays reference VOR receiver, VOR frequency or identification, course, DME, and TO/FROM indication
- weather radar, TCAS, and terrain are not displayed in CTR VOR mode.

MAP –

- displays FMC–generated route and map information, airplane position, heading, and track
- 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 in PLN mode.

2 ND Center (CTR) Switch (inner)

Push –

- displays the full compass rose (centered) for APP, VOR, and MAP modes
- subsequent pushes alternate between expanded and centered displays.

3 VOR/ADF Switches

Displays VOR or ADF information on the respective ND.

VOR – displays the VOR pointer, VOR frequency or identification and associated DME information in all modes except PLAN.

OFF – removes VOR and ADF displays.

ADF – displays the ADF pointer and ADF frequency or identification in all modes except PLAN.

4 Map Switches

The map switches:

- displays selected detailed ND data
- displays can be selected simultaneously
- second push removes the data.

WXR (weather radar) – turns the weather radar on and off, and displays weather radar information (refer to Chapter 11, Flight Management, Navigation). Also displays range information when in the expanded APP or VOR modes.

STA (station) –

- displays high and low altitude navigation aids, if the ND range selector is in the 10, 20 or 40 NM range
- displays high altitude navigation aids, if the ND range selector is in the 80, 160, 320, or 640 NM range.

WPT (waypoint) – displays waypoints, if the ND range selector is in the 10, 20 or 40 NM range.

ARPT (airport) – displays airports on all ranges.

DATA – displays the FMC estimated time of arrival, altitude at each waypoint, and altitude constraints at each waypoint.

POS (Position) –

- displays ADIRU and GPS positions
- displays VOR raw data radials extended from the nose of the airplane to the stations displayed on the CDU NAV RAD page.

TERR (terrain) – displays terrain data. (Refer to Chapter 15, Warning Systems.)

5 ND Range Selector (outer)

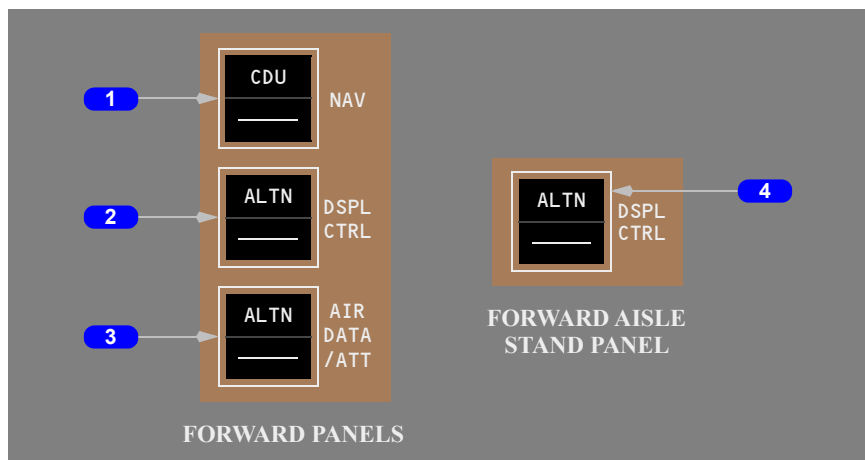
Selects the desired ND nautical mile range scale.

6 ND Traffic (TFC) Switch (inner)

Push – displays TCAS ND information. (Refer to Chapter 15, Warning Systems.) Also displays range information when in the expanded APP or VOR modes.

Instrument Source Select Panels

The instrument source switches are provided for use if a display-related failure is not detected by automatic system monitors. Normally, the display system automatically reconfigures for failures without the pilot having to use these switches.



1 Navigation (NAV) Source Switch

Off – normal position (CDU not visible, switch out):

- with the FMC selector in AUTO, the active FMC provides the information to generate the ND map
- if both FMCs fail, the CDU provides navigation data.

CDU – non-normal position (CDU visible, switch in). The selected CDU generates the ND map. Normally, the sources are:

- left ND map – left CDU
- right ND map – right CDU.

2 Display Control (DSPL CTRL) Source Switch

Off – normal position (ALTN not visible, switch out):

- automatically selects display processing channels for the left outboard and inboard, or right outboard and inboard display pairs
- reconfigures display processing channels as required for display unit or processing channel failures.

ALTN – non-normal position (ALTN visible, switch in). An alternate display processing channel is selected to replace the current display processing channel.

3 Air Data / Attitude (AIR DATA/ATT) Source Switch

Off – normal position (ALTN not visible, switch out):

- the ADIRU provides air data and attitude information to the PFD and ND
- Alternate sources or the SAARU are automatically selected to replace ADIRU air data or attitude, as required.

ALTN – non-normal position (ALTN visible, switch in). The PFD and ND alternate air data/attitude source is selected as follows:

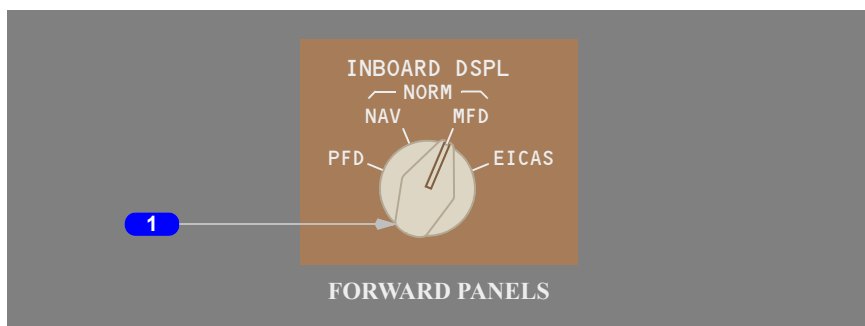
- air data (captain): SAARU single channel
- air data (first officer): ADIRU single channel
- attitude (captain and first officer): SAARU.

4 Center Display Control (DSPL CTRL) Source Switch

Same as the display control source switches for the left and right inboard and outboard display units, except this switch controls the upper center and lower center display units.

Heading Reference and Inboard Displays

Inboard Display Controls



1 INBOARD Display (DSPL) Selector

Selects what is displayed on each inboard display unit.

PFD – displays the PFD, blanks the PFD on the outboard display unit, and inhibits selections made from the display select panel.

NAV – displays the ND and inhibits selections made from the display select panel.

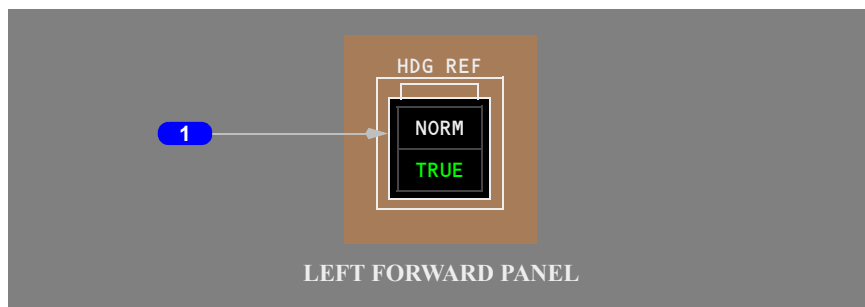
MFD – displays the selection made on the display select panel.

EICAS –

- displays EICAS
- inhibits most selections made from the display select panel (limited ENG, FUEL, and AIR displays can be selected)
- blanks the upper center display unit.

Note: The PFD automatically appears on an inboard display unit if the adjacent outboard display unit fails, regardless of switch position.

Heading Reference Controls



1 Heading Reference (HDG REF) Switch

Pushing alternately selects the heading reference for the PFDs, NDs, AFDS, and FMCs.

NORM –

- normally references magnetic north
- automatically references true north when north of 82°N latitude (or north of 70°N between 80°W and 130°W) or south of 82°S latitude (or south of 60°S between 120°E and 160°E) for PFDs, NDs, and FMCs.
- provides no reference for AFDS roll modes other than LNAV when north of 82°N latitude (or north of 70°N between 80°W and 130°W) or south of 82°S latitude (or south of 60°S between 120°E and 160°E).
- automatically references true north when north of 82°N latitude (or north of 73°N between 80°W and 170°W) or south of 82°S latitude (or south of 60°S between 120°E and 160°E) for PFDs, NDs, and FMCs.
- provides no reference for AFDS roll modes other than LNAV when north of 82°N latitude (or north of 73°N between 80°W and 170°W) or south of 82°S latitude (or south of 60°S between 120°E and 160°E).

TRUE – references true north regardless of latitude.

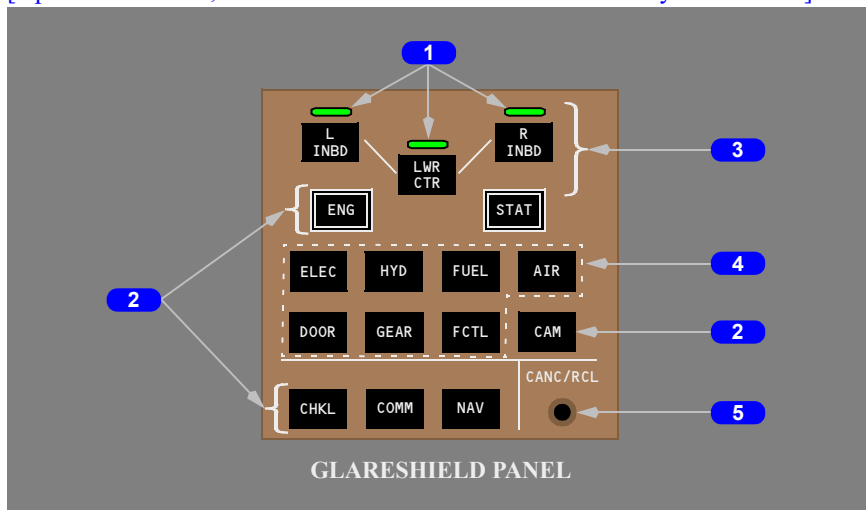
When the AFDS roll mode is HDG SEL, switching the heading reference switch from NORM to TRUE or TRUE to NORM engages the HDG HOLD mode.

777 Flight Crew Operations Manual

When the AFDS roll mode is TRK SEL, switching the heading reference switch from NORM to TRUE or TRUE to NORM engages the TRK HOLD mode.

Display Select Panel (DSP)

[Option – 777-300, 777-300ER Ground Maneuver Camera System Switch]

**1 Display Lights**

Illuminates to show the display unit the display select panel controls.

2 Display Switches

Pushing the switch displays the associated display. Pushing the same switch a second time blanks the display or (left and right inboard display units) redisplay the ND if there is only one page of messages. If there are more than one page of messages, pushing STAT pages through the messages.

ENG – secondary engine EICAS (Ch. 7).

STAT – status page:

- hydraulic system indications (Ch. 13)
- APU indications (Ch. 7)
- oxygen system indications (Ch. 1)
- status messages for dispatch determination (Ch. 15).

CHKL – checklist (this chapter).

COMM – communications (Ch. 5).

NAV – navigation display (this chapter).

[777-300, 777-300ER]

CAM – ground maneuver camera system (this chapter).

3 Multifunction Display (MFD) Switches

Selects the active MFD (left inboard, lower center, or right inboard display unit) for display selection.

The appropriate left or right INBOARD DISPLAY selector must be in the MFD or EICAS position. The other display select panel switches determine what is displayed on the selected MFD.

4 Synoptic Switches

Pushing the switch displays the associated synoptic. Synoptics present a simplified view of system status as an aid for crew situational awareness. Pushing the same switch a second time blanks the display or (left and right inboard display units) redispays the ND.

ELEC – electrical system (Ch. 6).

HYD – hydraulic system (Ch. 13).

FUEL – fuel system (Ch. 12).

AIR – air systems (Ch. 2).

DOOR – doors (Ch. 1).

GEAR – landing gear and brake systems (Ch. 14).

FCTL – flight control system (Ch. 9).

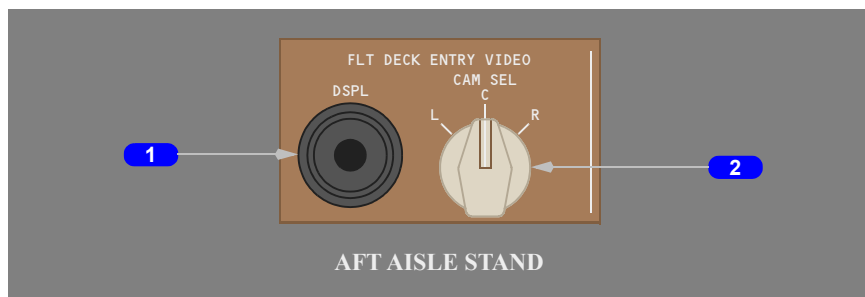
5 Cancel/Recall (CANC/RCL) Switch

Refer to Warning Systems, Chapter 15.

Flight Deck Entry Video Surveillance System (FDEVSS)

[Option – Flight Deck Security Video on MFD]

Flight Deck Entry Video Panel



1 Display (DSPL) Switch

Push – displays surveillance video on active MFD.

If using an INBD display unit, the appropriate left or right INBOARD DSPL selector must be in the MFD position.

Second push – cancels display of surveillance video on active MFD.

2 Camera (CAM) Selector (SEL)

Selects camera location for display on selected MFD.

L – displays view of door 1L & flight deck door area.

C – displays view from flight deck door looking aft.

R – displays view from door 1R looking toward cross-aisle.

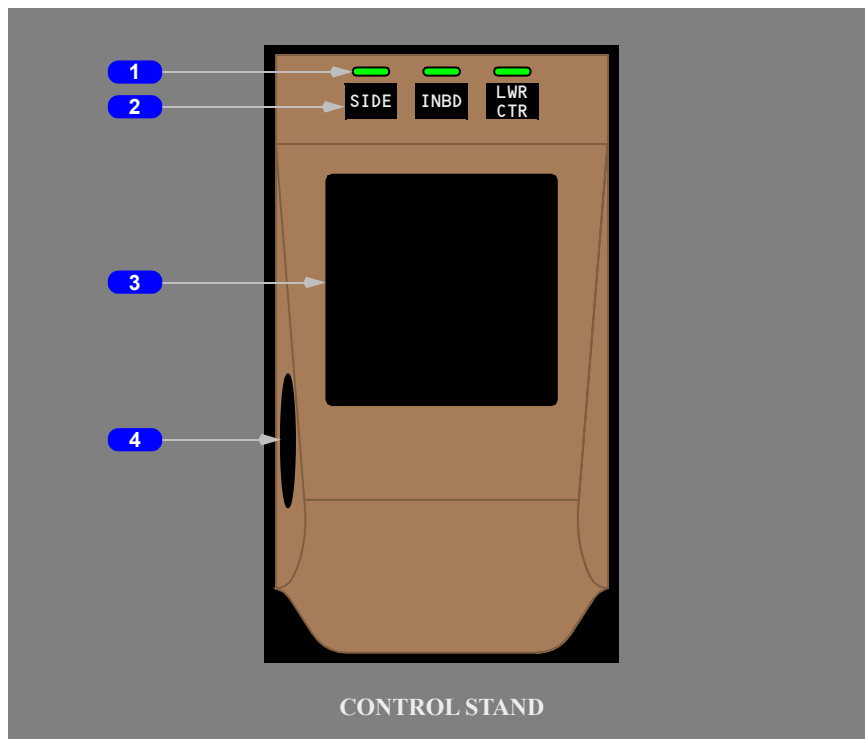
Cursor Control Device (CCD)

[Option – Side Display]

The left CCD controls the left inboard, left side, and lower center display unit cursor position and operation.

The right CCD controls the right inboard, right side, and lower center display unit cursor position and operation.

The left CCD is shown; the right CCD is similar, except the cursor select, SIDE, and LWR CTR switches are located on the opposite side of the CCD.



1 Cursor Location Lights

The associated annunciator light illuminates to indicate which display unit is selected.

2 Cursor Location Switches

Selects the display unit where the cursor appears (side, inboard, or lower center display) and automatically deselects the previous display unit.

3 Touch Pad

Finger movement on the touch pad moves the cursor on the selected display. Lifting the finger off the pad and putting it back down in a different location (except the corner areas) does not move the cursor. The cursor only moves when the finger is moved on the touch pad surface.

Corner areas – placing a finger in one of the four corners puts the cursor in that respective corner of the screen. Moving the cursor into a corner region without lifting the finger from the pad does not have this effect.

4 Cursor Select Switch

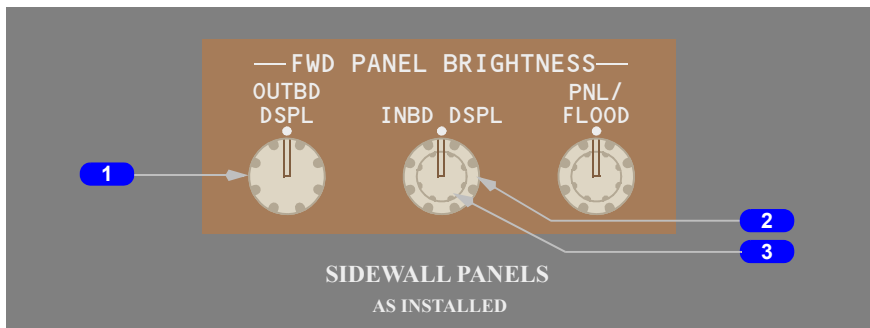
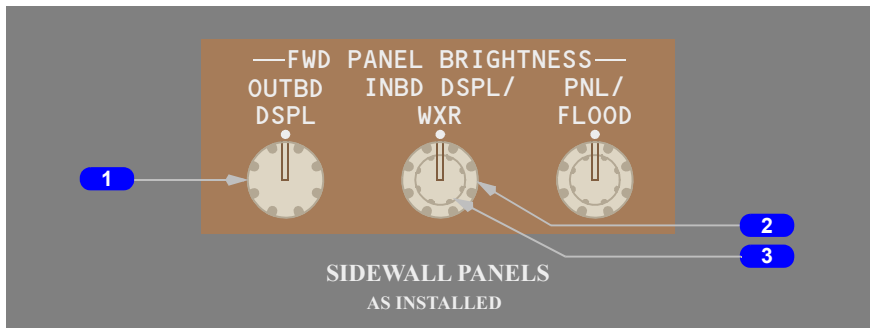
Push – activates the area of the screen that the cursor is currently in, such as a menu item or command button. The area is highlighted by a white border to indicate it can be selected.

The switch is used to select menus, checklists, checklist steps, and other functions.

Display Brightness Controls

Forward Panel Brightness Controls

The left panel is shown.



1 Outboard Display (OUTBD DSPL) Brightness Control

Rotate – adjusts the brightness of the outboard display unit.

2 Inboard Display (INBD DSPL) or (INBD DSPL/WXR) Brightness Control (outer)

Rotate – adjusts the brightness of the inboard display unit.

[777-200 with GPWS with Look-Ahead Terrain Feature]

3 Inboard Display (INBD DSPL) or (INBD DSPL/WXR) Brightness Control (inner)

Rotate – adjusts weather radar or terrain display brightness on the inboard display unit.

Weather radar and terrain data cannot be displayed at the same time.

[777-300]

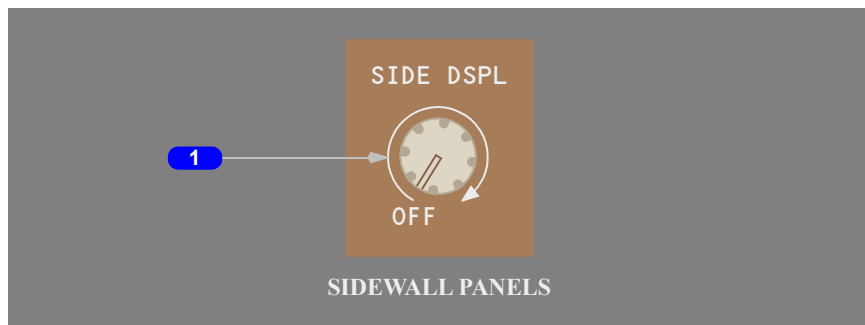
3 Inboard Display (INBD DSPL) Brightness Control (inner)

Rotate – adjusts weather radar, terrain display, or ground maneuver camera display brightness on the inboard display unit.

Only one function can be displayed at a time.

Side Display Brightness Controls

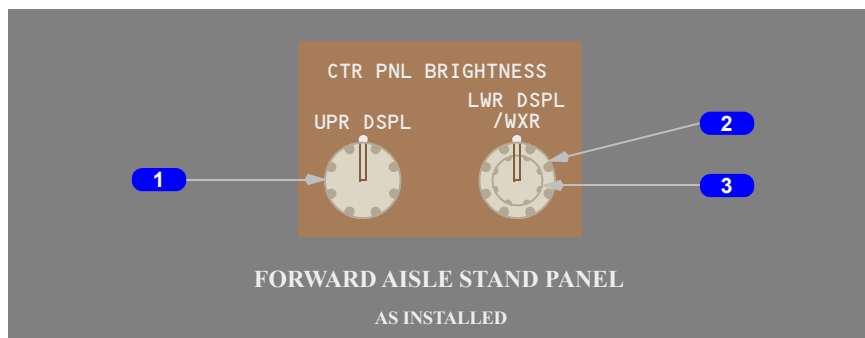
[Option]

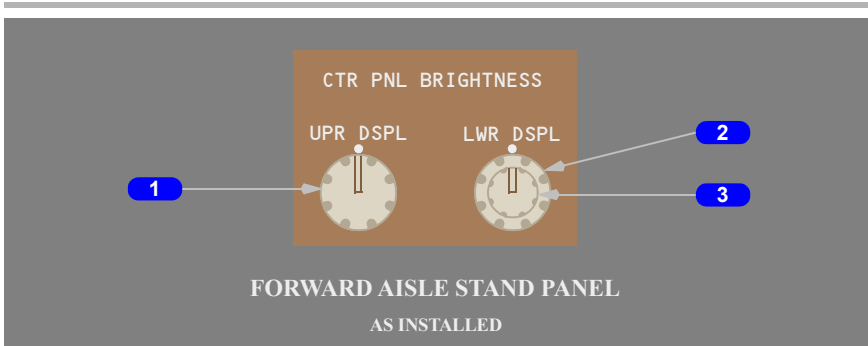


1 SIDE Display (DSPL) Brightness Control

Rotate – adjusts the brightness of the side display unit.

Center Panel Brightness Controls



**1 Upper Display (UPR DSPL) Brightness Control**

Rotate – adjusts the brightness of the upper center display unit.

2 Lower Display (LWR DSPL) or (LWR DSPL/WXR) Brightness Control (outer)

Rotate – adjusts the brightness of the lower center display unit.

[777-200 with GPWS with Look-Ahead Terrain Feature]

3 Lower Display (LWR DSPL) or (LWR DSPL/WXR) Brightness Control (inner)

Rotate – adjusts weather radar or terrain display brightness on the lower center display unit.

Weather radar and terrain data cannot be displayed at the same time.

[777-300]

3 Lower Display (LWR DSPL) Brightness Control (inner)

Rotate – adjusts weather radar, terrain display, or ground maneuver camera brightness on the lower center display unit.

Only one function can be displayed at a time.

Standby Flight Instruments

The standby flight instruments include the:

[ISFD]

- integrated standby flight display
- standby magnetic compass

[non ISFD]

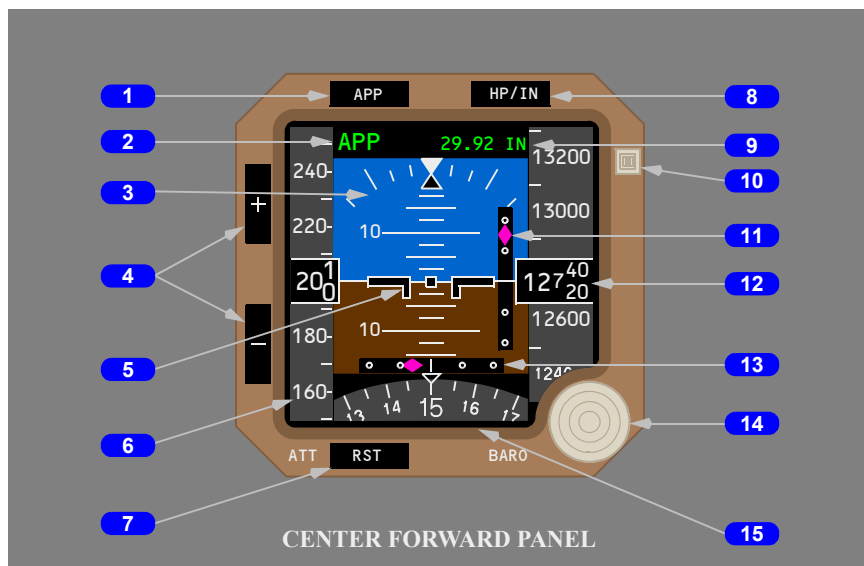
- standby magnetic compass
- standby attitude indicator
- standby airspeed indicator
- standby altimeter.

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The standby attitude, airspeed, and altimeter indicators are small flat panel liquid crystal display units.

Integrated Standby Flight Display (ISFD)

Provides an independent source of attitude, airspeed, and altitude information.



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 position with reference to the horizon.

6 Airspeed Indications

Indicates airspeed when above 30 knots.

7 Attitude Reset (ATT RST) Switch

Push and hold at least two seconds -

- aligns horizon with the airplane symbol
- reset takes approximately ten seconds
- starts new initialization sequence if previous attempt failed (ground only).

8 Hectopascal/Inch (HP/IN) Switch

Push - changes units of 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 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 Selector (BARO)

Rotate - changes barometric setting.

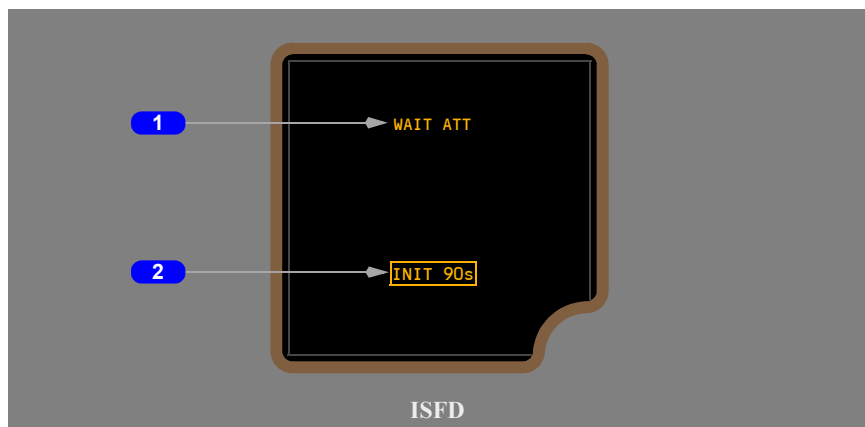
Push -

- selects standard barometric setting (29.92 inches Hg/1013 HPA)
- if STD 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

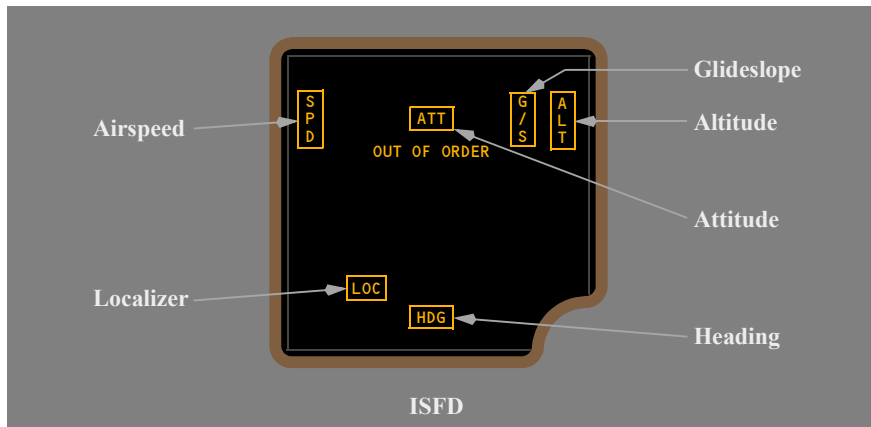
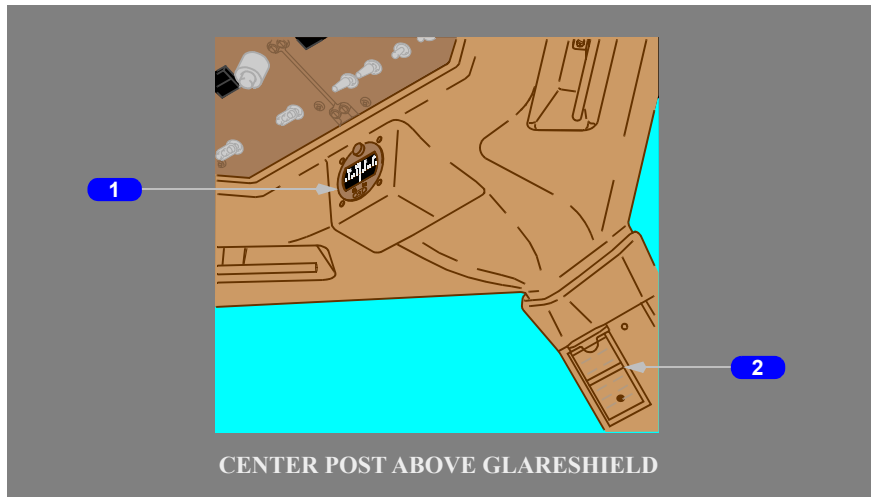
INIT 90s (amber) - countdown of 90 second initialization -

- countdown stops if excessive motion is detected
- countdown resumes when motion stops
- ATT:RST displays if initialization is not complete within six minutes.

ISFD Failure Flags

Failure flag replaces appropriate display.

OUT OF ORDER indicates instrument system failure.

**Standby Magnetic Compass**

1 Standby Magnetic Compass

Displays magnetic heading.

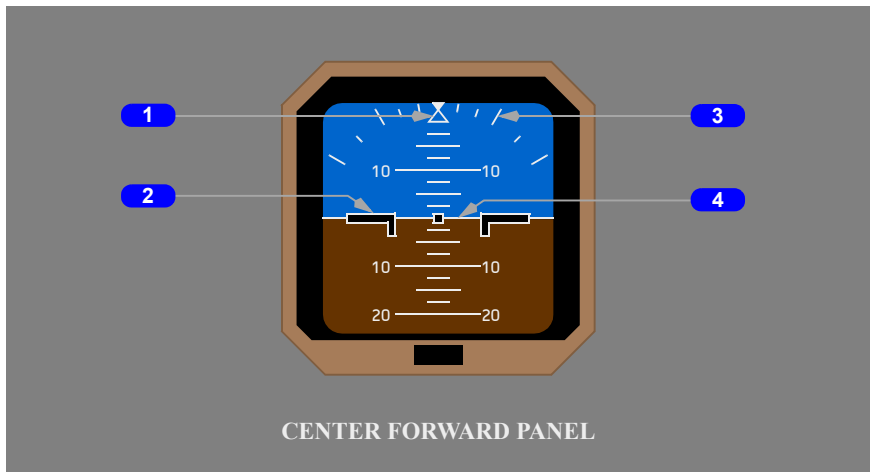
2 Standby Magnetic Compass Correction Card

Provides appropriate heading corrections.

Standby Attitude Indicator

[non ISFD airplanes]

The standby attitude indicator displays SAARU attitude.



1 Bank Pointer

Indicates airplane bank.

2 Airplane Symbol

Indicates airplane attitude with reference to the SAARU horizon.

3 Bank Scale

Fixed reference for the bank pointer.

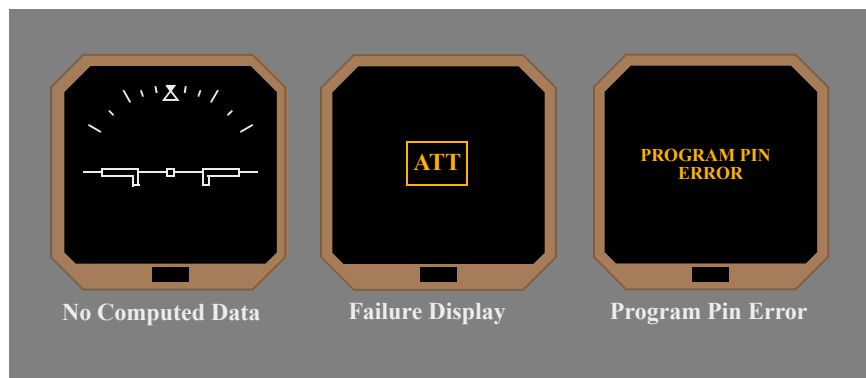
Scale marks are at 0, 10, 20, 30, 45, and 60 degrees.

4 Horizon Line and Pitch Scale

Indicates the SAARU horizon relative to the airplane symbol.

Pitch scale is in 2.5 degree increments.

Standby Attitude Indicator Non Normal Displays



No Computed Data – No computed data from the SAARU.

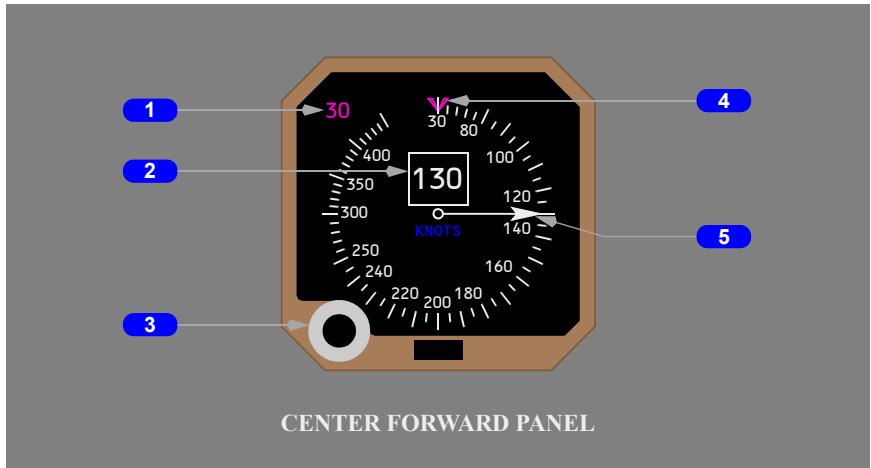
Failure Display – Data from the SAARU fails.

Program Pin Error – Program pin connection invalid.

Standby Airspeed Indicator

[non ISFD airplanes]

The standby airspeed indicator displays airspeed from a dedicated pitot and static air data module. The indicator does not use ADIRU or SAARU information.



1 Selected Speed

Displays the speed selected with the bug selector and indicated by the standby airspeed bug.

2 Current Standby Airspeed

Displays current airspeed.

3 Standby Airspeed Bug Selector

Rotate (outer) – adjusts the standby airspeed bug.

Push (inner) – turns the standby airspeed display bug off and on.

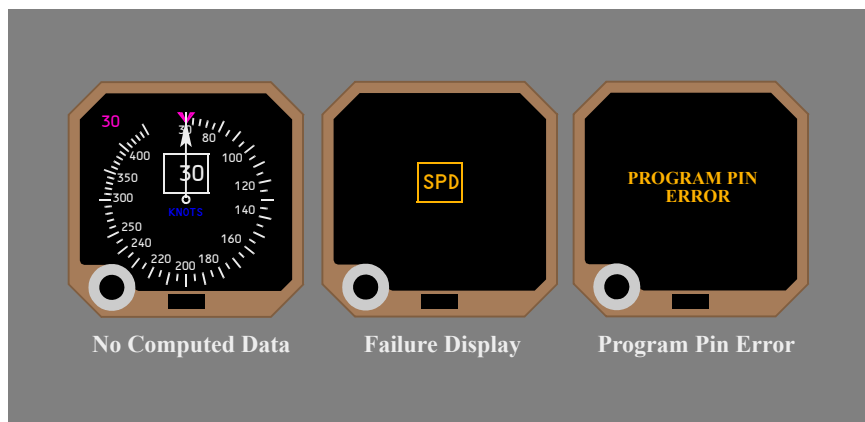
4 Standby Airspeed Bug

Points to the speed selected with the bug selector.

5 Current Standby Airspeed Pointer

Indicates current airspeed.

Standby Airspeed Indicator Non Normal Displays



No Computed Data – No input or airspeed 30 knots or less.

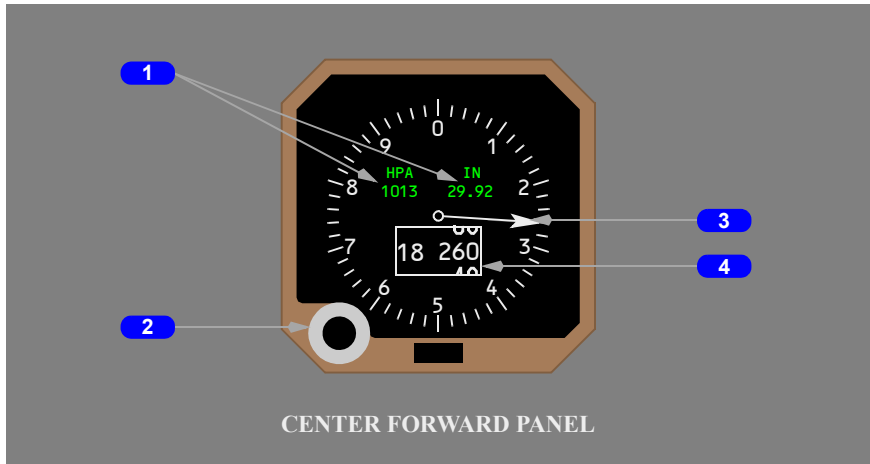
Failure Display – Indicator of air data input fails.

Program Pin Error – Program pin connection invalid.

Standby Altimeter

[non ISFD airplanes]

The standby altimeter displays barometric altitude from a dedicated air data module.



1 Barometric Reference

Indicates the selected barometric reference in inches (IN) and Hectopascals (HPA).

2 Standby Barometric Selector

Rotate (outer) – adjusts the altimeter barometric reference.

Push (inner) – switches between standard and the last selected barometric reference.

3 Altitude Pointer

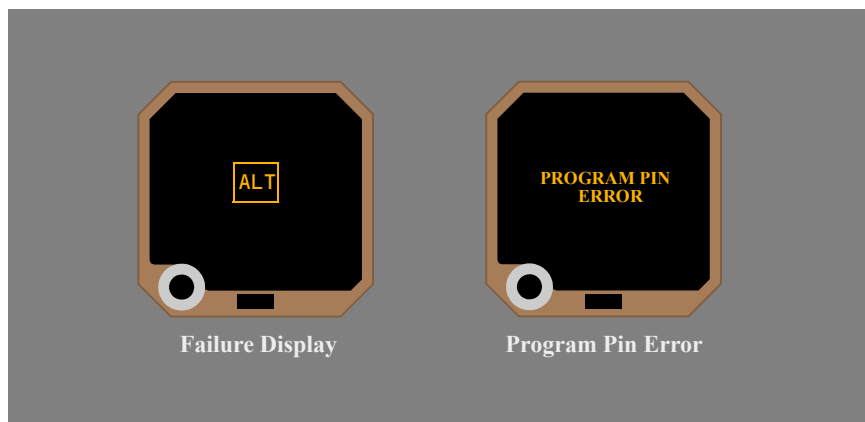
Indicates barometric altitude in hundreds of feet.

One full rotation of the pointer is 1000 feet.

4 Current Altitude

Indicates barometric altitude.

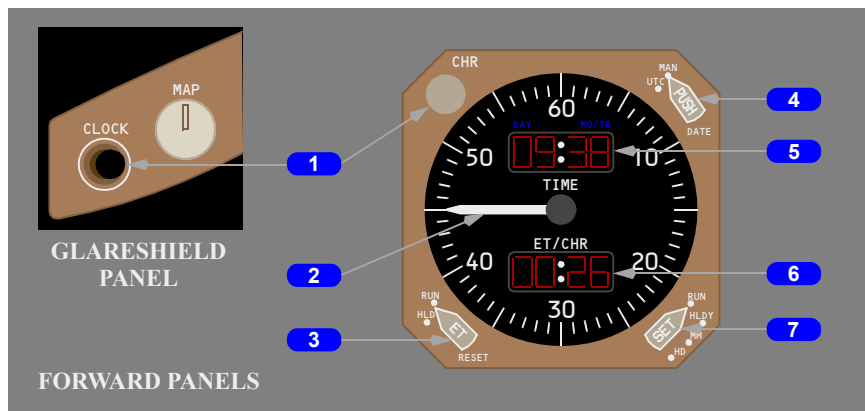
Standby Altimeter Indicator Non Normal Displays



Failure Display – No computed data or indicator failure.

Program Pin Error – Program pin connection invalid.

Clock



1 Chronograph (CHR or CLOCK) Switch

Push – subsequent pushing starts, stops, resets the chronograph.

2 Chronograph Pointer

Indicates chronograph seconds.

3 Elapsed Time (ET) Selector

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.

4 Time/Date Selector

MAN (Manual) – the clock is manually set to a time and date.

UTC – the clock is automatically set to the UTC date and time.

Push –

- alternately displays the day–month, then year in the time/date window
- subsequent selection displays only the time in the time/date window.

5 Time/Date Window

Displays time (hours, minutes) when time is selected on the time/date selector.

Alternately displays day–month and year when date is selected on the time/date selector.

6 Elapsed Time (ET)/Chronograph (CHR) 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 will be displayed after the chronograph is reset.

7 Clock Set Selector

Sets the time and date when the time/date selector is set to manual.

HD (hours, day) –

- advances hours when time is selected on the time/date selector
- advances days when date is selected on the time/date selector.

MM (minutes, month) –

- advances minutes when time is selected on the time/date selector
- advances months when date is selected on the time/date selector.

HLDY (hold, year) –

- stops the time indicator and sets the seconds to zero when time is selected on the time/date selector
- advances years when date is selected on the time/date selector.

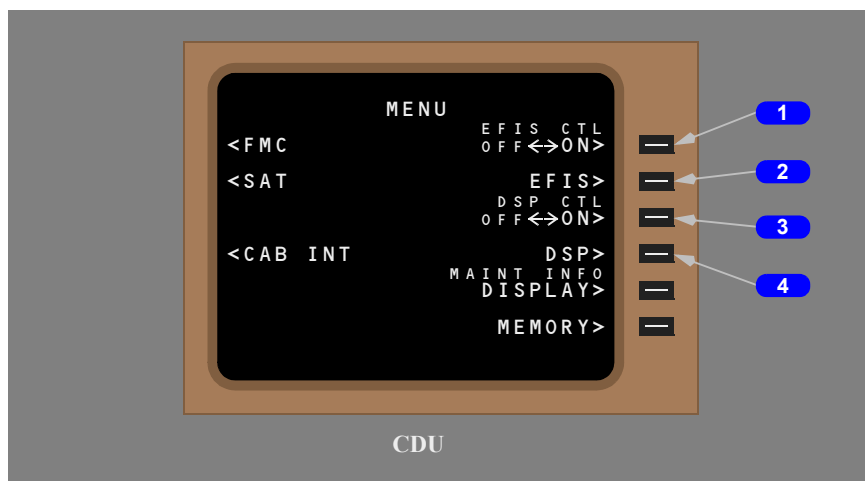
RUN – starts the time indicator.

EFIS Control Panels and Display Select Panel (DSP) – CDU Alternate Control

The CDU provides an alternate way to control the functions of the EFIS control panel and/or the display select panel.

Note: The control callouts on the following pages correspond to the control names on the EFIS control panels and the display select panel.
Explanations of the CDU functions are the same as on the related control panels.

CDU EFIS/DSP Control Selection



1 EFIS Control (CTL) Select Key

Transfers control of the EFIS from the EFIS control panel to the CDU (left EFIS control panel transfers to the left CDU, right EFIS control panel transfers to the right CDU).

2 EFIS Page Select Key

Selects the EFIS CONTROL page when EFIS control is on.

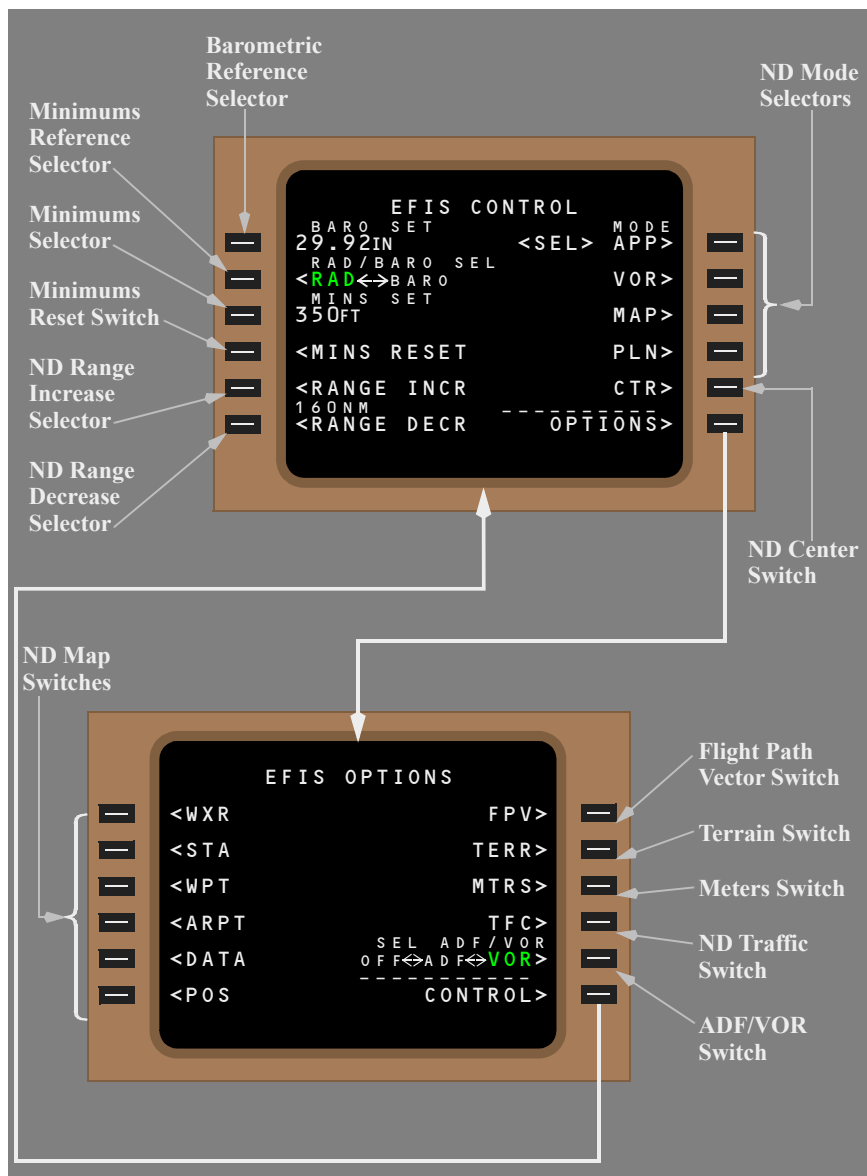
3 Display Select Panel Control (DSP CTL) Select Key

Transfers control of the display select panel control from the display select panel to the CDU.

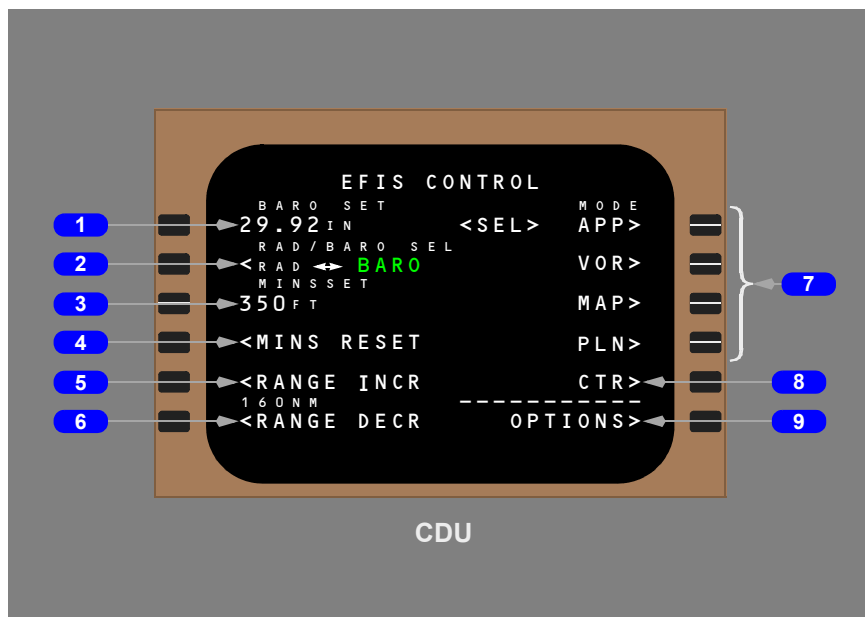
4 Display Select Panel (DSP) Page Select Key

Selects the DISPLAY SELECT PANEL CONTROL page when the DSP control is on.

EFIS Control CDU Pages



EFIS Control Page



1 Barometric (BARO) SET

Valid entry is reference barometric setting.

- entries of 22.00 to 32.00 or 2200 to 3200 display as IN (inches of mercury)
- entries of 745 to 1084 display as HPA (hectopascals)
- entry of "I" to change the displayed value to IN
- entry of "H" to change the displayed value to HPA
- entry of "S" or "STD" displays 29.92 IN or 1013 HPA (depending on units being displayed on BARO SET line) and displays STD on the PFD.

2 Radio (RAD) or Barometric (BARO) Select (SEL)

- Push - alternately selects RAD (radio altimeter) or BARO (barometric altimeter) as the minimums reference on the PFD. Selected mode displays in large green font.

3 Minimums (MINS) SET

- Entered minimums display on respective PFD.
- BARO selected in 2L, valid entries are -101 to 15000 feet.
- RAD selected in 2L, valid entries are -20 to 999 feet.

4 Minimums (MINS) RESET

Push - resets the minimums alert on the PFD.

5 RANGE Increase (INCR)

Push - increases ND nautical mile range scale.

6 RANGE Decrease (DECR)

Push - decreases ND nautical mile range scale.

7 MODE

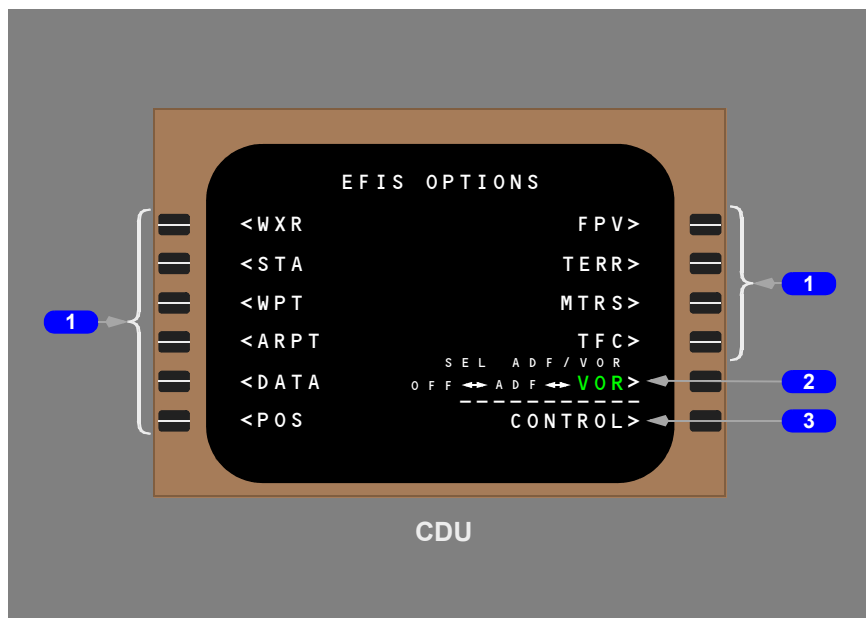
Push - selects desired ND display.

8 Center (CTR)

Push - alternately displays centered and expanded APP, VOR, and MAP modes.

9 OPTIONS

Push - displays EFIS OPTIONS page.

EFIS Options Page



1 WXR, POS, MTRS, FPV, TFC, TERR, WPT, STA, ARPT, DATA

Push - selects respective PFD/ND options.

2 ADF/VOR

Push - sequentially selects ADF, VOR, or OFF for the pointer display on the ND. Selected mode displays in large green font.

ADF - displays the ADF pointers and frequency on the ND in all modes except PLAN.

VOR - displays the VOR pointer, frequency, and associated DME on the ND in all modes except PLAN.

OFF - removes ADF and VOR data from the ND.

2 VOR

Push - sequentially selects VOR or OFF for the pointer display on the ND. Selected mode displays in large green font.

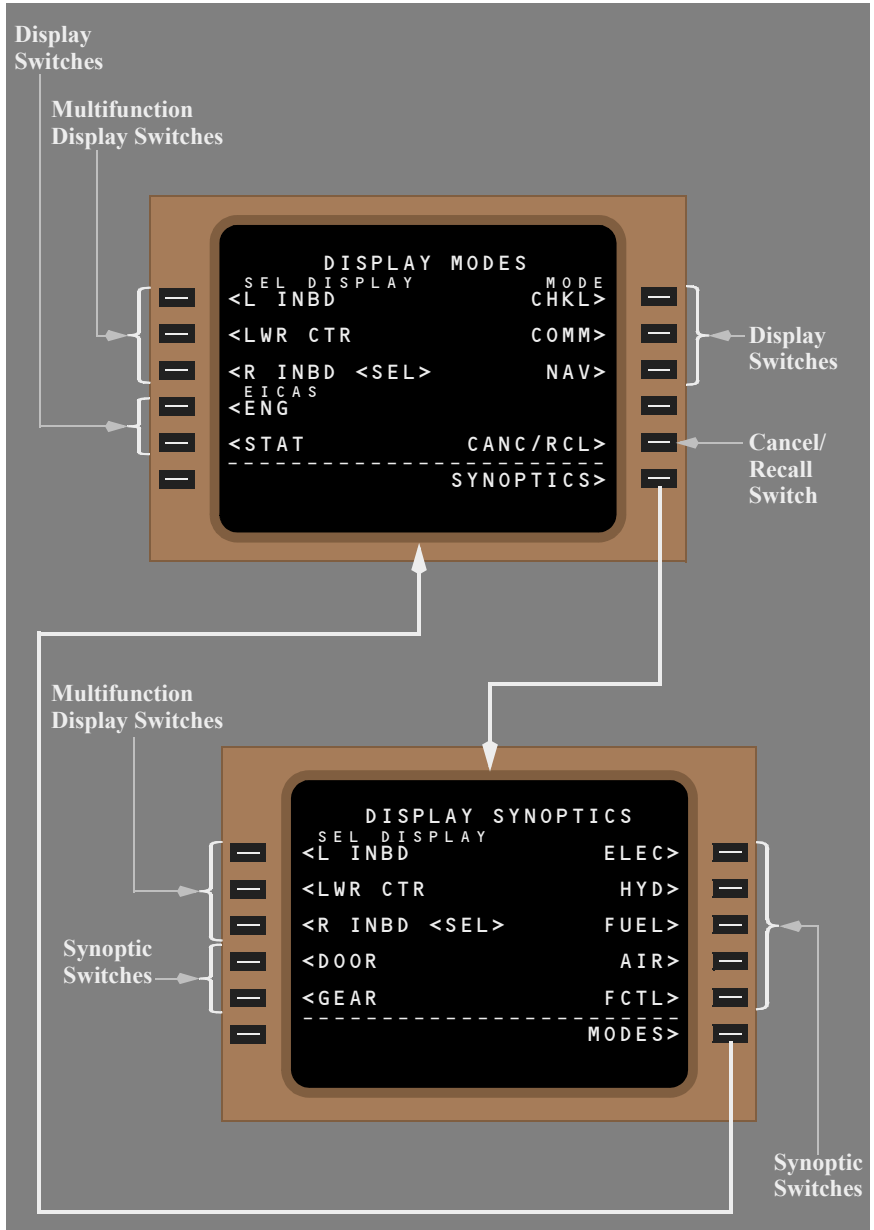
VOR - displays the VOR pointer, frequency, and associated DME on the ND in all modes except PLAN.

OFF - removes VOR data from the ND.

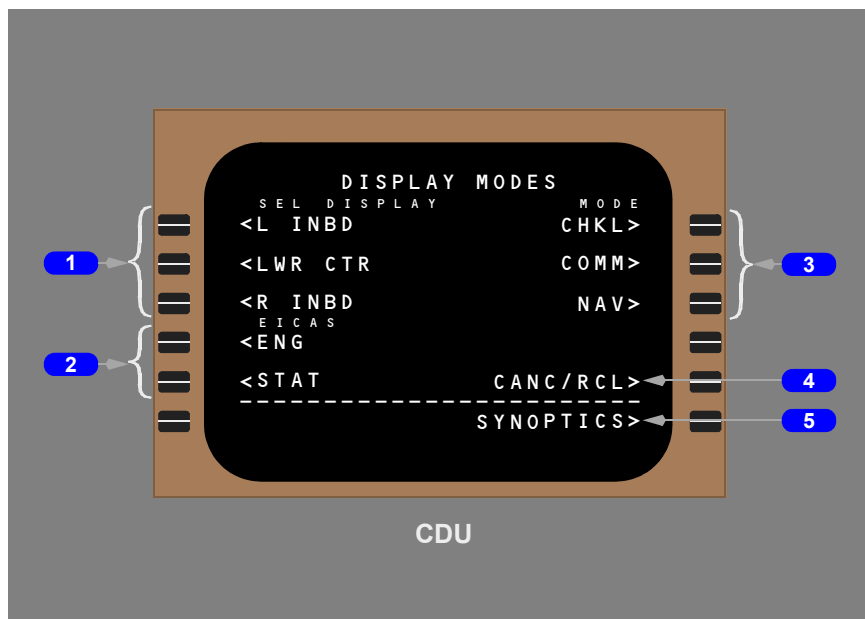
3 CONTROL

Push - selects EFIS CONTROL CDU page.

Display Select CDU Pages



Display Modes Page



1 SEL DISPLAY

Push - selects display to be used.

2 EICAS

Push - selects EICAS display mode.

3 MODE

Push - selects display mode.

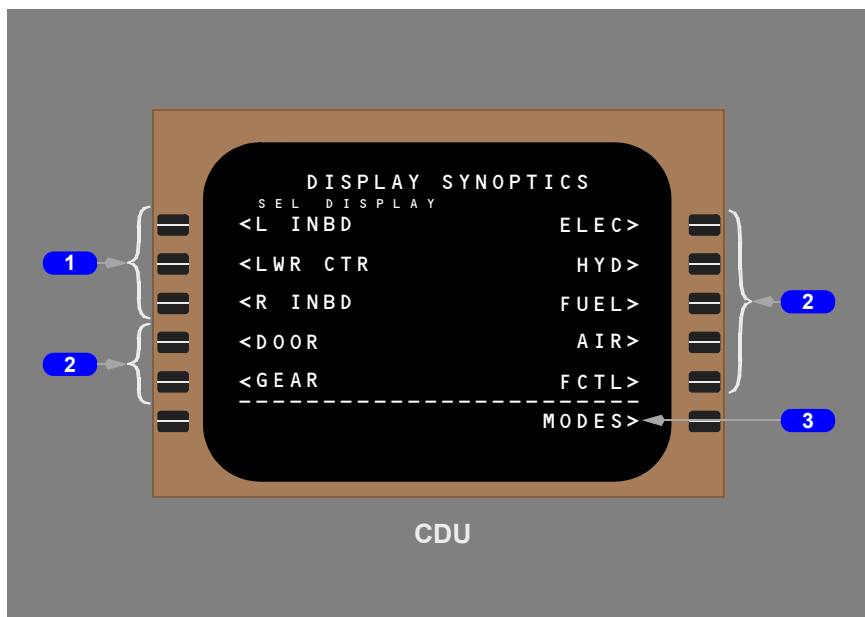
4 CANC/RCL

Push - cancels/recalls EICAS messages. Refer to Warning Systems, Chapter 15.

5 SYNOPTICS

Push - selects DISPLAY SYNOPTICS page

Display Synoptics Page



1 SEL DISPLAY

Push - selects display to be used.

2 Synoptics

Push - selects desired synoptic.

3 MODES

Push - selects DISPLAY MODES page.

Intentionally
Blank

**Flight Instruments, Displays
System Description****Chapter 10
Section 20****Introduction**

The flight instruments and displays supply information to the flight crew on six flat panel liquid crystal display units:

- Captain and First Officer primary flight display (PFD)
- Captain and First Officer navigation display (ND)
- the engine indication and crew alerting system (EICAS)
- the multifunction display (MFD).

Detailed information on the following subjects is found in other sections of this chapter:

- PFD – Section 30
- ND – Section 40
- Electronic Checklist – Sections 50 and 60.
- Electronic Flight Bag - Section 65.

Display Selection and Control

During normal operations:

- the inboard display selectors are set to MFD
- PFDs are displayed on the two outboard display units
- NDs are displayed on the two inboard display units
- EICAS is displayed on the upper center display unit
- the lower center display unit is blank. The secondary engine display is the default display at power-up.

Inboard Display Selectors

The inboard display selectors are used to select PFD, ND (NAV position), MFD, or EICAS displays on the inboard display units.

The normal position is MFD. With MFD selected, ND information is displayed on the inboard display units if NAV is selected on the display select panel (refer to Display Select Panel in this section).

In the ND, PFD, and EICAS positions, only the selected displays can appear on the inboard display units.

With MFD selected on the inboard display selector, the following ND and EFIS control logic applies:

- if both pilots have an ND on the inboard displays, then each EFIS control panel controls its corresponding ND display
- if there is an ND display on one inboard display unit and on the lower center display unit, then the pilot who does not have an ND on the inboard display unit controls the ND on the lower center display unit
- if neither pilot has an ND display on the inboard display unit, and there is an ND display on the lower center display unit, then the left EFIS control panel controls the lower center display unit
- if both pilots have an ND display on the inboard display unit, and there is an ND on the lower center display unit, then the left EFIS control panel controls the left inboard display unit and the lower center display unit. The ND on the left inboard and the lower center display units are identical.

EFIS Control Panels

The EFIS control panels control display options, mode, and range for the respective PFDs and NDs. Refer to the PFD and ND sections of this chapter.

If an EFIS control panel fails, the displays can be controlled through the related CDU. This CDU capability is available at all times, but inhibits inputs from the respective EFIS control panel.

Display Select Panel

The display select panel controls the MFD format on the left and right inboard display units and the lower center display unit. The selected display is indicated by the illuminated annunciator light on the display select panel (L INBD, R INBD, LWR CTR).

[\[777-300, 777-300 ER Ground Maneuver Camera System and Flight Deck Security Video on MFD option shown\]](#)

After a display unit is selected, the appropriate display is selected (ENG, STAT, ELEC, HYD, FUEL, AIR, DOOR, GEAR, FCTL, CAM, CHKL, COMM, or NAV on the DSP, or FDEVSS by the DSPL switch on the flight deck entry video panel).

A new display selection automatically replaces the previous one. A second selection of the same display for the lower center display unit blanks the display. A second selection of the same display on either inboard display causes display of the ND. If there is more than one page of messages, pushing STAT pages through the messages.

Pushing the COMM or CHKL switch for either inboard display unit shows the selected display. The cursor automatically appears on the selected display.

Display select panel control is also available through any CDU. This capability is available at all times. Once display select panel control is selected on one CDU, it cannot be selected on the other two CDUs.

When used as an MFD, the lower center display unit and the two inboard display units can display the following displays:

- ND (NAV switch)
- status page (STAT switch)
- secondary engine EICAS (ENG switch)
- system synoptics (ELEC, HYD, FUEL AIR, DOOR, GEAR, FCTL switches)
- communications pages (COMM switch)
- electronic checklist (CHKL switch)

[\[777-300, 777-300ER Ground Maneuver Camera System\]](#)

- ground maneuver camera system display (CAM switch)

[\[Option - Flight Deck Security Video on MFD\]](#)

- flight deck entry video security system (flight deck entry video panel DSPL switch)

When an inboard display selector is in the PFD position, new displays selected from the display select panel to that inboard display are inhibited. The annunciator light above the associated display select panel switch is also inhibited.

When an inboard display selector is in the EICAS position, only the ENG, AIR, and FUEL switches can affect the display. Pushing one of those switches causes the display of the respective compacted blocks of information on the EICAS display. The cancel/recall switch operates normally. Refer to these chapters for more information on compact EICAS displays:

- Chapter 2, Air Systems
- Chapter 7, Engines, APU
- Chapter 12, Fuel.

The inboard display selectors have no effect on the inboard displays if an outboard display unit fails; the PFD automatically moves to the inboard display unit regardless of the position of the inboard display selector.

Upper center display unit failure automatically switches the EICAS display to the lower center display unit. A subsequent EICAS selection on either of the inboard display selectors brings the EICAS display to that inboard display unit, and assuming no latched condition exists, the lower center display unit initially displays secondary engine instruments. Following this initial display configuration, the lower center display unit can be used in its usual MFD mode.

Display Brightness Control

The MASTER BRIGHTNESS control provides simultaneous brightness adjustment for all displays and panel lighting. Also, each display unit has an individual control with limited range control when master brightness is on, and full range control when master brightness is off.

Two remote light sensors, located left and right on the top of the glareshield, measure brightness in the forward field of view and adjust the overall display brightness as required. Individual sensors on the front of each display unit also affect display brightness. The CDUs, mode control panel displays, standby flight instruments, and aisle stand panel displays are also controlled by the automatic display brightness control system.

Note: If display brightness cannot be set as desired when master brightness is on, pushing the MASTER BRIGHTNESS switch off may allow setting display brightness to an appropriate level using individual brightness controls.

Instrument Display Source Selection

The display system automatically reconfigures to compensate for most faults. The instrument display source select panels provide manual switches for the pilots to use if certain faults are not corrected automatically.

Instrument source select switches provide alternate information sources for the PFDs and NDs. These switches provide automatic source selection when in the off position (switch out, with the ALTN and CDU switch annunciations not visible).

If there is an undetected source failure (a display is missing or parts of a display appear faulty), the non-normal (ALTN or CDU) position provides the capability for manual selection of PFD and ND sources.

Undetected display source failures, such as missing/faulty display information or intermittent display blanking, may not result in automatic switching. The CDU position of the NAV switch or the ALTN position of the DSPL CTRL or AIR DATA/ATT switches provide the capability to manually select PFD and ND sources.

A center display control source switch is provided for the center displays.

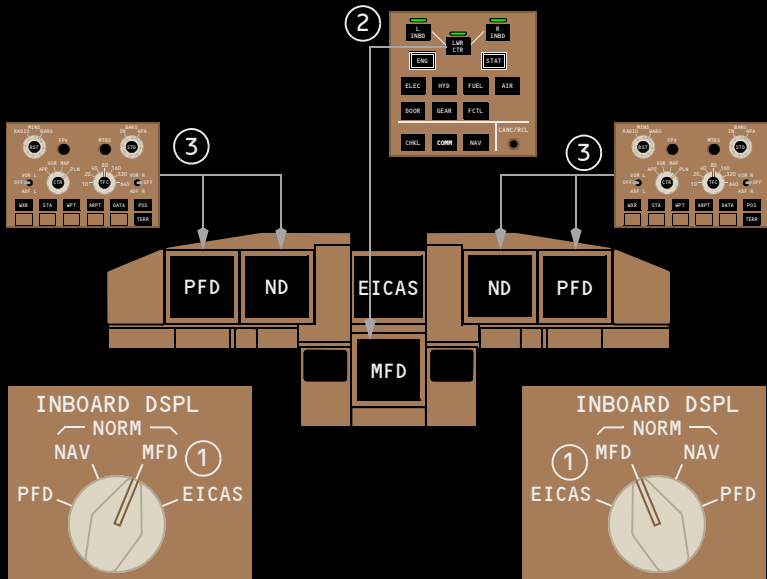
Display Selection and Control Examples

The following examples show display selections.

777 Flight Crew Operations Manual

Normal Display Configuration

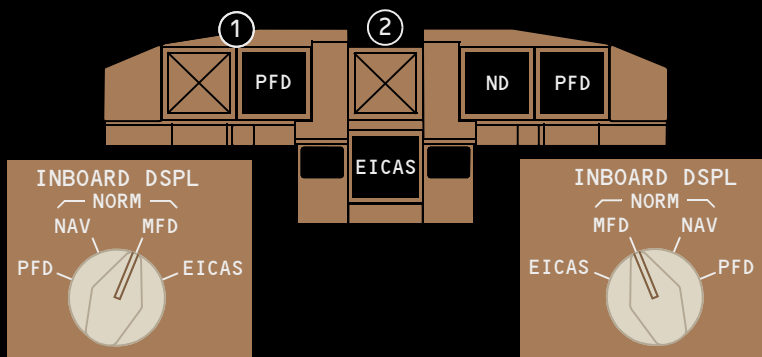
- ① The INBOARD DISPLAY selectors are set to MFD.
- ② The lower center display unit is the preferred MFD controlled by the display select panel.
- ③ The outboard display units display PFDs and the inboard display units display NDs. The related control panel controls what is on the PFD and ND.



Display Unit Failure Automatic Switching

- ① If an outboard display unit fails, the PFD automatically moves to the inboard display unit. The INBOARD DISPLAY selector and the display select panel no longer have any control over that inboard display unit.
- ② If the upper center display unit fails, the EICAS display automatically moves to the lower center display unit.

Pushing the ENG display switch switches EICAS between primary and compacted modes if no pop-up condition is active. The display select panel can still display compact engine, air and fuel synoptics. The CANCEL/RECALL switch operates normally.

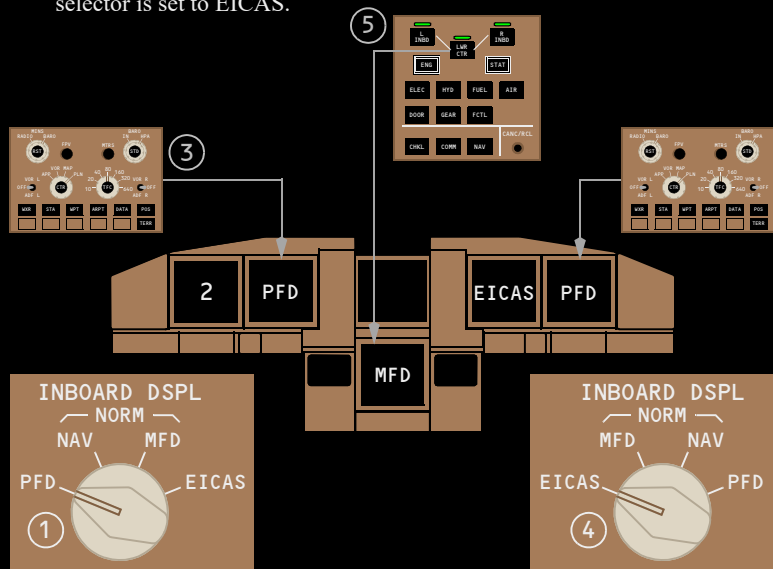


Inboard Display Switching

- ① The left INBOARD DISPLAY selector is set to PFD. With an INBOARD DISPLAY selector in any position other than MFD, the selector position alone determines what is displayed on the display unit. The left inboard display cannot display any selections made on the display select panel.
- ② The left outboard display blanks and the PFD moves to the left inboard display unit.
- ③ The left EFIS control panel controls the PFD.
- ④ The right INBOARD DISPLAY selector is set to EICAS.

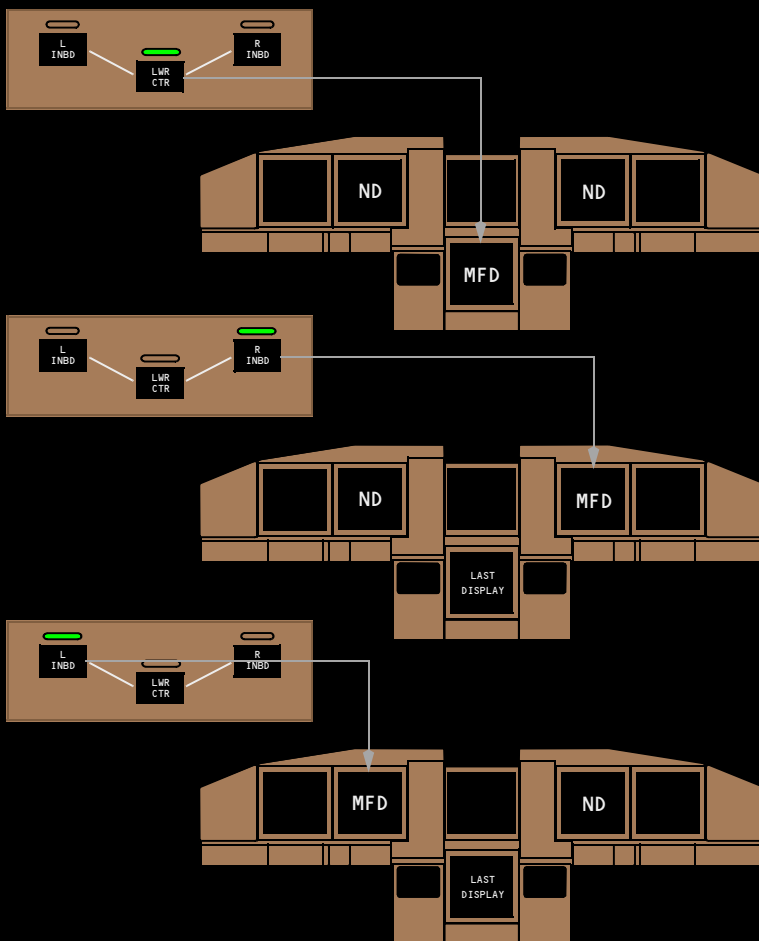
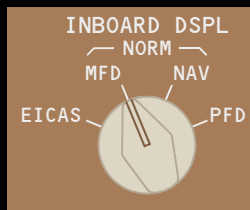
The right inboard display cannot display selections made on the display select panel, except for compact engine, air and fuel synoptics, and the CANCEL/RECALL switch functions.

- ⑤ The upper center display blanks and the EICAS display moves to the right inboard display unit. Now there is no ND visible. Either pilot could use the display select panel to display an ND on the lower center display unit (refer to the following pages).



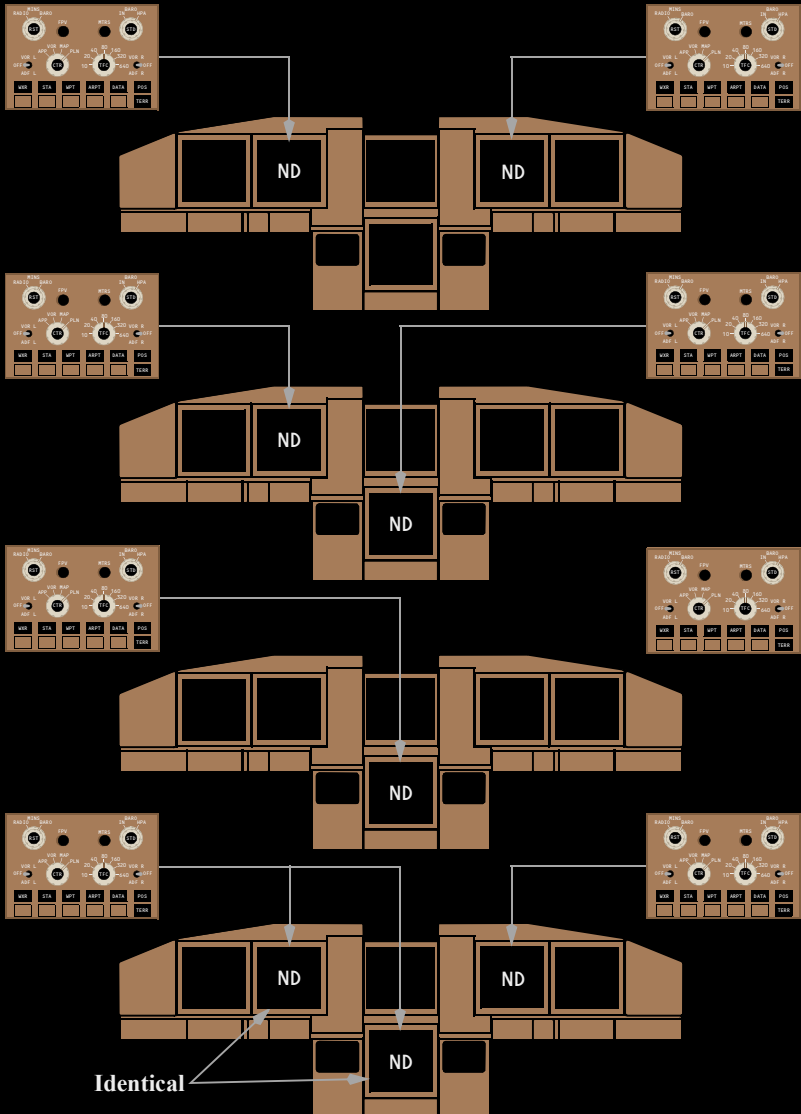
Display Select Panel MFD Selection

With the INBOARD DISPLAY selectors set to MFD, the display select panel display switches are used to designate a display as an MFD. The designated display (L INBD, LWR CTR, or R INBD) is then controlled by the other display select panel selections (ENG, STAT, CHKL, COMM, NAV or one of the system synoptics).



EFIS Control Panel Multiple ND Control

This shows which EFIS control panel controls which ND when multiple NDs are displayed, or when the ND is displayed on the lower center display unit.



Ground Maneuver Camera System

[777-300, 777-300ER]

The ground maneuver camera system provides the flight crew with views of the nose gear and main gear areas during taxi operations.

The system has three cameras. The cameras supply a color image to a three-way split screen display on any multifunction display (MFD).

The nose landing gear camera is on the lower side of the fuselage. The nose landing gear camera video is displayed on the upper section of the MFD ground maneuver camera display.

The left and right main landing gear cameras are on the leading edges of the respective horizontal stabilizer. The left and right main landing gear camera video is displayed on the lower section of the ground maneuver camera display. The system automatically compensates for approximately 80 percent of stabilizer movement to keep the cameras pointed correctly.

A black stripe is painted on the top of each wing to provide guidance when the tires are in shadow. The outboard edge of each stripe corresponds to the location of the outboard tire faces on each main landing gear.

The camera windows are heated to prevent the formation of ice, frost, or condensation from blocking the camera view. Window heat operates automatically when the cameras are operating.

The camera (CAM) display switch on the display select panel (DSP) is pushed to display the ground maneuver camera system video on a multifunction display (MFD). The system is powered whenever airplane DC and AC electrical power is available and the In-Flight Entertainment System/Passenger Seats (IFE/PASS SEATS) Power Switch is ON.

To display ground maneuvering camera system video images while viewing surveillance video, select an appropriate MFD, and press CAM on the display select panel twice.

Ground maneuver camera lights can be turned on with the CAMERA LTS switch on the overhead panel. The BEACON switch must be on and the nose landing gear down for the camera lights to operate. The lights are located on the outboard flap track fairing of each wing and on the aft side of the nose landing gear strut.

Flight Deck Entry Video Surveillance System (FDEVSS)

[Option – Flight Deck Security Video on MFD]

The flight deck entry video surveillance system provides video images of the flight deck door entrance area under all lighting conditions, enabling positive identification of anyone requesting access to the flight deck.

The system consists of three cameras with infrared illumination, a flight deck entry video panel, and a video interface unit. The cameras are mounted in the forward cabin and are positioned to capture different viewing angles of anyone near the flight deck door entrance area. The flight deck entry video panel is located on the aft aisle stand. Surveillance video may be displayed on one of the L INBD, LWR CTR, or R INBD MFDs or all of them simultaneously.

Control and Operation

The IFE/PASS SEATS switch controls power to the flight deck entry video surveillance system. The MFD switches on the DSP are used to select a display unit. If selecting an inboard display, the appropriate left or right INBOARD DSPL selector must be set to MFD.

The flight deck entry video panel consists of a display switch and a camera selector. Pushing the display switch activates display of surveillance video on the selected MFD. Rotating the camera selector allows selection of the desired viewing angle. By repeating the selection process, different surveillance videos may be displayed on different MFDs simultaneously. To display surveillance video while displaying ground maneuvering camera video, select an MFD and press DSPL on the Flight Deck Entry Video Panel twice. Once displayed, pushing the display switch cancels surveillance video on the selected MFD and causes the display unit to either blank (LWR CTR) or revert to ND (L or R INBD). Pushing any DSP display/synoptic switch also cancels surveillance video on the selected MFD.

Cursor Control Devices (CCD)

The CCDs provide control of the display cursor.

For detailed information on the following subjects, refer to:

- Chapter 5, Communications
- the Electronic Checklist sections in this chapter
- the Electronic Flight Bag section in this chapter

CCD Touch Pad

The CCD uses a touch pad. Touching the pad translates the touch location coordinates to the affected display, placing a cursor at those coordinates on the selected display.

The cursor moves relative to finger movement across the touch pad. Except for the four corners of the touch pad, lifting the finger off the touch pad and touching a different location does not move the cursor. Only finger motion in contact with the touch pad moves the cursor.

Touching a corner immediately places the cursor in the corresponding corner of the display. This helps the pilot quickly locate the cursor and speeds access to the selections at the four corners of the display.

CCD Cursor Location Control

Selecting a menu, communications, or checklist function requires the use of the cursor location switches.

If a new function is selected on an inboard display that requires a communication, checklist, or maintenance function, then the system automatically selects the respective cursor control device to that display.

If a new function requiring a cursor is selected on the lower center display, then the system automatically selects the CCD not currently being used on an inboard display to the lower center display. If neither cursor is in use, it selects the CCD cursor that was previously displayed on the lower center display. Cursor selection defaults to the left CCD on power-up.

The cursor location light above the switch illuminates to indicate the selected display unit.

Selecting a display where there is no function requiring a cursor has no effect. For example, if the inboard display does not display a communications or checklist page, pushing an INBD cursor location switch has no effect on the selected inboard display.

Only one CCD can access a given display at a time. The last pilot who selects the cursor on the selected MFD has control. The other cursor disappears from the display and the cursor location light on that CCD extinguishes. The cursors are visually different so the pilots know who is currently in control of the cursor on a display.

If both pilots are accessing the same checklist or communications functions on different displays, both are forced to the same page, with that page controlled by the pilot with cursor control.

Standby Flight Instruments

The standby flight instruments include:

[non ISFD airplanes]

- standby attitude indicator
- standby airspeed indicator
- standby altimeter

- standby magnetic compass.
- [\[ISFD airplanes\]](#)
- integrated standby flight display
 - standby magnetic compass.

Integrated Standby Flight Display (ISFD)

The ISFD displays attitude, airspeed, altitude, ILS, and magnetic heading information. The ISFD receives airspeed and altitude from a dedicated pitot and static air data module. Attitude information is provided by internal inertial sensors. ILS information is provided by the center ILS receiver. The display receives its heading information from the same source as the captain's primary flight display. Heading information is not available in polar regions.

Note: The standby magnetic compass must be used to validate heading information.

The left flight control DC bus powers the ISFD. The left flight control DC bus is initially powered when the main ac busses are powered and remains powered with the main busses out. Ten seconds after receiving power, a 90 second initialization sequence begins. ATT and INIT 90s messages display during initialization. Initialization will stop if airplane movement is excessive and will resume when airplane movement is acceptable for initialization. Upon completion of the initialization sequence, attitude information displays.

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. When the ATT:RST message displays, pushing the Attitude Reset switch resets the horizon line with the airplane symbol.

On the ground, pushing the Attitude Reset switch must be accomplished with the airplane stationary. In flight, pushing the Attitude Reset switch must be accomplished with the airplane in wings level, non-accelerated flight. During attitude reset, the ATT 10s message displays. Failure to maintain straight and level flight for 10 seconds may result in an ATT:RST message. If attitude reset is unsuccessful, the ATT:RST message remains displayed and the attitude will not be displayed.

Standby Attitude Indicator

[\[non ISFD airplanes\]](#)

The standby attitude indicator displays SAARU attitude. A bank indicator and pitch scale are provided.

Standby Airspeed Indicator

[non ISFD airplanes]

The standby airspeed indicator displays airspeed calculated from two standby air data modules (one pitot and one static). It provides current airspeed in knots as a digital readout box and with an airspeed pointer.

Standby Altimeter

[non ISFD airplanes]

The standby altimeter displays altitude calculated from the standby (static) air data module. Current altitude is displayed digitally. A pointer indicates altitude in hundreds of feet. The pointer makes one complete revolution every 1,000 feet.

Standby Magnetic Compass

A standard liquid-damped magnetic standby compass is provided. A card located near the compass provides heading correction factors.

Radio Altimeter (RA)

The radio altimeter measures airplane altitude above terrain. Radio altitude is displayed on the PFD.

There are three radio altimeter systems: left, center, and right. If all three radio altimeter systems are inoperative or degraded, the RA flag is displayed on the PFD. The radio altimeter systems send data to:

- autopilot flight director
- autothrottle
- GPWS
- TCAS
- weather radar
- primary flight control system

Clock

A clock is located on each forward panel. Each clock displays airplane information management system (AIMS) generated UTC time and date, or manually set time and date. The AIMS UTC time comes from the global positioning system (GPS). In addition to time, the clocks also provide alternating day-month and year, elapsed time, and chronograph functions.

Display System Information Sources

Air Data Inertial Reference System (ADIRS)

The ADIRS provides:

- primary, secondary and standby air data
- inertial reference information.

The major components of the ADIRS are:

- one air data inertial reference unit (ADIRU)
- one secondary attitude air data reference unit (SAARU)
- eight air data modules
- six static ports
- three pitot probes
- two angle-of-attack vanes
- one total air temperature probe.

Air Data Inertial Reference Unit (ADIRU)

The ADIRU is the primary source for speed, altitude, attitude and inertial navigation position information. The ADIRU processes information measured by its internal gyros and accelerometers, and from air data module inputs, angle-of-attack vanes and other systems.

The ADIRU is described in Chapter 11, Flight Management, Navigation.

Secondary Attitude Air Data Reference Unit (SAARU)

The SAARU is the secondary source for speed, altitude, and attitude information. The SAARU processes information measured by its internal gyros and accelerometers, and from air data module inputs, angle-of-attack vanes, and other systems.

[\[non ISFD airplanes\]](#)

The SAARU also transmits roll and pitch attitude information to the standby attitude display.

The SAARU does not provide navigational position data. The SAARU is described in Chapter 11, Flight Management, Navigation.

Air Data

Three static ports are located on the left side of the airplane and three static ports are located on the right side of the airplane. Left and right static ports are paired through pneumatic tubing to each of the left, center and right air data modules. The air data modules convert static air pressure to a digital output for use by other systems. The center static ports are also connected to an independent air data module to provide static pressure measurement to the standby airspeed indicator and the standby altimeter.

Two pitot probes (right and center) are mounted on the right forward section of the airplane. One pitot probe (left) is mounted on the left forward section of the airplane. An air data module is connected to each pitot probe. These air data modules convert dynamic air pressure to a digital output for use by other systems. The center pitot probe also provides dynamic pressure to the standby air data module to provide dynamic pressure measurement to the standby airspeed indicator.

Three static ports are located on the left side of the airplane and three static ports are located on the right side of the airplane. Left and right static ports are paired through pneumatic tubing to each of the left, center and right air data modules. The air data modules convert static air pressure to a digital output for use by other systems. The center static ports are also connected to an independent air data module to provide static pressure measurement to the ISFD.

Two pitot probes (right and center) are mounted on the right forward section of the airplane. One pitot probe (left) is mounted on the left forward section of the airplane. An air data module is connected to each pitot probe. These air data modules convert dynamic air pressure to a digital output for use by other systems. The center pitot probe also provides dynamic pressure to the standby air data module to provide dynamic pressure measurement to the ISFD.

Angle-of-Attack

There are two angle-of-attack vanes, one located on each side of the forward fuselage. The vanes measure airplane angle-of-attack relative to the air mass.

[Option - AOA Indication]

The primary source of data for the AOA indicator on the PFD is supplied by the ADIRU, with the SAARU as the backup source. The source selection is automatic in the event of primary source failure.

Total Air Temperature

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 ADIRU and the SAARU to compute total air temperature.

Static Air Temperature

Static air temperature, displayed on the CDU PROGRESS page, comes from the ADIRU, using total air temperature probe information. In the event the ADIRU value is invalid, the SAARU computed value is displayed.

Intentionally
Blank

Flight Instruments, Displays Primary Flight Displays (PFDs)

Chapter 10 Section 30

Introduction

The PFDs present a dynamic color display of all the parameters necessary for flight path control. The PFDs provide the following information:

- flight mode annunciation
- radio altitude
- airspeed
- [\[Option\]](#)
- angle of attack
- [\[Option\]](#)
- instrument landing system display
- ground speed
- approach minimums
- altitude
- heading/track indications
- vertical speed
- engine fail, GPWS, and PWS alerts
- attitude
- steering information

Navigation Performance Scales

Failure flags are displayed for airplane system failures. Displayed information is removed or replaced by dashes if no valid information is available to the display system (because of out-of-range or malfunctioning navigation aids). Displays are removed when a source fails or when no system source information is available.

Flight mode annunciations are described in Chapter 4, Automatic Flight.

Airspeed

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.

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.

CAUTION: Reduced maneuver capability exists when operating within the amber regions below the minimum maneuvering speed or above the maximum maneuvering speed. During non-normal conditions the target speed may be below the minimum maneuvering speed.

Ground Speed

[Option]

Ground speed is digitally displayed below the airspeed tape when the Mach number is less than 0.40.

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.

[Option – Minimums Pointer, RA Minimums BARO Bug and No Line]

The selected barometric approach minimum is indicated on the altitude tape with a triangular pointer and a line when BARO minimums are selected. When RADIO minimums are selected, the pointer is still set at BARO minimums; there is no line.

[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.

The current barometric reference is displayed below the altitude tape. A preselected barometric reference can be displayed when STD is displayed.

Landing reference is selectable between QNH and QFE on the APPROACH REF page of the FMC. QNH is the normal operating mode. Selecting QFE sets the destination landing altitude indication to zero altitude. With the landing reference set to QFE, changing the barometric setting from STD to QFE changes the PFD altitude tape background color to green. With QFE selected and climb mode active, changing the barometric setting from QFE to STD causes the landing reference to toggle from QFE to QNH and the altitude tape background color changing from green back to normal. A description of QFE operation is contained in the Landing Reference 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.

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 low speeds when the flaps are up and at all times when the flaps are down.

Steering Indications

The flight director steering indications are displayed when the associated flight director switch is on.

TCAS resolution advisories are displayed in the attitude indication area. Refer to Chapter 15, Warning Systems.

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, or the MCP FPA reference 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 flight path angle (FPA) symbol shows the selected flight path angle when the MCP FPA reference switch is selected on and either the flight director or autopilot is engaged.

The FPV and FPA symbols are displayed in two sizes and brightness levels. The large, bright FPV/FPA symbols are displayed when the previously stated selections are made and the flight director is off. The small, dim FPV/FPA symbols are displayed when the previously stated selections are made and the flight director is displayed.

Radio Altitude

[Option – Basic Numeric RA Display]

The current radio altitude is displayed in the bottom center of the attitude indication area when radio altitude is below 2,500 feet AGL.

Angle of Attack

The angle of attack is displayed above the upper right corner of the attitude indication area. Digital and round dial formats are used.

Stick shaker indicator, zero reference line, and approach reference band are displayed on the round dial.

The zero degree reference line is the 4:30 position with additional reference lines every 5 degrees from -5 to +20 degrees.

Instrument Landing System Indications

ILS glide slope 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.

The localizer pointer and scale appear at the bottom of the attitude indication.

[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 – Baro/Radio Minimums Altitude Display]

The selected radio altitude or barometric approach minimums set on the EFIS control panel are displayed near the bottom left of the altitude display.

Heading/Track Indications

Selected 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 bug is displayed on the outside of the compass rose. The MCP selected track bug is displayed on the inside of the compass rose.

Heading or track is displayed based on the position of the MCP HDG/TRK reference switch. The selected heading or selected track is annunciated 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.

Engine Fail, GPWS, and PWS Alerts

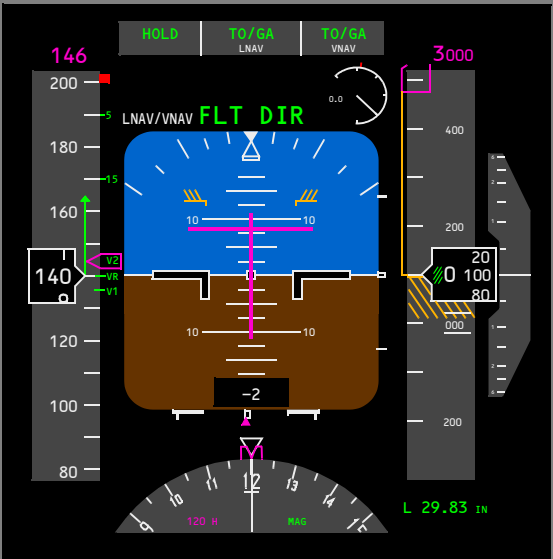
Engine fail, GPWS, and PWS alerts are displayed in large capital letters between the attitude display and the heading/track compass rose. Refer to Chapter 15, Warning Systems.

Typical PFD Displays

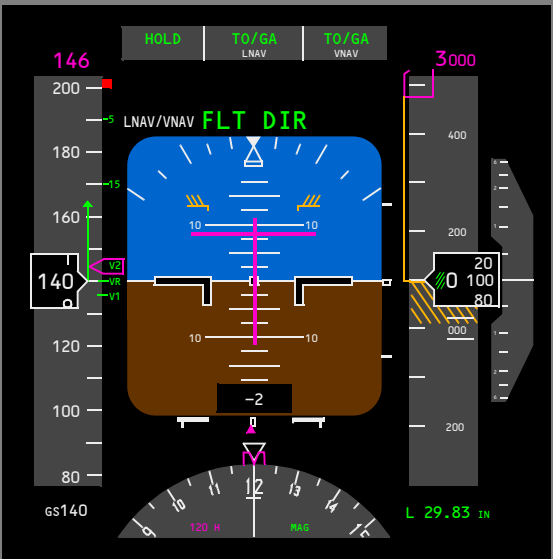
Typical PFD configurations for six phases of flight follow. The autopilot, LNAV, and VNAV are engaged for climb, cruise, descent, approach, and landing. The AFDS approach mode is used for approach and landing.

PFD Takeoff Display

[Option - AOA Indication, Nav Perf]



[Option - Ground Speed Display, Nav Perf]



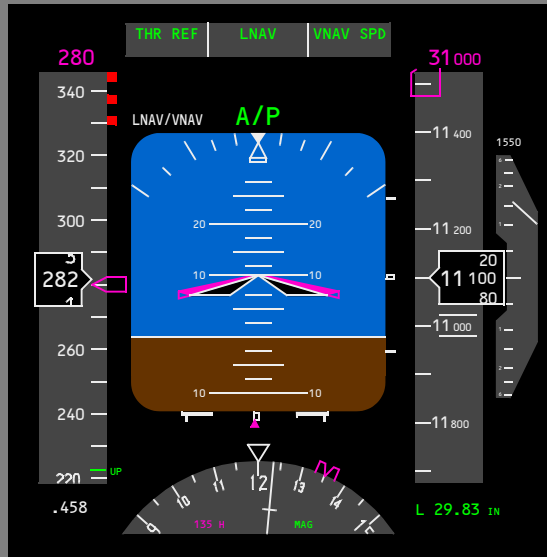
The image displays a Primary Flight Display (PFD) with the following elements:

- Top Bar:** Three tabs labeled "THR REF", "LNAV", and "VNAV SPD".
- Altitude Scale (Left):** A vertical scale from 220 to 340 feet. A magenta "280" is at the top. A magenta box highlights the "282" mark, with a "5" above it and a "1" below it. A magenta arrow points to this box. A magenta "UP" indicator is at the bottom left.
- Altitude Scale (Right):** A vertical scale from 11 000 to 11 400 feet. A magenta box highlights the "31 000" mark. A magenta "20" is above the "11 100" mark, and a magenta "80" is below it.
- Central Display:** A large blue and brown rectangular area. The top half is blue and labeled "LNAV/VNAV" and "A/P". The bottom half is brown. A magenta crosshair is centered. A magenta "3" is in the center of the crosshair. A magenta "10" is at the bottom. A magenta "20" is on the left and right sides. A magenta "15" is at the top. A magenta "1" is at the bottom. A magenta "2" is at the bottom right. A magenta "3" is at the bottom left. A magenta "4" is at the bottom right. A magenta "5" is at the bottom left. A magenta "6" is at the bottom right. A magenta "7" is at the bottom left. A magenta "8" is at the bottom right. A magenta "9" is at the bottom left. A magenta "10" is at the bottom right. A magenta "11" is at the bottom left. A magenta "12" is at the bottom right. A magenta "13" is at the bottom left. A magenta "14" is at the bottom right. A magenta "15" is at the bottom left. A magenta "16" is at the bottom right. A magenta "17" is at the bottom left. A magenta "18" is at the bottom right. A magenta "19" is at the bottom left. A magenta "20" is at the bottom right. A magenta "21" is at the bottom left. A magenta "22" is at the bottom right. A magenta "23" is at the bottom left. A magenta "24" is at the bottom right. A magenta "25" is at the bottom left. A magenta "26" is at the bottom right. A magenta "27" is at the bottom left. A magenta "28" is at the bottom right. A magenta "29" is at the bottom left. A magenta "30" is at the bottom right. A magenta "31" is at the bottom left. A magenta "32" is at the bottom right. A magenta "33" is at the bottom left. A magenta "34" is at the bottom right. A magenta "35" is at the bottom left. A magenta "36" is at the bottom right. A magenta "37" is at the bottom left. A magenta "38" is at the bottom right. A magenta "39" is at the bottom left. A magenta "40" is at the bottom right. A magenta "41" is at the bottom left. A magenta "42" is at the bottom right. A magenta "43" is at the bottom left. A magenta "44" is at the bottom right. A magenta "45" is at the bottom left. A magenta "46" is at the bottom right. A magenta "47" is at the bottom left. A magenta "48" is at the bottom right. A magenta "49" is at the bottom left. A magenta "50" is at the bottom right. A magenta "51" is at the bottom left. A magenta "52" is at the bottom right. A magenta "53" is at the bottom left. A magenta "54" is at the bottom right. A magenta "55" is at the bottom left. A magenta "56" is at the bottom right. A magenta "57" is at the bottom left. A magenta "58" is at the bottom right. A magenta "59" is at the bottom left. A magenta "60" is at the bottom right. A magenta "61" is at the bottom left. A magenta "62" is at the bottom right. A magenta "63" is at the bottom left. A magenta "64" is at the bottom right. A magenta "65" is at the bottom left. A magenta "66" is at the bottom right. A magenta "67" is at the bottom left. A magenta "68" is at the bottom right. A magenta "69" is at the bottom left. A magenta "70" is at the bottom right. A magenta "71" is at the bottom left. A magenta "72" is at the bottom right. A magenta "73" is at the bottom left. A magenta "74" is at the bottom right. A magenta "75" is at the bottom left. A magenta "76" is at the bottom right. A magenta "77" is at the bottom left. A magenta "78" is at the bottom right. A magenta "79" is at the bottom left. A magenta "80" is at the bottom right. A magenta "81" is at the bottom left. A magenta "82" is at the bottom right. A magenta "83" is at the bottom left. A magenta "84" is at the bottom right. A magenta "85" is at the bottom left. A magenta "86" is at the bottom right. A magenta "87" is at the bottom left. A magenta "88" is at the bottom right. A magenta "89" is at the bottom left. A magenta "90" is at the bottom right. A magenta "91" is at the bottom left. A magenta "92" is at the bottom right. A magenta "93" is at the bottom left. A magenta "94" is at the bottom right. A magenta "95" is at the bottom left. A magenta "96" is at the bottom right. A magenta "97" is at the bottom left. A magenta "98" is at the bottom right. A magenta "99" is at the bottom left. A magenta "100" is at the bottom right.
- Speed Scale (Bottom):** A semi-circular scale from 10 to 15. A magenta "135 H" is at the bottom left. A magenta "MAG" is at the bottom right. A magenta "12" is at the bottom center. A magenta "11" is at the bottom left. A magenta "10" is at the bottom left. A magenta "9" is at the bottom left. A magenta "8" is at the bottom left. A magenta "7" is at the bottom left. A magenta "6" is at the bottom left. A magenta "5" is at the bottom left. A magenta "4" is at the bottom left. A magenta "3" is at the bottom left. A magenta "2" is at the bottom left. A magenta "1" is at the bottom left. A magenta "0" is at the bottom left. A magenta "1" is at the bottom right. A magenta "2" is at the bottom right. A magenta "3" is at the bottom right. A magenta "4" is at the bottom right. A magenta "5" is at the bottom right. A magenta "6" is at the bottom right. A magenta "7" is at the bottom right. A magenta "8" is at the bottom right. A magenta "9" is at the bottom right. A magenta "10" is at the bottom right. A magenta "11" is at the bottom right. A magenta "12" is at the bottom right. A magenta "13" is at the bottom right. A magenta "14" is at the bottom right. A magenta "15" is at the bottom right. A magenta "16" is at the bottom right. A magenta "17" is at the bottom right. A magenta "18" is at the bottom right. A magenta "19" is at the bottom right. A magenta "20" is at the bottom right. A magenta "21" is at the bottom right. A magenta "22" is at the bottom right. A magenta "23" is at the bottom right. A magenta "24" is at the bottom right. A magenta "25" is at the bottom right. A magenta "26" is at the bottom right. A magenta "27" is at the bottom right. A magenta "28" is at the bottom right. A magenta "29" is at the bottom right. A magenta "30" is at the bottom right. A magenta "31" is at the bottom right. A magenta "32" is at the bottom right. A magenta "33" is at the bottom right. A magenta "34" is at the bottom right. A magenta "35" is at the bottom right. A magenta "36" is at the bottom right. A magenta "37" is at the bottom right. A magenta "38" is at the bottom right. A magenta "39" is at the bottom right. A magenta "40" is at the bottom right. A magenta "41" is at the bottom right. A magenta "42" is at the bottom right. A magenta "43" is at the bottom right. A magenta "44" is at the bottom right. A magenta "45" is at the bottom right. A magenta "46" is at the bottom right. A magenta "47" is at the bottom right. A magenta "48" is at the bottom right. A magenta "49" is at the bottom right. A magenta "50" is at the bottom right. A magenta "51" is at the bottom right. A magenta "52" is at the bottom right. A magenta "53" is at the bottom right. A magenta "54" is at the bottom right. A magenta "55" is at the bottom right. A magenta "56" is at the bottom right. A magenta "57" is at the bottom right. A magenta "58" is at the bottom right. A magenta "59" is at the bottom right. A magenta "60" is at the bottom right. A magenta "61" is at the bottom right. A magenta "62" is at the bottom right. A magenta "63" is at the bottom right. A magenta "64" is at the bottom right. A magenta "65" is at the bottom right. A magenta "66" is at the bottom right. A magenta "67" is at the bottom right. A magenta "68" is at the bottom right. A magenta "69" is at the bottom right. A magenta "70" is at the bottom right. A magenta "71" is at the bottom right. A magenta "72" is at the bottom right. A magenta "73" is at the bottom right. A magenta "74" is at the bottom right. A magenta "75" is at the bottom right. A magenta "76" is at the bottom right. A magenta "77" is at the bottom right. A magenta "78" is at thebottom right. A magenta "79" is at the bottom right. A magenta "80" is at the bottom right. A magenta "81" is at the bottom right. A magenta "82" is at the bottom right. A magenta "83" is at the bottom right. A magenta "84" is at the bottom right. A magenta "85" is at the bottom right. A magenta "86" is at the bottom right. A magenta "87" is at the bottom right. A magenta "88" is at the bottom right. A magenta "89" is at the bottom right. A magenta "90" is at the bottom right. A magenta "91" is at the bottom right. A magenta "92" is at the bottom right. A magenta "93" is at the bottom right. A magenta "94" is at the bottom right. A magenta "95" is at the bottom right. A magenta "96" is at the bottom right. A magenta "97" is at the bottom right. A magenta "98" is at the bottom right. A magenta "99" is at the bottom right. A magenta "100" is at the bottom right.
- Bottom Right:** A magenta "L 29.83 IN" is at the bottom right.

DO NOT USE FOR FLIGHT

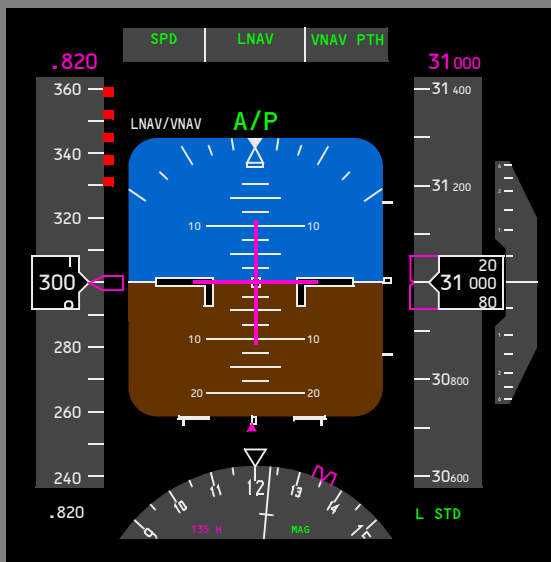
777 Flight Crew Operations Manual

[Option - Integrated Cue Flight Director, Nav Perf]

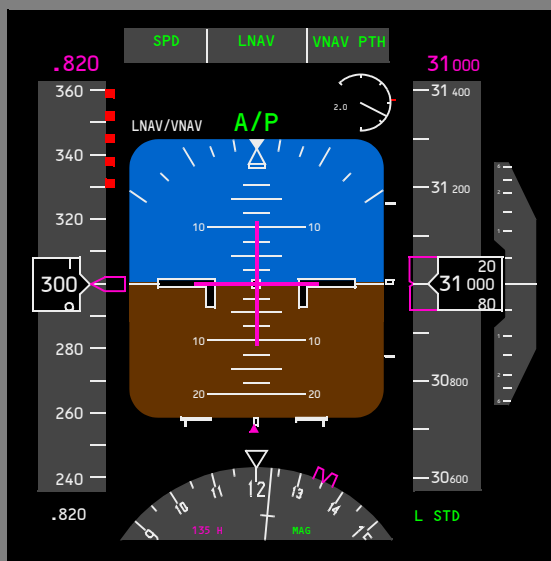


PFD Cruise Display

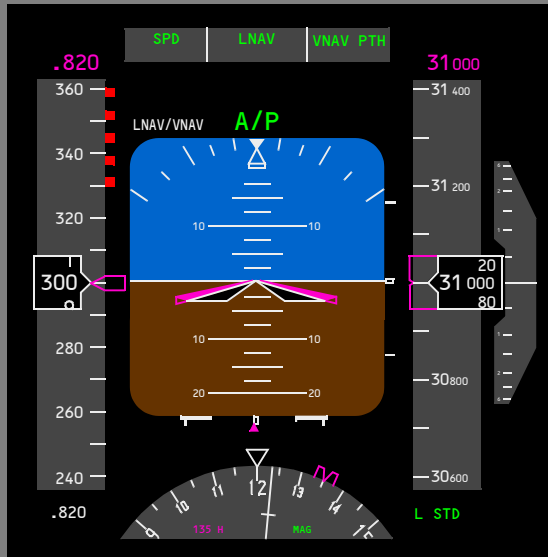
[Option – Split Cue Flight Director, Nav Perf]



[Option – AOA Indication, Nav Perf]

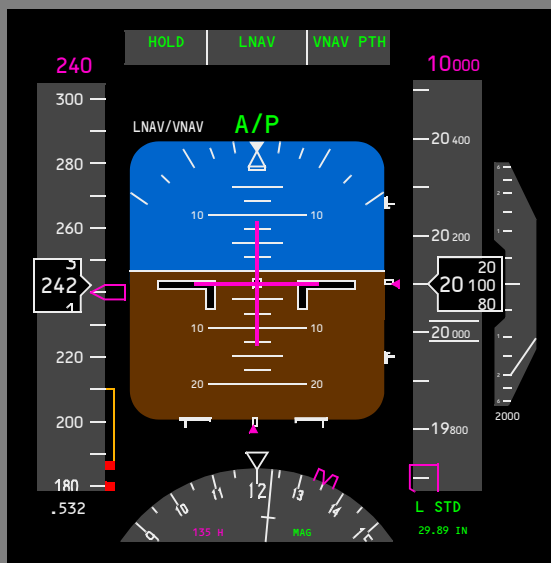


[Option - Integrated Cue Flight Director, Nav Perf]

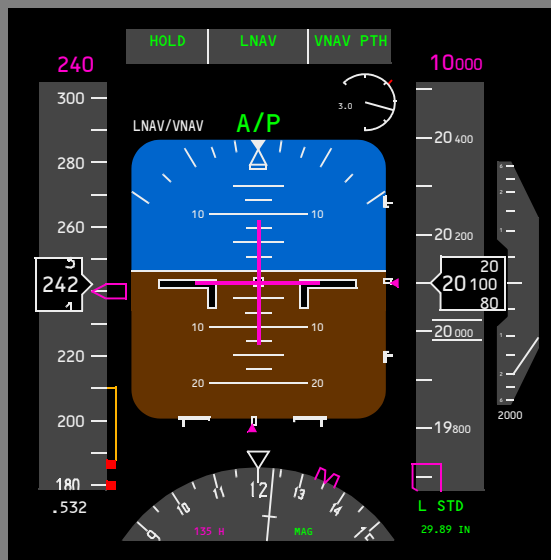


PFD Descent Display

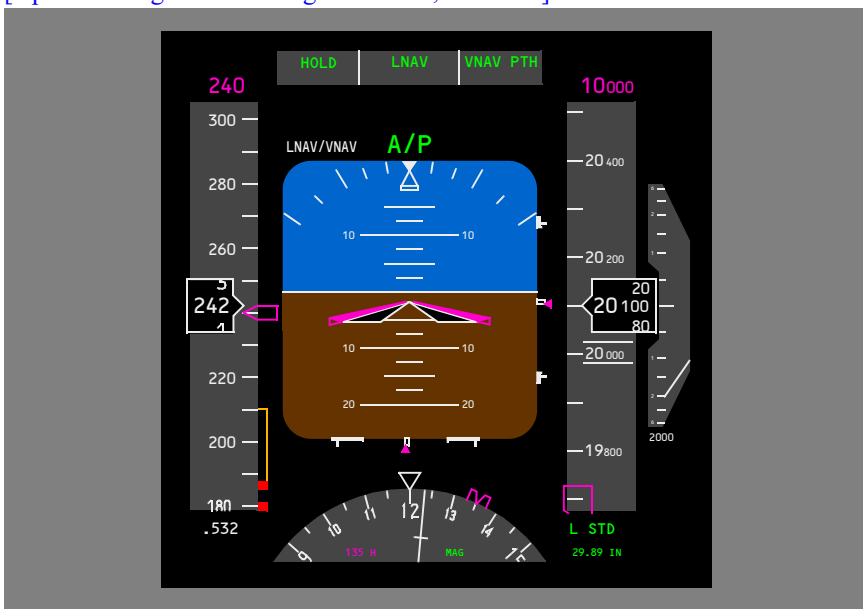
[Option – Split Cue Flight Director, Nav Perf]



[Option – AOA Indication, Nav Perf]

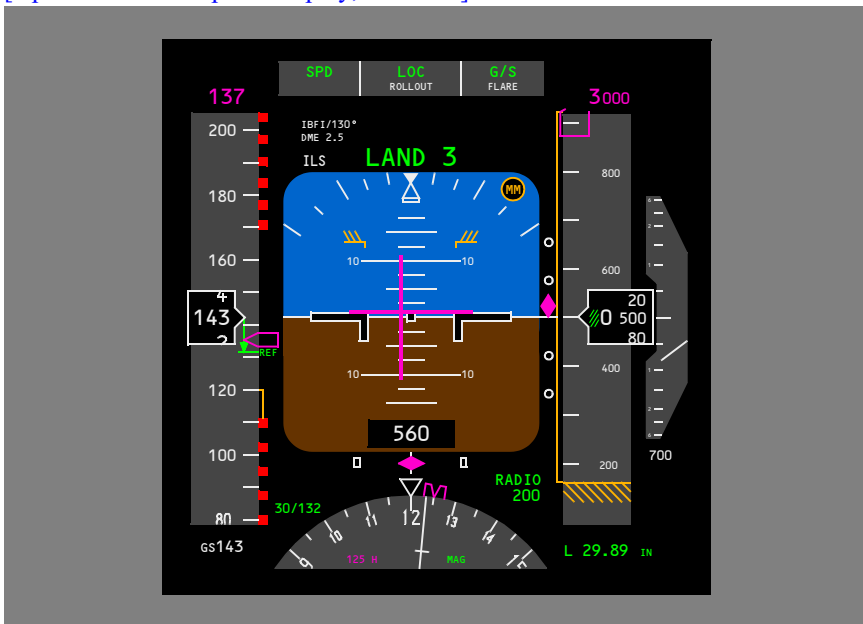


[Option - Integrated Cue Flight Director, Nav Perf]

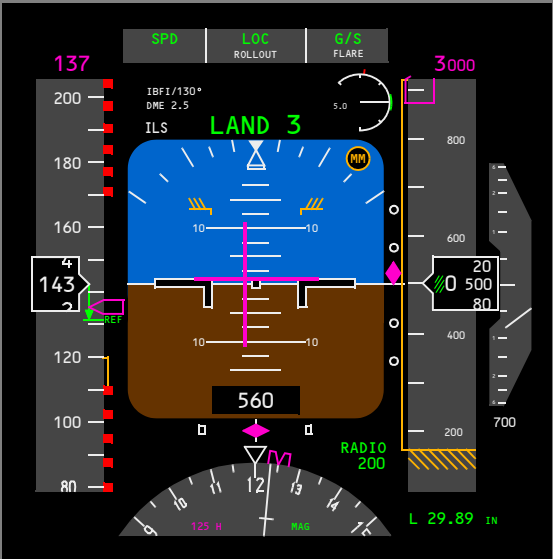


PFD Approach Display

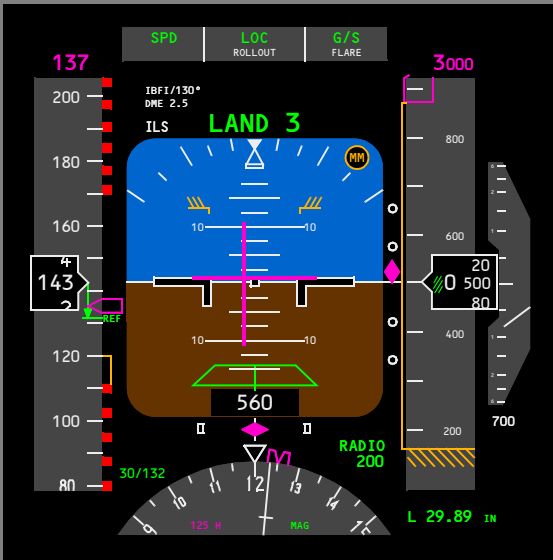
[Option - Ground Speed Display, Nav Perf]



[Option – AOA Indication, Nav Perf]



[Options – Basic, Split Cue Flight Director, Numeric RA Display, Landing Altitude Reference Bar, Rising Runway, Nav Perf]

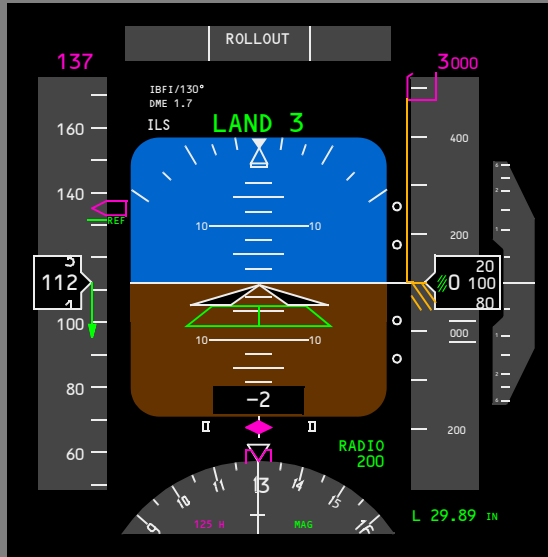


The image shows a detailed cockpit instrument panel from a flight simulator. At the top center is a black bar with the word "ROLLOUT" in white. Below it, the main display area is divided into several sections:

- Top Left:** A vertical scale from 60 to 160. A pink number "137" is positioned above the scale. A green arrow points down from the 100 mark.
- Top Center:** Text reads "IBF1/130°", "DME 1.7", and "ILS". Below this is a large blue rectangular area representing the sky, with a green "LAND 3" indicator. The sky area contains horizontal lines and a small triangle pointing up. Below the sky is a brown rectangular area representing the ground, also with horizontal lines and a small triangle pointing down. A black box with "-2" is centered between the sky and ground areas.
- Top Right:** A circular gauge with a needle pointing to "0.0". To its right is a vertical scale from 80 to 3000. A pink number "3000" is positioned above the scale. A yellow line runs vertically along the scale, with a pink rectangle at the top.
- Middle Left:** A black box containing the numbers "112" and "1" stacked vertically. A green arrow points down from the "112" box.
- Middle Right:** A black box containing the numbers "20", "100", and "80" stacked vertically. A green arrow points up from the "80" box.
- Bottom Left:** A speedometer with markings from 0 to 160. The needle points to "125". Text below the needle reads "30/132" and "125 H".
- Bottom Center:** A heading indicator with markings from 0 to 180. The needle points to "12". Text below the needle reads "MAG".
- Bottom Right:** A fuel gauge with markings from 0 to 100. The needle points to "29.89". Text below the needle reads "L 29.89 IN".

777 Flight Crew Operations Manual

[Option - Integrated Cue Flight Director, Numeric RA Display, Landing Altitude Reference Bar, Rising Runway, Nav Perf]



Intentionally
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Flight Instruments, Displays
Navigation Displays**Chapter 10**
Section 40

Introduction

The NDs provide a mode-selectable color flight progress display. The modes are:

- MAP
- APP (approach)
- VOR
- 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.

[Option – Track-Up Display]

Presented track up, this mode shows airplane position relative to the route of flight against a moving map background.

[Option – Heading-Up Display]

Presented heading up, this mode shows airplane position relative to the route of flight against a moving map background.

Displayed information can include:

- selected and 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 ILS 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. The heading reference switch is used to manually select magnetic or true reference. The compass display is automatically referenced to true north when the airplane is north of 82° north or south of 82° south latitude, or near the magnetic poles with the heading reference switch in NORM.

Track

Track is supplied by the FMC during normal operation and by the CDU when in alternate navigation.

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 removed 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 primary display system removes information from the center of the display outward; information near the outer selected range area is still displayed. The message can be removed by:

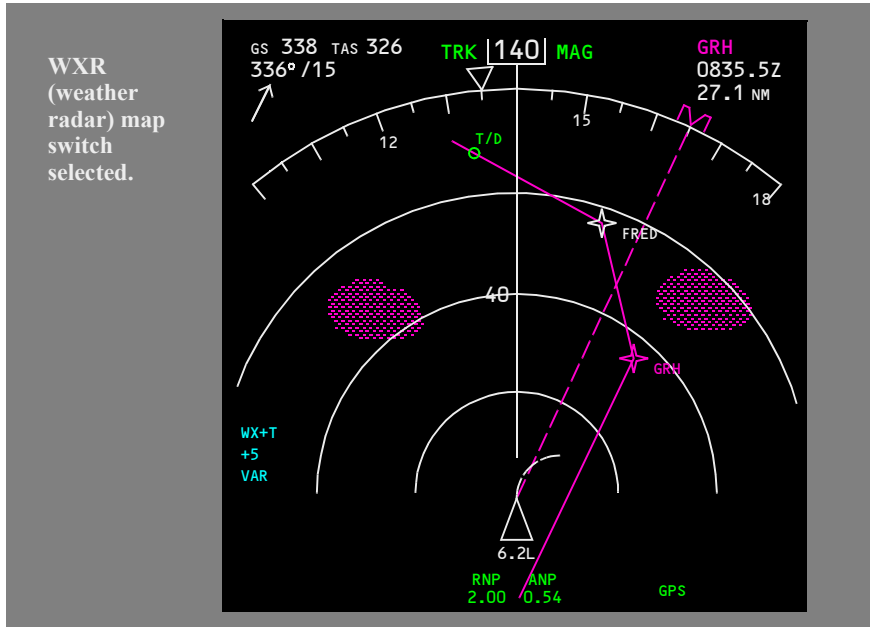
- reducing the amount of map information
- reducing range, or
- deselecting one or more of the EFIS control panel map switches (STA, WPT, ARPT, DATA, POS).

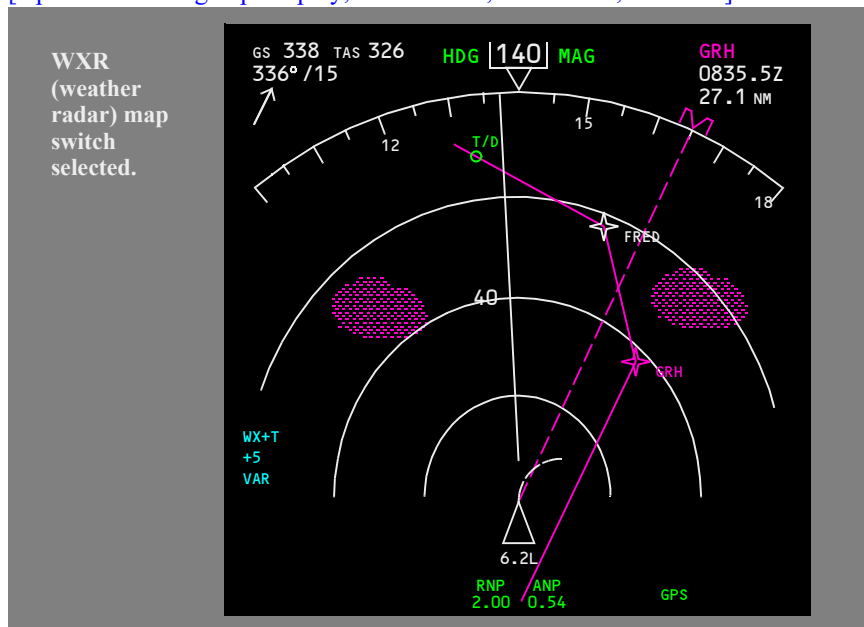
Typical ND Map Displays

Typical ND map displays are shown on the following pages. Examples of other ND displays (centered map, approach, VOR, and plan modes) are shown in Section 10 of this chapter.

ND Expanded Map Displays

[Option – Track-Up Display, Basic Radar, not autotilt, Nav Perf]

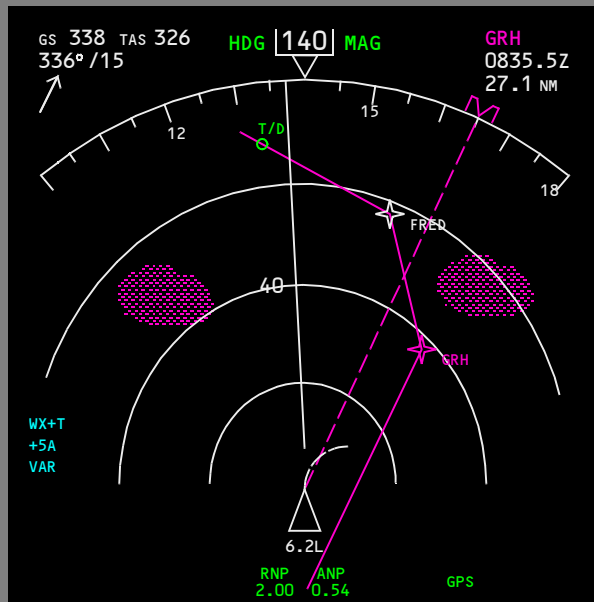




777 Flight Crew Operations Manual

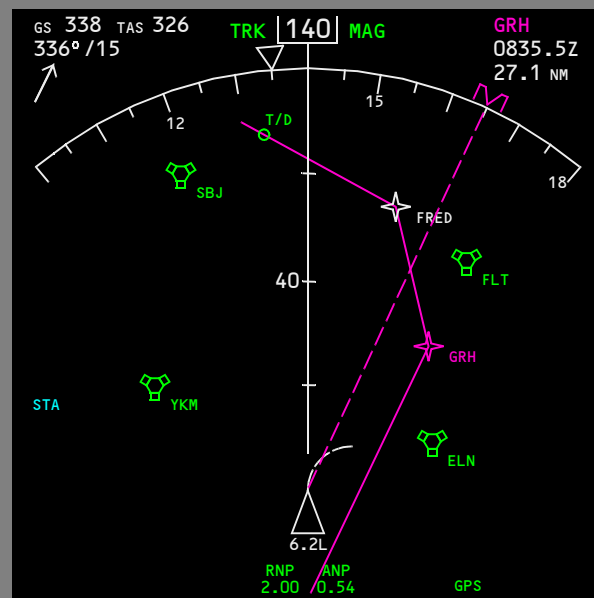
[Option – Heading–Up Display, Basic Radar, autotilt, Nav Perf]

WXR
(weather
radar) map
switch
selected.

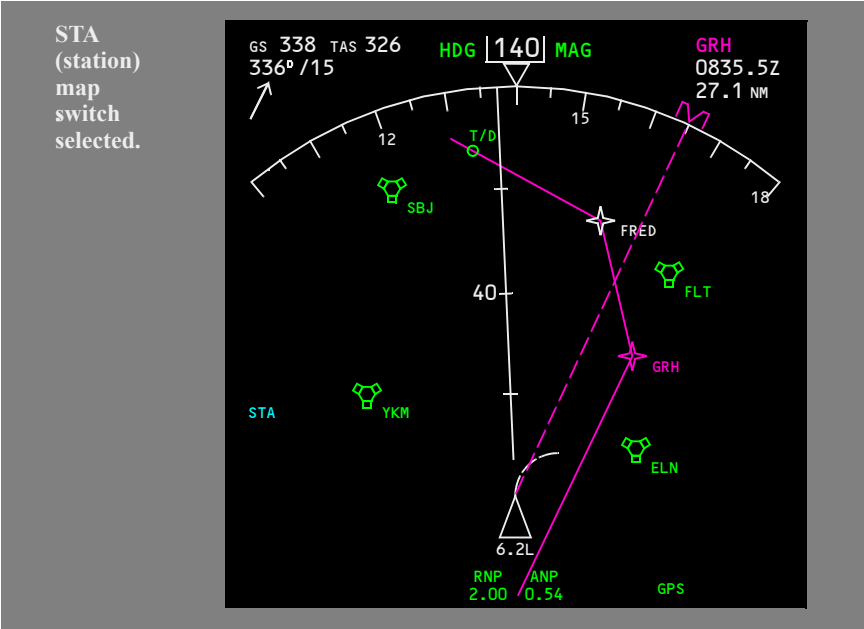


[Option – Track–Up Display, Nav Perf]

STA
(station)
map
switch
selected.



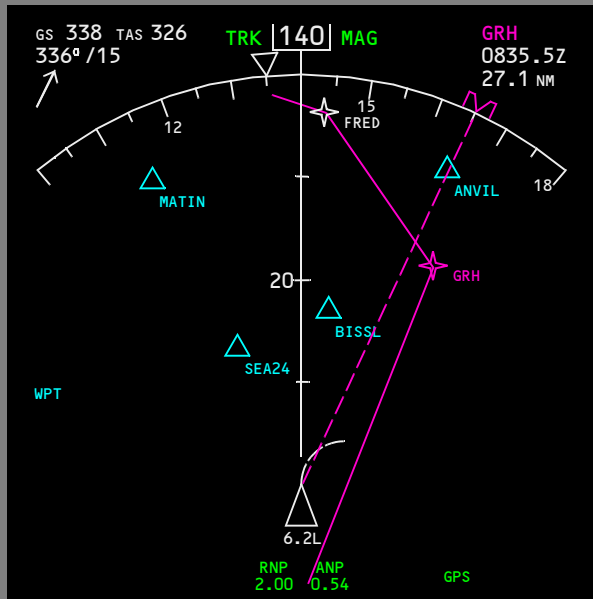
[Option – Heading–Up Display, Nav Perf]



777 Flight Crew Operations Manual

[Option – Track-Up Display, Nav Perf]

WPT
(waypoint)
map switch
selected.

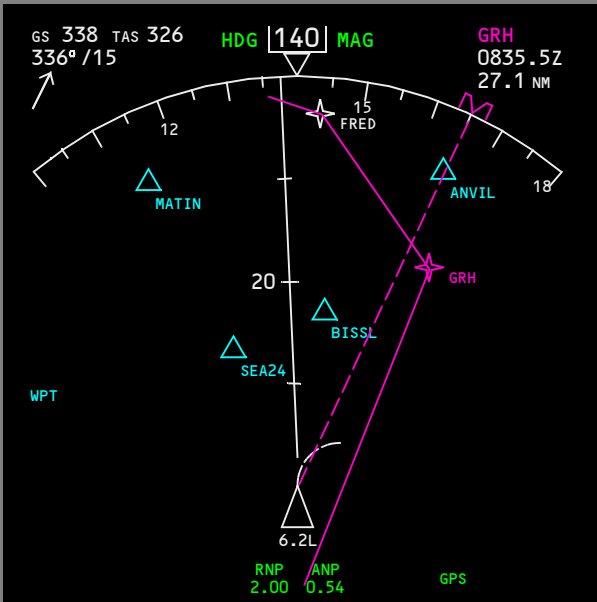


ARPT
(airport)
map switch
selected.

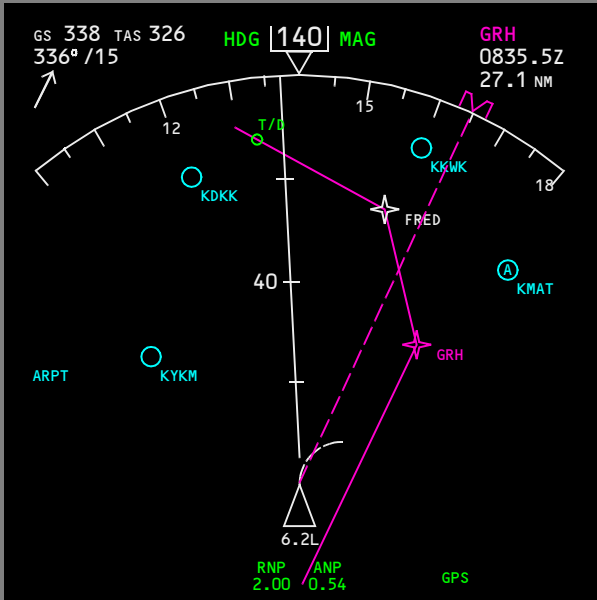


[Option – Heading-Up Display, Nav Perf]

WPT
(waypoint)
map switch
selected.

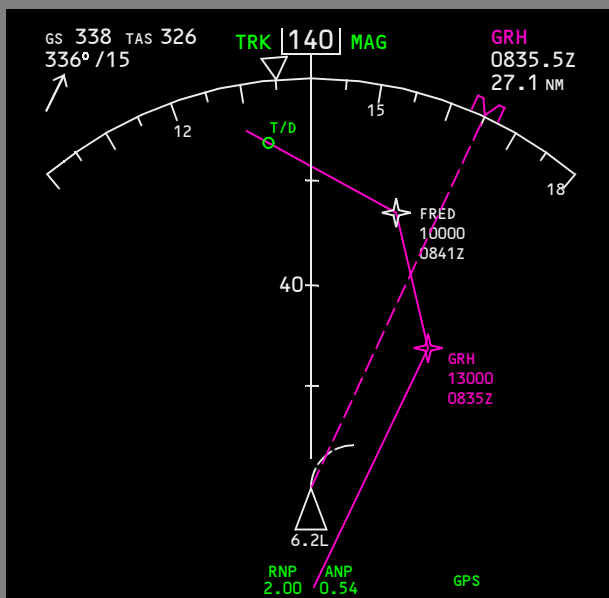


ARPT
(airport)
map switch
selected.

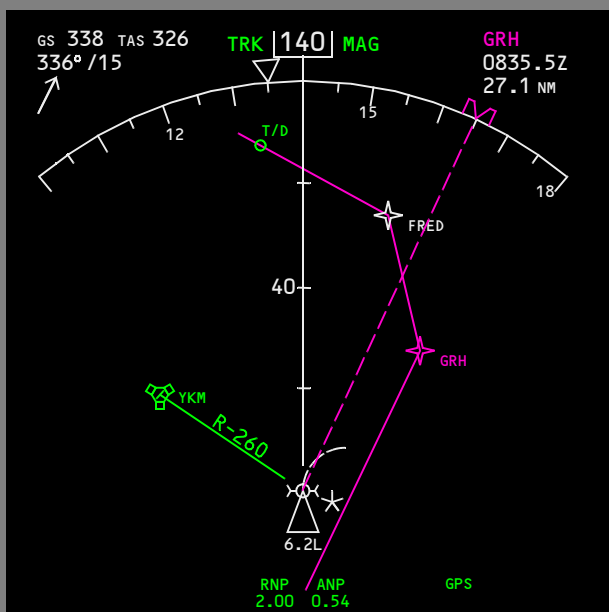


[Option – Track-Up Display, Nav Perf]

**DATA map
switch
selected.**



**POS
(position)
map switch
selected.**



ND Symbolology

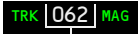

The following symbols can be displayed on each ND, depending on EFIS control panel switch selections. Colors indicate the following:

- W (white) – present status, range scales
- G (green) – dynamic conditions
- M (magenta) – command information, pointers, symbols, fly-to condition
- B (blue or cyan) – inactive or background information
- A (amber) – cautions, faults, flags
- R (red) – warnings.


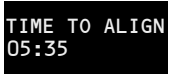
Heading, Track, and Speed



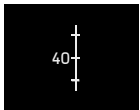
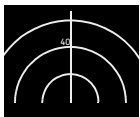



Symbol	Name	ND Mode	Remarks
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[Option - Map Track Up]

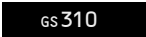
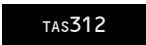
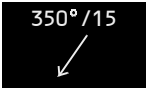
	Track orientation (G), current track (W), and track reference (G)	Shows track in MAP, MAP CTR.	Displays TRK as the orientation, the current track, and MAG or TRU as the reference, and points to the heading on the compass rose.
	Heading orientation (G), current heading (W), heading reference (G), and heading pointer (W)	Shows HDG (heading) in 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 - Grid Heading]

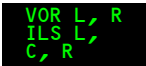
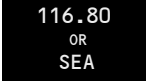
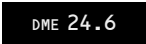

	Grid heading (W)	MAP, MAP CTR, PLAN	Displays above 70 degrees latitude.
	ADIRU time to align (W)	All	Indicates time remaining for IRU alignment. Replaces wind direction/speed and wind arrow, on the ground, during alignment.

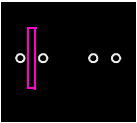
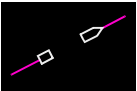



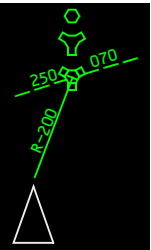
Symbol	Name	ND Mode	Remarks
	Selected heading bug (M)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Displays the MCP–selected heading. A dashed line (M) may extend from the marker to the airplane symbol. In the MAP mode with LNAV, LOC, or ROLLOUT engaged, the dashed line is removed 10 seconds after the selected heading bug is moved.
	Selected track bug (M)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Displays the MCP–selected track. A dashed line (M) may extend from the marker to the airplane symbol.
	Track line and range scale (W)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Indicates current track. Number indicates range (VOR CTR and APP CTR do not display range).
	Range arcs (W)	MAP, MAP CTR, VOR CTR, APP CTR	Replaces the range scale when TCAS, weather radar, or terrain is selected.
	Heading/track reference (G) box (W) in TRU, box (A) if TRU displayed in descent	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Indicates heading/track is referenced to magnetic north or true north. Switching from TRU to MAG displays a box around MAG for 10 seconds.
	Expanded compass (W)	MAP, APP, VOR	Displays 90 degrees of compass rose.
	Current heading pointer (W)	MAP, MAP CTR	Points to current heading on the compass rose.

777 Flight Crew Operations Manual




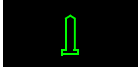
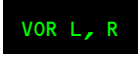



Symbol	Name	ND Mode	Remarks
	Groundspeed (W)	All	Current ground speed.
	True airspeed (W)	All	Current true airspeed displayed above 100 knots.
	Wind direction/speed and wind arrow (W)	All	Indicates wind bearing, speed, and direction, with respect to display orientation and heading/track reference. Arrow not displayed in the PLAN map mode.

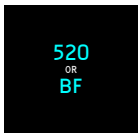
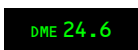
Radio Navigation

Symbol	Name	ND Mode	Remarks
	Reference receiver (G)	VOR, VOR CTR, APP, APP CTR	Indicates the selected receiver as the display reference.
	ILS (W)/VOR (W) Reference receiver frequency or identifier display	VOR, VOR CTR, APP, APP CTR	Located in the upper 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.
	DME distance (W)	VOR, VOR CTR, APP, APP CTR	Located in the upper corner. Indicates DME distance to the reference navaid.
	Reference ILS or VOR course (W)	VOR, VOR CTR, APP, APP CTR	Indicates the VOR course or ILS localizer course.



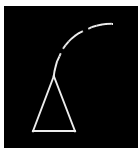
Symbol	Name	ND Mode	Remarks
	ILS localizer or VOR course deviation indication (M) and scale (W)	VOR, VOR CTR, APP, APP CTR	Displays LOC or VOR course deviation. Deviation indicator points in direction of VOR or ILS selected course. For ILS deviation, indicator fills (M) when less than 2 1/2 dots from center.
	Selected course pointer (W) and line (M)	VOR, VOR CTR, APP, APP CTR	Displays CDU–selected course.
	Glide slope pointer (M) and scale (W)	APP, APP CTR	Displays glideslope position and deviation. Deviation indicator fills (M) when less than 2 1/2 dots from center.
	To/from indication (W)	VOR CTR	Located near airplane symbol. Displays VOR TO/FROM indication.
	To/from indication (W)	VOR, VOR CTR	Displays VOR to/from indication.
	VOR (B, G), DME/TACAN (B, G), VORTAC (B, G)	MAP, MAP CTR	When the EFIS control panel STA map switch is selected on, appropriate nav aids are displayed (B). Tuned VHF nav aids are displayed in green, regardless of switch selection. When a nav aid is manually tuned, the selected course and reciprocal are displayed.
	VOR/DME raw data radial and distance (G)		When the POS map switch is selected on, the station radial extends to the airplane.

777 Flight Crew Operations Manual



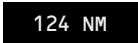
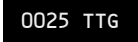


Symbol	Name	ND Mode	Remarks
	Left VOR (G) or ADF (B) pointer head and tail	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Indicates bearing to (head) or from (tail) the tuned station, if selected on the respective EFIS control panel.
	Right VOR (G) or ADF (B) pointer head and tail		
	Left VOR (G) pointer head and tail	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Indicates bearing to (head) or from (tail) the tuned station, if selected on the respective EFIS control panel.
	Right VOR (G) pointer head and tail		
	VOR (G) selection	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located lower left or right corner. Represents VOR position of the EFIS control panel VOR/ADF switches.
	ADF (B) selection	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located lower left or right corner. Represents ADF position of the EFIS control panel VOR/ADF switches.
	INOP (W) selection	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Represents INOP position of the EFIS control panel VOR/INOP switches.
	VOR frequency or identifier (G)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located lower left or right corner. Frequency is displayed before identifier is decoded. Decoded identifier replaces the frequency. Small size characters indicate only DME information is being received.


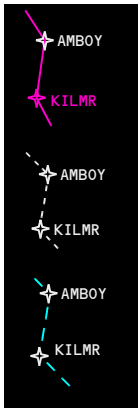
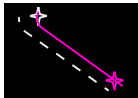

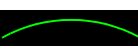
Symbol	Name	ND Mode	Remarks
	ADF frequency or identifier (B)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located lower left or right corner. Frequency is displayed before identifier is decoded. Decoded identifier replaces the frequency.
	DME distance (G)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located in the lower corners. Indicates DME distance to the referenced navaid.

Map

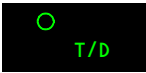
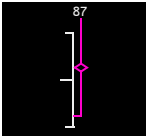

Symbol	Name	ND Mode	Remarks
	Airplane symbol (W)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle.
	Airplane symbol (W)	VOR CTR, APP CTR	Current airplane position is at the center of the symbol.
	Position trend vector (W) (dashed line)	MAP, MAP CTR	Predicts position at 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: <ul style="list-style-type: none"> • greater than 20 NM, 3 segments • = 20 NM, 2 segments • = 10 NM, 1 segment.


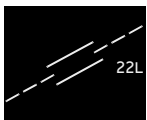


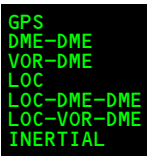
777 Flight Crew Operations Manual

Symbol	Name	ND Mode	Remarks
	Airplane symbol (W)	PLAN	Indicates actual position and track along the flight plan route in plan mode only. Inhibited north of 82N latitude and south of 82S latitude.
	Active waypoint identifier (M)	MAP, MAP CTR, PLAN	Indicates the active flight plan waypoint, the next waypoint on the route of flight.
	Active waypoint distance (W)	MAP, MAP CTR, PLAN	Distance to the active waypoint.
	Active waypoint time to go during alternate navigation (W)	MAP, MAP CTR, PLAN	Indicates CDU calculated time to go in hours and minutes to active waypoint during alternate navigation.
	Active waypoint ETA (W)	MAP, MAP CTR, PLAN	Indicates ETA at the active waypoint. Time is based on distance to go and ground speed. It does not consider FMC performance predictions and may differ from other FMC ETAs that do.
	Waypoint: active (M), inactive (W)	MAP, MAP CTR, PLAN	Active – represents the waypoint the airplane is currently navigating to. Inactive – represents the waypoints on the active route.




Symbol	Name	ND Mode	Remarks
	Off route waypoint (B)	MAP, MAP CTR	When the EFIS control panel WPT map switch is selected on, waypoints not on the selected route are displayed, in ND ranges of 10, 20, or 40.
	Flight plan route: active (M), modified (W), inactive (B)	MAP, MAP CTR, PLAN	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 (B) between waypoints.
	Offset path and identifier: active route (M), modified route (W)	MAP, MAP CTR, PLAN	Presents a dashed line parallel to and offset from the active or modified route.
	Route data: active waypoint (M), inactive waypoint (W)	MAP, MAP CTR	When the EFIS control panel DATA map switch is selected on, entered or procedural altitude and ETAs for route waypoints are displayed. Times consider FMC performance predictions and wind data.
	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.

777 Flight Crew Operations Manual

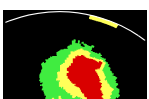
Symbol	Name	ND Mode	Remarks
	Altitude profile point and identifier (G)	MAP, MAP CTR	Indicates the approximate map position of the FMC-calculated T/C (top-of-climb), T/D (top-of-descent), S/C (step climb), and E/D (end of descent) points. Predicted altitude/ETA points entered on the FIX page display the altitude/ETA along with the profile point. Deceleration points have no identifier.
	VNAV path pointer (M) deviation scale (W) digital vertical path deviation (W) vertical path deviation band (M)	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 indicates more than ± 20 feet.
	Airport and runway (W)	MAP, MAP CTR, PLAN	Displayed when selected as the origin or destination and ND range is 80, 160, 320, or 640 NM.

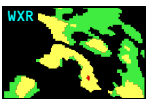
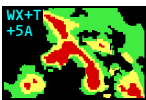
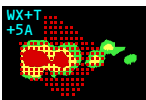
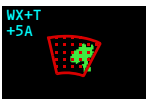
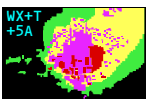


Symbol	Name	ND Mode	Remarks
	Airport (B)	MAP, MAP CTR, PLAN	Displayed on MAP or MAP CTR mode when the EFIS control panel ARPT map switch is selected on. Display of origin and destination airports on MAP, MAP CTR, or PLAN mode is not affected by ARPT map switch selection.
	Airport and runway (W)	MAP, MAP CTR, PLAN	Displayed when selected as the origin or destination and ND range is 10, 20, or 40 NM. Dashed runway centerlines extend 14.2 NM.
	Energy management circles (B, W)	MAP, MAP CTR	Indicates clean (B) and speedbrake (W) energy management circles as defined on the CDU OFFPATH DES page.
	Selected reference point and bearing distance information (G)	MAP, MAP CTR, PLAN	Displays the reference point selected on the CDU FIX page. Bearing and/or distance from the fix are displayed with dashes (G).
	FMC position update status (G)	MAP, MAP CTR	Indicates the system providing FMC position update.

777 Flight Crew Operations Manual


Symbol	Name	ND Mode	Remarks
	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.

[Option - Collins WXR]


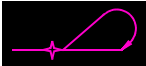
	Weather radar Path Attenuation Compensation (A)	MAP, MAP CTR, VOR, APP	Attenuated region behind rainfall (radar shadow) is indicated by amber arc on outer range ring.
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Symbol	Name	ND Mode	Remarks
[Option - WXR V2.0]			
 	Core Threat Assessment (R, A, 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.
	Selected map options (B)	MAP, MAP CTR	Displays EFIS control panel selected map options.
	North up arrow (G)	PLAN	Indicates map background is oriented and referenced to true north.

777 Flight Crew Operations Manual


Symbol	Name	ND Mode	Remarks
	Map source annunciation (G)	MAP, MAP CTR	Displays ND source if: <ul style="list-style-type: none">• CDU is selected on respective navigation source select switch• both FMCs fail, or• a manually selected FMC fails.

[\[AIMS 2003\]](#)

	Holding pattern: active route (M), modified route (W), inactive route (B)	MAP, MAP CTR, PLAN	A holding pattern appears when in the flight plan. Depicts entry path until entry completed.
	Procedure turn: active route (M), modified route (W), inactive route (B)	MAP, MAP CTR, PLAN	A procedure turn appears when in the flight plan. It increases in size upon entering the procedure turn. Also used for procedure hold course reversal.





Symbol	Name	ND Mode	Remarks
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[AIMS 2003]


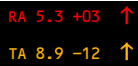



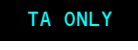



	Alternate airports (B)	MAP, MAP CTR, PLAN	PLAN: displays up to four alternate airports. When 640 NM range is selected, offscale airports are displayed with a directional arrow relative to PLAN center point and distance blanked. MAP, MAP CTR: displays FMC or pilot selected primary alternate airport. When EFIS control panel ARPT map switch is selected on, displays up to four alternate airports. When 640 NM range is selected, offscale airports are displayed with a directional arrow and distance relative to airplane position.
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TCAS

Refer to Chapter 15, Warning systems for more information.





Symbol	Name	ND Mode
	TCAS resolution advisory (RA), relative altitude (R)	MAP, MAP CTR, APP, VOR
	TCAS traffic advisory (TA), relative altitude (A)	MAP, MAP CTR, APP, VOR
	TCAS proximate traffic, relative altitude (W)	MAP, MAP CTR, APP, VOR
	TCAS other traffic, relative altitude (W)	MAP, MAP CTR, APP, VOR

777 Flight Crew Operations Manual



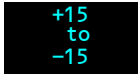









Symbol	Name	ND Mode
	TCAS TA, absolute altitude	MAP, MAP CTR, APP, VOR
	TCAS no bearing message (RA–R, TA–A)	MAP, MAP CTR, APP, VOR
	TCAS traffic alert message (RA–R, TA–A)	All
	TCAS off scale message (RA–R, TA–A)	MAP, MAP CTR, APP, VOR
	TCAS mode (B)	MAP, MAP CTR, APP, VOR
	TCAS mode (B)	All
	TCAS mode (B)	All
	TCAS mode (A)	MAP, MAP CTR, APP, VOR
	TCAS mode (A)	MAP, MAP CTR, APP, VOR

Radar[\[Typical\]](#)

Refer to Chapter 11, Flight Management, Navigation for more information.


Symbol	Name	ND Mode
	Weather radar test mode (B) (A)	MAP, MAP CTR, APP, VOR
	Precipitation only mode (B)	MAP, MAP CTR, APP, VOR
	WXR and turbulence mode (B)	MAP, MAP CTR, APP, VOR
	WXR and threat mode (B)	MAP, MAP CTR, APP, VOR

[\[Option - WXR V2.0\]](#)

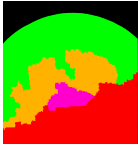

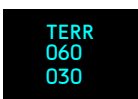






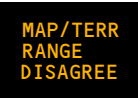
Symbol	Name	ND Mode
	WXR receiver gain (B)	MAP, MAP CTR, APP, VOR
	Mode used with down-tilt, when ground mapping (B)	MAP, MAP CTR, APP, VOR
	WXR antenna tilt (B)	MAP, MAP CTR, APP, VOR
	WXR antenna automatic tilt mode selected (B)	MAP, MAP CTR, APP, VOR
	WXR antenna manual tilt mode selected (B)	MAP, MAP CTR, APP, VOR
	WXR system failure (A)	MAP, MAP CTR, APP, VOR
	WXR receiver transmitter failure (A)	MAP, MAP CTR, APP, VOR
	WXR antenna fault (A)	MAP, MAP CTR, APP, VOR
	Automatic tilt mode failure (A)	MAP, MAP CTR, APP, VOR
	WXR control panel failure (A)	MAP, MAP CTR, APP, VOR
	WXR loss of attitude data (A)	MAP, MAP CTR, APP, VOR
	WXR calibration fault (A)	MAP, MAP CTR, APP, VOR

Look-Ahead Terrain

Refer to Chapter 15, Warning systems for more information.



Symbol	Name	ND Mode
	Obstacle display (R, A, G)	MAP, MAP CTR, APP, VOR

777 Flight Crew Operations Manual

Symbol	Name	ND Mode
	Terrain display (R, A, G, M)	MAP, MAP CTR, APP, VOR
	Obstacle annunciation (R, A)	All
	Terrain mode annunciation (C) and highest and lowest terrain or obstacle altitudes (R, A, G, M)	MAP, MAP CTR, APP, VOR
	Terrain test mode annunciation (C)	All
	Terrain annunciation (R, A)	All
	Terrain status annunciation (A)	MAP, MAP CTR, APP, VOR
	Terrain status annunciation (A)	MAP, MAP CTR, APP, VOR
	Terrain status annunciation (A)	MAP, MAP CTR, APP, VOR
	Terrain range status annunciation (A)	MAP, MAP CTR, APP, VOR
	Terrain range status annunciation (A)	MAP, MAP CTR

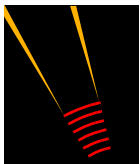

Runway Awareness and Advisory System

Refer to Chapter 15, Warning systems for more information.

Symbol	Name	ND Mode
	On Taxiway caution alert (A)	MAP, MAP CTR, VOR, APP
	Short Runway caution alert (A)	MAP, MAP CTR, VOR, APP

Predictive Windshear

Refer to Chapter 15, Warning systems for more information.

Symbol	Name	ND Mode
	Predictive windshear symbol (R, B, A)	MAP, MAP CTR, APP, VOR
	Windshear annunciation (R, A)	All

Flight Instruments, Displays
Electronic Checklist Displays

Chapter 10
Section 50

Normal Checklist



1 Open Loop Indicator

Indicates the line item is an open loop action item. Requires flight crew confirmation to become complete.

2 Cursor Selection Box

Highlights the cursor selection area.

3 Complete Indicator

Indicates the line item is complete.

4 Normal Checklist (NORMAL) Key

Select -

- shows the next incomplete normal checklist
- shows normal checklists menu page when all normal checklists are complete

5 Line Item Override (ITEM OVRD) Key

Select - overrides the line item in the current line item box. Item shows cyan.

6 Action Item

Shows (white) - the action item is incomplete.

Shows (green) - the action item is complete.

Shows (cyan) - the action item is inactive or overridden.

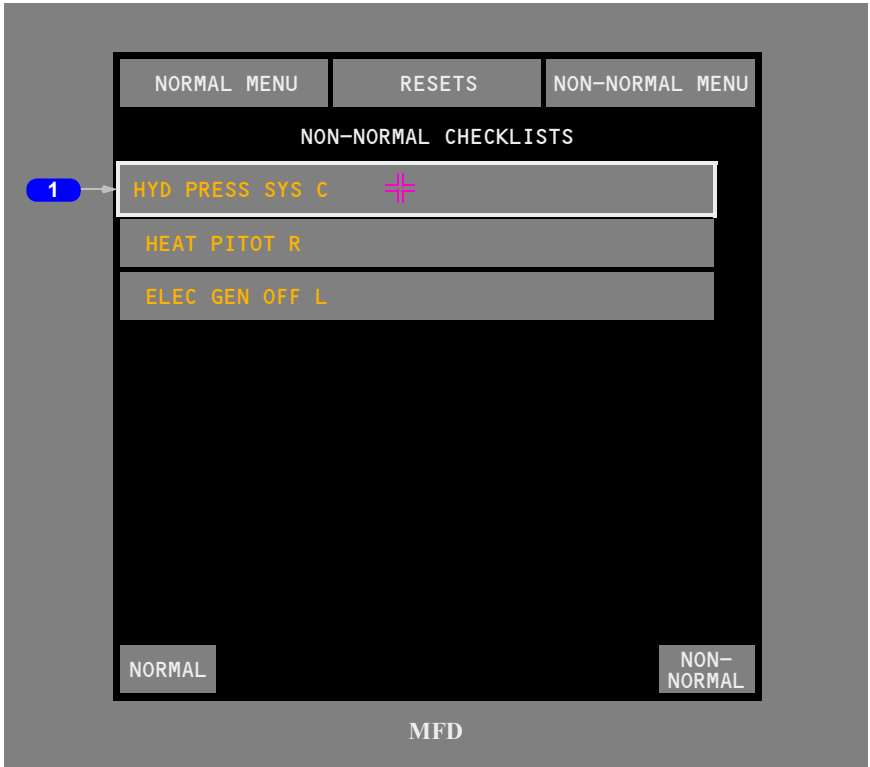
7 Current Line Item Box

Highlights the current incomplete line item.

8 Checklist Reset (CHKL RESET) Key

Select - starts the current checklist from the beginning. All line items become incomplete and the current line item box, the cursor selection box, and the cursor move to the first incomplete line item.

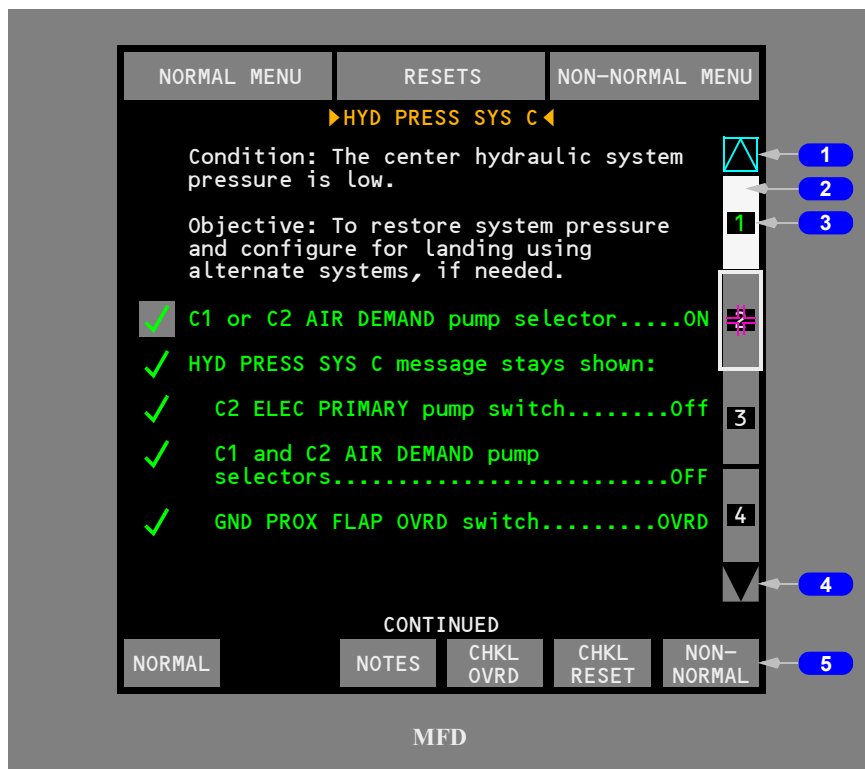
Non-Normal Checklist Queue



1 Checklist Key

Select - shows the checklist for the title on the key.

Non-Normal Checklist



1 Previous Page Key

Select - shows the previous checklist page.

Shows (gray) - the previous page is available.

Shows (cyan) - the key is inactive. The first page of the checklist is shown.

2 Checklist Page Key

Select - shows the checklist page corresponding to the page number on the key.

Shows (white) - the checklist page corresponding to the page number on the key is currently shown.

Shows (gray) - the checklist page corresponding to the page number on the key is not currently shown.

3 Checklist Page Number

Shows (white) - the checklist page is incomplete.

Shows (green) - the checklist page is complete.

4 Next Page Key

Select - shows the next checklist page.

Shows (gray) - the next page is available.

Shows (cyan) - the key is inactive. The last page of the checklist is shown.

5 Non-Normal checklist (NON-NORMAL) Key

Shows when there are additional incomplete non-normal checklists in the checklist queue.

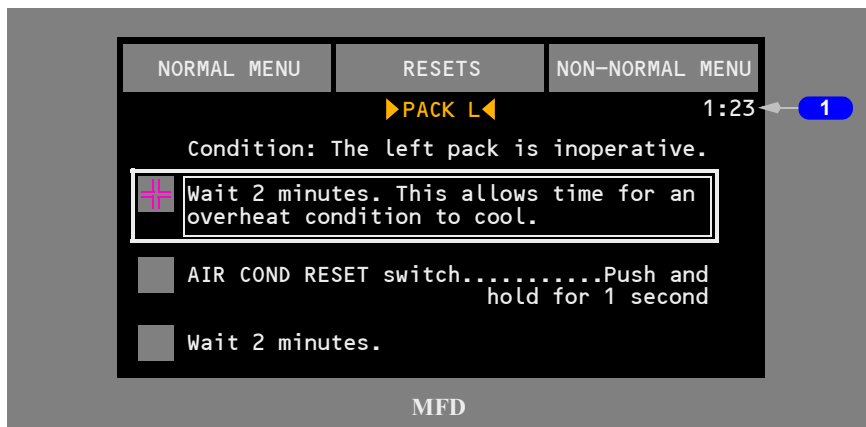
Select -

- shows the next incomplete non-normal checklist when one incomplete non-normal checklist is in the checklist queue
- shows the non-normal checklist queue when more than one incomplete non-normal checklist is in the checklist queue

Shows (white) - an incomplete non-normal checklist has not been shown.

Shows (amber) - an incomplete non-normal checklist has been shown but is not currently shown.

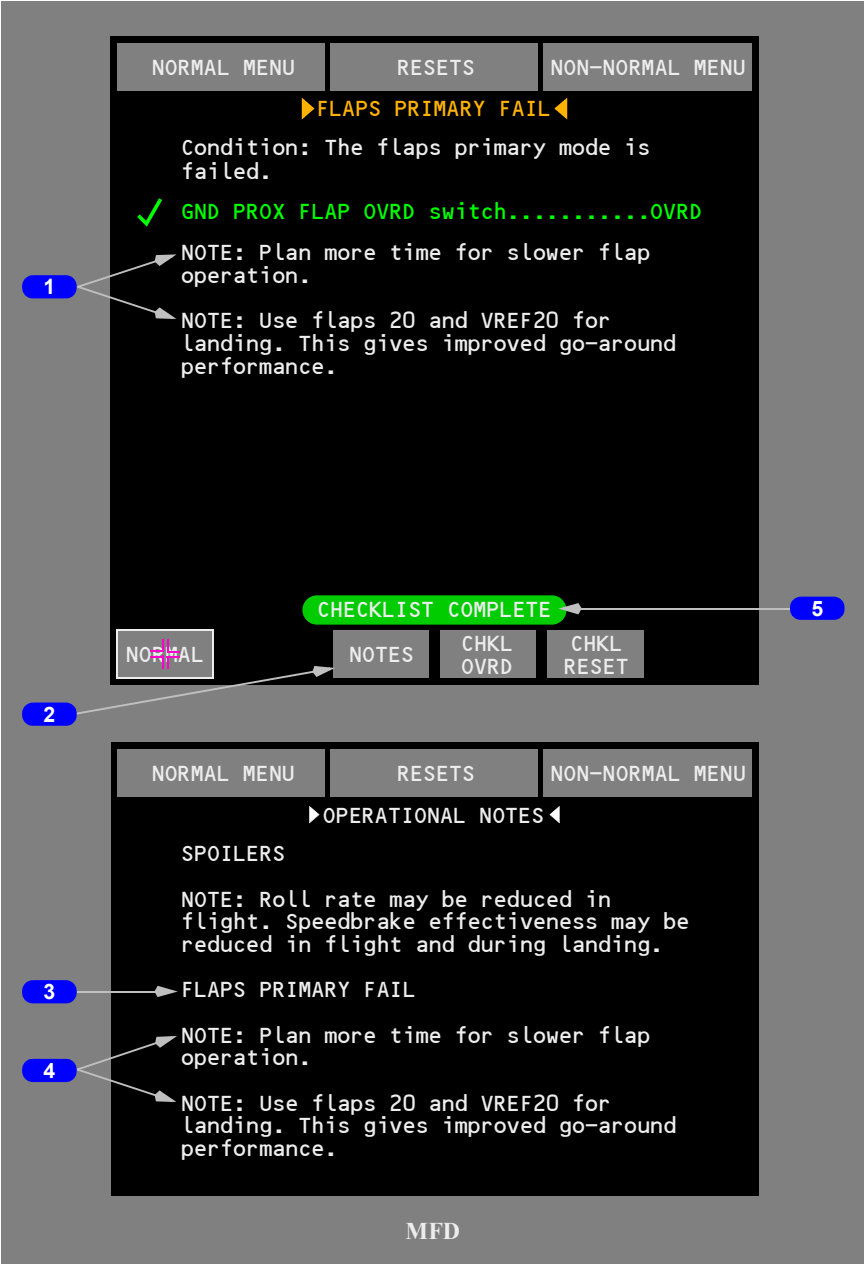
Checklist Timer



1 Timer

Shows the time remaining of a time delay for the current line item. If the line item is complete, the current line item box stays on the line item until the timer expires.

Operational Note



1 Operational Notes

Shown in a non-normal checklist.

2 Operational Notes (NOTES) Key

Select - shows the operational notes page.

3 Checklist Reference

Indicates the non-normal checklist from which operational notes originated.

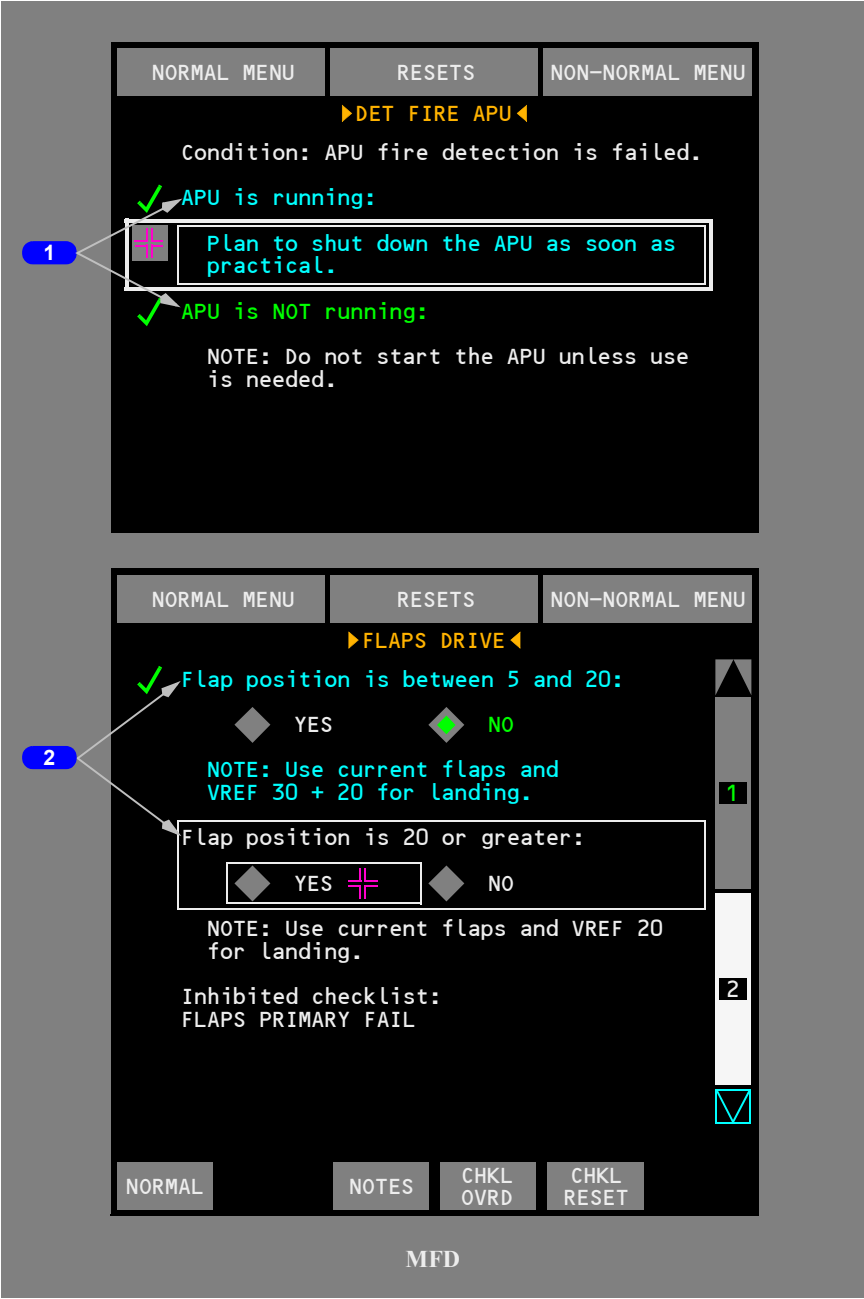
4 Operational Notes

Shown on the operational notes page.

5 CHECKLIST COMPLETE Indicator

Shows when all of the line items are either complete, inactive, or overridden, and all the pages have been shown.

Conditional Line Item



1 Closed Loop Conditional Line Items

Shows (white) - the conditional line item is incomplete.

Shows (cyan) - the conditional line item is sensed false. All line items indented below the conditional line item become inactive and show cyan. The current line item box, cursor selection box, and cursor skip the inactive items and move to the next incomplete line item.

Shows (green) - the conditional line item is sensed true. The current line item box, cursor selection box, and cursor move to the next incomplete line item.

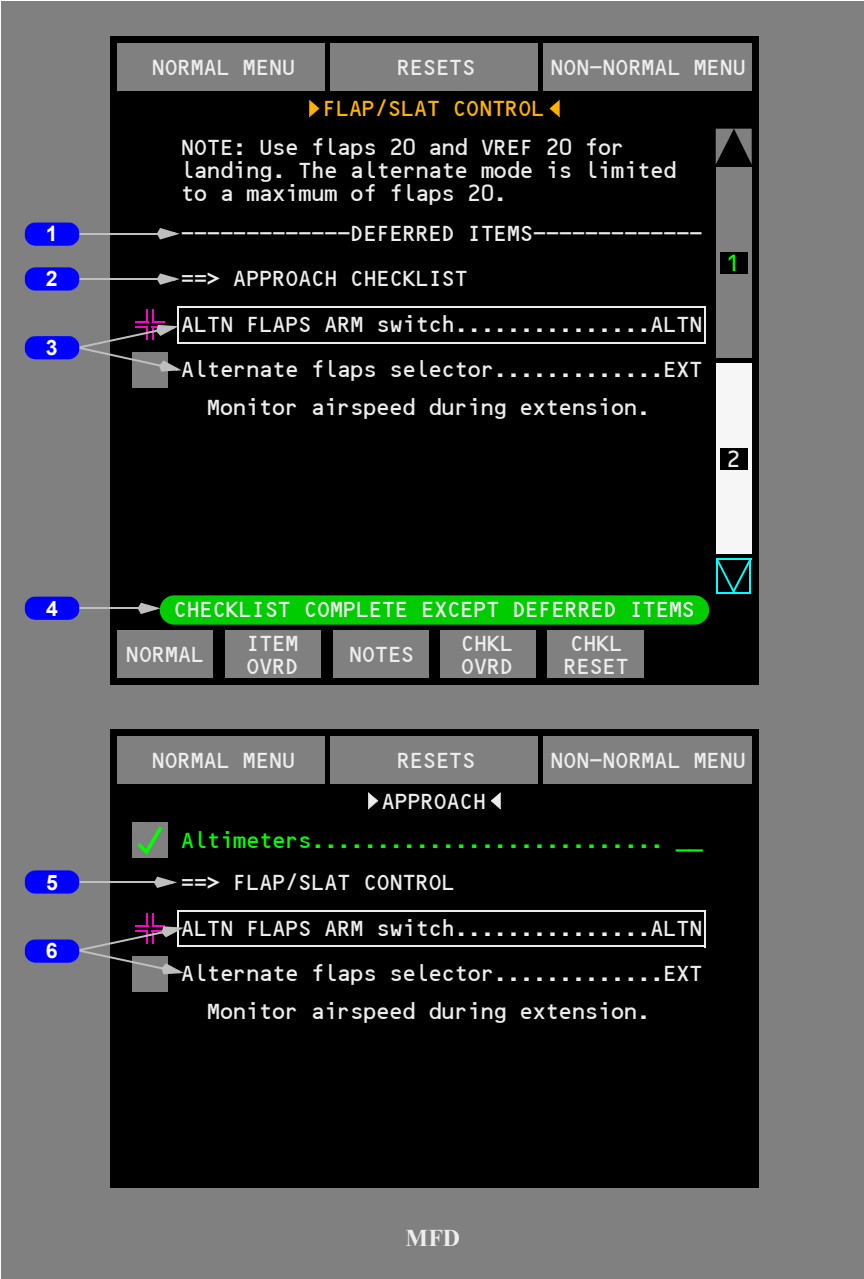
2 Open Loop Conditional Line Items

Shows (white) - the conditional line item is incomplete.

Shows (cyan) - the conditional line item is selected NO. All line items indented below the conditional line item become inactive and show cyan. The current line item box, cursor selection box, and cursor skip the inactive items and move to the next incomplete line item.

Shows (green) - the conditional line item is selected YES. The current line item box, cursor selection box, and cursor move to the next incomplete line item.

Deferred Line Item



1 Deferred Line Items Separator

Separates deferred line items from non-normal checklist line items. All the line items below the separator are deferred.

2 Checklist Reference

Indicates the normal checklist to which deferred line items go.

3 Deferred Line Items

Shown in a non-normal checklist.

4 CHECKLIST COMPLETE EXCEPT DEFERRED ITEMS Indicator

Shows when all line items except deferred line items are either complete, inactive, or overridden, and all pages before the deferred line items separator have been shown.

5 Checklist Reference

Indicates the non-normal checklist from which deferred line items originated.

6 Deferred Line Items

Shown in a normal checklist.

Inhibit Checklist Line Item



1 Inhibit Checklist Line Item

Shows checklists which are inhibited or removed from the checklist queue and whose checklist icons are inhibited or removed from the EICAS display.

Checklist Override



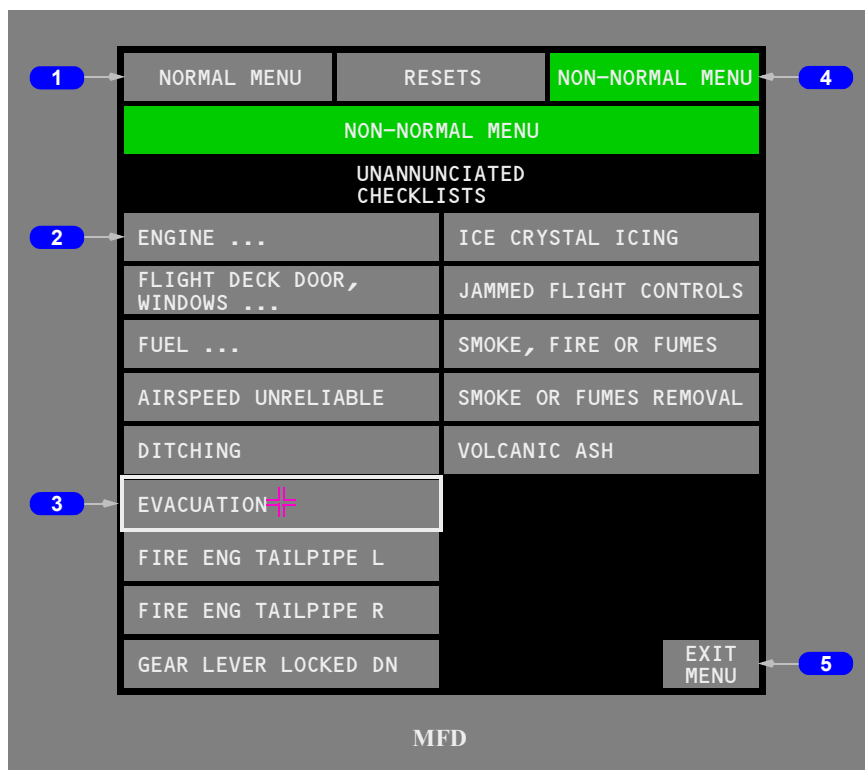
1 Checklist Override (CHKL OVRD) Key

Select - overrides the current checklist.

2 CHECKLIST OVERRIDDEN Indicator

Shows when the checklist is overridden. All the line items show cyan.

Checklists Menu Page



1 Normal Menu (NORMAL MENU) Key

Select - shows the normal checklists menu. The menu contains checklist keys for the normal checklists.

2 Menu Key

Indicated by three dots after the menu title.

Select - shows the checklists menu page for the title on the key.

3 Checklist Key

Select - shows the checklist for the title on the key.

4 Non-Normal Menu (NON-NORMAL MENU) Key

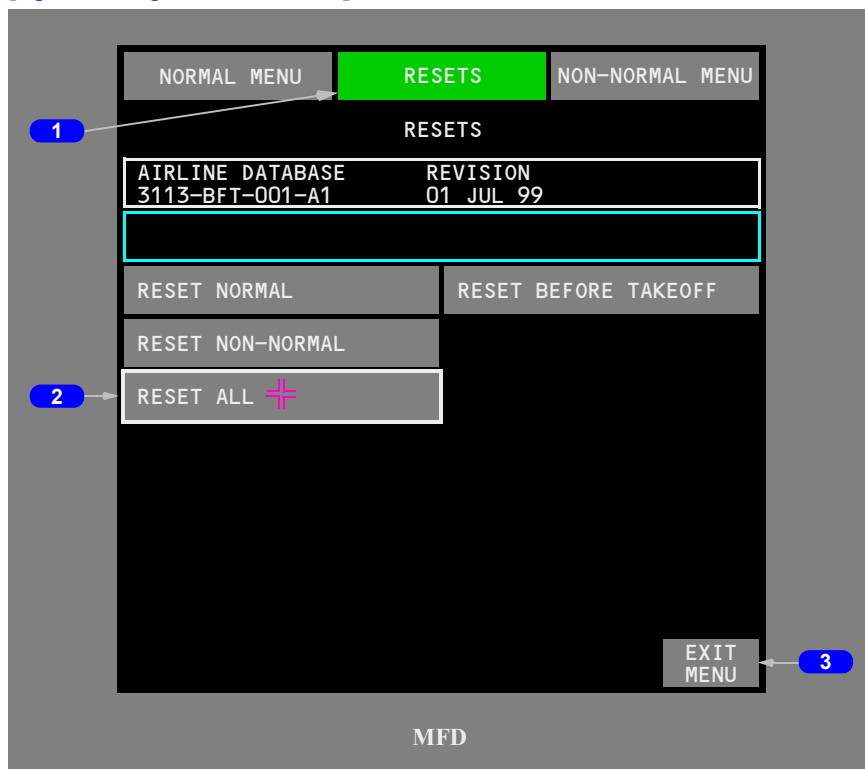
Select - shows the non-normal checklists menu page. The page contains menu keys for the airplane systems.

5 Exit Menu (EXIT MENU) Key

Select - exits page for access to the normal and non-normal checklist keys.

Resets Page

[Option - Single ECL Database]



1 Resets Menu (RESETS) Key

Select - shows the checklist resets page.

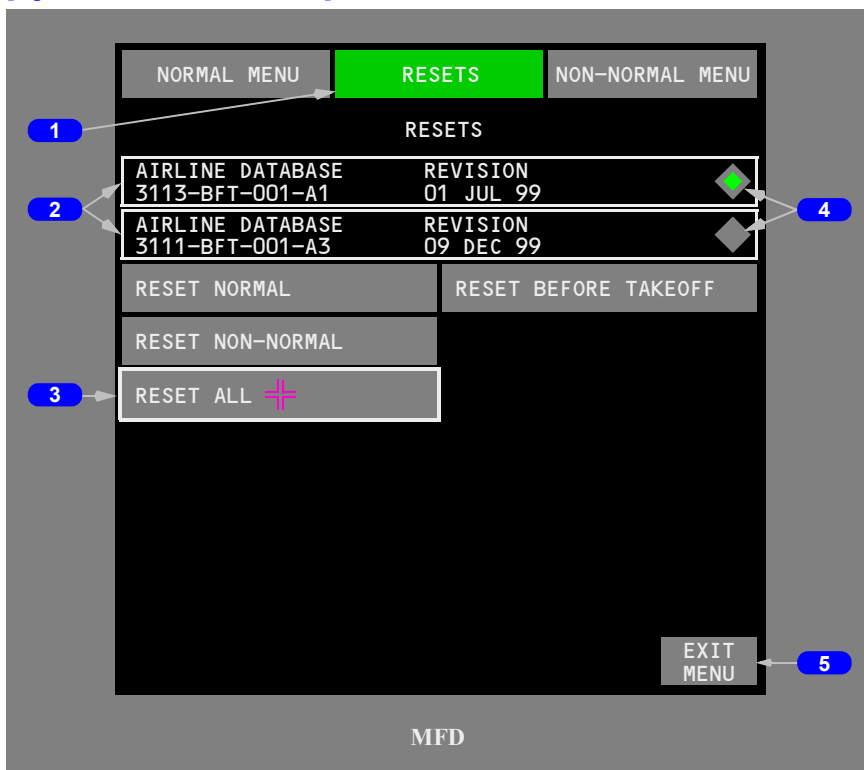
2 Reset Key

Select - resets checklists corresponding to the title on the key. All affected checklists become incomplete.

3 Exit Menu (EXIT MENU) Key

Select - exits page for access to the normal and non-normal checklist keys.

[Option - Dual ECL Database]



1 Resets Menu (RESETS) Key

Select - shows the checklist resets page.

2 Database Selection Keys

Select -

- activates associated checklist database
- selection is only available on the ground

Shows (white) - the database is available for selection.

Shows (cyan) - the key is inactive. Database is inhibited from selection or database is invalid.

3 Reset Key

Select - resets checklists corresponding to the title on the key. All affected checklists become incomplete.

4 Active Database Indicators

Shows (green) - the database is active.

Shows (gray) - the database is inactive.

5 Exit Menu (EXIT MENU) Key

Select - exits page for access to the normal and non-normal checklist keys.

Flight Instruments, Displays
Electronic Checklist Description**Chapter 10**
Section 60

Introduction

The electronic checklist (ECL) system shows normal and non-normal checklists on a multifunction display (MFD). The electronic checklist system is not required for dispatch, and a paper checklist or other approved backup checklist must be available on the flight deck.

The checklist display switch on the display select panel opens the electronic checklist. The flight crew operates the checklist with the cursor control devices (CCDs). Cursor control devices and MFD selection are described in the System Description section of this chapter.

Electronic Checklist Operation

Pushing the checklist display switch on the display select panel shows the correct checklist (see Checklist Priority, this section, for the checklist priority order). Only one checklist can show at a time.

Three types of checklists can be shown:

- normal
- non-normal for an EICAS message (annunciated)
- non-normal for a condition without an EICAS message (unannunciated)

After each normal checklist is complete, pushing the checklist display switch twice or selecting the normal key shows the next normal checklist in sequence.

Some checklist steps must be checked off by the flight crew to show as complete. Other checklist steps are automatically checked off from sensed flight deck control positions, airplane system status, or EICAS messages.

Checklist Pages

A checklist can have one or more pages. If a checklist is longer than one page, page keys show on the right side of the page.

When a checklist has more than one page and the line items on the current page are complete, the cursor moves to the checklist page key for the next page. CONTINUED shows at the bottom of the page. Pressing the CCD cursor select switch shows the next checklist page.

When a checklist is complete and there are no additional checklists in the non-normal checklist queue, the cursor automatically moves to the normal checklist key in the lower left corner of the page. Pressing the CCD cursor select switch shows the next normal checklist in sequence. If there are checklists in the non-normal queue, the cursor moves to the non-normal key in the lower right corner of the page. Pressing the CCD cursor select switch shows the next non-normal checklist (if only one is in the queue) or the non-normal checklist queue.

Checklist Status

The checklist complete indicator shows at the bottom of all pages of the checklist when all of the line items are either complete, inactive, or overridden, and every page has been shown. If the flight crew chooses not to do a line item, the line item can be overridden with the line item override key at the bottom of the page. When a line item is overridden, the text changes color to cyan and the current line item box moves down to the next incomplete line item. If the flight crew chooses to not complete a checklist, the checklist can be overridden by selecting the checklist override key at the bottom of the page. When a checklist is overridden, the text of the entire checklist changes color to cyan, and the checklist overridden indicator shows at the bottom of all pages.

Checklist Line Items

A checklist has one or more line items. These are the types of line items:

- free text
- action item
- operational note
- conditional
- inhibit checklist

Free text items show text and have no further function. The other line item types are described below.

Incomplete line items have white text. Complete line items have green text with a complete indicator (a green check mark) to the left. Overridden and inactive line items have cyan text.

When the checklist is opened, the current line item box moves to the first incomplete line item. When the cursor is on that line item, the cursor selection box encloses the current line item box. When the line item becomes complete, the cursor, the cursor selection box, and the current line item box move to the next incomplete line item.

Action Items

Each step in a checklist that requires a flight crew action is an action item. There are two types of action items: closed loop and open loop.

Closed Loop Action Items

Closed loop action items continuously monitor the position of a flight deck switch, lever, or selector. In a few cases, actual system state, such as flap or landing gear position, is monitored. When the control is in the required position, the action item color changes to green and the complete indicator shows to the left of the action item. The current line item box then moves to the next incomplete line item.

Open Loop Action Items

Open loop action items require the flight crew to manually confirm completion with the CCD. Open loop action items do not monitor control position or system state. Open loop action items look different from closed loop action items. Open loop action items have an open loop indicator, a gray box to the left of the line item. When the cursor is within the current line item box or the open loop indicator, and the CCD cursor select switch is pushed, the action item color changes from white to green and a complete indicator shows on the open loop indicator. The current line item box then moves to the next incomplete line item.

Operational Notes

Operational notes are for the ongoing consequences of a non-normal condition, such as inoperative equipment or operational limitations. The flight crew should read all operational notes, but the current line item box does not stop on an operational note because no immediate flight crew action is required. Operational notes have white text, unless inactive or overridden.

The operational notes page stores active operational notes for easy access and review by the flight crew later in flight. After a non-normal checklist that has operational notes is opened, the operational notes are available for the rest of the flight on the operational notes page. Access to the operational notes page is by the operational notes key at the bottom of the checklist page. Operational notes on the operational notes page have a checklist reference with the title of the checklist from which they came.

If there is more than one page of operational notes, page keys show.

The status of an operational note is based on the status of the EICAS message for the checklist with the note. If the EICAS message blanks, unneeded notes can also blank from the notes page.

Conditional Line Items

Conditional line items control the path through a complex checklist. The current line item box steps through line items or it skips line items based on a condition.

There are two types of conditional line items: open loop and closed loop.

Open Loop Conditional Line Items

Open loop conditional line items have choices labeled YES and NO. When the conditional line item becomes the current line item, the cursor moves to the YES - NO line. The flight crew uses the CCD to select the correct answer.

If the flight crew selects YES, the line items indented below the conditional line item become active. The current line item box moves to the first incomplete line item.

If the flight crew selects NO, the line items indented below the conditional line item become inactive and change color to cyan. The current line item box skips the inactive items. Inactive operational notes are removed from the operational notes page. Inactive deferred line items are removed from their normal checklist. Inactive inhibit checklist line items have no effect.

The YES - NO choices remain available after a selection is made. The flight crew can change selections at any time.

A group of two or more open loop conditional line items can be a mutually exclusive set. When the flight crew selects YES on any one of the items in the exclusive set, all of the other items are automatically set to NO. However, the opposite is not true. If all but one of the items are selected NO, the last item is not automatically set to YES. The flight crew must manually select YES on one of the conditional line items in the exclusive set.

Closed Loop Conditional Line Items

A closed loop conditional line item works the same as an open loop item except the choice is made automatically based on a monitored flight deck control, an EICAS message, or an airplane system state. If the condition is true, the conditional line item changes color to green and the line items indented below it become active. If the condition is false, the conditional line item and the line items indented below it become inactive and change color to cyan. The current line item box skips the inactive items.

Inhibit Checklist Line Items

One airplane system failure can cause more than one EICAS alert message (a primary message and one or more consequential messages). The flight crew should do the checklist for the primary message not the consequential messages. Inhibit checklist line items remove unneeded non-normal checklists (consequential checklists) from the checklist queue.

Consequential EICAS alert messages can show for a primary failure condition. For example, the AUTO SPEEDBRAKE message shows due to a HYD PRESS SYS C condition. Consequential EICAS alert messages can also show due to flight crew actions in a non-normal checklist. For example, a PACK L message shows when the flight crew selects the pack off in the SMOKE, FIRE AND FUMES checklist. An inhibit checklist line item in the primary checklist inhibits the consequential checklists.

The inhibit checklist line item shows the consequential checklists which are inhibited. The inhibit has the following effects on a consequential checklist:

- the checklist icon is removed from the consequential EICAS message
- the consequential checklist is removed from the checklist queue
- operational notes from the consequential checklist are removed from the operational notes page
- deferred line items are removed from the normal checklists

If a consequential checklist has steps, notes, and information that are needed for the primary failure condition, then these are included in the primary checklist.

An inhibit checklist line item becomes active when the message for the primary condition shows, before its checklist is opened.

In the paper checklist, an inhibit checklist line item shows as "Do not accomplish the following checklist".

Deferred Line Items

Deferred line items are items that are part of a non-normal checklist, but must be done later in the flight, usually during approach.

When a non-normal checklist that has deferred line items is opened, the deferred line items are automatically added to the end of a normal checklist. Deferred line items in a normal checklist have a checklist reference with the title of the checklist from which they came. Any type of line item can be a deferred line item.

A non-normal checklist that has deferred line items is complete when all line items before the deferred line items are complete. The checklist complete except deferred items indicator shows at the bottom of the page.

If the non-normal condition occurs after completion of the normal checklist that would get the deferred line items, the non-normal checklist is complete when all line items, including the deferred line items, are complete.

Timers

Timers help the flight crew keep track of time delays that are part of checklists. The timer shows in the upper right hand corner of the checklist page. All timers are countdown timers. Timers can be part of action items or conditional line items.

A timer on a line item starts when the line item just before it is complete. Timers run in the background. This allows the flight crew to leave the checklist to accomplish other tasks and then return to the checklist. Timers are white when they are running. When the timer is done, it shows ":00" and the color changes to amber.

The current line item box does not move to the next incomplete line item until the line item with the timer is complete and the timer is done.

Checklist Menu Operation

Usually, the flight crew uses the checklist display switch on the display select panel and the normal and non-normal keys to select checklists. Checklists can also be selected and opened with menus. The normal menu, the resets page, and the non-normal menu can be selected with the keys at the top of the checklist page, using the CCD.

An exit menu key is in the lower right corner of all menu pages. This exits the menu page to allow access to the normal and non-normal checklist keys.

Normal Menu

Normal checklists are on the normal menu in the sequence they are completed in a normal flight.

Non-Normal Menu

The non-normal menu has submenus by airplane system. An airplane system submenu has the checklists for that system. If a system has more checklists than can fit on a page, additional submenus group checklists by name. Submenu titles end with "...".

Resets Page

The resets page shows the checklist database part number and revision information and the following manual resets:

- RESET NORMAL
- RESET NON-NORMAL
- RESET ALL

Other manual resets can also be on this page. These can reset more than one checklist. See Checklist Resets in this section.

Note: RESET NORMAL, RESET NON-NORMAL, and RESET ALL are intended for ground use only. If they are used in flight, RESET NON-NORMAL and RESET ALL will reset completed non-normal checklists, requiring the crew to start the checklists over. It can also cause needed operational notes and deferred line items to be lost.

Dual Database

[\[Option - Dual ECL Database\]](#)

The dual database feature allows two ECL databases to be available. The flight crew can select either database on the RESETS menu using the CCD. A green diamond shows the active database. The flight crew can select either ECL database on the ground. The database selection keys are inhibited in flight. Changing the active ECL database also resets all checklists.

Checklist Priority

Air/ground logic, fuel control switch and start selector position, and EICAS message level determine the priority for checklists when the checklist display switch is pushed.

On the ground with both fuel control switches in CUTOFF and both engine start selectors in NORM, the priority is:

- checklists for EICAS warning messages
- NORMAL checklists (incomplete or not yet opened)

On the ground with one or both fuel control switches in RUN, one or both engine start selectors in START; or in the air, the priority is:

- checklists for any EICAS alert messages that have icons
- incomplete unannunciated checklists
- NORMAL checklists

Normal Checklists

Normal electronic checklists are used the same way as paper checklists. The flight crew does the normal procedures from memory, then they read the checklist to confirm the actions.

Normal Checklist Access

The checklist sequence is:

- PREFLIGHT
- BEFORE START
- BEFORE TAXI
- BEFORE TAKEOFF
- AFTER TAKEOFF
- DESCENT
- APPROACH
- LANDING
- SHUTDOWN
- SECURE

When each normal checklist is complete, the normal checklist key shows the next incomplete normal checklist in the sequence.

The flight crew can open any normal checklist from the normal menu. If a completed normal checklist is opened from the menu, it is reset.

Normal Checklist Completion

When all of the line items in a checklist are complete, the checklist complete indicator (white text on a green background) shows at the bottom of the checklist page.

When a checklist is overridden, the checklist overridden indicator (white text on a cyan background) shows at the bottom of the checklist page.

Incomplete Normal Checklist Alerting

[\[AIMS-2 BP v17 or later\]](#)

The EICAS caution message CHKL INCOMPLETE NORM shows to alert the crew when critical line items in a checklist are not complete before the corresponding phase of flight. Also, the normal checklist key changes color to amber to show that one or more normal checklists are incomplete.

These are the critical flight phases:

- before takeoff phase - occurs when the airplane is on the FMC takeoff runway and aligned for takeoff
- approach phase - occurs when the airplane descends through the FMC transition altitude, and the flap handle is not in UP
- landing phase - occurs when the airplane descends below 800 feet (or 500 feet by airplane option) above the FMC landing altitude

The CHKL INCOMPLETE NORM message shows until the normal checklist is complete or overridden. The checklist icon shows with the CHKL INCOMPLETE NORM message to alert the flight crew to open the checklist, but there is no non-normal checklist for this EICAS message.

Non-Normal Checklists

Non-normal electronic checklists are used the same way as paper checklists. Non-normal checklists are done by read-and-do. If a checklist has memory steps, the flight crew does those steps before opening the checklist.

Non-Normal Checklist Access and Checklist Icon

Usually, the flight crew opens annunciated non-normal checklists by pushing the checklist display switch. Any non-normal checklist can be opened using the non-normal menu.

EICAS messages determine which non-normal checklist shows automatically. If the checklist for an EICAS alert message has not been opened or is incomplete, the message has an icon, a white box to the left of the message. (See section 10.50 for information about the checklist icon.)

If an EICAS alert message has no icon, the checklist is complete, there is no checklist for the message, or another checklist inhibits the icon.

If one EICAS alert message with an icon shows, pushing the checklist display switch shows the checklist for that message. If more than one EICAS alert message with an icon shows, pushing the checklist display switch shows a list with the non-normal checklist queue. If there are more than ten checklists in the queue, the queue has more than one page.

Checklists in the queue are in the same order as the messages show on EICAS. If there are any active unannunciated checklists, they show in the queue after all of the annunciated checklists.

When an EICAS alert message shows, its checklist automatically goes into the queue. When the checklist is complete, the EICAS alert message can still show, but the checklist is removed from the queue. A checklist is also removed from the queue when it is inhibited by another checklist that becomes active.

The flight crew uses the CCD to select a checklist from the queue. When a checklist is open, the non-normal checklist key returns to the queue if there are other non-normal checklists in the queue.

If EICAS alert messages show or blank while the checklist queue is shown, the queue does not change automatically. The flight crew must exit the queue and open it again to see the checklists for the new EICAS messages.

Non-Normal Unannunciated Checklists

Non-normal checklists for conditions that do not have EICAS messages are unannunciated checklists. Unannunciated checklists can be opened only from menus. UNANNUNCIATED CHECKLISTS is the first submenu on the non-normal menu. This submenu provides quick access to all unannunciated checklists.

When an unannunciated checklist is opened, it remains in the checklist queue until it is complete.

If the flight crew opens an unannunciated checklist and chooses not to complete it, the checklist must be overridden.

Non-Normal Checklist Completion

When all of the line items in a checklist are complete or inactive, the checklist complete indicator (white text on a green background) shows at the bottom of the checklist page.

When all of the line items in a checklist are complete or inactive, except for the deferred items, the checklist complete except deferred items indicator (white text on a green background) shows at the bottom of the checklist page.

When a checklist is overridden, the checklist overridden indicator (white text on a cyan background) shows at the bottom of the checklist page.

If a checklist is opened and not completed, then another checklist is opened, the text in the non-normal checklist key changes color to amber.

Hidden Non-Normal Checklist Alerting

[\[AIMS-2 BP v17 or later\]](#)

The EICAS advisory message CHKL NON-NORMAL shows when there is a non-normal checklist in the queue, its EICAS message is blank, and ECL is not open. The CHKL NON-NORMAL message alerts the flight crew to open ECL and complete the checklist. The message blanks when ECL is opened.

The hidden checklist condition usually occurs when the flight crew completes checklist memory items (for example, in response to an engine fire) that cause the EICAS message to blank, but there is still a checklist in the queue that must be completed. It also occurs when an unannunciated checklist is partially completed, then ECL is closed.

The checklist icon shows with the CHKL NON-NORMAL message to alert the flight crew to open the checklist, but there is no non-normal checklist for this EICAS message.

Checklist Resets

If a checklist is complete or partially complete and the flight crew wishes to begin the checklist again, the checklist can be reset. Selecting the checklist reset key at the bottom of the page resets the checklist: all action items and conditionals become incomplete. The current line item box moves to the first incomplete line item.

For some conditions, such as go-around, resets set the normal checklists back to a previous phase of flight. There are automatic resets and manual resets.

Normal Checklist Automatic Reset Conditions

Automatic checklist resets occur for the following conditions:

- go-around - if the airplane is in the air, the landing gear is not up, and TO/GA is selected, then all normal checklists beginning with the AFTER TAKEOFF checklist automatically reset
- touch-and-go - if the airplane has transitioned from air to ground, takeoff thrust is reached with ground speed greater than 80 knots, and the thrust reversers not deployed, then all normal checklists beginning with the AFTER TAKEOFF checklist automatically reset
- normal menu selection - if a previously completed normal checklist is opened from the normal menu, it automatically resets

Normal Checklist Manual Resets

The following manual resets are available for normal checklists:

- reset normal - the RESET NORMAL key resets all normal checklists. The flight sequence begins again
- individual checklist reset - the checklist reset key at the bottom of a checklist page resets the current checklist. The checklist can be started again

Non-Normal Checklist Manual Resets

The following manual resets are available for non-normal checklists:

- reset non-normal - the RESET NON-NORMAL key resets all non-normal checklists. Icons show on any active EICAS messages with checklists that were previously completed. Use of the RESET NON-NORMAL function in flight is not recommended
- individual checklist reset - the checklist reset key at the bottom of a checklist page resets the current checklist. The checklist can be started again

Manual Reset All

The RESET ALL key resets all normal and non-normal checklists. The flight sequence begins again for normal checklists. Icons show on any active EICAS messages with checklists that were previously completed. Use of the RESET ALL function in flight is not recommended.

Overrides

There are two types of override functions: item override and checklist override.

Item Override

The flight crew uses item override when they choose not to complete an action item. If the action has been done but the closed-loop sensing does not show the action item as complete, the flight crew can override the action item. This allows the checklist to be complete.

The line item override key is available on all checklists. When an item is overridden the color changes to cyan. Closed loop and open loop action items can be overridden.

Conditional line items (open loop or closed loop) cannot be overridden. Action items indented below a conditional line item can be overridden.

Checklist Override

The flight crew uses checklist override when a checklist in the non-normal queue will not be completed or if the flight crew opens a checklist from a menu but chooses not to complete it.

The checklist override key overrides the current checklist. All of the line items change color to cyan. The checklist overridden indicator shows at the bottom of the page. For a non-normal checklist, all of its operational notes are removed from the operational notes page, deferred line items are removed from their normal checklists, and inhibit checklist line items become inactive.

Electronic Checklist System Inoperative

If the checklist display switch is pushed and the electronic checklist system is inoperative, the message CHECKLIST NOT AVAILABLE shows on the MFD. If the electronic checklist system has been disabled by maintenance, the message CHECKLIST DISABLED shows on the MFD.

When the electronic checklist system is inoperative or disabled, checklist icons do not show with any EICAS messages.

Flight Instruments, Displays
Electronic Flight Bag (EFB)**Chapter 10**
Section 65[\[Option\]](#)

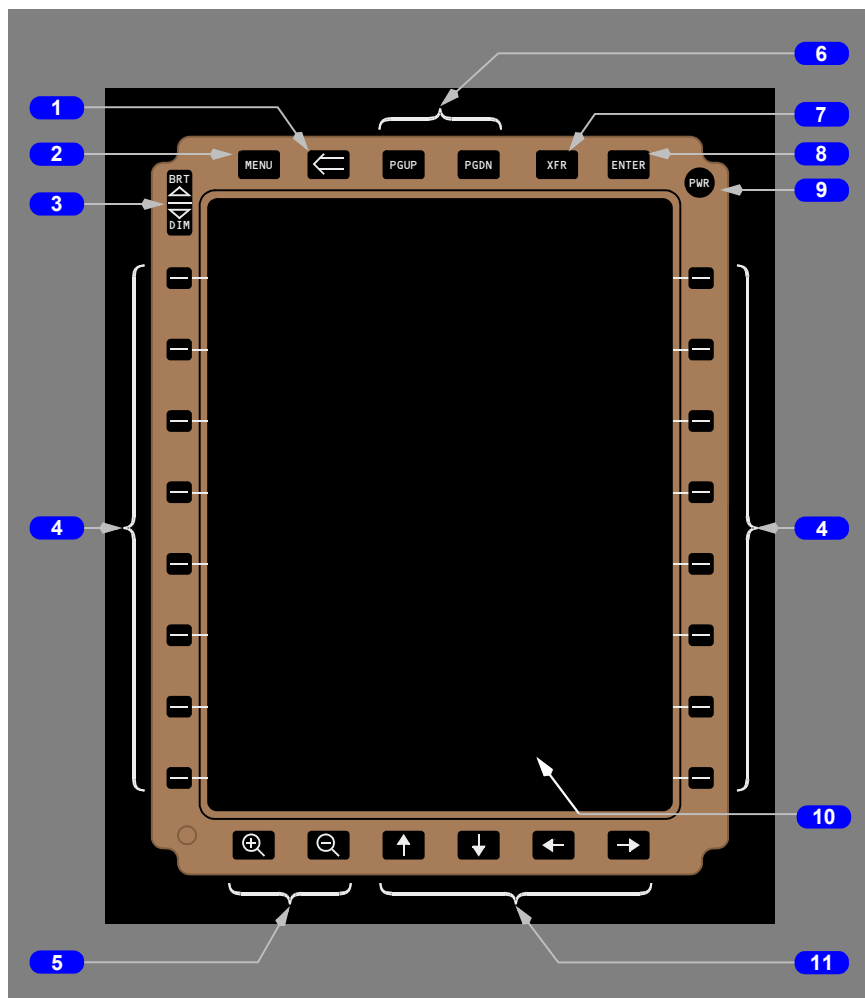
Introduction

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 flight crew interacts with the EFB through display units located on the side panels. The display units operate independently of each other.

Under typical flight conditions, the majority of pilot interactions consists of manipulating Line Select Keys or the touch screen on a display unit to move back and forth among applications, within applications, and to display data. In addition, the flight crew can use the cursor control device (CCD) or an optional keyboard.

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 keys, revising application names, and defining the order in which applications appear. Descriptions and illustrations provided in this section are examples of a typical installation and may not reflect the exact installed configuration.

Display Unit



1 Back Key

Returns to the previous level within an application.

2 Main Menu (MENU) key

Displays MAIN MENU.

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

8 Enter (ENTER) Key

Activates a high-lighted item when applicable.

9 Power (PWR) Switch

Turns the display backlight on or off.

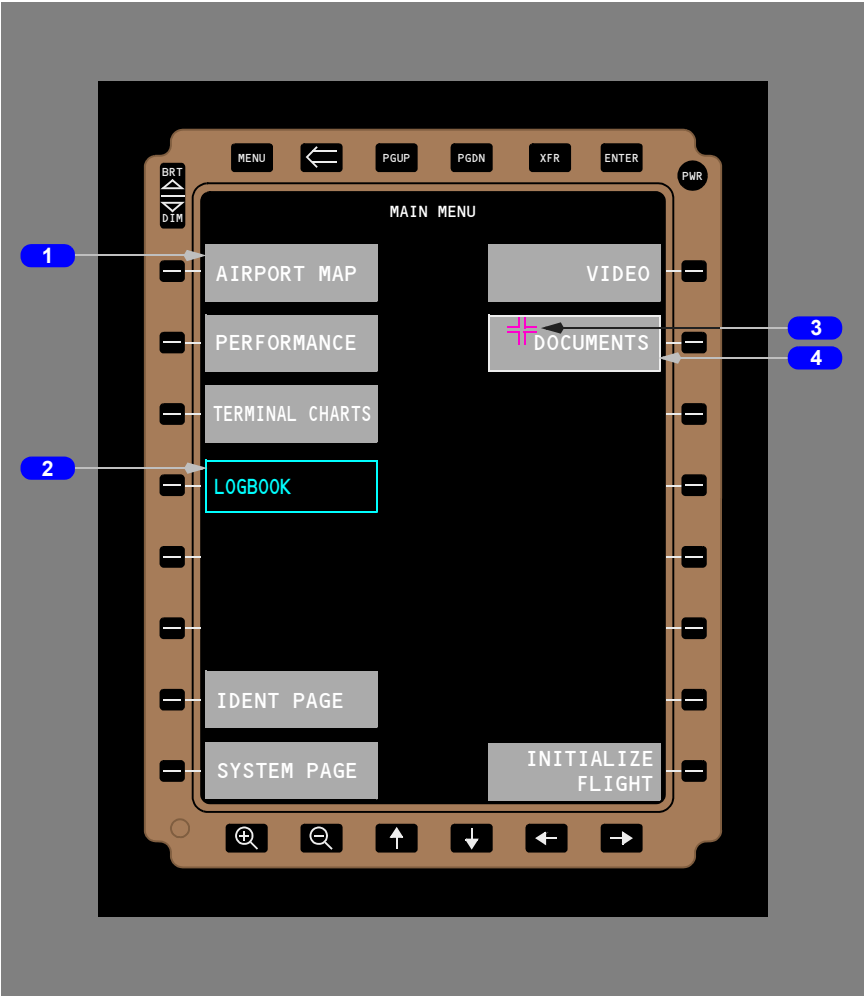
10 Touch sensitive screen

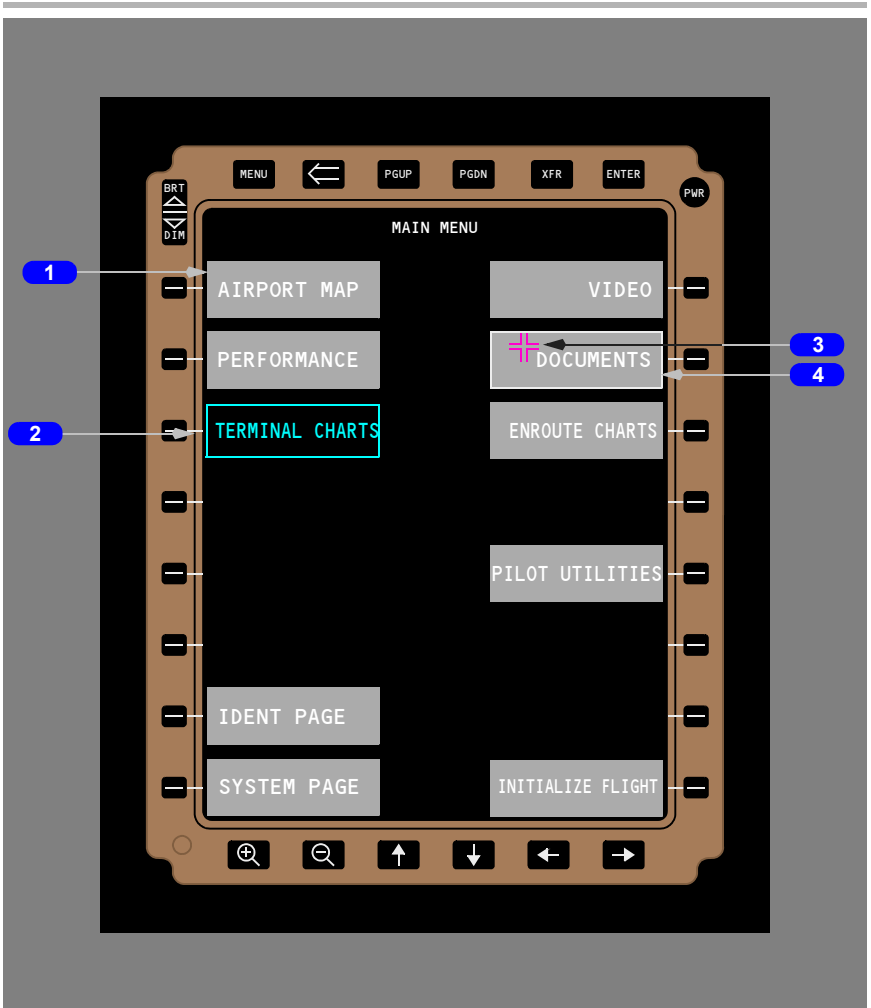
Enables direct selection on the display screen, and in some applications panning and scrolling.

11 Arrow Keys

Moves the viewing window over the display in the direction of the selected arrow.

Display Description



**1 Selectable Applications**

Menu items for selectable applications display in white text with gray background.

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:

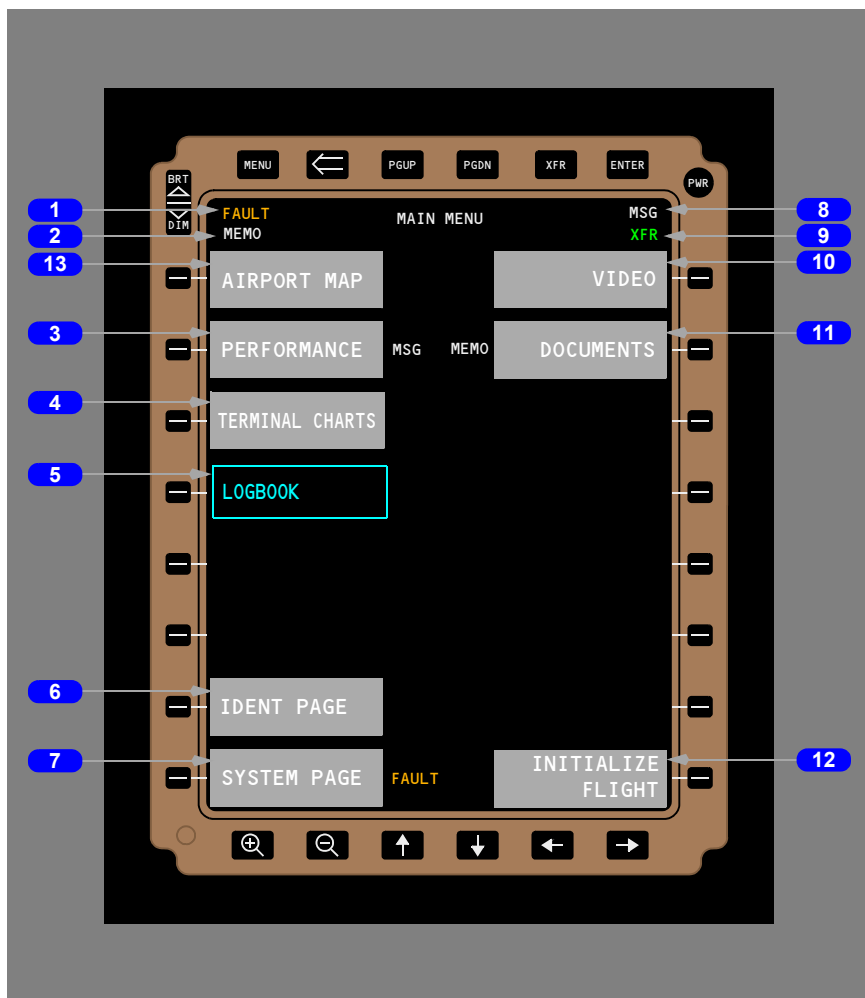
- The cursor is moved over the menu item
- The selectable menu item is touched
- A line select key is selected

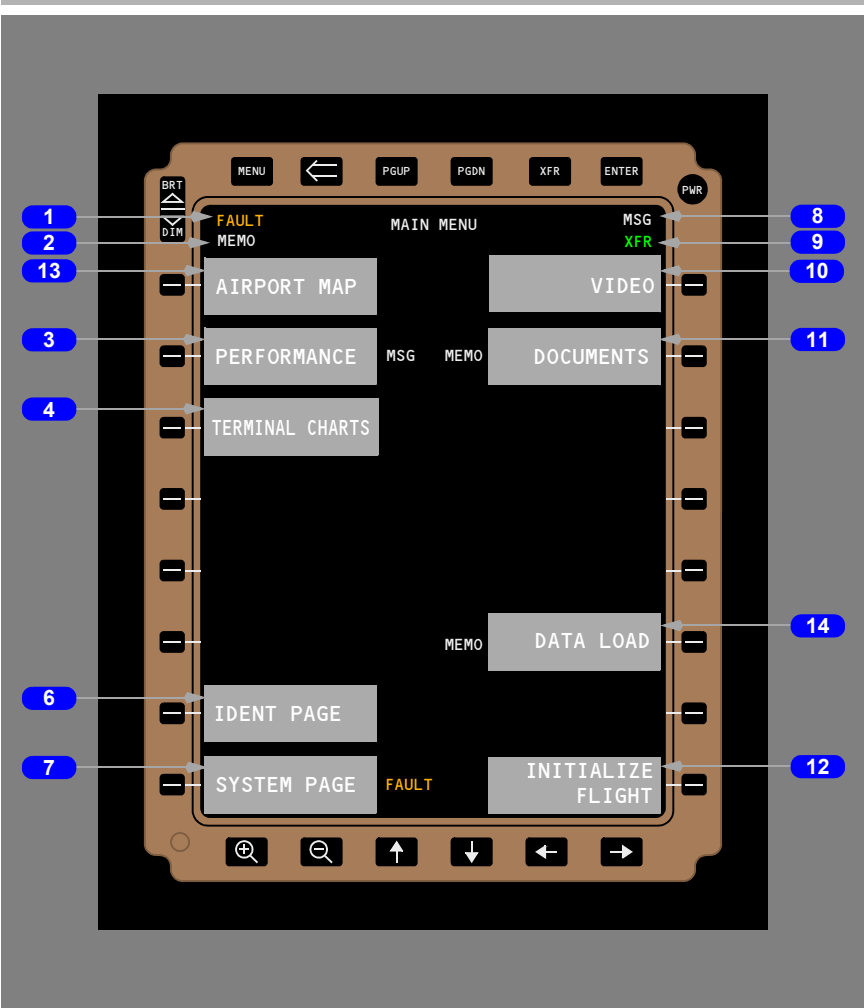
A selectable application is selected when:

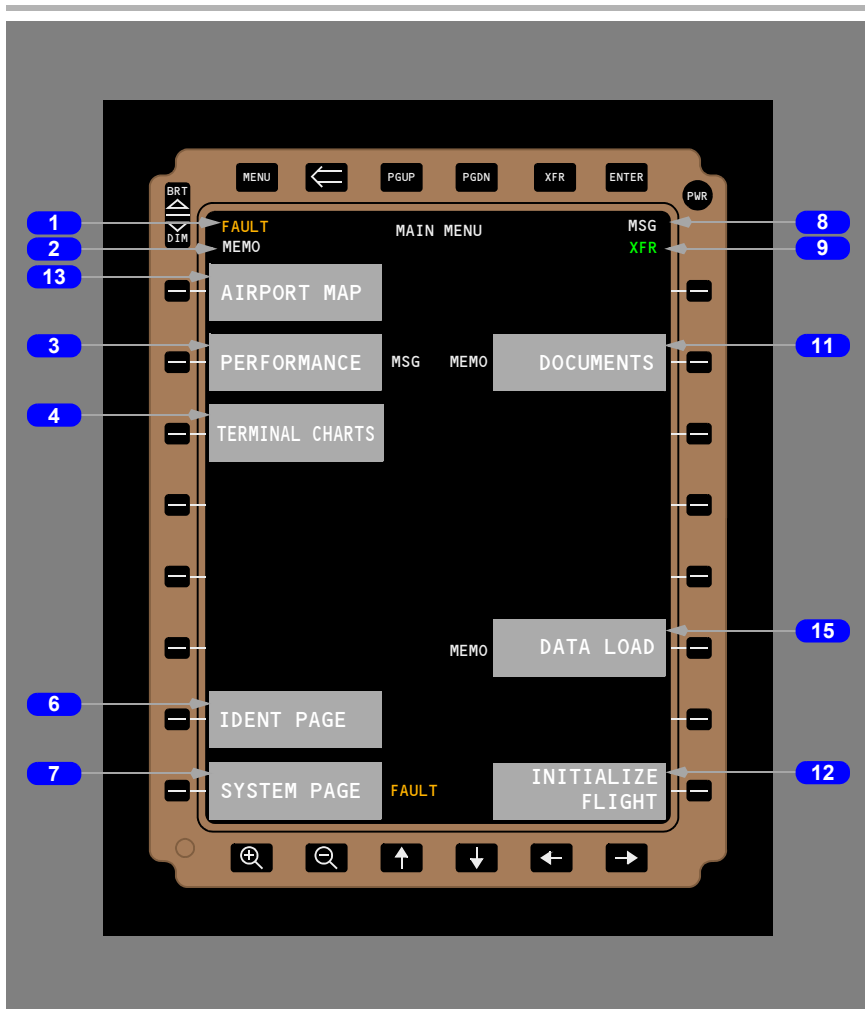
- It is high-lighted with the cursor and the cursor select switch is pushed
- A menu item is touched and released
- A line select key is selected

The menu item for a selected application displays a green background momentarily and then the selection displays.

Main Menu (Typical)







1 FAULT

Displayed (amber) -

- A fault has occurred within an application
- Displays in the header regardless of the application displayed
- Displays next to the SYSTEM PAGE where fault message can be viewed and cleared
- Removed from header upon selection of the SYSTEM page

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.

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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 PERFORMANCE Application

Selects the PERFORMANCE application.

- After flight initialization, displays the takeoff performance page
- Subsequent selections of the application display the selection that was in view when the application was last exited

4 TERMINAL CHARTS

Selects the TERMINAL CHARTS application.

- After flight initialization, displays the ROUTE SETUP page.
- Origin and destination information downloaded from the FMS.

5 LOGBOOK

Selects the LOGBOOK application.

6 IDENT PAGE

Displays the IDENT page.

7 SYSTEM PAGE

Displays the SYSTEM page.

8 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

9 XFR

Displayed (green) -

- The display is in transfer mode
- No selections except MENU and XFR are enabled

10 VIDEO Application

Displays views from surveillance cameras of area outside the flight deck door.

11 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

12 INITIALIZE FLIGHT

Initializes all the installed applications for flight

- 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

13 AIRPORT MAP Application

Selects the AIRPORT MAP application.

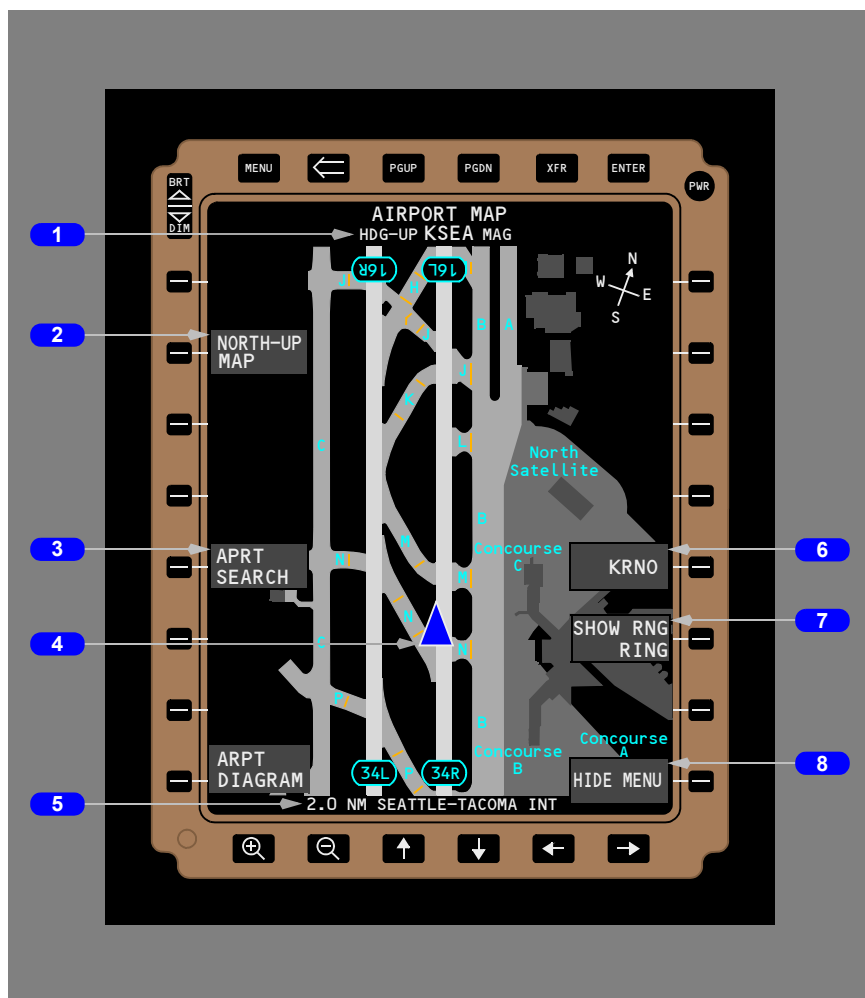
- After flight initialization, displays the departure airport in HDG-UP (heading up) mode when on the ground at the departure airport
- Displays the destination airport NORTH-UP when in the air
- Displays the destination airport HDG-UP when on the ground at the destination airport

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 Heading Up (moving) Map

The airplane symbol remains stationary and the map moves to provide the location and orientation of the airplane relative to the map.



1 Map Reference

Displays the map reference.

- HDG-UP (heading 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
- 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

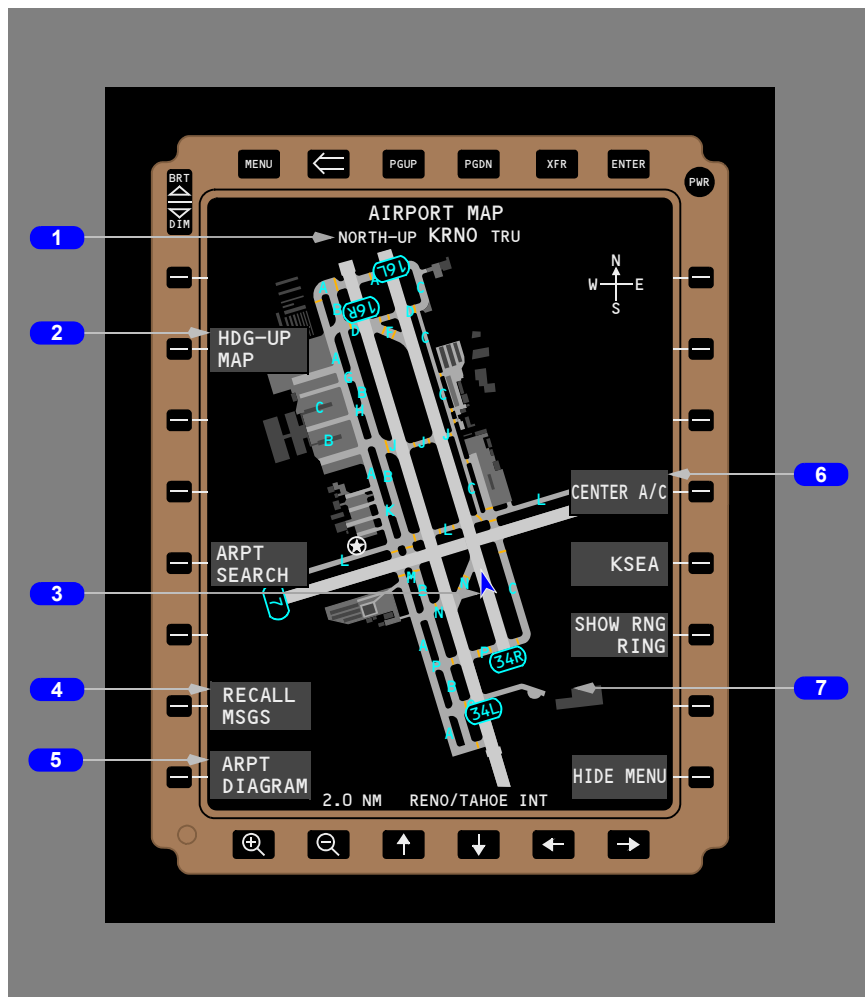
Displays or removes a 1000 foot radius range ring around the airplane symbol.

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.



1 Map reference

Displays the map reference

- NORTH UP
- TRU (true) heading

2 HDG-UP MAP

On the ground, selects heading up moving map display.

In the air, the prompt is HDG -UP ARMED. This enables an automatic change to the HDG-UP display upon landing.

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 ARPT (Airport) DIAGRAM

Displays the airport chart (10-9 chart) for the displayed airport map.

6 CENTER A/C

Centers airplane symbol horizontally and vertically on the display.

7 Map fault message display area

Amber fault messages display in this area. More than one message may display at a time.

Airport Map Faults

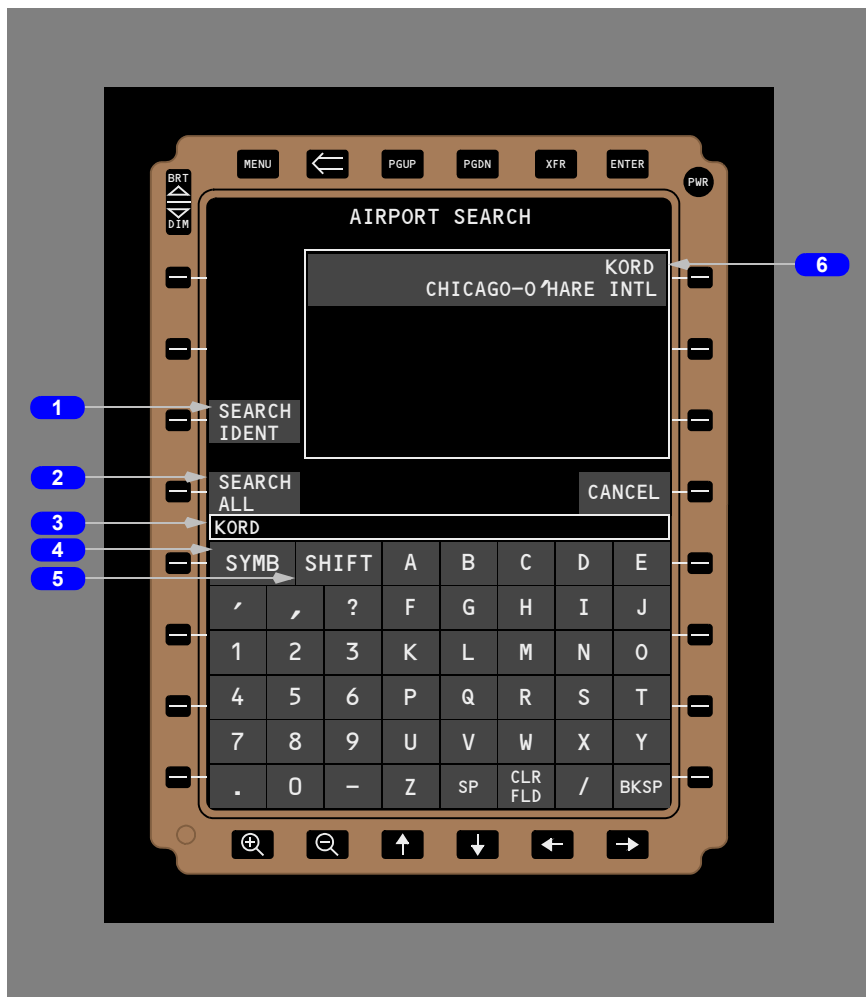
Display (amber) -

Faults may appear on both NORTH-UP and HDG-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

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.

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3 Scratchpad

4 SYMB/NUM key

Alternates between SYMB and NUM.

- SYMB displays symbols on the keypad
- NUM displays numbers on the keypad

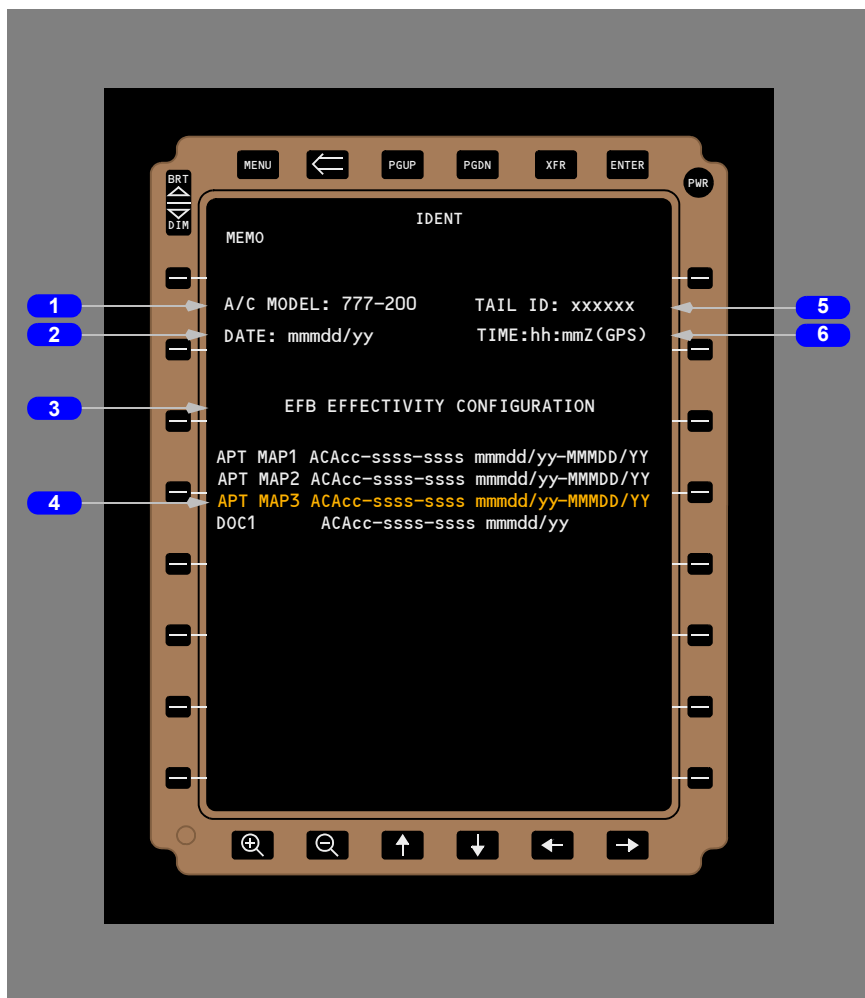
5 SHIFT key

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 (Typical)



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.

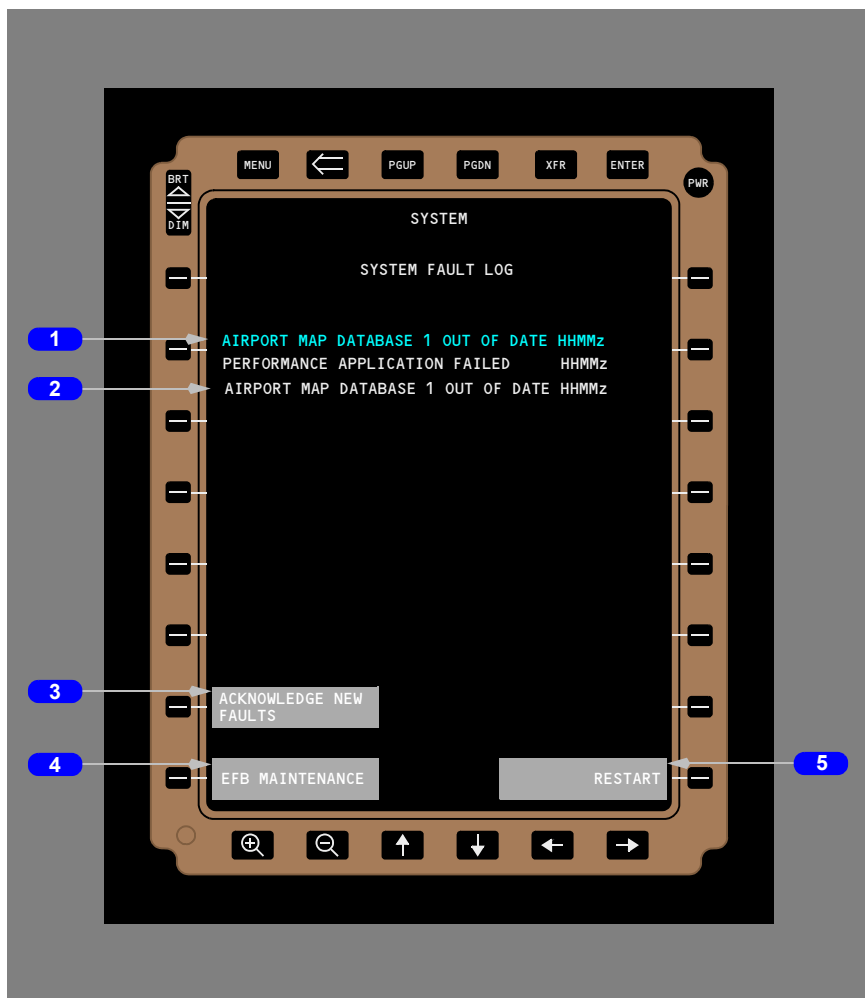
5 TAIL ID

Display of tail identification number.

6 TIME

Display of time and source of time.

SYSTEM page (Typical)



1 Acknowledged fault

Fault information is displayed in cyan.

2 Unacknowledged 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

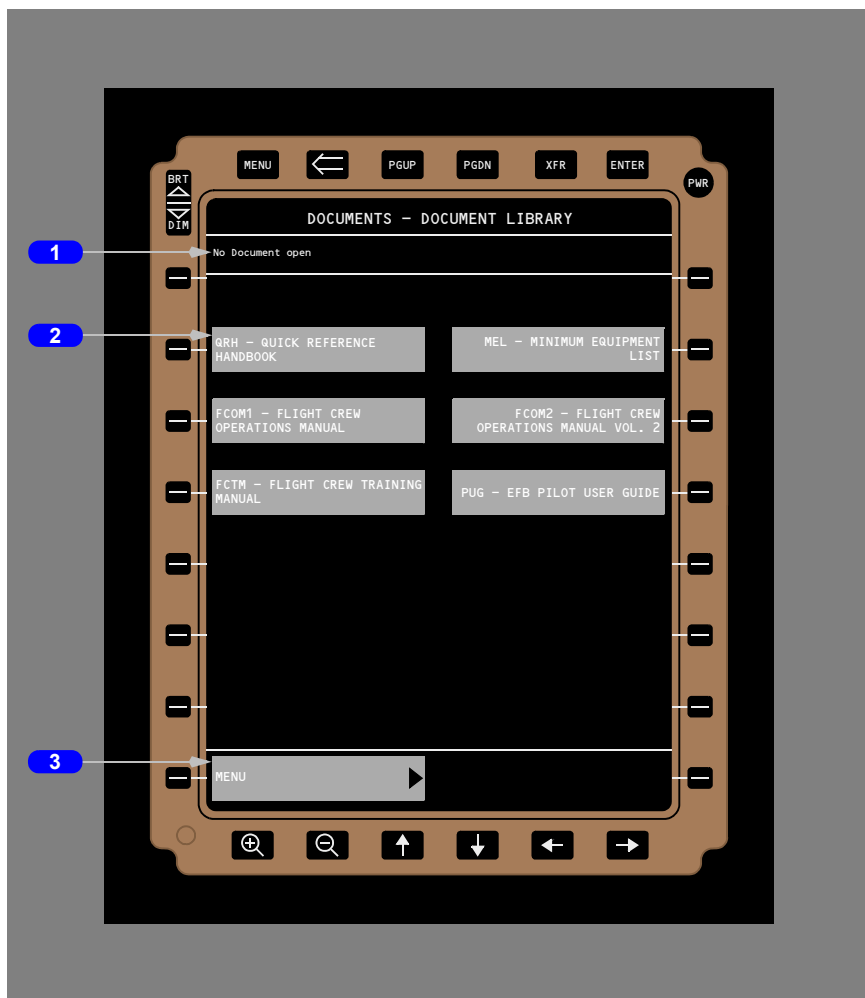
4 EFB MAINTENANCE

Provides access to the maintenance menu page.

5 RESTART

Re-initializes Windows applications.

Documents (Typical)



1 Document hierarchy header

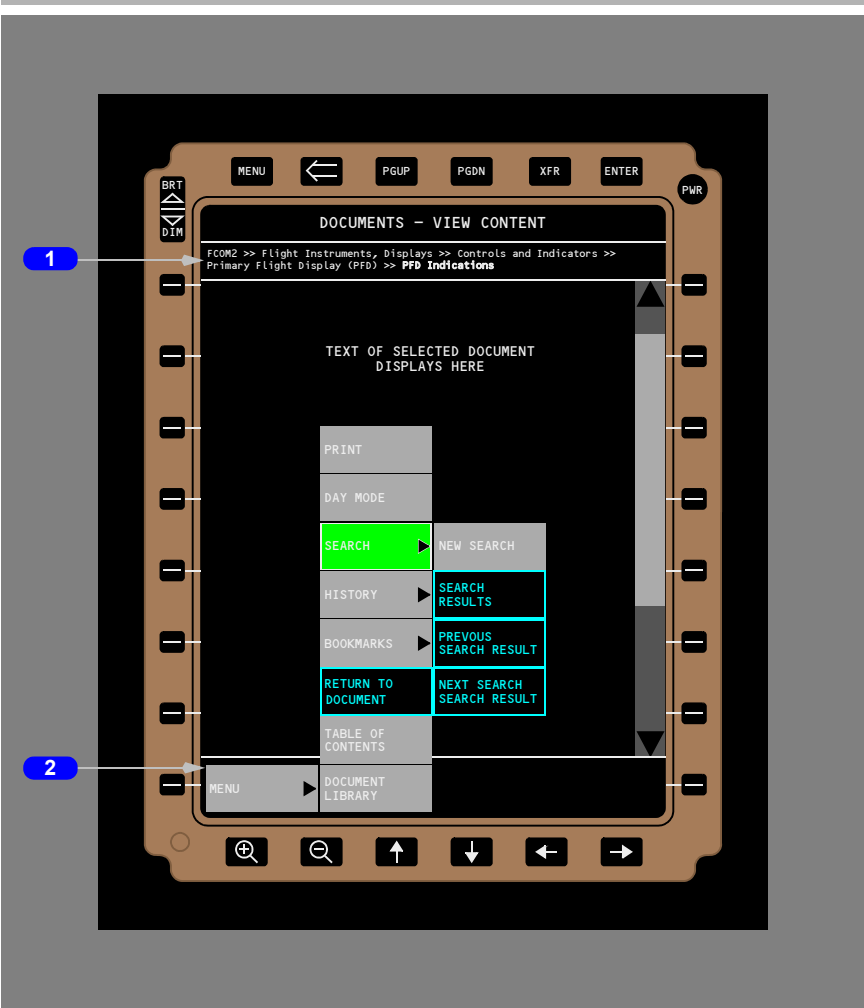
Displays the selected document, section, and sub-section.

2 Selectable documents

Displays the installed and selectable documents.

3 MENU

Initiates cascading menu.



1 Document hierarchy header

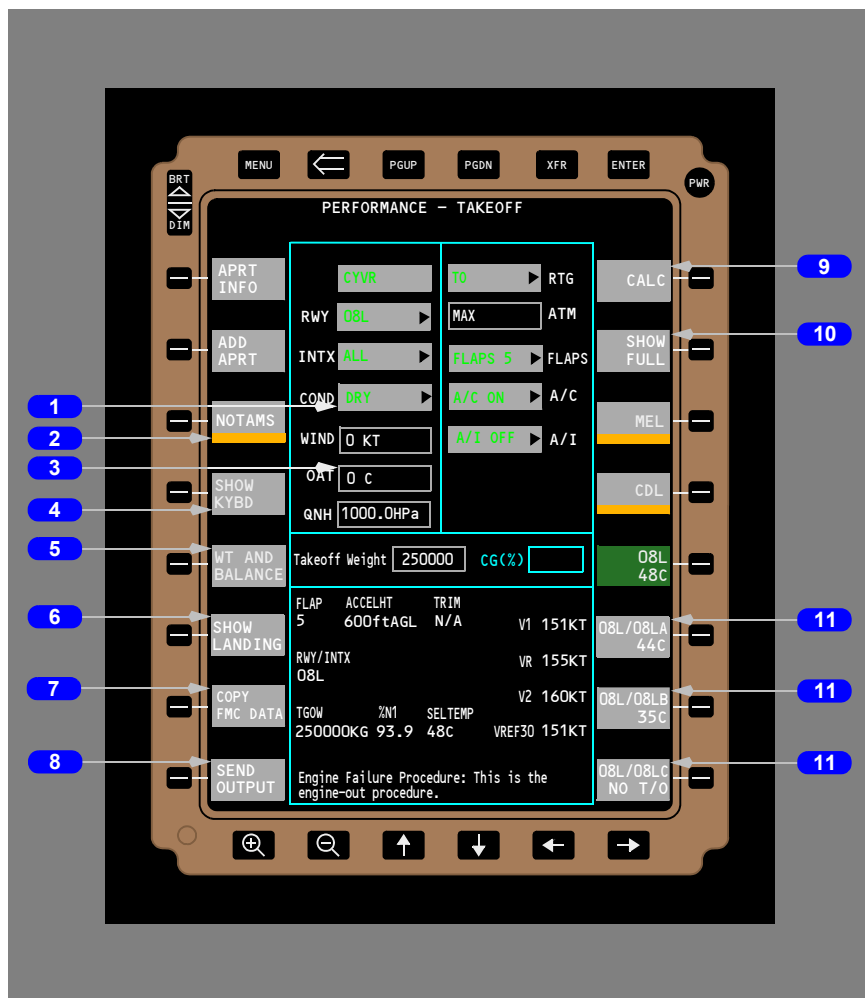
Displays the current document, section, and sub-section.

2 MENU

Initiates cascading menu. Selected item has green background, available item has gray background, and item not selectable is blue. For example, if another function is selected, the RETURN TO DOCUMENT function turns white with a gray background.

- **PRINT** - Information displayed in the VIEW CONTENTS screen is printed on the flight deck printer (if applicable).
- **DAY MODE** - Indicates inactive display mode, selection changes mode to mode indicated. Day mode is dark text on a light background, night mode is light text on a dark background.
- **SEARCH** - Initiates search in multiple documents.
- **HISTORY** - Displays a list of entries as links for information previously displayed in the VIEW CONTENTS screen.
- **BOOKMARKS** - Provides link to return to item bookmarked.
- **RETURN TO DOCUMENT** - Allows return to document from subordinate function.
- **TABLE OF CONTENTS** - For the document selected.
- **DOCUMENT LIBRARY** - Provides list of all available documents.

Performance (Typical)



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 COPY FMC DATA

Cross loads applicable data from FMC.

8 SEND OUTPUT

Opens listing with available options for saving or printing data.

9 CALC (Calculate)

- Cyan - data has not been entered in all required fields
- White - all required fields have data

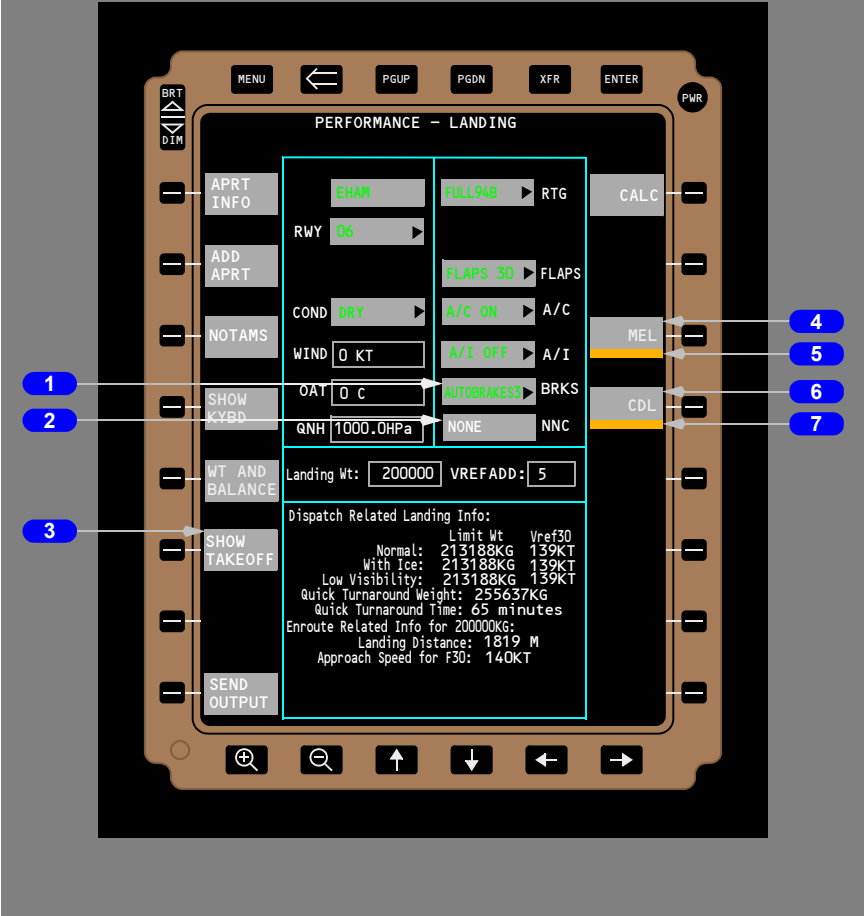
Selection initiates the calculation of takeoff data.

10 SHOW FULL

Selection displays full thrust data for the airport/runway entered.

11 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



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

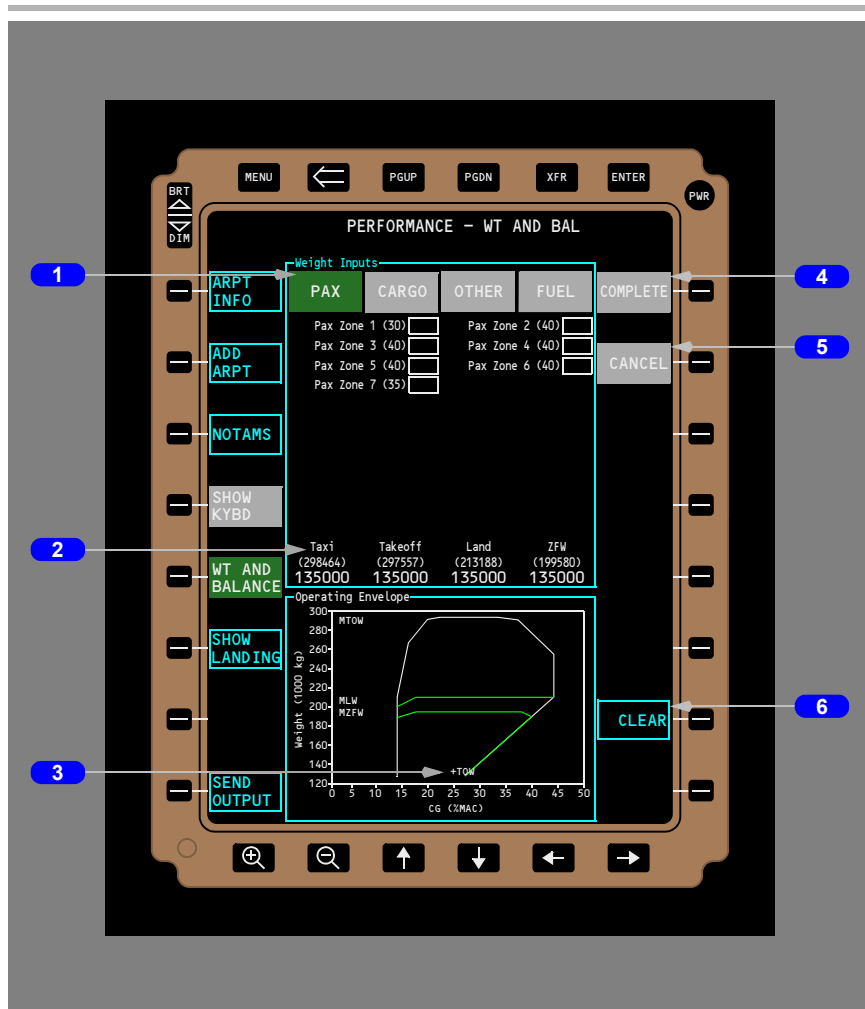
Indicates an active MEL item exists that will be considered in the calculations.

6 CDL

Displays the CDL page.

7 Amber bar

Indicates an active CDL item exists that will be considered in the calculations.



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.

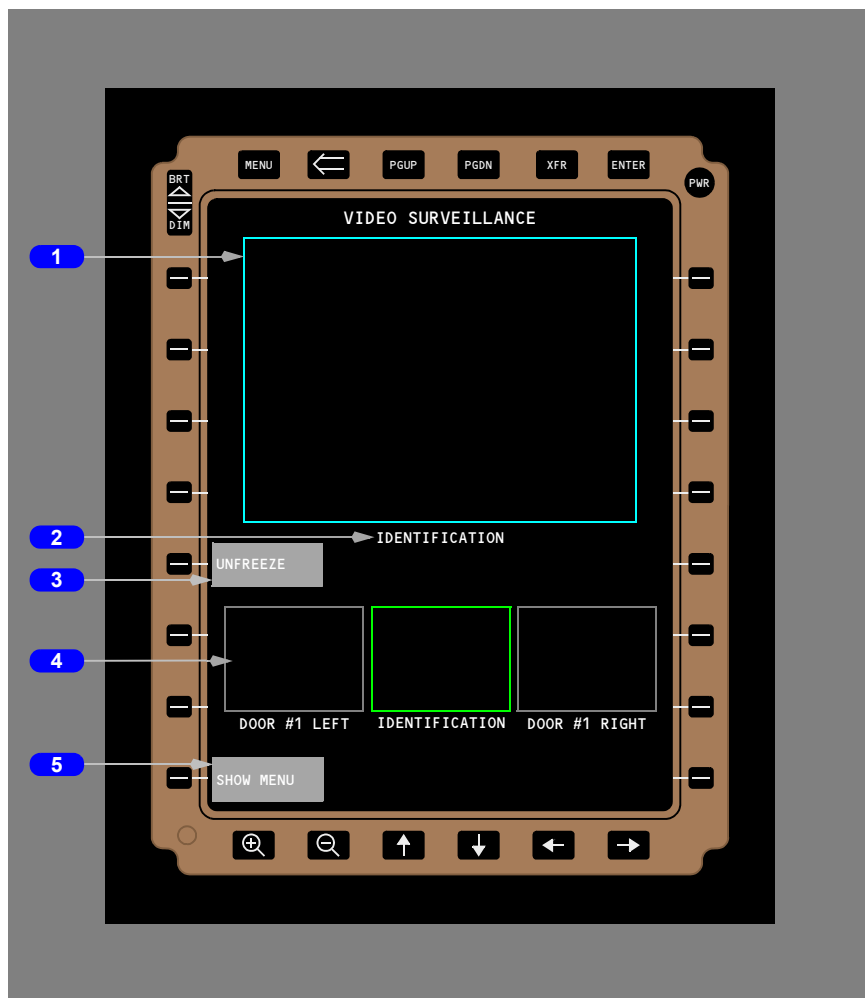
5 CANCEL

Clears all entries and returns to the takeoff page.

6 CLEAR

Clears all entries.

Video Surveillance (Typical)



1 Primary Display

- Selected thumbnail image displays in this area with green border
- Border changes to cyan when FREEZE is selected
- Border is amber when the selected image is not available and NO VIDEO SIGNAL displays

2 Display selection

Name of the selected thumbnail image displays here.

3 FREEZE/UNFREEZE

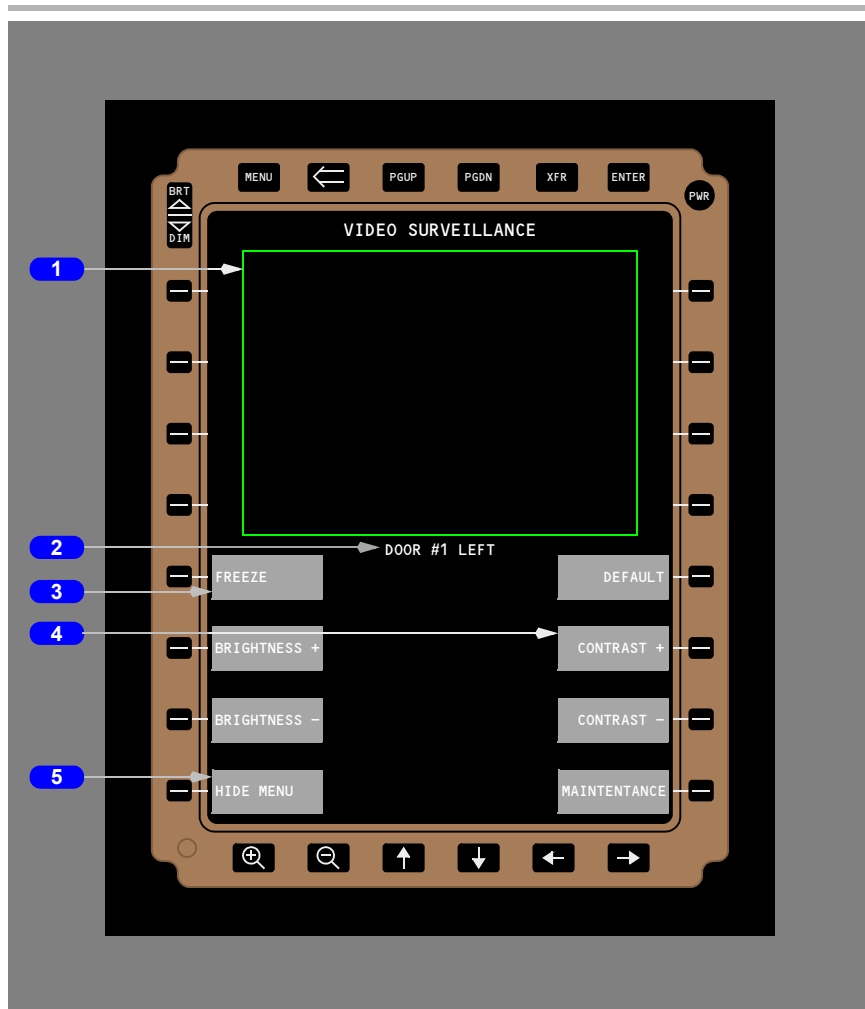
- Selection freezes the image in the primary display
- The display box changes to cyan while the image is frozen
- The menu changes to UNFREEZE

4 Thumbnails

- Thumbnail images display here
- Images with a gray border may be selected for display in the primary display
- Selected image has a green border
- Border is white when the cursor is moved over the image
- Border is amber when the image is not available and NO VIDEO SIGNAL displays

5 SHOW/HIDE MENU

- Selecting SHOW MENU adds the BRIGHT, CONTRAST, and MAINTENANCE menus
- After selecting SHOW MENU, the menu changes to HIDE MENU



1 Primary Display

- Selected thumbnail image displays in this area with green border
- Border changes to cyan when FREEZE is selected
- Border is amber when the selected image is not available and NO VIDEO SIGNAL displays

2 Display selection

Name of the selected thumbnail image displays here.

3 FREEZE/UNFREEZE

- Selection freezes the image in the primary display
- The display box changes to cyan while the image is frozen
- The menu changes to UNFREEZE

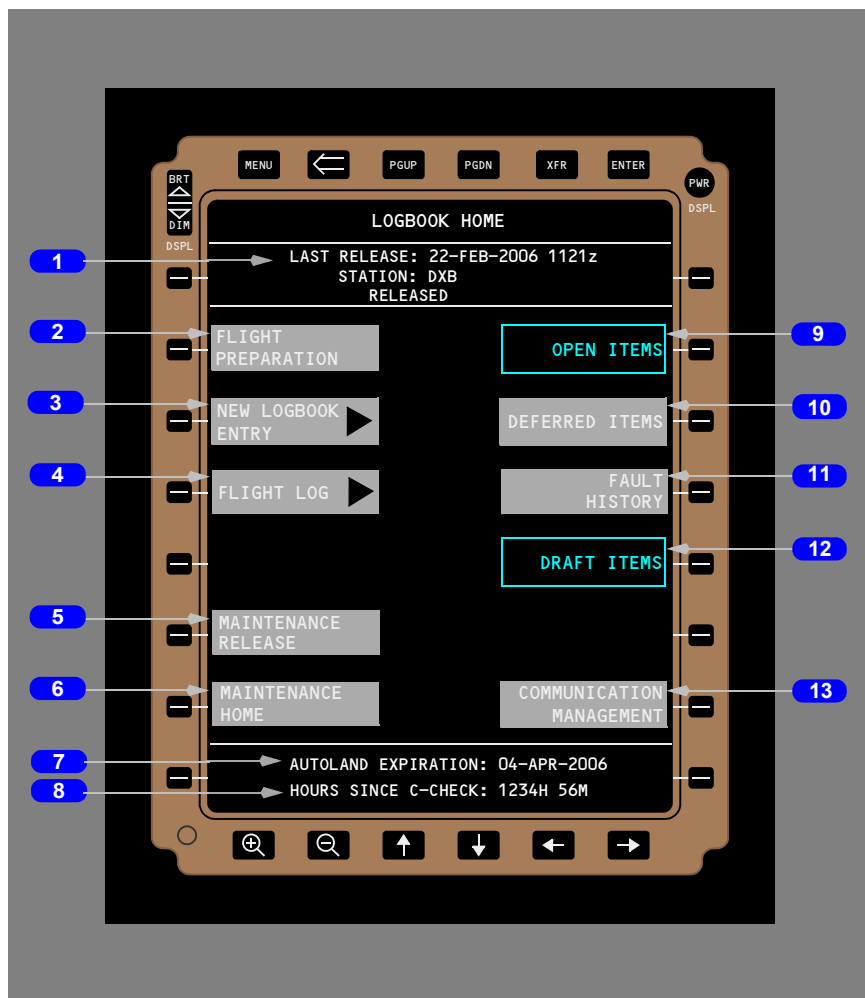
4 BRIGHT/CONTRAST

Changes the brightness and contrast of the image in the primary display as indicated by the + and - selections.

5 SHOW/HIDE MENU

- Selecting HIDE MENU removes the BRIGHT, CONTRAST, and MAINTENANCE menus
- After selecting HIDE MENU, the menu changes to SHOW MENU

Logbook (Typical)



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

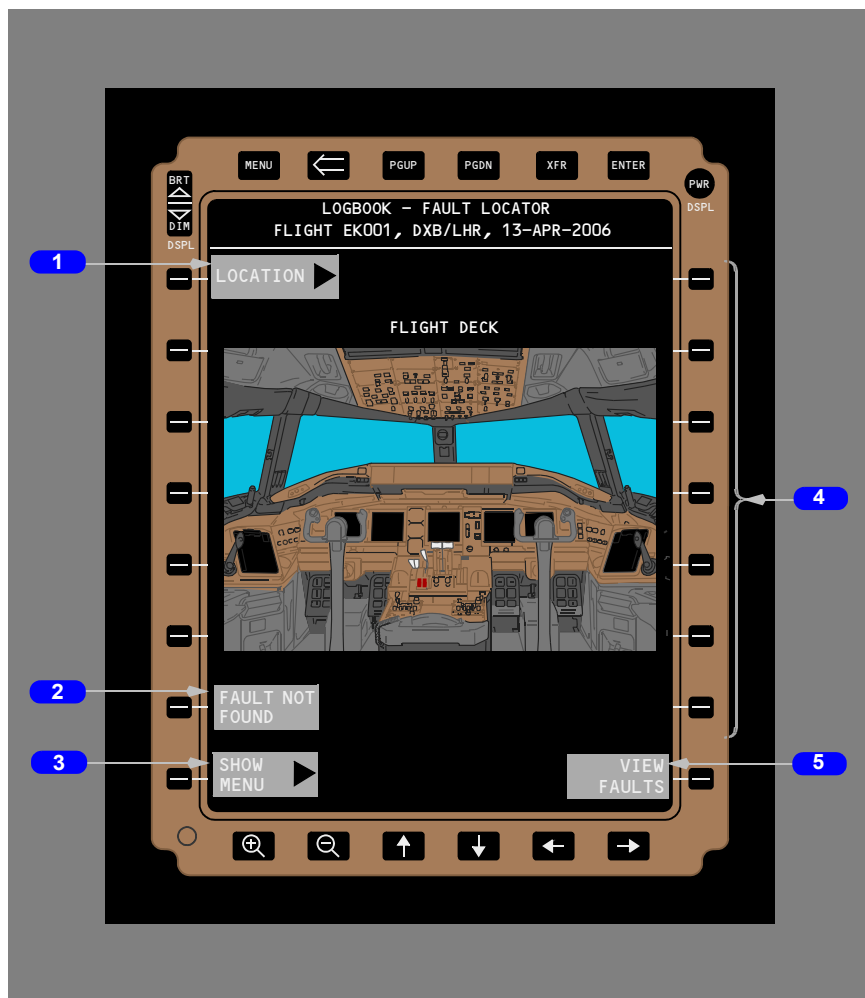
Lists all fault reports for the aircraft. It provides a description of the fault report plus the time it was reported and the current status. This list is organized by the DATE/TIME field.

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.



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 that either shows or hides the extended menu selections.

4 Panel Selection Area

Selection of a boxed area 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 that are returned.

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Flight Instruments, Displays**Chapter 10****EICAS Messages****Section 70****Flight Instruments, Displays EICAS Messages**

Note: The OVERSPEED warning and the ALTITUDE ALERT caution messages are covered in Chapter 15, Warning Systems.

The following EICAS messages can be displayed.

Message	Level	Aural	Message Logic
ALTN ATTITUDE	Advisory		Both AIR DATA/ATTITUDE source switches are in the ALTN position.
BARO SET DISAGREE	Advisory		Captain's and first officer's barometric settings disagree.
CHKL INCOMPLETE NORM	Caution	Beeper	A normal checklist needs to be completed.
CHKL NON-NORMAL	Advisory		A non-normal checklist is not complete, the ECL is not displayed, and the related EICAS message is not shown.
DISPLAY SELECT PNL	Advisory		Left, center, or right CDU control of the display select panel is active.
EFIS CONTROL PNL L, R	Advisory		EFIS control panel is inoperative or CDU control of the EFIS control panel is active.
SGL SOURCE AIR DATA	Advisory		Both PFDs are receiving air data from the same single channel source.
SGL SOURCE DISPLAYS	Caution	Beeper	A single source of display information is being used by some or all display units.
SGL SOURCE RAD ALT	Advisory		Both PFDs are using the same source for radio altimeter information.
SINGLE SOURCE F/D	Advisory		Both PFDs are using the same source for flight director information.
VMO GEAR DOWN	Memo		Vmo value set for dispatch with landing gear extended.

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**Flight Management, Navigation
Table of Contents****Chapter 11
Section TOC**

Controls and Indicators	11.10
Flight Management System	11.10.1
Control Display Unit (CDU)	11.10.1
Function and Execute Keys	11.10.4
Alpha/Numeric and Miscellaneous Keys	11.10.6
CDU Page Components	11.10.7
CDU Page Color	11.10.9
FMC Selector	11.10.12
Air Data Inertial Reference System (ADIRU)	11.10.13
Transponder Panel	11.10.14
Weather Radar Panel	11.10.20
Navigation Systems Description	11.20
Introduction	11.20.1
Navigation Systems Flight Instrument Displays	11.20.1
Global Positioning System (GPS)	11.20.2
GPS Displays	11.20.2
GPS Data	11.20.2
GPS System Schematic	11.20.3
Inertial System	11.20.4
Air Data Inertial Reference System (ADIRS)	11.20.4
Air Data Inertial Reference Unit (ADIRU)	11.20.4
Secondary Attitude and Air Data Reference Unit (SAARU)	11.20.5
Air Data and Attitude Sources	11.20.6
ADIRS Schematic, Normal Mode	11.20.8
ADIRS Schematic, With NAV ADIRU INERTIAL Message	11.20.10
Radio Navigation Systems	11.20.12
Automatic Direction Finding (ADF)	11.20.12
Distance Measuring Equipment (DME)	11.20.12

Instrument Landing System (ILS)	11.20.13
Navaid Identifier Decoding	11.20.14
VOR	11.20.15
Transponder	11.20.16
Weather Radar	11.20.17
Threat Assessment Feature	11.20.18
Flight Management System Description	11.30
Introduction	11.30.1
Flight Management Computer (FMC)	11.30.2
Control Display Units (CDUs)	11.30.3
Flight Management System Operation	11.31
Introduction	11.31.1
Preflight	11.31.1
Takeoff	11.31.2
Climb	11.31.2
Cruise	11.31.2
Descent	11.31.2
Approach	11.31.2
Flight Complete	11.31.2
Operational Notes	11.31.3
Terminology	11.31.5
Maintenance Index	11.31.7
Navigation Position	11.31.8
FMC Position Update	11.31.8
FMC Polar Operations	11.31.10
Navigation Performance	11.31.13
Lateral Navigation (LNAV)	11.31.15
Waypoints	11.31.15
ND Map Displays	11.31.22
Vertical Navigation (VNAV)	11.31.23
Vertical Actual Navigation Performance (VANP)	11.31.23

Speed/Altitude Constraints	11.31.23
Takeoff and Climb	11.31.24
MCP Altitude Intervention	11.31.26
Cruise	11.31.26
Cruise Climb	11.31.26
Step Climb	11.31.27
Cruise Descent	11.31.28
Required Time of Arrival (RTA)	11.31.28
MCP Speed Intervention	11.31.28
Descent	11.31.29
Early Descent	11.31.32
Cruise and Descent Profile (Instrument Approach Using VNAV)	11.31.33
Approach	11.31.35
Missed Approach	11.31.36
Engine Out Operation	11.31.37
Takeoff and Climb	11.31.37
Climb (Above EO Max Alt)	11.31.39
Cruise (Above EO Max Alt)	11.31.39
Data Entry Rules	11.31.41
Altitude Entry	11.31.41
Airspeed Entry	11.31.41
Data Pairs	11.31.42
Flight Management Computer	11.32
FMC Databases	11.32.1
Thrust Management	11.32.2
Reduced Thrust Takeoff	11.32.4
Derated Thrust Climb	11.32.5
Fuel Monitoring	11.32.6
Loss of FMC Electrical Power	11.32.8
FMC Failure	11.32.9
Single FMC Failure	11.32.9
Dual FMC Failure	11.32.9

Air Traffic Control Data Link	11.33
Air Traffic Control Data Link	11.33.1
Company Data Link	11.34
Company Data Link	11.34.1
Data Link	11.34.3
Uplinks	11.34.5
Data Link Management	11.34.11
CDU Data Link Status Displays	11.34.11
FMC Communications Page	11.34.12
FMC Preflight	11.40
Introduction	11.40.1
Preflight Page Sequence	11.40.1
Minimum Preflight Sequence	11.40.2
Supplementary Pages	11.40.3
Preflight Pages – Part 1	11.40.4
Initialization/Reference Index Page	11.40.4
Identification Page	11.40.6
Position Initialization Page 1/3	11.40.11
Position Reference Page 2/3	11.40.14
Position Reference Page 3/3	11.40.17
Route Page 1/X	11.40.19
More Route Page Prompts for an Active Route	11.40.22
Route Page 2/X	11.40.23
Departure/Arrival Index Page	11.40.26
Departures Page	11.40.28
Navigation Radio Page	11.40.30
VOR	11.40.30
ADF	11.40.33
ILS	11.40.34
ILS Tuning Status	11.40.36
Preflight Pages – Part 2	11.40.38
Performance Initialization Page	11.40.38

Thrust Limit Page	11.40.43
Takeoff Reference Page 1/2	11.40.47
Takeoff Reference Page 2/2	11.40.54
Menu Page	11.40.59
FMC Takeoff and Climb	11.41
Introduction	11.41.1
Takeoff.	11.41.1
Climb	11.41.2
Altitude Intervention.	11.41.2
Climb Page	11.41.3
RTE X LEGS Page.	11.41.7
Thrust Limit Page	11.41.10
Engine Out Climb	11.41.12
EO CLB Page	11.41.12
Engine Out Departure.	11.41.13
Air Turnback	11.41.15
Arrivals Page	11.41.15
FMC Cruise.	11.42
Introduction	11.42.1
LNAV Modifications.	11.42.2
RTE LEGS Page Modifications	11.42.2
Add Waypoints.	11.42.3
Delete Waypoints	11.42.5
Change Waypoint Sequence.	11.42.6
Remove Discontinuities	11.42.7
Direct To And Intercept Course To	11.42.8
Intercept Course From	11.42.11
Select Desired Waypoint Page	11.42.13
Airway Intercept.	11.42.15
Route Offset	11.42.18
Cruise Page	11.42.19
All Engine Cruise	11.42.19

Engine Out Cruise	11.42.22
VNAV Modifications	11.42.25
Cruise Climb	11.42.25
Planned Step Climb	11.42.25
Calculated Step Climb	11.42.27
Constant Speed Cruise	11.42.32
Cruise Descent	11.42.33
Early Descent	11.42.34
Navigation Data	11.42.35
Reference Navigation Data Page	11.42.35
Fix Information Page	11.42.38
Route and Waypoint Data	11.42.42
Route Data Page	11.42.42
Wind Data	11.42.44
Wind Page	11.42.45
Position Report Page	11.42.47
In-Flight Position Update	11.42.49
Progress Pages	11.42.51
Progress Page 1	11.42.51
Progress Page 2	11.42.54
RTA Progress Page 3	11.42.57
RNP Progress Page 4	11.42.60
FMC Descent and Approach	11.43
Introduction	11.43.1
Descent	11.43.2
Altitude Intervention	11.43.2
Descent Page	11.43.3
Descent Forecast Page	11.43.7
Offpath Descent Page	11.43.9
Engine Out Descent	11.43.10
Approach	11.43.11
Arrivals Page	11.43.12
Arrivals Page – IFR Approaches	11.43.13

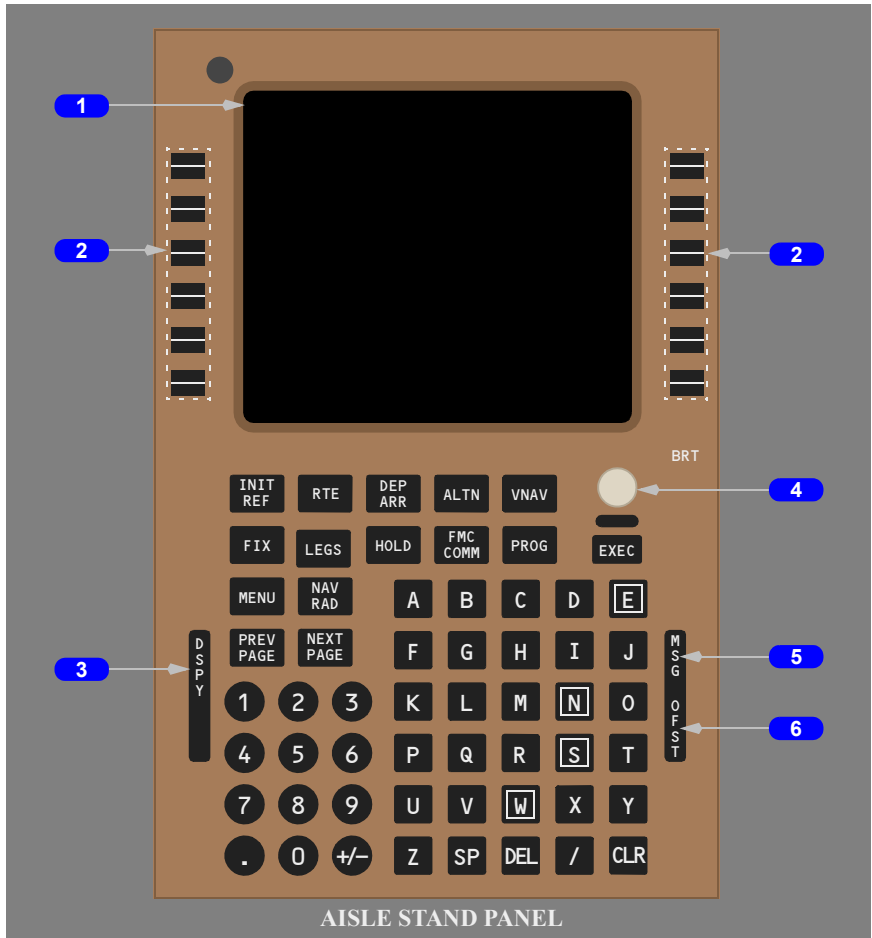
Arrivals Legs Page	11.43.15
Arrivals Page – VFR Approaches	11.43.16
Procedure Hold (in lieu of procedure turn) Legs Page	11.43.19
Approach Reference Page	11.43.20
Alternate Airport Diversions	11.43.23
Alternate Page 1/2	11.43.23
Alternate List Page 2/2	11.43.27
XXXX Alternate Page	11.43.28
Holding	11.43.32
Holding Entry	11.43.32
Hold Page (First Hold)	11.43.32
HOLD Page (Existing Hold)	11.43.36
FMS Alternate Navigation System Description	11.50
Introduction	11.50.1
Alternate Navigation Waypoints	11.50.2
Alternate Lateral Navigation	11.50.2
Route Changes	11.50.2
Course Reference	11.50.2
Alternate Navigation Radio Tuning	11.50.2
Alternate Navigation CDU Pages	11.50.4
Alternate Navigation Legs Page	11.50.4
Alternate Navigation Progress Page	11.50.6
Alternate Navigation Radio Page	11.50.8
EICAS Messages	11.60
Navigation EICAS Messages	11.60.1
FMC Messages	11.60.3
FMC Alerting Messages	11.60.4
FMC Communications Messages	11.60.8
FMC Advisory Messages	11.60.9
FMC Entry Error Messages	11.60.11
CDU Annunciator Lights	11.60.13

Intentionally
Blank

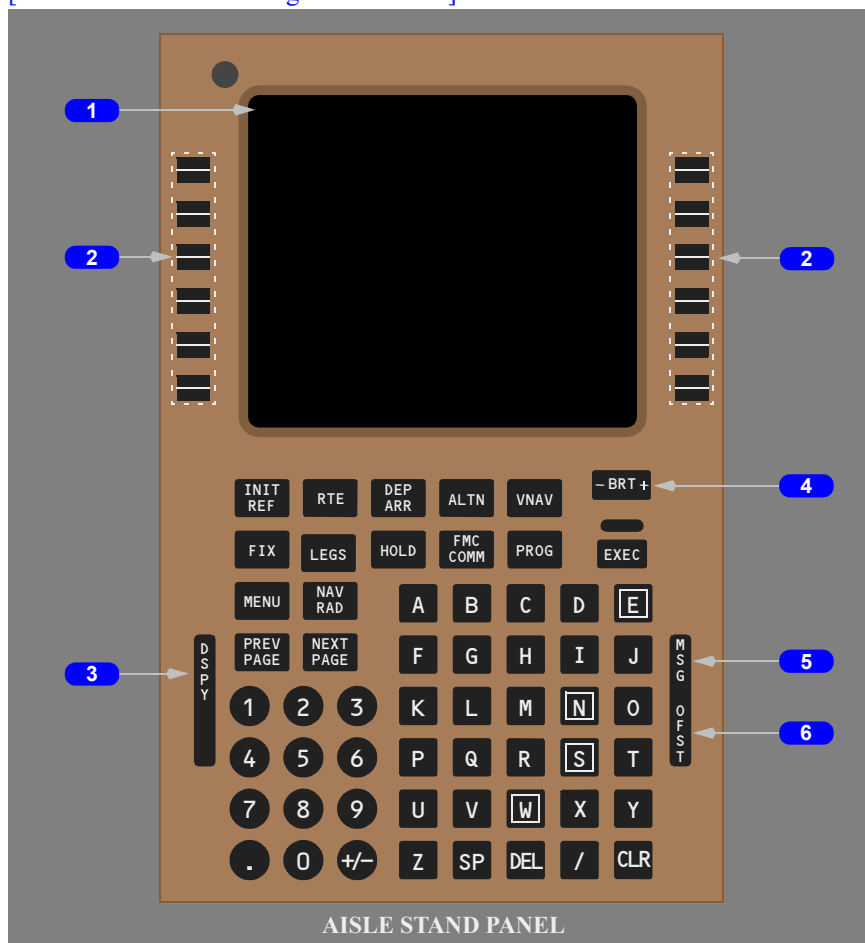
**Flight Management, Navigation
Controls and Indicators**

**Chapter 11
Section 10**

**Flight Management System
Control Display Unit (CDU)**



[CDU with rocker arm brightness control]



1 Control Display Unit (CDU) Display

Displays 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 displays in scratchpad.

Conventions -

- scratchpad must be blank for line select transfer
- data can not be transferred to a blank line
- a blank scratchpad can not be transferred to a line
- not all data can be modified
- message displays if inappropriate entries attempted.

3 Display (DSPY) Light

Illuminated (white) –

- when RTE page 3 or greater, RTE LEGS page 2 or greater, RTE DATA page 2 or greater is displayed
- when airplane is not in holding pattern shown on HOLD page
- when modification is in progress, and any RTE, RTE LEGS, RTE DATA, HOLD, or VNAV page is shown.

4 Brightness (BRT) Control

Rotate – controls display brightness.

4 Brightness (BRT) Control

Push –

- “+” increases brightness
- “-” decreases brightness
- 24 segment light brightness bar displays in the scratchpad and remains displayed for 2 seconds after release of the + or - push. Existing scratchpad information is saved and displays following fade of the brightness bar

5 Message (MSG) Light

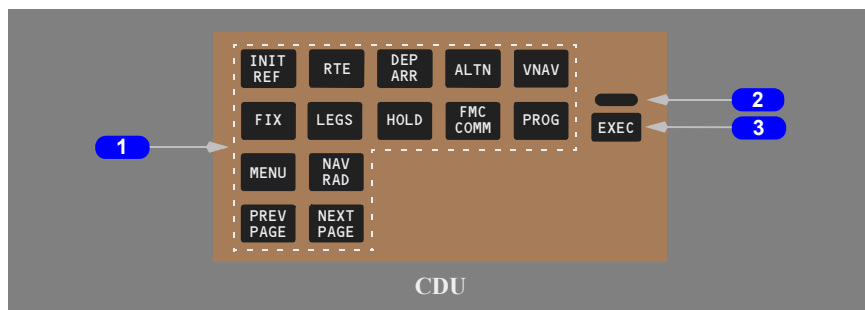
Illuminated (white) –

- scratchpad displays message
- pushing clear key extinguishes light and clears message.

6 Offset (OFST) Light

Illuminated (white) – LNAV gives guidance for lateral route offset.

Function and Execute Keys



1 CDU Function Keys

Push –

- INIT REF – displays page for data initialization or for reference data
- RTE – displays page to input or change origin, destination, or route
- DEP ARR – displays page to input or change departure and arrival procedures
- ALTN – displays page to modify destination and route for alternate diversion
- VNAV – displays page to view or change vertical navigation path data
- FIX – displays page to create reference points on ND map
- LEGS –
 - displays page to evaluate or modify lateral and vertical route data
 - displays page to correlate route waypoints on the ND
- HOLD – displays page to create holding patterns and display holding pattern data, or to exit holding pattern
- FMC COMM – displays FMC data link status page
- PROG – displays page to view dynamic flight and navigation data, including waypoint and destination ETAs, fuel remaining, arrival estimates, and RTA and RNP information
- MENU – displays page to choose subsystems controlled by CDU
- NAV RAD – displays page to view or control navigation radio tuning
- PREV PAGE – displays previous page of multiple page displays (for example, LEGS pages)
- NEXT PAGE – displays next page of multiple page displays.

2 Execute Light

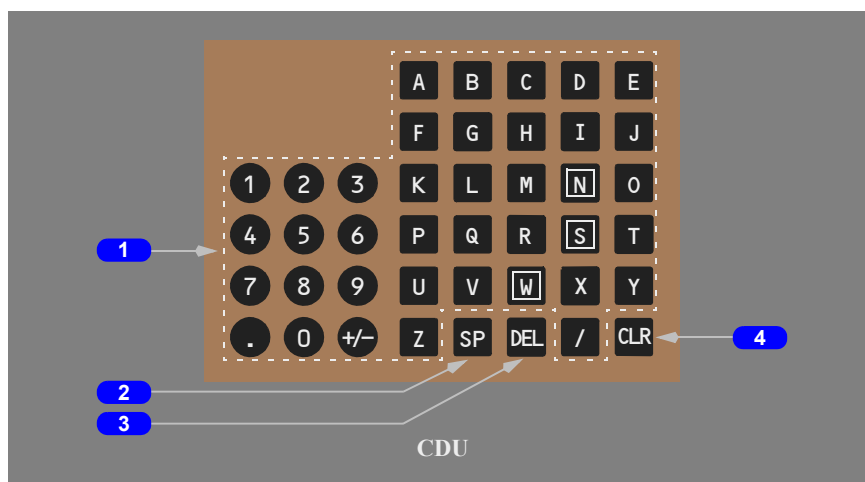
Illuminated (white) – active data is modified but not executed.

3 Execute (EXEC) Key

Push –

- activates data modification(s)
- extinguishes execute light.

Alpha/Numeric and Miscellaneous Keys



1 Alpha/Numeric Keys

Push –

- puts selected character in scratchpad
- Slash (/) key – enters “/” in scratchpad
- Plus Minus (+/-) key – first push enters “-” in scratchpad. Subsequent pushes alternate between “+” and “-”.

2 Space (SP) Key

Push –

- enters space in scratchpad
- enters underscore character “_” in scratchpad when CDU is used as input device for systems other than FMC.

3 Delete (DEL) Key

Push – enters “DELETE” in scratchpad.

4 Clear (CLR) Key

Push –

- clears last scratchpad character
- clears scratchpad message.

Push and hold – clears all scratchpad data.

CDU Page Components



1 Page Title

Subject or name of data displayed on page.

ACT (active) or MOD (modified) indicates whether page contains active or modified data.

2 Boxes

Data input is mandatory.

3 Line Title

Title of data on line below.

4 Data Line

Displays –

- prompts
- selectors
- data associated with line title.

Large font indicates crew entered or verified data. Small font indicates FMC computed data.

5 Page Number

Left number is page number. Right number is total number of related pages. Page number is blank when only one page exists.

6 Dashes

Data input is optional.

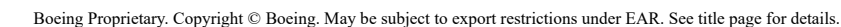
Boeing Proprietary. Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details.

7 Prompts

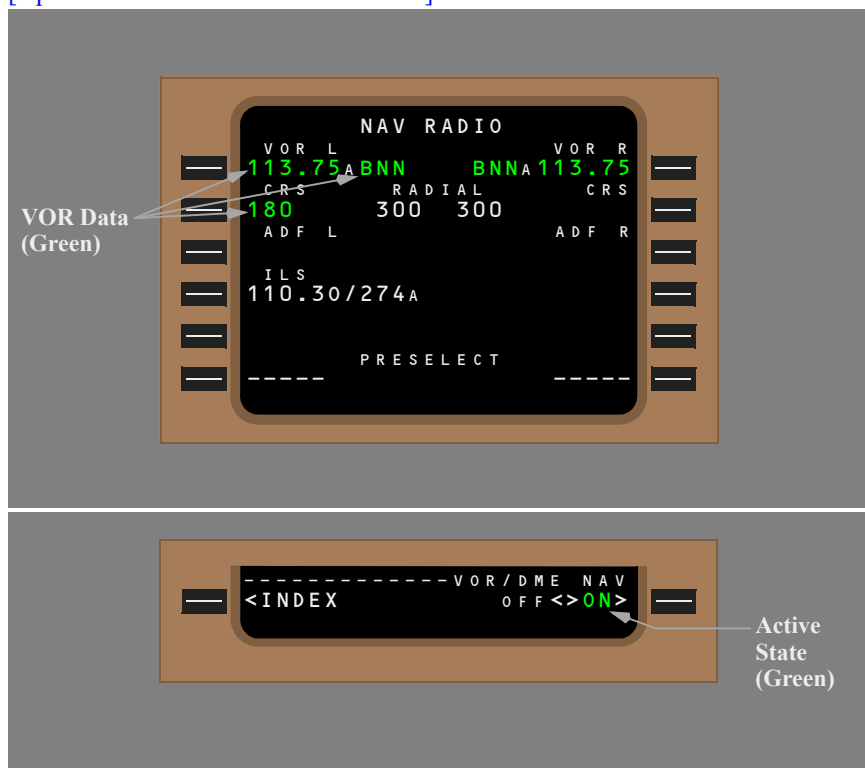
Display pages, select modes, and control displays. Caret “<” or “>” is before or after prompt.

8 Scratchpad

Displays messages, alphanumeric entries, or line selected data.



[Option: ADF removed or not installed]



Color is used as follows:

- black – background color of page

[Option: ADF installed]

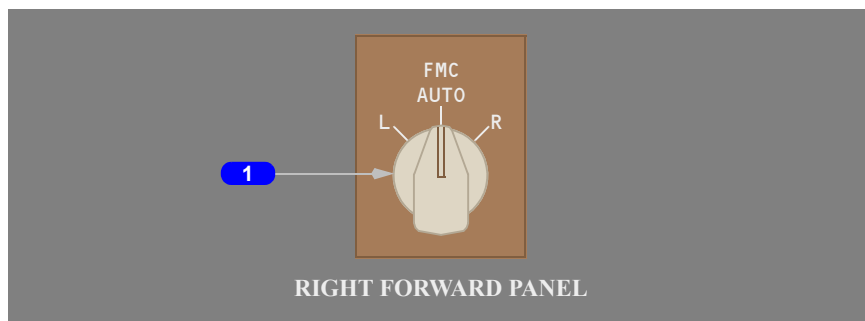
- cyan –
 - ADF frequencies
 - inactive RTE page title

[Option: ADF removed or not installed]

- cyan –
 - inactive RTE page title
- green –
 - navigation radio data
 - 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

- shaded white –
 - modifications
 - MOD precedes page titles of modified pages
- white – most data.

FMC Selector



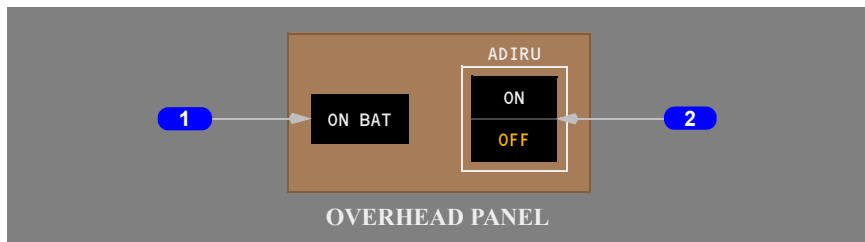
1 FMC Selector

L – selects left FMC to provide guidance commands.

AUTO – automatically selects other FMC if one FMC fails.

R – selects right FMC to provide guidance commands.

Air Data Inertial Reference System (ADIRU)



1 On Battery (ON BAT) Light

Illuminated (white) – airplane battery powers ADIRU.

Note: The ON BAT light illuminates when the ADIRU switch is selected ON and ground power or primary power is subsequently removed or fails (battery power only remains).

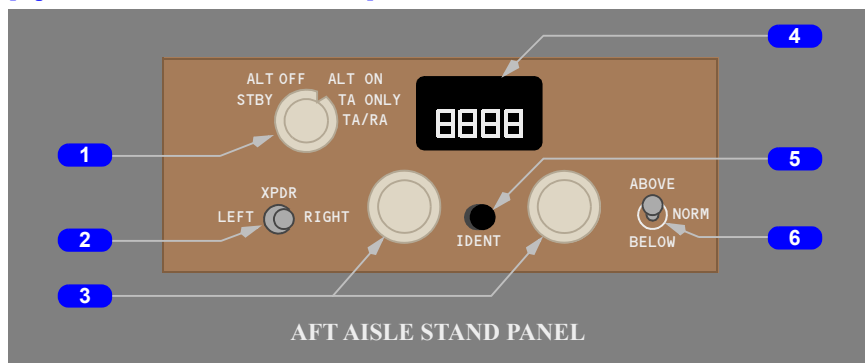
2 ADIRU Switch

ON – applies power to ADIRU.

OFF – removes power when airspeed is less than 30 knots.

Transponder Panel

[Option: Bendix 071-01503-2901]



1 Transponder Mode Selector

STBY (standby) –

- transponder disabled
- ADS-B out (if installed) disabled.

ALT OFF (altitude) –

- transponder enabled in modes A and S
- altitude reporting disabled
- ADS-B out (if installed) enabled

ALT ON (altitude) –

- transponder enabled in modes A, C, and S
- in flight, altitude reporting enabled
- ADS-B out (if installed) enabled

TA ONLY (traffic advisory) and TA/RA (traffic advisory/resolution advisory) –
Refer to Chapter 15, Warning Systems.

2 Transponder (XPDR) Switch

LEFT – selects left transponder and ADIRU as source for transponder altitude reporting.

RIGHT – selects right transponder and SAARU as source for transponder altitude reporting.

3 Transponder Code Selectors

Rotate – sets transponder code.

4 Transponder Code Display

Displays transponder code.

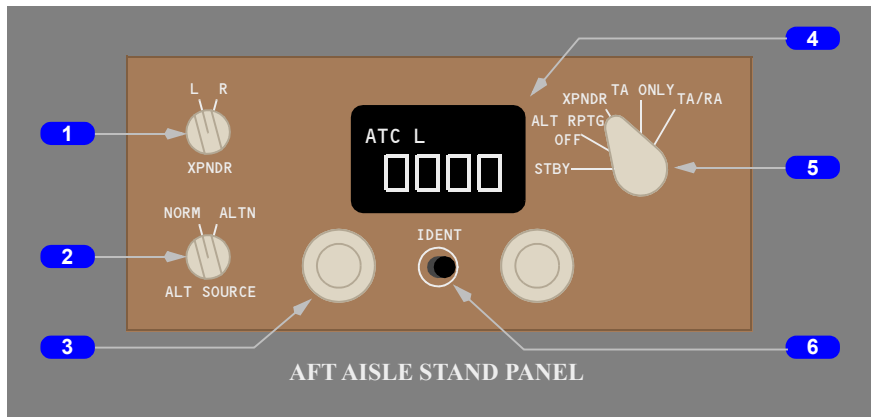
5 Identification (IDENT) Switch

Push – transmits ident signal.

6 TCAS Airspace Switch

Refer to Chapter 15, Warning Systems.

[Option: Gables G7131-01, -02]

**1 Transponder (XPNDR) Selector**

L – selects left transponder.

R – selects right transponder.

2 Altitude (ALT) SOURCE Selector

NORM (normal) – selects ADIRU as source for altitude reporting.

ALTN (alternate) – selects SAARU as source for altitude reporting.

3 Transponder Code Selectors

Rotate – Sets transponder code in transponder.

4 Transponder Code Window

ATC L, ATC R – transponder selected.

Displays transponder code.

5 Transponder Mode Selector

STBY (standby) –

- transponder disabled
- ADS-B out (if installed) disabled

ALT RPTG (altitude reporting) OFF –

- transponder enabled in modes A and S
- altitude reporting disabled
- ADS-B out (if installed) enabled

XPNDR (transponder) –

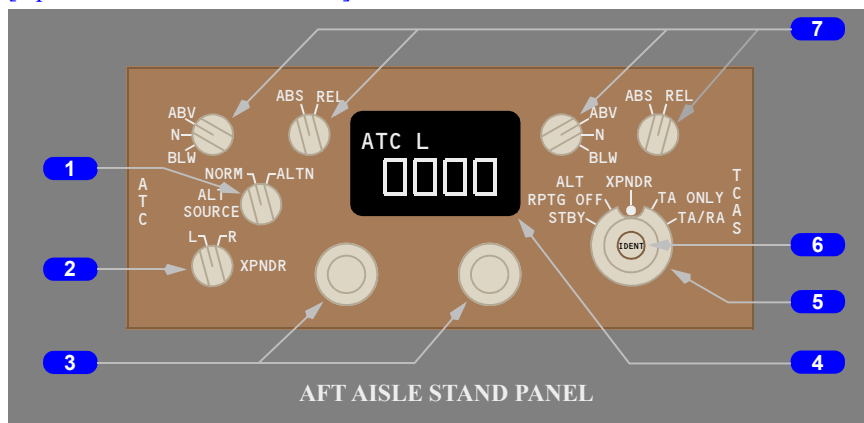
- transponder enabled in modes A, C, and S
- in flight, altitude reporting enabled
- ADS-B out (if installed) enabled

TA (traffic advisory) ONLY and TA/RA (resolution advisory) – Refer to Chapter 15, Warning Systems.

6 Identification (IDENT) Switch

Push – transmits an identification signal.

[Option: Gables G7131-03, -04]



1 Altitude (ALT) SOURCE Selector

NORM (normal) – selects ADIRU as source for altitude reporting.

ALTN (alternate) – selects SAARU as source for altitude reporting.

2 Transponder (XPNDR) Selector

L – selects left transponder.

R – selects right transponder.

3 Transponder Code Selectors

Rotate – Sets transponder code in transponder.

4 Transponder Code Window

ATC L, ATC R – transponder selected.

Displays transponder code.

5 Transponder Mode Selector

STBY (standby) –

- transponder disabled
- ADS-B out (if installed) disabled

ALT RPTG (altitude reporting) OFF –

- transponder enabled in modes A and S
- altitude reporting disabled
- ADS-B out (if installed) enabled

XPNDR (transponder) –

- transponder enabled in modes A, C, and S
- in flight, altitude reporting enabled
- ADS-B out (if installed) enabled

TA (traffic advisory) ONLY and TA/RA (resolution advisory) – Refer to Chapter 15, Warning Systems.

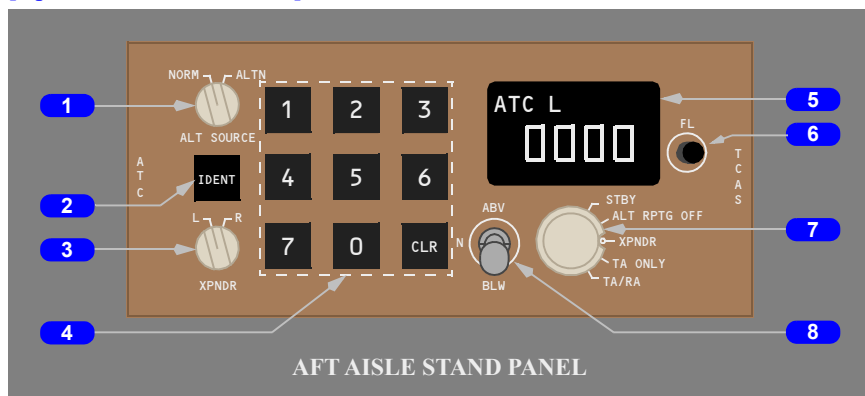
6 Identification (IDENT) Switch

Push – transmits an identification signal.

7 TCAS Controls

Refer to Chapter 15, Warning Systems.

[Option: Gables G7156-01]



1 Altitude (ALT) SOURCE Selector

NORM (normal) – selects ADIRU as source for altitude reporting.

ALTN (alternate) – selects SAARU as source for altitude reporting.

2 Identification (IDENT) Switch

Push – transmits ident signal.

3 Transponder (XPNDR) Selector

L – selects left transponder.

R – selects right transponder.

4 Transponder Code Switches

Push – sets transponder code.

5 Transponder Code Display

ATC L, ATC R – transponder selected.

Displays transponder code.

6 TCAS Flight Level (FL) Switch

Refer to Chapter 15, Warning Systems.

7 Transponder Mode Selector

STBY (standby) –

- transponder disabled
- ADS-B out (if installed) disabled

ALT RPTG OFF (altitude reporting) –

- transponder enabled in modes A and S
- altitude reporting disabled
- ADS-B out (if installed) enabled

XPNDR (transponder) –

- transponder enabled in modes A, C, and S
- on the ground, and in flight, altitude reporting enabled
- ADS-B out (if installed) enabled

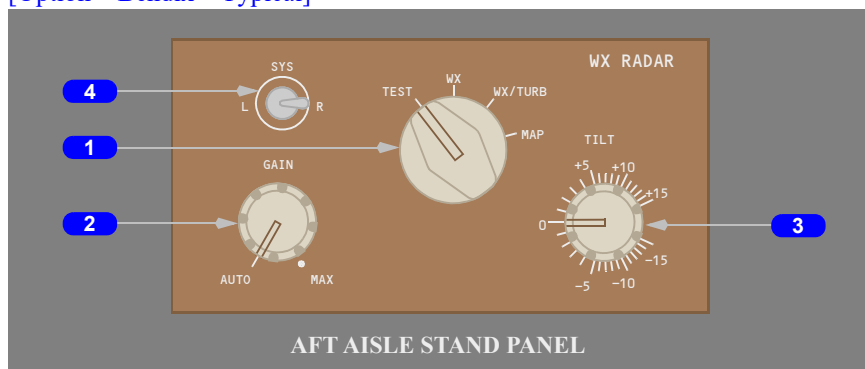
TA ONLY (traffic advisory) and TA/RA (traffic advisory/resolution advisory) –
Refer to Chapter 15, Warning Systems.

8 TCAS Airspace Switch

Refer to Chapter 15, Warning Systems.

Weather Radar Panel

[Option – Bendix – Typical]



1 Mode Selector

Rotate – Selects mode and controls display on NDs.

TEST –

- tests weather radar system operation without transmitting
- displays test pattern and any fault message on ND with WXR selected (except in PLAN, CTR VOR, and CTR APP modes)
- when on the ground, selecting WXR on the EFIS control panel and TEST on the weather radar control panel activates an 8 second test. Initially, the EICAS alert message WINDSHEAR SYS displays. Next, the amber WINDSHEAR annunciation displays and the aural MONITOR RADAR DISPLAY sounds. Finally, the red WINDSHEAR annunciation displays and the aural GO AROUND WINDSHEAR AHEAD, and then WINDSHEAR AHEAD, WINDSHEAR AHEAD sounds
- the test pattern remains displayed until WXR is selected off on the EFIS control panel, another mode is selected on the Mode Selector, or an actual PWS alert is detected. The source of any faults displays in the weather radar tilt field on the ND.

WX (weather) – displays weather radar returns at selected gain level.

WX/TURB (turbulence) – displays weather radar returns and turbulence.

Turbulence display available with display ranges of 40 miles or less.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

MAP – displays ground returns at selected gain level.

2 GAIN Control

Rotate – sets receiver sensitivity in WX, WX/TURB, and MAP modes.

AUTO (automatic) – maintains optimum receiver sensitivity.

3 TILT Control

Rotate clockwise – radar antenna tilts up to selected degrees from horizon.

Rotate counterclockwise – radar antenna tilts down to selected degrees from horizon.

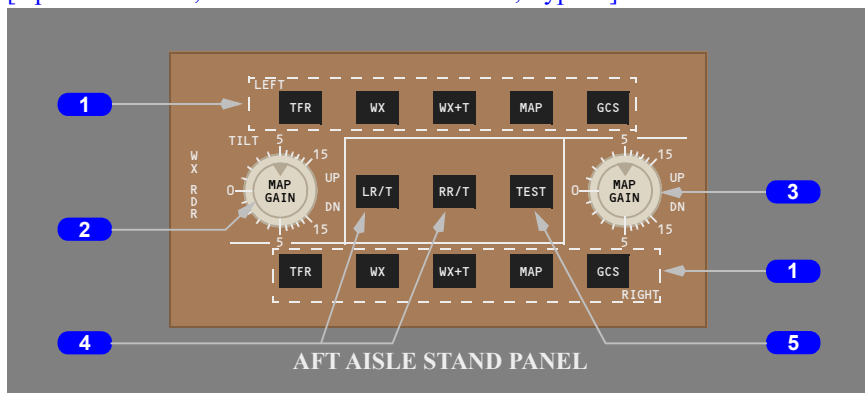
[Option: Bendix 2041220-0412]

4 System (SYS) Switch

Selects R/T for operation.

L or R – selects desired R/T.

[Option – Collins, Push-Button Mode Selection, Typical]

**1 Mode Switches**

Push – selects mode.

LEFT – controls displays on left ND.

RIGHT – controls displays on right ND.

TFR (transfer) – transfers other ND display selections to related ND.

Note: Selecting both TFR switches at the same time results in the TEST mode; test pattern displays.

WX – displays weather radar returns at selected gain level.

WX+T (turbulence) – displays weather returns and turbulence within precipitation at calibrated gain level. Turbulence display available with display ranges of 40 nm or less. Selecting a range greater than 40 nm changes mode to WX.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

MAP – displays ground returns at selected gain level.

GCS (ground clutter suppression)

- IN – reduces amount of ground returns
- OUT – displays ground returns.

Note: Continuous operation is not recommended because weather return intensity may be reduced.

[Option: Collins 622-5130-205]

2 MAP GAIN Control

Rotate inner knob – sets receiver sensitivity in MAP mode on related ND. Full clockwise sets receiver sensitivity at the preset calibrated level.

3 Tilt Control

Rotate outer knob clockwise – tilts radar antenna up.

Rotate outer knob counterclockwise – tilts radar antenna down.

4 Receiver/Transmitter (R/T) Switches

Push -

- LR/T – selects left R/T. Pushes out RR/T switch.
- RR/T – selects right R/T. Pushes out LR/T switch

5 TEST Switch

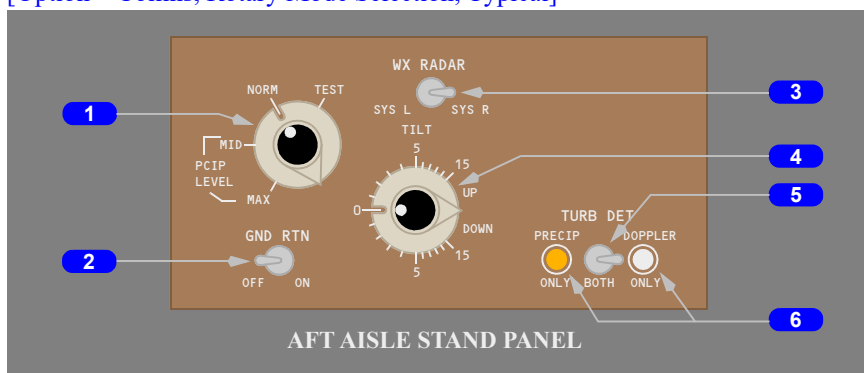
Push -

- tests weather radar system operation without transmitting
- displays test pattern and PWS symbol at the end of the test and any fault message on ND with WXR selected (except in PLAN, CTR VOR, and CTR APP modes).

777 Flight Crew Operations Manual

- when on the ground, selecting WXR on the EFIS control panel and TEST on the weather radar control panel activates a 12 second test. Initially, the amber WINDSHEAR annunciation displays and the aural MONITOR RADAR DISPLAY sounds. Next, the Master Warning Light illuminates and the EICAS alert message WINDSHEAR SYS displays. Finally, the red WINDSHEAR annunciation displays and the aural GO AROUND WINDSHEAR AHEAD, and then WINDSHEAR AHEAD, WINDSHEAR AHEAD sounds
- the test pattern and PWS symbol remain displayed until WXR is selected off on the EFIS control panel, another mode is selected on the Mode Selector, or an actual PWS alert is detected. The source of any faults displays in the weather radar tilt field on the ND.

[Option – Collins, Rotary Mode Selection, Typical]



1 Mode Selector

Rotate – Selects mode.

Precipitation (PCIP) LEVEL –

- MAX (maximum) – adjusts gain to maximum level
- MID (midway) – adjusts gain midway between calibrated and maximum level.

NORM – displays weather returns at preset calibrated gain level.

TEST-

- tests weather radar system operation without transmitting
- displays test pattern and PWS symbol at the end of the test and any fault message on ND with WXR selected (except in PLAN, CTR VOR, and CTR APP modes).

- when on the ground, selecting WXR on the EFIS control panel and TEST on the weather radar control panel activates a 12 second test. Initially, the amber WINDSHEAR annunciation displays and the aural MONITOR RADAR DISPLAY sounds. Next, the Master Warning Light illuminates and the EICAS alert message WINDSHEAR SYS displays. Finally, the red WINDSHEAR annunciation displays and the aural GO AROUND WINDSHEAR AHEAD, and then WINDSHEAR AHEAD, WINDSHEAR AHEAD sounds
- the test pattern and PWS symbol remain displayed until WXR is selected off on the EFIS control panel, another mode is selected on the Mode Selector, or an actual PWS alert is detected. The source of any faults displays in the weather radar tilt field on the ND.

2 Ground Return (GND RTN) Switch

OFF – returns radar to normal operating mode.

Note: Continuous operation is not recommended because weather return intensity may be reduced.

ON – reduces amount of ground returns.

3 RADAR Transfer Switch

Selects R/T for operation.

SYS L – selects left weather radar system.

SYS R – selects right weather radar system.

4 Tilt Control

Rotate clockwise – tilts radar antenna up.

Rotate counterclockwise – tilts radar antenna down.

5 Turbulence (TURB) Detection (DET) Switch

PRECIP (precipitation) ONLY – displays weather returns only.

BOTH – displays weather and turbulence returns.

DOPPLER ONLY – displays turbulence returns within precipitation with display ranges of 40 nm or less.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

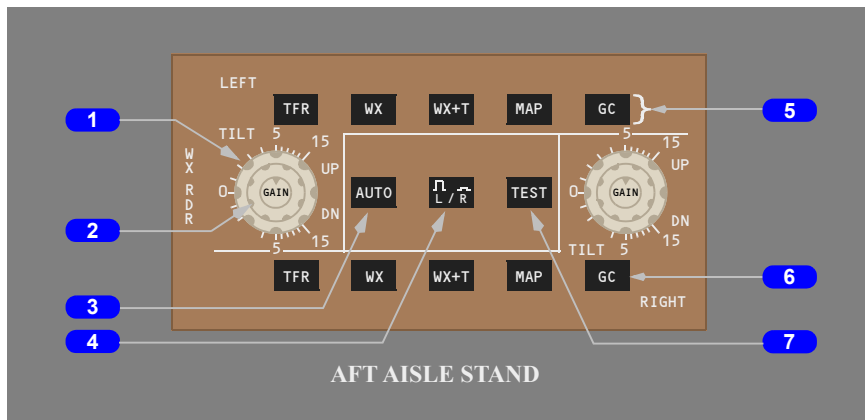
6 Turbulence Detection Lights

PRECIP ONLY (amber) – Turbulence detection switch set to PRECIP ONLY position.

777 Flight Crew Operations Manual

DOPPLER ONLY (amber) – Turbulence detection switch set to DOPPLER ONLY position.

[Option: Collins -622-5130-801]

**1 TILT Control**

Rotate outer knob clockwise – tilts radar antenna up.

Rotate outer knob counterclockwise – tilts radar antenna down.

2 GAIN Control

Rotate inner knob - adjusts receiver sensitivity (by detent) in MAP, WX, and WX+T modes. The 12 o'clock position sets radar sensitivity to the standard calibrated reflectivity level and is the recommended position for normal operation. Rotating the control clockwise increases sensitivity; rotating counterclockwise decreases sensitivity.

3 AUTO Switch

IN - both Captain's and First Officer's controls operate in automatic mode to optimize long and short range weather detection. Ground clutter suppression is operative. Manual tilt control is not available.

OUT - both Captain's and First Officer's controls operate manually. Ground clutter suppression is not available.

[Option: L/R RT installed]

4 System Select Switch

IN - selects right system.

OUT - selects left system.

5 Mode Switches

Control display on respective ND.

Push -

TFR (transfer) - selects opposite display.

Note: Selecting both TFR switches at the same time results in the TEST mode; test pattern displays.

WX (weather) - displays weather returns.

WX + T (weather + turbulence) - displays weather returns and turbulence within precipitation. Turbulence displays out to 40 nm for all selected ranges.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

MAP - displays ground returns at selected gain level.

6 Ground Clutter (GC) Switch

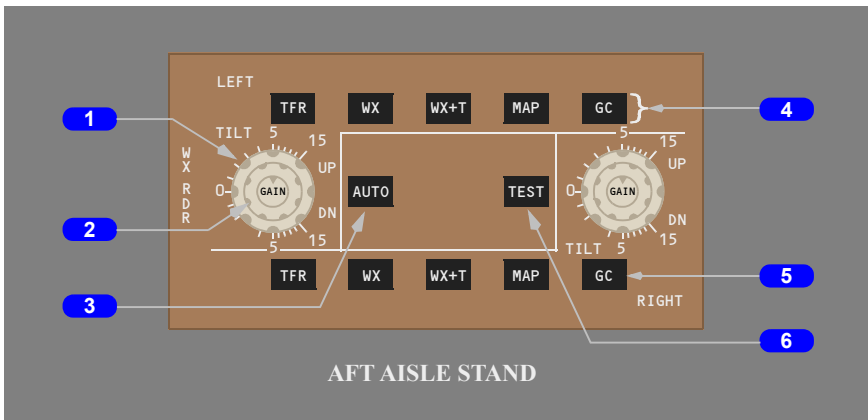
Push - allows ground clutter to display when pushed and held.

7 TEST Switch

Push –

- tests weather radar system operation without transmitting
- displays test pattern and PWS symbol at the end of the test and any fault message on ND with WXR selected (except in PLAN, CTR VOR, and CTR APP modes)
- when on the ground, selecting WXR on the EFIS control panel and TEST on the weather radar control panel activates a 12 second test. To activate the aural messages, TEST must be selected after WXR is selected on the EFIS control panel. Initially, the amber WINDSHEAR annunciation displays and the aural MONITOR RADAR DISPLAY sounds. Next, Master Warning Light illuminates and the EICAS alert message WINDSHEAR SYS displays. Finally, the red WINDSHEAR annunciation displays and the aural GO AROUND WINDSHEAR AHEAD, and then WINDSHEAR AHEAD, WINDSHEAR AHEAD sounds
- the test pattern and PWS symbol remain displayed until WXR is selected off on the EFIS control panel, another mode is selected on the Mode Selector, or an actual PWS alert is detected. The source of any faults displays in the weather radar tilt field on the ND

[Option: Collins-622-5129-801 Single R/T]



1 TILT Control

Rotate outer knob clockwise – tilts radar antenna up.

Rotate outer knob counterclockwise – tilts radar antenna down.

2 GAIN Control

Rotate inner knob - adjusts receiver sensitivity (by detent) in MAP, WX, and WX+T modes. The 12 o'clock position sets radar sensitivity to the standard calibrated reflectivity level and is the recommended position for normal operation. Rotating the control clockwise increases sensitivity; rotating counterclockwise decreases sensitivity.

3 AUTO Switch

IN - both Captain's and First Officer's controls operate in automatic mode to optimize long and short range weather detection.

Ground clutter suppression is operative. Manual tilt control is not available.

OUT - both Captain's and First Officer's controls operate manually. Ground clutter suppression is not available.

4 Mode Switches

Control display on respective ND.

Push -

TFR (transfer) - selects opposite display.

Note: Selecting both TFR switches at the same time results in the TEST mode; test pattern displays.

WX (weather) - displays weather returns.

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WX + T (weather + turbulence) - displays weather returns and turbulence within precipitation. Turbulence displays out to 40 nm for all selected ranges.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

MAP - displays ground returns at selected gain level.

5 Ground Clutter (GC) Switch

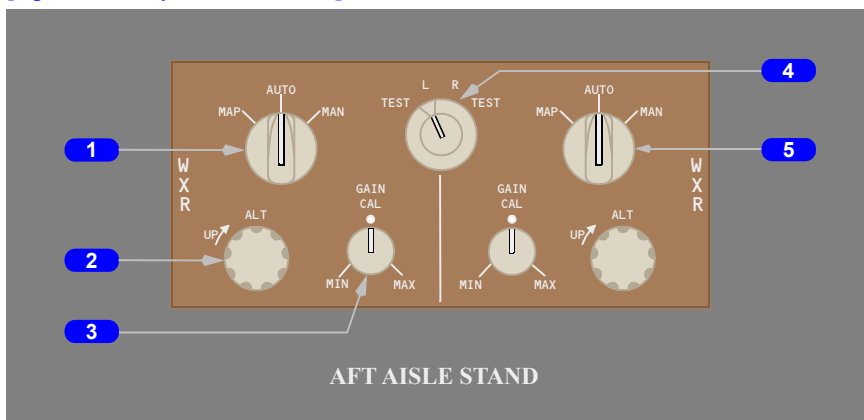
Push - allows ground clutter to display when pushed and held.

6 TEST Switch

Push –

- tests weather radar system operation without transmitting
- displays test pattern and PWS symbol at the end of the test and any fault message on ND with WXR selected (except in PLAN, CTR VOR, and CTR APP modes)
- when on the ground, selecting WXR on the EFIS control panel and TEST on the weather radar control panel activates a 12 second test. To activate the aural messages, TEST must be selected after WXR is selected on the EFIS control panel. Initially, the amber WINDSHEAR annunciation displays and the aural MONITOR RADAR DISPLAY sounds. Next, Master Warning Light illuminates and the EICAS alert message WINDSHEAR SYS displays. Finally, the red WINDSHEAR annunciation displays and the aural GO AROUND WINDSHEAR AHEAD, and then WINDSHEAR AHEAD, WINDSHEAR AHEAD sounds
- the test pattern and PWS symbol remain displayed until WXR is selected off on the EFIS control panel, another mode is selected on the Mode Selector, or an actual PWS alert is detected. The source of any faults displays in the weather radar tilt field on the ND

[Option: Honeywell RDR4000]



1 Captain's Mode Selector

Map – displays full coverage ground map.

AUTO – displays weather presentation.

MAN – displays constant altitude weather presentation.

2 Altitude Selector

Rotating clockwise raises the layer of weather return by 1000 feet per click.

Rotating counterclockwise lowers the layer of weather return by 1000 feet per click. Active when MAN mode selected.

3 Gain Selector

Rotate to vary the weather presentation gain. CAL position automatically sets standard thresholds. In AUTO or MAN mode, rotating the selector toward MIN reduces precipitation intensity thresholds requiring greater intensity precipitation levels to display in red. Rotating the selector toward MAX increases precipitation intensity thresholds allowing lesser intensity precipitation levels to display in red. MAX gain should only be used at cruise altitudes to help see less reflective frozen storm tops.

4 System Selector

Rotate – selects left or right radar system. When changing the selection, display of weather data may be slightly delayed. This is due to refreshing the radar memory buffer.

TEST – with WXR selected on at least one EFIS Control panel, places radar system in test mode. When selecting TEST, weather radar panel lighting increases to full bright, dims, then returns to the brightness setting selected prior to selecting TEST.

Time TEST Selected	Approximately 2 Seconds	Approximately 4 Seconds	Approximately 6 Seconds
PWS FAIL/INOP	On	OFF ("ON" if failure detected)	
PWS VISUAL ALERTS	Off	Amber WINDSHEAR on both NDs	Red WINDSHEAR on both NDs and PFDs
PWS AURAL ALERTS	None	Tone "Monitor Radar Display"	"Go Around, Windshear Ahead, Windshear Ahead, Windshear Ahead"
DISPLAY	Normal Test Pattern (No PWS Icon)		

No fault indications shown after completion of the test sequence indicates full radar system operation is available.

Left (L) – selects number one transmitter/receiver for normal weather operation.

Right (R) – selects number two transmitter/receiver for normal weather operation.

5 First Officer's Mode Selector

Map – displays full coverage ground map.

AUTO – displays weather presentation.

MAN – displays constant altitude weather presentation.

**Flight Management, Navigation
Navigation Systems Description****Chapter 11
Section 20**

Introduction**[Option: ADF installed]**

Navigation systems include global positioning system (GPS), air data inertial reference system (ADIRS), VOR, DME, ILS, ADF, ATC transponder, weather radar, and the flight management system (FMS). The FMS is described in the Flight Management System Description section of this chapter.

[Option: ADF removed or not installed]

Navigation systems include global positioning system (GPS), air data inertial reference system (ADIRS), VOR, DME, ILS, ATC transponder, weather radar, and the flight management system (FMS). The FMS is described in the Flight Management System Description section of this chapter.

Navigation Systems Flight Instrument Displays

Refer to Chapter 10, Flight Instruments, Displays for flight instrument display system operations and typical instrument displays.

Global Positioning System (GPS)

Left and right GPS receivers are independent and supply very accurate position data to the FMC. GPS tuning is automatic.

GPS Displays

POS REF 3/3 page displays the left and right GPS position. The ND annunciates GPS when the FMC uses GPS position updates.

When the POS (position) switch on the EFIS control panel is selected, the ND map displays the left and right GPS symbols. The GPS symbols are identical and display as a single symbol when the GPS receivers calculate the same position.

GPS Data

If the ADIRU becomes inoperative during flight, the EICAS displays the message NAV ADIRU INERTIAL and the FMC uses only GPS data to navigate.

Use the GPS NAV prompt on the POS REF page to inhibit GPS navigation data. The EICAS message GPS alerts the crew when both GPS systems have failed.

GPS position updates should be used during all approaches in which the FMC database and approach procedures are referenced to the WGS-84 reference datum. GPS updates should be inhibited for other approach operations not based on WGS-84 unless other appropriate procedures are used.

GPS position updates should be used for all other operations unless a specific state requires the use of other update provisions within their airspace (eg, to accommodate a non-WGS reference datum or other reason).

The diagram illustrates the architecture and output of a GPS receiver system. At the top, four GPS transmitters are shown sending signals to an aircraft equipped with GPS receivers. Below the aircraft, the system architecture is shown, consisting of two antennas connected to separate GPS receivers (left and right). These receivers are connected to a central Flight Management Computer (FMC) and a Displays Function block. The FMC outputs data to a display showing NAV MODE, FMC POSITION, NAV SENSOR POSITIONS, and POS REF. The Displays Function block outputs data to a MAP DISPLAY, which shows a map with various symbols and data points.

GPS Receiver Architecture:

- GPS TRANSMITTER (4 units)
- GPS RECEIVERS (on aircraft)
- ANTENNA (2 units)
- GPS RECEIVER - LEFT
- GPS RECEIVER - RIGHT
- FLIGHT MANAGEMENT COMPUTER
- DISPLAYS FUNCTION

Display Output:

NAV MODE

FMC POSITION

NAV SENSOR POSITIONS

POS REF

MAP DISPLAY

FMS POSITION UPDATE STATUS

GPS POSITION SYMBOL

GPS NAV PROMPT

Inertial System

Air Data Inertial Reference System (ADIRS)

The ADIRS calculates airplane altitude, airspeed, attitude, heading, and position data for the displays, flight management system, flight controls, engine controls, and other systems. The major components of ADIRS are the air data inertial reference unit (ADIRU), secondary attitude and air data reference unit (SAARU), and air data modules.

Air Data Inertial Reference Unit (ADIRU)

The ADIRU supplies primary flight data, inertial reference, and air data. The ADIRU is fault-tolerant and fully redundant.

ADIRU Power

Initial power-up requires battery bus power and the ADIRU switch to be ON. If the ADIRU is switched off, it must complete a full realignment cycle before the airplane can be moved.

If electrical power is subsequently removed from the airplane and the Battery switch is switched OFF, the hot battery bus continues to supply electrical power to the ADIRU. The ON BAT light illuminates, and the horn in the landing gear wheel well sounds to alert maintenance personnel the ADIRU is on battery power.

When the ADIRU switch is OFF, the ADIRU remains powered for a few seconds.

In flight, system logic prevents the ADIRU from becoming unpowered if the ADIRU switch is inadvertently switched OFF.

ADIRU Alignment

On initial power-up, the ADIRU enters the align mode. The EICAS memo message ADIRU ALIGN MODE displays. Attitude or heading/track data is removed from the PFDs. Airplane latitude/longitude position must be entered on the CDU POS INIT page. The airplane should not move until alignment is complete.

If the latitude/longitude position is not close to the position of the origin airport, the scratchpad message INERTIAL/ORIGIN DISAGREE displays. If the crew-entered latitude/longitude position does not pass internal ADIRU comparison tests, the scratchpad message ENTER INERTIAL POSITION displays.

If a new airplane present position entry fails the internal check twice, the scratchpad message ALIGNMENT REINITIATED displays. The system automatically starts a new alignment cycle.

In rare cases, a new airplane present position update of the ADIRU may cause the EICAS message NAV UNABLE RNP to momentarily display. This occurs if the entered ADIRU position is far different than the GPS position. The message displays until the FMC reconciles the difference between the new ADIRU position and the GPS position.

When the alignment is complete, the ADIRU changes to the navigate mode and the airplane can be moved. If the airplane stops for an extended period, the ADIRU changes to the automatic realign mode and refines the alignment until the airplane moves again.

In the automatic realign mode, ADIRU velocity and acceleration errors are reset to zero. The inertial position can be manually updated when the ADIRU is in the automatic realign mode by entering a new latitude/longitude position on the POS INIT 1/3 page. The ADIRU cannot be realigned in flight.

Note: A position update is recommended if the total time in the navigation mode is expected to exceed 24 hours.

Secondary Attitude and Air Data Reference Unit (SAARU)

The SAARU is a secondary source of critical flight data for displays, flight control systems, and other systems. If the ADIRU fails, the SAARU automatically supplies attitude, heading, and air data. SAARU heading must be manually set to the standby compass magnetic heading periodically.

If ADIRU inertial data fails, the EICAS caution message NAV ADIRU INERTIAL displays. The SAARU supplies attitude data to the PFD and three minutes of backup heading. The heading is based on ADIRU heading prior to failure. The CDU POS INIT page displays the SET HDG prompt three minutes after ADIRU failure. Use the SET HDG prompt to periodically set the SAARU heading to the standby compass magnetic heading. There are no other prompts to remind the crew to enter or to update the SAARU heading.

The following functions are inoperative after failure of the inertial reference portion of the ADIRU:

AFDS Modes:

- LNAV
- VNAV
- TO/GA
- LOC
- GS
- FPA
- TRK HOLD/SEL
- HDG HOLD/SEL*

Navigation Functions:

- FMC VNAV pages
- FMC Performance Predictions
- ND Wind Direction and Speed (wind arrow)

PFD Functions:

- Flap Maneuver Speeds
- PFD Heading*

Note: *This function is operative when standby magnetic compass heading is entered on the POS INIT page.

Note: ND map mode display following ADIRU failure references TRK.

Note: The autobrake is also inoperative.

The following additional functions are inoperative after failure of the inertial reference portion of the ADIRU and loss of GPS information:

- ND Map (center and expanded)
- CDU active leg course and distance
- CDU direct-to a waypoint
- FMC Alternate Airport DIVERT NOW
- FMC navigation radio autotuning

Restoration of the SAARU heading allows navigation in the ND VOR mode using radio navigation data. The FMC navigation data LNAV/VNAV guidance is no longer available when the ADIRU fails.

[Option - without ISFD]

The SAARU supplies the only source of attitude data to the standby attitude indicator display.

SAARU power-up is completely automatic at airplane power-up. There are no SAARU controls.

Air Data and Attitude Sources

The ADIRU and SAARU receive air data from the same three sources. The ADIRU and SAARU validate the air data before it may be used for navigation.

The three air data sources are the left, center, and right pitot and static systems. Air data is valid when two or more sources agree in the ADIRU, SAARU, or both.

When ADIRU air data is invalid and the AIR DATA/ATT switch is in the off position, valid SAARU air data is used. Refer to Chapter 10, Flight Instruments, Displays for a description of the AIR DATA/ATT switch.

Single channel operation occurs when the ADIRU and SAARU air data are invalid. The left PFD displays the ADIRU air data from the left pitot static system (left channel). The right PFD displays the SAARU air data from the right pitot static system (right channel).

[Option - with AIMS V17 or (V16 and AIMS-1)]

The EICAS message AIR DATA SYS displays.

[Option - not AIMS V17 or not (V16 and AIMS-1)]

The EICAS message NAV AIR DATA SYS displays.

The air data modules are remote sensors for the air data functions within the ADIRU and SAARU. They measure static and pitot pressure. Both the ADIRU and SAARU receive data from all air data modules. In addition, the ADIRU and SAARU each receive data from the two angle of attack vanes and a dual element total air temperature probe.

[Option - Without ISFD]

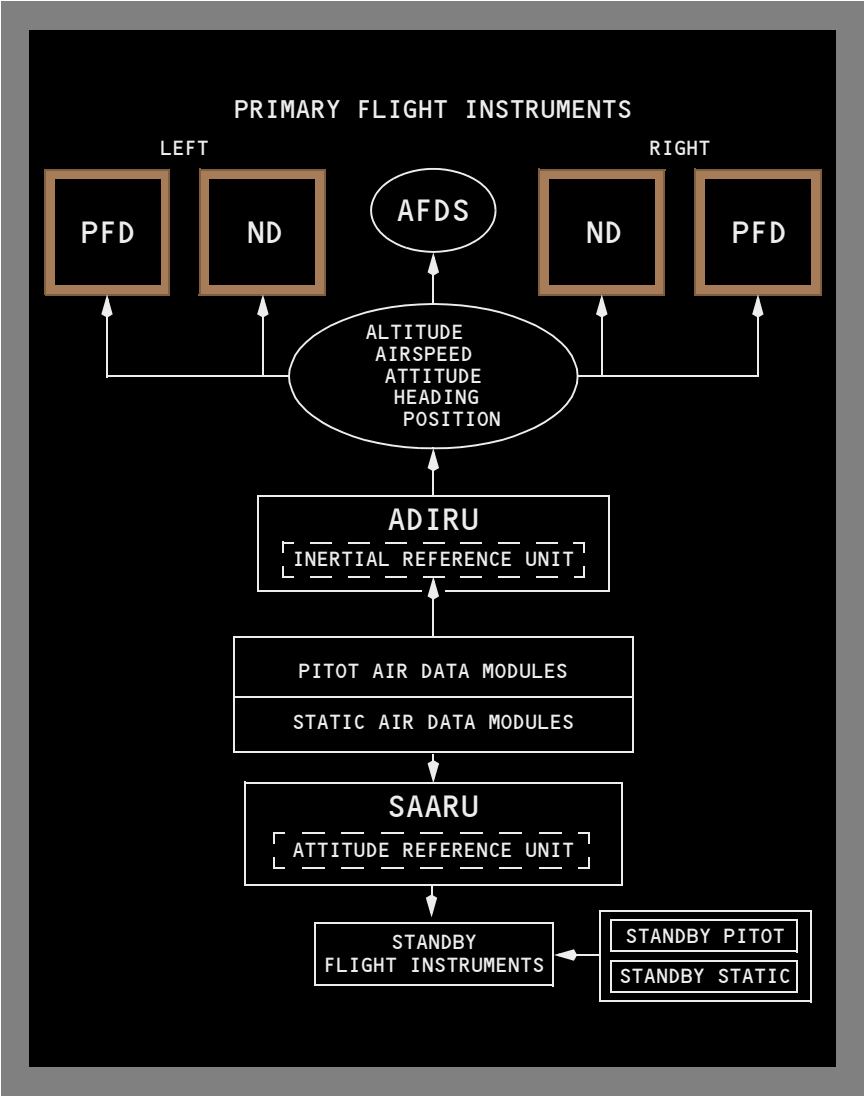
The standby flight instrument displays receive data from the center pitot and static ports through standby air data modules. Altitude and airspeed are independent of ADIRU and SAARU values. SAARU provides attitude information.

[Option - With ISFD]

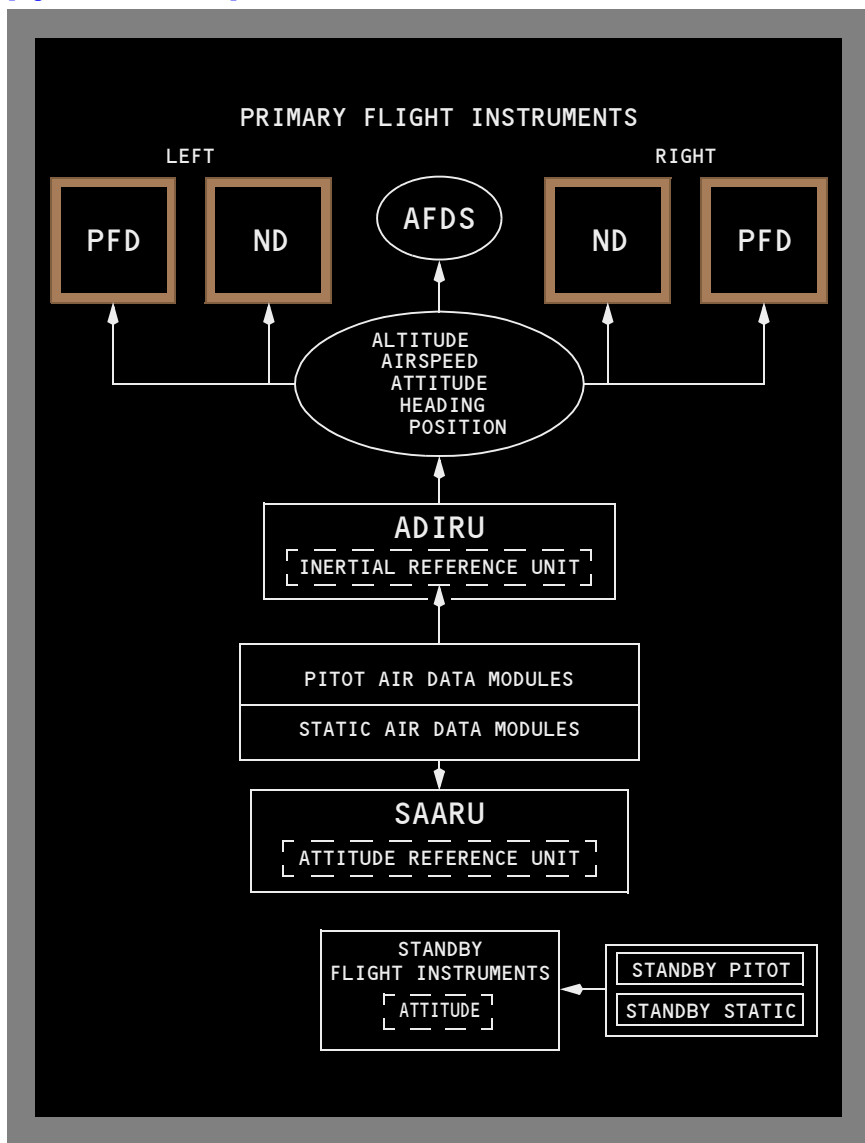
The standby flight instrument displays receive data from the center pitot and static ports through standby air data modules. Altitude, attitude, and airspeed are independent of ADIRU and SAARU values.

ADIRS Schematic, Normal Mode

[Option - Without ISFD]

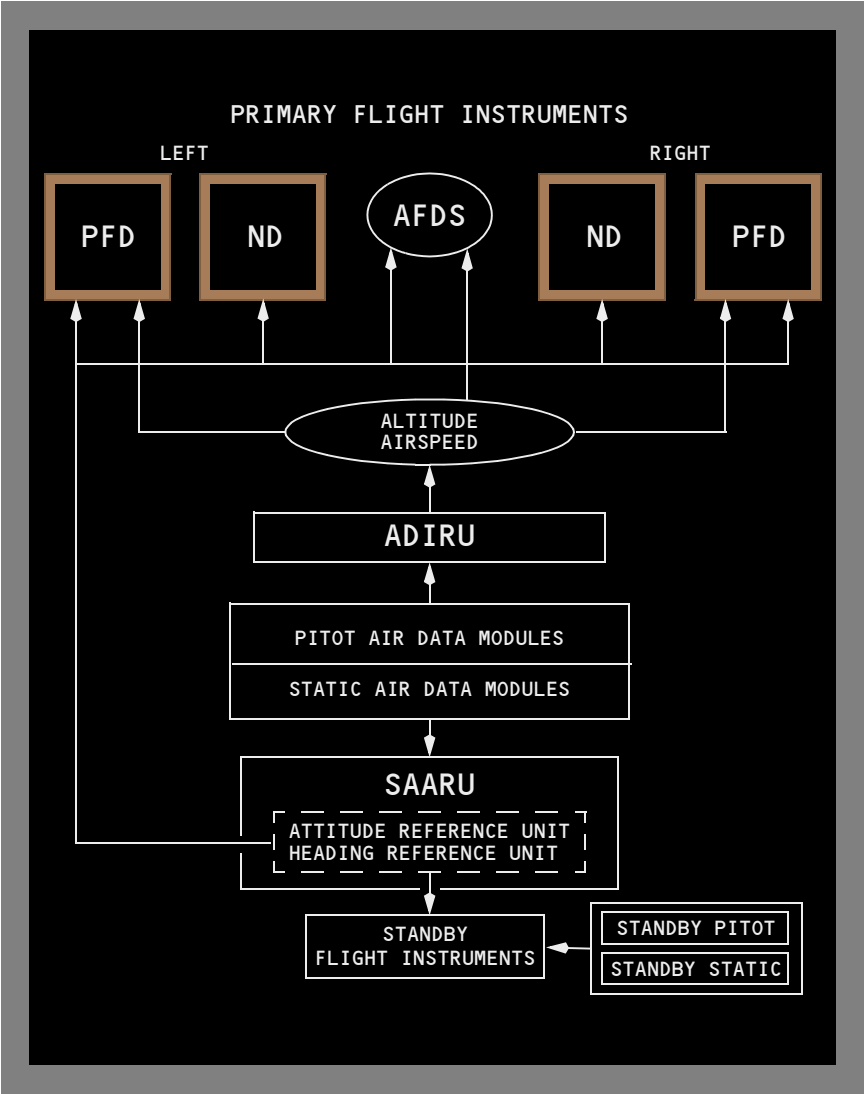


[Option - With ISFD]

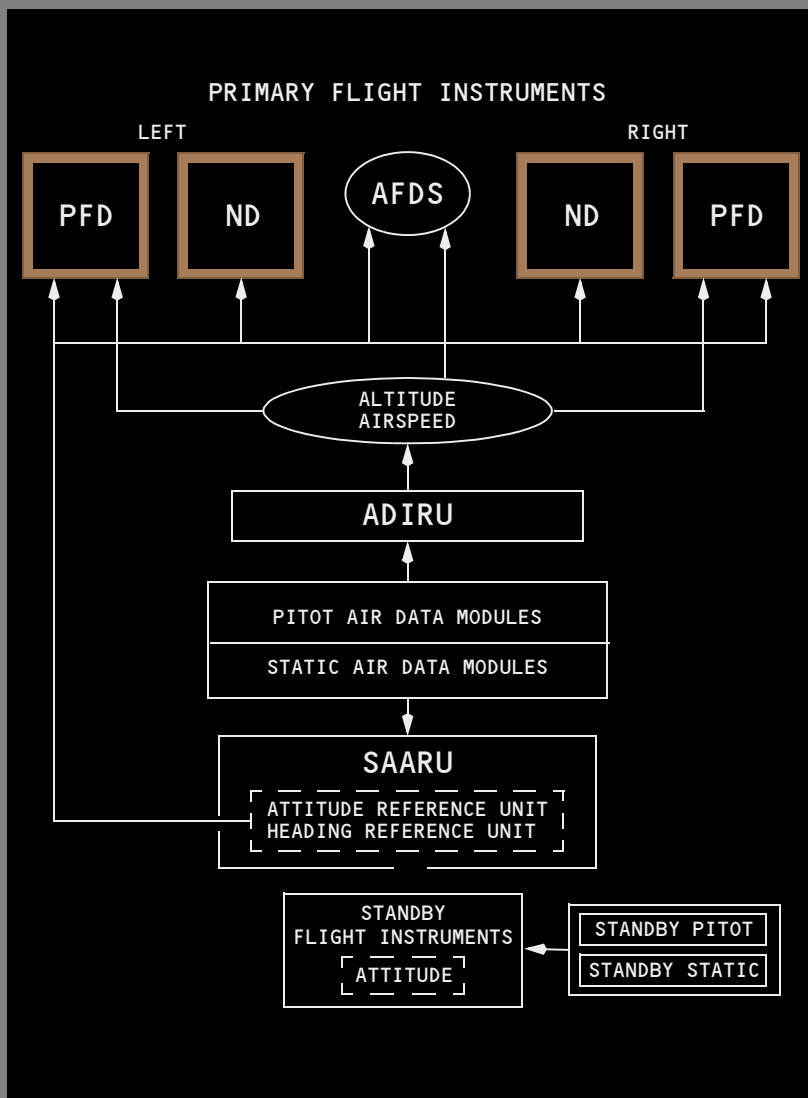


ADIRS Schematic, With NAV ADIRU INERTIAL Message

[Option - Without ISFD]



[Option - With ISFD]



Radio Navigation Systems

Automatic Direction Finding (ADF)

[Option: ADF installed]

Two ADF systems are installed. Either ADF can be manually tuned from the left or right CDU on the NAV RADIO page.

ADF Displays

Left and right ADF bearings display on the ND when the related VOR/ADF switch is in the ADF position. ADF data is cyan.

If both FMCs fail, the left and right ADF radios are tuned on the related left and right CDU ALTN NAV RADIO page.

Distance Measuring Equipment (DME)

Two DME systems are installed. The DMEs are usually tuned by the FMC, but may be tuned manually.

DME Tuning

DME is tuned manually when the VOR portion of a VOR/DME pair is entered on the NAV RADIO page. The FMC tunes DME as necessary for radio position updates. Manual DME tuning does not inhibit FMC DME tuning.

The FMC uses two DMEs for position updates. DME/DME position updates are usually more accurate than VOR/DME updates. The FMC cannot tune specific DMEs if the nav aids are inhibited on the REF NAV DATA page.

After dual FMC failure, the left DME is tuned with the left CDU and the right DME is tuned with the right CDU. Each DME is tuned to the VOR displayed on the CDU unless the related EFIS control panel ND mode selector is set to APP. In APP, the DME is tuned to the ILS.

DME Displays

DME distance displays on the ND map when operating in the VOR mode. DME distances also display when the ND mode selector is in the VOR or APP position, and either or both VOR L or VOR R switches are selected. DME distance also displays on the PFD when the ILS receivers are tuned to a collocated DME and localizer facility.

POS REF page 2/3 displays the identifiers of the DME stations used for FMC position updates.

Instrument Landing System (ILS)

Three ILS receivers are installed. They are usually tuned by the FMC, but can be tuned manually on the NAV RADIO page.

ILS Tuning

Two conditions must be met for FMC ILS autotuning to occur:

- an ILS, LOC, Back Course, LDA (localizer-type directional aid), or SDF (simplified directional facility) approach have been selected to the active route, and
- the airplane is within 50 NM from the top of descent, 150 NM of the landing runway threshold, or the FMC is in descent mode

On initial takeoff, ILS autotuning is inhibited for 10 minutes to prevent clutter on the PFD. Selection and execution of a new approach in the active flight plan causes the ILS to autotune to the new approach frequency, even if this is accomplished during the 10 minute takeoff inhibit period. ILS autotune inhibit does not apply to subsequent takeoffs on the same flight (for example, touch-and-go or stop-and-go landings).

All three ILS receivers can be manually tuned from the NAV RADIO page at anytime unless ILS approach tuning inhibit is active.

ILS approach tuning inhibit is active when:

- the autopilot is engaged and either the localizer or glideslope is captured
- Only the flight director is engaged, and either the localizer or the glideslope is captured, and the airplane is below 500 feet radio altitude, or
- on the ground, the localizer is alive, airplane heading is within 45 degrees of the localizer front course, and ground speed is greater than 40 knots

ILS tuning is again enabled when:

- either TO/GA switch is pushed
- the autopilot is disengaged and both flight director switches are switched off, or
- the MCP approach mode is deselected above 1500 feet radio altitude

The ILS frequency is automatically retuned when ILS tuning is enabled and a new approach is selected on the CDU.

After dual FMC failure, the left and center ILS receivers are tuned with the left CDU on the ALTN NAV RADIO page. The right ILS receiver is tuned with the right CDU on the ALTN NAV RADIO page.

ILS Displays

The tuned ILS frequency displays on the PFD and on the ND in the approach mode.

Localizer and glideslope deviation display on the PFD. Localizer and glideslope deviation, and selected course display on the ND when that ND is in the approach mode. Front or back course deviation is determined from airplane heading.

Navaid Identifier Decoding

[Option: ADF installed]

The Morse code identifier of a tuned VOR, ILS, DME, or ADF can be converted to alpha characters. The decoded identifier then displays 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 data base.

[Option: ADF removed or not installed]

The Morse code identifier of a tuned VOR, ILS, or DME can be converted to alpha characters. The decoded identifier then displays 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 data base.

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 display as “KAI”, or the Boeing Field ILS may display 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 displayed or an incorrect identifier displays.

VOR

Two VOR receivers are usually tuned by the FMC but, can be tuned manually by the crew. The tuned VORs display on the ND and may be used for position updates.

VOR Tuning

The crew manually tunes VORs on the NAV RADIO page.

The FMC can tune a VOR and a collocated DME for position updates. The FMC uses VOR/DME radio position updates when more accurate sources are not available. Specific VOR/DME pairs can be inhibited on the REF NAV DATA page. If the crew enters two VOR identifiers on the NAV RADIO page, then the FMC cannot tune any other station for VOR/DME updates.

After dual FMC failure, the VOR radios can be manually tuned on the CDU ALTN NAV RADIO page. The left VOR is tuned with the left CDU and the right VOR is tuned with the right CDU.

VOR Displays

The NAV RADIO page displays FMC–tuned or manually–tuned VOR data. POS REF page 2/3 displays the identifier of the VOR and DME pair used for position updates.

The ND displays the identifier or frequency of the VORs tuned on the NAV RADIO page. The FMC usually tunes the same VOR in the left and the right. The ND VOR L VOR R data are usually the same.

Left and right VOR bearings display on the ND map when the related EFIS control panel VOR/ADF switch is in the VOR position. VOR bearings also display when the ND mode selector is in the VOR or APP position, and either or both VOR L or VOR R switches are selected. The VOR frequency and selected course display in the upper right hand corner of the ND when operating in the VOR mode. The ND also displays course deviation when operating in the VOR mode.

Transponder

The transponder panel controls two ATC transponders and the traffic alert and collision avoidance system (TCAS). Traffic displays if the transponder mode selector is in TA ONLY or TA/RA. The transponder responds to Mode S interrogations in all modes except STBY; and when on the ground, it provides airport position. In flight, the selected transponder activates beacon and altitude reporting when the transponder mode selector is in XPNDR, TA ONLY, or TA/RA. The EICAS advisory message TRANSPONDER L or TRANSPONDER R displays if a transponder fails. If altitude reporting fails, the transponder can be switched to the alternate altitude source. Refer to Chapter 15, Warning Systems, for a description of TCAS.

[Option: ADS-B/Squitter installed]

Transponders provide selective interrogation and downlink information, such as flight number, airspeed or groundspeed, magnetic heading, altitude, GPS position, etc., depending on the level of enhancement. Some airports use transponder information to monitor airplane position on the ground when the transponder is active (mode selector not in STANDBY). Transponder enhancements also enable air traffic controllers in some areas of the world to use Automatic Dependent Surveillance-Broadcast (ADS-B). TCAS modes should not be used on the ground for ground tracking.

[Option: ADS-B/Squitter installed]

The left (right) GPS is connected to the left (right) transponder. If GPS input to the selected transponder is unavailable, ADS-B Out position reporting is lost or degraded and ATC is alerted. If advised by ATC ADS-B Out communications are lost or degraded, selection of the other transponder restores communications and reporting.

Weather Radar

The weather radar system consists of receiver–transmitter unit, antenna, and control panel. Radar returns display on the ND in all modes except:

- Plan mode
- VOR Center
- APP (Approach) Center

The EFIS control panel weather radar (WXR) map switch controls power to the transmitter/receiver and controls the weather radar display on the ND. The radar display range automatically adjusts to the ND range selected on the EFIS control panel.

[Option: Predictive Windshear installed]

The weather radar system performs various levels of self test on power up, during each sweep, and when descending through 2,300 feet AGL.

Multiscan weather radar collects data from different scans and merges the information into a total weather picture. Software eliminates ground clutter resulting in clutter-free viewing of significant weather out to 320 nm. When operating in the automatic mode, multiple radar scans at pre-selected tilt angles detect short, mid, and long range weather. Tilt and gain inputs are not required. This results in weather detection at all ranges and in all phases of flight. Additional processing ensures data from thunderstorm tops within 5,000 feet of the airplane remain on the radar display until it no longer poses a danger; thus, enabling flight around thunderstorms that may not be visible otherwise.

The CDU can control the EFIS control panel functions, including the WXR. The weather radar operating modes and fault conditions display on the ND.

Turbulence can be sensed by the weather radar only when there is sufficient precipitation. Clear air turbulence cannot be sensed by radar.

[Option: PWS installed]

The weather radar also provides predictive windshear alerting (refer to Chapter 15, Warning Systems).

Threat Assessment Feature

[Option: WxR V2.0 installed]

The Threat Assessment feature uses a combination of data from vertical and horizontal sweep data to predict the presence of turbulence and hail in anvil and electrified stratiform clouds. Navigation Display colors are enhanced to accurately reflect the weather threat. High altitude (>25,000 ft) threats display as red speckled patterns in green, amber, or black regions on the ND. An extended pattern shows the downwind direction. Low altitude (<25,000 ft) threats display as red speckled patterns in green or amber regions indicating a threat in a cell. This is an indication of a region where airplane induced lightning may occur. This function is active only with AUTO and WX+T selected.

Predictive OverFlight (POF) protection displays a cell growing into the flight path, but not currently a threat. POF displays can be an indication of clear air turbulence above a growing cell even if the visible cell may not reach the flight path. POF displays as a red enclosure with red dots. POF is active only with AUTO and WX+T selected.

When operating in AUTO, two-level turbulence detection displays severe turbulence with solid magenta areas while light-to-moderate turbulence areas display with magenta dots. Severe turbulence is for airplane loads 0.3 g or greater; light turbulence is for airplane loads 0.2 g or less.

When operating in AUTO and WX+T, threat assessment is operative for the descent profile. It is not necessary to switch to manual operation during descent.

Refer to Chapter 10.40 for ND Symbology.

Introduction

The flight management system (FMS) aids the flight crew with navigation, in-flight performance optimization, automatic 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 on the airspeed, altitude, and thrust indicators to help in flying efficient profiles.

The flight crew enters the applicable route and flight data into the CDUs. The FMS then uses the navigation database, airplane position, and supporting system data to calculate commands for manual and automatic flight path control.

The FMS tunes the navigation radios and sets courses. The FMS navigation database supplies the necessary data to fly routes, SIDs, STARs, holding patterns, and procedure turns. Cruise altitudes and crossing altitude restrictions are used to calculate VNAV commands. Lateral offsets from the programmed route can be calculated and commanded.

Flight Management Computer (FMC)

The basis of the flight management system is the flight management computer function. Since the term FMC is universally understood, it is used here for standardization and simplification.

Under normal conditions, one FMC accomplishes the flight management tasks while the other FMC monitors. The second FMC is ready to replace the first FMC if system faults occur.

The FMC uses flight crew–entered flight plan data, airplane systems data, and data from the FMC navigation database to calculate airplane present position and pitch, roll, and thrust commands necessary to fly an optimum flight profile. The FMC sends these commands to the autothrottle, autopilot, and flight director. Map and route data are sent to the NDs. The EFIS control panels select the necessary data for the ND. The mode control panel selects 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 is certified for area navigation when used with navigation radio and/or GPS updating. The FMC and CDU are used for enroute and terminal area navigation, RNAV approaches, and to supplement primary navigation during all types of instrument approaches.

Control Display Units (CDUs)

The flight crew controls the FMC using three CDUs. The CDUs give alternate display, communications control, and navigation capability if there is a dual FMC failure (refer to the Alternate Navigation section of this chapter). The center CDU is a backup for the left or right CDU in case of a failure and automatically takes over functionality of the failed CDU. Only the left and right CDUs tune navigation radios when alternate navigation is active.

Left and right CDUs provide backup to the left and right EFIS control panels, while the center CDU provides EFIS control panel backup for a failed left or right CDU. If the EFIS control panel or the display select panel fails, a manual selection of the CDU backup mode can be made on the MENU page.

Refer to Chapter 10, Flight Instruments, Displays for a description of alternate display control. Refer to Chapter 5, Communications, for a description of communications control.

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**Flight Management, Navigation
Flight Management System Operation****Chapter 11
Section 31****Introduction**

When first powered, the FMS is in the preflight phase. When completing a phase, the FMS changes to the next phase in this order:

- preflight
- takeoff
- climb
- cruise
- descent
- approach
- flight complete

Preflight

During preflight, the flight crew enters the flight plan and load sheet data into the CDU. Some data can be entered by data link. The flight plan defines the route of flight from the origin to the destination and initializes LNAV. Flight plan and load sheet data provide performance data to initialize VNAV.

Required preflight data consists of:

- initial position
- route of flight
- performance data
- takeoff data

Optional preflight data includes:

- navigation database selection
- route 2
- alternate airport
- standard instrument departure (SID)
- standard terminal arrival route (STAR)
- thrust limits
- wind

Preflight starts with the IDENT page. If the IDENT page is not displayed, it can be selected with the IDENT prompt on the INIT/REF INDEX page. Visual prompts help the flight crew select CDU preflight pages. Preflight pages can be manually selected in any order.

After data on each preflight page is entered and checked, pushing the lower right line select key selects the next preflight page. After selecting ACTIVATE on the ROUTE page, the execute (EXEC) light illuminates. Pushing the EXEC key activates the route.

The departure/arrival (DEP/ARR) page can be used to select a SID. Selection of the SID may cause a route discontinuity. Resolution of the discontinuity and execution of the modification should be accomplished on the LEGS page.

When all required preflight entries are complete, the PRE–FLT line title on the TAKEOFF REF page is replaced by dashes and the THRUST LIM prompt displays at the next page select line location.

Takeoff

The takeoff phase starts with selection of TO/GA and terminates with thrust reduction for climb. LNAV and VNAV can be armed before takeoff to activate at the applicable altitude (refer to Chapter 4, Automatic Flight).

Climb

The climb phase starts at thrust reduction for climb and terminates at the top of climb (T/C) point. The T/C is where the airplane reaches the cruise altitude entered on the PERF INIT page.

Cruise

The cruise phase starts at the T/C point and terminates at the top of descent (T/D) point. Cruise can include step climbs and en route descents.

Descent

The descent phase starts at the T/D point or when the VNAV descent page becomes active, and terminates at the start of the approach phase.

Approach

The approach phase starts when the first waypoint of the procedure sequences or when the runway is the active waypoint and the distance to go is less than 25 nm.

Flight Complete

Thirty seconds after engine shutdown, 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.

Operational Notes

When operating in the LNAV and VNAV modes, observe system operation for unwanted pitch, roll, or thrust commands. If unwanted operation is observed, select heading select and flight level change modes.

The system must be carefully monitored for errors following:

- activation of a new data base
- power interruption
- ADIRU failure

The FMC will not sequence the active waypoint when more than 21 nm off the active route and not on an offset route. Return to the active route can be accomplished using the DIRECT TO or INTERCEPT COURSE TO/FROM procedures.

Incorrect waypoint sequencing can occur when attempting route modifications within approximately 1 NM of the active waypoint for modifications that result in a small course change, or within approximately 4 NM of the active waypoint for modifications that results in a large course change.

When approaching an active waypoint, the following should be avoided:

- executing a lateral offset
- entering a vertical or lateral flight plan change
- executing a DIR-TO with ABEAM selected.

If a route modification is active when a waypoint is sequenced, the route modification should be erased and reattempted.

CAUTION: Should an uncommanded turn occur when using LNAV, select HDG SEL to follow the flight plan, then perform a DIRECT TO to the waypoint that prematurely sequenced. Reengage LNAV as needed.

When a waypoint is in the route more than once, certain route modifications (such as DIRECT TO and HOLD) use the first waypoint in the route.

Some SIDs or STARS contain a heading vectors leg. VECTORS waypoints display on the ND as a magenta line without an end point leading away from the airplane symbol. If LNAV is active, the DIRECT TO or INTERCEPT COURSE TO/FROM procedures can be used to start waypoint sequencing beyond the vectors leg.

When entering airways in a route page, the start and end waypoints must be in the data base. A route segment must be entered as a DIRECT leg.

During a climb or descent, changing the altimeter setting near the planned level off can cause altitude capture to fail, and the aircraft may continue to climb or descend past the planned level off altitude.

If the engines remain operating between flights, entering a new cruise altitude before the next flight recalculates the proper vertical profile.

If a climb to cruise altitude is necessary after completing a descent, a new cruise altitude entry must be made. Cruise altitude can be entered on the CLB page.

DIRECT TO courses are segments of a great circle route. When entering a DIRECT TO waypoint on the LEGS page, the course above the waypoint before execution is the arrival course at the waypoint. However, after execution, the course is the current course to fly to the waypoint. These courses may not be the same.

Terminology

The following paragraphs describe FMC and CDU terminology.

Active – flight plan data used to calculate LNAV or VNAV guidance commands.

Activate – changing a route from inactive to active for navigation by:

- selecting the ACTIVATE prompt
- pushing the execute (EXEC) key

Altitude constraint – a crossing restriction at a waypoint.

Delete – using the DELETE key removes FMC data and reverts to default values, dash or box prompts, or a blank entry.

Econ – a speed schedule calculated to minimize operating cost. The economy speed is based on the cost index. A low cost index causes a lower cruise speed. Maximum range cruise or the minimum fuel speed schedule may be obtained by entering a cost index of zero. This speed schedule ignores the cost of time. A minimum time speed schedule may be obtained by entering a cost index of 9999. This speed schedule calls for maximum flight envelope speeds. A low cost index may be used when fuel costs are high compared to operating costs.

Enter – putting data in the CDU scratchpad and line selecting the data to the applicable location. New characters can be typed or existing data can be line selected to the scratchpad for entry.

Erase – removing entered data, which has resulted in a modification, by selecting the ERASE prompt.

Execute – pushing the illuminated EXEC key to make modified data active.

Inactive – data not being used to calculate LNAV or VNAV commands.

Initialize – entering data required to make the system operational.

Message – FMC information displayed in the scratchpad.

Modify – changing active data. When a modification is made to the active route or performance mode, MOD displays in the page title, ERASE displays next to line select key 6 left, and the execute key illuminates.

Prompt – CDU symbols that aid the flight crew in accomplishing a task. Prompts can be boxes, dashes, or a caret (< or >) line to remind the flight crew to enter or validate data.

Purge – select the PURGE prompt to remove all airports uplinked to the ALTN LIST.

Select – pushing a key to obtain the necessary data or action, or to copy selected data to the scratchpad.

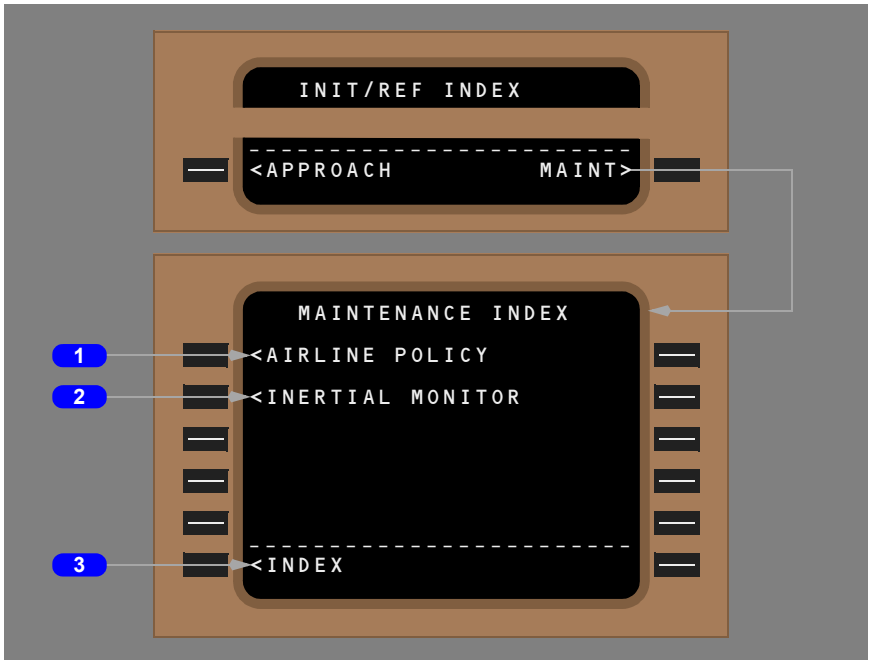
Speed restriction – an airspeed limit associated with a specified altitude entered by the flight crew.

Speed transition – an airspeed limit associated with a specified altitude entered by the FMC.

Waypoint – a point on the route or in the navigation database. It can be a fixed point such as a latitude and longitude, VOR or ADF station, or an airway intersection. A conditional waypoint is not associated with a land reference; it is based on a time or altitude requirement. An example of a conditional waypoint is “when reaching 4,000 feet”.

Maintenance Index

The MAINTENANCE INDEX page prompts are used only on the ground.



1 AIRLINE POLICY

The airline policy pages display operating parameters kept in the airline maintained file. The FMC references this file for data before it calculates default values. These pages are not usually used by the flight crew.

2 INERTIAL MONITOR

This is a maintenance function.

3 INDEX

Push – displays the INIT/REF INDEX page.

Navigation Position

[Option: AIMS V14 installed]

The FMC position is determined from GPS, navigation radio, and ADIRS systems. When receiving reliable GPS data, the FMC position is from a GPS updated FMC position. If GPS data is not available, cannot be validated, or is inhibited, the FMC position is updated using navigation radios, when enabled. Further, if navigation radios are not available or not reliable, the FMC position is the inertial (ADIRU) position.

FMC Position Update

[Option: AIMS V14 installed]

FMC position may be manually updated to any of the navigation system positions. This update is accomplished on POS REF page 2.

On the ground, the FMC calculates present position based on ADIRU and/or the GPS data.

If GPS updating is not available due to loss of signals, pushing a TO/GA switch updates the FMC position to the runway threshold or to the position shift position, when entered. When making an intersection takeoff, the intersection displacement distance from the runway threshold must be entered on the TAKEOFF REF page. With GPS NAV ON, the TO/GA update is inhibited.

In flight, the FMC position is the ADIRU inertial position updated by GPS source data to compensate for inertial reference errors. Radio navaid updating can be activated by selecting the RAD NAV INHIBIT toggle to OFF on the REF NAV DATA page. Updating priority is based on the availability of valid data from these sources. With all ADIRUs failed and GPS operative and valid, the FMC position is the GPS position.

The FMC automatically tunes VOR, DME, and ILS radios for position updating and displays them on the ND and NAV RADIO page. Selection is related to the active route and any procedure (SID, STAR, etc.) in the active route. Manually selecting VOR frequencies or identifiers precludes the FMC from autotuning other VOR/DME frequencies for position updating; however, the FMC continues to tune DME-DME pairs for position updating.

When available, GPS is the ADIRU inertial position updating source. With GPS inoperative or inhibited and with NAV RAD INHIBIT selected to OFF, ADIRU inertial position updating occurs in the following priority order:

- LOC and DME-DME
- LOC and collocated VOR/DME
- LOC
- DME-DME
- collocated VOR/DME.

The station identifiers in use by the FMC for navigation radio updating display on the POS REF page 2. Radio navaid updating is inhibited unless the RAD NAV INHIBIT toggle is selected to OFF on the REF NAV DATA page.

Primary FMC Position Update Source	POS REF page 2/3	ND Annunciation
GPS	GPS	GPS
LOC, DME DME valid; GPS invalid*	LOC-RADIO	LOC-DME-DME
LOC, VOR DME valid; GPS invalid*	LOC-RADIO	LOC-VOR-DME
LOC valid; GPS, DME, VOR invalid*	LOC- INERTIAL	LOC
DME valid; GPS invalid	RADIO	DME-DME
VOR DME valid; GPS invalid	RADIO	VOR-DME
GPS, VOR, DME invalid	INERTIAL	INERTIAL
GPS valid, ADIRU failed	GPS	GPS
GPS invalid; ADIRU failed	blank	map not available
<p>Localizer updating is inhibited when GPS/INERTIAL is the navigation update mode.</p> <p>* The FMC changes to LOC updating when:</p> <ul style="list-style-type: none"> • the tuned localizer is associated with the destination runway • the airplane is less than 6,000 feet above localizer navaid elevation • the airplane is less than 20 nm from the localizer navaid for a front course approach or less than 12 nm for a back course approach • the airplane is within a 25° sector of the inbound localizer course • the difference between airplane track and the localizer course is less than a 45° intercept angle 		

FMC Polar Operations

When entering the polar region, automatic switching to a true north reference is annunciated by a white box around the word TRU on the ND. A TRUE heading reference can be selected with the heading reference switch inside or outside the polar region. The ND displays a green box around the word MAG to annunciate the change back to magnetic reference when leaving the polar region. If the heading reference is TRU in the descent phase, the ND displays a flashing amber box around the word TRU.

[Option - Grid Heading Display]

The current GRID heading displays near the top of both NDs when the airplane is north of 70°N or south of 70°S. The GRID heading is not used by any airplane system.

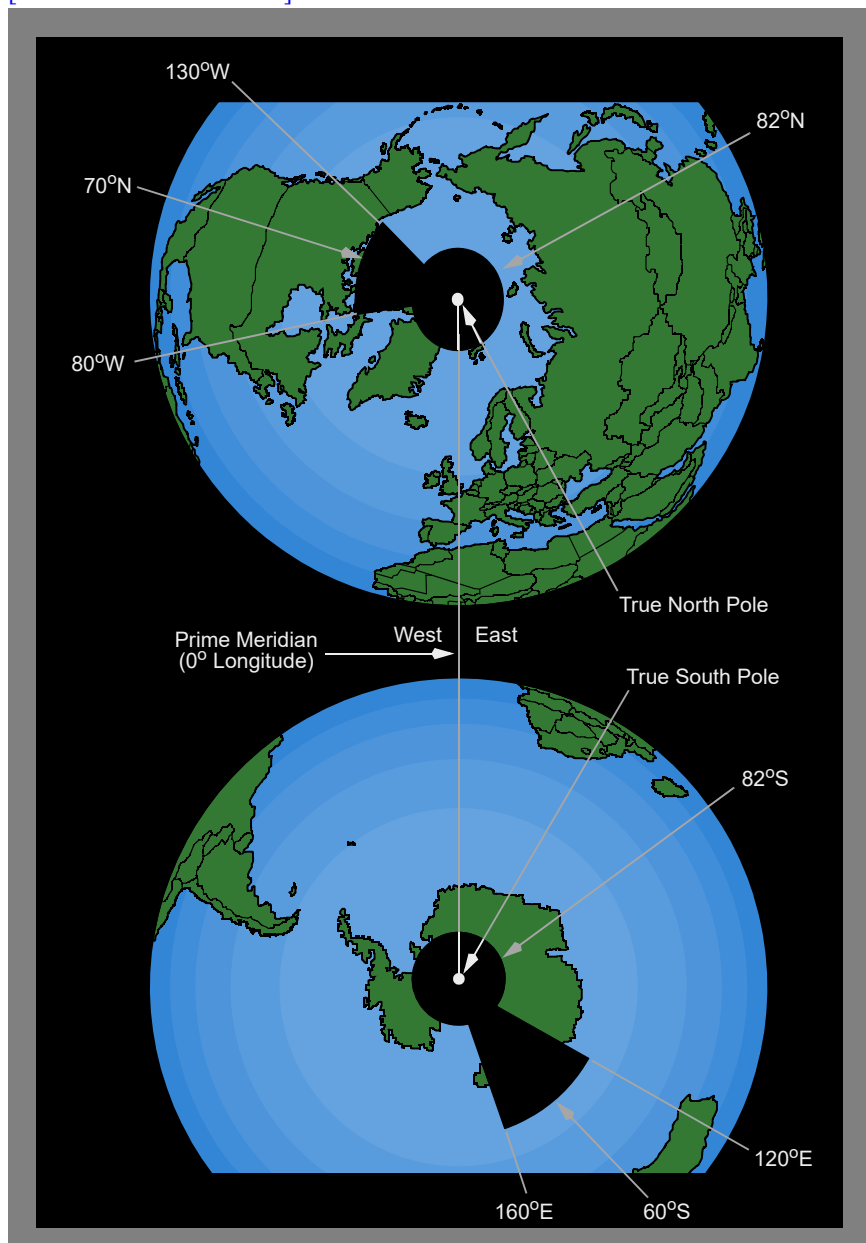
Note: When operating the autopilot in the polar region in other than LNAV, the TRUE position on the heading reference switch must be selected.

Note: When operating north of 82°N or south of 82°S using the ND PLAN mode, the airplane position symbol does not display.

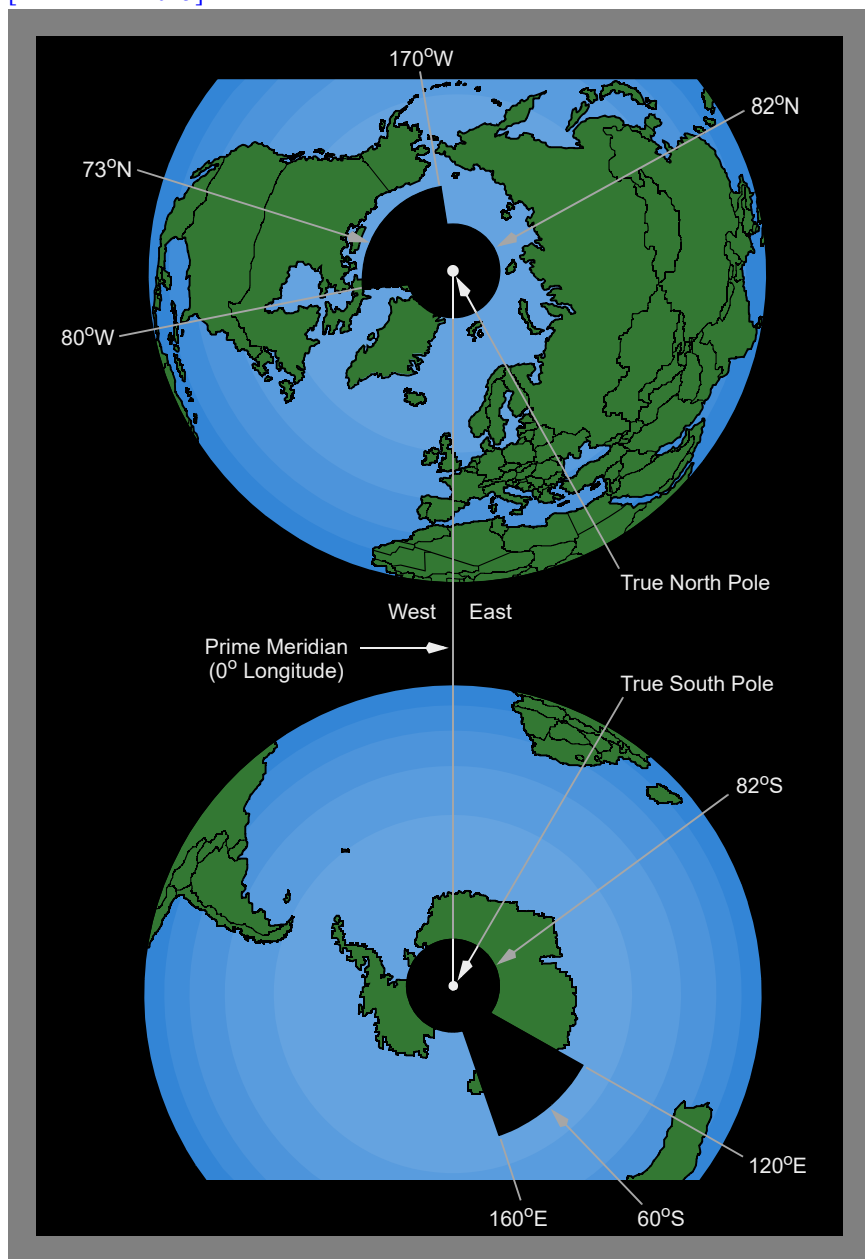
Note: If the ADIRU fails in a polar region, the EICAS message NAV ADIRU INERTIAL displays and all autopilot and AFDS roll modes fail. When heading information is restored by entry of a reference heading on the POS INIT page, HDG SEL and HDG HOLD roll modes are restored. GPS continues to provide navigation data to the FMC and active route information displays on the ND. When operating in this degraded mode, heading on the POS INIT page may be referenced to magnetic, true, or grid heading. The heading display drifts significantly under these conditions. Periodic updating of the heading reference on the POS INIT page should be accomplished at least every 10 minutes.

FMC Polar Regions

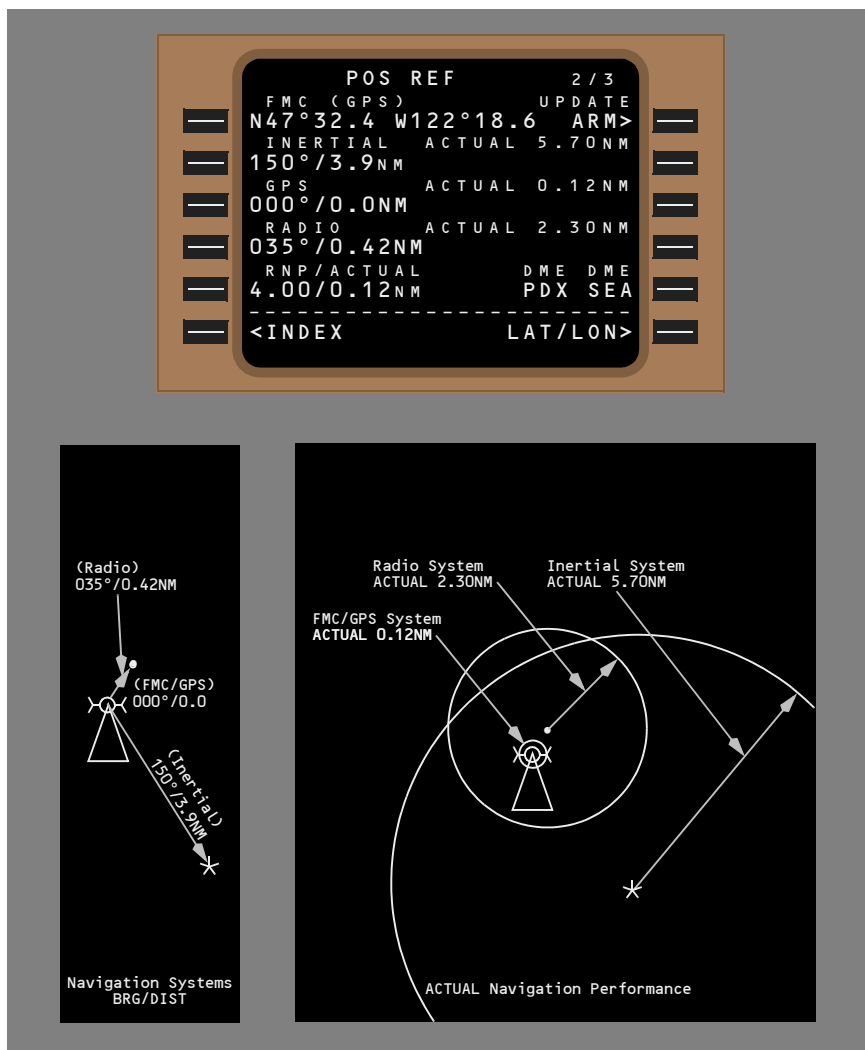
[MAGVAR 1995 or 2005]



[MAGVAR 2015]



Navigation Performance



The FMC uses data from the navigation systems to accurately calculate the position of the airplane. The current FMC position displays on line 1 of the POS REF page 2. The primary source of update displays in parentheses above the FMC position.

Navigation system positions display on the left side of lines 2 through 4. The bearing/distance is from the FMC position to the individual navigation system position.

The FMC position displays on the ND at the tip of the triangle. All other positions display relative to the FMC. The RADIO position is shown above as a •, but is not shown on the ND. The ACTUAL navigation performance circles shown above do not display on the ND.

Actual Navigation Performance

Actual navigation performance (ANP) is the FMC position accuracy. It displays on the POS REF page 2, lines 1 - 3, for the navigation source displayed on the left side. ACTUAL navigation performance is a circular prediction centered at the FMC position. Airplane position is estimated to be within this ACTUAL navigation performance circle 95 percent of the time.

After a manual position update using the ARM function on the POS REF page 2, the ACTUAL navigation performance of the FMC changes to the ACTUAL navigation performance of the selected navigation source. In the example above, selection of the NOW> prompt on the INERTIAL line would change the FMC ACTUAL navigation performance to 5.7 NM. The FMC then updates from the best available navigation system and eventually, the manual update has no effect on position calculation. Some automatic updates can be inhibited; GPS on POS REF page 3 and VOR/DME updates on the REF NAV DATA page.

Radio navaid updating is inhibited unless the RAD NAV INHIBIT toggle is selected to OFF on the REF NAV DATA page.

Required Navigation Performance

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 takeoff, en route, oceanic/remote, terminal, and approach phases of flight. The flight crew may enter an RNP value, if required. RNP displays on POS REF page 2.

Lateral Navigation (LNAV)

LNAV provides steering commands to the next waypoint or the selected route intercept point. When armed on takeoff, LNAV engages at or above 50 feet, when laterally within 2.5 nautical miles of the active route leg. FMC LNAV guidance normally provides great circle courses between waypoints. However, when an arrival or approach from the FMC data base is entered into the active route, the FMC commands a heading, track, or a DME arc to comply with the procedure.

The FMC creates a path allowing the airplane to turn before reaching a "fly-by" waypoint. When a waypoint is defined as a "fly-over", the FMC directs the airplane to fly directly over the waypoint before turning. The flight path shows on the ND using reduced range.

Waypoints

Waypoint (navigation fix) identifiers display on the CDU and navigation display. The CDU message NOT IN DATABASE displays if a manually entered waypoint identifier is not kept in the data base. 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 Waypoints

VHF – waypoints located at VHF nav aids (VOR/DME/LOC) are identified by one, two, three or four character facility identifier. Examples:

- Los Angeles VORTAC – LAX
- Tyndall TACAN – PAM
- Riga Engure, Latvia – AN

NDB – waypoints located at NDBs are identified by use of the station identifier. Example: FORT NELSON, CAN – YE.

Fix Waypoints

Waypoints located at fixes with names containing five or fewer characters are identified by the name. Examples:

- DOT
- ACRA
- ALPHA

Long Waypoints

Waypoints with more than five characters are abbreviated using the following rules sequentially until five characters remain. For double letters, one letter is deleted. Example:

- KIMMEL becomes KIMEL

Keep the first letter, first vowel and last letter. Delete other vowels starting from right to left. Example:

- BAILEY becomes BAILY

The next rule abbreviates names even further. Apply the previous rule, then delete consonants from right to left. Example:

- BRIDGEPORT becomes BRIDGPRT then BRIDT

Fixes with multi-word 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 Waypoints

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

Waypoints located at unnamed flight information region (FIR), upper flight information region (UIR), and controlled airspace reporting points are identified by the three-letter airspace type identification followed by a two-digit sequence number. Example:

- FRA01

Unnamed oceanic control area reporting points in the northern hemisphere use the letters N and E, while points 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
- S52° W075° becomes 5275W
- N75° W170° becomes 75N70
- S07° W120° becomes 07W20
- N50° E020° becomes 5020E
- S50° E020° becomes 5020S
- N06° E110° becomes 06E10
- S06° E110° becomes 06S10

Procedure Arc Fix Waypoint Names

Unnamed terminal area 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. Example:

- EPH252°/24 = D252X

An unnamed waypoint along a DME arc with a radius greater than 26 miles is identified by the station identifier and the DME radius. Example:

- CPR338°/29 = CPR29
- CPR134°/29 = CP29A
- CPR190° /29 = CP29B

Procedure Fix Waypoints

Marker beacons are 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 applicable prefix:

-
- | | |
|----------------------------------|--|
| • RX – runway extension fix | • BM – back course marker |
| • FA – VFR final approach fix | • MD – minimum descent altitude |
| • CF – final approach course fix | • A – (+ an alpha) step down fix |
| • FF – final approach fix | • RW – runway threshold |
| • IF – initial approach fix | • MA – missed approach point other than RW |
| • OM – outer marker | • TD – touchdown point inboard of RW |
| • MM – middle marker | |
| • IM – inner marker | |

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 | • ()L – localizer only()B –backcourse ILS |
| • F() – final approach fix | • ()D – VOR/DME |
| • P() – missed approach point | • ()V – VOR only |
| • I() – initial approach fix | • ()S – VOR with DME points |
| • D() – minimum descent altitude | • ()N – NDB |
| • T() – touch down point | • ()Q – NDB with DME points |
| • R() – runway centerline intercept. | • ()M – MLS |
| • ()I – ILS | • ()T – Tacan |
| | • ()R – RNAV |

Examples: CI32R, PV15, FN24L.

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 are identified by the ICAO identifier.

DME step down fixes are identified by the distance and a “D”.

Examples: 138D, 106D, 56D, 3D.

Duplicate Waypoints

When a waypoint which has a duplicate identifier in the navigation database is entered, the SELECT DESIRED WPT page displays. The page lists the latitude/longitude of duplicate waypoints and the fix type.

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[Option: AIMS V16 not installed]

Entering a waypoint identifier in the route a second time causes the FMC to extend the route back to the first entered waypoint. The incorrect routing can be resolved by entering the latitude/longitude of the second waypoint. After sequencing the first waypoint, the latitude/longitude entry can be deleted and the duplicate waypoint entered. Replacing the latitude/longitude is not required; however, replacing the latitude/longitude enables the use of the waypoint identifier for navaid updating.

[Option: AIMS V16 installed]

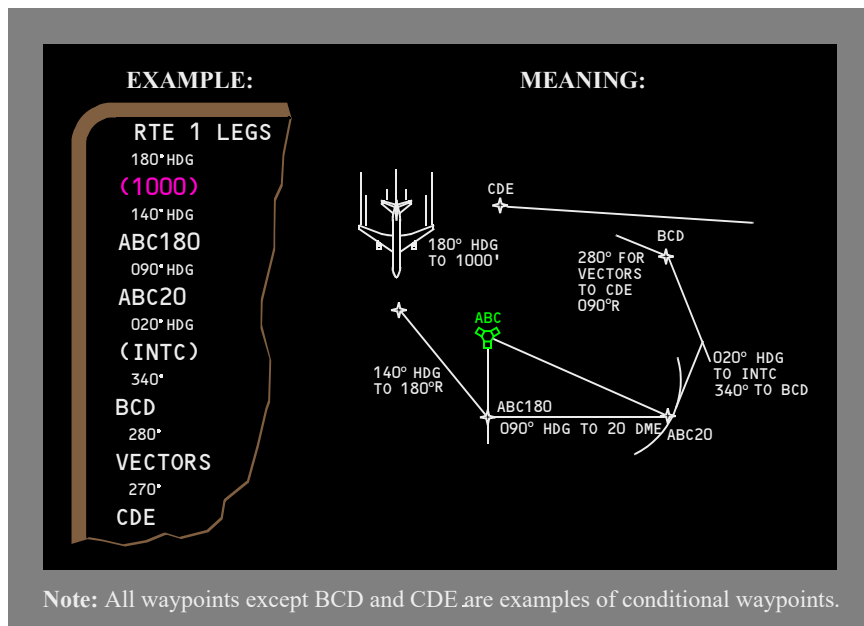
Entering a waypoint identifier in the route a second time displays the SELECT DESIRED WPT page. The page lists the latitude/longitude of duplicate waypoints and fix type. Line selecting the latitude/longitude of the desired waypoint enters that waypoint on the page from which the SELECT DESIRED WPT was accessed.

Conditional Waypoints

Conditional waypoints may display in the route when selecting a DEPARTURES or ARRIVALS page procedure. Usually, conditional waypoints cannot be manually entered on a route or legs page. These waypoints indicate when an event occurs and are not at a geographically-fixed position. The types of conditions are:

- climb/descent through an altitude
- intercepting a course
- flying a heading to a radial or DME distance
- heading vectors to a course or fix

Altitude and course intercept conditional waypoints display on the CDU inside (parenthesis) marks. The diagram below shows conditional waypoints.



Manually Entered Latitude/ Longitude Waypoints

Pilot defined waypoints entered as a latitude and longitude display in a seven-character format. Latitude and longitude waypoints are entered with no space or slash between the latitude and longitude entries. Leading zeros 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 displays as N47W008
- N47° 15.4' W008° 3.4' is entered as N4715.4W00803.4 and displays as N47W008

Manually Entered Place Bearing/Distance or Place Bearing/Place Bearing Waypoints

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:

[Option: AIMS V16 not installed]

- SEA330/10 becomes SEA01

- SEA330/OLM020 becomes SEA02

[Option: AIMS V16 installed]

- SEA330/10 becomes SEA-01
- SEA330/OLM020 becomes SEA-02

The two digit sequence numbers reserved for RTE1 are 01 through 49. The two digit sequence numbers reserved for RTE2 are 51 through 99.

Manually Entered Airway Crossing Waypoints

Airway crossing fixes are entered as a five character waypoint name or by entering consecutive airways on the ROUTE page. In the latter case, the display is an X followed by the second airway name. Example: entering J70 on the VIA line of the ROUTE page causes box prompts to display opposite on the same line. Leaving the box prompts empty and entering J52 on the next VIA line, directly below J70, causes the FMC to calculate the intersection of the two airways and replace the boxes with the waypoint identifier, XJ52.

Manually Entered Latitude or Longitude Reporting Point Waypoints

Latitude or longitude reporting waypoints are entered as the full latitude or longitude followed by a dash, then the increment chosen for the following multiple waypoints. Example:

- W060–10 adds waypoints starting at W060 in ten degree increments from that point to the destination
- the entry must be made on a LEGS page on any line before the first reporting point
- usually, this entry is made on the active waypoint line and proper sequencing is performed by the FMC

Manually Entered Along–Track Waypoints

Along–track waypoints are created on the active route and do not cause route discontinuities when they are created.

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 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:

[Option: AIMS V16 not installed]

- VAMPS/25 is 25 miles after VAMPS on the present route and displays as VAM01

- ELN/-30 is 30 miles before ELN on the present route and displays as ELN01
- [\[Option: AIMS V16 installed\]](#)
- VAMPS/25 is 25 miles after VAMPS on the present route and displays as VAM-01
- ELN/-30 is 30 miles before ELN on the present route and displays as ELN-01

ND Map Displays

The route shows on the ND in the map, map center, and plan modes. The display color and format represent the following status:

- an inactive route shows as a dashed cyan line
- a pending active route shows as a dashed white line
- the active route shows in magenta
- modifications to an active route show as dashed white lines
- modified waypoints show in white
- executed route offsets show as a dashed magenta line
- missed approach route shows as a solid magenta line.

The FMC position is represented by the apex of the airplane symbol shown on the ND. All ND map data is shown relative to this apex.

When adequate GPS or radio updating is not available, the ND map can show a shift error. This error results in the shown position of the airplane, route, waypoints, and navigation aids being shifted from their actual position. An undetected, across track map shift can result in the airplane flying a ground track that is offset from the desired track. An undetected, along track map shift can result in the flight crew initiating altitude changes earlier or later than desired. In either case, an undetected map shift can compromise terrain or traffic separation.

Map shift errors can be detected by comparing the position of the airplane on the ND map with data from the ILS, VOR, DME, and ADF systems.

Map shift errors can be detected by comparing the position of the airplane on the ND map with data from the ILS, VOR, and DME systems.

Vertical Navigation (VNAV)

VNAV provides vertical profile guidance through the climb, cruise, and descent phases of flight. Three VNAV CDU pages correspond to these flight phases. Pressing the VNAV function key displays the active phase page. Other VNAV pages display using the next or previous keys.

Vertical Actual Navigation Performance (VANP)

[Option: Nav Perf Scales installed]

Vertical Actual Navigation Performance is the FMC estimate of the quality of altitude determination. It displays on the RNP PROGRESS page. VANP is the estimated maximum altitude error. The FMC computes the vertical path and the certainty the actual altitude is within a vertical range equal to plus or minus the displayed VANP value.

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 by the setting given in the approach clearance for the display to be valid.

Speed/Altitude Constraints

VNAV controls the path and speed to comply with waypoint crossing constraints. Waypoint crossing constraints are entered on the LEGS page waypoint line by pushing the applicable key on the right side of the CDU. Barometric altitude constraints must be below the cruise altitude to be valid. Values entered as part of a procedure and manually entered constraints are shown in large font. FMC predicted values do not act as constraints, and display in small font.

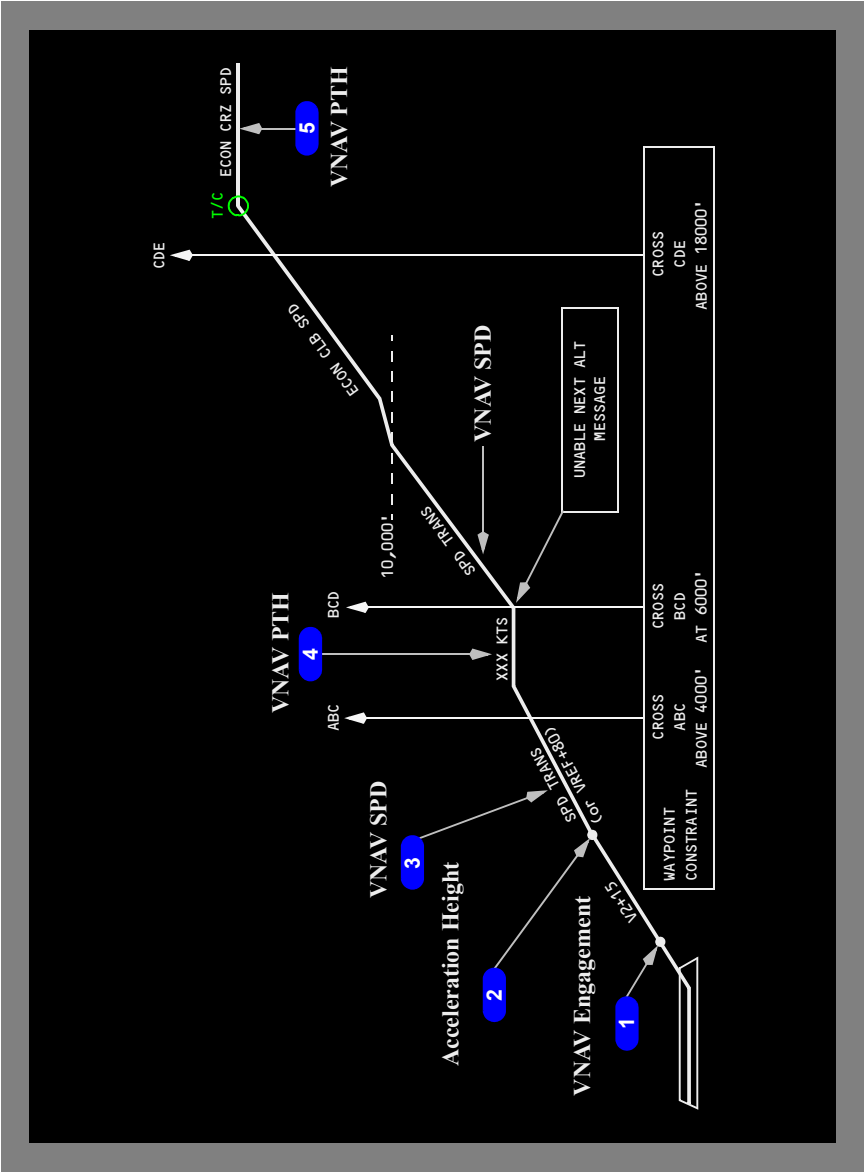
A waypoint constraint is magenta when it is active. The constraint does not have to be in line 1 to be active. Waypoints can have altitude or airspeed/altitude constraints.

Modified waypoint constraints are shaded white until they are executed. Speed constraint entries require an altitude constraint at the same waypoint. All speed constraints are considered by the FMC as at or below constraints.

At or above altitude constraints are entered with a suffix letter A (example: 220A). At or below altitude constraints are entered with a suffix letter B (example: 240B). Mandatory altitude constraints are entered without any suffix letter (example: 270).

Altitude constraints with two altitudes may be entered in either order. The lower altitude constraint, followed by a suffix letter A, and the upper altitude constraint, followed by a suffix letter B (example: 220A240B or 240B220A).

Takeoff and Climb



1 Takeoff

If armed for takeoff, VNAV activates at 400 feet and pitch guidance continues to maintain the target airspeed.

During takeoff, the FMC updates the target airspeed to the current airspeed until VNAV activates. The target airspeed is between $V_2 + 15$ and $V_2 + 25$ knots.

2 Acceleration Height

At acceleration height or altitude capture below acceleration height, VNAV commands an airspeed increase to a speed 5 knots below the flap placard speed for the existing flap setting. When flaps are retracted or at an AFDS capture altitude, VNAV commands the greater of $V_{REF} + 80$ knots or the speed transition associated with the origin airport, limited by configuration.

The FMC changes the thrust reference limit to the selected climb thrust at the thrust reduction point.

3 VNAV Climb

VNAV climb profile uses VNAV SPD or VNAV PTH at the default climb speed or pilot selected climb speed to remain within all airspeed and altitude constraints of an active route Standard Instrument Departure. Autothrottle uses the armed climb thrust limit.

If the climb speed profile cannot achieve an altitude constraint, the UNABLE NEXT ALT scratchpad message displays.

4 Climb Constraints

VNAV enters the VNAV PTH mode to remain within departure or waypoint constraints. Speed maintained during this time can be:

- procedure based speed restriction
- waypoint speed restriction
- default VNAV climb speed
- manually entered climb speed

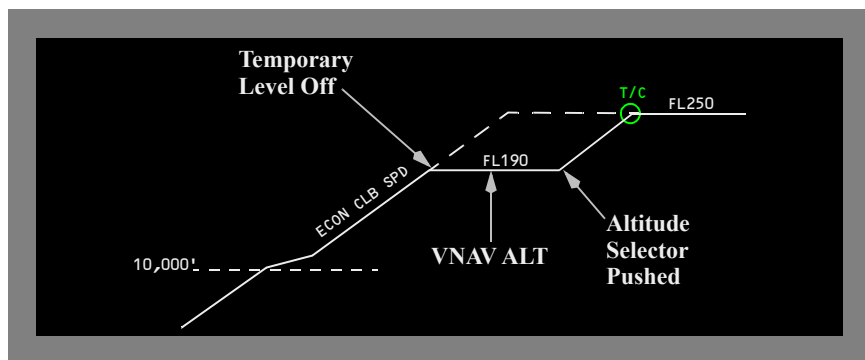
If the FMC predicts the airplane will not reach an altitude constraint, the FMS-CDU message UNABLE NEXT ALT displays. Speed intervention can be used by pushing the IAS/MACH selector and manually setting a lower airspeed to provide a steeper climb; or, climb derates can be deleted on the THRUST LIMIT page.

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 climb phase to cruise phase. The T/C displays any time the FMC calculates a change from climb phase to cruise phase, such as step climb.

The T/C point displays on the map as a green open circle with the label T/C.

MCP Altitude Intervention



Whenever the airplane levels off at an MCP altitude not in the FMC, VNAV ALT annunciates. For example, 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 example, the speed after the temporary level off would be ECON CLB SPEED.

Setting the clearance altitude in the MCP window and pushing the altitude selector continues the climb. VNAV SPD activates. Pitch maintains FMC speed and thrust increases to the armed reference thrust limit. In the example, the airplane climbs to FMC CRZ ALT and then levels at FL250 in cruise.

Cruise

During cruise, the FMC commands economy cruise speed or the pilot entered speed until reaching the top-of-descent (T/D) point. Other cruise speed options are:

- long range (LRC)
- engine out (ENG OUT)
- flight crew entered speed
- flight crew entered constant Mach between two or more waypoints
- required time of arrival (RTA)

The FMC commands maximum range cruise speed with the cost index set to zero. Cost index modifications are allowed until within ten miles of the top of descent.

Cruise Climb

Setting an altitude above the current cruise altitude in the MCP altitude window and pushing the altitude selector causes the cruise altitude to be set to the MCP altitude and the airplane to climb to the new cruise altitude. The CRZ page displays ACT ECON CRZ CLB.

Step Climb

Fuel and ETA calculations assume the airplane climbs at each calculated step climb point as airplane weight decreases. FMC calculated step climb increments are based on the step size shown on the CRZ page. Entering a step size of zero causes the FMC to assume a constant altitude cruise.

Flight crew entry of a STEP TO altitude on the CRZ page or "S" on a waypoint on the LEGS page overrides FMC step climb calculations. Entry of a step altitude on the LEGS page overrides a STEP TO entry made on the CRZ page.

Calculated step altitudes display on the LEGS page. The distance and ETA to the next step point (calculated or flight crew entered) display on the CRZ and PROGRESS pages. They also display on the ND map display with a green circle and "S/C".

The FMC calculates step climb locations and altitudes as a function of lateral flight plan, current cruise speed mode and altitude, entered forecast winds and temperatures, step size, cruise cg, and gross weight.

The primary factor affecting step climb calculation is the entry of accurate forecast cruise winds and temperatures on the WINDS page. Unless enroute winds are entered, all step climb locations and altitudes are calculated assuming zero wind. IRS winds are not used in the calculation of step climb data.

For ECON cruise, step climbs are optimized to provide minimum trip cost according to the entered Cost Index. For other selected speeds, calculated step climbs minimize trip fuel.

Calculated step locations display on the ND (S/C); the next step displays on the ECON CRZ page. Flight plan calculations of time and fuel at destination are based on executing step climbs as calculated. Legs page waypoint altitudes reflect the optimum step climb profile.

Inflight entry of a STEP TO altitude in 1R causes the FMC to use the entered enroute winds and temperatures to calculate the optimum location for a climb to the step altitude; the ETA and DTG for the step display in 2R. Following entry of an altitude in 1R, the FMC uses only that altitude to calculate data for 2R. When the FMC calculates an immediate step climb to the entered altitude is optimal, 2R displays NOW. If the FMC determines remaining at the current altitude for the duration of the flight is more optimal than flying at the entered altitude, 2R displays NONE.

Planned step climb points (S/C) may be entered on the Legs page at selected waypoints. In this case, both altitude and step location are constrained. With planned step climb points entered, flight plan calculations assume a constant cruise altitude until reaching the planned step waypoint. Optimized step climb calculations resume after passing the last planned step climb waypoint.

When either a manually entered, or a planned step climb point entered on the LEGS page is sequenced and NOW is shown in 2R on the CRZ page, the step climb point shown in 1R can be deleted.

When the last planned step is a step descent, step climbs are no longer calculated.

Optimum (OPT) altitude calculation does not use forecast or IRS winds and temperatures. Recommended (RECMD) altitude calculation is based on step size, current CRZ ALT, and entered forecast enroute winds and temperatures.

All altitude calculations are limited by maximum (MAX) altitude.

If a climb is not initiated within 5 minutes after passing a planned or calculated step climb point, the EICAS message VNAV STEP CLIMB displays.

If a climb is not initiated within 5 minutes after passing a planned or calculated step climb point and the difference between the CRZ ALT shown in 1L and the STEP TO altitude shown in 1R of the CRZ page is greater than 3,500 feet, the EICAS advisory message VNAV STEP CLIMB displays.

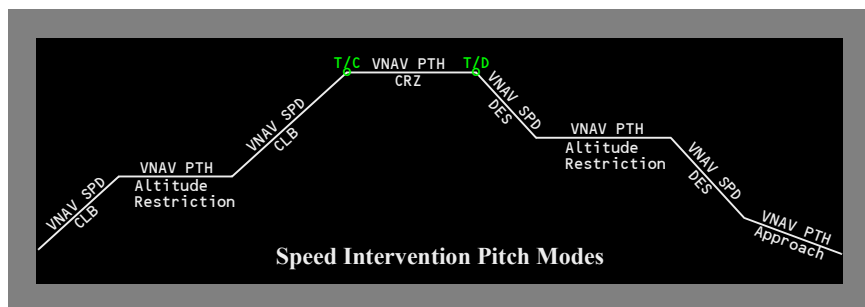
Cruise Descent

Setting an altitude below the current cruise altitude in the MCP altitude window and pushing the altitude selector (more than 50 nm from a T/D) causes the cruise altitude to be set to the MCP altitude and the airplane to descend to the new cruise altitude. The CRZ page displays ACT ECON CRZ DES. If the altitude set in the altitude window is below the speed transition (SPD TRANS) or restriction (SPD RESTR) altitude displayed on the DES page, those altitudes and speeds are deleted. Transition or speed restrictions must be maintained by flight crew action.

Required Time of Arrival (RTA)

VNAV controls cruise speed to arrive at a specified waypoint within ± 30 seconds of a specified time. If the RTA is not achievable, the FMC displays the scratchpad message UNABLE RTA.

MCP Speed Intervention



With VNAV active, pushing the IAS MACH selector enables speed intervention. Speed intervention allows the flight crew to change airplane speed with the IAS/MACH selector.

The above illustration shows the VNAV pitch flight mode annunciation for each phase of flight when using speed intervention.

In a VNAV descent after the T/D, VNAV PTH changes to VNAV SPD during speed intervention. In all other phases, the pitch mode does not change with speed intervention. Pitch controls speed in VNAV SPD mode, and during the VNAV PTH descent prior to speed intervention. Otherwise, thrust controls speed in VNAV PTH mode.

During a VNAV, non-ILS approach while using speed intervention, the pitch mode is VNAV PTH. The vertical path is maintained regardless of IAS MACH selector changes.

If a “direct to” is executed to a waypoint in the approach, VNAV transitions to the approach phase when the airplane passes the “direct to” waypoint. If a waypoint located after the first waypoint of an FMC database approach is added and executed, VNAV will not transition to approach phase when passing the first waypoint of the approach.

Descent

The FMC calculates a descent path based on airspeed and altitude constraints and the end of descent (E/D) point. Dashes display on the LEGS page for speed and altitude descent waypoints. When an arrival or approach procedure is selected on the ARRIVALS page and incorporated into the flight plan, the FMC creates an E/D. The E/D is located 50 feet above the runway threshold (RW waypoint) for all approaches except VOR approaches. The E/D for VOR approaches is the missed approach point; which may be the VOR, runway waypoint (RWXXX), or a named waypoint. During cruise, an E/D is also created when an altitude constraint is entered on the LEGS page on a downstream waypoint.

The top of descent (T/D) is the point where the cruise phase changes to the descent phase. A green circle T/D symbol displays on the ND at the start descent phase point. The FMC displays a T/D symbol at each point in the descent profile which represents a transition from a level segment to a descent segment. The descent path starts at the T/D and includes waypoint altitude constraints. The path to the first constraint is based on:

- idle thrust
- speedbrakes retracted
- FMC cruise wind
- wind entries on the DESCENT FORECAST page
- predicted use of anti-ice
- applicable target speed

The descent may be planned at economy Mach/CAS (based on Cost Index) or a manually entered Mach/CAS. VNAV will not command an economy target speed greater than 314 knots (VMO/MMO minus 16 knots) or a pilot entered speed greater than 319 knots (VMO/MMO minus 11 knots).

The FMC creates the descent path with a deceleration at the speed transition altitude (typically 250 knots below 10,000 feet). VNAV plans a speed target 10 knots below the transition speed to allow for unknown tailwinds.

Descent path segments after the first altitude constraint waypoint are constructed as straight line point-to-point segments. If the VNAV path segment is too shallow to be flown satisfactorily at IDLE thrust, the FMC commands speed on thrust levers (SPD). Elevators control the shallow descent path.

If flight plan modifications or unknown winds occur when above the first speed constraint, VNAV varies speed to maintain the path up to the following limits:

- with greater than 15 knots below the target speed, the autothrottle changes from IDLE/HOLD to SPD to provide thrust to accelerate to the target speed. If the autothrottle is not active, the scratchpad message THRUST REQUIRED displays. The airspeed may decrease to minimum maneuvering speed. Subsequently, VNAV commands the airplane to fly below the path to stop the deceleration. If VNAV can no longer maintain the airplane within 150 feet of the path without further deceleration, speed reversion occurs, the pitch mode annunciation changes from VNAV PTH to VNAV SPD, VNAV resets the target speed to 5 knots above the greater of best holding speed or minimum maneuvering speed, and the scratchpad message THRUST REQUIRED displays again
- with greater than 314 knots (VMO/MMO minus 16 knots), the scratchpad message DRAG REQUIRED displays. The airplane may accelerate up to 319 knots (VMO/MMO minus 11 knots) to maintain the path. If further correction is required, VNAV may allow the airplane to rise up to 150 feet above the path. If VNAV can no longer maintain the airplane within 150 feet of the path without further acceleration, speed reversion occurs, the pitch mode annunciation changes from VNAV PTH to VNAV SPD, VNAV resets the target speed to 314 knots (VMO/MMO minus 16 knots), and the scratchpad message DRAG REQUIRED displays again

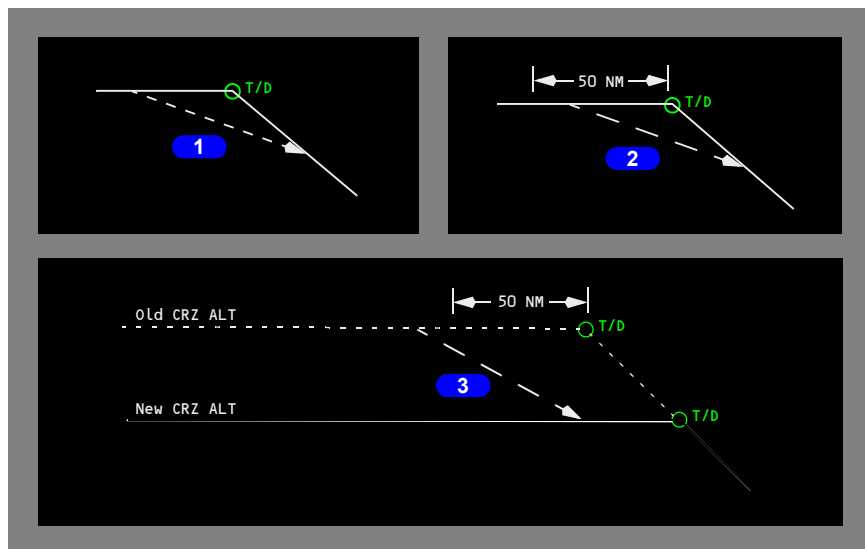
If flight plan modifications or unknown winds occur when below the first speed constraint, VNAV varies speed to maintain the path up to the following limits:

- with greater than 10 knots below the target speed, the autothrottle changes from IDLE/HOLD to SPD to provide thrust to accelerate to the target speed. If the autothrottle is not active, the scratchpad message THRUST REQUIRED displays. The airspeed may decrease to minimum maneuvering speed. Subsequently, VNAV commands the airplane to fly below the path to stop the deceleration. If VNAV can no longer maintain the airplane within 150 feet of the path without further deceleration, speed reversion occurs, the pitch mode annunciation changes from VNAV PTH to VNAV SPD, VNAV commands a speed 10 knots less than the transition speed for the destination airport (not less than minimum maneuvering speed), and the scratchpad message THRUST REQUIRED displays again
- with greater than 10 knots above target speed, the scratchpad message DRAG REQUIRED displays. The airplane may accelerate up to 15 knots above target speed to maintain the path. The maximum speed excursion allowed is 5 knots above the transition speed after the airplane is below transition altitude for the destination airport or 5 knots below the flaps placard speed if flaps are extended. If further correction is required, VNAV may allow the airplane to rise up to 150 feet above the path to stop the acceleration. If VNAV can no longer maintain the airplane within 150 feet of the path without further acceleration, speed reversion occurs, the pitch mode annunciation changes from VNAV PTH to VNAV SPD, VNAV commands a speed 10 knots less than the transition speed for the destination airport, and the scratchpad message DRAG REQUIRED displays again

Early Descent

When a descent is started before the T/D, VNAV commands a descent at a reduced descent rate until the idle descent path is intercepted.

Start an early descent by setting a lower altitude and selecting the DES NOW prompt on the DES page or by pushing the MCP altitude selector. In an early descent, the autothrottle mode annunciation is initially THR, followed by HOLD, allowing the pilot to adjust the rate of descent. The pitch mode is VNAV SPD.



1 DES NOW

Use the DES NOW prompt on the VNAV DES page. VNAV starts an early descent and captures the idle descent path.

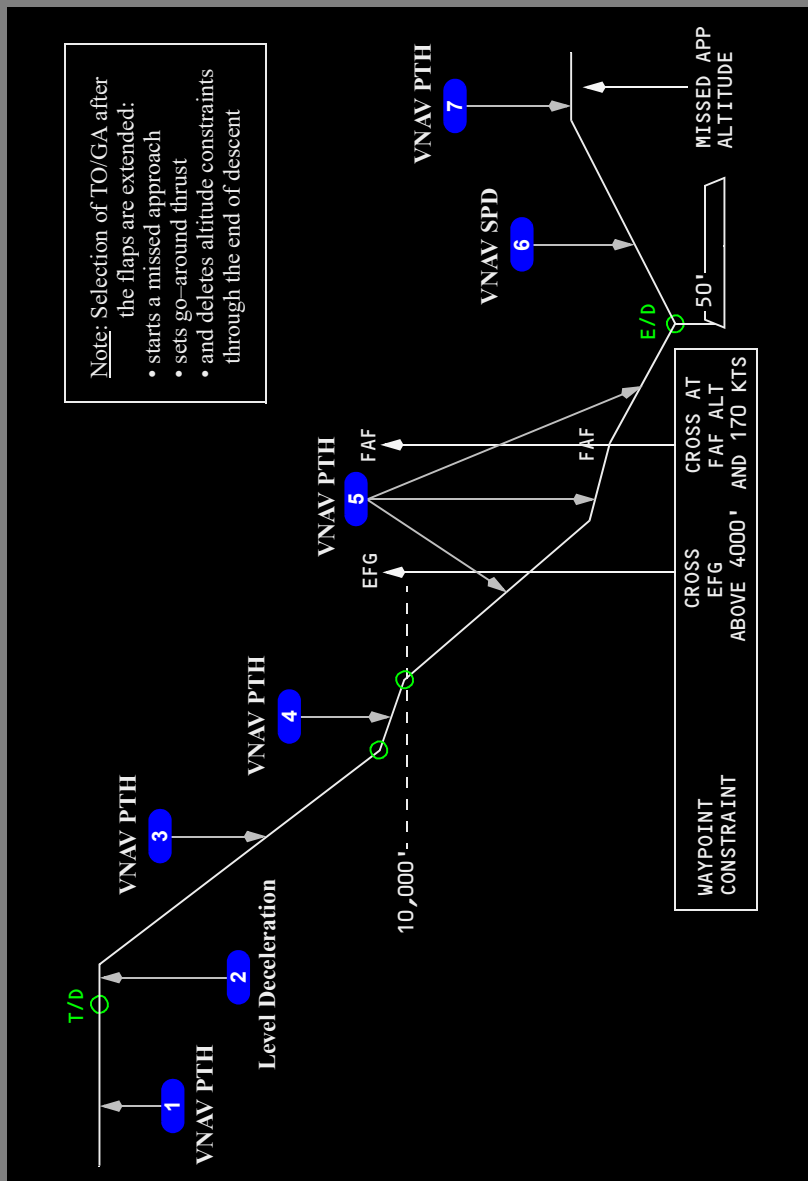
2 Within 50 NM of Top of Descent Point

Use the MCP altitude selector to start an early descent. Within 50 NM of the top of descent point, VNAV starts an early descent and captures the idle descent path.

3 More than 50 NM from Top of Descent Point

Use the MCP altitude selector to start a cruise descent. If the distance from the top of descent is more than 50 NM, VNAV begins a cruise descent to the new cruise altitude. VNAV may not capture the idle descent path since the target airspeed is economy cruise and the descent path is based on idle thrust and economy descent airspeed. In the example, VNAV levels at the new cruise altitude.

Cruise and Descent Profile (Instrument Approach Using VNAV)



1 Cruise

Before the top of descent, FMC is in cruise mode and commands VNAV PTH and ECON cruise speed.

2 Level Deceleration Phase

At top of descent, FMC transitions to descent and commands the airspeed to ECON descent speed and maintains altitude in VNAV PTH.

3 Descent

Nearing descent speed, VNAV commands a descent in VNAV PTH at ECON descent speed.

4 Descent Deceleration Phase

Before the speed restriction altitude, the FMC commands the target descent airspeed. The pitch mode remains VNAV PTH and the descent rate approximates 500 feet per minute.

5 Descent and Approach

When at target speed, VNAV commands a descent and starts approach in VNAV PTH at commanded speed. Extending flaps from UP to 1 arms go-around; EICAS displays GA as the reference thrust limit. Activation of VNAV changes the reference thrust limit to CRZ; selection of landing flaps (25 or 30) changes the reference thrust limit to GA. Prior to extending flaps to a landing position and with VNAV PTH and CRZ reference thrust limit, pressing TO/GA changes the reference thrust limit to GA.

6 Missed Approach

When selected during missed approach, VNAV activates in VNAV SPD.

7 Missed Approach Level Off

At missed approach altitude, VNAV SPD changes to VNAV PTH.

Approach

The FMC transitions to "on approach" mode for any of the following conditions:

- the descent phase is active and flaps are out of up, or
- the airplane has sequenced the first waypoint (or FAXXX) of the active approach, or
- the airplane is on a direct-to or intercept course-to the active waypoint and the distance to go is less than 12 NM, or
- the missed approach point is the active waypoint and the distance to go is less than 25 NM

The approach condition may be delayed if the flight crew manually inserts, bypasses, or deletes an approach waypoint on the LEGS page.

The FMC transitions out of "on approach" under the following conditions:

- the pilot selects TO/GA
- the airplane lands
- the airplane flies beyond the last waypoint in the approach (missed approach waypoint or runway). The VNAV page title changes from "ACT xxxxx DES" to "ACT END OF DES"

When the FMC is "on approach", the following features are available:

- the IAS/MACH window can be opened and the command speed can be set while VNAV remains in VNAV PTH descent; VNAV commands the set speed
- the MCP altitude can be set above the airplane altitude for the missed approach. When the MCP altitude setting is at least 300 feet above the current airplane altitude, VNAV continues to command a descent
- VNAV remains in VNAV PTH and follows the descent path unless the airplane accelerates to within 5 knots of the current flap placard and the airplane rises more than 150 feet above the path. In this case, VNAV PTH changes to VNAV SPD
- When a glide path angle is specified for one or more legs on the approach, it displays on the LEGS page and VNAV provides VNAV PTH guidance at the displayed angle. When sequencing a waypoint prior to a descent leg specified by a glide path angle, VNAV commands level flight until the airplane intercepts the descent path

Note: Display of a specified glide path angle is not limited to approaches. A glide path angle may be defined for a leg in a STAR and displays on the LEGS page for the procedure.

Selection of another approach can be accomplished on the ARRIVALS page. An along-course intercept to an approach waypoint in the new approach can be selected on the "INTC CRS TO" line on the LEGS page or by selecting the "XXXXX INTC>" prompt on the ARRIVALS page.

Missed Approach

A missed approach is accomplished by selection of either TO/GA switch. The following features are available:

[Option: Auto LNAV engage installed]

- VNAV can only be activated when the airplane climbs above 400 feet radio altitude

[Option: Auto LNAV engage installed]

- if an LNAV path is available, LNAV automatically activates:
 - above 50 feet radio altitude when autopilot is not engaged, or
 - above 200 feet radio altitude when autopilot is engaged

Note: Route discontinuities after the missed approach will prevent the TO/GA to LNAV function from activating.

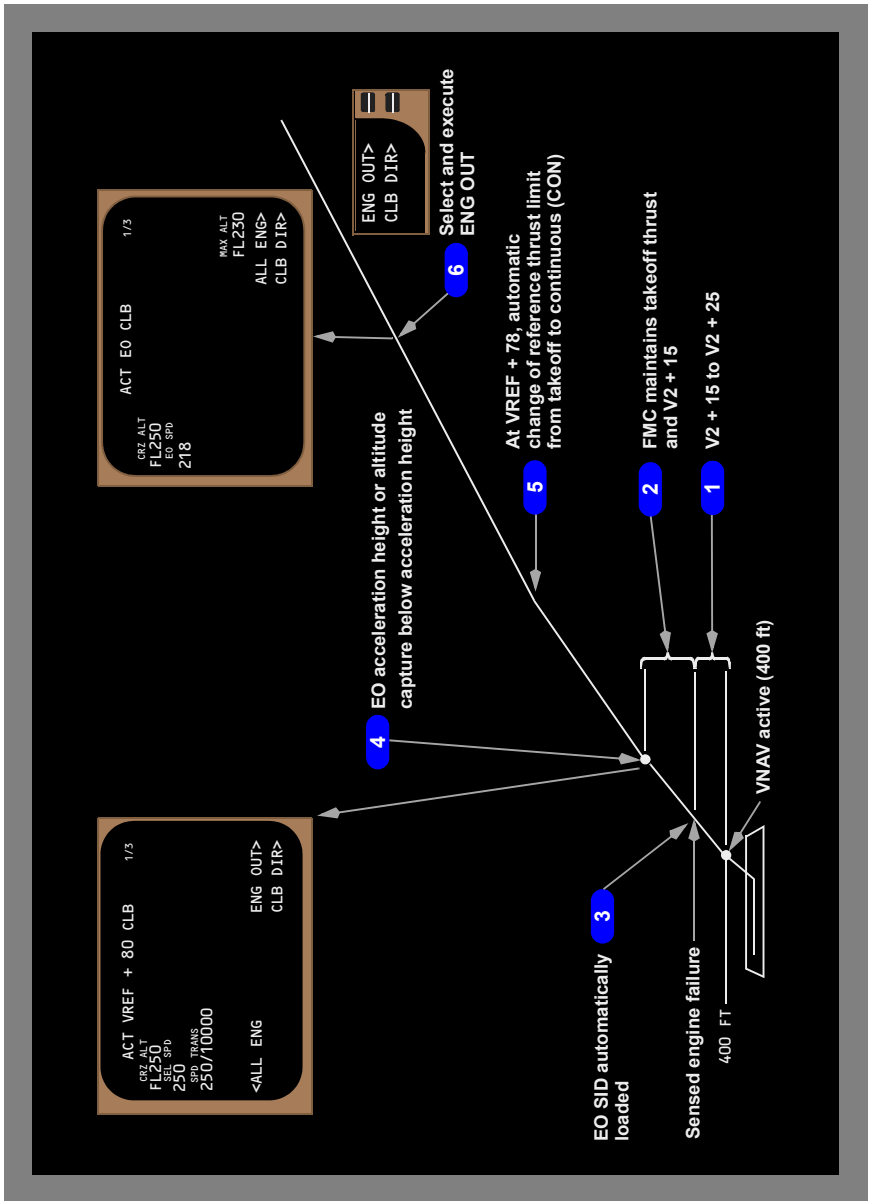
- all descent altitude constraints below the current airplane altitude are deleted; the waypoints are retained in the active flight plan
- the highest altitude in the missed approach procedure becomes the new cruise altitude
- the FMC transitions from active descent to active climb. This transition also occurs when the airplane climbs toward the MCP altitude and flaps are retracted from a landing position (25 or 30 towards 20, or 20 towards 5). For example, when a missed approach is accomplished without pushing the TO/GA switch.
- AFDS guidance to fly the published missed approach procedure to the new cruise altitude is active when VNAV (and LNAV) is selected
- when cruise phase is active, the speed target is the most restrictive of speed transition, best hold speed, or ECON cruise (above speed transition altitude)

Executing a missed approach causes the flight phase transition from descent or end of descent to climb when:

- the MCP altitude window is set to an altitude greater than current altitude, and
- the airplane is climbing at a rate greater than 600 fpm, and
- flaps have been retracted from the landing position

Engine Out Operation

Takeoff and Climb



1 Takeoff

Condition: before a sensed engine failure and above VNAV activation altitude.

Result: VNAV SPD commands a climb at $V2+15$ to $V2+25$ knots. Autothrottle annunciation is THR REF and the thrust limit is takeoff.

2 Sensed Engine Failure

Condition: after VNAV activation, engine failure is sensed, airplane below engine out acceleration height and below the thrust reduction point entered on the TAKEOFF REF page.

Result: VNAV remains in VNAV SPD and commands $V2 + 15$ knots. Autothrottle remains in THR REF and the thrust limit remains takeoff (TO).

3 EO SID

Condition: flaps out of up and an engine out standard instrument departure (EO SID) in the FMC database.

Result: FMC loads the EO SID as a flight plan modification. The modification may be either executed or erased.

4 EO Acceleration Height

Condition: at EO acceleration height or altitude capture below acceleration height.

Result: VNAV commands an acceleration to $VREF + 80$ knots, limited by the airplane configuration (flap placard). The VNAV climb page title displays the ACT $VREF + 80$ CLB page.

5 Thrust Reduction

Condition: airplane has accelerated to $VREF + 78$ knots

Result: thrust is automatically reduced from selected takeoff to continuous (CON) thrust. If the engine failure occurs above the thrust reduction point, the current climb thrust is maintained.

6 VNAV Climb (Engine Out)

Condition: Selecting the ENG OUT> prompt on the VNAV CLB page displays applicable engine out performance data. Execution activates engine out performance data and terminates the VNAV engine out takeoff phase.

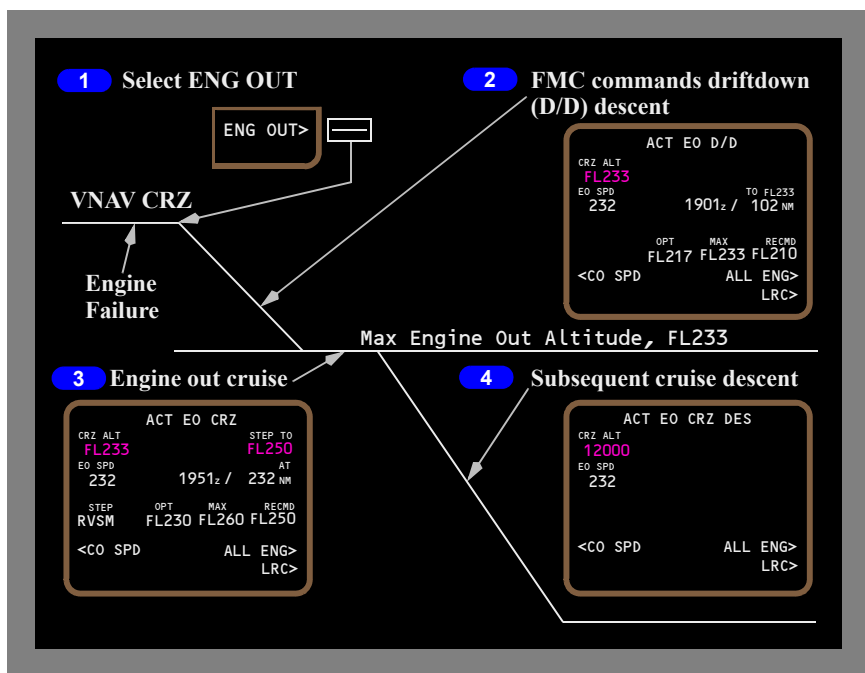
Result: the FMC engine out climb function is active, the pitch mode is VNAV SPD, the command speed is EO SPD, and the reference thrust limit is CON.

Climb (Above EO Max Alt)

When the airplane is above the engine out maximum altitude, selection of ENG OUT> on the VNAV CLB page or the XXXX ALTN page creates a modification and displays applicable engine out driftdown (D/D) performance data enabling the a descent to the engine out maximum altitude. Execution of the modification activates the engine out driftdown function.

Cruise (Above EO Max Alt)

When the airplane is above the engine out maximum altitude, selection of ENG OUT> on the VNAV CRZ page or the XXXX ALTN page creates a modification and displays applicable engine out driftdown (D/D) performance data. When executing the ENG OUT modification, the reference thrust limit becomes CON, thrust levers advance to CON, the default command speed is EO SPD, and the EO MAX altitude shows as the cruise altitude in 1L. The EO MAX altitude shown in 1L does not change with time or changes in command speed.



1 Engine Out Modification

Selecting ENG OUT> creates a modification and displays the applicable engine out driftdown (D/D) performance data.

2 Drift Down Execution

A driftdown descent can be initiated by setting the MCP altitude at or below EO MAX altitude and executing the modification.

Result:

- VNAV commands EO SPD
- when EO SPD is achieved, VNAV controls the driftdown descent rate to a minimum of 300 feet per minute (fpm)
- time and distance for the D/D to EO MAX altitude show at 2R
- VNAV captures the MCP altitude and commands EO CRZ

Executing the ENG OUT modification without descending changes the pitch mode to VNAV ALT. A driftdown descent does not start until setting the altitude at or below EO MAX altitude and pushing the altitude selector. The result above describes the driftdown.

A normal enroute cruise descent can be initiated by setting the MCP altitude to a lower altitude and pushing the altitude selector.

Result:

- the airplane descends in a normal VNAV cruise descent at two-engine ECON speed
- the reference thrust limit is CLB/CRZ
- the airplane descends at ECON CRZ and approximately 1,250 fpm

During the enroute cruise descent, when the airplane is above EO MAX altitude, executing the ENG OUT modification commands a driftdown descent to the EO MAX altitude. The command speed is E/O SPD. The rate of descent decreases to a minimum of 300 fpm.

3 Engine Out Cruise

When VNAV captures the EO MAX altitude, the VNAV cruise page title becomes EO CRZ and the pitch annunciation is VNAV PTH, regardless of the MCP altitude window setting. Calculations for EO Step Climb display at 2R. Thrust limit remains in CON.

4 Subsequent Cruise Descent

The FMC is in engine out mode. When the airplane is more than 50 nm from T/D, setting a lower MCP altitude and pushing the altitude selector executes an engine-out cruise descent.

Result: VNAV cruise descent at approximately 1,250 fpm at EO SPD. When the EO cruise descent intersects the planned descent profile, descent mode becomes active.

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 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; displays as 800
- 1,500 feet is entered as 015 or FL015; displays as 1500
- 11,500 feet is entered as 115 or FL115; displays as FL115
- 25,000 feet is entered as 250 or FL250; displays 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; displays as 50
- 835 feet is entered as 0835; displays as 840
- 1,500 feet is entered as 1500; displays as 1500
- 8,500 feet is entered as 8500; displays as 8500
- 9,994 feet is entered as 9994; displays 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; displays as 50
- 835 feet is entered as 00835; displays as 840
- 1,500 feet is entered as 01500; displays as 1500
- 8,500 feet is entered as 08500; displays as FL085
- 9,995 feet is entered as 09995; displays as FL100
- 11,500 feet is entered as 11500; displays as FL115
- 25,000 feet is entered as 25000; displays as FL250

Negative altitude entries are allowed to -1000 feet.

Airspeed Entry

Airspeeds can be entered into the FMC as calibrated airspeed, CAS, or Mach number, M. 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 constraints.

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.

**Flight Management, Navigation
Flight Management Computer****Chapter 11
Section 32****FMC Databases**

The FMC contains three databases:

- performance
- navigation
- airline modifiable information (AMI).

The performance database supplies performance data to the flight crew. It supplies the FMC with data to calculate pitch and thrust commands. All pertinent data can be displayed on the CDU. The database includes:

- airplane drag and engine characteristics
- maximum and optimum altitudes
- maximum and minimum speeds.

The navigation database includes most data found on navigation charts. This data can be displayed on the CDU or ND. The database contains:

- location of VHF navigation aids
- airports
- runways
- other airline selected data, such as SIDs, STARs, approaches, and company routes
- transition altitudes.

The FMC contains two sets of navigation data, each valid for 28 days. Each set corresponds to the usual navigation chart revision cycle. The FMC uses the active data for navigation calculations. The contents of the navigation database are periodically updated and transferred to the FMC before the expiration date of the active data.

The AMI file contains airline specified data. If the FMC senses a conflict in an AMI value after a new AMI data load, the scratchpad displays the message CHECK AIRLINE POLICY.

Thrust Management

The thrust management function operates the autothrottle in response to flight crew mode control panel inputs or to FMC commands. Reference thrust limits can be selected on the THRUST LIM page. FMC autothrottle commands are made while VNAV is engaged. Thrust management:

- calculates reference thrust limits and thrust settings, or follows FMC thrust settings
- commands thrust levers
- senses and transmits autothrottle failures
- commands thrust equalization through the engine electronic controls.

[PW, RR Engines]

Thrust limits are expressed as EPR limits. Thrust equalization references EPR.

[GE Engines]

Thrust limits are expressed as N1 limits. Thrust equalization references N1.

Thrust management calculates a reference thrust for the following thrust settings:

[Option – With Takeoff Thrust Derate, Climb Derates, Takeoff Bump]

- | | |
|--|---|
| • TO – takeoff | • TO B – takeoff bump
(increased takeoff thrust) |
| • TO 1 – takeoff one | • CLB – climb |
| • TO 2 – takeoff two | • CLB 1 – climb one |
| • D–TO – assumed temperature
takeoff | • CLB 2 – climb two |
| • D–TO 1 – derate one assumed
temperature takeoff | • CRZ – cruise |
| • D–TO 2 – derate two
assumed temperature takeoff | • CON – continuous |
| | • G/A – go-around. |

[Option – Without Takeoff Thrust Derate, With Climb Derates]

- | | |
|---|---------------------|
| • TO – takeoff | • CLB 1 – climb one |
| • D–TO – assumed temperature
takeoff | • CLB 2 – climb two |
| • TO B – takeoff bump
(increased takeoff thrust) | • CRZ – cruise |
| • CLB – climb | • CON – continuous |
| | • G/A – go-around. |

[Option-With APU-to-Pack takeoff thrust limit]

In addition, with the APU-to-Pack takeoff option, “A-TO”, “A-TO 1”, “A-TO 2”, or “A-TO B” thrust setting displays.

[Option- With APU-to-Pack takeoff thrust limit]

In addition, with the APU-to-Pack takeoff option, “A-TO” or “A-TO B” thrust setting displays.

[PW, RR Engines]

With VNAV active, the reference thrust limit changes for the phase of flight. Thrust settings can be selected on the THRUST LIM page. The reference thrust limit displays above EICAS EPR indications.

[GE Engines]

With VNAV active, the reference thrust limit changes for the phase of flight. Thrust settings can be selected on the THRUST LIM page. The reference thrust limit displays above EICAS N1 indications.

The flight crew can specify the thrust reduction height where the change from takeoff to climb thrust takes place by making an entry on the CDU TAKEOFF REF page. This can be an altitude from 400 feet to 9,999 feet, an entry of 1 for Flaps 1, or an entry of 5 for flaps 5.

Reduced Thrust Takeoff

Reduced thrust takeoffs lower EGT and extend engine life.

Derate/Variable Takeoff Rating

[Option – With Takeoff Thrust Derate]

Two fixed derates can be selected on the THRUST LIM page. TO 1 and TO 2 reduce takeoff thrust by percentages specified by the operator [Airline Selectable Option]. The derate percentages can be set between maximum takeoff thrust and the maximum certified derate in one percent increments. The Airplane Flight Manual (AFM) provides performance data for these derates.

With both TO 1 and TO 2, 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. Use the takeoff speeds calculated by the FMC for the selected derate or variable takeoff rating condition.

Derate/variable takeoff rating can be further reduced by assumed temperature.

Assumed Temperature Thrust Reduction Takeoff

Entering an assumed temperature higher than the actual temperature reduces takeoff thrust.

[Option: Deep Derate not installed]

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.

[Option - With Deep Derate Takeoff Thrust]

The maximum thrust reduction authorized is 40 percent below the full rating. With this option, fixed takeoff derates are not available. 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.

The assumed temperature thrust setting is not considered a limitation. The assumed temperature reduction can be removed. If conditions are encountered where more thrust is necessary, the crew can manually apply full thrust.

Note: When the flight crew enters an assumed temperature resulting in thrust reduction; and, manually arms CLB, a decrease in OAT may cause the FMC to recalculate V-speeds and arm CLB 1 or 2 on the THRUST LIM page. The scratchpad message TAKEOFF SPEEDS DELETED displays.

Derated Thrust Climb

[Option – With Climb Thrust Derate]

During climb, CLB 1 and CLB 2 derates are gradually removed. In cruise, the thrust reference defaults to CLB or CRZ [Airline Selectable Option]. The reference can be manually selected on the THRUST LIM page.

[Option – 12,000 Feet Washout]

Two fixed climb thrust derates can be selected on the THRUST LIM page. CLB 1 uses a 10 percent derate of CLB thrust to 10,000 feet, then increases thrust linearly with altitude to CLB thrust at 12,000 feet. CLB 2 uses a 20 percent derate of CLB thrust to 10,000 feet, then increases thrust linearly with altitude to CLB thrust at 12,000.

[Option – 30,000 Feet Washout]

Two fixed climb thrust derates can be selected on the THRUST LIM page. CLB 1 uses a 10 percent derate of CLB thrust to 10,000 feet, then increases thrust linearly with altitude to CLB thrust at 30,000 feet. CLB 2 uses a 20 percent derate of CLB thrust to 10,000 feet, then increases thrust linearly with altitude to CLB thrust at 30,000 feet.

Use of an assumed temperature reduced thrust takeoff or takeoff derate affects automatic selection of climb derate. For a thrust reduction less than 10 percent, maximum climb thrust is automatically selected by the FMC. For takeoff thrust reductions or derates from 10 percent to less than 20 percent, CLB 1 is selected. CLB 2 is selected for all takeoff thrust reductions or derates equal to or greater than 20 percent. On the ground, the pilots may override the automatic climb derate selection after the takeoff selection is complete.

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 system or from manual entries. Fuel quantity values display on the PERF INIT page as calculated (CALC), MANUAL, or SENSED. They display on PROGRESS page 2 as TOTALIZER and CALCULATED. TOTALIZER and SENSED values are the same data with different names.

The FMC usually uses the calculated value for performance computations. Before engine start, the calculated value is set to agree with the fuel quantity indicating system value. When the FMC receives a positive fuel flow signal at engine start, the calculated value is independent of the fuel quantity system and decreases at the fuel flow rate.

During fuel jettison, the calculated value is set equal to the fuel quantity system value. When fuel jettison is completed, the calculated value is independent of the fuel quantity indicating system and decreases at the fuel flow rate. This fuel quantity value displays as CALC (calculated) on the PERF INIT page and CALCULATED on PROGRESS page 2.

If the flight crew inputs a fuel quantity, the line title changes to MANUAL and replaces the calculated value. Like the calculated value, the manual value is updated by fuel flow rate.

The calculated value is invalid if fuel flow data is invalid. The FMC uses the fuel quantity indicating system quantity for performance computations. The line title on the PERF INIT page changes to SENSED and displays as TOTALIZER on PROGRESS page 2.

[Option: AIMS V17 or earlier installed; not V16]

The fuel used by each engine is calculated with its related fuel flow signal. FUEL USED displays on PROGRESS page 2. FUEL USED values are retained through flight completion and are subsequently cleared at engine start or following a long-term power interrupt on the ground. If the fuel flow signal is invalid for greater than two minutes after engine start or is invalid while on the ground, the display blanks.

[Option: AIMS V16 installed]

The FMC continually estimates the fuel at the destination airport when the active route is flown. The EICAS message INSUFFICIENT FUEL displays if the estimate is less than the fuel reserve value; or, if no reserve value entered, then 4,000 lbs (1,814 kgs). For a pending activation route or for the active route in a modified state, the message displays in the scratchpad.

[Option: AIMS V16 not installed]

The FMC continually estimates the fuel at the destination airport when the active route is flown. The scratchpad displays the message INSUFFICIENT FUEL if the estimate is less than the fuel reserve value; or, if no reserve value entered, then 4,000 lbs (1,814 kgs).

The EICAS message FUEL DISAGREE displays if the FMC calculates a large difference between the fuel quantity indicating system quantity and calculated value. Totalizer or calculated fuel quantity can be selected with the USE prompt on PROGRESS page 2.

Note: FMC calculated fuel predictions assume a clean configuration. Flight with gear or flaps extended cause fuel prediction errors. Fuel predictions are accurate after the gear and flaps are retracted.

If the actual fuel temperature reaches the minimum value displayed on the PERF INIT page, the EICAS advisory message FUEL TEMP LOW displays.

Loss of FMC Electrical Power

The FMC must have continuous electrical power to operate. When the electrical power is interrupted and returns, the FMC restarts.

After restart, the performance data displayed on the PERF INIT page must be re-entered. The route previously in use is available but must be reactivated.

The flight crew must modify the active waypoint to activate LNAV. Selecting the applicable active waypoint and proceeding direct or intercepting a course to the waypoint allows LNAV activation.

FMC Failure

Single FMC Failure

The scratchpad message SINGLE FMC L or SINGLE FMC R displays after loss of a single FMC. The EICAS advisory message FMC MESSAGE displays. Crew action is not necessary to change to single FMC operation. LNAV and VNAV, if active, remain active and all flight plan and performance data is retained.

A software reset may occur while in single FMC operation. The active route becomes inactive, the performance data is erased, and LNAV and VNAV (if engaged) modes fail. To regain FMC operation, activate and execute the flight plan, enter the necessary performance data, and engage LNAV and VNAV.

Note: If the MENU page and the scratchpad message TIMEOUT RESELECT display, the FMC is no longer connected to the CDU. Selecting the <FMC prompt connects the CDU to the FMC.

Dual FMC Failure

If both FMCs fail, LNAV and VNAV fail. The EICAS advisory message FMC displays. The CDUs supply route data to the NDs, and one of the CDUs supplies LNAV guidance to the autopilot. LNAV can be reselected on the mode control panel. FMS alternate navigation using the CDUs is discussed in Section 50 of this chapter.

Dual FMC failure may inhibit the autothrottle system. If it is available, it may be used in conjunction with any valid autopilot roll and/or pitch mode.

Note: If the MENU page displays and the <FMC prompt is not displayed in line 1, pushing the LEGS function key displays the ALTN NAV LEGS page, the PROG key displays the ALTN NAV PROGRESS page, and the NAV RAD key displays the ALTN NAV RADIO page.

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Flight Management, Navigation
Air Traffic Control Data Link**Chapter 11**
Section 33

Air Traffic Control Data Link

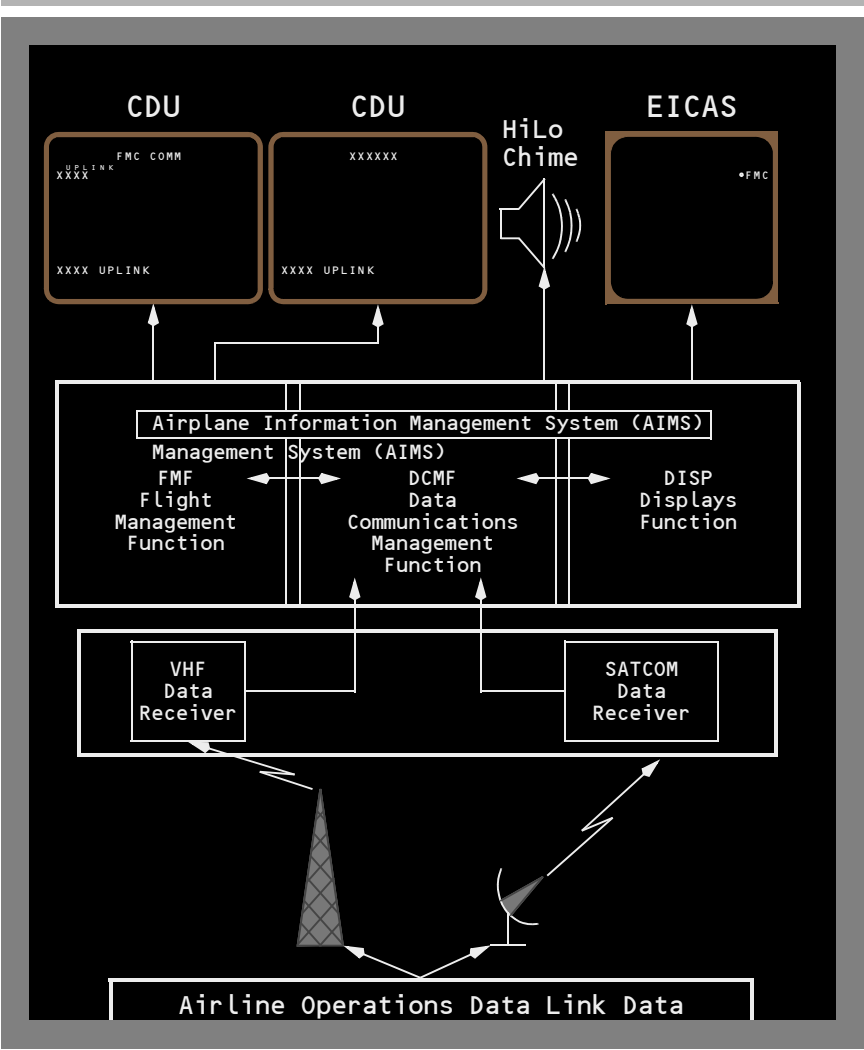
Most Air Traffic Control data link functions are accomplished on the MFD. The CDU is used as an input keyboard for downlink message forms. Uplink messages which contain route modifications are loaded into the FMC using the LOAD FMC function on the MFD ATC page. Execution of an ATC loaded modification is accomplished using normal FMC modification procedures.

Refer to chapter 5, Communications, section 40, MFD Communications, for a description of ATC data link.

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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 data 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

[Option – With Takeoff Datalink]

Select a REQUEST prompt to start the downlink request for data. REQUEST prompts are on PERF INIT, TAKEOFF REF, DESCENT FORECAST, RTE, ALTN, ALTN LIST, or RTE DATA pages. Downlink reports of the active route may be accomplished by selection of the REPORT prompt on the RTE page and a position report may be downlinked by selection of the REPORT prompt on the POS REPORT page.

When the communications function is unable to prepare FMC downlinks, the words FAIL, NO COMM, or VOICE display on CDU pages in place of REQUEST and REPORT prompts. The data link status also displays on the FMC COMM page. Radios supporting data link operations can be reconfigured by the crew through the MFD COMM function; refer to Chapter 5, Communications. The status messages are:

- FAIL –
 - the AIMS data communications management function is inoperative, or
 - both the VHF and SATCOM data radios have failed
- NO COMM –
 - the VHF and SATCOM data radios are operational but not available
 - the VHF data radio has failed and the SATCOM data radio is not available, or
 - the SATCOM data radio has failed and the VHF data radio is not available
- VOICE – all available radios are operating in the VOICE mode

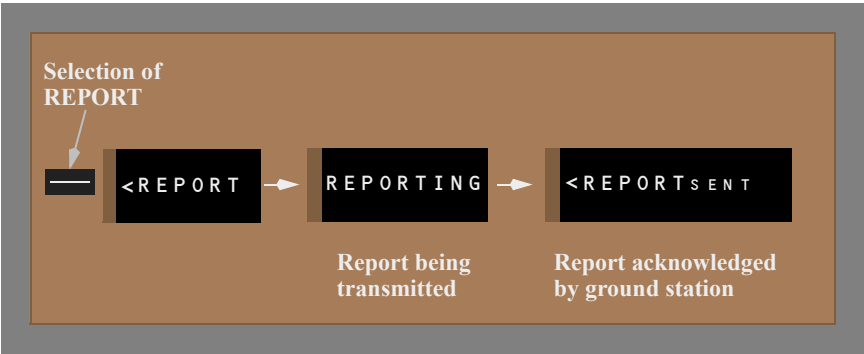
Reports

Pushing the line select key for the REPORT sends a downlink 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 data requests from the airline dispatcher. The FMC response in these cases is completely automatic and no flight crew action is necessary.

Uplinks

Uplinked data may be loaded automatically or may require flight crew action. Two uplinks automatically load data into the FMC 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/PURGE prompts, FMC modification ERASE prompt or EXEC key, or when the page with the uplink is selected. Glareshield-mounted accept and reject switches operate the same as MFD ACCEPT/REJECT prompts.

[\[Option – With Takeoff Data Link\]](#)

Data can be uplinked from the airline dispatcher directly to the PERF INIT, TAKEOFF REF, DESCENT FORECAST, RTE, ALTN, ALTN LIST, and WIND pages. The uplinks are annunciated to the crew by the •FMC EICAS communications alert and a Hi-Lo Chime. The uplink is identified by a CDU scratchpad message and by the presence of an UPLINK label over the applicable COMM page prompt.

[\[Option – With Takeoff Data Link\]](#)

Takeoff uplinks are not annunciated until:

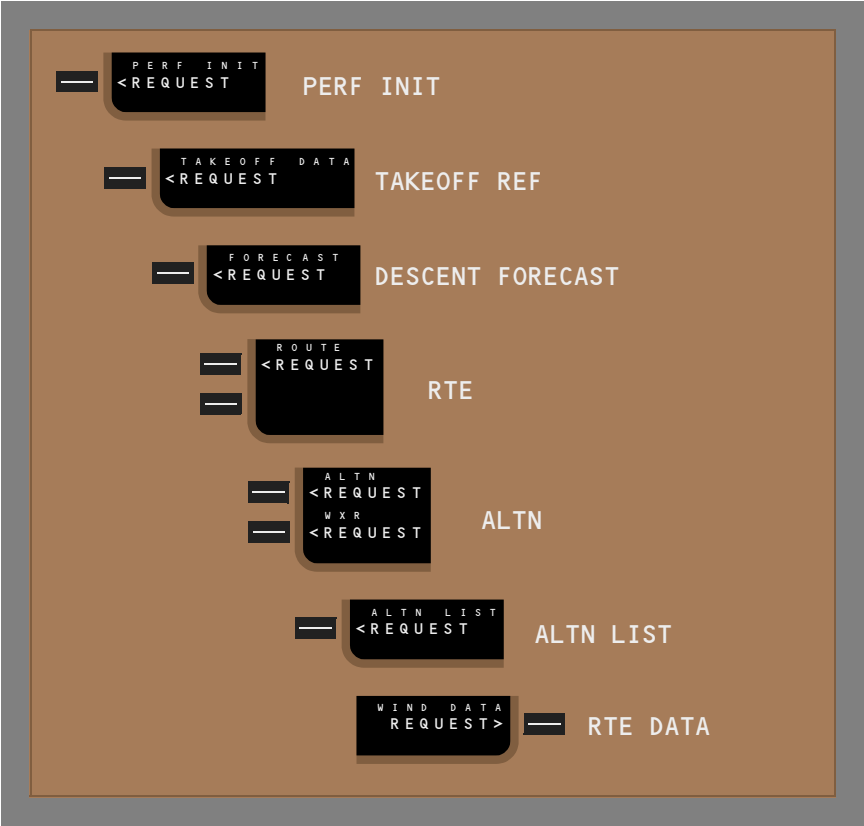
- gross weight is entered on the PERF INIT page
- a route is activated
- the active route has a departure runway (and intersection, if applicable) matching the TAKEOFF uplinks (up to six takeoff records can be uplinked)

If there is no active route, wind uplinks are not annunciated, and the <WIND prompt on the COMM page is not shown.

Requests

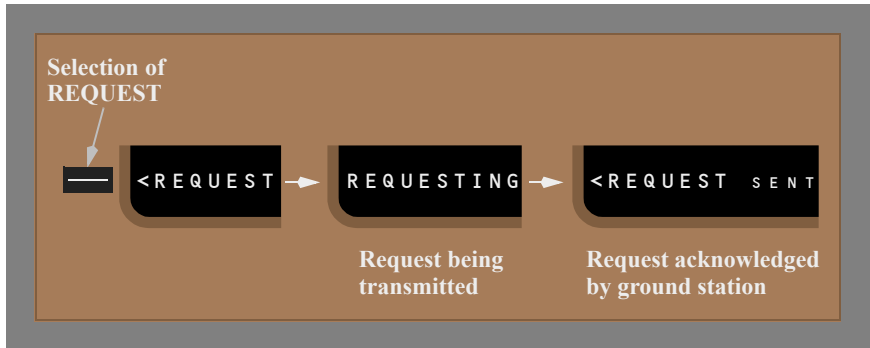
A REQUEST prompt on each page downlinks a unique request applicable to that page. The pages below contain request prompts.

[\[Option – With Takeoff Data Link\]](#)



Request Status

Below is a typical sequence of status in response to sending a request.



FMC Data Link Uplinks (Accept/Reject)

[\[Option – With Takeoff Data Link\]](#)

ACCEPT and REJECT display on the PERF INIT, TAKEOFF 1/2, and ALTN pages after receipt of uplink data.

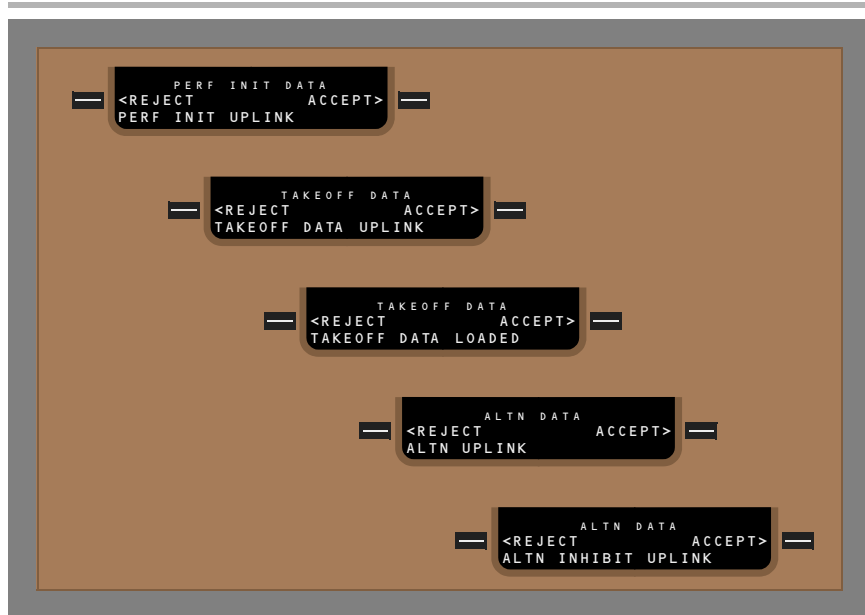
Uplink data displays initially in small font for preview.

Select ACCEPT prompt:

- displays uplinked data in large font
- replaces previous data with uplinked data
- changes page to pre-uplink format
- clears scratchpad message
- transmits a downlink accept message (if enabled)

Select REJECT prompt:

- replaces uplinked data with previous data
- changes page to pre-uplink format
- clears scratchpad message
- transmits a downlink reject message (if enabled)



FMC Data Link Uplinks (Load/Purge)

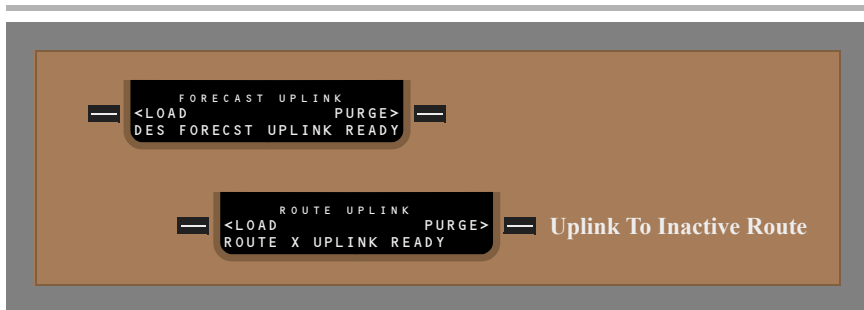
LOAD and PURGE display on the DESCENT FORECAST page after receipt of uplink data. LOAD and PURGE display on the active RTE 1 or RTE 2 page when there is an uplink to the inactive route.

Select LOAD prompt:

- loads uplinked data into FMC for viewing
- clears scratchpad message
- replaces previous data with uplinked data
- changes page to pre-uplink format
- transmits a downlink accept message (if enabled)

Select PURGE prompt:

- replaces uplinked data with previous data
- changes page to pre-uplink format
- clears scratchpad message
- transmits a downlink reject message (if enabled)



FMC Data Link Uplinks (Load/Exec-Erase)

LOAD displays on the RTE and WIND pages after receipt of uplink data.

After the uplinked data is loaded, the EXEC light illuminates and the ERASE prompt displays.

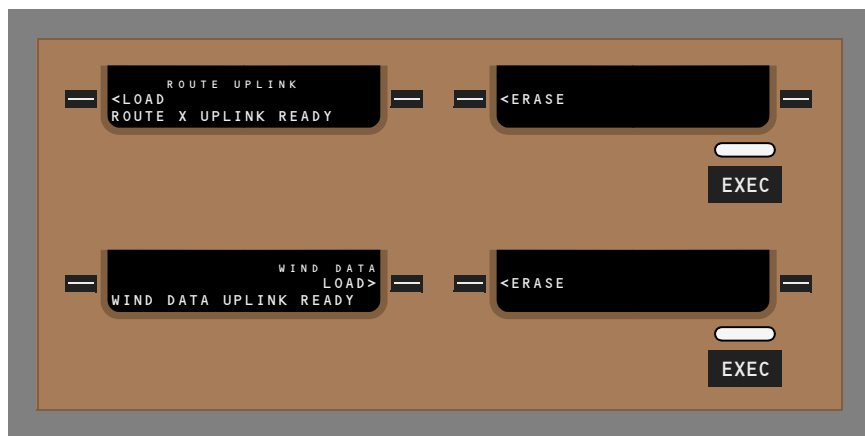
Select LOAD prompt:

- loads uplinked data into FMC
- loaded data can be viewed
- clears scratchpad message
- replaces existing data with modified uplinked data
- changes page title to MOD
- shows ERASE prompt
- illuminates EXEC light

Push the EXEC key to:

- put modified data in active flight plan
- change page format to pre-uplink format
- transmit a downlink accept message (if enabled)

Select ERASE prompt to:



- remove modified data
- return page display to pre-uplink format
- transmit a downlink reject message (if enabled)

FMC Data Link Uplinks (Automatic)

FLT NO and ALTN LIST data can be automatically uplinked and loaded. FLT NO automatically loads into the RTE 1/x page without flight crew action. The list of 20 alternates automatically loads into the ALTN LIST page without flight crew action.

The FLT NO can be uplinked as part of a route uplink. If the route uplink is rejected, the FLT NO remains loaded on the RTE 1/x page.

The scratchpad messages FLIGHT NUMBER UPLINK or ALTN LIST UPLINK stay in the scratchpad display queue until the applicable CDU page is selected.



Data Link Management

The flight crew should monitor system status of FMC data link. This is accomplished on various CDU pages or on the FMC COMM page. Changes to data link system operating modes are accomplished with the COMM function on the display select panel.

CDU Data Link Status Displays

Data link operation is verified when the correct line title displays above the prompt. In the example below, the line title ROUTE is above the REQUEST and REPORT prompts on the RTE page.



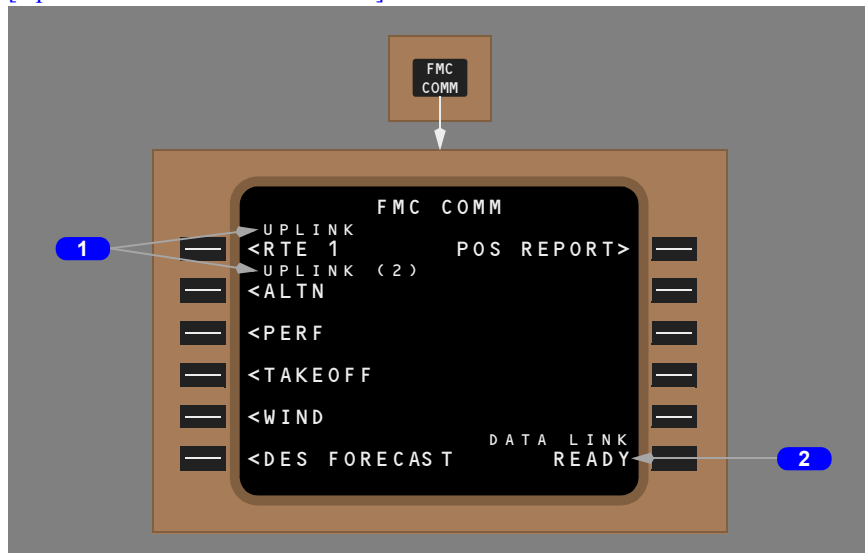
When the data link system is not operating, the CDU data line changes to NO COMM, VOICE, or FAIL and the line title changes to DATA LINK.



FMC Communications Page

General data link status displays on the FMC COMM page. Page select prompts display for each FMC page with access to data link data.

[Option – With Takeoff Data Link]



[Option – With Takeoff Data Link]

1 Uplink Status

The page line title displays UPLINK when an uplink message is pending and all preprocessing is complete. Preprocessing of uplinks ensures prerequisite data is available before the uplink message can be selected. Examples of preprocessing include:

- RTE ALTN, ALTN LIST, PERF, TAKEOFF, and WIND uplinks are held until route activation or modifications are complete
- Subsequent uplinks of the same type are held until previous uplinks are included or discarded by the flight crew
- TAKEOFF uplink is held until gross weight is entered, a pending PERF uplink is included or discarded, or a takeoff runway is entered

When both ALTN and ALTN LIST uplinks are pending, (2) displays to the right of UPLINK in the line title.

The EICAS message •FMC displays whenever any UPLINK message is pending.

2 DATA LINK

Displays the data link system status.

System status can be:

- READY
- NO COMM
- VOICE
- FAIL

Page Select Prompts

[\[Option – With Takeoff Data Link\]](#)

Selection of any of these prompts displays the related page:

- | | |
|-----------|----------------|
| • RTE X | • WIND |
| • ALTN | • DES FORECAST |
| • PERF | • POS REPORT |
| • TAKEOFF | |

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Flight Management, Navigation
FMC Preflight**Chapter 11**
Section 40

Introduction

Completion of the FMC preflight requires data entry in all minimum required data locations. Entry of all required and optional preflight data optimizes FMC accuracy.

Data link can load preflight data from airline ground stations. Using data link reduces the number of required flight crew actions. Manual flight crew entries replace existing data.

[Option: T/O Datalink installed]

Data link can also be used to load takeoff data onto the TAKEOFF REF pages.

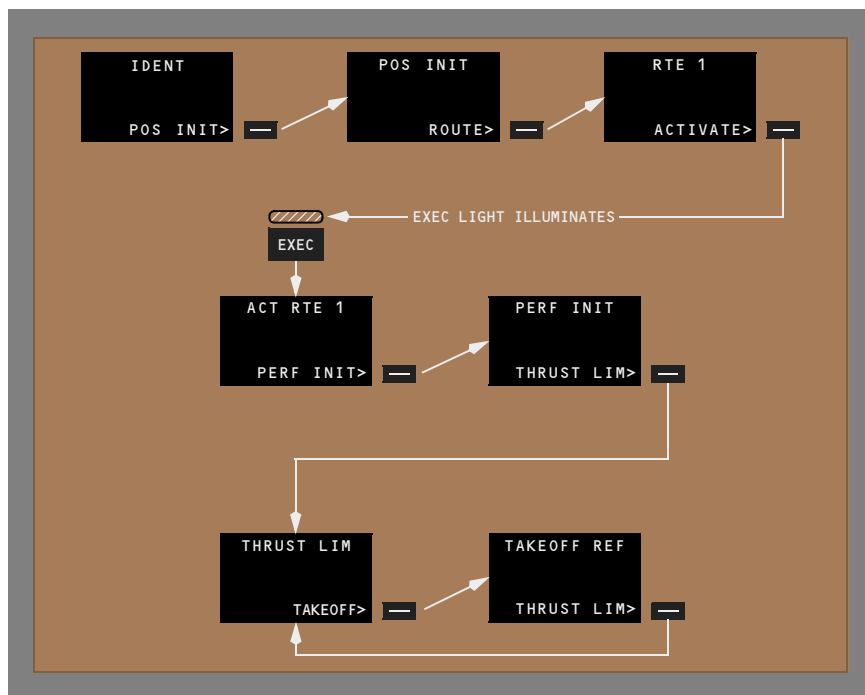
Preflight Page Sequence

The identification page usually displays when power is applied to the FMC. Preflight flow continues in this sequence:

- identification (IDENT) page
- position initialization (POS INIT) page
- route (RTE) page
- DEPARTURES page (no prompt)
- navigation radios (NAV RAD) page (no prompt)
- performance initialization (PERF INIT) page
- thrust limit (THRUST LIM) page
- takeoff reference (TAKEOFF REF) page

Some of these pages are also used in flight.

Minimum Preflight Sequence



During preflight, a prompt in the lower right directs the flight crew through the minimum requirements for preflight completion. Selecting the prompt key displays the next page in the flow. If a required entry is missed, a prompt on the TAKEOFF page leads the flight crew to the preflight page missing data.

Airplane inertial position is necessary for FMC preflight and flight instrument operation.

A route must be entered and activated. The minimum route data is origin and destination airports, and a route leg.

Performance data requires entry of airplane weights, fuel reserves, cost index, and cruise altitude.

Takeoff data requires a flap setting and center of gravity.

Supplementary Pages

Supplementary pages are sometimes required. These pages have no prompts and interrupt the usual sequence. Discussions of each page includes methods to display the page.

When the route includes SIDs and STARs, they can be entered using the DEPARTURES or ARRIVALS pages.

Route discontinuities can be removed using the RTE LEGS pages. Similarly, speed/altitude restrictions are entered and removed on the RTE LEGS page described in the FMC Cruise section of this chapter.

Alternate airports are added on the ALTN page. The ALTN page is described in the FMC Descent/Approach section of this chapter.

Waypoints, navigation, airport, and runway data is referenced on the REF NAV DATA page. The REF NAV DATA page is described in the FMC Cruise section of this chapter.

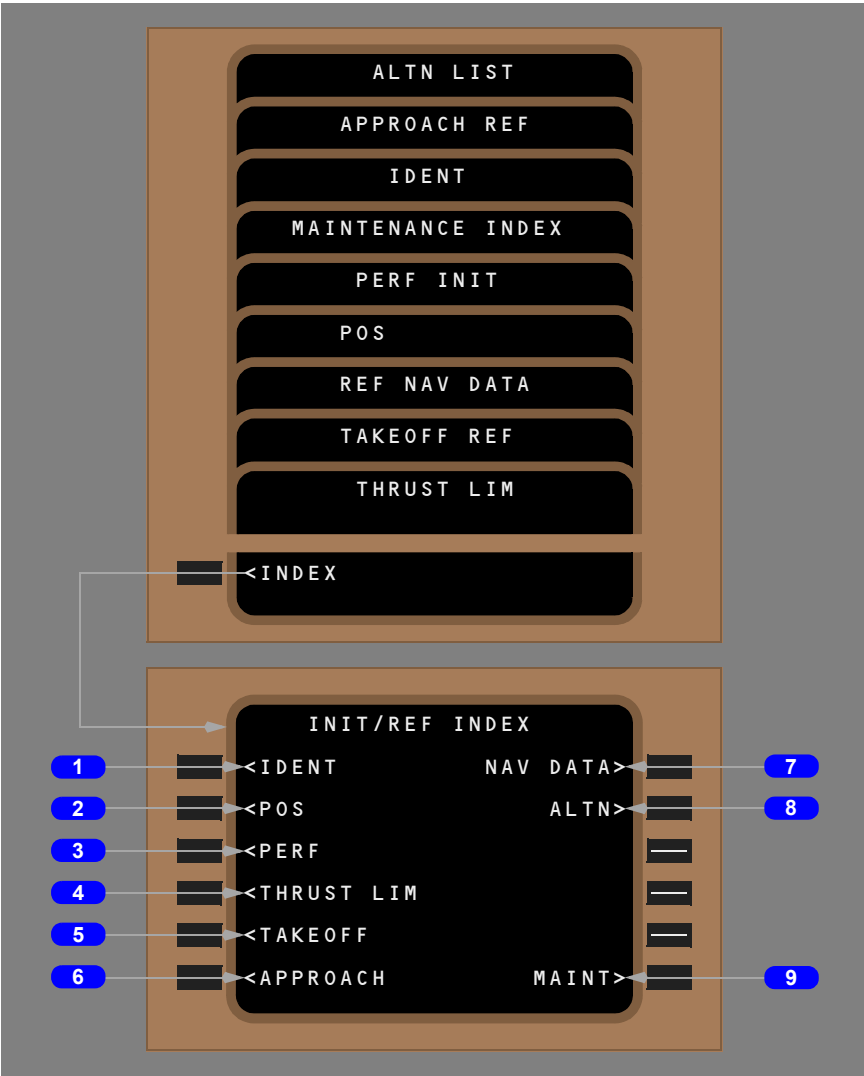
VNAV performance is improved if forecast winds and temperatures are entered during the preflight. Wind and temperature data for specific waypoints is entered on the WIND page. The WIND page is described in the FMC Cruise section of this chapter.

Preflight Pages – Part 1

The preflight pages are presented in the sequence used during a typical preflight.

Initialization/Reference Index Page

The initialization/reference index page allows manual selection of FMC pages. It gives access to pages used during preflight and not usually used in flight.



1 Identification (IDENT)

The IDENT page is used to verify basic airplane data and currency of the navigation database.

2 Position (POS)

The POS INIT page is used for ADIRU initialization.

The POS INIT page is also used for initialization of SAARU heading in the event the ADIRU fails.

3 Performance (PERF)

The PERF INIT page is used for initialization of data required for VNAV operations and performance predictions.

4 Thrust Limit (THRUST LIM)

The THRUST LIM page is used to select thrust limits and derates.

5 TAKEOFF

The TAKEOFF REF page is used to enter takeoff reference data and V speeds.

6 APPROACH

The APPROACH REF page is used for entry of the approach VREF speed.

7 NAV DATA

The REF NAV DATA page is used for data on waypoints, navaids, airports, and runways. NAV DATA pages are accessible only from this page.

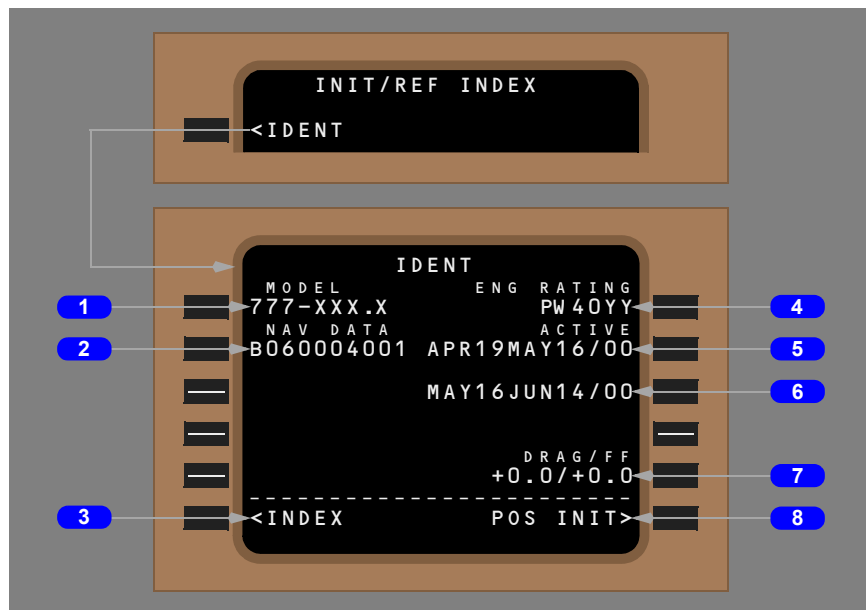
8 Alternate (ALTN)

The ALTN page is used for alternate airport planning and diversions.

9 Maintenance (MAINT)

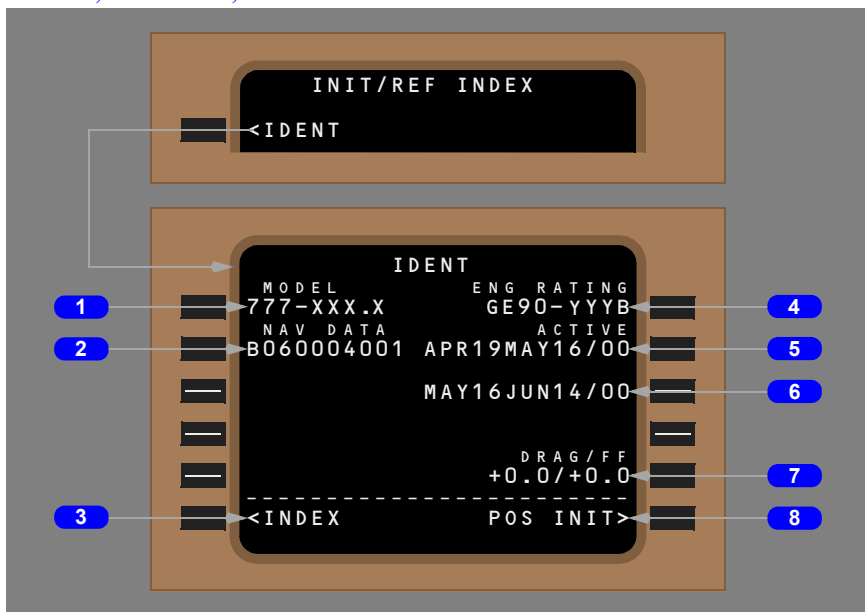
For maintenance use only; displays maintenance pages.

777-300

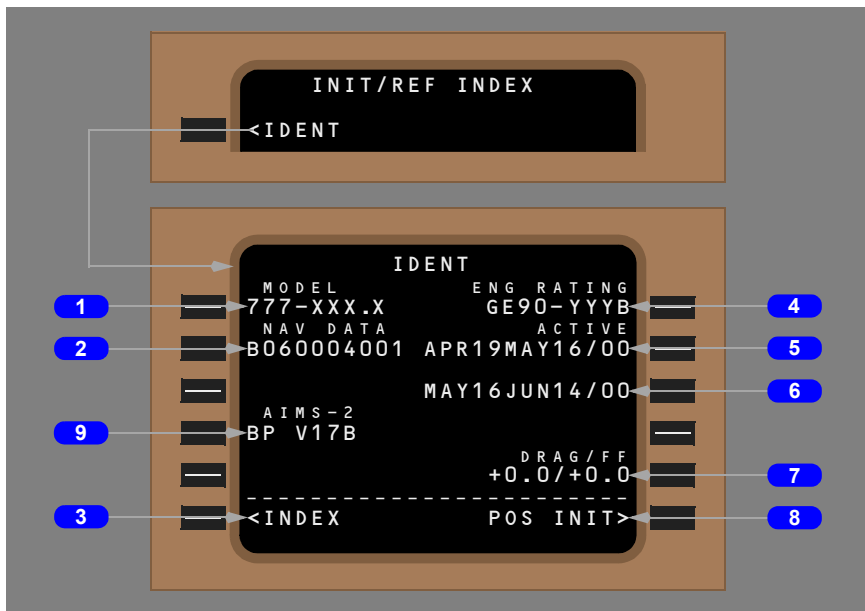


777 Flight Crew Operations Manual

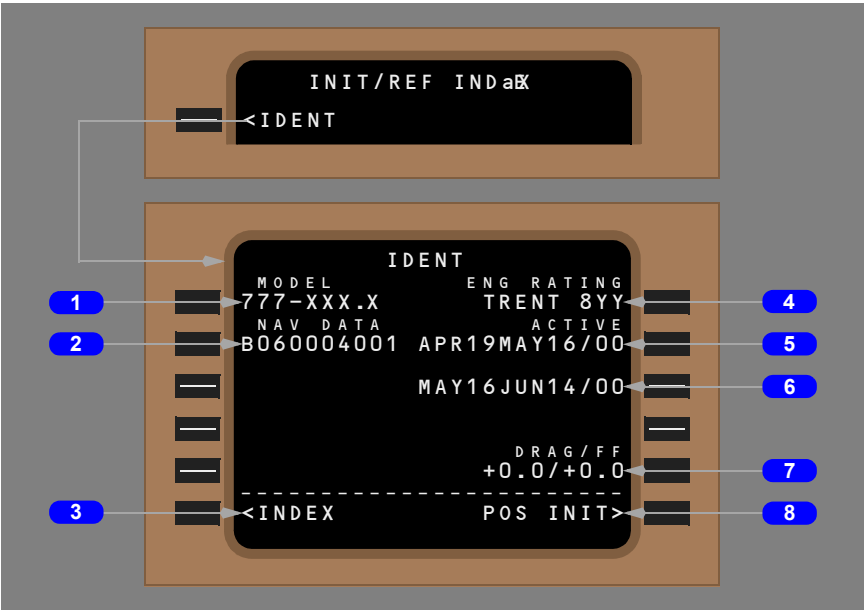
777-200, 777-200LR, 777F



777-300ER



777-200ER



1 MODEL

Displays airplane model as follows:

Ident Page Model	Airplane
777-200	777-200

Ident Page Model	Airplane
777-200.1	777-200ER

Ident Page Model	Airplane
777-200.2	777-200LR

Ident Page Model	Airplane
777-200.3	777-200ER with extended forward CG

Ident Page Model	Airplane
777-200.4	777F

777 Flight Crew Operations Manual

Ident Page Model	Airplane
777-300	777-300

Ident Page Model	Airplane
777-300.1	777-300ER

2 NAV DATA

Displays the navigation database identifier.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 ENG RATING

Displays engine model and thrust rating. Header displays INTERMIX RATING for engine intermix installations. YY or YYY is the engine thrust rating.

5 ACTIVE

Displays the effectivity date range for the active navigation database.

If the active navigation database is out of date, it can be changed to the inactive navigation database. Pushing the date range prompt of the inactive navigation database copies that date into the scratchpad. Pushing the date range prompt of the active navigation database transfers the scratchpad date up to the ACTIVE database line. The previous active date moves to the inactive date line.

The line title ACTIVE is above the active navigation database date. No line title is above the inactive navigation database date. The navigation database date can only be changed on the ground. Changing the navigation database removes all previously entered route data.

When an active database expires in flight, the expired database is used until the active date is changed after landing.

6 Inactive Date Range

Displays the effectivity date range for the inactive navigation database.

7 DRAG/FF

Displays the airplane drag and fuel flow correction factors.

8 Position Initialization (POS INIT)

Push – displays the POS INIT page.

9 AIMS Software Blockpoint

Displays the current AIMS blockpoint software loaded.

Position Initialization Page 1/3

The position initialization page allows entry of airplane present position for ADIRU alignment. The same page is used to enter the heading for SAARU initialization when the ADIRU is inoperative.

Data on the first page is used to initialize the ADIRU. In the event the ADIRU becomes inoperative in flight, initialization of the SAARU heading is accomplished on this page.

The diagram illustrates the Position Initialization Page 1/3, showing three screens with various fields and numbered callouts (1 through 9) indicating specific data entry points.

Screen 1 (Top):

- INIT REF** button.
- Inertial Position Not Entered** message.
- INIT/REF INDEX** button.
- <POS** button.

Screen 2 (Middle):

- POS INIT** title.
- 1 / 3** page indicator.
- LAST POS** field: **N47°32.4 W122°18.6**.
- REF AIRPORT** field: **---**.
- GATE** field: **---**.
- UTC** field: **1430z**.
- GPS POS** field: **N47°32.4 W122°18.6**.
- SET INERTIAL POS** field: **□□□□.□ □□□□.□**.
- <INDEX** button.
- ROUTE** field: **<---**.

Screen 3 (Bottom):

- UTC** field: **1430z**.
- GPS POS** field: **N47°32.4 W122°18.6**.
- SET HDG** field: **---°**.
- <INDEX** button.
- ROUTE** field: **<---**.

Numbered callouts (1-9) point to specific fields or buttons:

- 1**: REF AIRPORT field.
- 2**: GATE field.
- 3**: UTC field.
- 4**: <INDEX button.
- 5**: LAST POS field.
- 6**: GPS POS field.
- 7**: SET INERTIAL POS field.
- 8**: ROUTE field.
- 9**: SET HDG field.

1 Reference Airport (REF AIRPORT)

Entry of the reference airport displays the airport latitude/longitude.
Optional entry.

Valid entries are ICAO four letter airport identifiers.

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 reference airport entered.

Valid entry is a gate number at the reference airport.

Displays the latitude and longitude of the reference airport gate.

Changes to dashes when a new reference airport entered.

Entry blanks at lift-off.

3 Coordinated Universal Time (UTC)

UTC (GPS) – displays time from GPS.

UTC (MAN) –

- displays time from captain's clock when operative; otherwise, displays time from first officer's clock
- hours set by entering desired hour reference
- minutes set by resetting appropriate pilot's clock

4 INDEX

Push – displays the INIT/REF INDEX page.

5 Last Position (LAST POS)

Displays the last FMC calculated position.

6 GPS Position (GPS POS)

Displays the GPS present position. During preflight, the GPS POS may not display due to satellite availability, performance, or unfavorable geometry.

7 Set Inertial Position (SET INERTIAL POS)

The set inertial position entry is required to initialize the ADIRU. Select the most accurate latitude/longitude from LAST POS, REF AIRPORT, GATE, GPS POS, or make a manual entry to initialize the ADIRU.

If an entry is not made before the ADIRU completes the initial alignment, the scratchpad message ENTER INERTIAL POSITION displays.

777 Flight Crew Operations Manual

If an entered position fails the ADIRU internal check, the scratchpad message ENTER INERTIAL POSITION displays. If the entered position fails the ADIRU check after the position is entered a second time, the scratchpad message ALIGNMENT REINITIATED displays.

The entered position is also compared with the FMC origin airport position. If the entered position is not within 6 NM of the FMC origin airport position, the scratchpad message INERTIAL/ORIGIN DISAGREE displays.

Dashes display when the ADIRU is in the automatic realignment mode and can receive a new position update. Enter the most accurate inertial position to remove any accumulated ADIRU position errors.

Enter airplane position latitude and longitude.

Boxes display within one minute of ADIRU power-up.

Blanks when the ADIRU changes from the alignment to the navigation mode.

Blanks when the airplane is moving or has not been stationary for a minimum of six minutes.

Dashes display when the ADIRU enters the automatic realignment mode on the ground.

New inertial position entries can be made after dashes display during ADIRU automatic realignment. New entries display for 2 seconds. After 2 seconds, dashes display to allow entry of another position.

8 ROUTE

Push – displays the ROUTE page.

9 SET HDG

Dashes display in flight when ADIRU is inoperative.

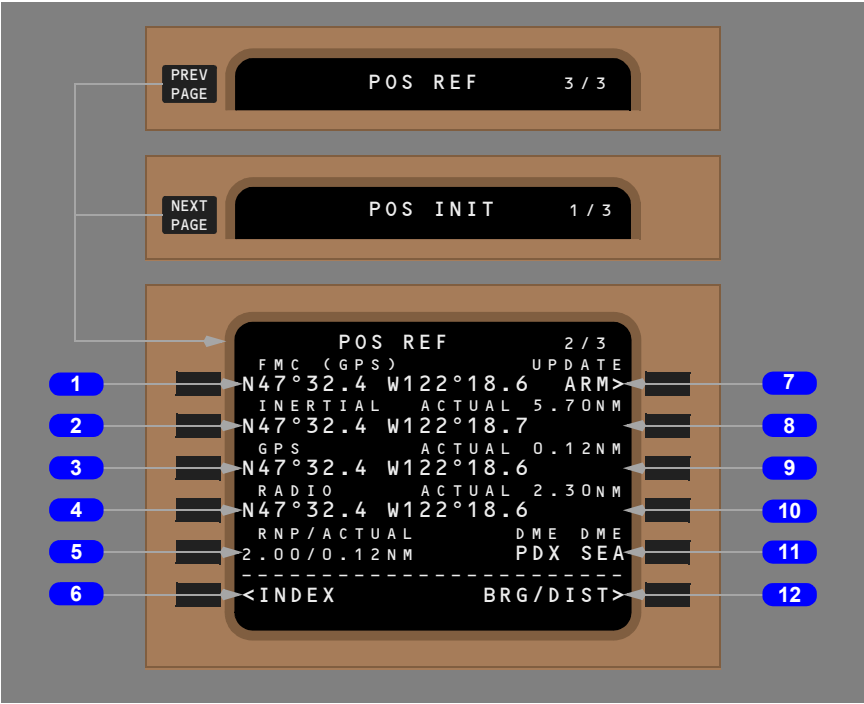
Entry of magnetic heading initializes SAARU.

Valid entry is 0 to 360 (0 or 360 displays as 360°). Entered heading displays in large font for two seconds, followed by dashes.

Position Reference Page 2/3

Position reference page 2 displays positions calculated by the FMC, ADIRU, GPS, and radio navigation receivers. The FMC position can be updated to ADIRU, GPS, or radio position on this page.

This page displays latitude/longitude or bearing/distance. All position displays are in actual latitude and longitude, as calculated by the related system. The ADIRU, GPS, and radio position data can be changed to bearing/distance.



1 FMC

The source used by the active FMC for position data displays next to the FMC line title. In the example, the FMC uses GPS for position data.

Displays the FMC calculated latitude/longitude.

Identifies the source for calculating the FMC position:

- GPS – position calculated from GPS position data
- INERTIAL – position calculated from ADIRU position data
- RADIO – position calculated from navigation radio position data

[Option: AIMS V14 installed]

- LOC-RADIO or LOC-INERTIAL – position updated by localizer data

2 INERTIAL

Displays latitude/longitude position determined by the ADIRU.

3 GPS

Displays latitude/longitude position determined by the GPS.

4 RADIO

After airborne, displays latitude/longitude position determined by navigation radios.

5 Required Navigation Performance and Actual Navigation Performance (RNP /ACTUAL)

Displays RNP values stored in the navigation database for departure and arrival procedures; or, if there are none, displays the default values stored within the FMC by flight phase. Also displays FMC actual navigation performance (ACTUAL).

Default RNP is in small font.

Valid RNP entries are in the range 0.01 to 99.9. Manual entry displays in large font and clear at flight completion; propagated to 2L RNP PROGRESS page 4.

ACTUAL entry not allowed.

When ACTUAL exceeds RNP for the time specified in the Operational Program Configuration (OPC), the EICAS message NAV UNABLE RNP displays.

6 INDEX

Push – displays the INIT/REF INDEX page.

7 UPDATE ARM

Push –

- arms FMC position update function
- changes prompt to ARMED
- adds NOW prompts to right side of INERTIAL, GPS, and RADIO lines

Push a NOW prompt key to update FMC position to the selected source.

8 ACTUAL – INERTIAL

Displays actual navigation performance of the ADIRU.

9 ACTUAL – GPS

Displays actual navigation performance of the GPS; blanks if GPS position data invalid.

10 ACTUAL – RADIO

Displays actual navigation performance of radio updating.

[Option: AIMS V14 installed]

11 Radio Update Station(s)/Mode

Displays radio station identifiers.

Position update mode is indicated in the line title:

- DME DME
- VOR DME

Selection of "VOR" at 6R on the REF NAV DATA page does not inhibit DME DME updating.

12 Bearing/Distance (BRG/DIST) or Latitude/Longitude (LAT/LON)

Push – alternates position data format between bearing/distance or latitude/longitude.

The page illustration is shown in the latitude/longitude display format.

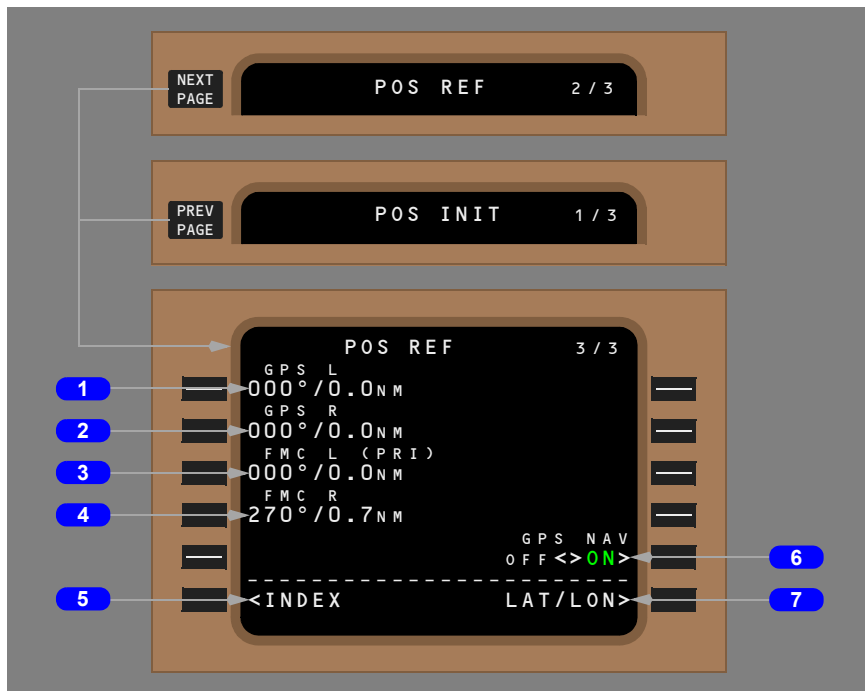
Latitude/longitude format displays are actual position.

Bearing/distance format displays the bearing and distance of other position sources relative to the FMC position.

Position Reference Page 3/3

On position reference page 3, the flight crew can observe the calculated positions from the left and right GPS receivers and the left and right FMC calculations. This page also allows the flight crew to enable or disable GPS position updates.

This page can display the bearing/distance or latitude/longitude format. The bearing/distance format displays bearing and distance of the position sources relative to the active FMC position on the POS REF 2/3 page. In the example, both the left and right GPS agree with the left FMC position.



1 GPS L

Displays the left GPS position.

2 GPS R

Displays the right GPS position.

3 FMC L

Displays the left FMC calculated position.

Primary (PRI) displays when the left FMC is active and the right FMC is inactive.

4 FMC R

Displays the right FMC calculated position.

PRI displays when the right FMC is active and the left FMC is inactive.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 GPS NAV

Push – alternately selects GPS NAV ON (enabled) and OFF (disabled).

OFF – GPS position data is not available to the FMC. OFF displays in large green letters; ON displays in small white letters.

ON – GPS position data is available to the FMC. ON displays in large green letters; OFF displays in small white letters.

Note: When power is initially applied to the airplane or when engines are shut down, GPS NAV is set to ON.

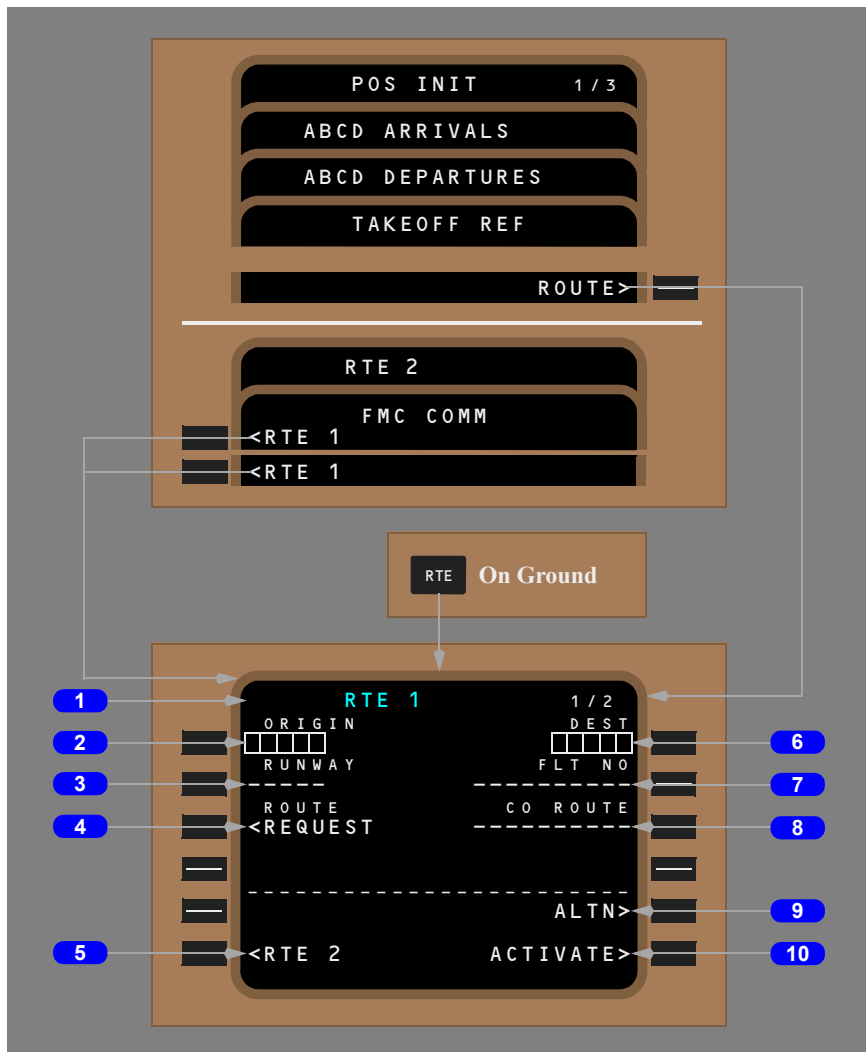
7 Latitude/Longitude (LAT/LON) or Bearing/Distance (BRG/DIST)

Push – alternately changes the display of position data on POS REF 2/3 and 3/3 to latitude/longitude format or bearing/distance format.

The page illustration is shown in the bearing/distance display mode.

Route Page 1/X

Two routes (RTE 1 and RTE 2) can be displayed in air traffic control format. Routes can be entered by the flight crew or uplinked through data link. All routes have two or more pages. The first route page displays origin and destination data. Subsequent route pages display route segments between waypoints or fixes. ROUTE 1 and ROUTE 2 allow management of alternate or future routes while leaving the active route unmodified. ROUTE 2 has an identical page structure as ROUTE 1. When RTE 2 is active, page display logic is the same as RTE 1.



1 Page Title

White when the route is active.

Cyan when the route is inactive or pending activation.

The white shaded word MOD precedes the page 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. The minimum number of route pages is 2.

2 ORIGIN

Entry:

- must be a valid ICAO identifier in the navigation database
- is made automatically when a company route is entered
- enables direct selection of departure and arrival procedures
- entry on the ground deletes route; in flight, entries are valid on the inactive route
- clears: wind levels on the WIND page, all existing company route identifiers, runways, destination airport, legs, and enroute procedures from an existing route

3 RUNWAY

Enter the applicable runway for the origin airport. Runway must be in the navigation database. Entry is optional.

New entries on an active route cause MOD to display in the route title.

Automatically entered when part of a company route.

Can be selected on the DEPARTURES page.

FMC deletes runway after the first waypoint is crossed.

4 ROUTE REQUEST

Line title displays DATA LINK when the data link status is NO COMM, VOICE, or FAIL.

Push – transmits a data link request for a flight plan route uplink.

Flight crew can enter origin, destination, runway, flight number, company route name, or route definition to qualify request.

5 RTE 2, ERASE

RTE 2:

Push – displays the RTE 2 page 1/x.

Allows access to an inactive route for creation and modification or activation.

Inactive route modifications do not alter the active route.

Prompt changes to RTE 1 when RTE 2 is displayed.

ERASE:

Push - deletes all lateral and vertical mods to the displayed modified route.

Selection of <ERASE while a pending activation route is displayed returns the inactive route.

6 Destination (DEST)

Entry:

- must be a valid ICAO identifier in the navigation database
- is made automatically when a company route is entered
- enables selection of departure and arrival procedures

7 Flight Number (FLT NO)

Valid entry is any ATC filed and flight crew entered, or uplinked company flight number up to 10 characters.

A pilot entry on the ATC LOGON/STATUS page propagates to the ROUTE page.

The Flight number displays in the PROGRESS pages 1/4 and 2/4 title.

[\[Option: Squitter installed\]](#)

Transponder transmits flight number to ATC when Eurocontrol-compliant transponder installed.

8 Company Route (CO ROUTE)

A company route can be called from the navigation database by entering the route identifier. The data supplied 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 flight crew entered or uplinked company route name. If the name is not contained in the NAV database, the entry is allowed and the scratchpad message NOT IN DATABASE displays.

Entry of a new company route replaces the previous route.

In-flight entry is inhibited for the active route.

9 Alternate (ALTN)

Push – displays the ALTN page.

10 ACTIVATE

Push the ACTIVATE key to arm the route for execution as the active route. When the EXECUTE 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.

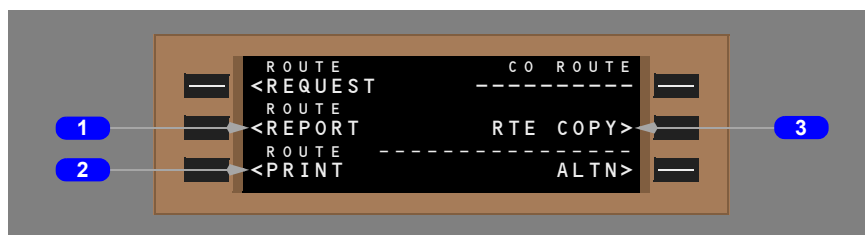
Activation of a route is required for completion of the preflight.

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

More Route Page Prompts for an Active Route



1 ROUTE REPORT

REPORT:

Push – transmits a flight plan downlink report.

LOAD:

Push – when the displayed route is inactive, it is replaced or modified by the flight plan uplink. When the displayed route is active, it is replaced or modified by the flight plan uplink and a modified route is created.

2 ROUTE PRINT

Push – sends the active route to the flight deck printer.

3 Route Copy (RTE COPY)

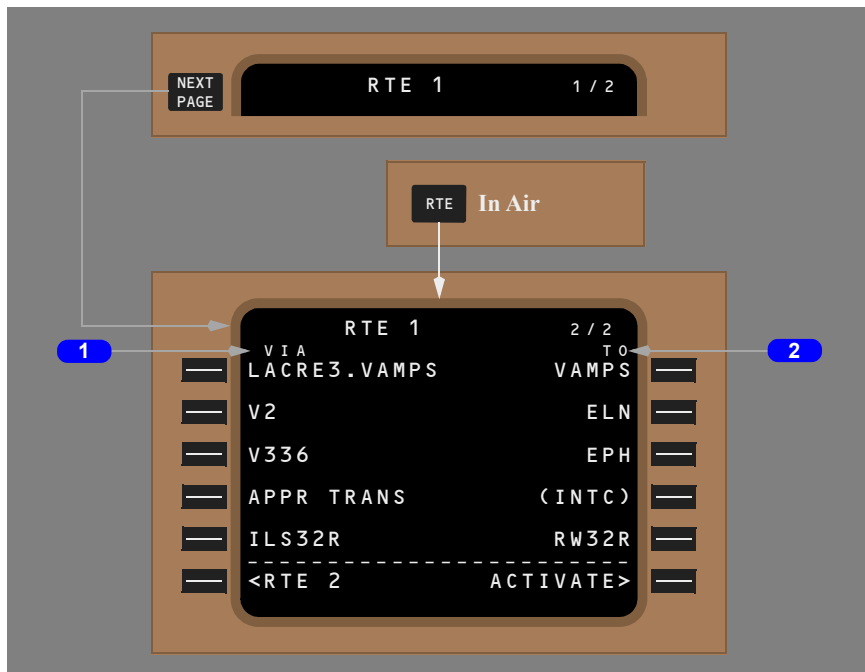
Push – copies the entire active route (RTE x) into the inactive route (RTE y).

Displayed only on the active route page.

Displays COMPLETE after the route is copied.

Route Page 2/X

The subsequent route pages 2/X through X/X, display route segments in air traffic control format. Route segments are defined as direct routing, airways, or procedures with start and end points such as waypoints, fixes, navaids, airports, or runways. More waypoints for each route segment are shown on the RTE LEGS page.



1 VIA

The VIA column displays the route segment to the waypoint or termination 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 boxes display in the TO column.

Valid entries can also include procedures or DIRECT. Procedures are usually entered through selections on DEPARTURES and ARRIVALS pages. DIRECT is usually 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
- intersect the previous VIA route segment

Dashes change to DIRECT if the TO waypoint is entered first.

Dashes display for the first VIA beyond the end of the route.

Invalid VIA entries display the scratchpad INVALID ENTRY message.

Invalid VIA entries are:

- airways and company routes which do not contain the TO waypoint of the previous line
- airways that do not intersect the previous airway
- airways or company routes that are not in the navigation database

The start and end waypoints determine whether the entered airway 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 start point of the next route segment or a route discontinuity is created between the segments.

Entry of a SID or transition enters the VIA and TO data for the route segments of the SID. A SID links to the next route segment when the final SID waypoint is part of the route segment.

When no SID is used, entering an airway on the first line of page 2 initiates an airway intercept from the runway heading and:

- replaces the airway with dashes in the first line VIA
- shows boxes in the first line TO waypoint
- moves the airway to line 2 after the TO waypoint is entered
- enters the first fix on the airway nearest to being abeam of the departure heading in the airway line TO waypoint

A route can contain segments formed by the intersection of two airways. Entering two intersecting airways in successive VIA lines without a TO waypoint causes the FMC to create an airway intersection waypoint to change from one segment to the next. The FMC created waypoint intersection (INTC) displays in the first airway segment TO waypoint.

LACRE3.VAMPS is an example of a SID selection made on the DEPARTURES page.

V2 and V336 are examples of airway entries.

APP TRANS is an example of a STAR selection made on the APPROACH page.

ILS32R is an example of an approach selection made on the APPROACH page.

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 shows DIRECT in the VIA column.

Data input is mandatory when boxes are displayed.

Valid waypoint entries for a DIRECT route segment are any valid waypoint, fix, navaid, airport, or runway.

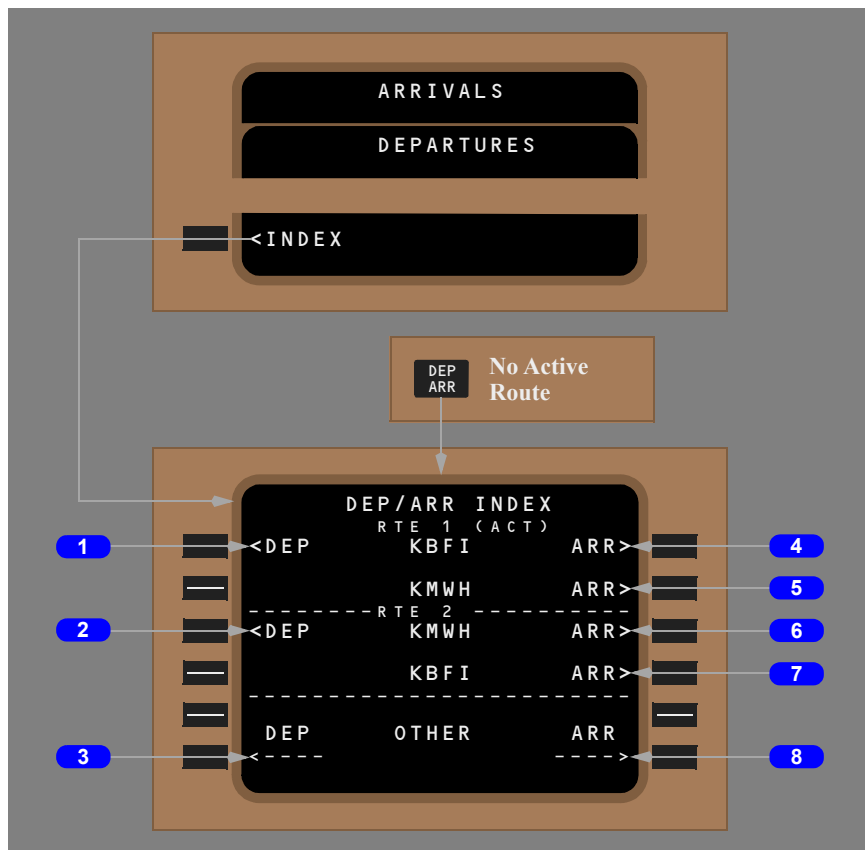
Valid waypoint entries for airways are waypoints or fixes on the airway.

Dashes display on the first TO waypoint after the end of the route.

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 data 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) – Route 1

Push – displays the departure page for route 1 origin airport.

2 Departure (DEP) – Route 2

Push – displays the departure page for route 2 origin airport.

3 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 data about airports that are not an origin or destination. The data can be viewed but cannot be selected because the airport is not on the route.

4 Arrival (ARR) – Route 1 Origin

Push – displays the arrival page for route 1 origin airport. Origin airport arrivals selection is used during a turn-back situation.

5 Arrival (ARR) – Route 1 Destination

Push – displays the arrival page for route 1 destination airport.

6 Arrival (ARR) – Route 2 Origin

Push – displays the arrival page for route 2 origin airport. Origin airport arrivals selection is used during a turn-back situation.

7 Arrival (ARR) – Route 2 Destination

Push – displays the arrival page for route 2 destination airport.

8 Arrival (ARR) – Other

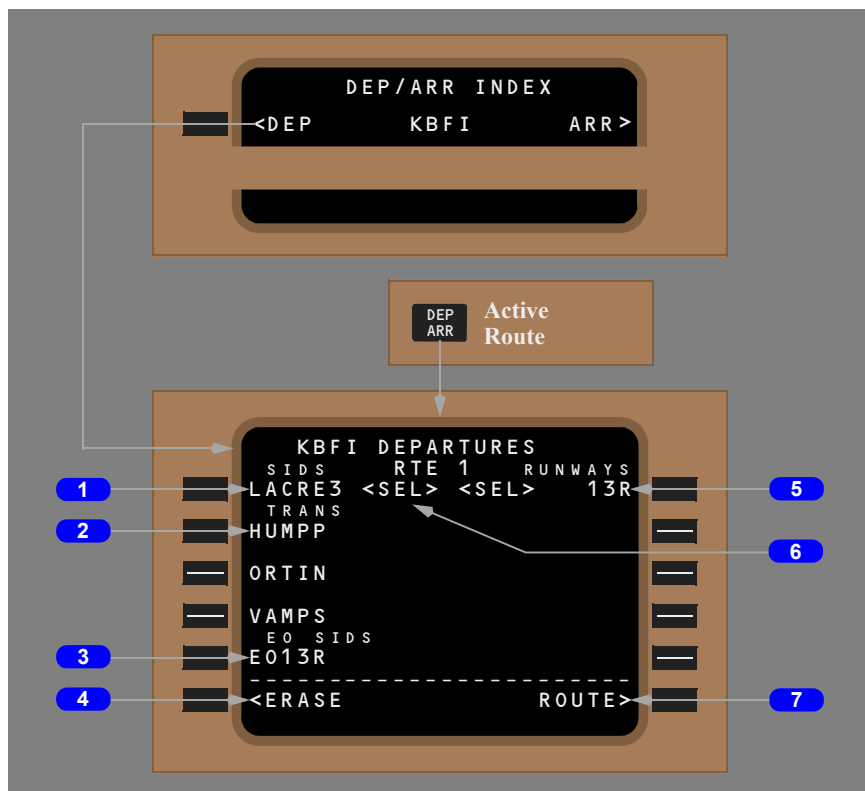
Displays the arrival page for the airport entered in this line through the scratchpad.

ARR prompt for OTHER allows display of arrival data about airports that are not an origin or destination. The data 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.

Pushing the DEP ARR function key displays the departures page for the inactive route when an inactive RTE or RTE LEGS page is displayed.



1 Standard Instrument Departures (SIDS)

Displays a list of SIDS for the airport.

Push –

- selects SID for use in the route
- other SIDs no longer display and transitions for the selected SID display
- runways for selected SID remain and others no longer display

2 Transitions (TRANS)

Displays transitions compatible with the selected SID.

Push –

- selects transition for entry in the route
- other transitions no longer display

3 Engine Out (EO) SIDS

Displays airline-defined single engine-out SIDs and all transitions for the selected runway. EO SID can be viewed before takeoff by line selecting and selecting the Legs page. EO SID automatically selected during takeoff if an engine-out detected prior to “flaps up”. The modification can be either executed or erased. If an EO SID does not exist, NONE displays.

PUSH - displays EO SID as the selected SID.

4 ERASE or INDEX

Erase displays when a route modification is pending. INDEX displays when no route modification is pending.

ERASE push – removes route modifications not executed and displays the original route.

INDEX push – displays the DEP/ARR INDEX page.

5 RUNWAYS

Displays a list of runways for the selected airport.

The runway selected on the RTE 1/X page displays as <SEL> or <ACT>.

Push –

- selects runway for use in the route. All other runways no longer display
- SIDs associated with selected runway remain, all others no longer display
- subsequent change of a runway deletes departure procedures previously selected

6 Selecting Options

Selecting an option displays <SEL> inboard of the option and creates a route modification. After executing the modification, <SEL> becomes <ACT>.

Executing a modification or leaving the page and returning displays all options and the <SEL> or <ACT> prompts.

7 ROUTE

Push – displays the related RTE page.

Navigation Radio Page

[Option: ADF active]

VOR and ILS navigation radios are normally autotuned by the FMC. ADF radios are manually tuned. The NAV RADIO page displays the VOR, ILS, and ADF radio status and allows manual control of these radios. Entering data on this page tunes the selected navigation radio. VOR courses can also be entered.

[ADF not installed on 200 Freighter; or, AIMS V14 delete option selected]

VOR and ILS navigation radios are normally autotuned by the FMC. The NAV RADIO page displays the VOR and ILS radio status and allows manual control of these radios. Entering data on this page tunes the selected navigation radio. VOR courses can also be entered.

VOR

[ADF not installed on 200 Freighter; or, AIMS V14 delete option selected. Line title shows "ADF"]





1 VOR Frequency and Tune Status

The tuning status displays adjacent to left and right VOR frequencies. Entry of a frequency or identifier manual–tunes a VOR. FMC autotunes VORs for procedure flying and route operations. The FMC also tunes related DMEs. The tuning status displays are:

- P (procedure autotuning) – FMC selects nav aids for approach or departure procedure guidance
- R (route autotuning) – FMC selects nav aids on the active route. The nav aid is the previous VOR or a downpath VOR within 250nm of aircraft position
- A (autotuning) – FMC selects a nav aid for best position orientation
- M (manual) – VOR is manual–tuned. Manual–tuning takes priority over FMC autotuning. Deletion of a manual–tuned frequency returns system to autotuning

Valid entries:

- VOR or non–ILS DME identifier or VOR frequency (XXX.X or XXX.XX)
- VOR identifier or frequency/course; the course displays on the CRS line

The identifier and frequencies are green and tuning status is white.

Note: When the airplane magnetic variation database and the VOR ground station assigned magnetic variation values differ, the ND VOR radial and ND POS green radial will not point directly to the VOR. This split will usually decrease as the airplane approaches the VOR.

2 CRS

Blank when in autotune.

Valid entry is a three-digit course. Data can be entered when dashes or a course are displayed.

With a VOR approach selected, sequencing an IAF/FAF causes the FMC to procedure autotune the VOR frequency. When the approach has a runway waypoint, the FMC selects the inbound course.

VOR course is green. Radial is white.

3 RADIAL

Displays radial from left and right VOR stations to the airplane.

ADF

[Option: ADF installed]

**1 ADF Frequency and Tune Status**

The tuning status displays adjacent to the left and right ADF frequencies. The tuning status displays are:

- ANT (antenna) – mode optimizes audio reception and removes ADF bearing data
- BFO (beat frequency oscillator) – mode for audio identification of stations transmitting unmodulated (CW) signals

Default tuning mode is ADF (no indication) giving both bearing data and audio.

Valid entries are XXX.X or XXXX.X.

Manual entry can be followed by A (ANT), B (BFO), or none, which defaults to the ADF mode.

Frequency is cyan and status is white.

ILS

[Option: ADF installed]



[ADF not installed on 200 Freighter; or, AIMS V14 delete option selected. Line title shows "ADF:".]



1 ILS Frequency/Course and Tune Status

The tuning status displays adjacent to the ILS frequency and course. The ILS receivers operate in FMC autotune or manual–tuning modes. The FMC autotunes the ILS frequency and course. When the ILS is not necessary, the FMC sets the ILS to PARK. This removes the displays from the PFD.

777 Flight Crew Operations Manual

Airplane position on the route determines the ILS operating mode. The operating mode displays are:

- PARK – the ILS is not being used and is not tuned
- XXX.XX/YYY PARK – the ILS is tuned for the selected approach but is not being used
- “A” indicates autotuning under FMC control for approach guidance
- “M” indicates the ILS is manually tuned

ILS autotuning is inhibited for ten minutes after takeoff and during manual-tuning. Autotuning and manual-tuning are inhibited when:

- the autopilot is engaged and either the localizer or glideslope is captured
- only the flight director is ON and either the localizer or glideslope is captured and the airplane is below 500 feet radio altitude
- on the ground with the localizer alive, the airplane heading within 45 degrees of the localizer front course and the ground speed is greater than 40 knots

Subsequent manual-tuning is enabled when:

- either TO/GA switch is pushed
- the autopilot is disengaged and both flight directors are switched off
- the MCP approach switch is deselected when the airplane is above 1500 feet radio altitude

Valid entries:

- ILS frequency and front course (XXX.XX/YYY)
- front course, with a frequency and course already entered (/YYY)

2 PRESELECT

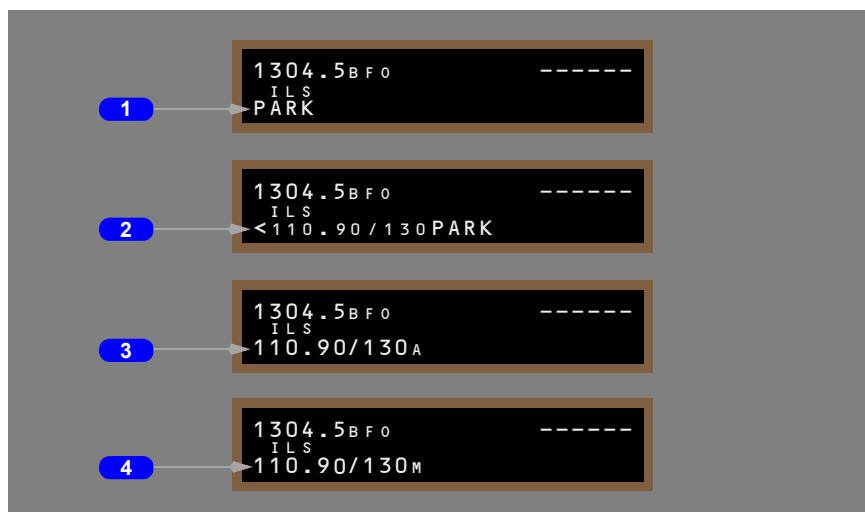
Any valid page data may be entered.

Put data into this line for later use. Data can be moved to the appropriate line when necessary.

ILS Tuning Status

The display initializes to PARK. When PARK displayed, the ILS is not tuned. The tuning status displays are:

- XXX.XX/YYY PARK – the ILS is autotuned for the selected approach but is not being used
- A (autotune) – ILS is autotuned for approach guidance
- M (manual) – ILS is manual-tuned



1 Park

PARK displays when:

- electrical power is first applied
- more than 200 NM from the T/D, or
- less than halfway to the destination

2 Tuning Status – Frequency, Course, and Park

ILS frequency, front course, and PARK display when an ILS, LOC, back course, localizer-type directional aid (LDA), or simplified directional facility (SDF) is selected, and:

- less than 200 NM from the T/D, or
- more than halfway to the destination, whichever represents the lesser distance to destination

Line selection manually tunes ILS.

3 Tuning Status – Autotune

ILS frequency, front course, and A display when an ILS, LOC, back course, LDA, or SDF is selected, and:

- less than 50 NM from the T/D, or
- less than 150 NM from the runway threshold, or
- FMC is in descent mode

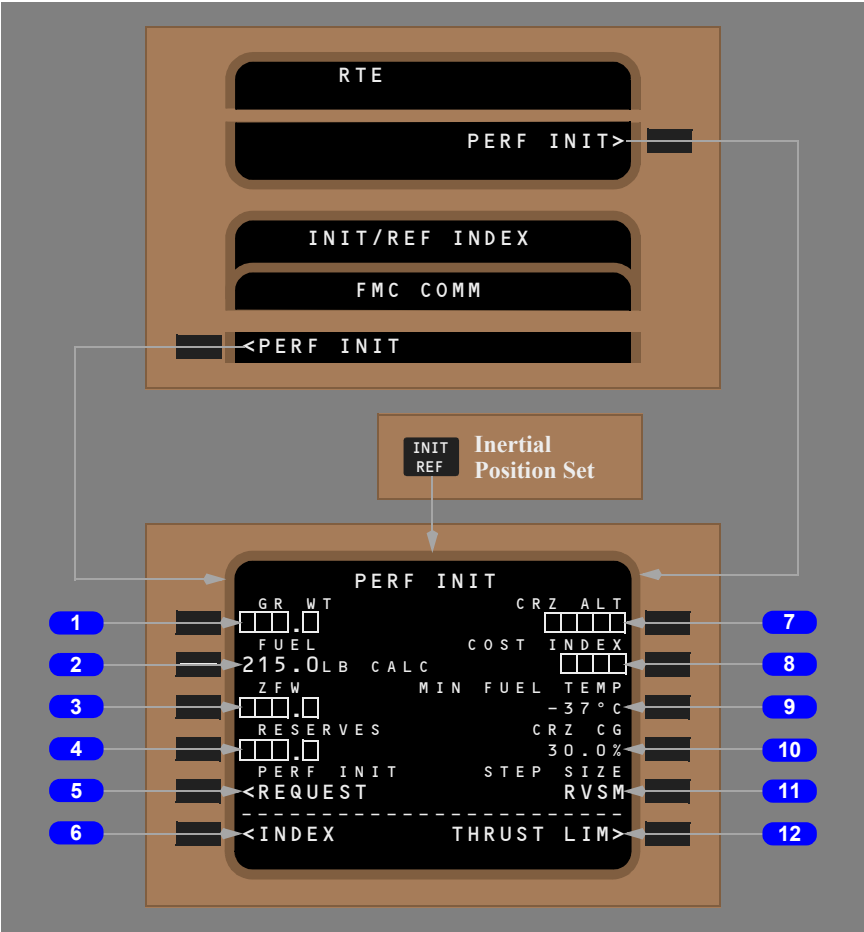
4 Tuning Status – Manual

Receiver tuned manually and valid frequency/course display.

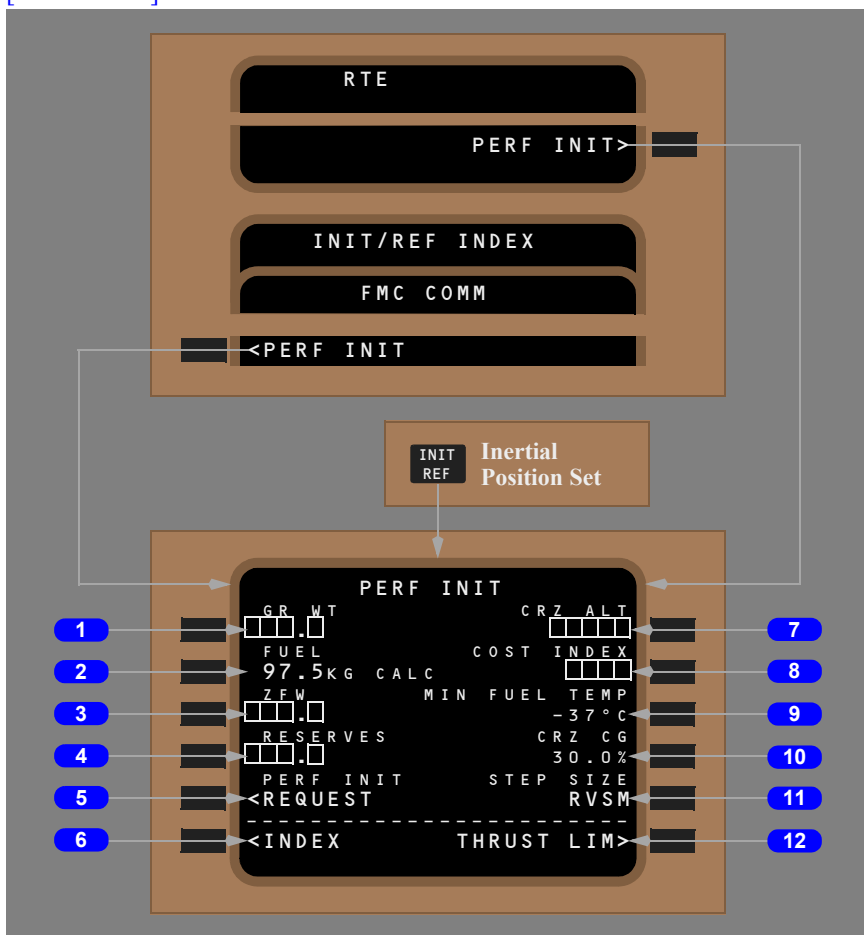
Preflight Pages – Part 2
Performance Initialization Page

The performance initialization page allows the entry of airplane and route data to initialize performance calculations. This data is required for VNAV calculations.

[\[English Units\]](#)



[Metric Units]



[Option: Gross Weight entry allowed]

1 Gross Weight (GR WT)

Airplane gross weight can be entered by the flight crew or calculated by the FMC after entry of zero fuel weight.

Valid entries are XXX or XXX.X.

Entering zero fuel weight first displays calculated gross weight.

Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

2 FUEL

Fuel on board displays when the fuel totalizer calculations are valid. The source for the display is included in the line:

- SENSED – fuel quantity is from the totalizer. Manual entry is not possible
- CALC (calculated) – fuel quantity is from FMC calculations. Manual entry is possible
- MANUAL – fuel quantity has been manually entered. A manual entry blanks TOTALIZER on PROGRESS page 2/3
- MANUAL – fuel quantity has been manually entered. The manual entry displays in 6R, CALCULATED, PROGRESS page 2/3

Valid entry is XXX or XXX.X.

Only manual entries can be deleted.

If one or more fuel quantity indicators has failed, box prompts display requiring a manual entry of total fuel quantity to initialize PERT INIT page information.

3 Zero Fuel Weight (ZFW)

Normally, ZFW is entered from the airplane dispatch papers and the FMC calculates the airplane gross weight.

Valid entry is XXX or XXX.X.

[Option: Gross Weight entry allowed]

Calculated zero fuel weight displays when airplane gross weight is entered first and fuel on board is valid.

Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

ZFW can be manually entered or uplinked. When a performance uplink is pending, uplinked values (small font) display beside the entered values (large font).

4 RESERVES

Valid entry is XXX or XXX.X.

Can be manually entered or uplinked. When a performance uplink is pending, uplinked values (small font) display beside the entered values (large font).

5 Performance Initialization Request (PERF INIT REQUEST)

Push – transmits a data link request for performance data uplink.

Flight crew can fill in ZFW, CG, cruise altitude, reserves, cost index, or fuel temperature to qualify request.

6 INDEX

Push – displays the INIT/REF INDEX page.

7 Cruise Altitude (CRZ ALT)

Cruise altitude can be entered by the flight crew or from a company route or uplink.

Entry displays this cruise altitude on the CLB and CRZ pages.

8 COST INDEX

Cost index is used to calculate ECON climb, cruise, and descent speeds. Larger values increase ECON speeds. Entering zero results in maximum range airspeed and minimum trip fuel. Cost index can be entered by the flight crew or from a company route or uplink.

Valid entries are 0 to 9999.

[Option: Min Fuel Temp installed]

9 Minimum Fuel Temperature (MIN FUEL TEMP)

Displays minimum fuel operating temperature (3 degrees C warmer than the fuel freeze temperature for a given fuel).

Default value from the airline policy page displays in small font and may not be deleted.

[Option: T/O Datalink installed]

A PERF INIT uplink containing a minimum fuel temperature value pending ACCEPT/REJECT displays in small font. Accepting causes the value to display in large font.

Valid entries are -99 to -1 in degrees C.

Flight crew entered value displays in large font.

When actual fuel temperature reaches the displayed value, the EICAS advisory message FUEL TEMP LOW displays.

10 Cruise Center of Gravity (CRZ CG)

The FMC uses the CRZ CG to calculate maximum altitude, and minimum and maximum amber band speeds. The flight crew may improve the accuracy of calculated maximum altitude and maneuver margin to buffet by entering the actual CRZ CG, when known. A flight crew entered value shows in large font. A more aft CRZ CG results in a less restrictive initial buffet envelope (higher maximum altitude, lower low-speed buffet speed, and increased high speed buffet speed).

[Option: AIMS V14 installed]

Unless modified, the CRZ CG displays the AMI default value in small font. If the value in AMI is blank, the CHECK AIRLINE POLICY message displays.

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[Option: T/O Datalink installed]

A PERF INIT uplink containing a cruise cg value pending ACCEPT/REJECT displays in small font. Accepting causes the value to display in large font.

The CRZ CG value does not change due to fuel burn.

[777-200s and 777Fs]

Valid entry is 14.0 through 44.0.

[777-300s or -300ERs]

Valid entry is 7.5 through 44.0.

11 STEP SIZE

Displays the climb altitude increment used for planning the optimum climb profile.

[Option: AIMS V14 installed]

Default value is: RVSM, ICAO, or 0 as selected in AMI.

[Option: AIMS V14 installed]

Valid entries are:

- "0" to inhibit predicted step climbs, or
- altitudes from 1000 to 9900 in 100 foot increments, or
- "I" for ICAO, or
- "R" for RVSM

In-flight entries are inhibited. In-flight step size changes are made on the CRZ page.

For a non-zero entry, performance predictions are based on step climbs at optimum points. For a zero entry, performance predictions are based on a constant CRZ ALT.

12 Thrust Limit (THRUST LIM)

Push – shows the THRUST LIM page.

Thrust Limit Page

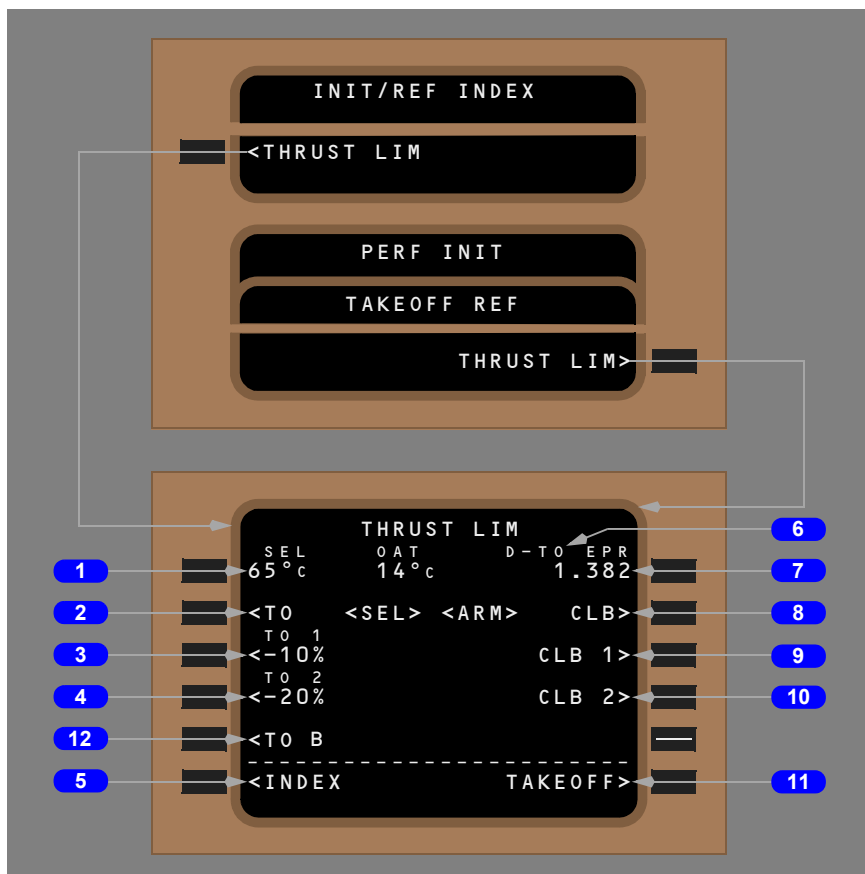
[Option: T/O 1/2 Thrust Limit installed]

The thrust limit page allows selection and display of reference thrust for takeoff. Takeoff thrust derate by use of assumed temperature is also accomplished on this page.

Additional page data displays are:

- <SEL> – identifies the selected takeoff thrust reference mode
- <ARM> – identifies the armed climb thrust reference mode

The <ARM> prompt changes to <SEL> when the armed climb mode becomes active.



[Option: APU-to-Pack T/O installed]

1 Assumed Temperature (SEL), APU-to-Pack, Outside Air Temperature (OAT)

Entry is allowed when the airplane is on the ground and dash prompts or large font temperature data is displayed.

Entry of an assumed temperature warmer than the OAT reduces takeoff thrust and displays D as part of the thrust reference mode.

Valid entries are 0 to 99 degrees Celsius (C) or 32 to 210 degrees Fahrenheit (F).

Entry of one, two, or three character temperature followed by “F” displays assumed temperature in degrees F; otherwise, assumed temperature displays in degrees C.

Uplinked temperatures display on both the THRUST LIM and TAKEOFF REF pages.

Flight crew entered or uplinked values replace previously displayed values.

Entry of a selected temperature change greater than one degree after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

“SEL-APU” displays in the header when the APU is running. Selection of “APU” from the scratchpad displays “APU” in the data line in small font representing the ARMED state. Approximately one minute after the second engine start, “APU” displays in large font representing the ACTIVE state. Entry of an assumed temperature, shutting down the APU, selecting another TO rating, or deleting the entry; deletes the APU selection.

OAT displays outside air temperature in degrees C. When SEL temperature is in degrees F, the OAT converts to degrees F.

The assumed temperature thrust derate is not the same as TO 1 and TO 2 fixed thrust derates described below. If TO 1 or TO 2 is selected and an assumed temperature is then entered, thrust is further derated.

2 Takeoff (TO)

Push – selects full rated (TO) takeoff thrust limit.

Selection of a new rating after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

3 Takeoff 1 (TO 1)

Push – selects percentage derate (TO 1) for takeoff thrust limit.

Takeoff thrust derate can be entered by uplink.

Selecting TO 1 arms CLB 1.

4 Takeoff 2 (TO 2)

Push – selects percentage derate (TO 2) for takeoff thrust limit.

Takeoff thrust derate can be entered by uplink.

Selecting TO 2 arms CLB 2.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 Thrust Reference Mode

Displays selected takeoff thrust mode.

"D-" displays when an assumed temperature derate is active.

[\[Option - Takeoff Bump\]](#)

The suffix B is added to the line title TO when Takeoff Bump is selected.

The prefix "A-" is added to the line title TO when APU-to-Pack takeoff is selected.

[\[Option – PW, RR Engines, With Takeoff Thrust Derates\]](#)

7 Takeoff EPR Limit

Displays the takeoff EPR calculated by the thrust management system. Displays N1 when the engines are operated in the alternate mode.

[\[Option – GE Engines, With Takeoff Thrust Derates\]](#)

7 Takeoff N1 Limit

Displays takeoff N1 calculated by the thrust management system.

8 Climb (CLB)

Push – selects the full rated (CLB) climb thrust limit.

Pushing a climb line select key overrides an automatic selection.

9 Climb 1 (CLB 1)

Push – selects a percentage derate (CLB 1) climb thrust limit.

Climb thrust derate can be entered by uplink.

10 Climb 2 (CLB 2)

Push – selects a percentage derate (CLB 2) climb thrust limit.

Climb thrust derate can be entered by uplink.

11 TAKEOFF

Push – displays the TAKEOFF REF page.

[Option – Takeoff Bump]

12 Takeoff Bump (TO B)

Push – selects additional takeoff thrust.

Selecting TO B arms CLB and inhibits assumed temperature derate.

Refer to the Airplane Flight Manual (AFM) for the performance limitations and data required to use this feature.

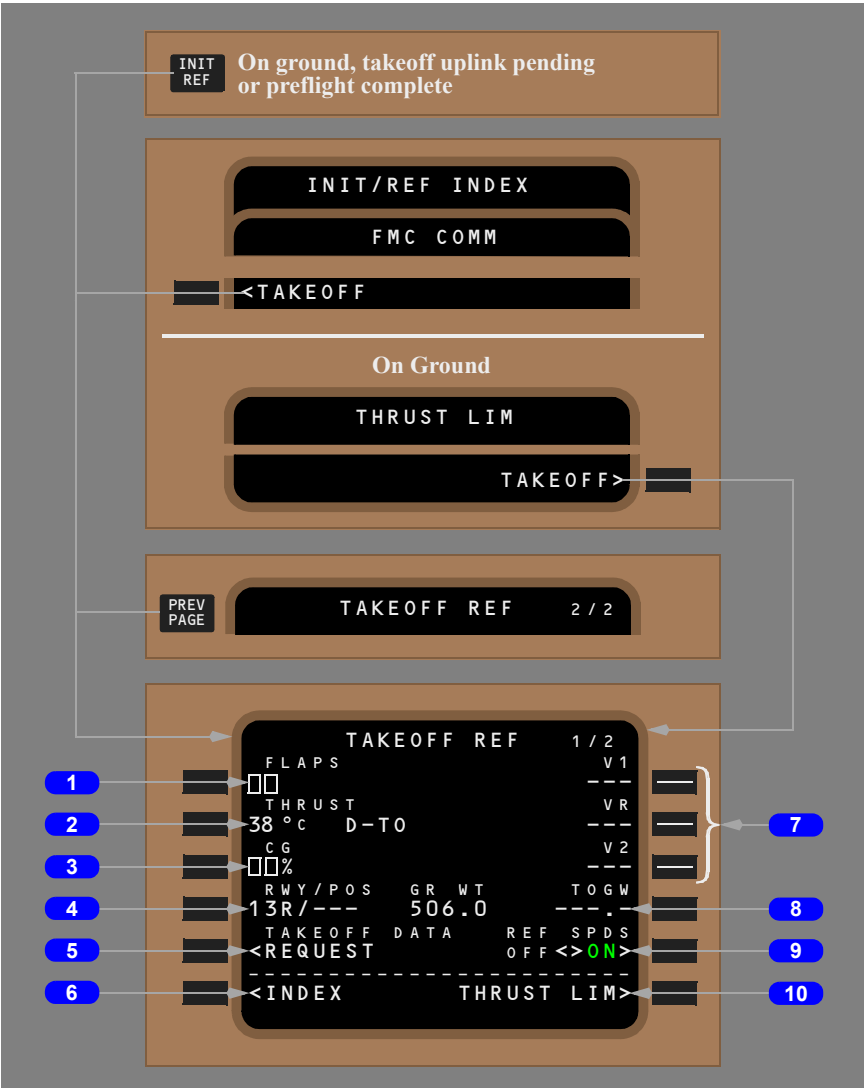
Takeoff Reference Page 1/2

[Option: T/O Datalink installed]

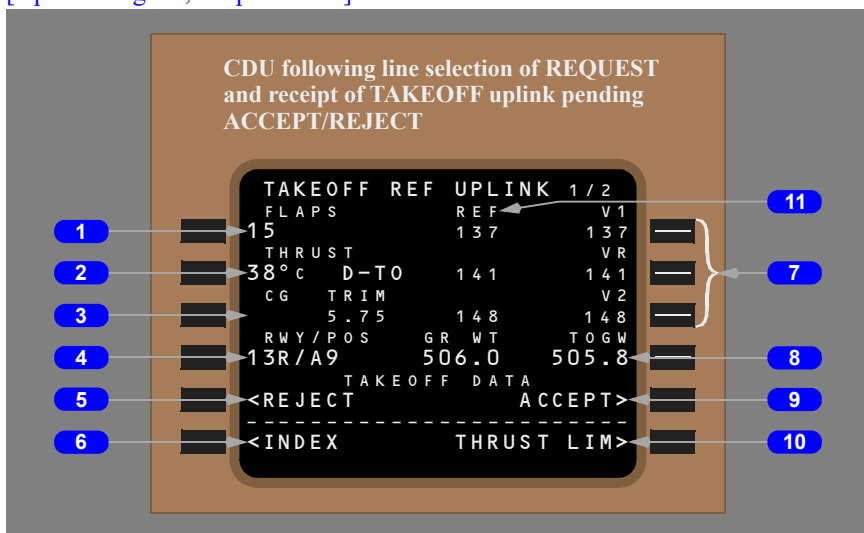
The takeoff reference page allows the flight crew to manage takeoff performance. Takeoff flap setting and V speeds are entered and verified. Thrust limits, takeoff position, and takeoff gross weight can be verified or changed. Preflight completion status is annunciated until complete.

Takeoff reference page entries finish the normal preflight. The takeoff flap setting must be entered and V speeds should be set before completion.

[Option: English, V-spds active]



[Option: English, V-spds active]

**1 FLAPS**

Displays takeoff flap setting. Valid entries are 5, 15, or 20.

Flight crew entry or uplink.

Entry of 5 when FLAPS 5 is the climb thrust reduction point displays the scratchpad message INVALID ENTRY.

Flap position is required for takeoff V speed calculations.

Entry of a value after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

[Option: APU-to-PACK]

2 THRUST

Displays takeoff thrust selected on THRUST LIM page, or flight crew or uplink entered assumed temperature for takeoff thrust derate calculations.

Entry is only allowed when the airplane is on the ground and dash prompts or large font temperature data is displayed.

[Option: TOB active]

Dashes display with TO B selected even though assumed temperature is not allowed. This indicates “APU” entry is allowed.

Entry of “APU” from scratchpad displays “A-XXX” with “XXX” being the takeoff thrust limit.

Valid entries are 0 to 99 degrees C or 32 to 210 degrees F.

Entry of a selected temperature change greater than one degree after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

3 Center of Gravity (CG) and TRIM

Valid entry is CG within the valid range.

After CG entered, the FMC:

- calculates and displays stabilizer takeoff setting to the right of the CG entry (trim display is in 0.25 unit increments)
- updates the takeoff green band displayed on stabilizer position indicators

4 Runway/Position (RWY/POS)

Displays the takeoff runway from the active RTE page.

Flight crew may enter or uplink runway; or intersection data, when planning an intersection takeoff.

[Option - POS SHFT feet]

Valid position entry is a one or two numeric in the range 0-99. It must be followed by two zeros and preceded by a slash (preceding the entry with a “-” means a longer takeoff distance is available; for example, -300 is 300 feet before the runway threshold).

[Option - POS SHFT meters]

Valid position entry is a one or two numeric in the range 0-30. It must be followed by two zeros and preceded by a slash (preceding the entry with a “-” means a longer takeoff distance is available; for example, -300 is 300 meters before the runway threshold).

Valid entry of a runway intersection is an alphanumeric up to three characters, preceded by a slash (/).

Entry of a runway or intersection after takeoff speeds are selected deletes V-speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

FMC position updating is inhibited when GPS is the primary FMC navigation source. When an intersection or position shift has been selected and an FMC position update is desired, GPS must be selected OFF.

5 TAKEOFF DATA REQUEST

REQUEST

Push – transmits a data link request for takeoff data uplink.

Flight crew can enter RWY, intersection or position shift, CG, TOGW, or OAT to qualify the request.

REJECT

Push – rejects the takeoff data uplink and returns the REQUEST prompt.

6 INDEX

Push – displays the INIT/REF INDEX page.

[Option: V-spds enabled]

7 V Speeds (V1, VR, V2)

Displays dashes when:

- required information not entered
- performance calculations are inhibited
- ADIRU is not aligned

Calculated speeds display in small font.

[Option: Alt. Fwd CG not installed]

Manually entered/selected or accepted uplink speeds replace calculated (REF) speeds. Speeds equal to or greater than calculated speeds are allowable. Entries less than calculated minimum V1, VR, or V2 speeds result in "MINV1", "MINVR", or "MINV2" display in line titles; minimum V1, VR, or V2 values display in large font on data lines.

[Alt Fwd CG - Enabled basic on 300ER or 200LR or 777F; w/ AIMS V14]

Manually entered or accepted uplink speeds replace calculated (REF) speeds. Speeds equal to or greater than calculated speeds are allowable. Entries less than calculated minimum V1, VR, or V2 speeds result in "MINV1", "MINVR", or "MINV2" display in line titles; minimum V1, VR, or V2 values display in large font on data lines. Minimum VR or V2 speeds may be up to five knots lower than calculated VR or V2 speeds.

[Option: AIMS V14 installed]

The FMC Takeoff Speed Relative Value check ensures V1 is less than or equal to VR and VR is less than or equal to V2.

Entry of V speeds not passing the check results in the scratchpad message TAKEOFF SPEEDS DELETED.

Push –

- selects V1, VR, and V2 to be sent to using systems, or
- crew entered V speeds replace calculated speeds
- display changes to large font; REF and caret no longer display

If performance data changes:

- FMC replaces existing speeds with FMC calculated speeds in small font
- V speeds are removed from the PFD

- PFD speed tape message NO V SPD displays
- scratchpad message TAKEOFF SPEEDS DELETED displays

Note: After an engine is started, the FMC recalculates the takeoff speeds. Any combination of gross weight, OAT, or pressure altitude resulting in a takeoff speed change of two or more knots from the previously calculated speeds, causes the FMC to recalculate takeoff speeds.

8 Gross Weight (GR WT), Takeoff Gross Weight (TOGW)

GR WT displays airplane gross weight from the PERF INIT page.

TOGW – entry of airplane takeoff gross weight different from GR WT requests new takeoff data using data link.

Valid entry is any weight within the allowable airplane takeoff gross weight range. Flight crew entered value is downlinked when the REQUEST prompt is selected.

Entry of a value after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

Deletion of the TOGW value returns V speeds to small font; displays REF and caret.

A takeoff uplink displays the uplinked TOGW and associated V speeds.

[Option: V1 enabled]

9 Reference Speeds (REF SPDS), ACCEPT

REF SPDS:

Enables or disables display of the FMC calculated reference (V) speeds in the center column to the left of the V speed lines.

Push toggles between ON and OFF.

ON – displays FMC calculated takeoff speeds for comparison with the V speeds in the right column.

OFF – deletes speeds from the center column.

The active state, ON or OFF, displays in large green font; the inactive state displays in small white font.

ACCEPT:

Push – accepts the uplink takeoff data; all pending uplink values are treated as if entered by the flight crew.

10 Thrust Limit (THRUST LIM)

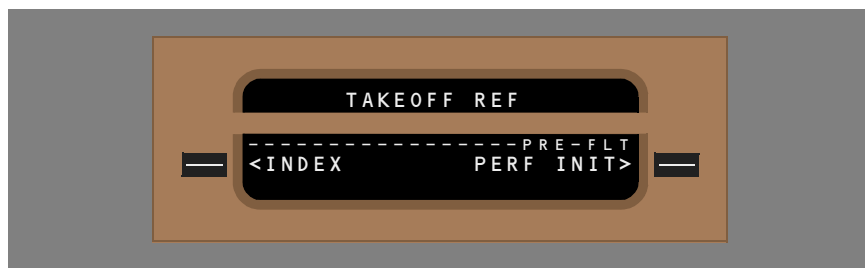
Push – displays THRUST LIM page.

[Option: V1 enabled]

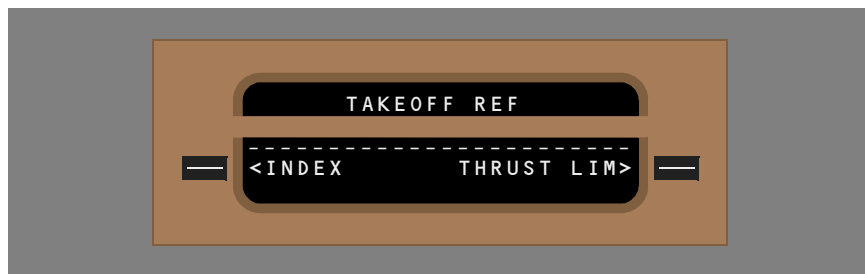
11 Reference (REF)

Displays the FMC calculated V speeds for comparison with flight crew entered or uplinked values. Display is enabled and inhibited by the REF SPDS prompt.

Preflight Status



If the required preflight entries are not complete, the words PRE-FLT display on the right side of the dashed line. Preflight pages requiring entries display below the dashed line as prompts.



When preflight entries are complete, a dashed line displays below the takeoff reference page data. The THRUST LIM prompt displays below the dashed line.

Takeoff Reference Page 2/2

[Option: T/O Datalink enabled]

The page title displays TAKEOFF REF UPLINK when a takeoff uplink is pending; otherwise, the title is TAKEOFF REF.

Note: Acceleration/thrust reduction heights are added to airport elevation causing acceleration/thrust reduction at the desired MSL altitude. For example, for an airport elevation of 980 feet, an entry of 2020 acceleration height causes acceleration at 3,000 feet MSL.

777 Flight Crew Operations Manual

[Option - JAA Rules or Alt T/O SPD Rules]

**1 Alternate Thrust (ALTN THRUST)**

Display is active if a TAKEOFF REF uplink has been accepted which includes alternate thrust data.

Line title may display:

- ALTN THRUST
- ALTN THRUST/FLAPS

Data may display temperature and:

- TO, TO/FLAPS
- TO 1, TO 1/FLAPS
- TO 2, TO 2/FLAPS
- yy° TO x (assumed temperature), yy° TO x/FLAPS

Push (with data on the line) – selects alternate thrust or alternate thrust/flaps for takeoff resulting in:

- recomputation of V speeds
- the line title displays STD THRUST or STD THRUST/FLAPS
- the ACCEPT/REJECT prompt displays on the TAKEOFF REF page 1/2
- new takeoff data displays
- the EICAS •FMC message displays
- the scratchpad message TAKEOFF DATA LOADED displays

2 WIND

Displays uplinked surface wind direction and speed.

Wind direction and speed can be entered by the flight crew or uplink.

Valid directions are from 0 to 360 degrees. (0 and 360 are shown as 000).

Valid speeds are from 0 to 250 knots.

Subsequent entries may be wind direction or speed only.

Entry of wind direction/speed results in calculation and display of RWY WIND.

Entry or uplink of a value after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

3 Runway Wind (RWY WIND)

Displays the calculated headwind/tailwind and crosswind components for the takeoff runway and surface wind.

Calculated values display in small font.

Speed displays in knots and:

- H for headwind
- T for tailwind
- R for right crosswind
- L for left crosswind

Flight crew entry is limited to headwind/tailwind entry.

Valid flight crew entries are a two digit number followed by H or T.

Flight crew speed entry without a letter defaults to a headwind component.

A flight crew entry clears the WIND line.

4 INDEX

Push – displays the INIT/REF INDEX page.

5 Engine Out Acceleration Height (EO ACCEL HT)

Displays acceleration height for flap retraction with an engine out.

Default value is from the airline policy file.

Valid entry is a height from 400 to 9999 feet.

6 Acceleration Height (ACCEL HT)

Displays acceleration height in Height Above Airport (HAA) for flap retraction.

Default value is from the airline policy file.

Entry is optional. Valid entry is an HAA height from 400 to 9999 feet. The FMC adds airport elevation to entered HAA acceleration height causing acceleration at an MSL altitude. For example, for an airport elevation of 980 feet, an entry of 2020 acceleration height causes acceleration at 3,000 feet MSL.

7 Climb Thrust and Thrust Reduction (THR REDUCTION) Altitude

Displays armed climb thrust rating and HAA height for reduction from takeoff thrust to climb thrust. Default THR REDUCTION value is from the airline policy file.

Entry

- is optional for preflight completion
- is an HAA height from 400 to 9999 feet. The FMC adds airport elevation to entered HAA thrust reduction height causing thrust reduction at an MSL altitude. For example, for an airport elevation of 980 feet, an entry of 1020 thrust reduction height causes thrust reduction at 2,000 feet MSL, or
- 1 for flaps 1 and 5 for flaps 5 (entry of 5 when FLAPS 5 is specified as the takeoff flap setting displays the scratchpad message INVALID ENTRY)

8 Limit Takeoff Gross Weight (LIM TOGW)

Displays takeoff gross weight limit for the uplinked data. Manual entry not allowed.

Prefix ALT or STD is added to line title when alternate or standard takeoff data is pending.

9 Reference Outside Air Temperature (REF OAT)

Used for takeoff datalink request.

Enter an outside air temperature:

- the FMC recalculates takeoff V speeds
- after takeoff speeds are selected, deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED
- for a downlink transmission

Displays flight crew entered or uplinked data entry.

Valid entries are -54 to 99 degrees C, or -65 to 199 degrees F

[Option - Alt T/O SPD Rules, not V1_VR_V2_INH.]

10 Slope/Condition (SLOPE/COND)

Displays flight crew entered or uplinked data entry.

Valid runway slope entries are 1 or 2 digit numbers between 0.0 through 2.0 in percent gradient. Slope entries may be preceded by U (for uphill) or D (for downhill). Entries without a U or D are assumed to be uphill.

Valid runway condition is “D” or “DRY” for dry or “W” or “WET” for wet.

Entry of “S” or “WET SK-R” displays “WET SK-R” and FMC computes V1 for a skid resistant runway.

Entry of a value after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

Menu Page

[Option: Single SATCOM installed]



1 FMC

Push – Connects FMC to CDU.

2 Satellite Communication/Cabin Interphone (SAT/CAB INT)

See Chapter 5, Communications.

3 EFIS Control (EFIS CTL)

See Chapter 10, Flight Instruments, Displays.

4 EFIS

When prompt is displayed, selection displays the EFIS CONTROL page.

5 Display Select Panel Control (DSP CTL)

See Chapter 10, Flight Instruments, Displays

6 Display (DSP)

When prompt is displayed, selection displays the DISPLAY MODES page.

7 Memory

Accessible only on the ground. For maintenance use only.

Intentionally
Blank

**Flight Management, Navigation
FMC Takeoff and Climb****Chapter 11
Section 41**

Introduction

The FMC takeoff phase starts with the selection of takeoff/go-around (TO/GA). Preparation for this phase starts in the preflight phase and includes entry of the TAKEOFF REF page data.

The takeoff phase changes to the climb phase when the FMC commands climb thrust. The climb phase continues to the top of climb point, where the cruise phase starts.

During takeoff and climb, the specific page listed below is used to:

- TAKEOFF REF page – make last minute changes to the departure runway
- DEPARTURES page – make last minute changes to the SID
- CLIMB page – modify climb parameters and monitor airplane climb performance
- RTE X LEGS page – modify the route and monitor route progress
- PROGRESS page – monitor the overall progress of the flight
- THRUST LIM page – select alternate climb thrust limits
- DEP/ARR INDEX page – select an approach during a turn-back

Takeoff

When changes are made to the departure runway and SID, the TAKEOFF REF and DEPARTURES pages must be modified to agree. The modified data are entered 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, based on rate of rotation.

Usually, LNAV and VNAV are armed before takeoff. When armed before takeoff, LNAV activates at 50 feet radio altitude and commands roll to fly the active route leg. VNAV activates at 400 feet above runway elevation and commands pitch to fly the climb profile.

Climb

At acceleration height or altitude capture below acceleration height, VNAV commands acceleration to a speed 5 knots below the flap placard speed for the existing flap setting. When flaps are retracted, VNAV commands the speed displayed on the SPD TRANS line.

At the climb thrust reduction point, the FMC commands a reduction to the armed climb thrust. Passing the transition altitude displayed on the SPD TRANS line, VNAV commands an acceleration to economy climb speed, which is maintained until entering the cruise phase. Waypoint speed constraints take priority, provided they are greater than VREF+80 or the transition 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 commanded speed. The commanded speed is magenta.

When the climb speed profile causes an anticipated violation of a waypoint altitude constraint, the FMC displays the CDU scratchpad message UNABLE NEXT ALT. A different speed profile that gives a steeper climb angle must be manually selected.

Altitude Intervention

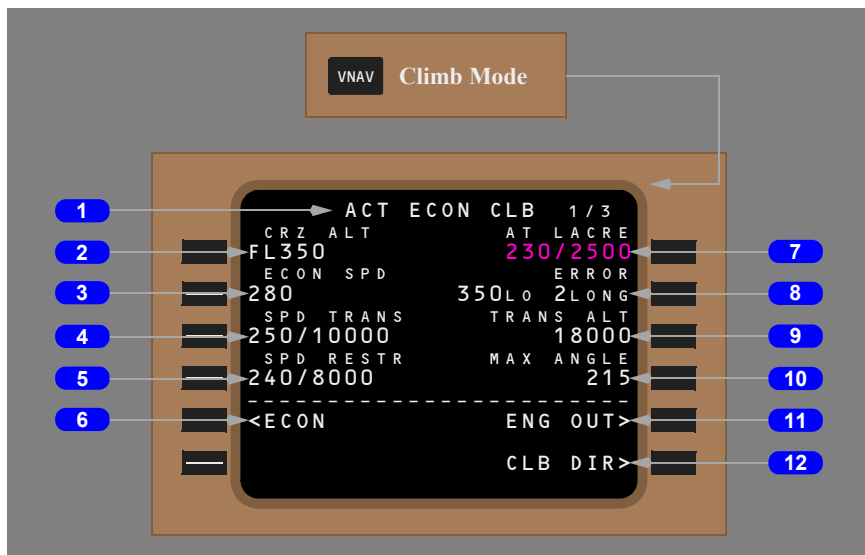
If an unplanned level-off is required, setting the altitude window to the required altitude causes the airplane to level at the set altitude. VNAV SPD changes to VNAV ALT. The climb can be continued by setting the altitude window to a higher altitude and pushing the altitude selector. If the altitude window is set to an altitude above other altitude constraints, each altitude constraint can be deleted by each push of the altitude selector. If cruise altitude is set in the altitude window, all waypoint altitude climb constraints to the T/C can be deleted by selection of the CLB DIR> prompt on the CLB page.

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, and from the airline policy file.

The climb page is the first of the three pages selected with the VNAV function key. When the FMC changes to the cruise mode, the climb page data is blanked.

FMC climb can be economy, fixed speed, or engine out.



1 Page Title

The page title displays active (ACT) or modified (MOD) climb. Usually, the title contains ECON for economy climb. Fixed speed and engine out modify the title.

- ACT ECON CLB – speed based on a cost index
- ACT MCP SPD CLB – MCP speed intervention selected
- ACT XXXKT CLB – fixed CAS climb speed selected
- ACT M.XXX CLB – fixed Mach climb speed selected
- ACT LIM SPD CLB – speed based on an envelope limiting speed

Fixed climb speeds are for:

- takeoff/climb acceleration segment constraints
- a flight crew selected speed (SEL SPD)
- a speed transition
- a speed constraint associated with an altitude
- waypoint speed constraints

2 Cruise Altitude (CRZ ALT)

Displays cruise altitude entered on PERF INIT page. Displays in magenta when the altitude is the FMC target altitude.

Valid entries are: XXX, XXXX, XXXXX, or FLXXX. Altitude displays in feet or flight level depending on transition altitude.

The altitude can be changed by two methods:

- A new cruise altitude can be manually entered from the CDU. The modified cruise altitude displays in shaded white until executed.
- A new cruise altitude can be entered in the altitude window. Pushing the altitude selector changes the cruise altitude. When intermediate altitude constraints exist between the airplane altitude and the new MCP altitude, each push deletes the next altitude constraint.

3 Economy Speed (ECON SPD), Selected Speed (SEL SPD), or Engine-Out Speed (EO SPD)

The FMC commanded speed is magenta. Below CAS/Mach transition altitude, CAS is magenta and Mach is white. Above CAS/Mach transition altitude, Mach is magenta and CAS is white.

Valid entries are CAS or Mach.

ECON SPD displays in the line title when speed is based on the cost index. The FMC commands ECON SPD at altitudes higher than waypoint constraints, speed restrictions, or speed transition altitude.

SEL SPD displays in the line title when flight crew enters speed or a speed constraint exists.

EO SPD displays in the line title when ENG OUT selected.

4 Speed Transition (SPD TRANS)

The speed transition line displays the transition speed/altitude from one of these sources:

- the navigation database value for the origin airport
- the greater of the transition speed associated with the origin airport or VREF+80 knots (example 250/10000)

Displays in magenta when it is the FMC command speed.

Not displayed above transition.

Can be deleted.

5 Speed Restriction (SPD RESTR)

Speed restrictions for an altitude less than the cruise altitude are manually entered on this line.

Dashes before entry by flight crew.

Valid entry is a CAS and altitude (example 240/8000).

An entry creates a modification. Entry is shaded white until executed; magenta when it is FMC command speed.

6 Economy (ECON)

Push – changes climb speed to ECON. Must be executed.

Prompt displays when the climb speed is not ECON.

7 Waypoint Constraint (AT XXXXX)

Displays airspeed and/or altitude constraint at waypoint XXXXX.

Can also display HOLD AT XXXXX followed by a speed/altitude constraint.

FMC commands the slower of constraint speed or performance speed.

Constraints are entered on RTE LEGS page.

Delete here or on RTE LEGS page.

Blank if no constraint exists.

Magenta when it is FMC command speed or altitude.

8 ERROR at Waypoint

Displays altitude discrepancy and distance past waypoint where altitude will be reached.

Blank if no error exists.

9 Transition Altitude (TRANS ALT)

Transition altitude for origin airport contained in navigation database. FMC uses 18,000 feet if transition altitude is not available.

Manually change transition altitude here or on DESCENT FORECAST page.

Valid entries are XXX, XXXX, XXXXX, or FLXXX.

CDU altitude data change from altitudes to flight levels above the transition altitude.

10 Maximum Angle (MAX ANGLE)

Displays maximum angle of climb speed.

Entry not allowed.

11 Engine Out (ENG OUT)

Push (below speed transition or restriction altitude) –

- displays MOD EO CLB page
- deletes climb speed transition or restriction data

Push (below engine-out maximum altitude) – displays MOD EO CLB page.

Push (above engine-out maximum altitude) –

- displays MOD EO D/D page
- cruise altitude (1L) lowered to engine-out maximum altitude if that altitude is less than the active cruise altitude

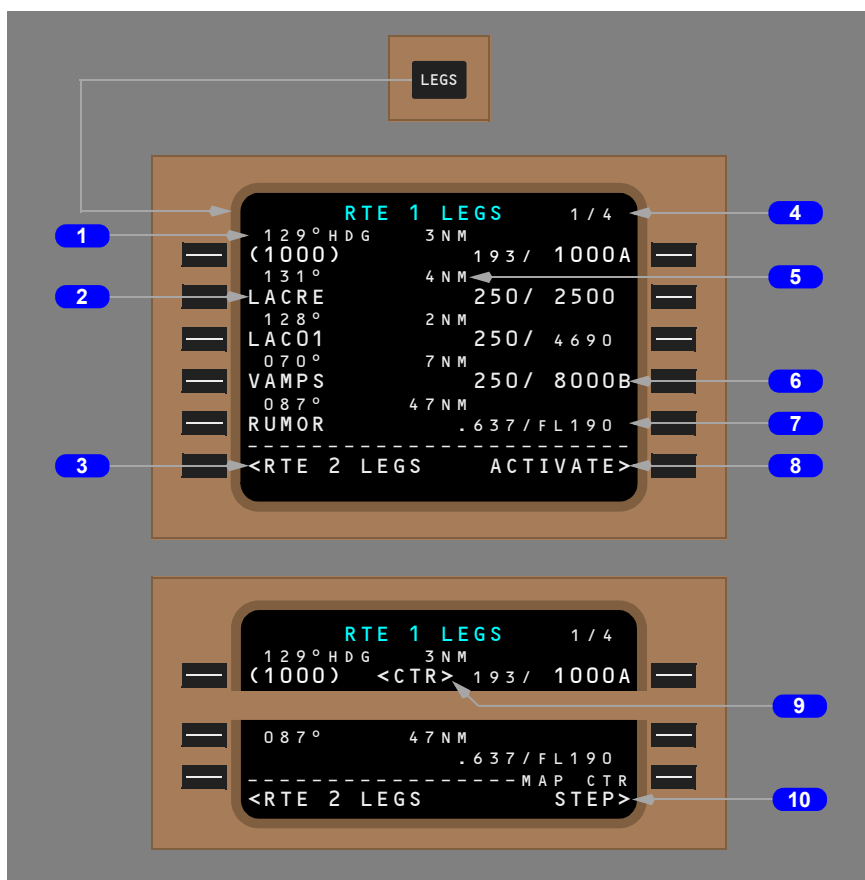
Shaded white until the modification executed. Upon execution, thrust reference limit becomes CON in all cases above.

12 Climb Direct (CLB DIR)

Displays when climb altitude constraint exists between current altitude and FMC cruise altitude.

Push – deletes all waypoint altitude constraints between the airplane altitude and the MCP altitude or FMC cruise altitude, whichever is lower. FMC cruise altitude is not affected.

RTE X LEGS Page

**1 Leg Direction**

Leg segment data in line title:

- courses – magnetic (xxx°) or true (xxx° T)
- arcs – arc radius in miles, ARC, turn direction (example: 12 ARC L)
- heading leg segments – xxx° HDG
- track leg segments – xxx° TRK
- special procedural instructions from database - HOLD AT, PROC TURN, or PROC HOLD (FMC exits hold when crossing the fix after entry)

Calculated great circle route leg directions may be different than chart values.

Dashes display for an undefined course.

2 Waypoint Identifier

Active leg is always the first line of the first active RTE X LEGS page.

Active waypoint is on active leg and is magenta. Modified waypoints are shaded white until executed.

All route waypoints display in flight sequence. Waypoints on an airway are included on the route legs page.

Waypoints can be modified. Examples:

- add waypoints
- delete waypoints
- change waypoint sequence
- connect route discontinuities

Displays the waypoint by name or condition.

Boxes display for route discontinuities.

Dashes display after the end of the route.

3 Route 2 Legs (RTE 2 LEGS)

Push –

- displays the RTE 2 LEGS
- when RTE 2 LEGS page displayed, prompt changes to RTE 1 LEGS

4 Page Title

Title format displays route status:

- RTE X LEGS (cyan) – inactive route
- ACT RTE X LEGS (white) – active route
- MOD (shaded white) RTE X LEGS (white) – modified active route

5 Distance to Waypoint

Distance (decreasing) from airplane to active waypoint or from waypoint to waypoint. Blank for some leg types (e.g. HDG or VECTORS).

6 Waypoint Speed/Altitude Constraints

Waypoint speed or altitude constraints display in large font.

Manual entry allowed in climb or descent phase. Entered by FMC when constraints are part of a procedure.

Magenta when it is an FMC commanded speed/altitude. Airspeed constraint may be magenta in one line with magenta altitude in another line.

Speed constraint is assumed to be at or below the displayed speed.

Valid entries are:

- speed entry can be airspeed or Mach
- altitude entry can be thousands of feet or flight level (19000, FL190)

777 Flight Crew Operations Manual

- XXX/XXXXX – airspeed/altitude entered simultaneously
- XXX, XXXX, XXXXX or /XXX, /XXXX, /XXXXX– altitude only
- enter FL 190 or 19,000 feet as 190 or 19000. Enter FL090 or 9,000 feet as 090 or 9000. Enter 900 feet as 009 or 0900. Enter 90 feet as 0090

Altitude constraint suffixes:

- blank – cross at altitude
- A – cross at or above altitude
- B – cross at or below altitude
- both – altitude block. If constraint is to cross between two altitudes when climbing, enter lower altitude followed by “A”; then, enter higher altitude followed by “B”. Example: 220A240B. Reverse the order for descent.
- S – planned step climb (refer to Chapter 11, Cruise)

7 Waypoint Speed/Altitude Predictions

Waypoint speed and altitude predictions display in small font.

Dashes display in predicted descent region prior to descent path calculation.

Descent path calculation requires an altitude constraint below cruise altitude.

Manual entry allowed in climb or descent phase.

8 ACTIVATE, Route (RTE) DATA

RTE DATA displays when active or modified LEGS exist (not in PLAN mode).

ACTIVATE displays on an inactive LEGS page (not in PLAN mode).

Push –

- ACTIVATE – prepares inactive flight plan for activation; illuminates the EXEC key, and displays LEGS page 1/X with first waypoint of the route at the top. Other pages may be accessed and modifications performed before execution.
- RTE DATA – displays route data page

MAP CTR STEP prompt displays when the EFIS control panel ND mode selector is in PLAN position.

9 Center (<CTR>)

Displays when PLAN mode selected.

Displays adjacent to the waypoint around which ND PLAN mode is centered.

10 MAP Center (CTR) STEP

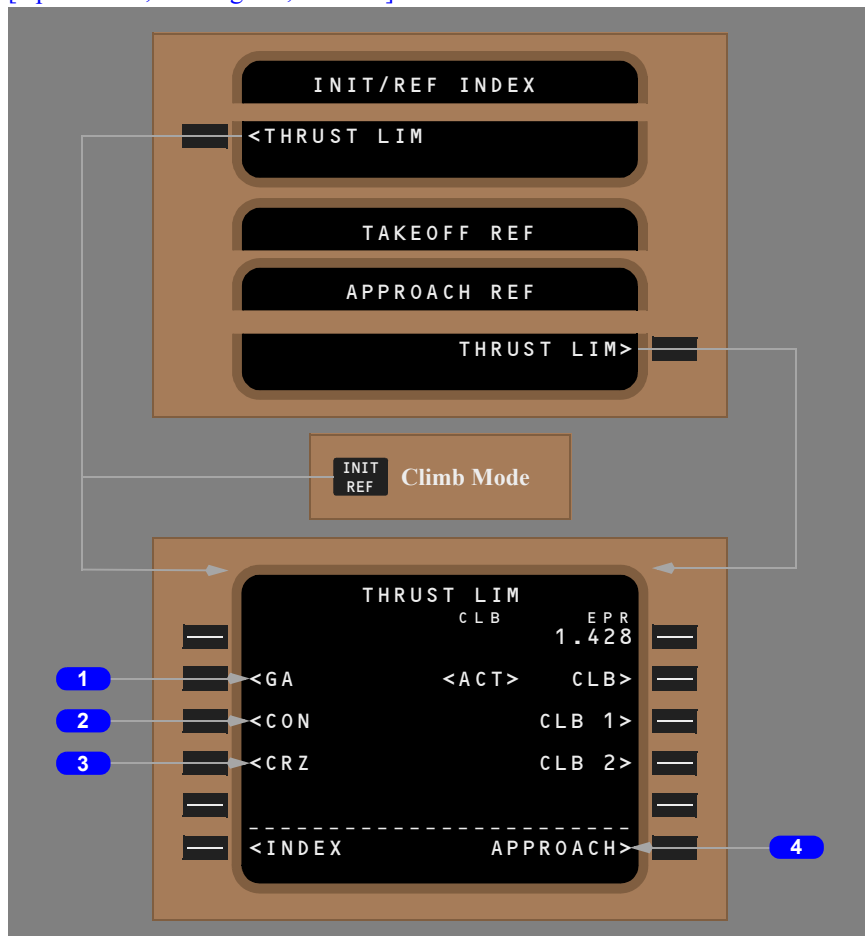
Replaces ACTIVATE or RTE DATA when PLAN mode selected.

Push - steps <CTR> to next waypoint. ND PLAN mode recenters.

Thrust Limit Page

Inflight thrust limits may be selected on this thrust limit page. When the FMC commands climb thrust; go-around, continuous, and cruise thrust limits replace takeoff thrust limits. The active thrust limit displays on the EICAS.

[Option: PW, RR Engines, CLB1/2]



1 Go-Around (GA)

Push – selects go-around thrust limit.

2 Continuous (CON)

Push – selects maximum continuous thrust limit.

3 Cruise (CRZ)

Push – selects cruise thrust limit.

4 APPROACH

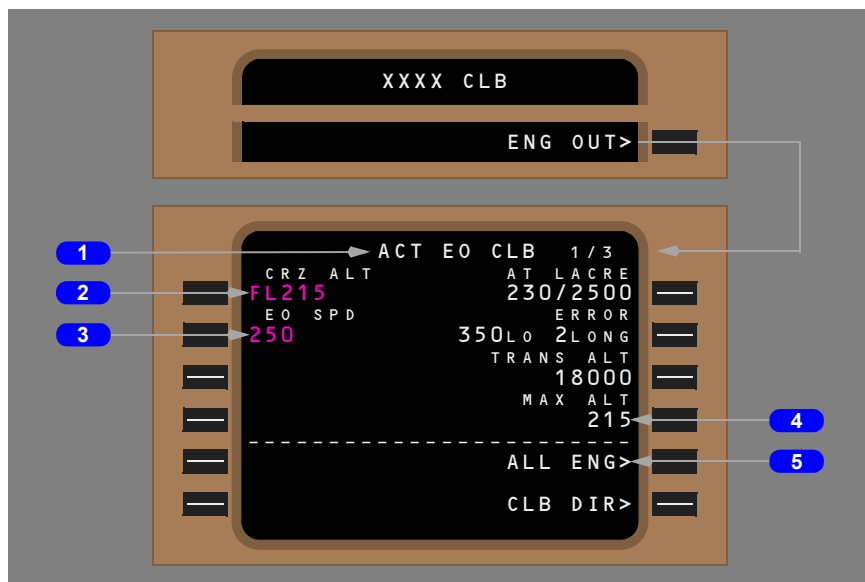
Push – displays APPROACH REF page.

Engine Out Climb

Engine out (EO) VNAV climb guidance is available on the EO CLB page. EO data with both engines operating can be displayed by selecting the ENG OUT prompt on the CLB page, without executing. Following an engine failure and selection of the ENG OUT prompt, execution displays the EO climb page.

EO CLB Page

The modified page displays engine out performance limitations. Manual entries are allowed. After execution, VNAV gives EO guidance in the climb and reference thrust limit changes to CON.



1 Page Title

Page title displays active (ACT) or modified (MOD) climb. Usually, the title contains ECON for economy climb.

Page titles include:

- ACT EO CLB - engine out selected with minimum drag climb speed
- ACT EO MCP CLB - MCP speed intervention selected
- ACT EO XXXKT CLB - fixed CAS climb speed selected
- ACT EO M.XXX CLB - fixed Mach climb speed selected

2 Cruise Altitude (CRZ ALT)

Displays cruise altitude if less than MAX ALT.

777 Flight Crew Operations Manual

Displays EO MAX ALT if less than cruise altitude.

Manual entry is allowed.

3 Engine Out Speed (EO SPD)

Displays engine out climb speed.

Valid entry is xxx for CAS.

Valid entry is o.xxx for Mach. Trailing zeros can be omitted.

A manual entry may cause MAX ALT to change.

4 Maximum Altitude (MAX ALT)

Displays lower of maximum altitude at engine out climb speed or cruise speed.

Entry not allowed.

5 ALL ENG

Push – modifies page to display all engine (ALL ENG) performance data.

Engine Out Departure



1 Engine Out Standard Instrument Departure (EO SID)

Engine out SIDs can be created by the airline for specific runways.

The FMC puts the EO SID into the route as a modification if:

- an engine failure is sensed
- flaps extended
- and the navigation database has an EO SID for the departure runway

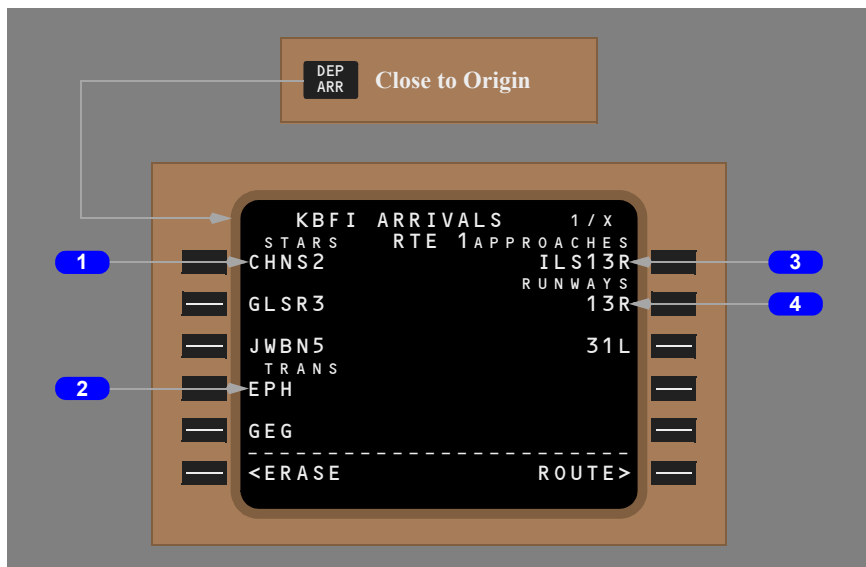
The modification can be executed or erased.

Air Turnback

Arrivals Page

During a turn-back situation, the flight crew requires quick access to the arrivals data for the origin airport. The arrivals page allows access without changing the destination on the route page.

During climb, less than 400 miles from the origin, and while nearer to the origin than the destination, push the DEP ARR function key to show the ARRIVALS page for the origin airport.



1 STARS

Displays STARS for origin airport.

2 Transitions (TRANS)

Displays transitions for origin airport.

3 APPROACHES

Displays approaches for origin airport.

4 RUNWAYS

Displays runways for origin airport.

Intentionally
Blank

Introduction

The cruise phase starts at the top of climb.

During cruise, the primary FMC pages are:

- RTE X LEGS
- CRZ
- PROGRESS

The RTE LEGS pages are used to modify the route. The CRZ pages display VNAV related data. The PROGRESS pages display flight progress data. During cruise, the specific page listed below is used to:

- POS REF page – verify the FMC position
- RTE DATA page – display progress data for each waypoint on the RTE LEGS page
- WINDS page – enter forecast wind and temperature
- REF NAV DATA page – display data about waypoints, nav aids, airports, or runways, and can be used to inhibit nav aids
- RTE X page – use to select a route offset
- FIX INFO page – display data about waypoints. Page data can be transferred to other pages to create new waypoints and fixes.
- SELECT DESIRED WAYPOINT page – shows a list of duplicate waypoints from the navigation database. The flight crew selects the correct waypoint from the list
- POS REPORT page – display data for a position report

The CLB page changes to CRZ at the top of climb. The CRZ CLB and CRZ DES pages change to CRZ at the new cruise altitude. The CRZ page changes to DES at top of descent.

LNAV Modifications

This section describes typical techniques to modify the route. The modifications include:

- add and delete waypoints
- remove discontinuities
- change waypoints sequence
- intercept a course

RTE LEGS Page Modifications

When modifications are made to a RTE LEGS page, several prompt or identifying features help the flight crew make the modifications, such as:

- ERASE
- INTC CRS TO
- INTC CRS FROM

Modified entries display in shaded white.

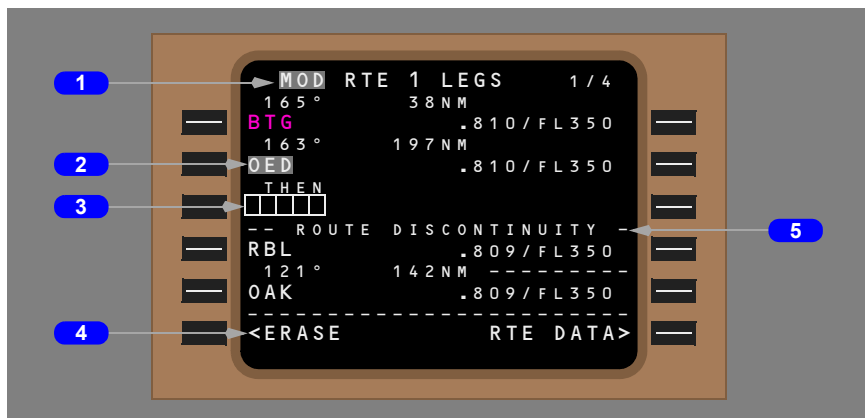
Add Waypoints

Waypoints can be added to the route at any point. Added waypoints are followed by route discontinuities.

First, enter the waypoint name in the scratchpad.

Second, locate the desired line in the flight plan and push the adjacent line select key. The scratchpad waypoint name is put into the selected line. The entered waypoint is connected to the waypoint above it via a direct route. A route discontinuity follows the waypoint.

For example, OED is typed into the scratchpad. Push line select key 2L to put OED into line 2. The FMC assumes BTG direct OED. RBL and the rest of the flight plan follow the route discontinuity.



1 Page Title

MOD (shaded white) – replaces ACT when modification in progress.

ACT (white) – replaces MOD when ERASE selected or execute key pushed.

2 Modified Waypoint

Waypoint name is shaded white until executed.

OED waypoint entered into the route after BTG. Modification creates a route discontinuity because OED was not in active route. The FMC now requires routing beyond OED.

3 Discontinuity Waypoint

Discontinuity is removed when applicable waypoint is entered in boxes.

4 ERASE

Push – removes all modifications and shows active data.

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Displays when the FMC contains modified data.

Removed when selected or modifications executed.

5 ROUTE DISCONTINUITY

Line title separates route segments when there is a discontinuity.

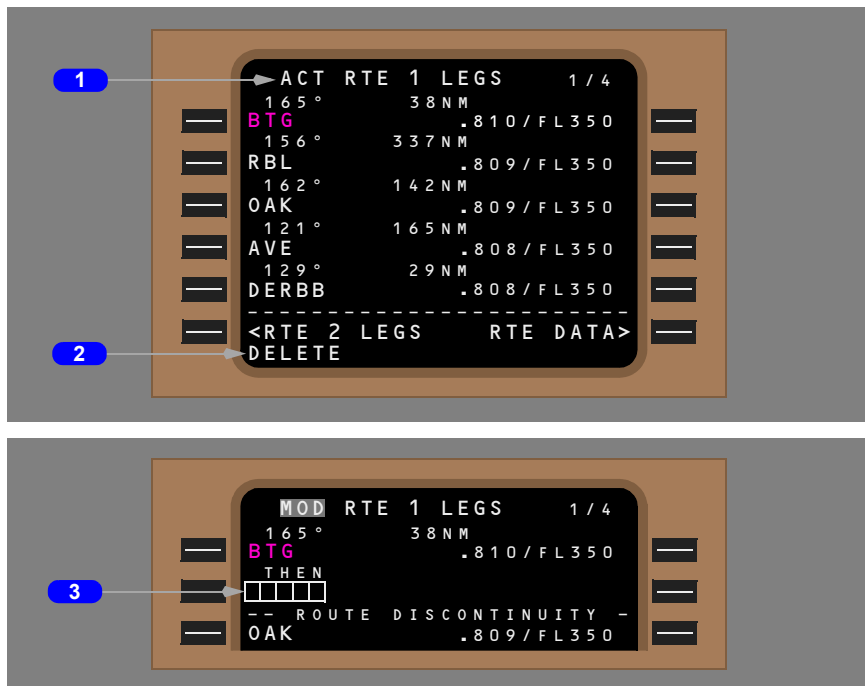
Note: Performance predictions to destination on the PROGRESS page are calculated assuming the route of flight is direct between waypoints on either side of a route discontinuity.

Delete Waypoints

Use the RTE LEGS page to remove waypoints from the route. The active waypoint can not be deleted. Two methods to remove a waypoint are:

- delete the waypoint with the DELETE function key
- change the waypoint's sequence

The data in the route before and after the deleted waypoint does not change. A discontinuity is put in the route when the DELETE function key is used to remove a waypoint.



1 Active Route

The active route shows RBL followed by OAK and AVE.

2 DELETE Entry

Pushing the DEL function key arms the delete function and selects DELETE to the scratchpad.

3 Route Discontinuity

With DELETE in the scratchpad, pushing the line select key for RBL deletes the waypoint. Boxes replace RBL and a route discontinuity displays.

Change Waypoint Sequence

Waypoints moved from one position in the flight plan to another do not cause route discontinuities.

The waypoint may be typed in the scratchpad or copied from the flight plan. To copy a waypoint from the flight plan, find the applicable waypoint on one of the RTE LEGS pages. Push the line select key adjacent to the waypoint.

The example below shows the flight plan being modified to fly from BTG direct OAK. Push the line select key adjacent to OAK to put OAK in the scratchpad. Push the line select key adjacent to RBL. RBL is removed from the flight plan and the routing is direct from BTG to OAK to AVE. The modification does not cause a route discontinuity. Several waypoints can be removed from the flight plan at a time with this method.



1 Active Route

The active route shows RBL followed by OAK and AVE. The clearance is to fly from BTG direct OAK. The OAK waypoint is selected to the scratchpad.

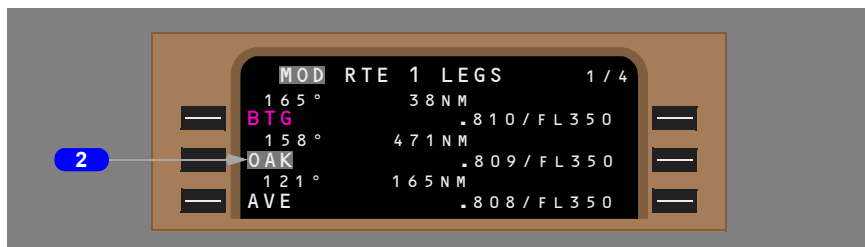
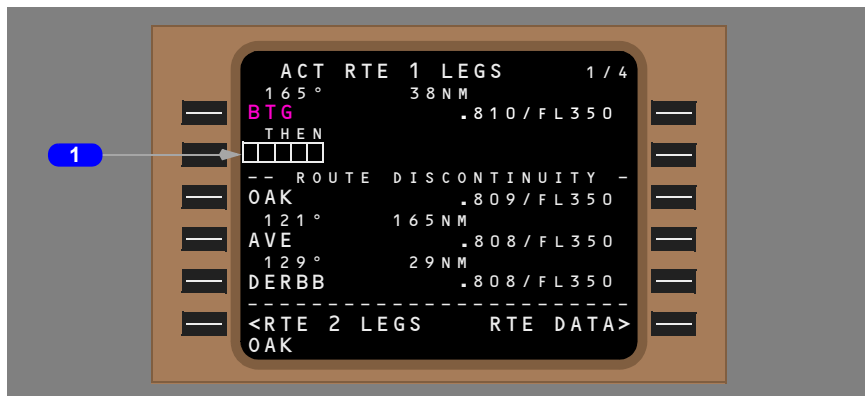
2 Change OAK's Sequence

OAK is selected to the waypoint after BTG. RBL is removed with no discontinuity.

Remove Discontinuities

A discontinuity exists when two waypoints are not connected by a route segment. Connect a route segment after the discontinuity to the route segment before the discontinuity to remove the discontinuity.

Copy the subsequent waypoint from the route into the scratchpad and enter it into the discontinuity, just as when adding a waypoint.



1 Route Discontinuity

The active route has a discontinuity after BTG. The example shows how to fly direct from BTG to OAK. Copy OAK to the scratchpad. Any subsequent waypoint in the route can be selected to the scratchpad to remove the discontinuity.

2 Continuous Route

Select OAK to the boxes to remove the discontinuity.

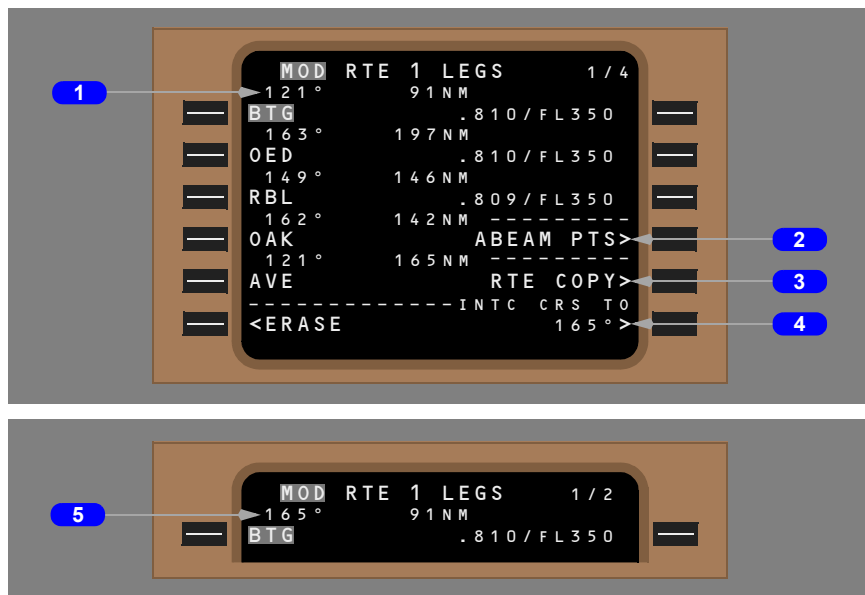
Entering a waypoint in the boxes which does not already exist on the route moves the discontinuity one waypoint further down the route.

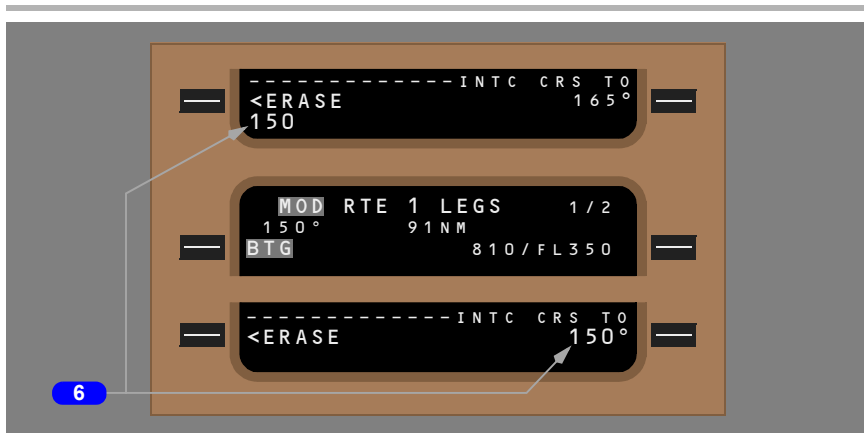
Direct To And Intercept Course To

If the airplane passes the last active route waypoint (or offset) or the last waypoint prior to a route discontinuity, LNAV maintains the current heading and the scratchpad message END OF ROUTE displays. If LNAV is not active, activation can be accomplished in the following three ways:

- When the airplane is within 2.5 miles of the active leg and on an intercept heading to the active leg, pushing the LNAV switch activates LNAV. The airplane turns to intercept the active leg. If the intercept angle is large, the airplane may overshoot the active leg.
- When more than 2.5 miles from the active leg, pushing the LNAV switch when the airplane is on an intercept heading to the active leg arms LNAV. Activation occurs as necessary to intercept the active leg with no overshoot. The intercept heading must intersect the active leg inbound before the active waypoint.
- Fly direct to a waypoint or intercept a course to a waypoint. Enter a waypoint in the RTE LEGS page active waypoint line to fly direct. Use the INTC CRS TO prompt in line 6R to create an intercept course to the waypoint. Pushing the LNAV switch arms or activates LNAV, depending on the distance to the active leg.

The example below depicts the airplane being off course to the right, followed by a modification to fly direct to BTG.





1 Leg Direction

Direct course from airplane present position to entered waypoint.

Execute to proceed direct to active waypoint.

2 Abeam Points (ABEAM PTS)

Push –

- creates place bearing distance waypoint on the Direct To leg abeam the bypassed waypoint if the bypassed waypoint was a database airport, navaid, NDB, or waypoint
- creates latitude/longitude waypoint on the Direct To leg abeam the bypassed waypoint if the bypassed waypoint was a latitude/longitude waypoint
- creates a new place bearing distance waypoint based on the original “place” on the Direct To leg abeam the bypassed waypoint if the bypassed waypoint was a place bearing distance waypoint
- creates a new latitude/longitude reporting point on the Direct To leg based on the entered latitude or longitude reporting point
- line title displays ABEAM PTS and line data displays SELECTED
- altitude/speed constraints for bypassed waypoints are removed

ABEAM PTS prompt displays whenever the active waypoint name is modified, usually for direct-to routing.

Abeam waypoints created from designated position reporting waypoints become position reporting waypoints.

3 Route Copy (RTE COPY)

Push –

- copies the active route into the inactive route
- erases previous inactive route
- line title displays RTE COPY and line data displays COMPLETE
- subsequent route modifications remove RTE COPY prompt

4 Intercept Course TO (INTC CRS TO) – Select

Displays whenever the active waypoint name is modified.

Displays boxes if entered waypoint not in the active route.

Displays current route course and prompt caret if entered waypoint in the active route.

When boxes displayed, valid entry is intercept course from 000° through 360°. May be changed until executed. Entered or selected value displays in large font.

Push –

- when current route course (165°) displayed, selects it as intercept course to active waypoint
- displays entry or current route course as course to active waypoint
- removes ABEAM PTS and RTE COPY prompts

5 Intercept Course

After pushing INTC CRS TO and prior to execution, displays direct-to inbound course at the waypoint; changed by entry in intercept course to (INTC CRS TO) line or by selecting intercept course to. After execution, displays current required track to fly inbound course to the waypoint.

6 Intercept Course TO (INTC CRS TO)

To change intercept course:

- enter the inbound intercept course (150°) in the scratchpad
- select the INTC CRS TO line to change the leg direction; intercept course to BTG of 150° is entered in the INTC CRS TO line and above the active waypoint

Intercept Course From

The steps to create an intercept course from a waypoint are like the steps for an intercept course to. The waypoint name in the scratchpad is suffixed with the outbound course.

An intercept course can be created outbound from a waypoint in the navigation data base or from present position. The waypoint does not have to be in the route. Entering a waypoint and course pair in the active waypoint line displays the INTC CRS FROM prompt. The FMC calculates a route leg with the waypoint as the origin of the entered course.

The example shows a 090° course from BTG, entered as BTG090. When this course intercept is line selected to the active waypoint line, the course (090°) displays in the leg direction and the waypoint displays as a conditional waypoint consisting of a course intercept (090°).



1 Waypoint and Outbound Course

Enter the waypoint name and outbound course in the scratchpad.

2 Present Position and Outbound Course

Enter P/P and outbound course in the scratchpad.

3 Active Outbound Course Entry

After the active waypoint line is selected, the outbound course displays. The waypoint name is not used.

For example, BTG090 is entered into the active waypoint line. The FMC calculates a new route leg with BTG as the origin on a outbound course of 090°.

4 Intercept Course From (INTC CRS FROM)

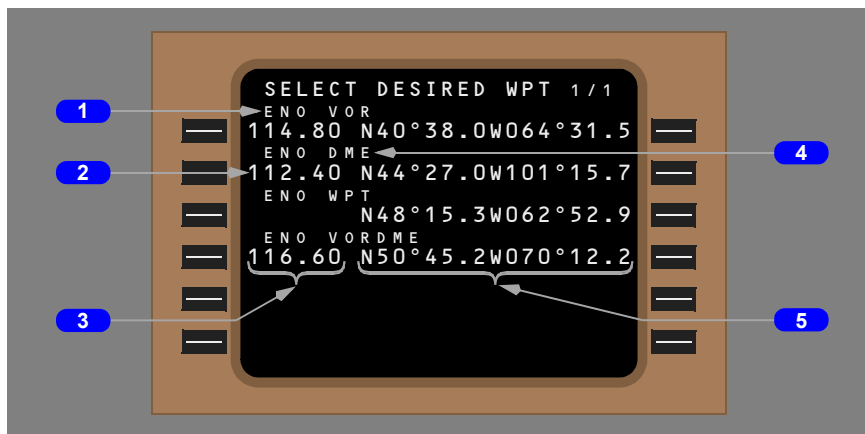
Displays outbound course from entered waypoint.

Shows the active waypoint name is modified with P/P or waypoint outbound entry.

Valid input is any course from 000° through 360°. May be changed until executed.

Select Desired Waypoint Page

The SELECT DESIRED WPT page displays after a waypoint entry when the FMC encounters more than one location for the same waypoint name. Selection of a waypoint returns the display to the previous page.



1 Identifier

Displays the identifier for the duplicate named waypoints. Select the correct waypoint by pushing the applicable left or right line select key.

2 Waypoint Lines

Display a sorted list of waypoints with identifier, navaid type, frequency, and coordinates;

- when page is accessed as a result of a flight plan modification, sort is based on proximity to the waypoint preceding the entered waypoint
- when page is accessed as a result of a DIR/INTC or REF NAV DATA entry, sort is based on proximity to current aircraft position

Push - selects waypoint location for use; returns display to page previously in use.

Pushing any CDU function key exits page without selecting a waypoint.

3 Frequency

Displays frequency of the navaid.

Blank if the waypoint is not a navaid.

4 Type

Displays the type of navaid for each duplicate name.

Blank if the waypoint is not a navaid.

5 Latitude/Longitude

Displays the latitude/longitude for each duplicate name.

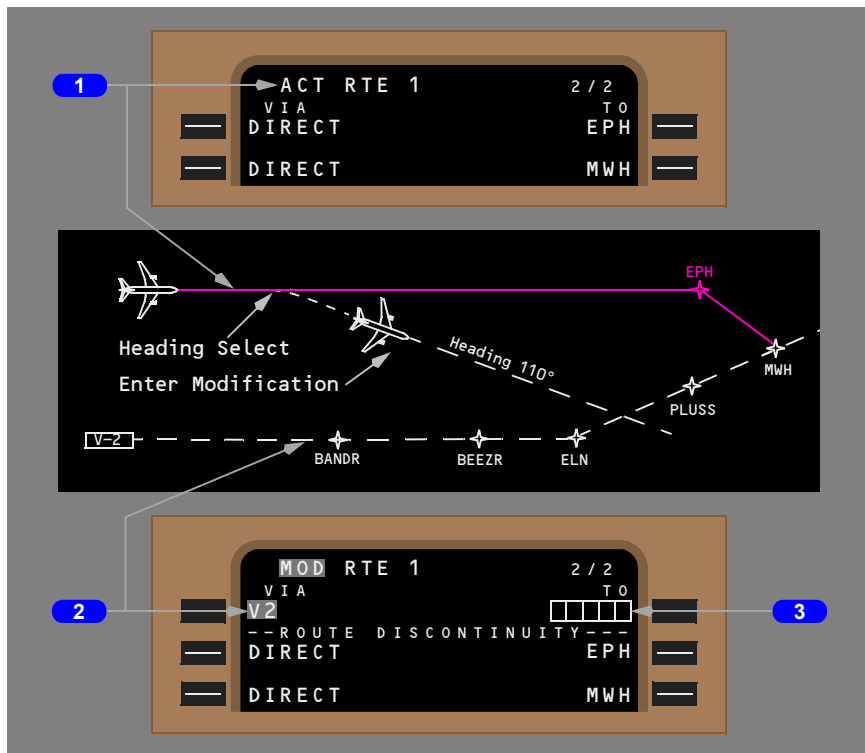
Airway Intercept

LNAV can be used to intercept an airway. An airway intercept changes the active waypoint on the RTE and LEGS pages.

Example

The active route is direct EPH, then direct MWH. ATC clears the airplane to:

- turn right heading 110°
- intercept V2 to MWH



1 Active RTE 1 Page

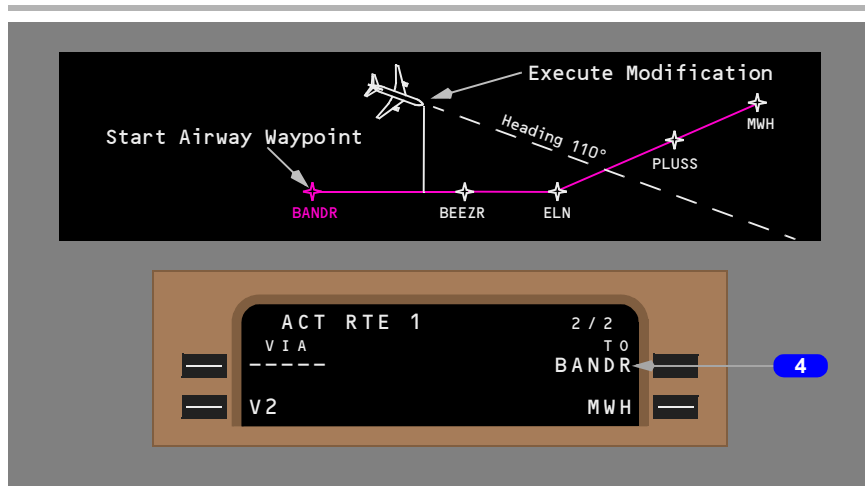
The route page before the ATC clearance.

2 Enter Airway

Enter the airway in the first VIA position on the RTE page. Boxes display in the TO position. A route discontinuity follows on the next line.

3 Airway Exit

Enter desired airway exit point (MWH) in the boxes.



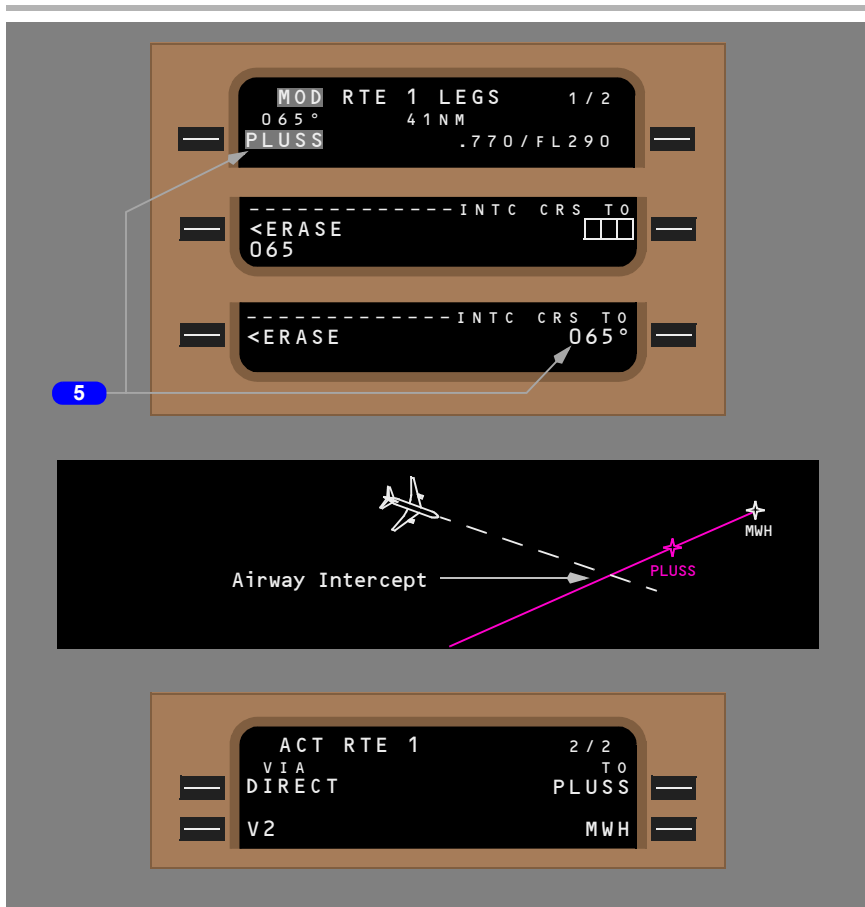
4 Start Airway Waypoint

After entering MWH in the boxes, the FMC selects the waypoint preceding the closest abeam location as the starting waypoint of the new airway. This waypoint displays under TO on line 1R. The entered airway and the selected exit point display on line 2. Executing the modification makes the FMC selected first waypoint the active waypoint; BANDR in this example. If the clearance heading intercepts the new route before the next downtrack waypoint (BEEZR), LNAV can be armed and will capture the new route. The active waypoint will sequence to next downtrack waypoint (BEEZR). Since the clearance heading will not intercept V2 prior to the next downtrack waypoint (BEEZR), use the intercept course procedure to make the inbound course to the next waypoint after the V2 crossing point the active leg segment.

The LEGS page displays this waypoint sequence:

- BANDR - the active waypoint
- BEEZR
- ELN
- PLUSS
- MWH - the V2 exit waypoint

The intercept heading crosses the V2 between ELN and PLUSS. Modify the LEGS page using a course intercept to the waypoint after the airway crossing, PLUSS, making PLUSS the active waypoint on the V2 airway. If the clearance heading does not intercept the new active leg segment, the NOT ON INTERCEPT HEADING scratchpad message displays.



5 New Active Waypoint

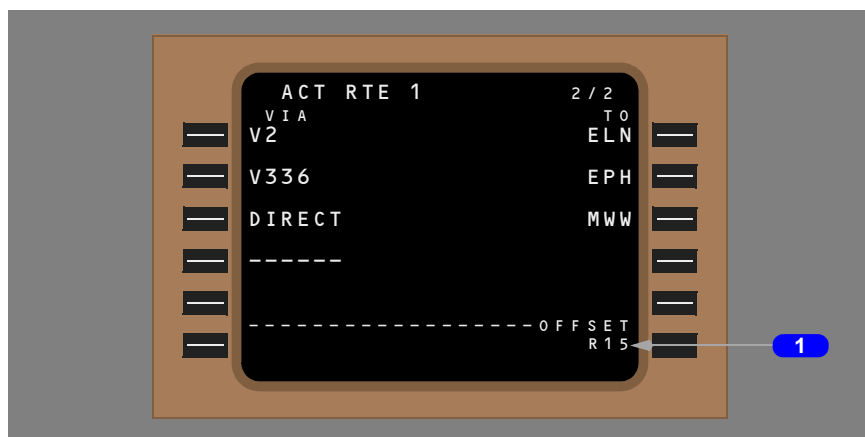
On the LEGS page, move PLUSS to the scratchpad, then to 1L. The INTC CRS TO displays boxes. Enter the V2 inbound course to PLUSS.

Following the course intercept to PLUSS modification and execution, the LEGS page displays PLUSS as the active waypoint. LNAV can be armed and the airway intercept can be completed.

Route Offset

The OFFSET function is available when the airplane is in flight and not on a SID, Standard Terminal Arrival Route (STAR), or transition. The offset route displays as a white dashed line on the ND until executed or erased. An executed offset route displays as a dashed magenta line and extends along the route to a STAR, approach or approach transition, discontinuity, end of route, track change greater than 135 degrees, or holding pattern. The original route displays as a solid magenta line. When executing the offset modification with LNAV active, the airplane turns to capture the offset course.

When on the route offset, active route waypoints sequence normally. However, during transition to or from an offset route greater than 21 nm, the crosstrack limit is extended to 200 nm.



1 OFFSET

Valid entry is L (left) or R (right) XX (XX is any number from 0 to 99). When executed, the CDU OFST light illuminates.

Offset removed by deleting, entering zero, or proceeding direct to a waypoint.

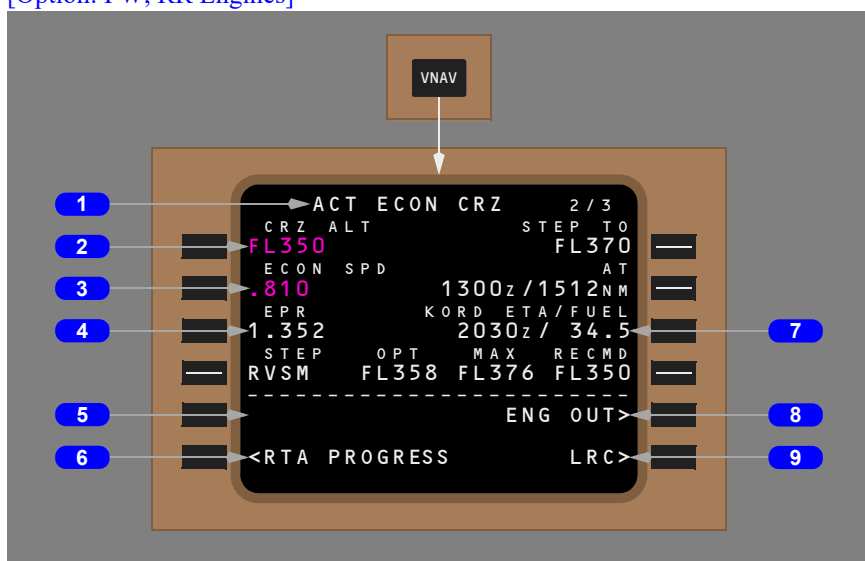
Cruise Page

All Engine Cruise

The cruise page is used to monitor and change cruise altitude and speed. Speed changes can be manually selected or automatically selected with the selection of other VNAV modes. Cruise climbs, cruise descents, and step climbs can be accomplished from the cruise page.

When using VNAV in economy mode, page data is based on operating at ECON SPD. Economy cruise speed is based on cost index. When the flight crew enters a selected speed, page data changes. When the FMC is in the engine out mode, the data reflects airplane capabilities with one engine inoperative. The long range cruise (LRC) mode calculates speeds to maximize airplane range.

[Option: PW, RR Engines]



1 Page Title

The page title displays active (ACT) or modified (MOD) cruise. Usually, the title contains ECON for economy cruise. Selected speeds, engine out, and long range cruise modify the title.

Page titles include:

- ACT ECON CRZ – speed based on cost index
- ACT ECON CRZ CLB or CRZ DES – cruise climb or descent with ECON speed
- ACT LRC CRZ – long range cruise speed selected

- ACT LRC CRZ CLB or DES - cruise climb or descent with LRC selected
- ACT MCP SPD CRZ – MCP speed intervention selected
- ACT XXXKT CRZ – fixed CAS cruise speed selected
- ACT M.XXX CRZ – fixed Mach cruise speed selected
- ACT LIM SPD CRZ – speed based on an envelope limiting speed
- ACT RTA CRZ - RTA cruise selected
- ACT RTA CRZ CLB - cruise climb with RTA selected

2 Cruise Altitude (CRZ ALT)

Displays cruise altitude entered on PERF INIT page.

Valid entries are: XXX, XXXX, XXXXX, OR FLXXX. Altitude displays in feet or flight level depending on the transition altitude.

Modified values display in shaded white.

A new entry changes the page title to CRZ CLB or CRZ DES when climb or descent initiated.

Changing the MCP altitude and pushing the altitude selector enters the MCP altitude as the active cruise altitude, without creating a modification.

3 Economy Speed (ECON SPD), Selected Speed (SEL SPD), Long Range Cruise Speed (LRC SPD), or Engine-Out Speed (EO SPD)

Displays target speed or Mach in magenta.

Valid entries are CAS or Mach.

MOD displays in the page title in shaded white until the modification is erased or executed.

ECON SPD displays in line title when speed based on the cost index.

SEL SPD displays in line title when flight crew enters speed.

LRC SPD displays in line title when LRC selected.

EO SPD displays in line title when ENG OUT selected.

CO SPD displays in line title with a company defined engine-out Mach/CAS cruise speed schedule selected.

[Option: PW, RR Engines]

4 EPR

Displays EPR to maintain level flight at the target airspeed.

[Option: GE Engines]

4 N1

Displays N1 to maintain level flight at the target airspeed.

5 Economy Speed (ECON), Company Speed (CO SPD), or Required Time Of Arrival RTA/Economy (RTA/ECON)

ECON

Push – selects VNAV economy speed. Displays when economy is not the cruise speed target.

CO SPD

Push – selects a Mach/CAS schedule defined in the AMI. Displays when engine-out has been selected and the company policy engine-out speed is not the current cruise speed target.

RTA/ECON

Push – selects RTA speed. Displays when an RTA waypoint is in the flight plan and RTA is not the cruise speed target.

6 Required Time Of Arrival (RTA) PROGRESS or Engine-Out Speed (EO SPD)

RTA PROGRESS

Push – displays RTA PROGRESS 3/4.

EO SPD

Push – changes cruise speed to engine-out minimum drag speed.

7 XXXX (Destination) ETA/FUEL, ETA/FUEL W/MOD

Displays estimated time of arrival and calculated fuel remaining at the destination.

Line Title displays "ETA/FUEL W/MOD" when a modified route is displayed.

Displays the same data for the alternate airport when a DIVERT NOW modification is selected from the ALTN page.

Calculations are based on optimum step climbs and cruise altitudes.

8 Engine Out (ENG OUT)

Push –

- displays MOD XXX CRZ page title; XXX is the active all engine CRZ speed mode before ENG OUT is selected
- changes command speed line title to EO SPD
- below engine-out maximum altitude: upon execution, thrust reference limit changes to CON and page title becomes ACT EO CRZ
- above engine-out maximum altitude: sets CRZ ALT to engine-out maximum altitude; and upon execution, thrust reference limit becomes CON and page title becomes ACT EO D/D

9 Long Range Cruise (LRC)

Push – changes cruise speed mode to LRC or EO LRC.

Engine Out Cruise

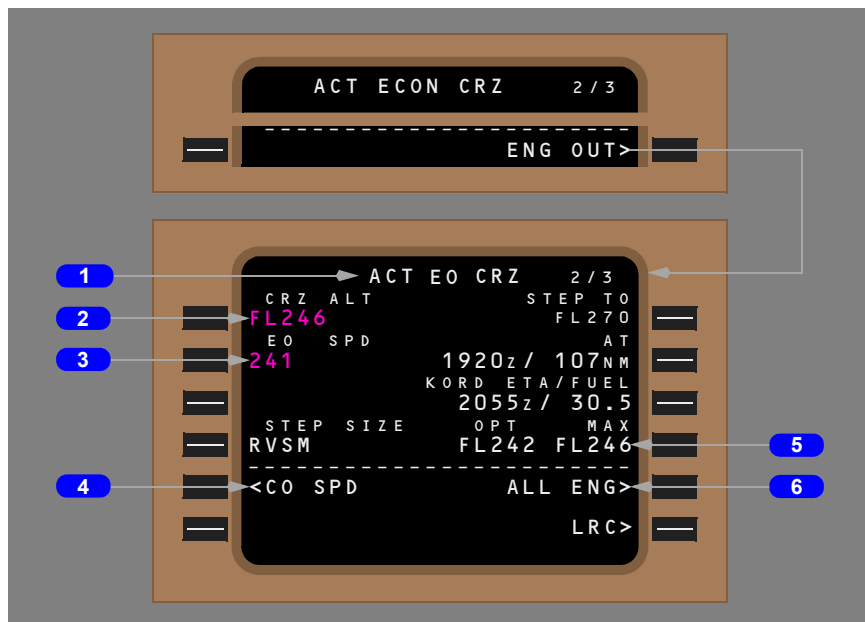
Engine out (EO) VNAV cruise guidance displays on the EO CRZ page. EO data with both engines operating can be displayed by selecting the ENG OUT prompt on the CRZ page, without executing. Following an engine failure and selection of the ENG OUT prompt, execution displays the appropriate EO CRZ page.

The modified page displays engine out performance information. When above the maximum engine out cruise altitude, VNAV calculates engine out guidance for drift down (D/D). This graphic is shown under Cruise (Above EO Max Alt), 11.31. The EO D/D page changes to the EO CRZ page when reaching the engine-out cruise altitude (shown below). LRC speed may be selected at 6R.

Subsequent engine-out cruise climb or descent is accomplished the same as two engine cruise climb or descent.

As the airplane gross weight decreases, maximum altitude increases. A step climb may be possible under these conditions.

The example is based on a cruise altitude above the maximum engine-out altitude. When ENG OUT is selected, the default target speed is EO SPD.



1 Page Title

The page title displays active (ACT) or modified (MOD) cruise.

- ACT EO CRZ – engine out selected with minimum drag cruise speed
- ACT EO MCP SPD – MCP speed intervention selected
- ACT EO XXXKT CRZ – fixed CAS cruise speed selected
- ACT EO M.XXX CRZ – fixed Mach cruise speed selected
- ACT EO D/D - engine out driftdown with EO speed
- ACT LRC D/D - engine out driftdown with LRC speed selected
- ACT EO LRC CRZ - engine out cruise with LRC speed
- ACT EO CRZ CLB/DES – cruise climb or descent with EO SPD selected

Page titles include:

2 Cruise Altitude (CRZ ALT)

Displays altitude from MAX ALT line when current CRZ ALT above MAX ALT.

Manual entry of an altitude above maximum engine-out altitude results in the scratchpad message, “MAX ALT FLXXX”.

Valid entries are the same as all engine cruise page.

3 Engine Out Speed (EO SPD)

Displays the target speed or Mach in magenta.

Manual entry is allowed.

Valid entries are the same as all engine cruise page.

A manually entered speed changes the line title to SEL SPD.

Selecting any speed shows engine out speed (EO SPD) as a select prompt at 6L.

Manual entries may change MAX altitude.

4 Company Speed (CO SPD)

Push – Modifies the page with company speed, engine out data from the airline policy page.

5 Optimum Altitude and Maximum Altitude (OPT, MAX)

OPT – calculation of OPT altitude is based on gross weight, cost index, cruise speed schedule, and cruise cg. Wind and temperature deviations from standard day are not used in the calculation. The optimum altitude is not calculated during an RTA cruise segment.

MAX – displays the maximum cruise altitude based on:

- current gross weight minus calculated fuel burn to climb to MAX altitude
- temperature
- engine out operation
- cruise reference thrust limit default set by airline (CRZ or CLB)
- speed (ECON, LRC, SEL, EO, or CO)
- residual rate of climb default set by airline (range: 100 to 999 feet per minute)
- disregards altitude or speed constraints
- cruise CG

6 ALL Engine (ENG)

Push – displays a MOD XXX CRZ page with performance based on both engines operating.

Selection and execution allows subsequent selection of two engine economy VNAV modes.

VNAV Modifications

During the cruise phase, VNAV can calculate two types of climbs: cruise and step climbs. Cruise and planned climbs can be entered by the flight crew. Optimum step climbs are calculated by the FMC. In all cases, the new climb altitude must be selected in the MCP altitude window before VNAV commands the climb.

Cruise Climb

Setting an altitude above the current cruise altitude in the MCP altitude window and pushing the altitude selector causes the cruise altitude to be set to the MCP altitude and the airplane to climb to the new cruise altitude. The reference thrust limit is CLB and the pitch flight mode annunciation is VNAV SPD.

Another method to accomplish a cruise climb: set a higher MCP altitude, enter the altitude in the CRZ ALT line, and execute.



1 During Cruise Climb

VNAV page title displays CRZ CLB in a climb to cruise altitude.

2 End of Cruise Climb

VNAV page title displays ECON CRZ after level off at cruise altitude.

Planned Step Climb

When a step climb is planned to start at a waypoint, the data can be entered on the RTE LEGS page. The FMC performance predictions assume the airplane will start the climb at the identified waypoint.

The FMC displays the distance and ETA to the step point on the PROGRESS page. The corresponding altitude profile point and identifier is shown on the ND.

[Option: AIMS V16 & AIMS-1 installed]

If a climb is not initiated within 5 minutes after passing a planned step climb point, the EICAS message VNAV STEP CLIMB displays.

[Option: AIMS V17B]

If a climb is not initiated within 5 minutes after passing a planned step climb point and the difference between the CRZ ALT shown in 1L and the STEP TO altitude shown in 1R of the CRZ page is greater than 3,500 feet, the EICAS advisory message VNAV STEP CLIMB displays.



1 Step Climb Altitude

Enter the cruise altitude as an altitude constraint and the letter S. The FMC assumes the step climb starts at the waypoint. Accomplish the step climb at the waypoint with the steps described in cruise climb.

Calculated Step Climb

With a non-zero value entered on the STEP SIZE line on the PERF INIT or CRZ page, the FMC calculates step climb points that minimize trip cost. For all speed modes, the step climb points are a function of the lateral flight plan, the entered COST INDEX (for ECON and RTA speed modes only), entered forecast winds and temperatures, CRZ ALT, gross weight, and STEP SIZE. Multiple step climbs are possible based on performance and route length. The calculated STEP TO altitude is less than or equal to the maximum altitude at the step point.

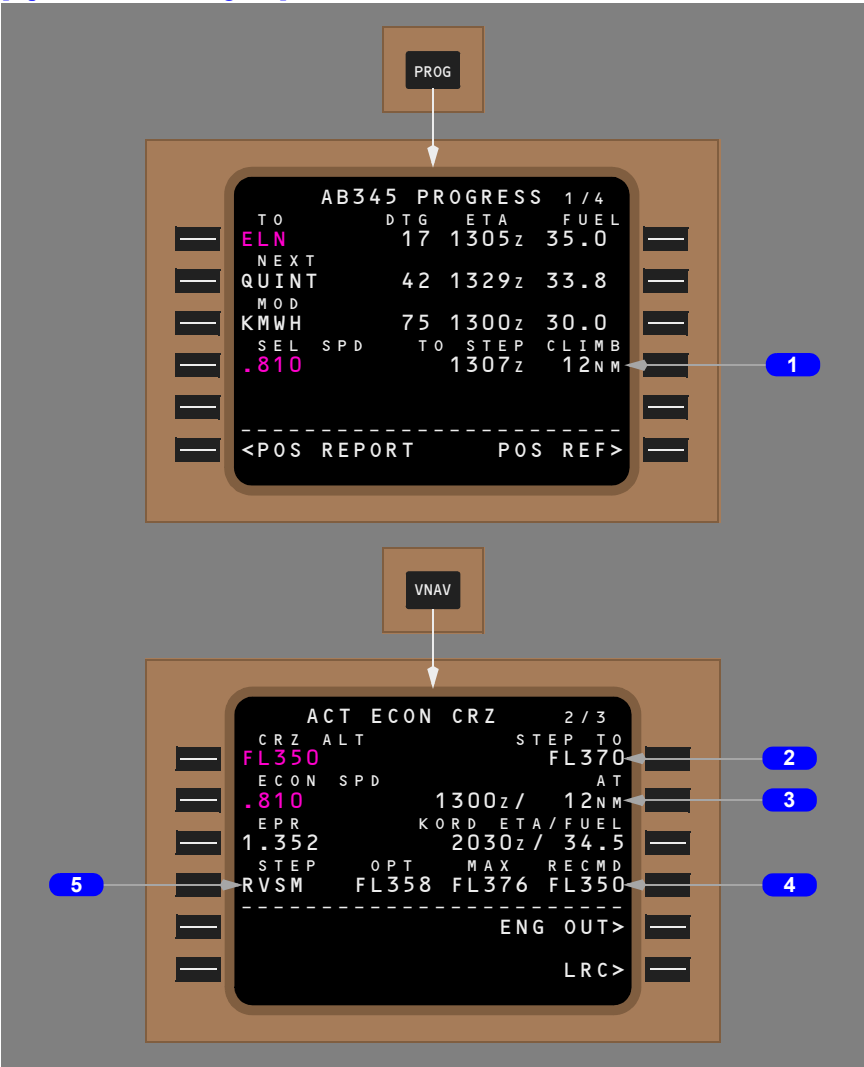
[Option: AIMS V16 & AIMS-1 installed]

If a climb is not initiated within 5 minutes after passing a calculated step climb point, the EICAS advisory message VNAV STEP CLIMB displays.

[Option: AIMS V17B]

If a climb is not initiated within 5 minutes after passing a planned step climb point and the difference between the CRZ ALT shown in 1L and the STEP TO altitude shown in 1R of the CRZ page is greater than 3,500 feet, the EICAS message VNAV STEP CLIMB displays.

[Option: PW, RR Engines]



1 TO STEP CLIMB

When the cruise climb start point is the next VNAV event, the line title changes to TO STEP CLIMB.

Displays the ETA and DTG to the point where the step climb starts.

If the airplane passes the step climb point and has not started to climb, the ETA and DTG are replaced with the word NOW.

When the FMC calculates a step climb is not advised, the ETA and DTG are replaced with the word NONE.

2 STEP TO

STEP TO displays when all the following are true:

- an active route exists and no pending activation or flight plan modification exists
- the airplane is more than 200 nm from the T/D for calculated or planned steps
- the airplane is more than 500 nm from the destination airport for calculated steps
- an engine out drift down is not active
- step size is not zero or a planned step exists when the step size is zero

The FMC calculates performance based on accomplishing step climbs at calculated step climb points throughout the flight plan.

An altitude can be entered to evaluate a step climb. The FMC calculates the step climb location using entered forecast winds and temperatures and displays data on this page and on the PROGRESS page 1, 4R.

Valid entries are FLXXX (or XXX flight level) or XXXXX (feet).

Entry of zero for step size causes the FMC to calculate performance data at the entered CRZ ALT with no step climbs.

Preflight entry of a non-zero increment, ICAO, or RVSM step size causes the FMC to calculate STEP TO altitudes correct for the direction of flight based on the entered CRZ ALT. Inflight changes to CRZ ALT affect calculation of STEP TO altitudes when using ICAO or RVSM step size.

Displays STEP TO altitude based on entering "S" (following altitude) on a waypoint on the LEGS page. The altitude displayed in 1R can be overwritten with a manual entry above or below CRZ ALT.

When using a non-zero step size, the STEP TO altitude is the next higher altitude, calculated by adding the step size increment to the current CRZ ALT. If step climbs have not been accomplished as calculated, multiple step increments may be used.

Entering an altitude above maximum altitude displays the scratchpad message MAX ALT FLXXX.

Blank when:

- there is no active flight plan, or
- within 200 NM of the T/D, or
- within 500 NM of the destination airport with no planned steps in the flight plan, or
- engine out drift down is active

3 TO FLXXX, AVAIL AT, AT XXXXXXXX, AT, TO T/D, NONE

AT:

Displays when there is an altitude in 1R not derived from a specified climb point. Displays the ETA and DTG to the optimum climb point.

AT XXXXXXXX:

Displays the LEGS page step climb waypoint when the FMC calculates the step climb can occur within 5 nm of the associated step climb waypoint. The data line displays ETA and DTG to the climb point. Displays NOW when passing the step climb point.

AVAIL AT:

Displays when a STEP TO the next step altitude entered on a LEGS page waypoint can not occur within 5 nm of the planned step point. The data line displays the ETA and DTG to the climb point. Displays NOW when passing the step climb point. Displays NONE when the planned step climb cannot be accomplished.

TO FLXXX:

Displays when the airplane is more than 200 nm from the T/D or more than 500 nm from the destination airport and engine out drift down is active. The data line displays the ETA and DTG to the climb point to the TO FLXXX altitude.

TO T/D:

Displays when the airplane is within 200 nm of the T/D or within 500 nm of the destination airport with no planned step climbs in the flight plan. The data line displays ETA and DTG to the T/D point.

NONE:

Displays when planned step climb cannot be accomplished.

4 Optimum, Maximum, and Recommended Altitude (OPT, MAX, RECMD)

Blank when RTA is active.

777 Flight Crew Operations Manual

OPT – calculation of OPT altitude is based on gross weight, cost index, cruise speed schedule, and cruise cg. Wind and temperature deviations from standard day are not used in the calculation. The optimum altitude is not calculated during an RTA cruise segment.

MAX – displays maximum altitude based on:

- current gross weight minus calculated fuel burn to climb to MAX altitude
- temperature
- number of engines operating
- cruise reference thrust limit default set by airline (CRZ or CLB)
- speed (ECON, LRC, SEL, or CO)
- residual rate of climb default set by airline (range: 100 to 999 feet per minute)
- disregards altitude or speed constraints
- cruise CG

RECMD – displays the most economical altitude to fly for the next 250 - 500 nm based on gross weight, cruise speed schedule, and entered forecast winds and temperatures at cruise altitudes. The FMC evaluates altitudes between 9,000 feet below the current CRZ ALT and up to MAX altitude. Recommended altitudes are consistent with the specified step size and step climb schedule. If the step size is zero, the recommended cruise level is calculated assuming a 2,000 feet step size. The recommended altitude is set to the CRZ ALT when within 200 nm of the T/D or within 500 nm of the destination airport. The recommended altitude is not calculated during an RTA cruise segment.

5 STEP SIZE

Used for calculation of optimum step point and step climb predictions.

[Option: AIMS V14 installed]

Displays default step climb size: RVSM, ICAO, or 0 as selected in AMI.

[Option: AIMS V14 installed]

Valid entries are:

- "0" to inhibit predicted step climbs, or
- altitudes from 1000 to 9900 in 100 foot increments, or
- "I" for ICAO, or
- "R" for RVSM

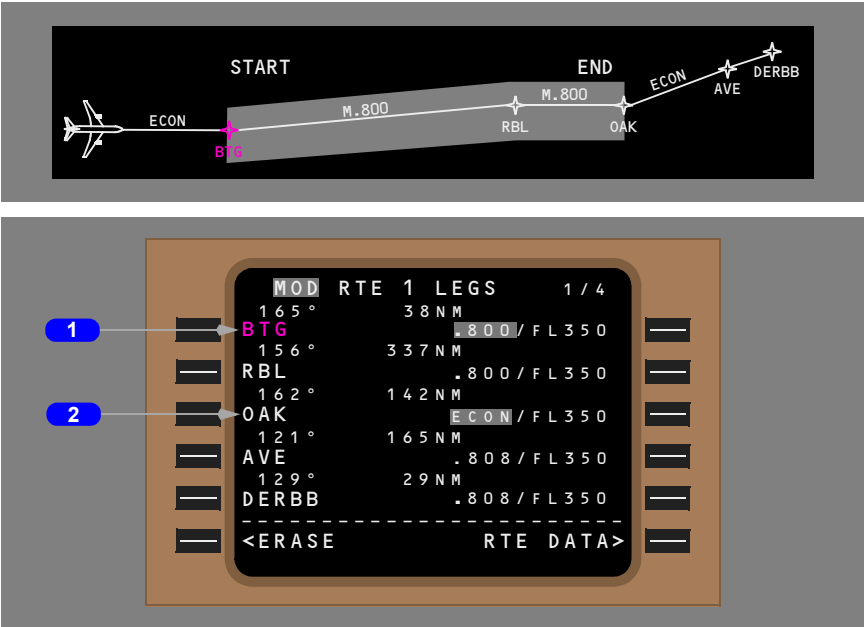
[Option: AIMS V14 installed]

Deletion of a manual entry returns step size to the default value.

Constant Speed Cruise

A speed for a cruise segment can be specified. A cruise segment has a start waypoint and an end waypoint. The airplane maintains a constant speed between the two waypoints. The waypoints must be in the cruise phase. The FMC controls the speed after the end waypoint or top of descent.

Modification must be executed.



1 Start Waypoint for Constant Speed Cruise

The constant speed cruise starts at BTG at .800 Mach. Entry is in Mach.

2 End Waypoint for Constant Speed Cruise

The constant speed cruise ends at OAK then ECON speed is used. If an RTA waypoint exists at RBL or OAK, the RTA is deleted.

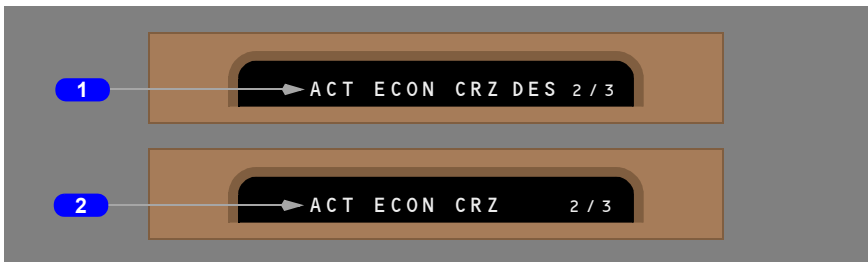
Entry can be a Mach number, ECON/ or E/, LRC/ or L/. If an RTA waypoint is in the flight plan, RTA/ or R/ may be entered.

If no end waypoint is specified, the constant speed terminates at top of descent.

The FMC may select the end waypoint if an RTA waypoint is entered. The FMC selects the end waypoint to allow enough distance to arrive at the RTA waypoint on time. In the example, if the FMC selected OAK as the end waypoint, RTA would replace ECON. See RTA PROGRESS page 3/4.

Cruise Descent

Setting an altitude below the current altitude in the MCP altitude window and pushing the altitude selector (more than 50 nm from a T/D) causes the cruise altitude to be set to the MCP altitude and the airplane to descend to the new altitude. The CRZ page displays ACT ECON CRZ DES. If the altitude set in the altitude window is below the speed transition (SPD TRANS) or restriction (SPD RESTR) altitude displayed on the DES page, those altitudes and speeds are deleted. Transition or speed restrictions must be maintained by flight crew action. The autothrottle sets a calculated thrust value for an approximate 1250 feet per minute descent. Pitch changes maintain the commanded cruise speed. Thrust levers can be manually positioned to adjust the descent rate.



1 During Cruise Descent

VNAV page title displays cruise phase in a descent to a new cruise altitude.

2 End of Cruise Descent

VNAV page title displays cruise phase after level off at new cruise altitude.

Early Descent

An early descent is a descent started prior to the T/D. The VNAV descent page becomes active.

During cruise, setting an altitude below the current altitude in the MCP altitude window and pushing the altitude selector activates the DES NOW function when the airplane is within 50 nm of the T/D or if the MCP altitude is set below the highest descent altitude constraint in the VNAV descent profile.

The autothrottle sets thrust to maintain the target descent rate; then annunciates HOLD. Pitch maintains the commanded speed. Thrust levers can be manually positioned to adjust the descent rate.

Another method to accomplish an early descent: set a lower MCP altitude, page forward to the VNAV DES page and line select DES NOW, and execute.



1 Descend Now (DES NOW)

The DES NOW prompt is shown on the descent page when the cruise phase is active. Selecting the DES NOW prompt and executing initiates a VNAV SPD descent of approximately 1250 feet per minute at ECON speed.

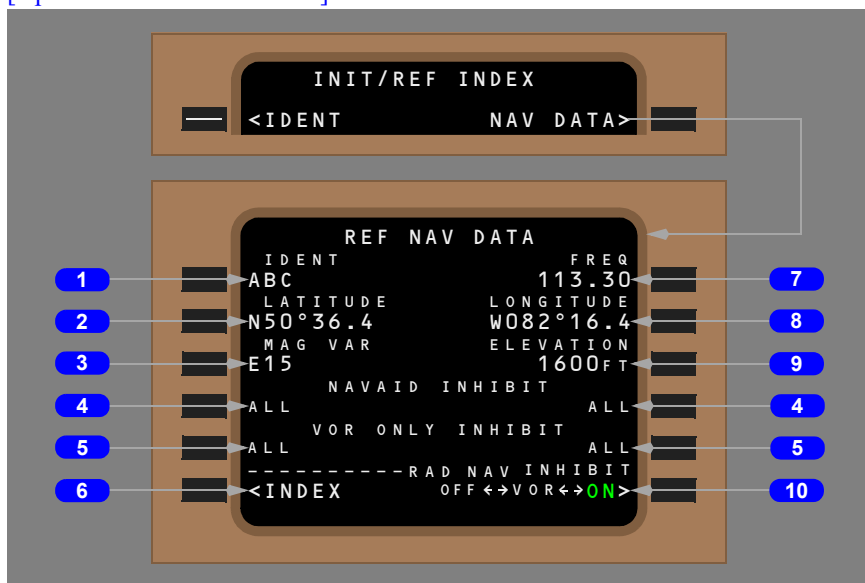
Upon reaching the planned descent path, VNAV commands pitch to capture the path and to maintain ECON speed, and sets IDLE thrust.

Navigation Data

Reference Navigation Data Page

The reference navigation data page displays data about waypoints, nav aids, airports, and runways. Use this page to inhibit FMC position updates from radio nav aids. The nav aids are always available for manual tune, autotune and the ND.

[Option: AIMS V14 installed]



1 Identification (IDENT)

Valid entries are any waypoint, nav aid, airport, or destination runway from the navigation database. Pilot defined waypoints such as latitude/longitude are also valid entries when in the active route.

Entry changes to dashes when page is exited and then reselected.

2 LATITUDE

Displays latitude of entered identifier.

3 Magnetic Variation (MAG VAR), LENGTH

MAG VAR - displays magnetic variation when entered identifier is a nav aid.

LENGTH - displays runway length when entered identifier is a runway.

4 NAVAID INHIBIT

Valid entries are: VOR, VOR/DME, VORTAC, or DME identifiers from the navigation database.

[Option: AIMS V14 installed]

Entries not allowed when RAD NAV INHIBIT displays ON in large font, green letters.

Inhibits use of entered navaids for updating by both FMCs.

[Option: AIMS V14 installed]

Entries clear at flight completion. "ALL" displays.

Deleting or overwriting removes a previous inhibit navaid.

5 VOR ONLY INHIBIT

Valid entries are VOR identifiers from the navigation database.

[Option: AIMS V14 installed]

Entries not allowed when RAD NAV INHIBIT displays ON or VOR in large font, green letters.

Inhibits use of only VOR portion of entered navaid for updating by both FMCs. DME–DME position updating is not inhibited.

[Option: AIMS V14 installed]

Entries clear at flight completion. "ALL" displays.

Deleting or overwriting removes a previous inhibit VOR.

6 INDEX

Push – displays the INIT/REF INDEX page.

7 Frequency (FREQ)

Displays frequency of entered identifier when it is a navaid.

8 LONGITUDE

Displays longitude of entered identifier.

9 ELEVATION

Displays elevation of entered identifier when it is a navaid, airport, or runway.

[Option: AIMS V14 installed]

10 RAD NAV INHIBIT

The default state of RAD NAV INHIBIT is ON; all radio updating (DME/DME, VOR/DME, LOC) is inhibited. "ALL" displays in NAVAID INHIBIT and VOR ONLY INHIBIT left and right lines. Entries are not allowed.

777 Flight Crew Operations Manual

Push – alternately selects RAD NAV INHIBIT: OFF, VOR, or ON.

OFF - all radio updating available to the FMC. OFF displays in large font, green letters. VOR and ON display in small font, white letters.

VOR - all VOR/DME updating inhibited. DME/DME updating is operable. VOR displays in large font, green letters. OFF and ON display in small font, white letters.

ON - all radio updating inhibited. ON displays in large font, green letters. OFF and VOR display in small font, white letters.

Note: When GPS is operable, radio updating is available, but is not used by the FMC for position updating.

Fix Information Page

[Option: Standard FIX Pages]

Two identical FIX INFORMATION pages are used to create waypoint fixes and waypoints for the ND. Some of the created waypoints can be copied into the route. The page can be cleared by selecting the ERASE FIX prompt or by using the DEL key.

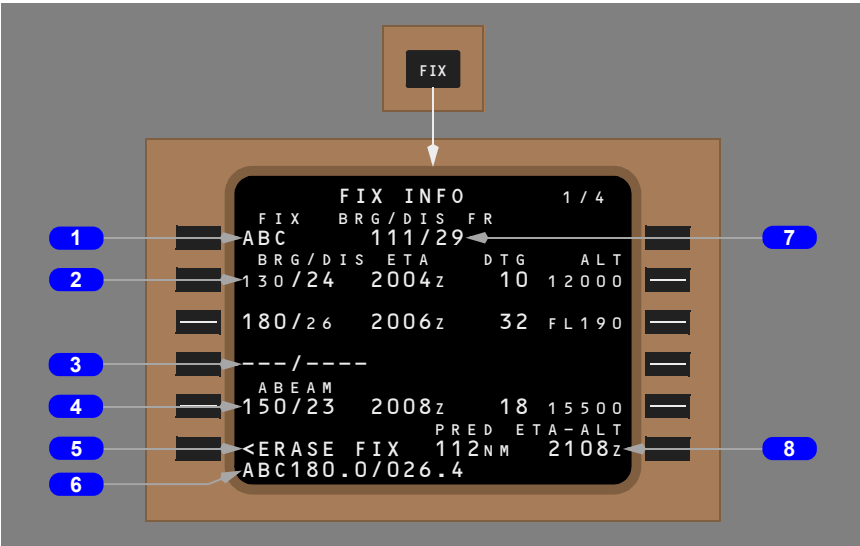
[Option: Enhanced FIX Pages]

Four identical FIX INFORMATION pages are used to create waypoint fixes and waypoints for the ND. Some of the created waypoints can be copied into the route. The page can be cleared by selecting the ERASE FIX prompt or by using the DEL key.

Magnetic/True Bearing

Magnetic or true fix bearings depend on airplane location. Refer to FMC Polar Operations, Flight Management Navigation, section 31.

[Option: 4 page FIX INFO installed]



[Option: Standard FIX Pages]

1 FIX

Valid entries are airports, nav aids, and waypoints from the navigation database. The selected fix displays on the ND and is highlighted by a green circle.

[Option: 4 page FIX INFO installed]

1 **FIX**

Valid entries are airports, nav aids, place bearing distance, place bearing/place bearing, along track, latitude/longitude, and waypoints from the navigation database. The selected fix displays on the ND and is highlighted by a green circle.

[Option: Standard FIX Pages]

2 **Bearing/Distance (BRG/DIS), ETA, DTG, ALT**

Valid entries are XXX/YYY:

- leading zeros can be omitted for distance entries
- distance (up to 511 nm) only entries must start with a slash (/)

Distances from the fix display on the ND as a circle around the fix.

When the circle intersects the active route, the ETA, DTG, and predicted altitude at the closest intersection display.

Bearings from the fix display on the ND as radial lines from the fix.

When the bearing intersects the active route, the ETA, DTG, and predicted altitude at the closest intersection display.

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.

Push - copies the fix place/bearing/distance into the scratchpad. This fix can be placed in the route on a LEGS or RTE page as a waypoint.

[Option: 4 page FIX INFO installed]

2 **Bearing/Distance (BRG/DIS), ETA, DTG, ALT**

Valid entries are XXX/YYYY:

- leading zeros can be omitted for distance entries
- distance (up to 9999 nm) only entries must start with a slash (/)

Distances from the fix display on the ND as a circle around the fix.

When the circle intersects the active route, the ETA, DTG, and predicted altitude at the closest intersection display.

Bearings from the fix display on the ND as radial lines from the fix.

When the bearing intersects the active route, the ETA, DTG, and predicted altitude at the closest intersection display.

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.

Push - copies the fix place/bearing/distance into the scratchpad. This fix can be placed in the route on a LEGS or RTE page as a waypoint.

3 Bearing/Distance (BRG/DIS) – Dashes

When entering a bearing or distance from the fix, a bearing or distance circle from the fix displays on the ND. ETA, DTG, and predicted altitude also display.

When entering a bearing and distance from the fix, a bearing and distance circle from the fix display on the ND. ETA, DTG, and predicted altitude do not display. Line selection to the scratchpad and entry into the flight plan results in the creation of a waypoint.

4 ABEAM

Displays ABEAM prompt.

Note: The ABEAM prompt is only available when entering a FIX that is contained in the navigation data base (NDB). When entering a FIX in coordinates form, the ABEAM prompt will not be available.

Push - displays bearing and distance from the fix perpendicular to the nearest segment of the flight plan path, and ETA, DTG, and altitude at the intersection point.

Second push - copies the fix place/bearing/distance into the scratchpad. This fix can be placed in the route on a LEGS or RTE page as a waypoint.

5 ERASE FIX

Push – removes all fix data from the page and the ND.

6 Route Intersection Point Copied

Pushing the line select key for one of the BRG/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.

7 Bearing/Distance From (BRG/DIS FR)

Displays the bearing and distance of the airplane from the fix.

8 Predicted Distance to ETA or Altitude (PRED ETA-ALT)

Valid entry is altitude, flight level, or time. Time entry must be followed by “Z”.

Entering an altitude or flight level displays the predicted along track distance and altitude or flight level on this line. The predicted airplane position displays on the ND route line as a green circle with the entered altitude/flight level.

777 Flight Crew Operations Manual

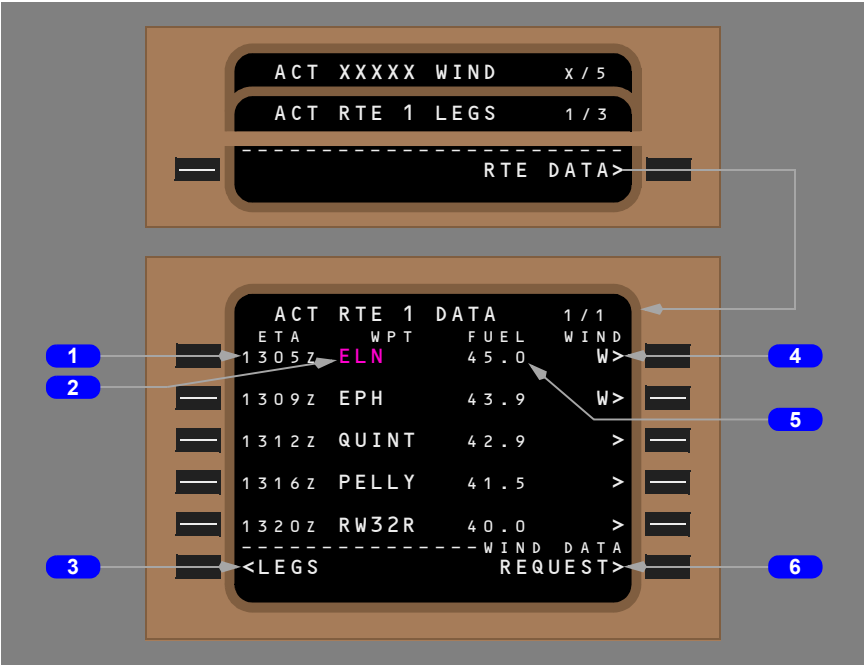
Entering a time displays the predicted along track distance and the time. The predicted airplane position displays on the ND route line as a green circle with the entered ETA.

Route and Waypoint Data

Route Data Page

The route data page displays data for each waypoint on the ACT RTE X LEGS page. This page also allows access to the WIND page. This page is available only for the active route.

The ETA and calculated fuel remaining at the waypoint display for each waypoint. Manual entry is not possible.



1 ETA

Displays ETA for waypoint.

2 Waypoint (WPT)

Displays identifier for waypoint.

3 LEGS

Push –displays RTE LEGS page.

4 WIND (W>/>)

W> - indicates waypoint winds have been entered.

> - winds not entered.

Push – selects WIND page for the selected waypoint.

5 FUEL

Displays the FMC calculated fuel remaining at the waypoint.

Note: ETA and estimated fuel calculations assume a direct flight across route discontinuities.

6 WIND DATA REQUEST

Push – transmits a data link request for wind and descent forecast data.

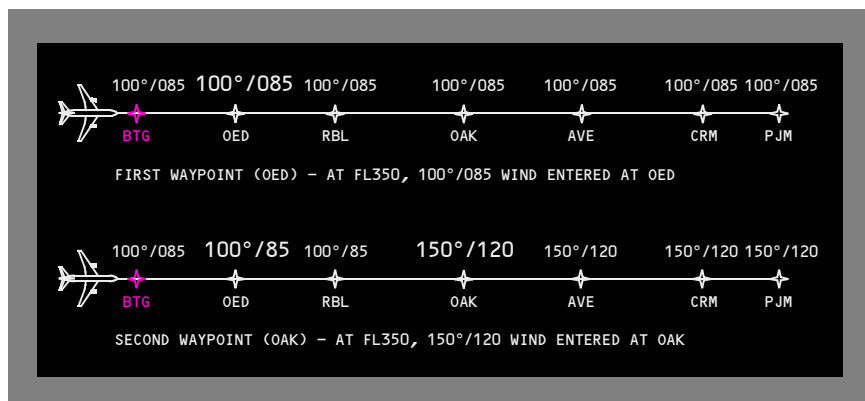
Flight crew may enter up to four altitudes on any wind page to qualify the request.

Wind Data

The FMC uses wind data to improve performance prediction accuracy. Wind data includes altitude and direction/speed.

The FMC applies the first entered wind data to all waypoints in the flight plan. Wind data entered at another waypoint (at the same altitude) changes wind data downtrack from the second entered waypoint either to the end of the track, or to the next entered wind. The wind data before the second entered waypoint does not change. Therefore, enter wind data for waypoints closest to the airplane, then enter wind data for waypoints downtrack from the airplane.

For example: at FL 350, 100°/085 is entered at waypoint OED. All waypoints in the route have the OED wind data. Then, additional wind data entered at OAK changes the wind data at OAK and through the end of the route.



Entered wind data are mixed with sensed wind data for performance predictions. The FMC uses entered winds for predictions far ahead of the airplane and sensed winds close to the airplane. The FMC mixes these winds for predictions in between. Sensed winds display on the progress page 2/4.

Inaccurate forecast wind and temperature information degrades the accuracy of the recommended altitude displayed on the cruise page.

The FMC adjusts ECON climb speed and top of climb using entered and/or sensed wind speed. FMC calculated ECON climb speed may fluctuate if top of climb is near a waypoint with approximately a 45 degree or larger track change and if a significant wind velocity has been entered or is predicted for that waypoint. This fluctuation does not occur when using a manually entered climb speed or speed intervention.

Wind Page

The wind page is used to enter forecast winds and temperatures at waypoints for up to four altitudes to enhance VNAV performance.

This data can be uplinked or manually entered.

Wind speed and direction are entered for the specific altitudes.

OAT can be entered for any one altitude. The FMC calculates the temperature for the entered altitudes using the standard lapse rate.

Altitudes are entered first. The altitudes can be entered in any order and are sorted and displayed in ascending order.

The screenshot shows the Wind Page interface. The top section displays 'ACT RTE 1 DATA' with '1305Z ELN' and '45.0' for 'WIND'. The bottom section displays 'MOD ELN WIND' with four lines of data: 'FL250 -41°C 280° / 70KT', 'FL210 -33°C 300° / 50KT', '17000 -25°C ---° / ---KT', and 'FL200 / -31°C'. The 'MOD' button is highlighted in white. Numbered callouts 1 through 7 point to various elements: 1 points to the 'MOD' button, 2 points to the 'ALT' field, 3 points to the 'OAT' field, 4 points to the 'ERASE' button, 5 points to the 'DIR / SPD' field, 6 points to the 'ALT / OAT' field, and 7 points to the 'RTE DATA' button.

1 Page Title

Displays ACT XXXXX, where XXXXX is the waypoint at which winds have been entered.

When a route is being modified, MOD in shaded white as shown in the page title.

2 Altitude (ALT)

Enter altitude or flight level for wind entries. Altitude data entry possible only on line 1L.

After data entry, data is sorted by altitude and placed in lines 1 through 4. Dashes display on right side of line for wind direction and speed entry.

When all four lines have data, one must be deleted before new data can be entered.

3 Altitude/Flight Level Data

Displays the altitude or flight level for wind or OAT entries.

Data entered on 1L displays on lines 1 through 4. Data entry is not possible in lines 2L through 4L.

OAT entries made using the ALT/OAT line display in large font. Calculated OAT based on standard lapse rate display in small font.

4 ERASE

Push – removes modified data.

5 Direction and Speed (DIR/SPD)

Displays dashes after altitude/flight level entry in the ALT line. Enter wind direction and speed for the altitude.

Displays entered wind direction and speed for related altitude.

Values propagate in both directions for the first wind entered and downtrack for other entered winds. Propagated values display in small white font.

Manual entries display in shaded white until executed, then in large white font.

6 Altitude/Outside Air Temperature (ALT/OAT)

Valid entries are altitude or flight level/and OAT. OAT is a one-to-three digit entry, including the sign; a plus sign is optional, a minus sign is mandatory. Valid range is -99 to 60.

The altitude for OAT does not have to be one of the wind altitudes. The FMC uses standard lapse rate to calculate and display the temperature at the other altitudes.

Manual entries display in shaded white until executed.

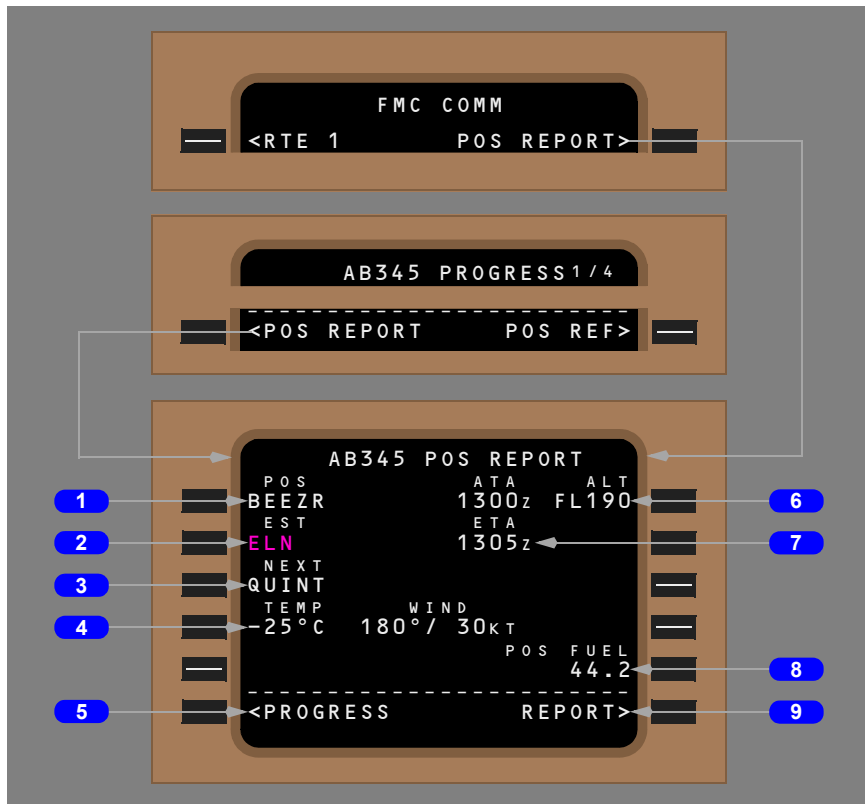
7 Route Data (RTE DATA)

Push – displays the RTE DATA page.

Position Report Page

The position report page displays data for a position report. A position report can be data linked from the page.

The page contains reference data only. Manual entries are inhibited.



1 Position (POS)

Waypoint used to report position. This is the previous active waypoint.

2 Estimate (EST)

The active waypoint displays in magenta.

3 NEXT

Waypoint after active waypoint.

4 Temperature and Wind (TEMP WIND)

TEMP displays the OAT in degrees C.

WIND displays the wind direction and speed.

5 PROGRESS

Push – displays the PROGRESS page.

6 Actual Time of Arrival and Altitude (ATA ALT)

ATA displays the actual time of arrival for the POS waypoint.

ALT displays the current airplane altitude.

7 ETA

Displays the estimated time of arrival for the active waypoint.

8 Position Fuel (POS FUEL)

Displays FMC calculated fuel remaining at the POS waypoint.

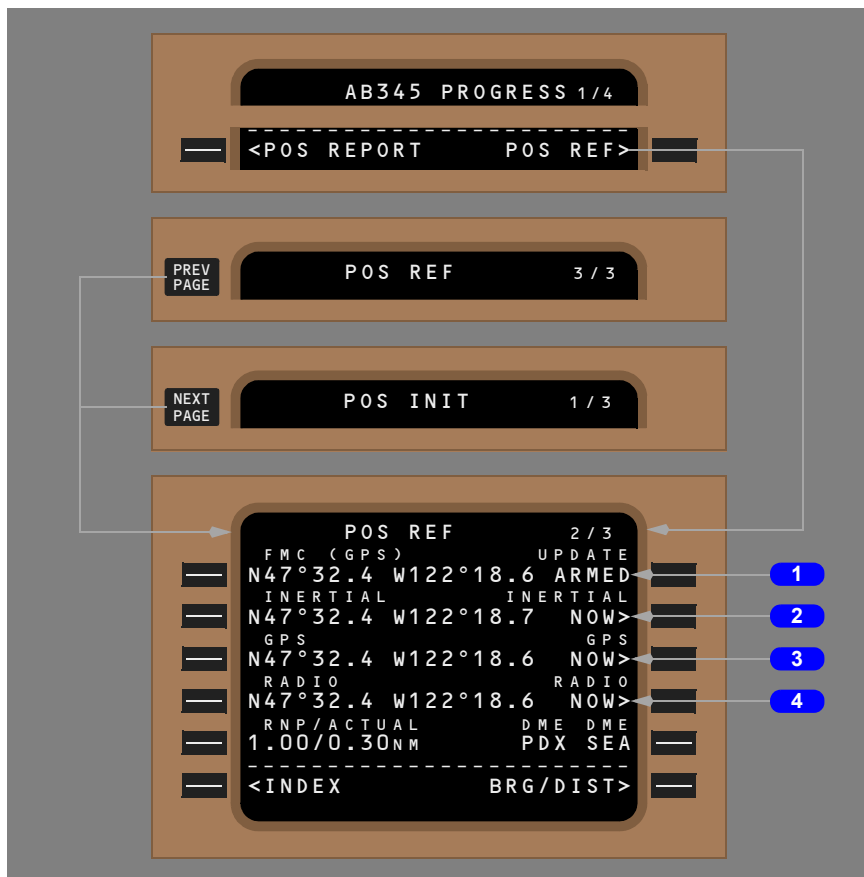
9 REPORT

Push – transmits a data link downlink of the data on this page.

The data link transmission of a position report requires the data link option be enabled, operational, and not in the voice or no-communications mode.

In-Flight Position Update

FMC position update can be accomplished on the POS REF 2/3 page in flight.



1 UPDATE ARMED

Pushing the ARM prompt arms the position update function. ARM changes to ARMED. Each of the position update sources have a NOW prompt.

2 INERTIAL NOW

Push – to update the FMC position from the inertial position.

3 GPS NOW

Push – to update the FMC position from the GPS position.

4 RADIO NOW

Push – to update the FMC position from the navigation radio position.

Progress Pages

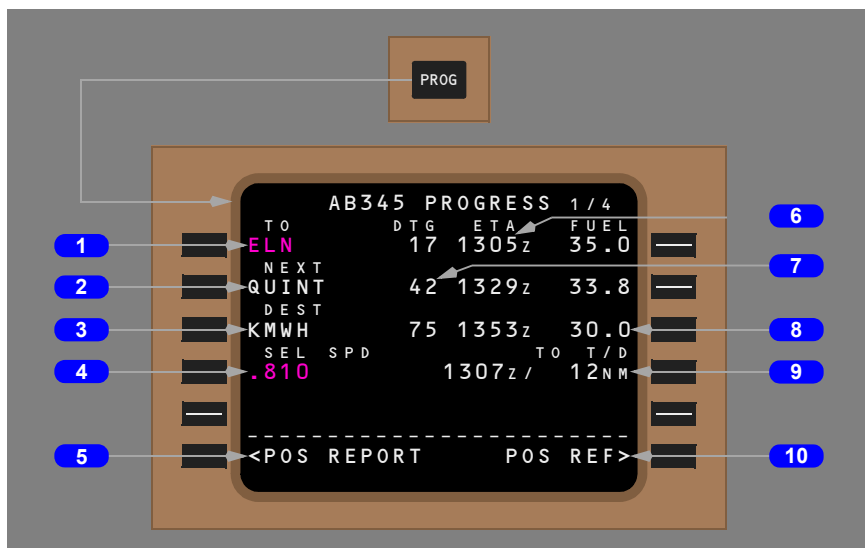
Progress Page 1

The progress page displays general flight progress data. The FMC Communication section of Chapter 5, Communications describes position reports.

The page title displays the company flight number entered on the RTE page.

Page one of the progress pages displays general data about:

- waypoints (active and next)
- destination data
- FMC speed
- T/C, T/D, etc.



1 TO

Active waypoint displays in magenta.

Can not be modified.

2 NEXT

Waypoint after TO waypoint displays in white.

Can not be modified

3 Destination (DEST)

Any waypoint or airport in navigation database, or any waypoint (except along track or latitude/longitude) in the active flight plan can be entered. The line titles are:

- DEST – performance predictions to destination. Default display
- DIR TO FIX – when entered waypoint is not in flight plan. Data is based on flying present position direct to the waypoint
- EN ROUTE WPT – when entered waypoint is in flight plan. Line data are based on flying the flight plan route to the waypoint
- MOD – a modification has been made on another page. Performance predictions include modification.

Remove entries with DELETE key or change all CDUs to a different page.

4 Selected Speed (SEL SPD)

The FMC active command speed displays in magenta.

The active speed mode is the same as on the active VNAV page, unless changed by the MCP or a limit. The speed modes are:

- | | |
|--|---|
| • ECON SPD – economy speed | • LIM SPD – speed is limited by VMO, MMO, flap limit, or buffet limit |
| • LRC SPD – long range cruise speed | • MCP SPD – MCP speed entered on the MCP IAS/MACH indicator |
| • SEL SPD – selected speed manually entered on the CDU | • VREF +80 – for engine out operations during takeoff |
| • EO SPD – engine out speed | • RTA SPD – RTA speed is active |
| • CO SPD – engine out operations at airline specified engine out company speed | |

5 Position Report (POS REPORT)

Push – displays the POS REPORT page.

6 ETA

Estimated time of arrival at waypoint or destination.

7 Distance To Go (DTG)

Distance to go to waypoint or destination.

8 FUEL

Estimated fuel remaining at waypoint or destination.

9 TO T/D

Data line displays ETA and DTG to line title point.

Data line displays NOW when the airplane is past the climb/descent point when STEP CLB or T/D displays in the line title.

Data line displays NONE when the line title is STEP CLB and the step has not been entered on the CRZ page or the FMC calculates a step climb is not advised.

Line titles are:

- TO T/C - top of climb
- TO STEP CLB – step climb data
- TO T/D – top of descent data
- TO E/D – end of descent data
- LEVEL AT – time and distance to level off in Drift Down mode

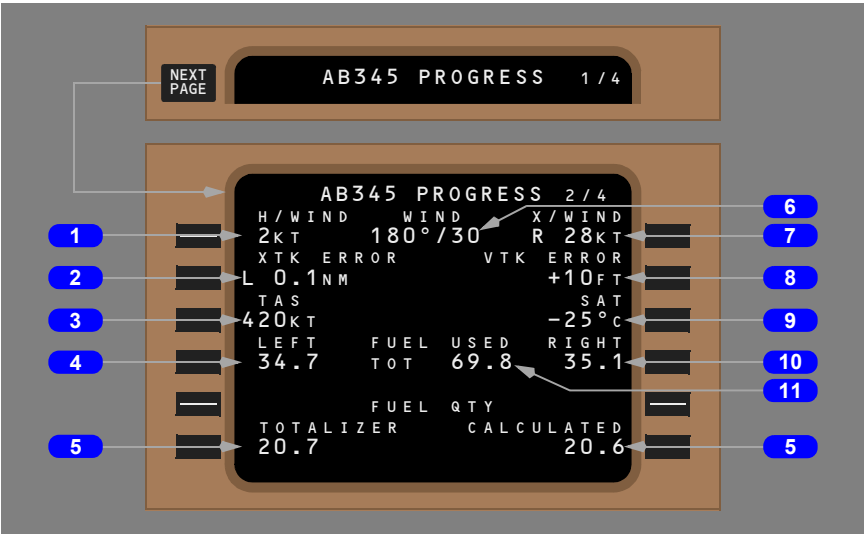
10 Position Reference (POS REF)

Push – displays position reference page.

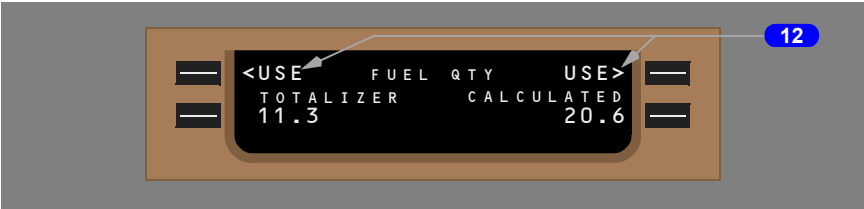
Progress Page 2

Progress page two contains:

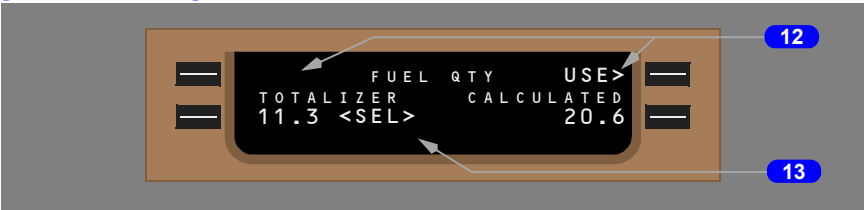
- wind data
- fuel data
- static air temperature
- true airspeed
- track error data



[not AIMS 14/16]



[After AIMS V16]



1 Headwind (H/WIND), Tailwind (T/WIND)

Displays headwind (H/WIND) or tailwind (T/WIND) component.

Wind component data is relative to the airplane.

2 Crosstrack Error (XTK ERROR)

Displays crosstrack (XTK) error in nautical miles left or right of the active route.

3 TAS

Displays airplane true airspeed.

4 LEFT FUEL USED

Displays fuel used by left engine sensed by fuel flow meters.

5 Fuel Quantity TOTALIZER, CALCULATED

The fuel remaining line displays two independent fuel quantities, TOTALIZER and CALCULATED. TOTALIZER is the total sum of individual fuel tank quantities computed by the Fuel Quantity Indicating System (FQIS). It is blank if the fuel quantity is manually entered on the PERF INIT page. The manually entered quantity displays under CALCULATED and the fuel quantity indicating system is not used until flight completion.

The fuel remaining line displays two independent fuel quantities, TOTALIZER and CALCULATED. TOTALIZER is the total sum of individual fuel tank quantities computed by the Fuel Quantity Indicating System (FQIS). When the fuel quantity is manually entered on the PERF INIT page, the manually entered quantity displays in 6R, CALCULATED.

[Option - GE engines]

When no manual fuel quantity entry is made on the PERF INIT page, CALCULATED displays the FMC calculated fuel quantity remaining. Before engine start, the CALCULATED value is set equal to the TOTALIZER. The displayed totalizer quantity can be between 99% and 101% of the actual fuel. After engine start, the CALCULATED fuel quantity is decreased by the fuel flow sensing system (FUEL USED). Sensed fuel flow tolerances may allow up to 88 lbs (or 40 kgs) per hour CALCULATED fuel quantity variation.

[Option - PW or RR engines]

When no manual fuel quantity entry is made on the PERF INIT page, CALCULATED displays the FMC calculated fuel quantity remaining. Before engine start, the CALCULATED value is set equal to the TOTALIZER. The displayed totalizer quantity can be between 99% and 101% of the actual fuel. After engine start, the CALCULATED fuel quantity is decreased by the fuel flow sensing system (FUEL USED). Sensed fuel flow tolerances may allow up to 161 lbs (or 73 kgs) per hour CALCULATED fuel quantity variation.

After fuel jettison or after all engines are shut down, CALCULATED resets to the totalizer system fuel quantity.

6 WIND

Displays current wind direction and speed referenced to true north.

7 Crosswind (X/WIND)

Displays left (L) or right (R) crosswind component relative to airplane heading.

8 Vertical Track Error (VTK ERROR)

Displays vertical path (VTK) error above (+) or below (-) vertical path.

9 Static Air Temperature (SAT)

Displays outside static air temperature.

10 RIGHT FUEL USED

Displays fuel used by right engine sensed by fuel flow meters.

11 FUEL USED Total (TOT)

Displays sum of the LEFT and RIGHT fuel used values.

12 USE

Push – selects method to calculate fuel quantity, either TOTALIZER or CALCULATED.

When USE is selected, it is used for performance computation and predictions. The other fuel calculation method blanks.

When USE is selected, it is used for performance computation and predictions. The other fuel calculation method remains available for USE selection.

EICAS message FUEL DISAGREE and USE prompts display when TOTALIZER and CALCULATED values disagree by a significant amount for 5 minutes.

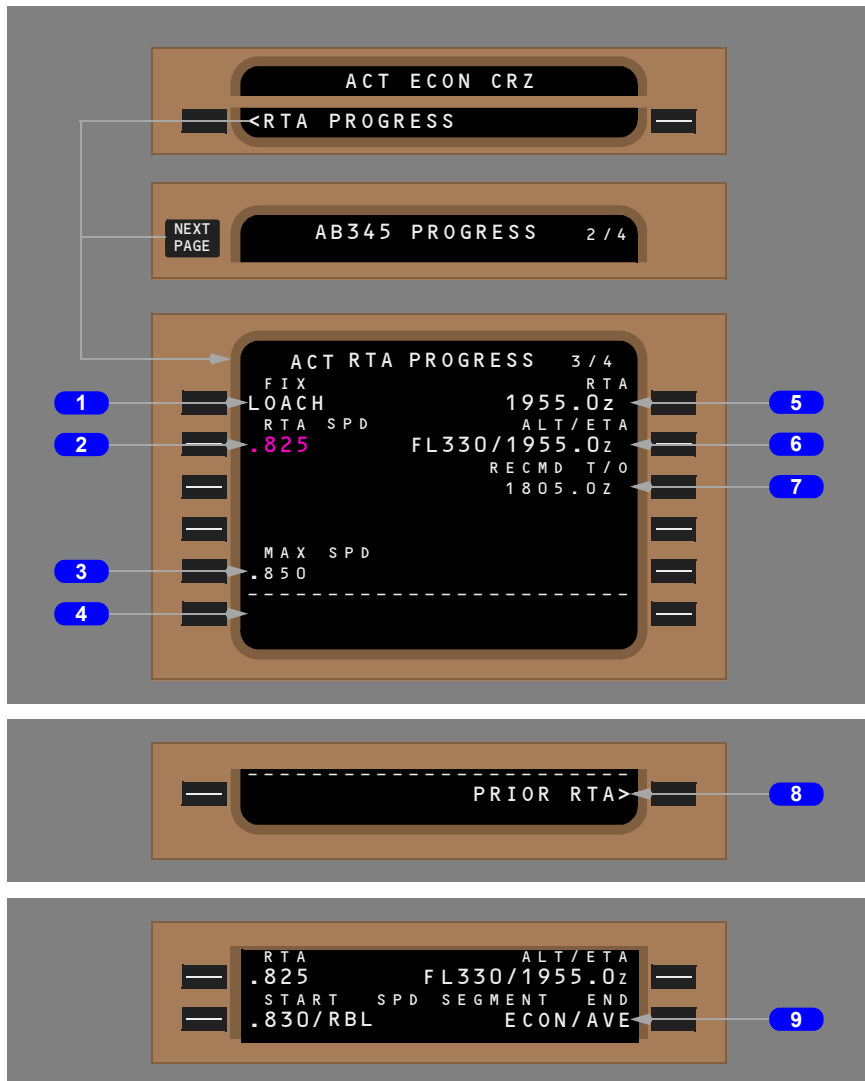
[After AIMS V16]

13 Select <SEL>

<SEL> shows which method is used to calculate fuel quantity, either TOTALIZER or CALCULATED. <SEL> displays next to the fuel quantity being used. TOTALIZER or CALCULATED selected by the USE prompt.

RTA Progress Page 3

Progress page three is used to enter data for required time of arrival (RTA). RTA can be entered or changed during preflight or in flight. Creating an RTA changes CRZ page title to RTA CRZ. RTA operates only in cruise.



1 FIX

Valid entry is a waypoint in the active or pending active route. Waypoints defined by coordinates must be down selected to the scratchpad, then selected to the FIX line.

Entry by flight crew or data link.

Entry displays boxes in 1R and RTA in the line title and ALT/ETA in 2R line title.

When RTA active, deletion of FIX terminates RTA and resumes ECON. Display returns to boxes.

When RTA not active, deletion of FIX erases a pending RTA MOD. Display returns to boxes.

Displays boxes when an active or modified route exists.

Displays blank if engine out has been selected.

2 Required Time Of Arrival Speed (RTA SPD)

Displays FMC computed cruise speed to accomplish RTA.

Displays blank if no RTA fix or time entered.

3 Maximum Speed (MAX SPD)

Valid entry is Mach .100 to .990; displays in large font.

Deletion of entered value displays default Mach .850 in small font.

4 Displays ERASE when modification pending

Push - displays previous unmodified page, or if no previous active values, deletes RTA in 1R.

5 Required Time Of Arrival (RTA)

Boxes display after entry of RTA FIX in 1L.

Valid entry is time from 0000.0 to 2359.9. Decimal entry of .0 is optional.

Suffix to RTA indicates:

- no suffix – arrive at entered time
- A – arrive at or after entered time
- B – arrive at or before entered time

Entry before takeoff causes recommended T/O time to display in small font.

Deletion terminates RTA and returns ECON as cruise mode.

6 Altitude/ETA (ALT/ETA)

Displays predicted altitude and ETA at RTA fix after entry of FIX in 1L.

Blank until performance data is entered.

7 Recommended Takeoff (RECMD T/O)

Displays T/O in line title and dashes until FIX entered.

Displays RECMD T/O in line title on the ground when a performance calculated takeoff time to meet an entered FIX displays in the data line.

Displays NOW when no takeoff time has been entered and the current time is later than the calculated time to meet an RTA at ECON speed.

Blanks in flight.

Valid entry is time from 0000.0 to 2359.9. Decimal entry of .0 is optional.

8 PRIOR RTA

Displays when an RTA fix and time exists, and the RTA fix is deleted or another cruise speed mode is selected prior to sequencing the RTA fix.

Push -

- displays previous RTA fix and time
- initiates RTA flight plan modification

9 Cruise Speed Segment

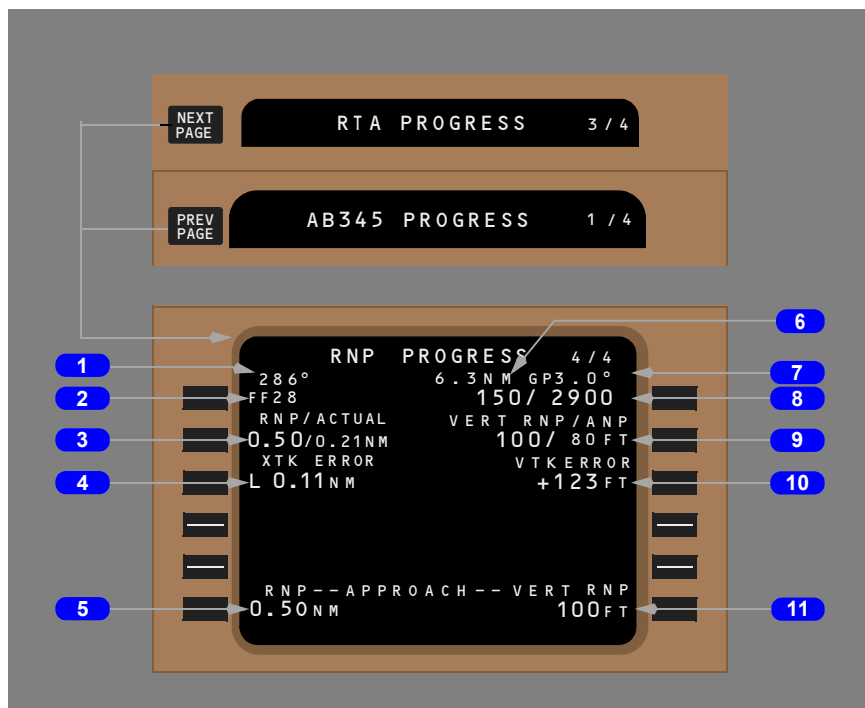
Displays cruise speed segment start and end waypoints when entered on the Legs page. Valid entries on the Legs page are: Mach, LRC or L, RTA or R, or ECON or E. The cruise speed segment shown ends at AVE and ECON airspeed is resumed. If an end waypoint has not been entered, the cruise speed segment ends at the T/D.

Entry of RTA or R after an RTA fix or entry of ECON or E before an RTA results in the scratchpad message INVALID ENTRY.

RNP Progress Page 4

[Option: NPS installed]

Progress page four displays concise RNP information. Some of the information on page 2 has been repeated to display all related RNP information together.



1 Leg Direction

Leg segment data in line title:

- courses – magnetic (xxx°) or true (xxx° T)
- arcs – distance in miles, ARC, turn direction (example: 24 ARC L)
- heading leg segments – xxx° HDG
- track leg segments – xxx° TRK
- special procedural instructions from database - HOLD AT, PROC TURN, or PROC HOLD (FMC exits hold when crossing the fix after entry)

Calculated great circle route leg directions may be different than chart values.

Dashes display for an undefined course.

2 Waypoint Identifier

Displays the next waypoint.

3 Required Navigation Performance and Actual Navigation Performance (RNP /ACTUAL)

Display same as 5L POS REF 2/3. Manual entry displays in large font; propagated to 5L POS REF 2/3 page.

4 Crosstrack Error (XTK ERROR)

Displays present crosstrack 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 applicable RNP (initial, intermediate, or final segment) for the selected approach.

Entry not allowed at 6L. Manual entry at 2L displays in large font.

Displays RNP from navigation database, if available. If not available, displays the default RNP for the approach flight phase from the FMC. Both display in small font.

6 Distance To Go

Displays the distance remaining to the next waypoint.

7 Glidepath

Displays the FMC computed glidepath for the approach.

8 Waypoint Speed/Altitude

Displays waypoint speed or altitude constraints in large font. Displays FMC predicted value in small font when no restrictions have been specified.

9 Vertical Navigation Performance

Displays both vertical RNP and ANP for the current leg.

Valid display range for vertical ANP is 0 to 999 feet.

Manual entries are allowed and display in large font.

Valid entries are 10 to 999 feet and may be suffixed with an optional "/".

Entries clear at flight completion.

Values from the navigation database display in small font.

10 Vertical Error (VTK ERROR)

Displays present vertical error from the FMC computed glidepath.

11 Vertical RNP (Approach)

Displays the lowest applicable vertical RNP for the approach.

Manual entries (entered in 2R) display in large font.

Values from the navigation database display in small font.

Introduction

The descent phase starts at the top of descent point and continues to the end of descent point. Planning for the descent phase starts during cruise.

The approach phase starts when the airplane is in the descent phase and flaps are out of up. In general, the approach starts no later than sequencing the final approach fix.

Alternates are available from preflight through approach phase of flight and can be selected or updated at any time. Diversion to an alternate can be accomplished during all phases of flight.

The only automatic page change in the descent/approach phases is the VNAV selected page change from cruise to descent at the top of descent.

Descent

During descent, LNAV is managed using the RTE LEGS and PROGRESS pages, as in the cruise phase. VNAV descent management is accomplished primarily on the DES page.

During descent, the specific page listed below is used to:

- DESCENT FORECAST page – enter forecast wind data to aid descent planning
- OFFPATH DES page – analyze descent performance with and without the use of speedbrakes
- ALTN page – manage the selection of alternate airports and diversions.

Altitude Intervention

If an unplanned level-off is required, setting the altitude window to the required altitude causes the airplane to level at the set altitude. VNAV PTH changes to VNAV ALT. The descent can be continued by setting the altitude window to a lower altitude and pushing the altitude selector. If the altitude window is set to an altitude below other altitude constraints, each altitude constraint can be deleted by each push of the altitude selector or, all waypoint altitude constraints between the current airplane altitude and the altitude window setting, can be deleted by selection of the DES DIR> prompt on the DES page.

Descent Page

The descent page is used to monitor and revise the descent path. Descent speeds are economy (ECON) and fixed speed (SEL). The default VNAV descent mode is ECON. A fixed speed descent is flown when speed intervention is used or a speed is entered on the DES page. The descent page blanks with DES as the title until an altitude constraint below the cruise altitude is entered.

This page title includes the VNAV speed mode. The ECON mode controls descent speed at the economy speed until reaching a lower speed restriction. The fixed speed mode controls descent speed at the fixed speed until a lower speed restriction is reached.

[\[Option Adds - Flight Path Angle, Vertical Bearing, Vertical Speed\]](#)

The diagram illustrates the layout of the 777 FMC Descent Page. It consists of several sections with numbered callouts (1-12) pointing to specific fields:

- PREV PAGE**: ACT ECON CLB 1 / 3
- NEXT PAGE**: ACT ECON CRZ 2 / 3
- VNAV Descent Mode**: A box indicating the current descent mode.
- Main Display Area**:
 - 1**: ACT ECON DES 3 / 3
 - 2**: E/D AT 2800 PELLY
 - 3**: ECON SPD 170 / 2800
 - 4**: SPD TRANS 240 / 10000
 - 5**: SPD RESTR --- / ---
 - 6**: <OFFPATH DES
 - 7**: AT PELLY 170 / 2800
 - 8**: WPT / ALT PELLY / 2800
 - 9**: FPA V/B V/S 2.9 3.2 880
 - 10**: FORECAST >
 - 11**: DES DIR >
 - 12**: FORECAST >
- Bottom Section**:
 - 13**: FORECAST >
 - 14**: <OFFPATH DES
 - 15**: DES NOW

1 Page Title

The page title shows active (ACT) or modified (MOD) descent. Usually, the title shows ECON for economy descent. Fixed speed descents modify the title.

The page title shows the type of descent:

- ACT ECON DES – speed based on a cost index
- ACT MCP SPD DES – MCP speed intervention is selected
- ACT XXXKT DES – fixed CAS descent speed profile
- ACT M.XXX DES – fixed Mach descent speed profile
- ACT LIM SPD DES – speed based on an envelope limiting speed
- ACT END OF DES – airplane has sequenced E/D constraint.

Fixed descent speeds are for:

- a flight crew entered selected speed (SEL SPD)
- a speed transition
- a speed restriction associated with an altitude constraint
- waypoint speed constraints.

2 End Of Descent At (E/D AT)

Shows the end of descent altitude and waypoint.

The end of descent point is a waypoint in the descent phase with the lowest altitude constraint.

The altitude shows in magenta when altitude becomes the FMC altitude target.

Page blanks if no E/D point exists.

3 Economy Speed (ECON SPD), Selected Speed (SEL SPD)

Both CAS and Mach values shows.

The FMC commanded speed is magenta. Initially, Mach is magenta and CAS is white. Below CAS/Mach transition altitude, CAS is magenta and Mach is white.

Valid entries are CAS or Mach.

ECON SPD shows in the line title when speed is based on cost index.

SEL SPD shows in the line title when flight crew enters speed or when transitioning into a selected speed segment (waypoint speed constraint, SPD RESTR, or SPD TRANS).

4 Speed Transition (SPD TRANS)

The transition speed is usually 10 knots less than the destination airport limiting speed from the navigation database. When no airport limit speed exists, the default speed of 240 knots shows. The transition altitude is the point the transition speed is active for the destination airport. When no altitude exists in the navigation database, the default of 10,000 feet shows.

Speed shows in magenta when it is the FMC speed target.

Blanks below SPD TRANS altitude.

Deleting causes the airplane to fly economy or selected speed if not limited by a waypoint constraint or speed restriction.

5 Speed Restriction (SPD RESTR)

Speed restrictions at altitudes higher than E/D altitude and not associated with specific waypoints are manually entered on this line.

Valid entry is a CAS and altitude (example 240/8000). Entry may be deleted.

Magenta when it is FMC command speed.

6 Off Path Descent (OFFPATH DES)

Push –

- shows the OFFPATH DES page.

7 AT XXXXX

Shows the next waypoint constraint from the RTE LEGS page.

XXXX is:

- the waypoint identifier
- HOLD AT XXXXX
- AT VECTORS
- AT (INTC).

The constraint is speed/altitude. Blanks when no constraint exists.

Can be deleted on this page.

VNAV commands the lesser of constraint speed or present performance speed.

Speed and/or altitude shows in magenta when they are the FMC target values.

8 FORECAST

Push –

- shows the DESCENT FORECAST page.

9 Descend Direct (DES DIR)

Push –

- deletes all waypoint altitude constraints between the airplane altitude and the MCP altitude. FMC cruise altitude is not affected

Shows in descent phase with altitude constraint between airplane and E/D.

10 Descend Now (DES NOW)

Push –

- starts a 1250 feet per minute descent schedule until intercepting the planned descent path
- activates the FMC descent phase.

Shows when the descent phase is not active and aircraft is airborne.

Shows when the descent phase is not active.

11 Waypoint/Altitude (WPT/ALT)

Line title appears at all times. Data line shows “-----/-----” when a descent profile does not exist in the flight plan. With a descent profile in the flight plan, data line shows the same waypoint/altitude restriction shown on the AT line (1R); it may be overwritten by pilot entry. Valid entry is any navigation database waypoint, latitude/longitude, or waypoint from the flight plan.

12 Flight Path Angle, Vertical Bearing, and Vertical Speed (FPA, V/B, V/S)

- FPA - shows the current airplane flight path angle whenever the airplane descends (data blanks if the airplane levels or climbs).
- V/B - shows vertical bearing from current position to the shown waypoint and altitude (data blank if WPT/ALT line shows “-----/-----”).
- V/S - shows required vertical speed to maintain the vertical bearing (data blank if WPT/ALT line displays “-----/-----”).

Descent Forecast Page

The descent forecast page is used to enter wind data for descent, and the altitude at which anti-ice use is anticipated for more accurate descent path calculation.

The primary entries are wind direction and speed for up to four descent altitudes, and the altitude that anti-ice is turned on.

The diagram illustrates the Descent Forecast page layout. At the top, a status bar shows 'ACT ECON DES 3 / 3'. Below it is a 'FORECAST' label. The main display area is titled 'DESCENT FORECAST' and contains the following fields:

TRANS LVL	TAI / ON	ALT
FL 180		
ALT	WIND DIR / SPD	
	--- ° / --- KT	
	--- ° / --- KT	
	--- ° / --- KT	
	--- ° / --- KT	
FORECAST		DES
<REQUEST		

Labels 1 through 6 point to specific fields:

- 1: TRANS LVL (FL 180)
- 2: ALT
- 3: FORECAST
- 4: TAI / ON
- 5: WIND DIR / SPD
- 6: DES

1 Transition Level (TRANS LVL)

Displays the transition level.

The transition level can be specified by the arrival procedure. The default transition level is FL 180.

Above transition level, altitudes are in flight levels. Below transition level, altitudes are in thousands of feet.

Valid entry is an altitude or flight level.

2 Altitude (ALT)

Enter altitude of forecast wind data.

Altitudes and flight levels can be entered in any order. Entries are not sorted.

Execute not necessary.

3 FORECAST REQUEST

Push – transmits a data link request for descent wind data.

4 Thermal Anti-Ice On Altitude (TAI/ON ALT)

Enter the altitude where anti-ice is first turned on during the descent.

5 Wind Direction/Speed (WIND DIR/SPD)

Enter the wind direction/speed for the specified altitude. Initial entry must have wind direction and speed, subsequent entries may have one or the other.

Execute not necessary.

6 Descent (DES)

Push – displays the DES page.

Offpath Descent Page

The offpath descent page allows the analysis of descent performance off the present route of flight, direct to a selected waypoint. Data entered on the page shows clean and drag descent ranges on the page and on the ND. The ranges are based on an entered waypoint and altitude constraint. The range can be used to determine if the altitude constraint can be met in a direct descent to the waypoint.

The FMC puts the last descent waypoint with an altitude constraint into DES TO.

The ECON SPD, SPD TRANS, SPD RESTR, and DES data are the same as the DES page.



1 Descend To (DES TO)

The waypoint for a direct-to descent. Usually, this is the E/D waypoint from the active route. Manual entry of waypoints on or off of the route are allowed. The DTG calculations are for a descent direct to the selected waypoint.

When within 150 feet of the DES TO altitude for a waypoint other than the E/D waypoint, the display automatically changes the DES TO waypoint to the E/D waypoint from the DES page.

A waypoint is entered for direct-to analysis.

2 Distance To Go (DTG)

Displays the straight line distance to the entered waypoint.

3 Speed/Altitude (SPD/ALT)

Displays the speed/altitude constraint for the entered waypoint.

A manual waypoint entry displays boxes for manual speed and altitude entry.

4 TO CLEAN

Distance to the clean descent circle. The distance is negative when a clean descent is no longer possible.

A clean circle assumes no drag devices are used for descent.

A direct descent to the DES TO waypoint at a SPD/ALT constraint is possible when the airplane is outside the clean circle. The clean circle displays on the ND when the DISPLAY prompt is ON.

5 TO DRAG

Distance to the drag descent circle. The distance is negative when a drag descent is no longer possible.

A drag circle assumes speedbrakes are UP for descent.

A direct descent to the DES TO waypoint at a SPD/ALT constraint is possible when the airplane is outside the drag circle. The drag circle displays on the ND when the DISPLAY prompt is ON and the airplane is inside the clean circle.

6 DISPLAY

Push – alternates between ON and OFF.

ON – displays the clean and drag circles on the ND. The drag circle does not display until the airplane position is inside the clean circle.

OFF – removes the clean and drag circles from the ND.

Selected state is large green font, otherwise small white font.

Automatically changes to OFF within 150 feet of the waypoint constraint altitude.

Engine Out Descent

There are no specific engine out pages for descent. Use the two engine descent planning features and pages.

Approach

During approach, roll and pitch modes usually change to the approach guidance supplied by navigation radios. The FMC continues to calculate and show present position and can supply 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:

- ARRIVALS page – to select arrival and approach procedures
- APPROACH REF page – to specify approach flap settings and set the approach VREF
- HOLD page – to manage holding patterns

Holding is described in this section but it can be used during any phase of flight.

Accessing the arrivals page more than 400 NM from the departure airport, more than halfway along the active route, beyond the top of climb and within two minutes of top of descent, or beyond the top of descent, displays arrivals for the destination airport. Prior to these points, accessing the arrivals page displays arrivals for the departure airport.

Sequencing any of the above points also causes the FMC to send landing altitude data to the cabin altitude controller. Until an arrival approach has been selected into the active flight plan, the destination airport altitude is used by the cabin altitude controller.

Arrivals Page

The arrivals page allows selection of a runway, approach, approach transition, standard terminal arrival route (STAR) or profile descent, and an arrival transition to the destination airport. The INDEX key accesses the DEP/ARR INDEX and provides arrival/departure data for any other airport in the navigation database. Route 1 and route 2 have separate arrival pages.

Airports are using multiple RNAV/ILS approaches to the same runway. ICAO has developed a naming convention which adds an additional character to the approach name; Z, Y, X,... in the approach title following the guidance source. The primary approach is identified as the “Z” approach; all subsequent procedures (normally with different missed approach paths) use the alpha characters in reverse order beginning with Y. This change requires approach names with up to eight characters, rather than the current maximum of six, to be encoded in the navigation database.

Selecting Options

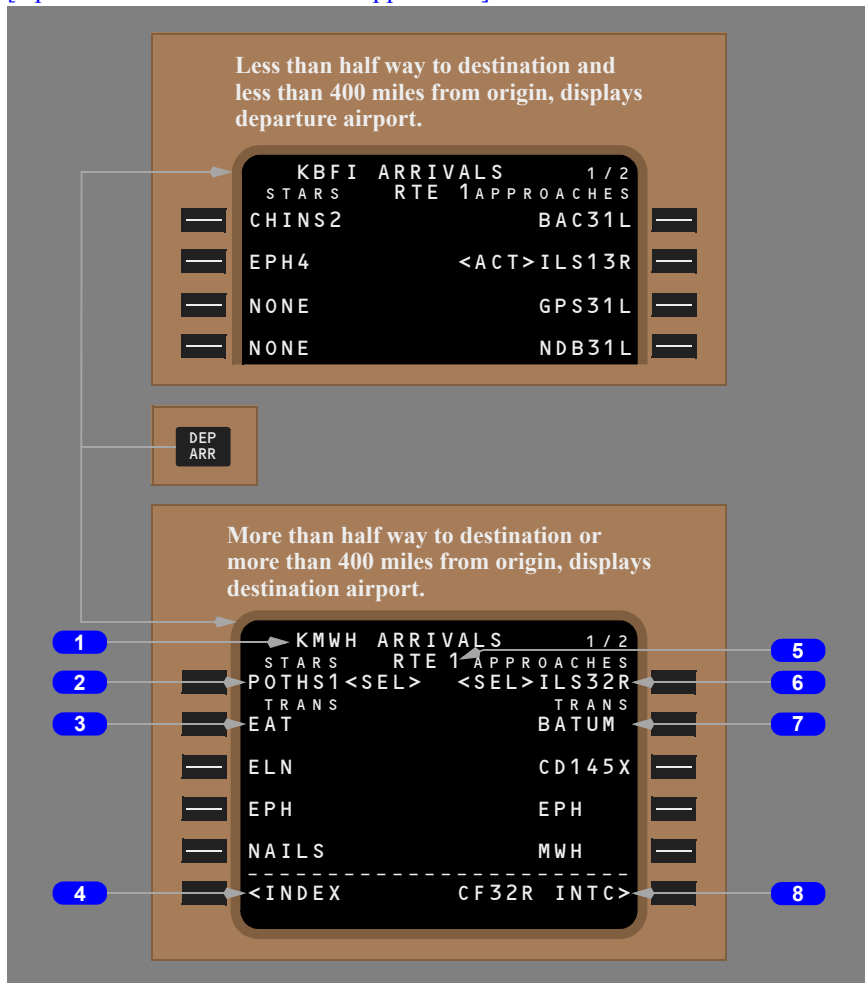
Selecting a runway, approach, approach transition, STAR/profile descent, or arrival transition displays <SEL> inboard of the selection and displays MOD in the page title. The other options within the same category are removed from the list. When the modification is executed, <SEL> changes to <ACT>. Selecting another page and returning to ARRIVALS displays all options; the applicable <SEL> or <ACT> prompts display.

When a STAR is selected followed by selection of an approach or runway and a transition exists in the navigation database, the transition waypoints with associated speed/altitude constraints are inserted into the flight plan linking the STAR to the approach or runway. If more than one transition exists, selection of the applicable transition is made under TRANS on the left side of the page. Some STARs serve more than one runway. If a STAR and runway are selected and subsequently a different runway is selected, and if the STAR is compatible with the new runway, the transition waypoints are inserted into the flight plan linking the STAR to the runway.

If a different STAR, runway, or STAR-runway combination is desired, selecting another page and returning to the ARRIVALS displays all options.

Arrivals Page – IFR Approaches

[Options shown: NDB and GPS Approaches]



1 Page Title

The destination airport identifier displays in the title.

Airports with more than 5 runways or STARs produce multiple arrivals pages.

2 Standard Terminal Arrivals (STARs), Profile Descents (PROF DES)

STARs display in a list under the STAR line title. Profile descents display below STARs under the PROF DES line title.

NONE displays when no STARS in the database.

Push -

- selects STAR or PROF DES for entry into the route, <SEL> displays
- all other arrival procedures no longer display and transitions for the selected procedure display
- deletes a previously selected procedure
- displays ERASE prompt

3 STAR Transitions (TRANS)

Displays list of transitions for the selected arrival procedure.

Push -

- selects transition for entry into the route
- all other transitions no longer display

4 INDEX

Push – displays the DEP/ARR INDEX page.

5 Route 1 (RTE 1)

Displays the active route number (RTE 1 or RTE 2).

6 APPROACHES

Displays the destination airport approaches.

Selection and execution of an ILS approach autotunes the ILS receivers and displays the course. Selection and execution of a back course (BAC) approach autotunes the ILS and displays the front course. BAC approaches cannot be flown in the MCP LOC or APP mode.

Push -

- selects approach for entry into the route; <SEL> displays; TRANS replaces RUNWAYS
- displays profile descents for the selected approach; deletes all other approaches and runways
- displays INTC prompt for the selected approach
- displays ERASE prompt

7 Approach Transitions (TRANS)

Displays a list of transitions to the selected approach.

Approach transitions include IAFs, feeder fixes, and fixes providing routing to the FAF.

777 Flight Crew Operations Manual

When transition not selected, approach will be a straight-in approach starting at a waypoint 4 to 8 miles outside the FAF. Waypoint may be a charted fix or CFXXX (XXX is the runway number).

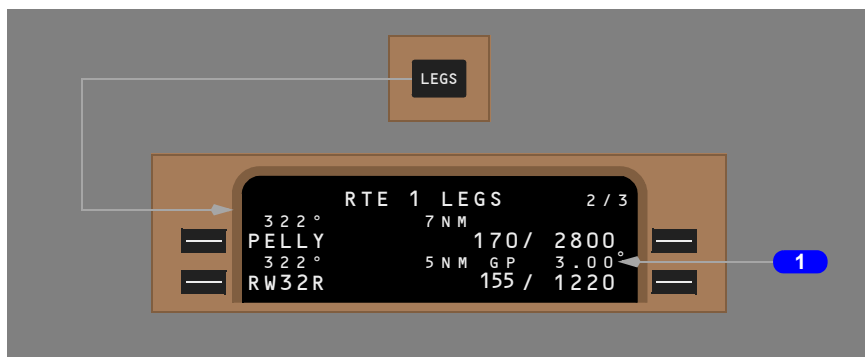
Push –

- selects transition for entry into the route
- deletes all other transitions
- displays INTC prompt for selected transition

8 Final Approach Fix Intercept (XXXXX INTC)

Selecting the prompt displays a modified RTE LEGS page with an intercept course to the approach transition fix (usually the IAF) for the selected approach.

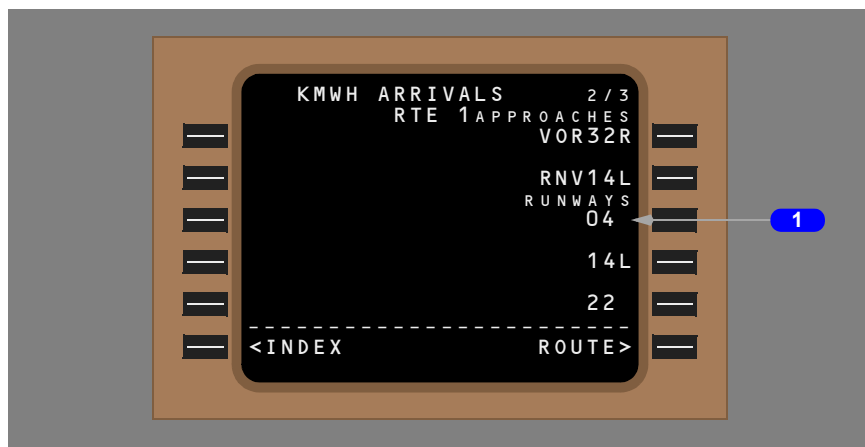
Arrivals Legs Page



1 Glide Path Display

Displays the glide path angle used by VNAV on final approach to the runway. If the runway was selected as part of a published approach, the displayed angle will be close to the published glide path angle, but may differ slightly.

Arrivals Page – VFR Approaches



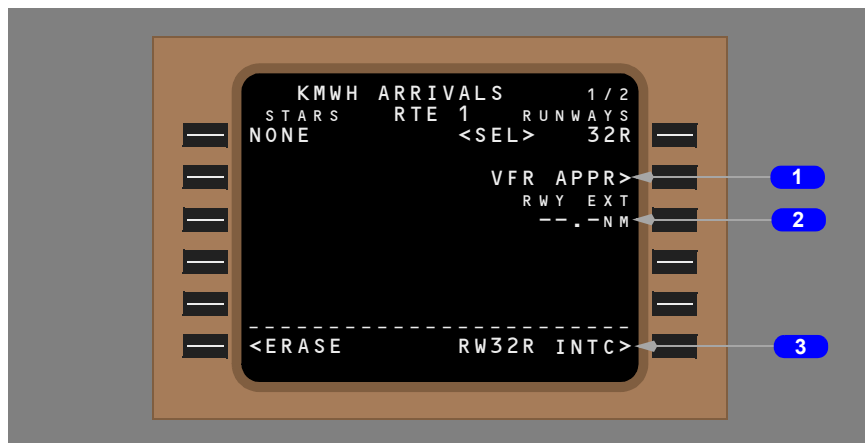
1 RUNWAYS

Displays list of runways for destination airport.

Push -

- selects runway for entry into the route; <SEL> displays
- deletes previously selected approach
- displays runway extension; and, VFR APPR when enabled in the navigation database
- no longer displays other runways and approaches
- displays approach intercept fix for selected runway

Arrivals Page With Runway Selected



1 VFR Approach (VFR APPR)

Displays when a VFR approach is in the navigation database for selected runway.

Push – following a discontinuity, creates a straight-in VFR approach beginning with a transition waypoint, FAXXX at 8 NM from the runway threshold with an airspeed /altitude constraint of 170 kts/2,000 feet above runway elevation.

The VFR approach ends with a runway altitude constraint of 50 feet.

Displays RWY EXT 8.0 NM and FPA of 3.0 degrees.

2 Runway Extension (RWY EXT)

Allows entry of end of descent target for VNAV guidance.

Creates a runway extension fix along runway centerline for LNAV guidance.

Entry deletes VFR APPR prompt.

3 Approach Intercept

Selecting an arrival runway displays an approach intercept waypoint on the approach course for the selected runway.

Push – modifies the flight plan, displays the RTE LEGS page, and activates the intercept course to function.

Arrivals Page With VFR Approach Selected



1 Runway Extension (RWY EXT)

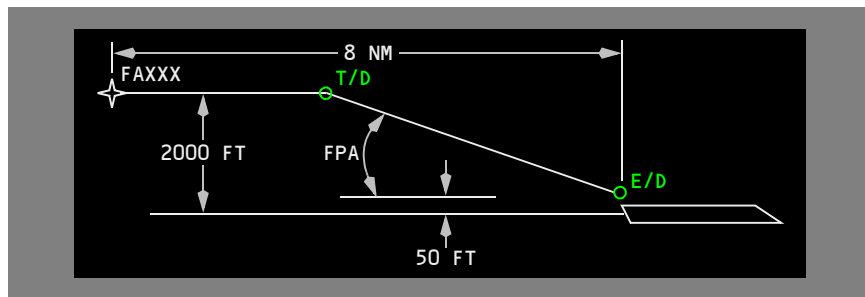
Following selection of a runway, the RWY EXT 8.0 waypoint, FAXXX, displays as part of the VFR APPR. Distance cannot be changed.

2 Flight Path Angle (FPA)

Displays descent flight path angle to 50 foot runway waypoint. Default is 3.0 degrees.

Valid entry is 2.4 to 3.7 degrees.

VFR Approach Path



The VFR approach is a level path until the VNAV descent path is intercepted. The descent path begins at the FAXXX waypoint altitude and terminates at the runway threshold at 50 feet. Default values display in RWY EXT and FPA.

Arrivals Page With Manually Entered Runway Extension



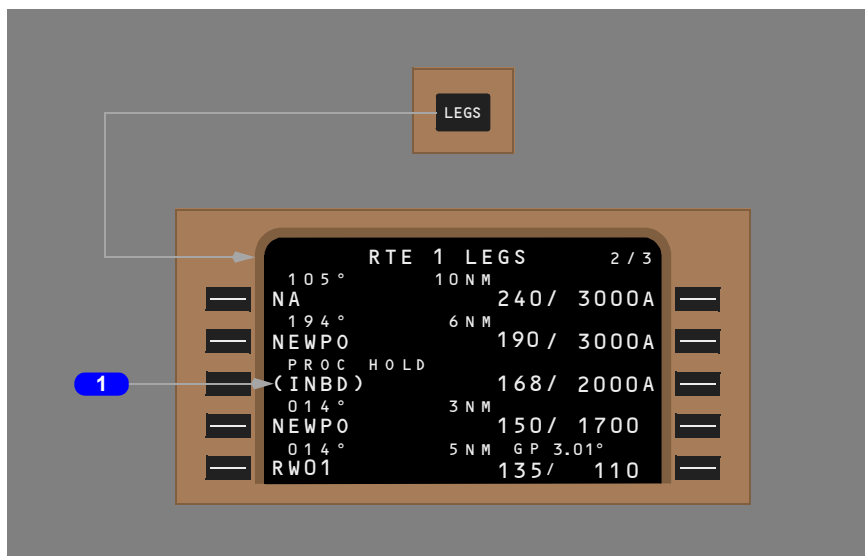
1 Runway Extension (RWY EXT)

Valid entries are from 1.0 to 25.0 miles from the runway threshold.

Entry allowed if VFR APPR is not selected. Entry removes VFR APPR prompt. Example shows 6 NM entered.

Makes waypoint RXYYY, where YYY is the runway; example: RX32R. Makes a route discontinuity before and after the waypoint.

Procedure Hold (in lieu of procedure turn) Legs Page

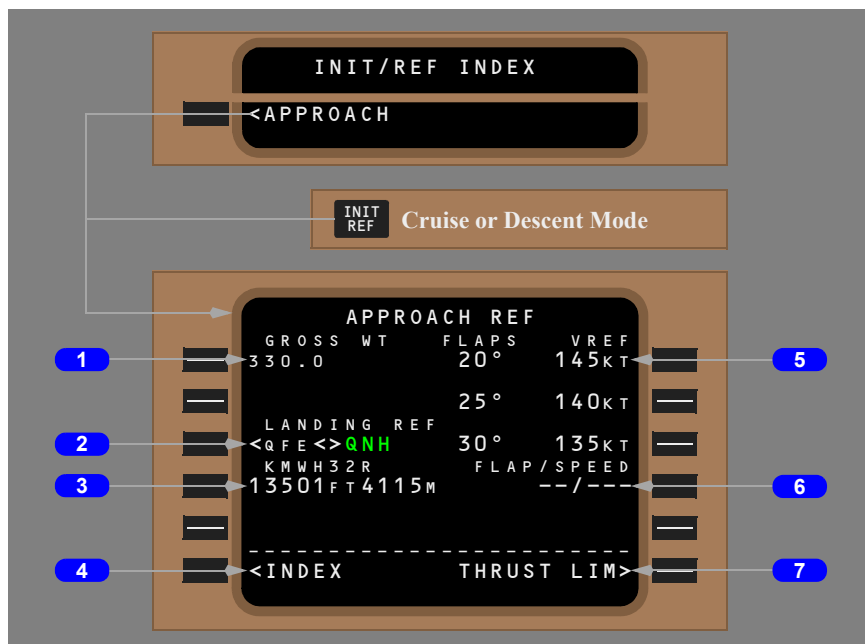


1 Inbound Waypoint

A conditional waypoint (“INBD”) is created at the end of the procedure turn. This waypoint displays on the ND as a small circle. The next line displays inbound heading and distance to the holding fix. The procedure hold is not displayed on a Hold page.

Approach Reference Page

The approach reference page displays approach planning data and approach reference speed (VREF) selection.



1 Gross Weight (GROSS WT)

FMC calculated airplane gross weight usually displays.

Manual entry is allowed in case the FMC calculated gross weight is unavailable or invalid, or to allow previewing recommended approach speeds at other than the calculated FMC gross weight. The manually entered gross weight becomes the FMC calculated gross weight when a different page is selected and the APPROACH REF page is reselected. Permanent changes to gross weight result in recalculation of all performance data and may only be made on the PERF INIT page.

Displays boxes when gross weight is not available from the FMC.

Valid entry is XXX.X.

2 Landing Reference (LANDING REF)

Landing reference is selectable between QNH and QFE. Usually, QNH is the operating mode.

Selecting QFE sets the cabin pressurization schedule, and the destination landing altitude indication to zero altitude. With the landing reference set to QFE, changing the barometric setting from STD to QFE changes the PFD altitude tape background color to green. With QFE selected and climb phase active, changing the barometric setting from QFE to STD causes the landing reference to toggle from QFE to QNH and the green background color is removed.

For QFE operations, refer to Supplementary Procedures, Flight Instruments, Displays.

Toggles between QFE and QNH. The active mode displays in large green font. The inactive mode displays in small white font.

3 Runway Length

The displayed runway reference changes based on distance along the planned FMC route. The destination airport is the reference when the present position is more than halfway or more than 400 NM from the origin airport along the planned route. The origin airport is the reference when the present position is less than halfway or less than 400 NM from the origin airport along the planned route.

Displays the length in feet and meters of the referenced runway.

4 INDEX

Push – displays the INIT/REF INDEX page.

5 FLAPS VREF

A gross weight is necessary for VREF speed calculation. Push the applicable line select key to select the correct VREF speed. The three VREF speeds are based on landing flap setting.

The displayed VREF speeds change based on distance along the planned FMC route and are a function of displayed gross weight, airport altitude and flap settings. The destination airport is the reference when the present position is more than halfway along the planned route. The origin airport is the reference when the present position is less than halfway from the origin airport along the planned route.

Displays the calculated reference speed for flaps 20°, 25°, and 30°.

The display is blank until a gross weight is displayed.

6 FLAP/SPEED

The flap position and VREF speed is entered for landing.

The VREF speed displays on the PFD.

Deletion of the data removes VREF from the PFD.

7 Thrust Limit (THRUST LIM)

Push – displays the THRUST LIM page.

Alternate Airport Diversions

ALTN page 1/2 data aids the flight crew in finding a suitable alternate airport. The page displays four airports in an ETA sequence. Each airport on the list has an XXXX ALTN page with more data. Select the XXXX ALTN page with a caret. ALTN LIST page 2/2 may contain a list of uplinked alternate airports.

Three alternate airport uplinks can be received. ALTN LIST page 1/2 can get an uplink for the entire page or for just the ALTN INHIB line. ALTN LIST page 2/2 can receive an uplink of alternate airport names.

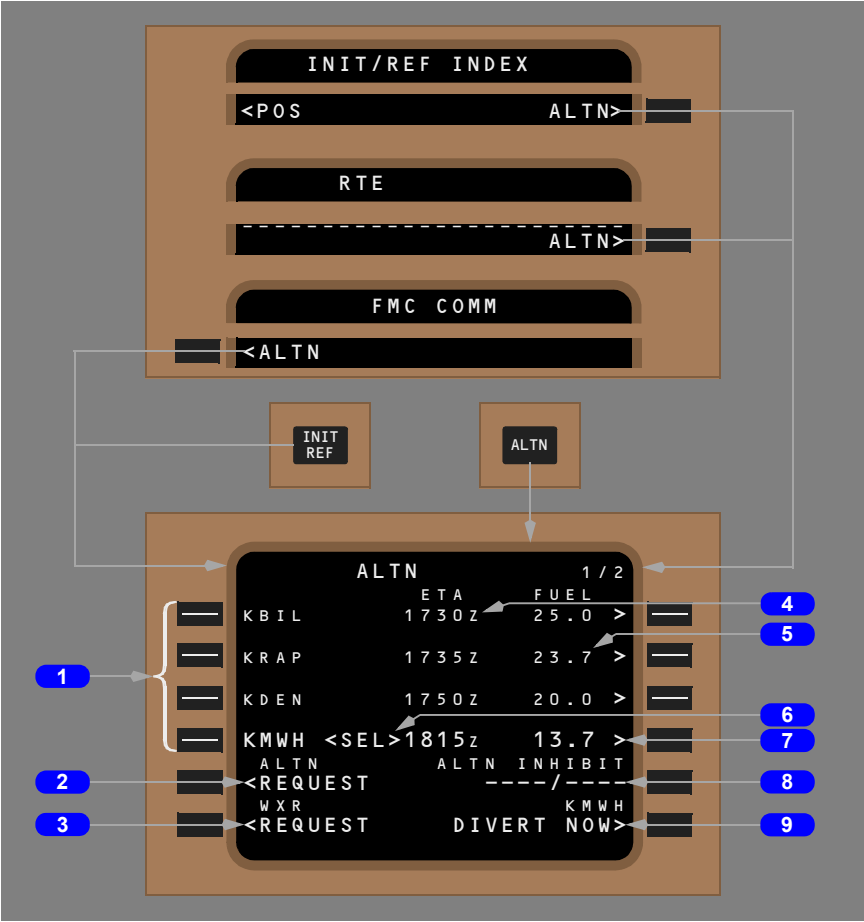
Alternate Page 1/2

The first alternate page displays alternate airport data. An alternate airport can be selected to change the flight plan destination.

The source of alternate airports can be:

- an uplink directly to this page
- automatic selection from the ALTN LIST page
- automatic selection from the navigation database
- manual entry

Alternate airports automatically selected from the alternate list or the navigation database display in small font. All four alternates display on the ND in cyan. The alternate airport symbols display when the ND is in the plan mode. The selected alternate airport displays at all times on the ND map. Other alternates display on the ND when the ARPT switch is on.



1 Alternate Airports

Displays the identifier of the four alternate airports in ETA order in flight; and, in distance order on the ground.

Valid manual entry is an airport from the navigation database.

A manual entry into a field displaying a small font value overwrites the small font value, but does not delete it from the Alternates Candidates list. After predictions are complete, the overwritten small font value is placed on the list according to ETA order. A manual entry into a field displaying a large font value overwrites the large font value. Manual entries display in large font.

The DELETE function key can be used to remove manually entered alternate airports from the ALTN page.

2 Alternate Request (ALTN REQUEST)

Push – transmits a data link request for a preferred list of alternates (up to four).

Uplinked airports display in ETA order but are assigned a preference number by the transmitting site. The scratchpad displays the message ALTN UPLINK when the alternate airport data arrives.

3 Weather Request (WXR REQUEST)

Push – transmits a data link request for alternate airport weather data.

Uplinked weather is sent to the flight deck printer.

4 ETA

ETA is calculated based on the routing, altitude, and speed displayed on the XXXX ALTN page. ETA is blank when the airplane is on the ground.

Displays the alternate airport ETA.

Blank when airplane is on the ground.

5 FUEL

Predicted arrival fuel is calculated based on the routing, altitude, and speed displayed on the XXXX ALTN page. The message UNABLE FUEL displays in the FUEL column if the predicted arrival fuel is less than zero.

Fuel values are blank when the airplane is on the ground.

Displays the alternate airport predicted arrival fuel.

6 Selected (<SEL>)

The selected alternate is identified with an <A> or <SEL> to the right of the airport identifier. Usually, the closest alternate is selected and identified with <A>. Manually selecting an alternate places <SEL> to the right of the airport identifier. The selected alternate identifier displays in the line title of the DIVERT NOW prompt.

The FMC selects the alternate airport with the earliest ETA. FMC selected alternates display <A> to the right of the airport identifier.

Entering a new airport into the list of four does not select the new airport.

Use the DELETE function key on a manually selected alternate to remove <SEL>. The automatic selection function selects a new alternate.

7 Alternate Select

Push - displays the XXXX ALTN page for the alternate airport adjacent to the > prompt.

8 Alternate Inhibit (ALTN INHIBIT)

An airport will not be one of the four alternate airports if entered into the alternate inhibit line.

One or two airports can be entered.

Alternate inhibits can be manually entered or uplinked. The inhibited airports may be uplinked with the ALTN UPLINK or separately. If uplinked separately, the scratchpad displays the message ALTN INHIBIT UPLINK.

Valid entries are airports from the navigation database.

9 DIVERT NOW

Selecting DIVERT NOW shows the route from the present position to the selected alternate using the route represented on the XXXX ALTN page for the diversion airport. The details of the route can be confirmed or modified before the diversion is executed.

Execution of the diversion:

- changes the route destination airport
- includes the route modification into the active flight plan
- deletes all parts of the original route that are not part of the diversion
- deletes all descent constraints in active route (the scratchpad message DESCENT PATH DELETED shows when DIVERT NOW is selected) if in active descent and VNAV engaged.

After a divert is executed the XXXX ALTN page is not updated until all CDUs are selected off of the XXXX ALTN page.

Push –

- makes an LNAV route modification for a divert to the selected alternate
- MOD XXXX ALTN page shows for the selected alternate
- SELECTED shows in place of DIVERT NOW
- blanks on ground
- blanks in the air when a diversion is not permitted.

Alternate List Page 2/2

The second alternate page displays a list of previously uplinked alternate airports. The alternates on the ALTN 1/2 page are selected from this list or from the navigation database when a list does not exist.



1 Alternate Airports List

These four lines contain up to 20 airports from which alternates can be selected and displayed on ALTN page 1/2 when preferred uplinked airports do not use all four lines.

The list is uplinked directly to this page. No manual entry is allowed. Manual airport entries are accomplished on the ALTN 1/2 page.

2 Alternate List Request (ALTN LIST REQUEST)

Push – transmits a data link request for an alternate airport list uplink.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 Alternate List Purge/Confirm (ALTN LIST PURGE/CONFIRM)

When no list exists, alternate airports can be selected from the navigation database.

Selecting the PURGE prompt arms the purge function and displays a CONFIRM prompt before the list is deleted.

Push – deletes all airports from the list.

A new list must be uplinked after a purge.

XXXX Alternate Page

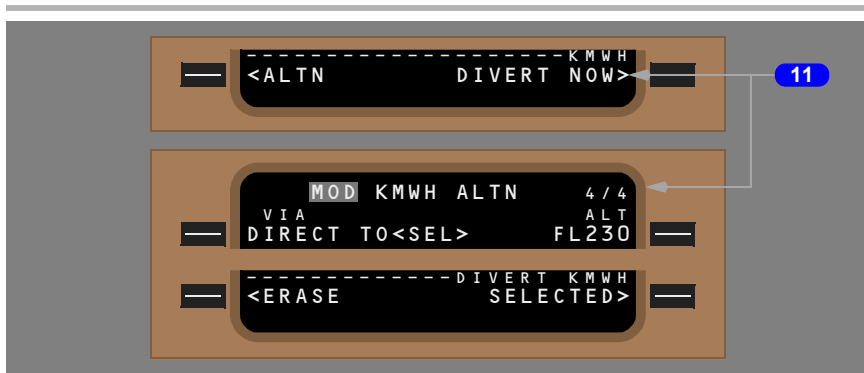
Each of the four alternate airports displayed on the ALTN page 1/2 has a related XXXX ALTN page. The XXXX ALTN pages display specific data about alternate airports, the route used for a diversion, and the conditions on which the ETA and fuel calculations are based. All data on the page is related to the alternate airport displayed in the page title.

Three route options to the airport can be selected:

- DIRECT TO – direct to alternate
- OFFSET – flight plan route with an offset
- OVERHEAD – flight plan route to a waypoint, then direct to alternate

The selected route option has an effect on ETA and fuel remaining. It is identified by <SEL>. Selection of a route option for one alternate selects the same route option for the other three alternates.





1 VIA DIRECT TO

Push – selects DIRECT TO route option.

All flight plan waypoints are deleted.

2 VIA OFFSET

Push –

- with scratchpad empty, selects OFFSET route option
- with offset data in scratchpad, enters offset data. Does not select offset option.

Entry and exit to the offset is the same as for the RTE page offset. Flight plan waypoints are retained.

3 VIA OVERHEAD

Push –

- with scratchpad empty, selects OVERHEAD option
- with overhead data in scratchpad, enters overhead data. Does not select overhead route option

Displays active waypoint in flight plan.

The waypoints up to the selected or entered overhead waypoint are retained, then routing is direct to the alternate airport. All waypoints after overhead waypoint are deleted.

Enter any waypoint in the active or modified route.

4 Engine Out (ENG OUT)

This prompt performs the same function as described on the cruise page in the FMC Cruise section. It can be selected before or after the diversion is selected.

5 Alternate (ALTN)

Push – displays the ALTN 1/2 page.

6 Altitude (ALT)

Entry of any valid altitude or flight level into this line causes a recomputation of ETA and arrival fuel. Altitude entries do not become part of the diversion modification. Altitude entries apply to all four alternates.

Displays the altitude for which ETA and arrival fuel are calculated.

The scratchpad message UNABLE ALT displays if the entry is above maximum altitude or the top of climb point for divert is after top of descent point for divert.

7 Speed (SPD)

Entry of speed or Mach number into this line causes a recomputation of ETA and arrival fuel. Speed entries do not become part of the diversion modification. Speed entries apply to all four alternates.

Speed modes available are:

- ECON (economy)
- LRC (long range cruise)
- EO (engine out)
- EO LRC (engine out long range cruise)
- CO (company speed)
- any CAS or Mach

8 WIND

Entry of data causes recomputation of ETA and arrival fuel. A wind entry can be made for each of the four alternates. A wind entry applies to only one alternate.

Valid entry is a direction in degrees/speed in knots from 1 to 250.

9 Altitude/Outside Air Temperature (ALT/OAT)

Entry of data into these lines causes a recomputation of ETA and arrival fuel. A separate ALT/OAT entry may be made for each of the four alternates.

Displays the OAT for a specific altitude.

Valid entry is an altitude/temperature in degrees C.

10 Alternate Airport ETA/Fuel (XXXX ETA/FUEL)

Displays calculated airport ETA and arrival fuel based on the selected route, altitude, and speed displayed on this page.

11 XXXX DIVERT NOW

This prompt performs the same function as described on the ALTN 1/2 page.

Note: After a divert is executed, the XXXX ALTN page data is not updated until all CDUs change to a page other than the XXXX ALTN page.

Holding

The FMC computes holding patterns with constant radius turns based on current wind 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.

With LNAV active before sequencing the holding fix, holding pattern entries are determined by the following:

- airplane track, not heading or direction from which the active route approaches the holding pattern, determines the entry method used (parallel, teardrop, or direct entry)
- the airplane flies the initial outbound leg a computed distance from the holding fix, rather than a specific time. The computed distance is a function of the command airspeed and computed wind at the time the holding pattern becomes active
- teardrop entries use a 40 degree offset angle
- 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.

Holding Entry

Airplane track to the holding fix determines the entry type; direct, teardrop, or parallel. To make efficient use of the holding airspace, lateral guidance may direct the initial turn to the holding pattern prior to crossing the holding fix (fly-by). The holding entry path displays on the ND. For all holding entry types, lateral guidance directs the airplane to fly-by or fly-over the holding fix and to remain on the holding side of the inbound holding course. Depending on the entry track for a direct entry, the flight path may extend slightly beyond the displayed outbound holding turn. For teardrop and parallel entries, the flight path remains within the confines of the depicted holding pattern displayed on the ND. Remaining within the prescribed holding airspace requires the airplane to be at holding airspeed at the holding fix.

Hold Page (First Hold)

The hold page is used to enter a holding pattern in the route.

When the flight plan does not contain a holding pattern, pushing the HOLD function key displays the RTE X LEGS page with the HOLD AT line.

Two versions of the hold page are possible:

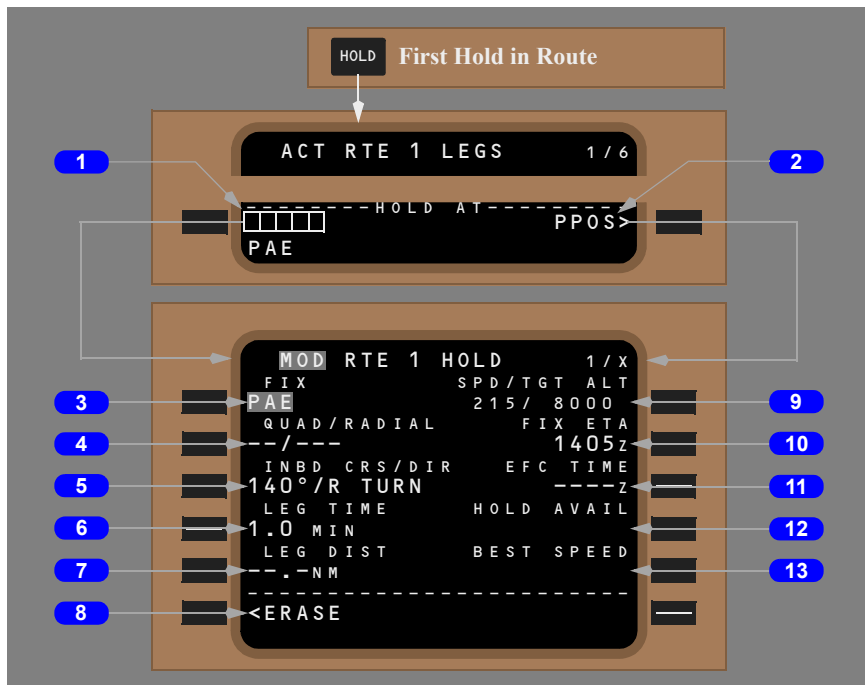
- an airway or procedure holding pattern
- a flight crew-entered holding pattern

777 Flight Crew Operations Manual

The holding page displays actual or default data about the holding pattern.

Entries modify the route. Modifications can be erased or executed.

Active holding patterns are magenta on the ND.



1 HOLD AT

Displays boxes to enter the holding fix: a RTE LEGS, database, or pilot-defined waypoint; a navaid or airport identifier; or a FAF already in the flight plan.

Entering a holding fix displays the RTE X HOLD page.

2 HOLD AT Present Position (PPOS)

Push -

- creates a holding pattern at present position
- execution establishes the holding fix at the position when EXEC is pushed and displays RTE HOLD

3 Holding FIX

Displays the holding fix.

4 Quadrant/Radial (QUAD/RADIAL)

Normally displays dashes.

Valid entry is X/XXX, XX/XXX, or /XXX. Example: NW/330.

Entry changes INBD CRS/DIR to agree.

5 Inbound Course/Direction (INBD CRS/DIR)

Displays inbound course and turn direction.

Valid entry is XXX (inbound course), XXX/X (inbound course/turn direction), /X or X (turn direction).

Entry changes QUAD/RADIAL to agree.

Displays magenta when the holding fix is the active waypoint.

6 Leg Time (LEG TIME)

Displays 1.0 MIN (minute) at or below 14,000 feet.

Displays 1.5 MIN above 14,000 feet.

Displays dashes when an entry made on LEG DIST line.

Valid entry is X, X.X, or .X.

When climbing/descending through 14,000 feet with VNAV active and the SPD/TGT ALT at 1R displays in large font, the FMC adjusts the leg time (1.0 MIN at or below 14,000 feet; 1.5 MIN above 14,000 feet).

7 Leg Distance (LEG DIST)

Normally displays dashes. Allows entry of leg distance for hold.

Entry displays dashed on LEG TIME line.

Valid entry is XX.X or X.X.

8 ERASE

Erases all FMC modifications.

9 Speed/Target Altitude (SPD/TGT ALT)

Dashes display or fix speed/altitude constraint from the RTE LEGS page.

Manual entries are in large font.

During cruise, entry of a target altitude lower than CRZ ALT modifies the DESCENT page and displays a T/D. After T/D, the DESCENT page remains active unless a new cruise altitude is entered.

Altitude, or speed and altitude may be entered.

Note: When descending to a HOLD with VNAV active and the entry altitude is expected to be above the clearance holding altitude, the clearance altitude must be entered in 1R to prevent the airplane from leveling when sequencing the holding fix.

10 FIX ETA

With no EFC TIME entry, displays time the airplane will next pass the holding fix.

With EFC TIME entry, displays time the airplane will pass the holding fix after the EFC time. The FMC uses this time to calculate downtrack ETAs and fuel values based on departing the holding fix at the new FIX ETA.

11 Expect Further Clearance Time (EFC TIME)

Normally displays dashes.

Valid entry is XXXX (time).

Entry changes performance predictions for the route after holding.

12 Hold Available (HOLD AVAIL)

Displays holding time available before requiring reserve fuel to reach the destination.

13 BEST SPEED

Displays the best holding speed for the airplane gross weight, altitude, and flap setting.

Note: May exceed ICAO limit speed.

HOLD Page (Existing Hold)

When one or more holding patterns exist in the route, push the HOLD key to display the hold page for the first holding pattern. When the hold is the next LNAV event, active commands display in magenta. Holding parameters can be monitored and changed on this page. New holding patterns are added using the NEXT HOLD prompt.

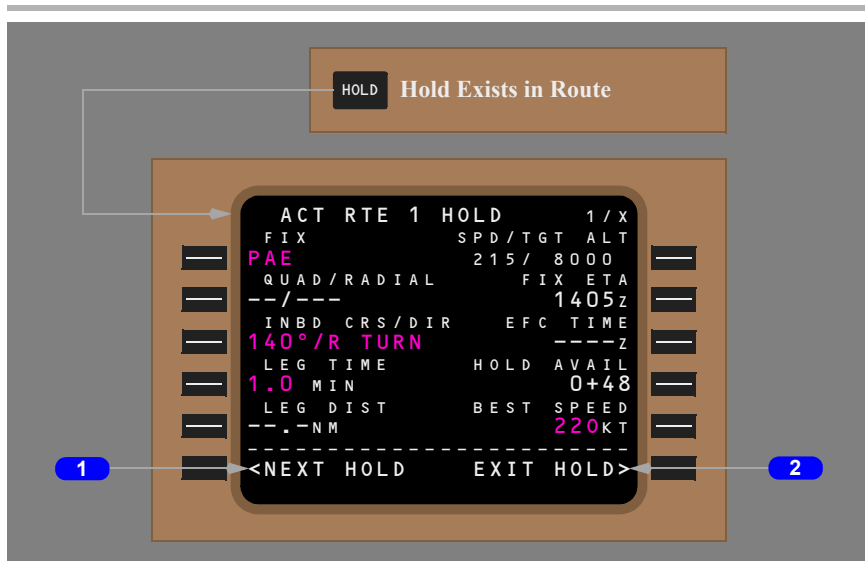
Most holding patterns are part of a procedure or airway and remain active until the flight crew executes an exit from holding. This may be accomplished in one of two ways.

- on the ACT RTE LEGS page, deleting or bypassing the HOLD AT waypoint causes LNAV to command a direct to the next waypoint
- on the ACT RTE HOLD page, selecting and executing EXIT HOLD> causes LNAV to command the airplane to continue in the holding pattern until arriving at the holding fix, at which time the airplane exits the holding pattern

Following execution of the exit hold, only the remaining portion of the holding pattern back to the holding fix displays. Exit from the holding pattern may occur prior to crossing the holding fix (“fly-by”) if the course to the next waypoint is not closely aligned with the holding inbound course. The exiting flight path will remain within the confines of the protected holding airspace. The exit flight path displays on the ND. At high groundspeed and extreme exit track angles (angle between the course to the next route waypoint and the inbound course to the holding fix), a path discontinuity, typically in the shape of a “Z”, may display on the ND as the exit flight path. In all instances, LNAV provides appropriate lateral guidance to intercept the active leg to the next route waypoint.

The FMC automatically commands an exit from some holding patterns in procedures under the following conditions.

- for instrument approach holding patterns designed as a course reversal in lieu of a procedure turn, the airplane exits holding upon arrival at the holding fix inbound. Header at 1L displays PROC HOLD
- for some holding patterns in SIDs, the airplane exits holding when arriving at an altitude. Header at 1L displays HOLD AT



1 NEXT HOLD

Push – displays a new hold page for a new holding pattern entry.

2 EXIT HOLD

Push –

- arms a holding pattern exit
- EXIT ARMED displays in shaded white; when executed, airplane returns to the holding fix via the inbound course for holding pattern exit

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Introduction

The CDUs can be used as an alternate navigation system if both FMCs fail. The CDUs calculate lateral navigation for the autopilot flight director system (AFDS). Pushing the LNAV switch engages the lateral steering commands. A master CDU is selected and uses ADIRU position data for navigation. VNAV is not available. Autothrottles may be available. The CDU can be used to tune the navigation radios.

During normal FMC operation, all system capabilities are contained within the FMCs. During alternate navigation operation, the CDUs use their own internal memory and computing capability. Active flight plan data from one CDU is copied to the other CDUs. Modifications display on the CDU used for the modifications. The other CDU displays the changes after execution.

All three CDUs receive inputs from the ADIRU. Usually, the left CDU provides information to the left ND map and the right CDU provides information to the right ND map. The center CDU is automatically selected after failure of the left or right CDU.

The autopilot selects a master CDU for lateral steering commands in this order:

- left CDU if functioning, then
- center CDU if functioning, then
- right CDU.

Alternate Navigation Waypoints

The CDUs do not have a performance or navigation database. The CDUs continuously copy the active route from the FMC. If both FMCs fail, the CDUs retain flight plan waypoints, except for conditional waypoints, offsets, holding patterns, and missed approach waypoints. Waypoints on the copied route can be referenced by either their identifier, or latitude and longitude.

New waypoints can only be entered in latitude and longitude. This includes waypoints the flight crew has deleted from the copied route.

Alternate Lateral Navigation

All CDU calculations are based on a great-circle course between waypoints. The CDU does not accept undefined waypoints or conditional waypoints. Complete departure or arrival/approach procedures cannot be manually entered or cross-loaded from the FMC if they contain undefined or conditional waypoints. The CDU makes a discontinuity at those waypoints. However, individual legs of a procedure can be manually entered or cross-loaded if they constitute a great-circle course.

Route Changes

Route changes are made on the ALTERNATE NAVIGATION LEGS page in almost the same manner as normal FMC operations. All courses between waypoints are direct routes. When the active waypoint is modified, the only navigational choice is present position direct to the modified active waypoint.

A route change to any one CDU displays on the other CDUs when the modification is executed.

Course Reference

The ADIRU supplies magnetic variation for present position. Only the active waypoint course can be referenced to magnetic north. All subsequent waypoint courses are true courses.

Alternate Navigation Radio Tuning

[Option: ADF installed]

The radios must be manually tuned on left and right CDUs in alternate navigation. The left CDU tunes the left VOR, DME, ADF, and left and center ILS. The right CDU tunes the right VOR, DME, ADF, and right ILS. Manual tuning is accomplished on the ALTERNATE NAVIGATION RADIO page.

[Option: ADF not installed]

The radios must be manually tuned on left and right CDUs in alternate navigation. The left CDU tunes the left VOR, DME, and left and center ILS. The right CDU tunes the right VOR, DME, and right ILS. Manual tuning is accomplished on the ALTERNATE NAVIGATION RADIO page.

Alternate Navigation CDU Pages

The alternate navigation system operates from three CDU pages:

- ALTERNATE NAVIGATION LEGS
- ALTERNATE NAVIGATION PROGRESS
- ALTERNATE NAVIGATION RADIO

Alternate Navigation Legs Page

This page displays data about each leg of the route. The route can be modified. Waypoint speed and altitude restrictions are not displayed because performance data is not available.



1 Page Title

If the ACT ALTN NAV LEGS page is modified, MOD ALTN NAV LEGS displays until the EXEC key is pushed.

2 Leg Direction

Displays course to the waypoint.

Course reference is M for magnetic, T for true.

Active waypoint leg direction can be magnetic or true. Subsequent waypoint leg directions are true.

3 Waypoint Identifier

Displays the waypoint by name or latitude/longitude.

Valid entries are waypoint names in the route or latitude/longitude for new waypoints.

4 Distance to Waypoint

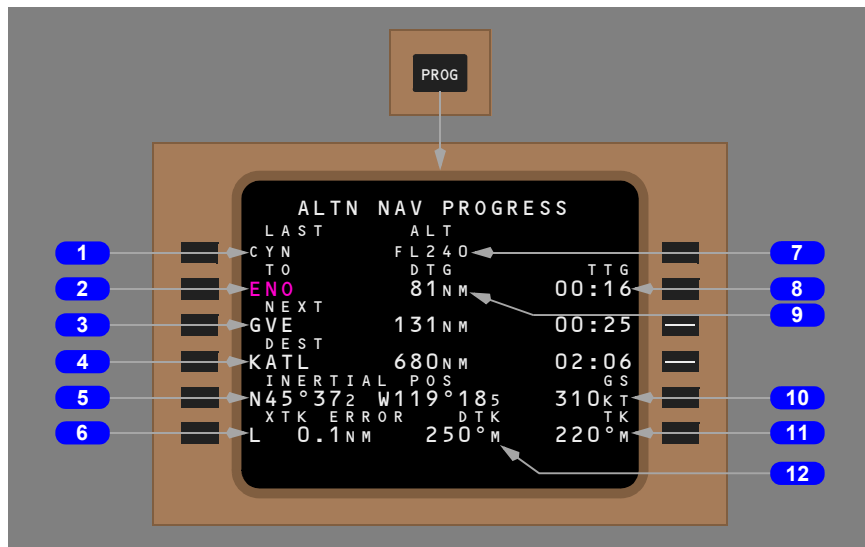
Displays the great circle distance between waypoints.

5 Waypoint Coordinates

Displays the waypoint coordinates.

Alternate Navigation Progress Page

This page displays general data about flight progress.



1 LAST

Displays the identifier of the last waypoint.

2 TO

Displays the active waypoint on the route. The waypoint identifier displays in magenta. This distance and time to go display to the right of the waypoint.

3 NEXT

Displays the waypoint after the TO waypoint. NEXT data displays in white.

4 Destination (DEST)

Displays the identifier for the route destination waypoint or airport. Any waypoint on or off the route can be entered. Time and distance data temporarily displays for that waypoint.

Display options:

- destination airport identifier; distance and time to go along track to the destination airport
- entry of an existing flight plan waypoint (identifier or latitude/longitude) causes the line title to change to ENROUTE WPT. Time and distance to go are from present position along the flight plan route to the entered waypoint
- entry of a waypoint not in the flight plan causes the line title to change to DIR TO ALTERNATE. Time and distance to go are from the present position direct to the new waypoint

5 Inertial Position (INERTIAL POS)

Displays ADIRU present position.

6 Cross Track Error (XTK ERROR)

Displays airplane left or right cross-track error in nautical miles from the active route track.

7 Altitude (ALT)

Displays airplane altitude when the LAST waypoint was crossed.

8 Time to Go (TTG)

Displays time to go to associated waypoint or destination.

9 Distance to Go (DTG)

Displays distance to go to associated waypoint or destination.

10 Ground Speed (GS)

Displays ADIRU groundspeed.

11 Track (TK)

Displays airplane track angle relative to the true or magnetic reference selected on the HEADING REFERENCE switch.

12 Desired Track (DTK)

Displays desired track angle relative to the true or magnetic reference selected on the HEADING REFERENCE switch.

Alternate Navigation Radio Page

Navigation radios are tuned on this page and related parameters display. If both FMCs fail, access is by the NAV RAD key on the left and right CDUs only. Autotune is not available. The CDUs operate independently for navigation radio tuning:

- the left CDU tunes the left radios and center ILS
- the right CDU tunes the right radios



1 VOR

Displays last selected VOR frequency. Tuning status displays as manual (M).

Valid entry is VOR frequency or VOR frequency/course.

Entry tunes related DME frequency.

2 Course (CRS)

Displays selected VOR course.

Valid entry is VOR course or VOR frequency/course.

3 ADF

Displays ADF frequency. Tuning status displays as ANT or BFO.

Displays dashes if no ADF frequency entered on NAV RAD or ALTN NAV RAD pages after initial power up.

Valid entry is ADF frequency or ADF frequency suffixed with A or B. Suffix may be changed after entry.

3 ADF

ADF tuning is inhibited.

4 ILS

Displays last selected ILS frequency, ILS frequency and course, or PARK.

Valid entries are:

- ILS frequency
- ILS frequency/front course
- front course only (a frequency must already be displayed)

Note: If the ILS was in autotune at the time of the FMC failure, the frequency and course are automatically copied to the ALTN NAV RADIO page.

Note: The ILS frequency displays PARK when no frequency is tuned. Deleting the ILS frequency parks a tuned ILS.

Note: ILS course and frequency must be entered on the left, center, and right ALTN NAV RADIO page.

The line title is L & C on the left CDU and R on the right CDU.

DME data for the ILS displays when the EFIS control panel ND mode selector is set to APP.

5 PRESELECT

Allows entry of two separate preselected frequencies and/or frequencies/courses.

Valid entries are any of the entries that can be made on the other lines.

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**Flight Management, Navigation
EICAS Messages****Chapter 11
Section 60****Navigation EICAS Messages**

The following EICAS messages can display.

Message	Level	Aural	Message Logic
ADIRU ALIGN MODE	Memo		ADIRU is in align mode.

[Option: AIMS V16 installed]

ADS-B OUT L, R	Advisory		Position data is not available to the transponder.
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[AIMS V16 and AIMS-1 installed or AIMS V17]

AIR DATA SYS	Caution	Beeper	Information from the air data sources is no longer being combined for display.
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FMC	Advisory		Both FMCs have failed or FMC selector is in L with left FMC failed or in R with right FMC failed.
-----	----------	--	---

[FMC L/R OPTION]

FMC L, R	Advisory		Affected FMC has failed.
----------	----------	--	--------------------------

FMC MESSAGE	Advisory		A message is in the FMC scratchpad.
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[OPTION SELECTED]

FMC RUNWAY DISAGREE	Caution	Beeper	Airplane is not on FMC origin runway when either engine's thrust is in the takeoff range.
---------------------	---------	--------	---

GPS	Advisory		GPS has failed.
ILS ANTENNA	Caution	Beeper	Two or more ILS receivers are not using the correct antennas for best reception.

[Option: AIMS V17A installed]

GPS L, R	Advisory		Left or Right GPS system failure.
----------	----------	--	-----------------------------------

Message	Level	Aural	Message Logic
---------	-------	-------	---------------

[Option: AIMS V16 installed]

INSUFFICIENT FUEL	Advisory		When active route is not in a modified state, FMC estimated fuel at destination is less than the entered RESERVES fuel.
-------------------	----------	--	---

NAV ADIRU INERTIAL	Caution	Beeper	ADIRU is not capable of providing valid attitude, position, heading, track, and groundspeed.
NAV AIR DATA SYS	Advisory		Information from the air data sources is no longer being combined for display.

[Option: AIMS V14 installed]

NAV UNABLE RNP	Caution	Beeper	Navigation performance does not meet required accuracy during all phases of flight.
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SINGLE SOURCE ILS	Caution	Beeper	Both PFDs and NDs are using the same source for ILS information.
TRANSPONDER L, R	Advisory		Affected transponder has failed.

[Option: AIMS V16 and AIMS-1 installed or AIMS V17]

VNAV STEP CLIMB	Advisory		The airplane is 5 minutes past a step climb point and no climb has been started.
-----------------	----------	--	--

[Option: AIMS V16 and AIMS-1 installed or AIMS V17]

VNAV STEP CLIMB	Advisory		The airplane is 5 minutes past a step climb point and the difference between the CRZ ALT and the STEP TO altitude shown on VNAV cruise page is greater than 3,500 feet, and no climb has been started.
-----------------	----------	--	--

FMC Messages

FMC messages indicate: degraded system operation, data input errors, or data link status. The messages are categorized as:

- alerting messages
- advisory messages
- communications messages
- entry–error advisory messages.

The scratchpad messages display according to their level of importance. A less important message replaces another message in the scratchpad when the CLEAR key is pushed or the condition is corrected.

The EICAS displays the advisory message FMC MESSAGE when there is an FMC alerting message. The EICAS displays the message •FMC when there is an FMC communications message. All FMC messages illuminate the CDU message (MSG) light. Clear the message or correct the condition to cancel the message.

FMC Alerting Messages

FMC alerting messages:

- display in the CDU scratchpad
- cause the EICAS advisory message FMC MESSAGE to display
- illuminate the CDU message light (MSG).

Use the CLEAR 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.

ALIGNMENT REINITIATED – ADIRU alignment has automatically restarted due to airplane motion, or if the flight crew–entered initial position fails the alignment comparison tests.

CHECK ALT TGT – VNAV activates when the airplane is between the MCP and FMC altitudes. VNAV maintains level flight.

CHECK AIRLINE POLICY – after loading a new airline modifiable information file, the FMC determines a parameter is invalid. The FMC uses the loaded value and notifies the flight crew of the difference. This is a maintenance function.

Note: If the scratchpad message is cleared, it does not display again for that load.

[Option: AIMS V17B installed]

CONFIRM OAT – Upon engine start, a manual OAT has been entered on the THRUST LIMIT page and must be confirmed to be valid.

DESCENT PATH DELETED – VNAV active and all waypoint altitude constraints defining the descent profile deleted.

Note: This message shows when in active descent, before execution of the modification which deletes the descent path.

DISCONTINUITY – LNAV active and the route is not defined after the waypoint (except when the waypoint is before a manually terminated leg, such as FM, VM, HM legs).

- FM – a course from a fix to a flight crew entered manual route termination
- VM – a heading leg from a fix to a flight crew entered manual route termination
- HM – a holding pattern to a flight crew entered manual route termination.

DRAW REQUIRED – VNAV active and additional drag required or autothrottle off and less thrust required to maintain the VNAV descent path.

END OF OFFSET – LNAV active and two minutes prior to end of active route offset. AFDS maintains last heading if active route offset overflown.

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END OF ROUTE – LNAV active and end of active route overflown. AFDS maintains last heading.

[Option: AIMS V17B installed]

ENTER CRZ ALT – The cruise altitude is required to restore the VNAV path.

ENTER INERTIAL POSITION – the flight crew–entered present position did not pass one of the ADIRU comparison checks, or the ADIRU is ready to change to navigate mode and has not received a present position entry. Use the CLEAR key to remove this message.

[Option: AIMS V17B installed]

ENTER OAT – no valid temperature from the air data system during preflight initiation.

ENG OUT SID MOD – an engine failure is sensed after takeoff before the flaps are fully retracted; the FMC has automatically loaded an available engine out standard instrument departure as a route modification to the active route.

ILS TUNE INHIBIT - MCP - flight control computers inhibiting changes in ILS tuning and either a manual operation in the ILS tuning field attempted or a new arrival ILS approach activated.

INERTIAL/ORIGIN DISAGREE – the airplane is on the ground and one of these conditions exist:

- The inertial position entered on the POS INIT page differs from the position of the origin airport in the active route by more than 6 NM.
- A route is activated and executed containing an origin airport with a position that differs from the ADIRU inertial position by more than 6 NM.

INSUFFICIENT FUEL – estimated fuel at destination less than entered RESERVES value. This may indicate an engine fuel leak.

[Option: AIMS V16 installed]

INSUFFICIENT FUEL – applies to a pending activation route or to the active route in a modified state and estimated fuel at destination is less than the entered RESERVES value.

LIMIT ALT FLXXX – the flight crew– or FMC–selected altitude is greater than the VNAV limit altitude.

LNAV BANK ANGLE LIMITED - before entering or while flying a curved path or holding pattern, the FMC predicts the LNAV roll command will be limited by thrust or buffet based roll limits.

NAV DATA OUT OF DATE – the clock calendar date is after the active navigation database valid calendar cycle.

NAV INVALID–TUNE XXXX – RNAV or VOR approach procedures must have a specific navaid tuned. It is either not tuned or a valid signal is not being received.

NO ACTIVE ROUTE – LNAV selected and no active route activated.

NO ROUTE DATA – in ALTN NAV, LNAV selected and the CDU does not have an active lateral route.

PERF/VNAV UNAVAILABLE – VNAV selected and gross weight, cost index, or cruise altitude are not entered.

RESET MCP ALT – 2 minutes prior to the top of descent point with VNAV active and MCP not set to altitude below cruise altitude.

RTA FIX DELETED – RTA fix has been deleted from the modified flight plan.

RW/ILS CRS ERROR –

- the airplane is within ILS automatic tuning range and the tuned ILS course does not match the course for the active arrival runway, or
- the FMC is not receiving valid course data from the same ILS the FMC is using for frequency data
- inhibited if scratchpad message ILS TUNE INHIBITED–MCP displayed.

RW/ILS FREQ ERROR –

- the airplane is within ILS automatic tuning range and the tuned ILS frequency does not match the frequency for the active arrival runway, or
- the FMC is not receiving valid frequency data from either ILS
- inhibited if scratchpad message ILS TUNE INHIBITED – MCP displayed.

SINGLE FMC L OPERATION – the right FMC is not operational.

SINGLE FMC R OPERATION – the left FMC is not operational.

TAKEOFF SPEEDS DELETED – selected V speeds are invalid.

THRUST REQUIRED – VNAV active, autothrottle disconnected, and additional thrust required to track VNAV descent path and maintain speed.

UNABLE FLXXX AT RTA FIX – predicted crossing altitude at RTA fix less than FLXXX, but predicted ETA within tolerance.

UNABLE HOLD AIRSPACE - the radius of the holding pattern calculated by the FMC exceeds the FMC maximum protected airspace limits.

UNABLE RTA – RTA not achievable within applicable arrival time tolerance.

UNABLE NEXT ALT – VNAV active and climb not sufficient to comply with waypoint altitude constraint.

777 Flight Crew Operations Manual

VERIFY POSITION – the FMC calculation of airplane present position is based on conflicting data. The possible conflicts are:

- the primary and secondary FMC positions differ by more than the greater of RNP or 0.4 NM for 5 seconds, or
- the difference between the FMC and the navigation aid being used (GPS, DME, VOR, or inertial) positions is greater than 12NM for 5 seconds

[Option: AIMS V17B installed]

- the FMC has detected an error in velocity between the ADIRU and the GPS.

[Option: AIMS V17B installed]

Note: The error in velocity between the ADIRU and the GPS can be observed by erratic groundspeed and/or wind velocity on the ND.

VERIFY RNP – POS REF 2/3 – the default RNP has changed due to a change in flight phase and the flight crew entered RNP value exceeds the new default RNP value.

VIA OFFSET INVALID – flight conditions invalidate the modification with a divert to an alternate airport via OFFSET.

FMC Communications Messages

FMC communications messages:

- display in the CDU scratchpad
- cause the EICAS communications message •FMC to display
- illuminate the CDU message light (MSG)
- cause the communications aural high-low chime to sound

ALTN UPLINK – Up to four company-preferred alternate airports and associated data has been received and is available for preview on the ALTN page.

ALTN INHIBIT UPLINK – uplink contains two airports for the ALTN page 1/2 ALTN INHIB line.

ALTN LIST UPLINK – a company list of up to 20 alternate airports has been received and is available on the ALTN LIST page.

DES FORECAST UPLINK READY – descent forecast data has been received and is available for loading on the DESCENT FORECAST page.

FLT NUMBER UPLINK – a new flight number has been received and is available on the RTE page 1/X.

INVALID TAKEOFF XXX/YYY – takeoff data for up to six runways or runway intersection pairs has been received but some data for one runway or runway intersection pair (RWXXX/YYY) is invalid.

PARTIAL ROUTE X UPLINK – a new route has been uplinked to the FMC but a portion of the route could not be loaded.

PERF INIT UPLINK – performance initialization data has been received and is available for preview on the PERF INIT page.

ROUTE X UPLINK READY – a new route or route modification has been received and is available for loading on the RTE X page.

[Option: T/O Datalink installed]

TAKEOFF DATA LOADED – An uplink containing takeoff data matching the runway/position entry on the takeoff page is available for preview (only displays after an initial takeoff uplink has been received) or alternate thrust and/or flaps have been selected.

[Option: T/O Datalink installed]

TAKEOFF DATA UPLINK – an uplink containing takeoff data matching the runway on the takeoff page is available for preview.

WIND DATA UPLINK READY – wind data has been received and is available for loading into the active route.

FMC Advisory Messages

FMC advisory messages display:

- on the CDU scratchpad
- and illuminate the CDU message light (MSG)

DELETE – DELETE key pushed.

HOLD AT XXXX – a waypoint not contained in the active route is entered into the HOLD AT box on the RTE LEGS page, after selection of the HOLD function key. Selection of HOLD AT XXXX into a RTE LEGS page waypoint line makes a holding fix at the XXXX waypoint.

INVALID ALTN UPLINK – a company-preferred list of alternate airports and associated alternate data has been received; the data is not valid and cannot be displayed.

INVALID ALTN LIST UPLINK – a company list of up to 20 alternate airports has been received; the data is not valid and cannot be displayed.

INVALID FLT NO UPLINK – a new flight number has been received; the data is not valid and cannot be displayed.

INVALID FORECAST UPLINK – descent forecast data has been received; the data is not valid and cannot be displayed.

INVALID PERF INIT UPLINK – performance initialization data has been received; the data is not valid and cannot be displayed.

INVALID ROUTE UPLINK – a new flight plan route or modification to the active flight plan route has been received; the data is not valid and cannot be displayed.

INVALID TAKEOFF UPLINK – takeoff data for up to six runways or runway-intersection pairs has been received; the data is not valid and cannot be displayed.

INVALID WIND DATA UPLINK – enroute wind data has been received; the data is not valid and cannot be displayed.

MAX ALT FLXXX – the altitude entry on any CDU page is above the performance calculated maximum altitude.

NOT ON INTERCEPT HEADING – LNAV selected and the airplane is outside active capture criteria and the present heading will not intercept the active leg.

ROUTE X UPLINK LOADING – a new flight plan route or modification to the active flight plan route has been received and is being loaded after flight crew selection of the LOAD prompt.

STANDBY ONE – the FMC requires more than 4 seconds to display data.

[Option: AIMS V17B installed]

STEEP DES AFTER XXXXXXXX - flight plan has a descent path angle greater than 6 degrees in MOD or ACTIVE states.

TIMEOUT–RESELECT – communication between the FMC and the CDU has failed. The flight crew must reselect FMC on the CDU MENU page.

UNABLE CRZ ALT – performance predicts a zero cruise time at the entered cruise altitude.

FMC Entry Error Messages

FMC entry–error messages:

- display in the CDU scratchpad
- illuminate the CDU message light (MSG)
- push the CLEAR key to remove the message before any data can be entered into the scratchpad

ARR N/A FOR RUNWAY – the runway/approach selected is not compatible with arrival selected.

CRS REVERSAL AT FA FIX – a conflict exists between the default final approach (FA) waypoint (result of a runway or VFR approach selection) and the flight plan before it.

ILS TUNE INHIBITED – MCP – ILS tuning is inhibited with the:

- autopilot engaged, and localizer or glideslope captured
- only the flight director is engaged and either the localizer or the glideslope is captured, and the airplane is below 500 feet radio altitude

Any attempt to manually change the ILS frequency or select another ILS approach on the CDU displays this message. To make the necessary changes:

- above 1500 feet radio altitude – deselect approach on the MCP
- below 1500 feet radio altitude – select TO/GA

or,

- disengage the autopilot
- turn both flight directors OFF, and
- turn at least one flight director ON

INVALID DELETE – deletion of selected data is not allowed.

INVALID ENTRY – entry format or range is incorrect for the selected field or the entered airway or TO waypoint does not coincide with the navigation database.

NOT IN DATABASE – data is not in the route or the navigation database.

ROUTE FULL – the route is filled to the allowable capacity.

RUNWAY N/A FOR SID – selected runway not compatible with SID.

TAKEOFF FLAPS DELETED – the FMC has deleted the takeoff flap setting on the TAKEOFF REF page. This occurs when the THRUST REDUCTION value is changed to the same value as the takeoff flap setting.

STANDBY ONE – the FMC temporarily prevents further CDU inputs.

UNABLE TO SEND MSG – the selected data link message cannot be transmitted.

V-SPEEDS UNAVAILABLE – for certain high thrust/low gross weight or low thrust/high gross weight takeoff conditions, FMC V-speeds are not calculated. Adjust gross weight and/or takeoff thrust limit to enable V-speed calculations.

VERIFY RNP ENTRY – the entered RNP value is greater than the default RNP value for the present flight phase or, less than the present Actual Navigation Performance.

CDU Annunciator Lights

These annunciator lights illuminate when certain conditions exist.

DSPY – a flight plan modification is pending and the RTE, RTE LEGS, RTE DATA, or RTE HOLD page not containing the active leg or route segment is displayed, or a VNAV page (CLB, CRZ, or DES) not corresponding to the active VNAV mode is displayed.

OFST – an offset path has been entered and executed.

MSG – an FMC message is waiting to display or is displayed.

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Fuel**Chapter 12****Table of Contents****Section TOC**

Controls and Indicators	12.10
Fuel System	12.10.1
Fuel Jettison System	12.10.3
Fuel Indications	12.10.4
Normal Fuel Indications	12.10.4
Expanded Fuel Indications	12.10.5
Fuel Jettison Indications	12.10.8
EICAS Fuel Synoptic Display	12.10.11
System Description	12.20
Introduction	12.20.1
Fuel Tank Locations and Capacities	12.20.1
Fuel Tank Locations	12.20.1
Fuel Tank Capacities	12.20.2
Fuel Quantity	12.20.5
Fuel Temperature	12.20.6
Nitrogen Generation System (NGS)	12.20.6
Fuel Pumps	12.20.6
Fuel Pump Operations	12.20.7
Suction Feed	12.20.8
Fuel Crossfeed and Fuel Imbalance	12.20.8
Fuel System Schematic	12.20.9
APU Fuel Feed	12.20.14
Fuel Jettison	12.20.14
Fuel Jettison Schematic	12.20.16
EICAS Messages	12.30
EICAS Alert Messages	12.30.1

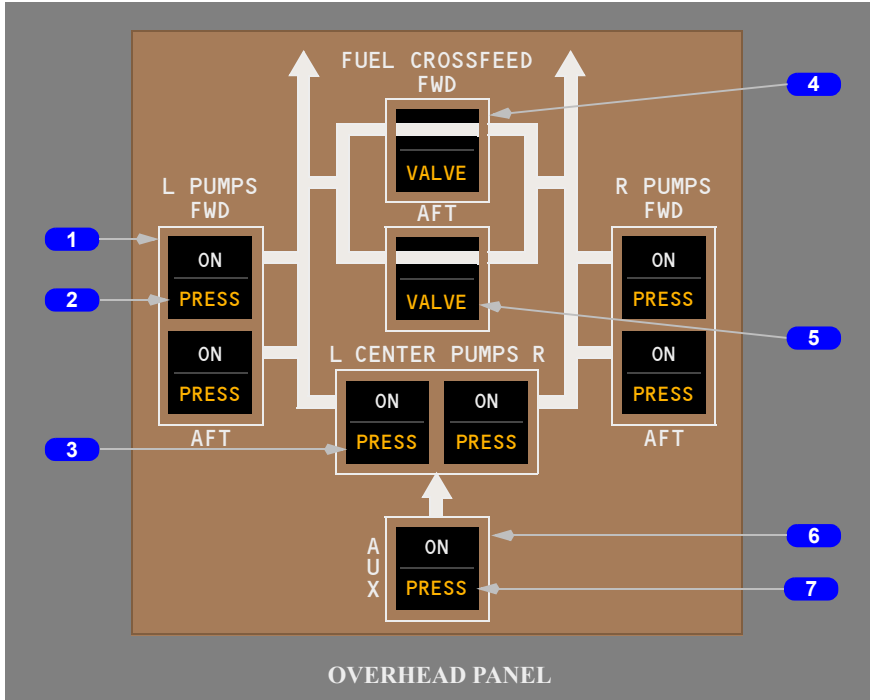
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Fuel
Controls and Indicators

Chapter 12
Section 10

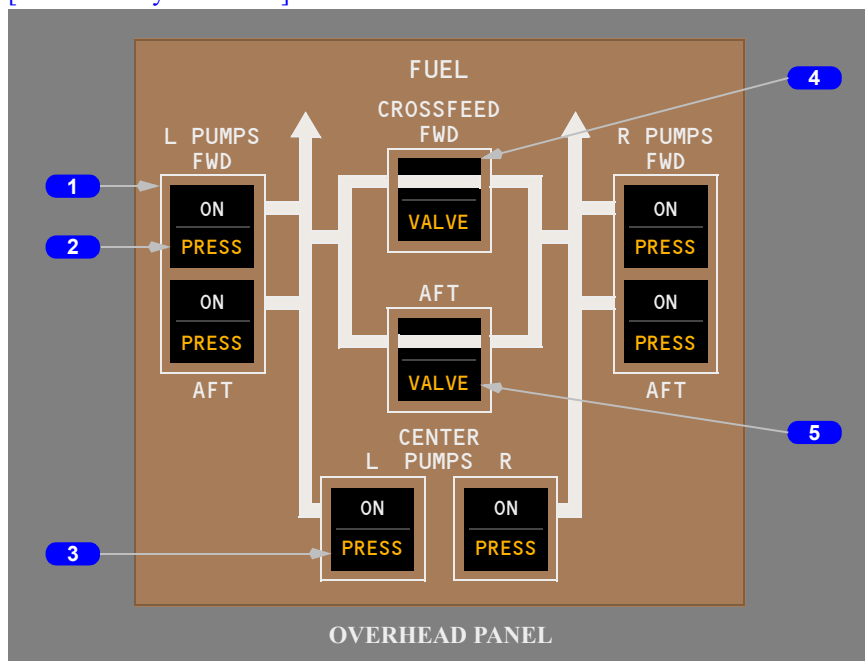
Fuel System

[777-200/-300 Series]
[Auxiliary Fuel Tank]



[777-200/-300 Series]

[Not Auxiliary Fuel Tank]



1 Fuel PUMPS Switches

ON – the fuel pump is commanded on.

2 Forward and Aft Fuel Pumps Pressure (PRESS) Lights

Illuminated (amber) – fuel pump output pressure is low.

3 Center Fuel Pumps Pressure (PRESS) Lights

Illuminated (amber) –

- fuel pump output pressure is low with the pump commanded on
- illumination is inhibited when the center tank fuel pump switch is off

4 Fuel CROSSFEED Switches

On (bar visible) – the crossfeed valve is commanded open.

5 Fuel Crossfeed VALVE Lights

Illuminated (amber) – the crossfeed valve is not in the commanded position.

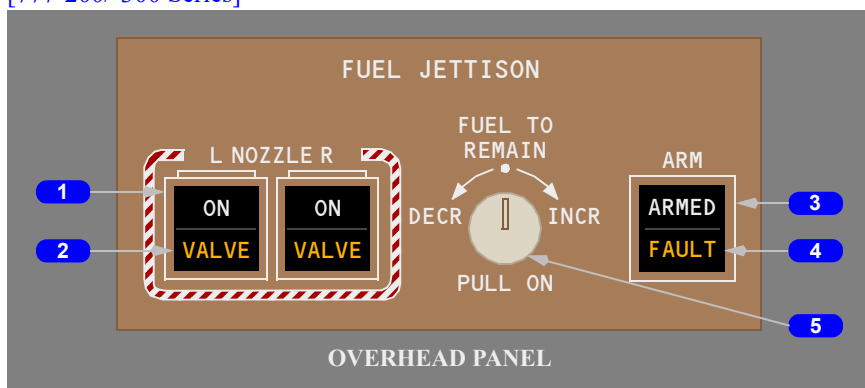
[\[Auxiliary Fuel Tank\]](#)**6 Auxiliary (AUX) Tank Switch**

ON – fuel transfer is commanded on.

[\[Auxiliary Fuel Tank\]](#)**7 Auxiliary (AUX) Pump Pressure (PRESS) Lights**

Illuminated (amber) –

- fuel pressure is low with fuel transfer commanded ON
- inhibited when the Auxiliary Tank switch is commanded off

Fuel Jettison System[\[777-200/-300 Series\]](#)**1 Fuel Jettison NOZZLE Switches**

ON – in flight, with the Fuel Jettison Arm switch in ARMED, and the total fuel quantity is greater than the fuel -to-remain:

- the center tank fuel jettison isolation valves, the main tank jettison pumps, and the fuel jettison nozzle valves are commanded by the fuel jettison to jettison fuel
- when both CENTER PUMPS switches are off, fuel will not be jettisoned from the center tank

2 Fuel Jettison Nozzle VALVE Lights

Illuminated (amber) – the jettison nozzle valve is not in the commanded position.

3 Fuel Jettison ARM Switch

ARMED –

- arms the fuel jettison system
- sets the fuel-to-remain to the maximum landing weight (MLW) quantity

4 Fuel Jettison FAULT Light

Illuminated (amber) –

- a fuel jettison system fault has occurred
- the fuel jettison system is inoperative

5 FUEL TO REMAIN Selector

PULL ON –

- changes the mode from MLW to MAN
- rotate (spring loaded to 12 o'clock position) –
 - (first detent) – decreases (DECR) or increases (INCR) the MAN fuel-to-remain quantity at the slow set rate
 - (second detent) – decreases (DECR) or increases (INCR) the MAN fuel-to-remain quantity at the fast set rate

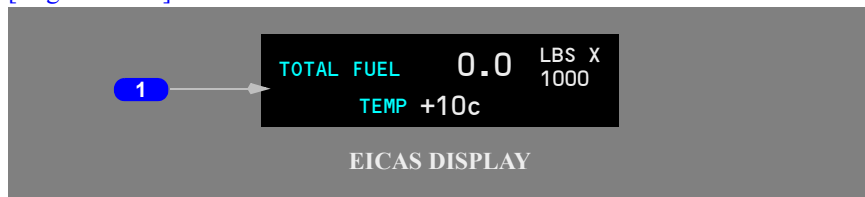
Off– sets the fuel-to-remain to the FMC maximum landing weight (MLW) fuel quantity.

Fuel Indications

Normal Fuel Indications

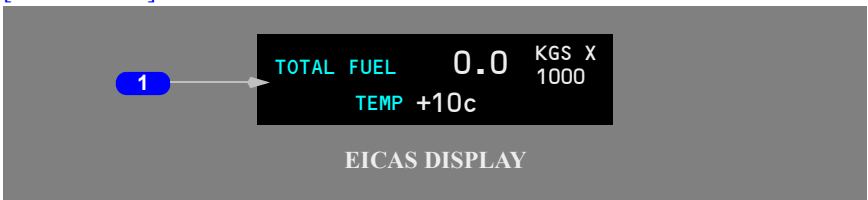
[\[777-200/-300 Series\]](#)

[\[English Units\]](#)



[\[777-200/-300 Series\]](#)

777 Flight Crew Operations Manual

[\[Metric Units\]](#)**1 Normal Fuel Indications**[\[English Units\]](#)

Total fuel quantity (pounds x 1000).

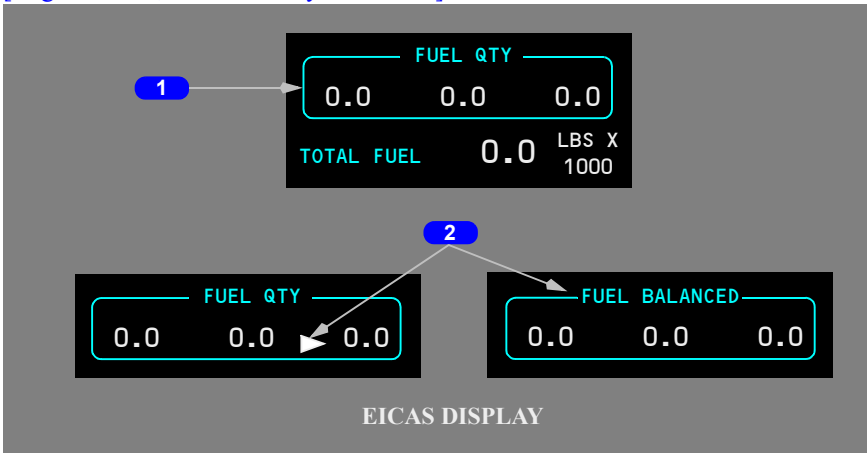
[\[Metric Units\]](#)

Total fuel quantity (kilograms x 1000).

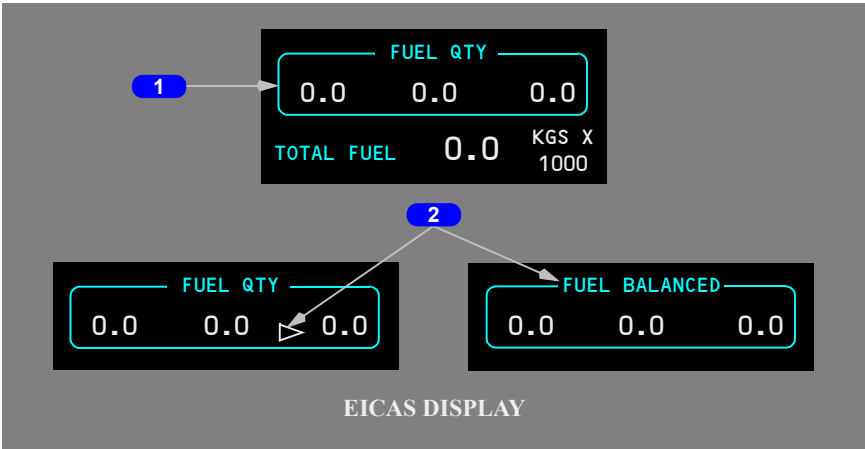
[\[AIMS V16, or later, Installed\]](#)

- (white) - FMC estimated fuel at the destination is sufficient.
- (amber) - FMC estimated fuel at the destination is less than the entered reserves fuel.

Fuel temperature (degrees Celsius).

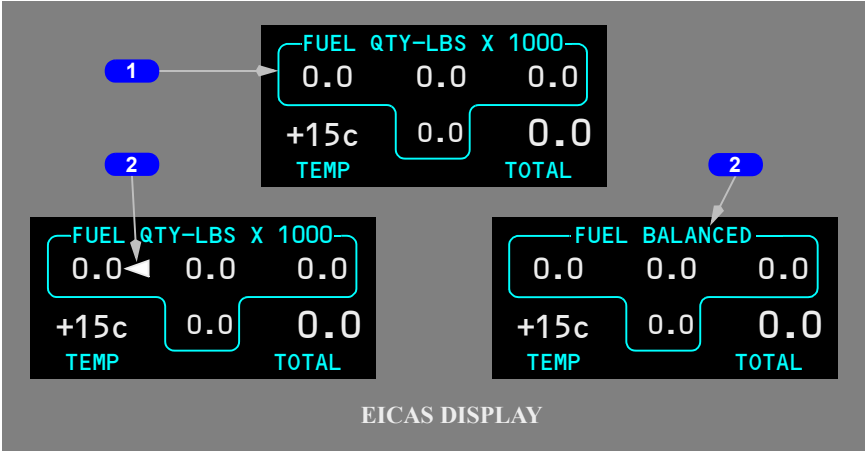
Expanded Fuel Indications[\[777-200/-300 Series\]](#)[\[English Units, w/o Auxiliary Fuel Tank\]](#)[\[777-200/-300 Series\]](#)

[Metric Units, w/o Auxiliary Fuel Tank]



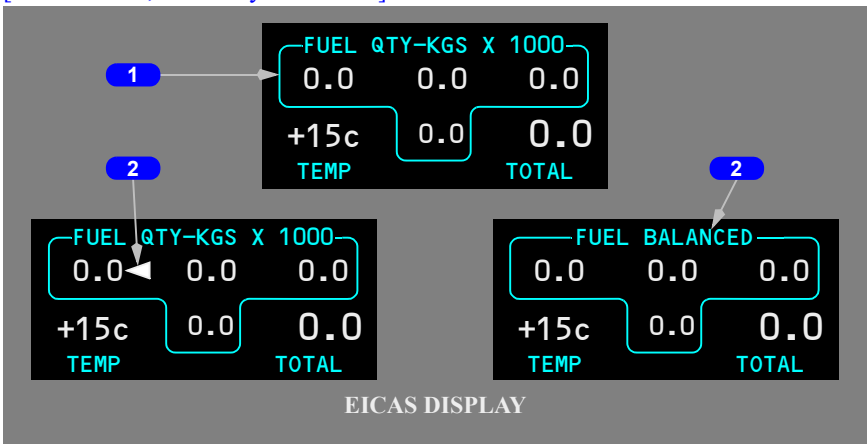
[777-200/-300 Series]

[English Units, Auxiliary Fuel Tank]



[777-200/-300 Series]

[Metric Units, Auxiliary Fuel Tank]



1 Expanded Fuel Indications

[777-200/-300 Series]

The expanded FUEL QUANTITY display (left main, center, and right main tank quantities) appears for any of the following conditions:

- one or both crossfeed valves open
- one or more fuel tank quantity indications are inoperative
- the FUEL IN CENTER alert message is displayed (center tank quantity is amber)
- the FUEL QTY LOW alert message is displayed (low main tank quantity is amber)
- the FUEL IMBALANCE alert message is displayed

[AIMS05, or later, installed]

- the airplane is on the ground and one or both engine(s) off

[Auxiliary Fuel Tank]

- the FUEL IN AUX alert message is displayed
- the FUEL AUX XFR alert message is displayed

[777-200/-300 Series]

[AIMS V16, or later, installed]

- the FUEL FLOW ENG L, R alert message is displayed

2 Fuel Imbalance Indications

A fuel imbalance pointer is displayed on the expanded fuel quantity display next to the low tank quantity for the following imbalance conditions.

A solid white pointer is displayed if:

[English Units]

- main tank fuel differs more than 1000 pounds
- main tank fuel differs more than 200 pounds and a crossfeed valve is open.

[Metric Units]

- main tank fuel differs more than 500 kilograms
- main tank fuel differs more than 100 kilograms and a crossfeed valve is open.

A solid amber fuel imbalance pointer replaces the white pointer if the FUEL IMBALANCE message is displayed.

The difference in fuel quantity which causes the FUEL IMBALANCE message to be displayed varies with total main tank fuel quantity.

The fuel imbalance pointer flashes if fuel balancing is going in the wrong direction.

[English Units]

When fuel is back in balance within 200 pounds between the main tanks – FUEL BALANCED replaces FUEL QTY on the expanded fuel quantity display and flashes for 5 seconds.

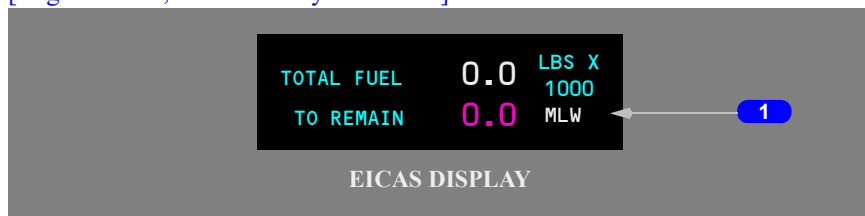
[Metric Units]

When fuel is back in balance within 100 kilograms between the main tanks – FUEL BALANCED replaces FUEL QTY on the expanded fuel quantity display and flashes for 5 seconds.

Fuel Jettison Indications

[777-200/-300 Series]

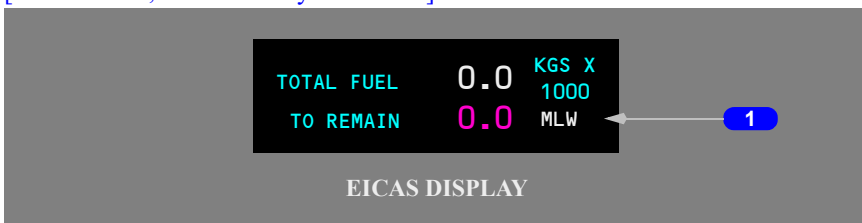
[English Units, Not Auxiliary Fuel Tank]



[777-200/-300 Series]

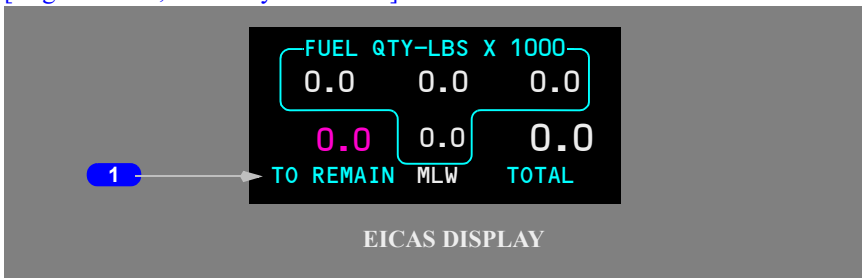
777 Flight Crew Operations Manual

[Metric Units, Not Auxiliary Fuel Tank]



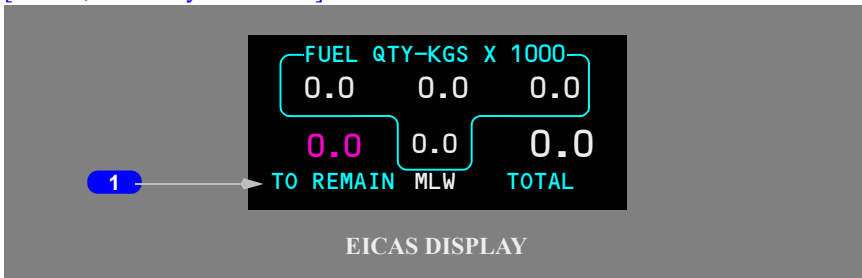
[777-200/-300 Series]

[English Units, Auxiliary Fuel Tank]



[777-200/-300 Series]

[Metric, Auxiliary Fuel Tank]

**1 Fuel Jettison Indications**

Fuel to remain (MLW displayed - white):

- fuel jettison system is ARMED
- the fuel to remain defaults to the fuel quantity that results in maximum airplane landing weight (including any difference between TOTALIZER and CALCULATED fuel) when jettison is complete
- the fuel to remain display replaces the fuel temperature display - magenta

Fuel to remain (MAN displayed - amber):

- fuel jettison system is ARMED
- the FUEL TO REMAIN selector is pulled on
- the quantity to remain can be changed by rotating the FUEL TO REMAIN selector to the slow or fast rate position.

EICAS Fuel Synoptic Display

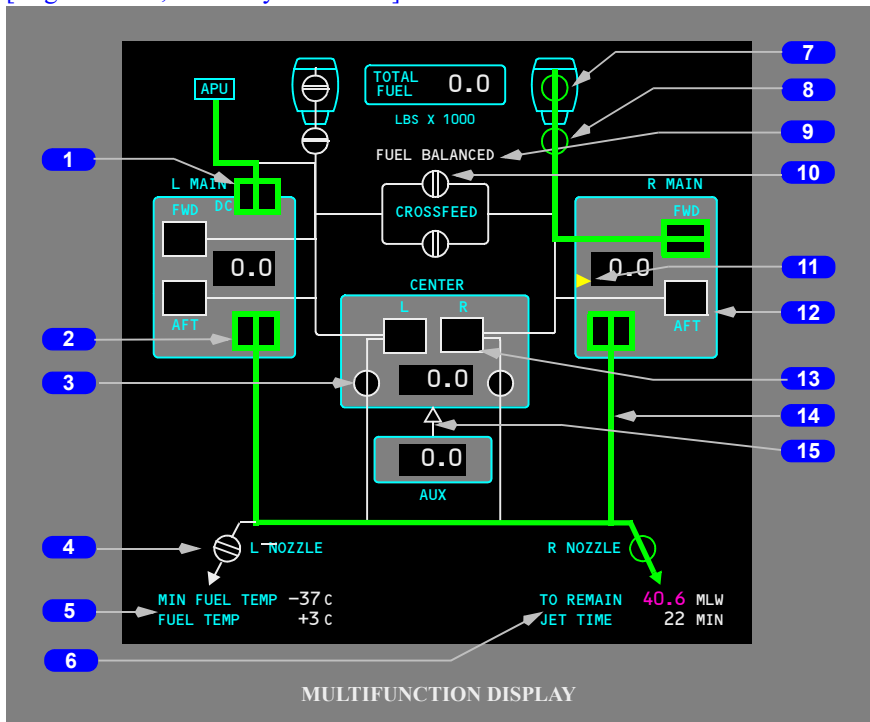
The EICAS fuel synoptic is displayed by pushing the FUEL Synoptic switch on the Display Select panel. Display Select panel operation is described in Chapter 10, Flight Instruments, Displays.

Fuel flow bars are displayed from a configuration of valve positions, switch positions, and pump status. Actual fuel flow and fuel pressure is not sensed or displayed, therefore fuel flow bars do not represent actual system operation.

The EICAS fuel synoptic display of valve, pump, and fuel flow bars are not included in the MMEL or the DDG. The EICAS fuel synoptic display of valve, and pump positions and status is not required for any flight crew normal or non-normal procedure.

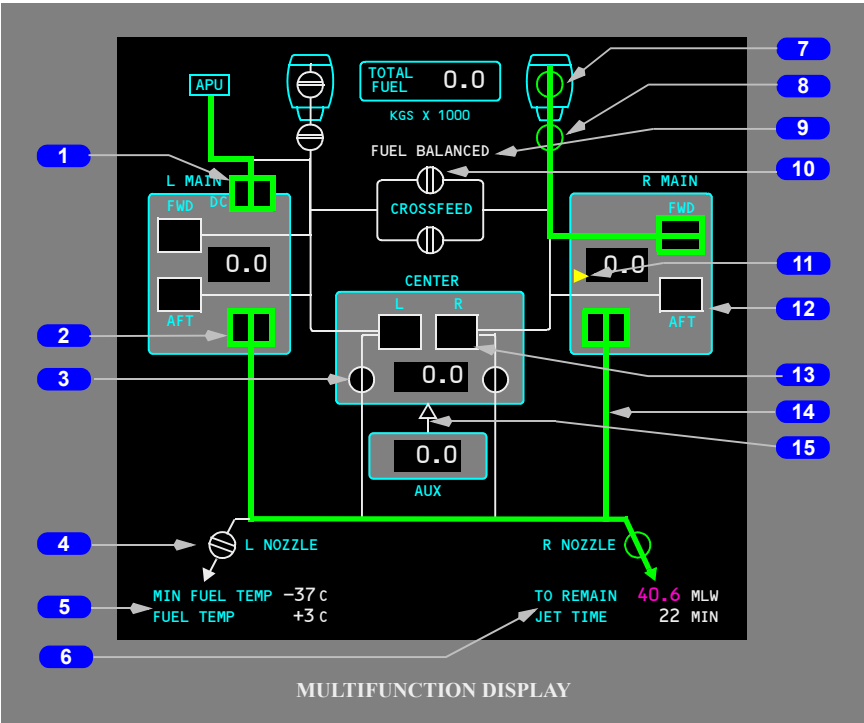
[777-200/-300 Series]

[English Units, Auxiliary Fuel Tank]



[777-200/-300 Series]

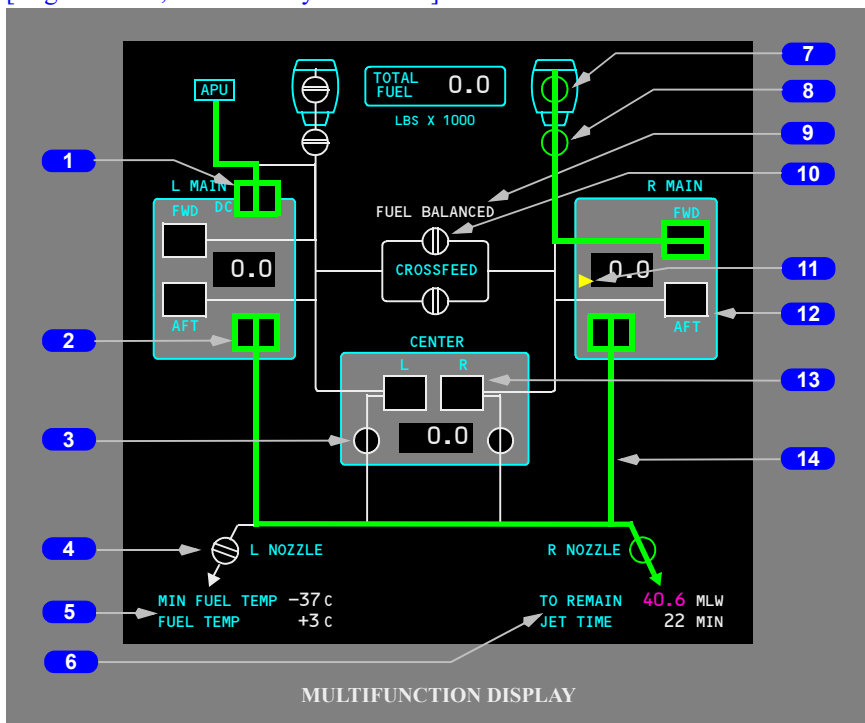
[Metric Units, Auxiliary Fuel Tank]



[777-200/-300 Series]

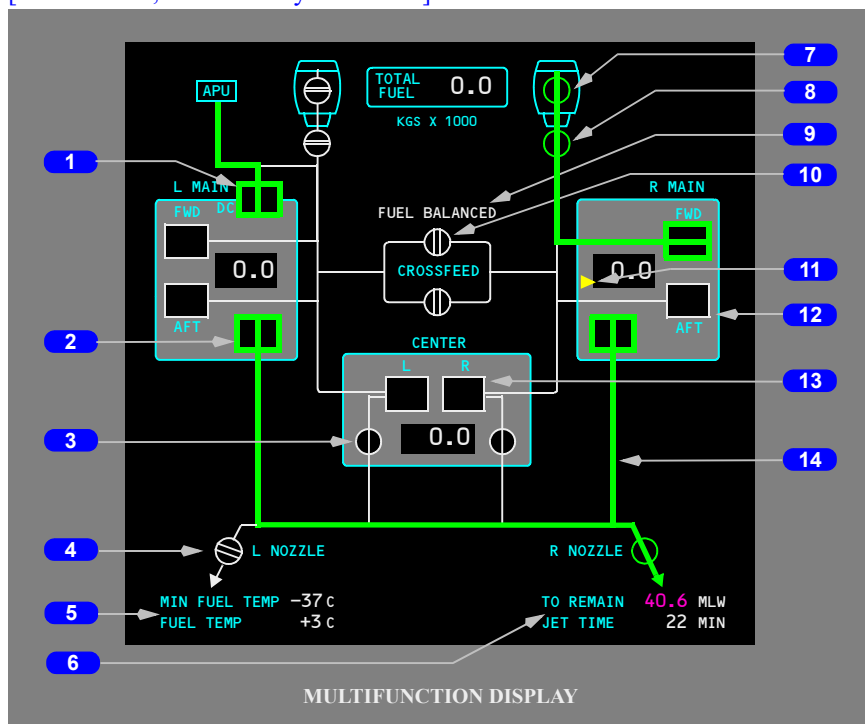
777 Flight Crew Operations Manual

[English Units, No Auxiliary Fuel Tank]



[777-200/-300 Series]

[Metric Units, No Auxiliary Fuel Tank]



1 APU DC Fuel Pump

Status of the APU DC fuel pump.

2 Main Tank Jettison Fuel Pumps

Status of the main tank jettison pump.

3 Center Tank Jettison Fuel Valves

Position of the center tank jettison valve.

4 Fuel Jettison NOZZLE Valves

Position of the fuel jettison nozzle valve.

5 Fuel temperature

Minimum (MIN) FUEL Temperature (TEMP) - white

- refer to Chapter 11, Flight Management, Navigation, Section 40, for description of minimum fuel temperature
- minimum fuel temperature display is invalid - blank

[777-200/-300 Series]

FUEL Temperature (TEMP) - temperature of the left main tank fuel

- normal temperature range - white
- high temperature - amber with "+"
- low temperature - amber with "-"
- fuel temperature display is invalid - blank

6 Fuel jettison indications

Fuel TO REMAIN lbs (kg)

- maximum landing weight (MLW) - white
- manual (MAN) - amber

Jettison (JET) TIME minutes (MIN) - white

7 Engine Fuel Valves

Position of the engine fuel valve.

8 Spar Fuel Valves

Position of the spar fuel valve.

9 FUEL BALANCED

When fuel balance is re-established, the fuel balance indication flashes for five seconds when the fuel is within 200 lbs (100 kgs) of balanced fuel - white

10 CROSS FEED Fuel Valves

Position of the cross feed fuel valve.

11 Fuel imbalance pointer

Points toward the main tank with the lower quantity

- main tank fuel differs more than 1,000 lbs (500 kgs) - white
- a cross feed switch is on and main tank fuel differs more than 200 lbs (100 kgs) - white
- if EICAS advisory message FUEL IMBALANCE is displayed - amber
- if fuel balancing is going the wrong direction - flashing amber

12 Main Tank Fuel Pumps

Status of the main tank fuel pump.

13 Center Tank Override/Jettison Fuel Pumps

Status of the override/jettison fuel pump.

14 Configuration for fuel flow bars

- pressure flow - green
- suction flow - amber

[English Units, With Auxiliary Fuel Tank]

15 Auxiliary tank fuel transfer system

Auxiliary fuel transfer system is displayed as:

- fuel transfer in progress - green
- fuel transfer not in progress and Auxiliary Tank switch is ON - white
- auxiliary fuel transfer failed - amber

Position of fuel system valves are displayed as:

- open - green circle with bars in-line with flow
- closed - white circle with bars across flow
- valve in transit - green circle with white bars
- failed open - amber valve open symbol with amber X
- failed closed - amber valve closed symbol with amber X
- valve position data is not available - white circle with no bars
- valve not in commanded position - amber valve symbol with amber X

Operating status of the main tank fuel pumps, center tank override/jettison fuel pumps, jettison fuel pumps, and the APU DC fuel pump is displayed as:

- powered and low pressure is not detected - green
- not powered or pump status is not available - white
- pump switch is ON and low pressure is detected or pump is failed - amber with amber X
- power or pump pressure is invalid - gray

Fuel quantity is displayed as:

- normal indication - white
- if EICAS advisory message FUEL IN CENTER is displayed - amber
- if EICAS advisory message FUEL LOW CENTER is displayed - amber
- if EICAS caution message FUEL QTY LOW is displayed - amber

[AIMS V16 or later]

- if EICAS advisory message INSUFFICIENT FUEL is displayed - amber
- invalid fuel quantity indication - blank

Fuel System Description

Chapter 12 Section 20

Introduction

The fuel system supplies fuel to the engines and the APU. The fuel is contained in a center tank, and left and right main tanks.

[\[Auxiliary Fuel Tank\]](#)

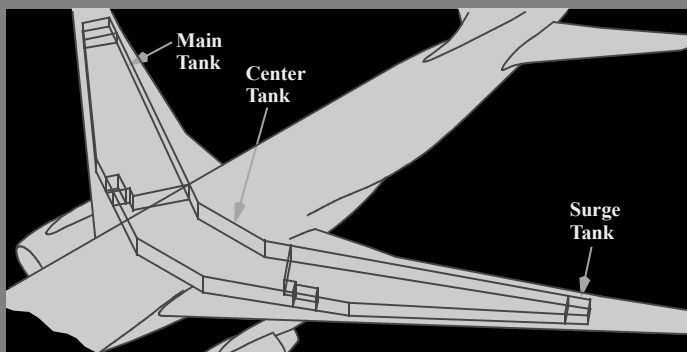
The fuel system supplies fuel to the engines and the APU. The fuel is contained in a center tank, left and right main tanks, and an auxiliary tank.

Refer to Chapter 7, Engines, for a description of the engine fuel system.

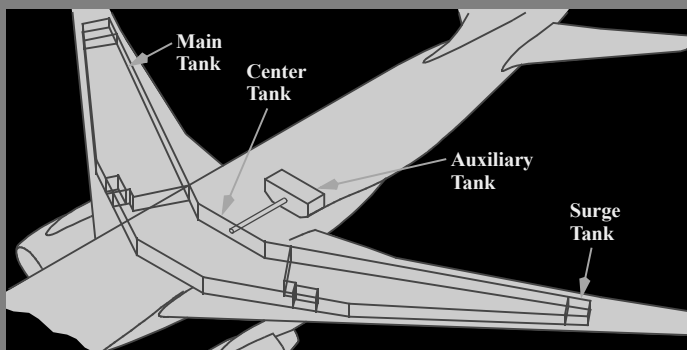
Fuel Tank Locations and Capacities

Fuel Tank Locations

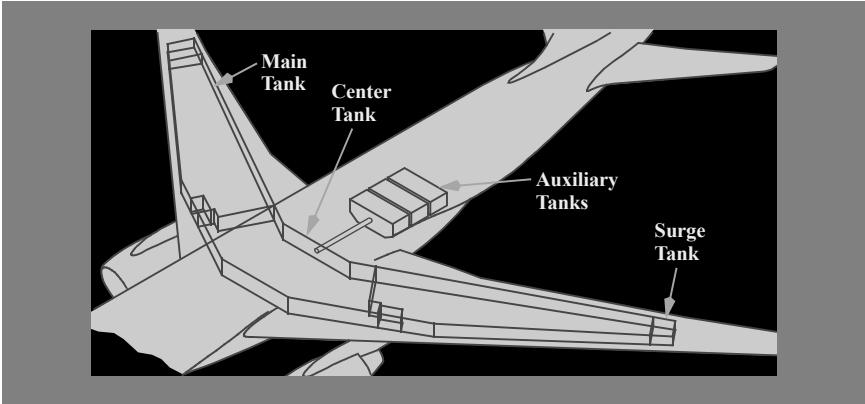
[\[777-200/-300 Series w/o Auxiliary Fuel Tank\]](#)



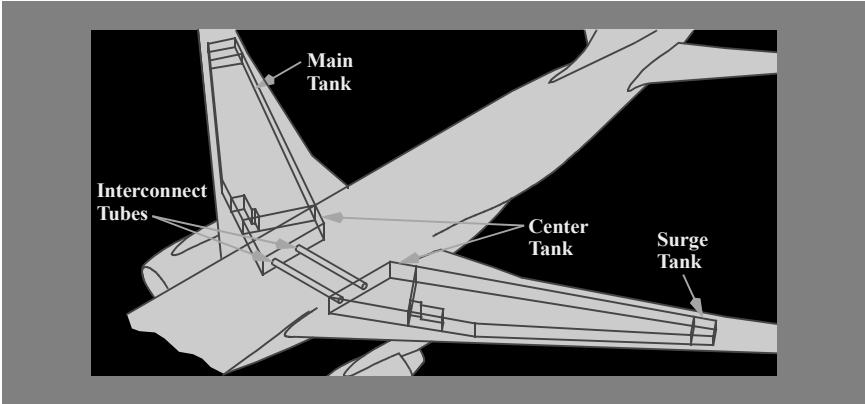
[\[777-200LR, Auxiliary Fuel Tank - One\]](#)



[777-200LR, Auxiliary Fuel Tank - Three]



[777-200]



Fuel Tank Capacities

[English Units, 777-200ER, 777-300]

Tank	Gallons	Pounds *
Left Main	9,560	64,100
Right Main	9,560	64,100
Center	26,100	174,900
Total	45,220	303,100
*Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.		

777 Flight Crew Operations Manual[\[Metric Units, 777-200ER, 777-300\]](#)

Tank	Liters	Kilograms *
Left Main	36,200	29,100
Right Main	36,200	29,100
Center	98,790	79,300
Total	171,190	137,500
* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter.		

[\[English Units, 777F, 777-200LR Not Auxiliary Fuel Tank, 777-300ER\]](#)

Tank	Gallons	Pounds *
Left Main	10,300	69,000
Right Main	10,300	69,000
Center	27,290	182,800
Total	47,890	320,800
*Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.		

[\[Metric Units, 777F, 777-200LR Not Auxiliary Fuel Tank, 777-300ER\]](#)

Tank	Liters	Kilograms *
Left Main	38,990	31,300
Right Main	38,990	31,300
Center	103,290	82,900
Total	181,270	145,500
* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter.		

[English Units, 777-200LR Auxiliary Fuel Tank - One]

Tank	Gallons	Pounds *
Left Main	10,300	69,000
Right Main	10,300	69,000
Center	27,290	182,800
Auxiliary	1,875	12,600
Total	49,765	333,400
*Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.		

[English Units, 777-200LR Auxiliary Fuel Tank - Three]

Tank	Gallons	Pounds *
Left Main	10,300	69,000
Right Main	10,300	69,000
Center	27,290	182,800
Auxiliary	5,625	37,700
Total	53,515	358,500
*Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.		

[Metric Units, 777-200LR Auxiliary Fuel Tank - One]

Tank	Liters	Kilograms *
Left Main	38,990	31,300
Right Main	38,990	31,300
Center	103,290	82,900
Auxiliary	7,100	5,700
Total	188,370	151,200
* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter.		

777 Flight Crew Operations Manual**[Metric Units, 777-200LR Auxiliary Fuel Tank - Three]**

Tank	Liters	Kilograms *
Left Main	38,990	31,300
Right Main	38,990	31,300
Center	103,290	82,900
Auxiliary	21,300	17,100
Total	202,570	162,600
* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter.		

[English Units, 777-200]

Tank	Gallons	Pounds *
Left Main	9,300	62,300
Right Main	9,300	62,300
Center	12,400	83,100
Total	31,000	207,700
* Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.		

[Metric Units, 777-200]

Tank	Liters	Kilograms *
Left Main	35,200	28,300
Right Main	35,200	28,300
Center	46,900	37,700
Total	117,300	94,300
* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter.		

Fuel Quantity

Fuel quantity is measured by sensors in each tank. Total fuel quantity is displayed on the primary EICAS display. Tank quantities and total fuel quantity are displayed on the FUEL synoptic display.

Expanded fuel indications showing the left main, center, and right main tank quantities are displayed when non-normal conditions occur.

[Auxiliary Fuel Tank]

Expanded fuel indications showing the left main, center, right main, and auxiliary tank quantities are displayed when non-normal conditions occur.

Fuel Temperature

Fuel temperature is displayed on the primary EICAS display. The temperature is normally displayed in white. It is displayed in amber when the fuel temperature approaches the fuel freeze temperature entered in the flight management system CDU. During jettison, the TO REMAIN quantity replaces the EICAS display fuel temperature indication.

Fuel temperature and minimum fuel temperature are also displayed on the fuel synoptic display.

Nitrogen Generation System (NGS)

The NGS converts bleed air to nitrogen-enriched air to reduce flammability of center wing tank fuel during all phases of flight and for a brief period after landing. To reduce bleed air demand NGS is shut down for engine out operation. NGS is also shut down when the Equipment Cooling switch is off or a Cargo Fire Arm switch is ARMED.

Fuel Pumps

Each fuel tank contains two AC-powered fuel pumps. A single pump can supply sufficient fuel to operate one engine under all conditions.

The two center tank fuel pumps are override/jettison pumps. The pumps have higher output pressure than the left and right main tank fuel pumps. The center tank override/jettison pumps override the main tank pumps so the center tank fuel is used before wing tank fuel.

The center tank fuel pumps will shut off automatically after 15 seconds of continuous low pressure. Automatic center tank fuel pump shutoff is inhibited during jettison.

When the main tank fuel pump switches are off, the switch PRESS lights illuminate and the EICAS advisory messages FUEL PUMP (L, R, FWD, or AFT) display. When the center fuel pump switches are off, the switch PRESS lights and pump pressure EICAS messages are inhibited.

[Auxiliary Fuel Tank - One]

The auxiliary tank contains one AC-powered fuel pump. Air pressure is used to transfer auxiliary fuel to the center tank if the AC-powered pump is inoperative.

[Auxiliary Fuel Tank - Three]

The auxiliary tank contains three AC-powered fuel pumps, one in each cell. Air pressure is used to transfer auxiliary fuel to the center tank if the AC-powered pumps are inoperative.

[Auxiliary Fuel Tank]

When the main tank fuel pump switches are off, the switch PRESS lights illuminate and the EICAS advisory messages FUEL PUMP (L, R, FWD, or AFT) display. When the center fuel pump and auxiliary switches are off, the switch PRESS lights and pump pressure EICAS messages are inhibited.

On the ground, both center fuel pumps operate only when two electrical power sources are available. With only one power source available and the center fuel pump switches on, the switch PRESS light on the non-powered side is illuminated and the pump pressure EICAS message is inhibited.

The left main tank contains a DC-powered fuel pump. It has no controls or indicators, other than the fuel synoptic display. The DC pump operates automatically to provide fuel to the APU when AC power is not available and the APU selector is ON.

Surge tanks are provided in each wing, outboard of each main tank. Fuel in the surge tanks and fuel remaining in the refueling manifold is drained into the main tanks.

Fuel Pump Operations

[Auxiliary Fuel Tank]

When the auxiliary fuel has transferred to the center tank, the FUEL LOW AUX message shows.

During flight, the FUEL IN CENTER message displays when both center fuel pump switches are off with fuel in the center tank. The FUEL LOW CENTER message displays when one or both center pump switches are ON and center tank quantity is low.

If a center pump has low output pressure, the fuel pump switch PRESS light illuminates and the message FUEL PUMP CENTER (L or R) displays.

Center Tank Fuel Scavenge System

When the main tank pumps are operating the fuel scavenge system transfers the fuel remaining in the center tank into the main tanks.

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 should effectively operate on suction feed.

Fuel pressure can be provided from a main tank with operating fuel pumps to both engines by opening the fuel crossfeed valve(s). Continued crossfeed use will result in a progressive fuel imbalance.

Fuel Crossfeed and Fuel Imbalance

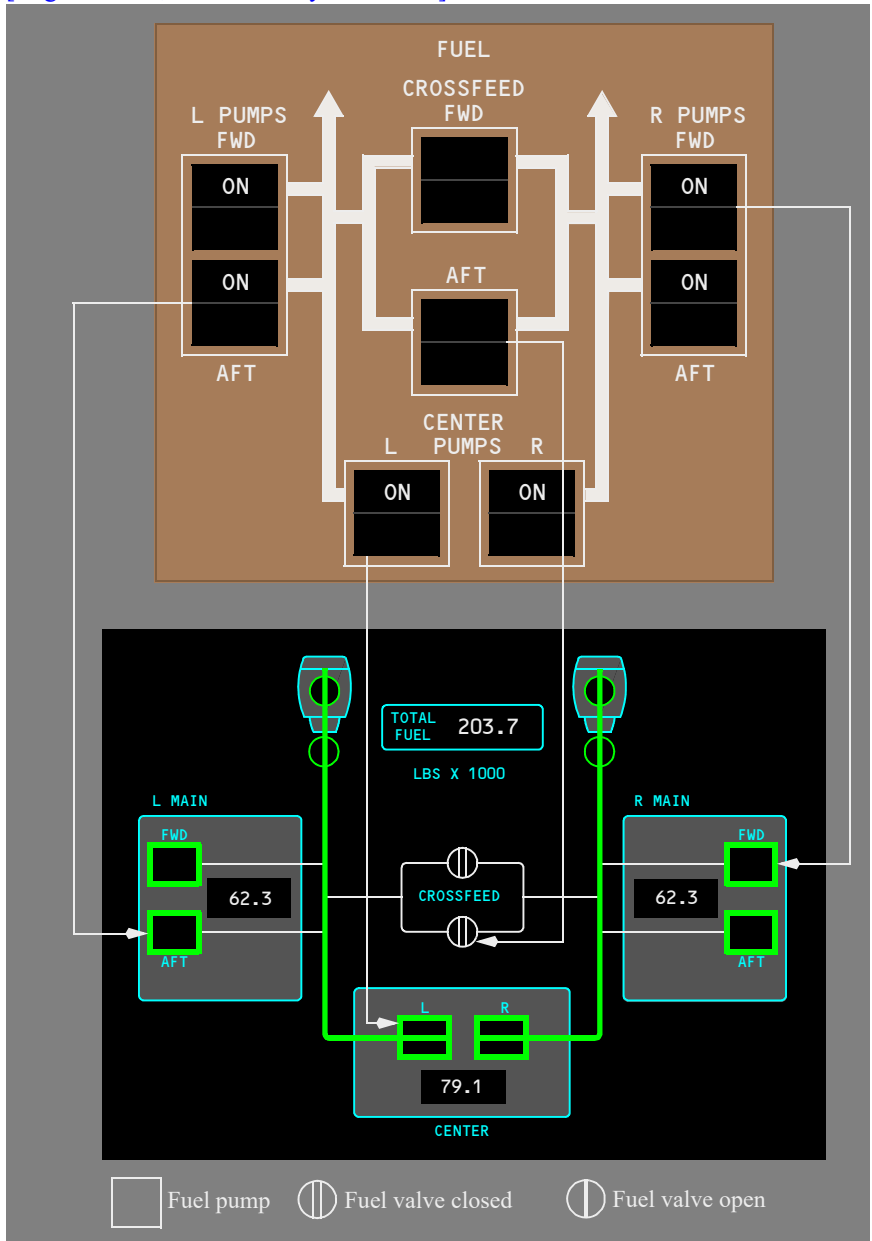
The fuel crossfeed system enables fuel to be supplied to either engine from any fuel tank. With both crossfeed valves closed, the left and right fuel tank to engine systems are isolated. With at least one crossfeed valve open in any phase of flight, fuel feed to either engine can be supplied from the opposite fuel tank.

If the fuel quantity in left and right main tanks differ by an excessive quantity, the EICAS alert message FUEL IMBALANCE is displayed.

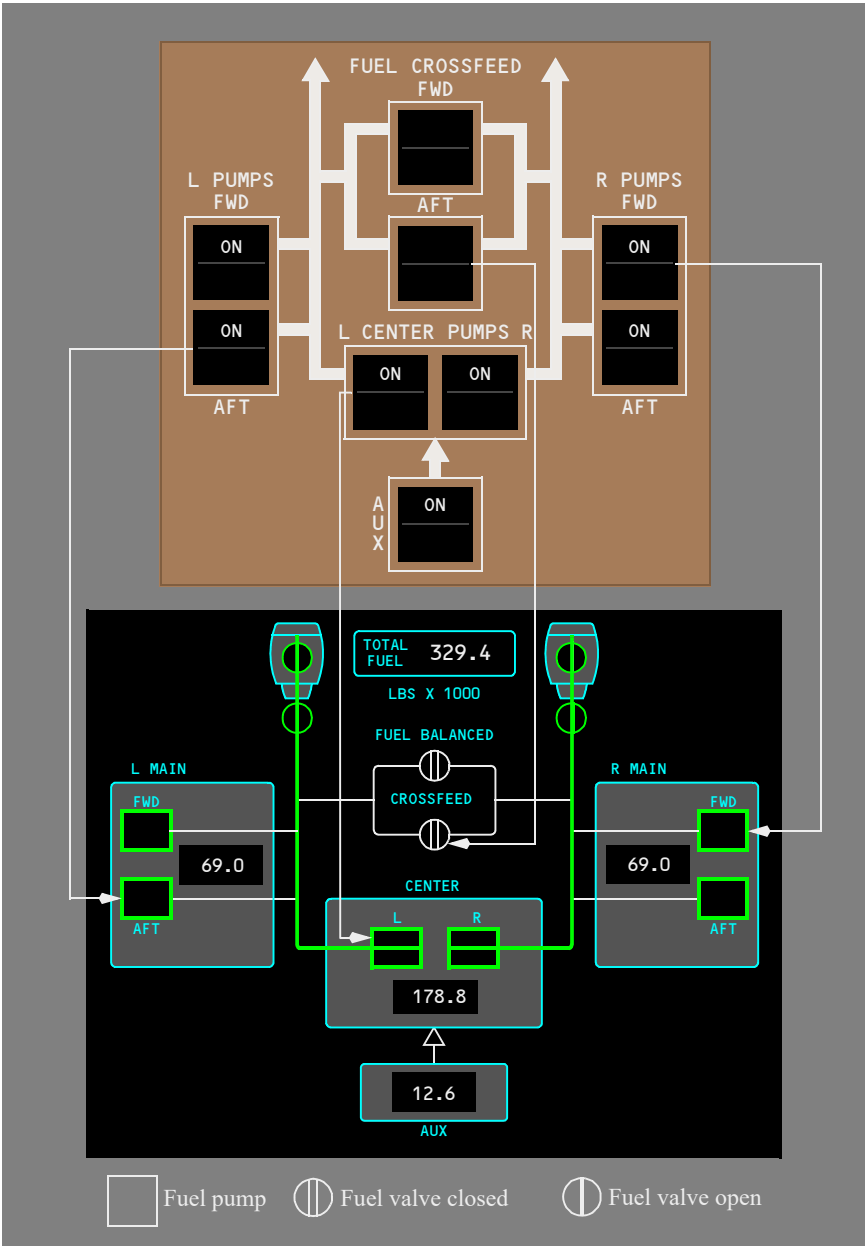
If a fuel crossfeed valve position does not agree with the switch position, the CROSSFEED switch VALVE light illuminates and the EICAS advisory message FUEL CROSSFEED is displayed.

Fuel System Schematic

[English Units, Not Auxiliary Fuel Tank]

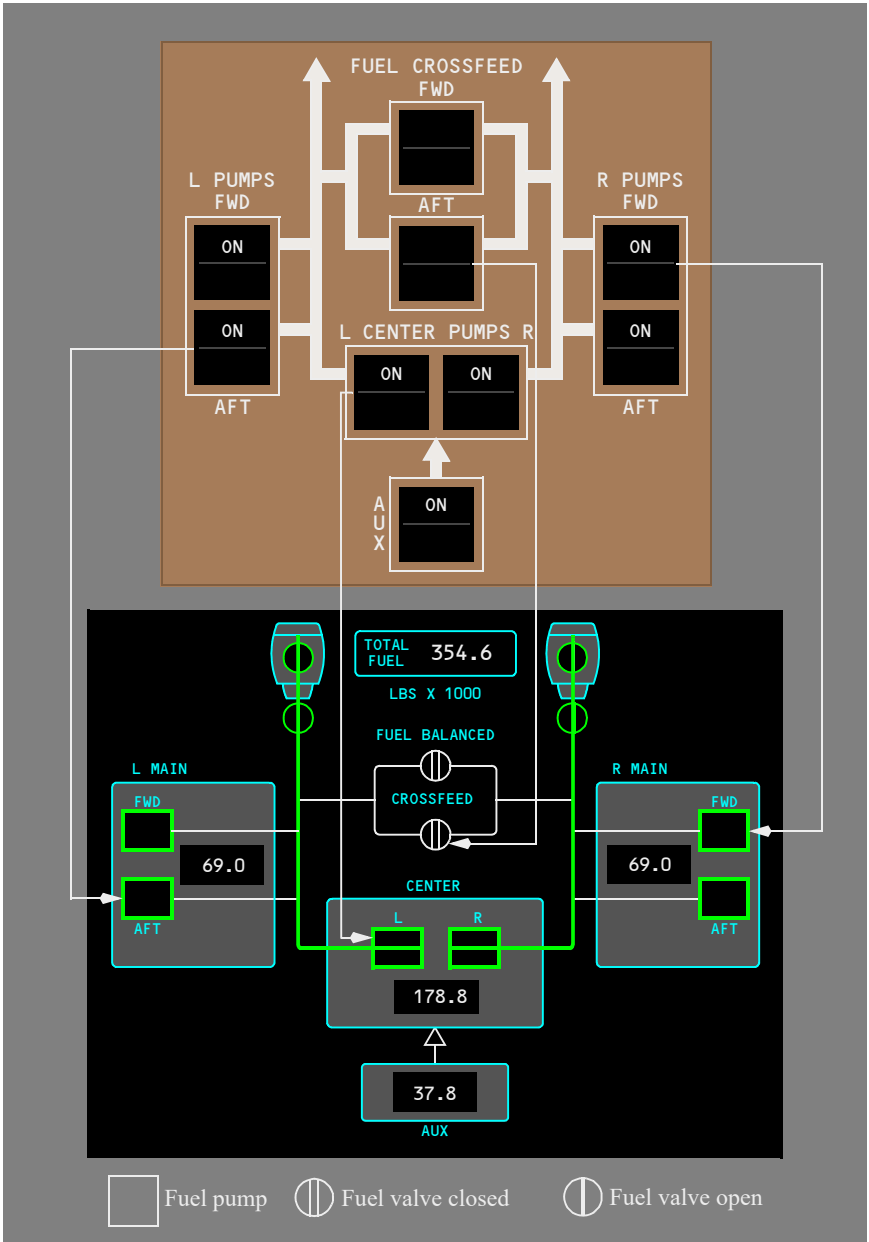


[English Units, Auxiliary Fuel Tank - One]

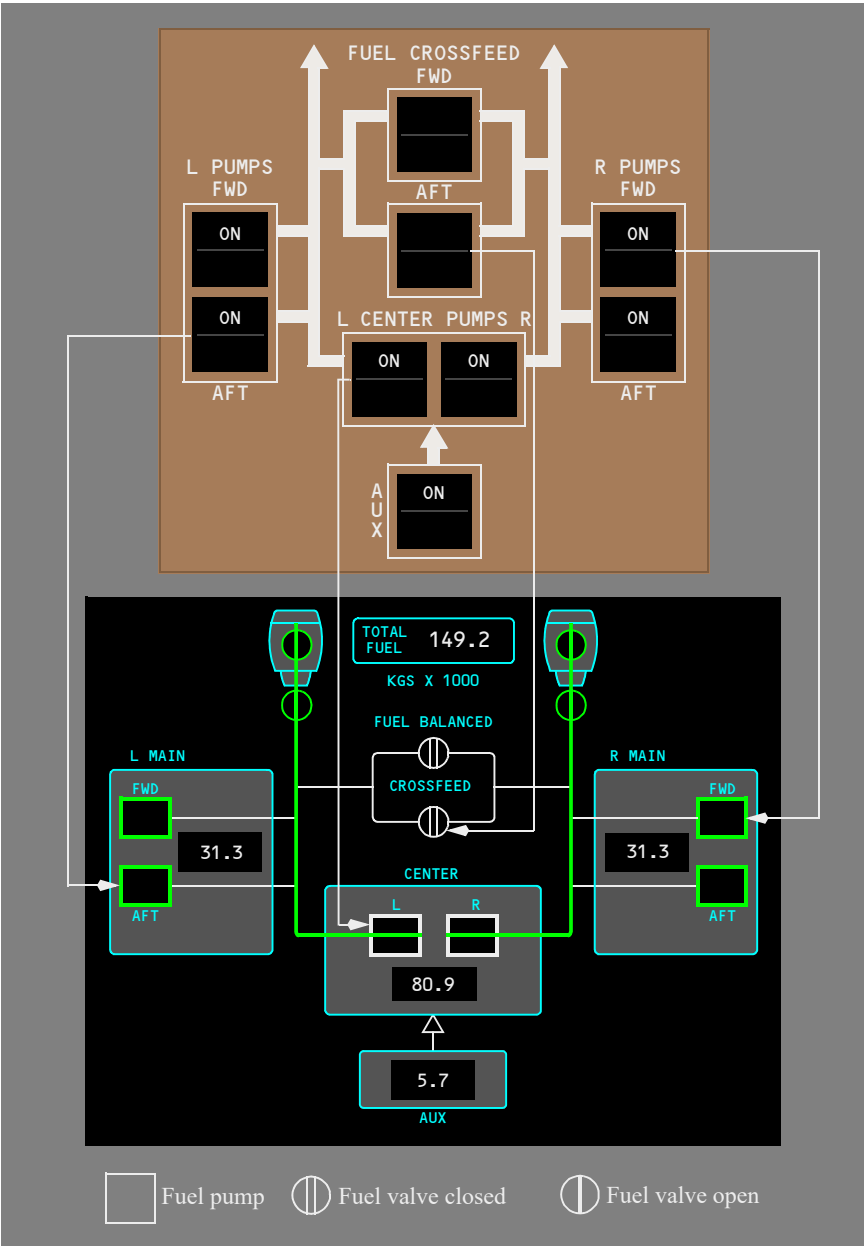


777 Flight Crew Operations Manual

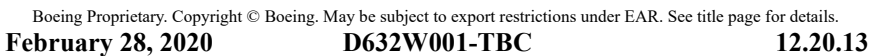
[English Units, Auxiliary Fuel Tank - Three]



[Metric Units, Auxiliary Fuel Tank - One]



[Metric Units, Auxiliary Fuel Tank - Three]



APU Fuel Feed

APU fuel is supplied from the left fuel manifold. APU fuel can be provided by any AC fuel pump supplying fuel to the left fuel manifold or by the left main tank DC fuel pump.

On the ground, with the APU switch ON and no AC power available, the DC pump runs automatically. With AC power available, the left forward AC fuel pump operates automatically, regardless of fuel pump switch position, and the DC fuel pump turns off.

In flight, the DC fuel pump operates automatically for quick left engine relight with the loss of both engines and all AC power.

Fuel Jettison

The fuel jettison system allows jettison from all fuel tanks. Fuel is jettisoned through jettison nozzle valves inboard of each aileron. Jettison pumps in the main tanks and override/jettison pumps in the center tank pump fuel overboard through the jettison nozzle valves.

Fuel jettison is initiated by pushing the FUEL JETTISON ARM switch to select ARMED. The jettison system automatically sets the fuel-to-remain to the MLW fuel quantity. The TO REMAIN quantity replaces fuel temperature on the EICAS display.

Pull on and rotate the FUEL TO REMAIN selector to manually decrease or increase the TO REMAIN quantity.

Main tank jettison begins when:

- the FUEL JETTISON NOZZLE switches are pushed ON
- the jettison nozzle valves open, and
- the main tank jettison pumps operate.

If the center tank override/jettison pumps are on, center tank fuel also jettisons. Center tank fuel will not jettison if the center tank override/jettison pumps are off.

The nozzles cannot open on the ground, regardless of switch positions.

In flight, jettison time displays in minutes on the fuel synoptic when the FUEL JETTISON ARM switch is ARMED. Jettison time increases with an increase in altitude. Jettison automatically stops when a value just above the TO REMAIN quantity is reached. The system shuts off the main tank jettison pumps and closes the center tank jettison isolation valves.

777 Flight Crew Operations Manual

[777-200ER, 777F, 777-200LR, 777-300, 777-300ER]

When the airplane is heavy and loaded near the forward CG, fuel is jettisoned from the center tank first to keep CG within limits; main tank jettison pump operation is delayed. The computed jettison time is automatically adjusted to reflect the increased jettison time.

[Auxiliary Fuel Tank]

Fuel jettison does not occur directly from the auxiliary tank. Auxiliary fuel is transferred to the center tank where it may be jettisoned. Auxiliary tank transfer is inhibited during jettison if necessary to help avoid an undesirable forward CG shift.

[English Units]

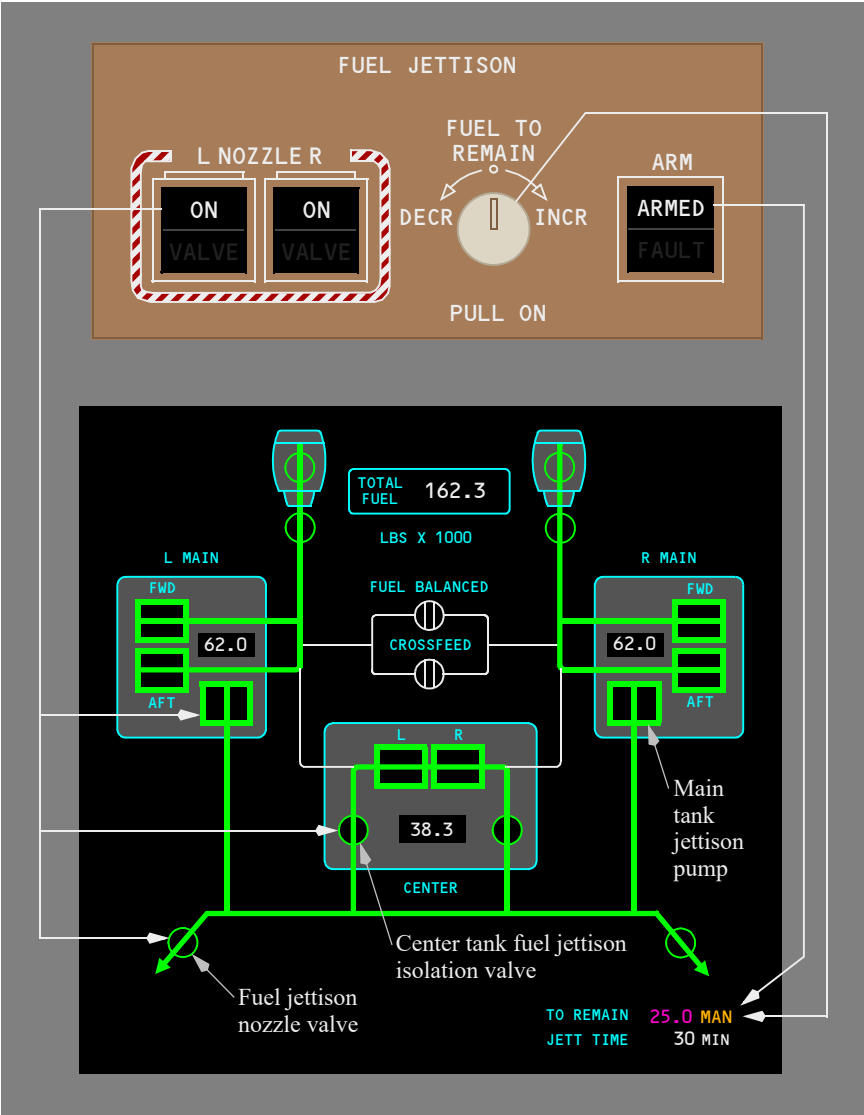
At least 11,500 pounds of fuel remains in each main tank after jettison is complete.

[Metric Units]

At least 5,200 kilograms of fuel remains in each main tank after jettison is complete.

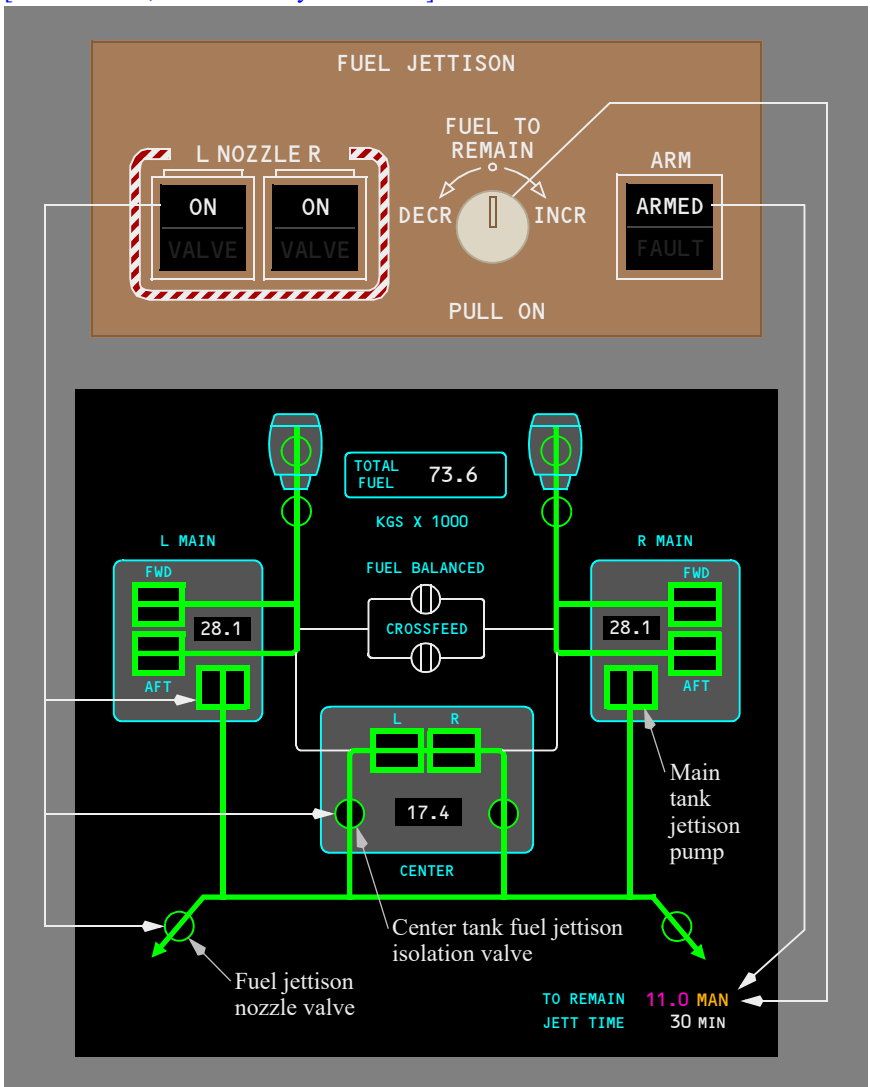
Fuel Jettison Schematic

[English Units, Not Auxiliary Fuel Tank]

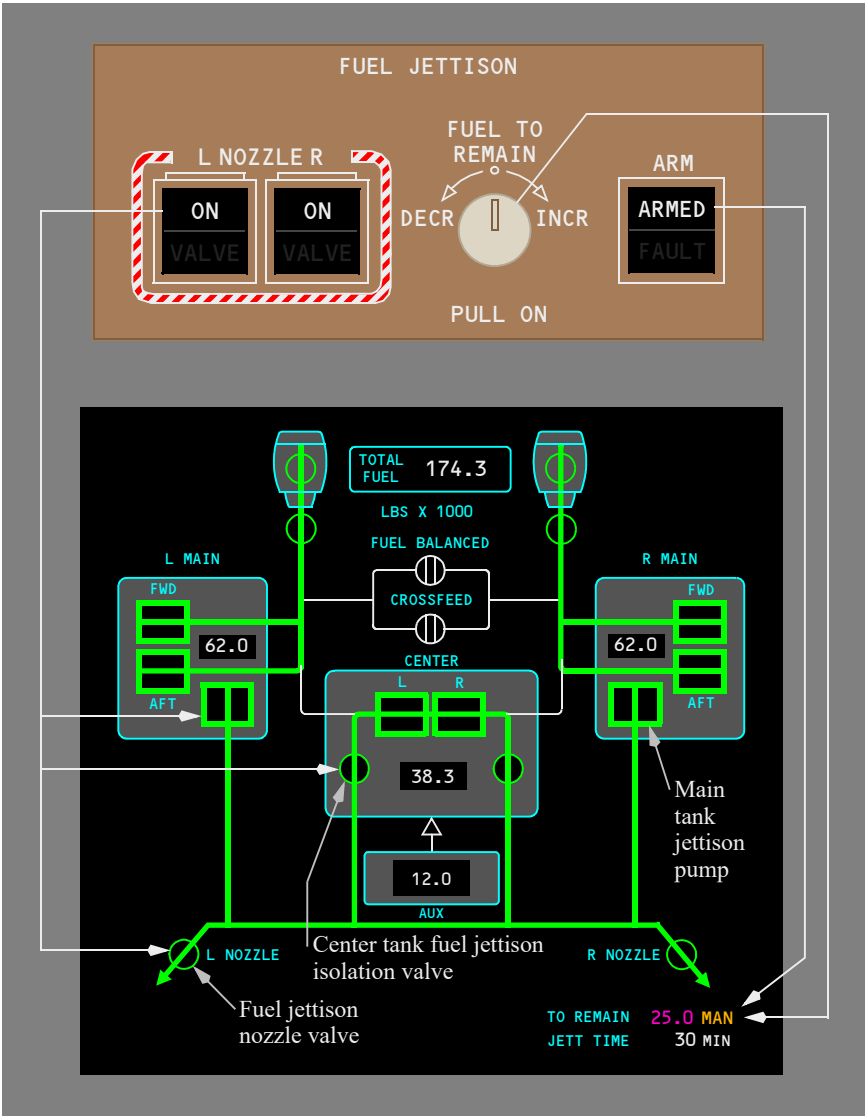


777 Flight Crew Operations Manual

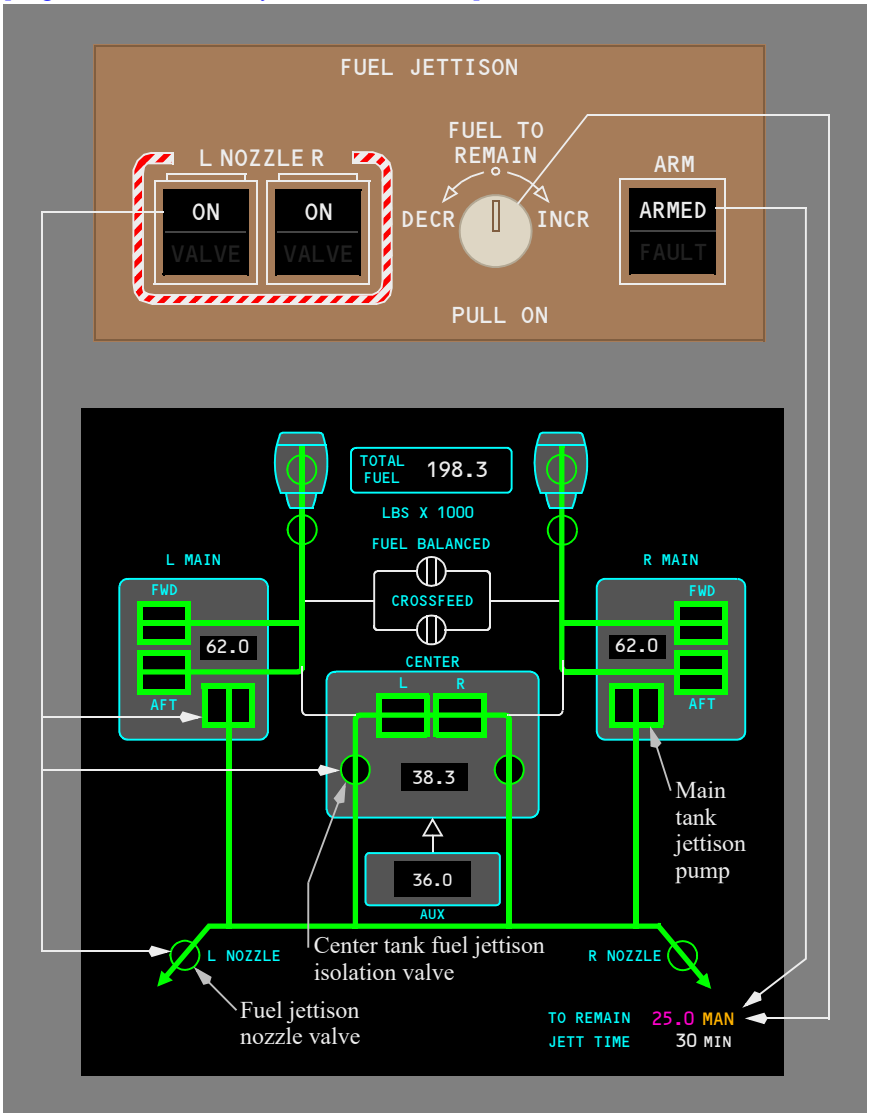
[Metric Units, Not Auxiliary Fuel Tank]



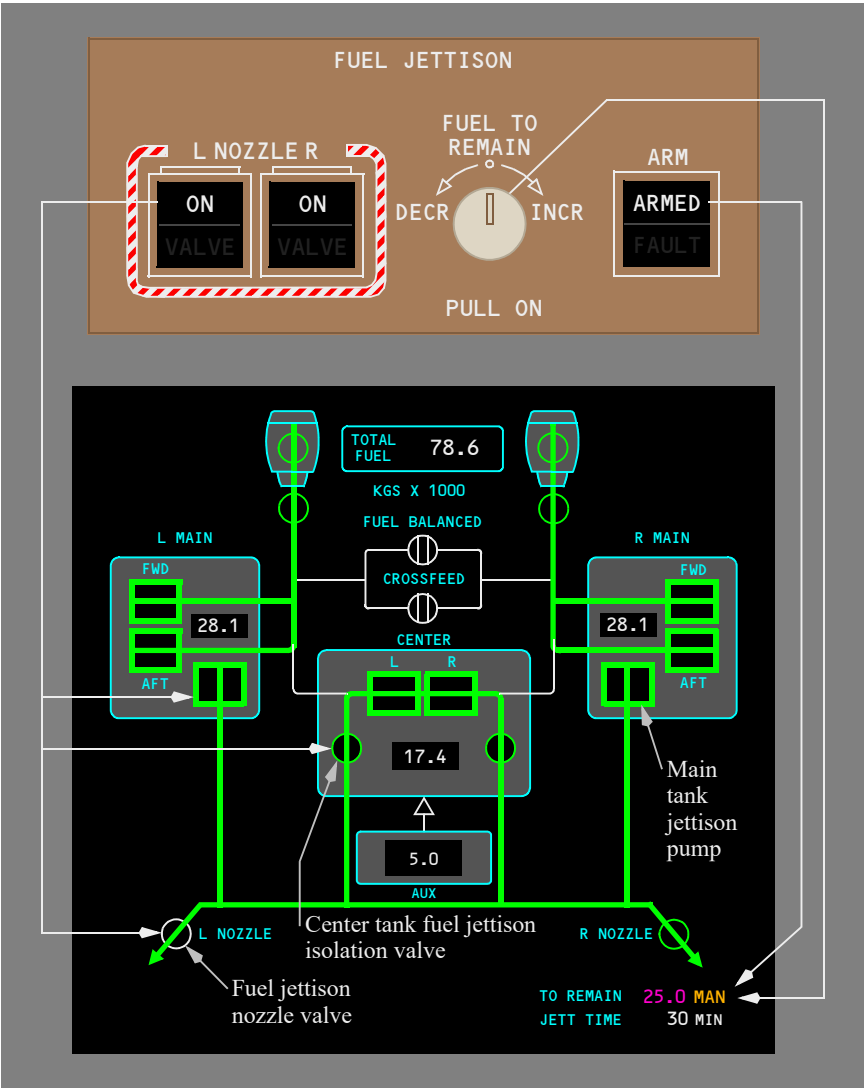
[English Units, Auxiliary Fuel Tank - One]



[English Units, Auxiliary Fuel Tank - Three]

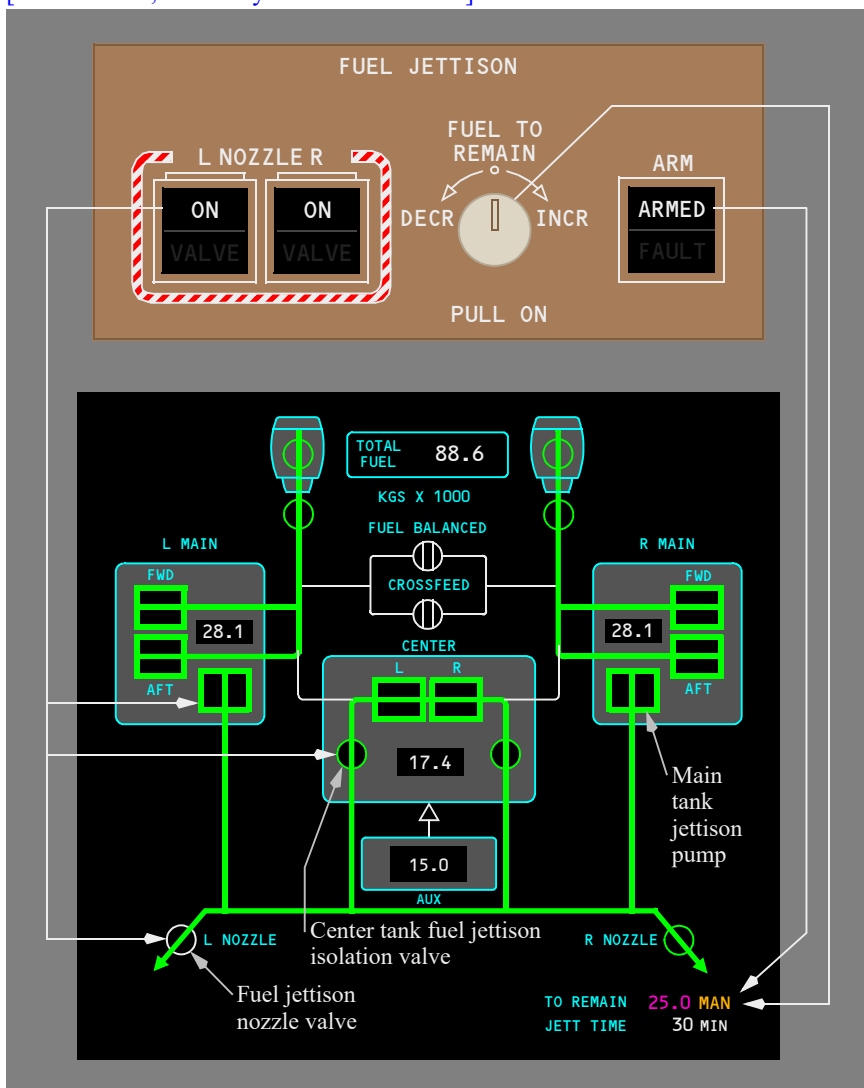


[Metric Units, Auxiliary Fuel Tank - One]



777 Flight Crew Operations Manual

[Metric Units, Auxiliary Fuel Tank - Three]



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Fuel
EICAS Messages**Chapter 12**
Section 30**EICAS Alert Messages**

Message	Level	Aural	Message Logic
FUEL AUTO JETTISON	Caution	Beeper	Total fuel quantity is less than or equal to the selected TO REMAIN quantity and a nozzle valve is open, or the fuel jettison automatic shutoff is failed.

[\[Auxiliary Fuel Tank\]](#)

FUEL AUX XFR	Caution	Beeper	Auxiliary fuel fails to transfer or is transferring slower than normal.
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FUEL CROSSFEED AFT, FWD	Advisory		Crossfeed valve is not in the commanded position.
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[\[777-200/-300 Series after AIMS Blockpoint 5\]](#)

FUEL DISAGREE	Advisory		Totalizer fuel quantity and FMC calculated fuel quantity disagree.
---------------	----------	--	--

[\[AIMS V16 or later\]](#)

FUEL FLOW ENG L, R	Advisory		Engine fuel flow is abnormally high.
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FUEL IMBALANCE	Advisory		Fuel imbalance between the main tanks is excessive.
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[\[Auxiliary Fuel Tank\]](#)

FUEL IN AUX	Advisory		Auxiliary fuel switch is OFF with fuel in the auxiliary tank.
-------------	----------	--	---

FUEL IN CENTER	Advisory		Both center fuel pump switches are off with fuel in the center tank.
----------------	----------	--	--

Message	Level	Aural	Message Logic
FUEL JETT NOZZLE L, R	Advisory		Jettison nozzle valve in not in the commanded position.
FUEL JETTISON MAIN	Advisory		Fuel jettison from the main tanks is inoperative.
FUEL JETTISON SYS	Caution	Beeper	Fuel jettison system is inoperative.

[Auxiliary Fuel Tank]

FUEL LOW AUX	Advisory		The AUX tank switch is ON and the auxiliary tank quantity is low.
-----------------	----------	--	---

FUEL LOW CENTER	Advisory		One or both CENTER PUMPS switches are ON and center tank quantity is low.
FUEL PRESS ENG L, R	Caution	Beeper	Engine is on suction feed.
FUEL PRESS ENG L+R	Advisory		Fuel pressure to both engines is low on the ground with the engines shut down.
FUEL PUMP CENTER L, R	Advisory		Center fuel pump output pressure is low.
FUEL PUMP L AFT, FWD	Advisory		Left aft or forward fuel pump output pressure is low.
FUEL PUMP R AFT, FWD	Advisory		Right aft or forward fuel pump output pressure is low.
FUEL QTY LOW	Caution	Beeper	Fuel quantity is low in either main tank.

[777-200, 777-200ER, 777-300]

[AIMS V14 or later]

FUEL SCAVENGE SYS	Advisory		Either main tank is less than 14,000 lbs and the center tank quantity is greater than 500 lbs for 15 minutes.
-------------------------	----------	--	---

777 Flight Crew Operations Manual

Message	Level	Aural	Message Logic
---------	-------	-------	---------------

[777-200, 777-200ER, 777-300]

[AIMS V14 or later]

FUEL SCAVENGE SYS	Advisory		Either main tank is less than 6,400 kgs and the center tank quantity is greater than 200 kgs for 15 minutes.
-------------------------	----------	--	--

[777F, 777-200LR, 777-300ER]

[AIMS V14 or later]

FUEL SCAVENGE SYS	Advisory		Either main tank is less than 18,000 lbs and the center tank quantity is greater than 500 lbs for 15 minutes.
-------------------------	----------	--	---

[777F, 777-200LR, 777-300ER]

[AIMS V14 or later]

FUEL SCAVENGE SYS	Advisory		Either main tank is less than 8,200 kgs and the center tank quantity is greater than 200 kgs for 15 minutes.
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FUEL TEMP LOW	Advisory		Fuel temperature is approaching minimum.
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FUEL VALVE APU	Advisory		APU fuel valve is not in the commanded position.
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[AIMS V16 or later]

INSUFFICIENT FUEL	Advisory		FMC-estimated fuel at destination is less then entered RESERVES fuel.
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Hydraulics**Chapter 13****Table of Contents****Section TOC**

Controls and Indicators	13.10
Hydraulic Panel	13.10.1
Hydraulic System Indications	13.10.3
Status Display	13.10.3
Hydraulic Synoptic Display	13.10.4
Miscellaneous Hydraulic System Controls	13.10.5
Engine Fire Panel	13.10.5
Flight Control Hydraulic Power Switches	13.10.5
System Description	13.20
Introduction	13.20.1
Left and Right Hydraulic Systems	13.20.1
Left and Right Hydraulic System Primary Pumps	13.20.1
Left and Right Hydraulic System Demand Pumps	13.20.1
Center Hydraulic System	13.20.2
Center Hydraulic System Primary Pumps	13.20.2
Center Hydraulic System Demand Pumps	13.20.2
Center Hydraulic System Non–Normal Operation	13.20.3
Ram Air Turbine (RAT)	13.20.3
Hydraulic Systems Schematic	13.20.4
EICAS Messages	13.30
EICAS Alert Messages	13.30.1

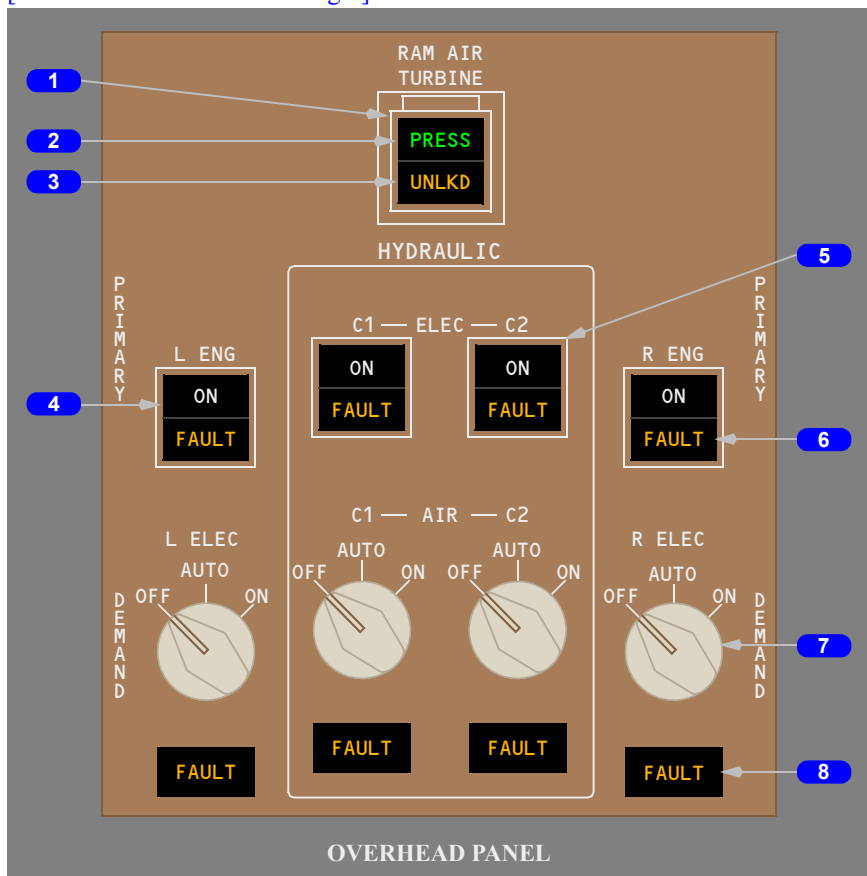
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Hydraulics Controls and Indicators

Chapter 13 Section 10

Hydraulic Panel

[777-200/-300 Series - Passenger]



1 RAM AIR TURBINE (RAT) Switch

Push – deploys the RAT.

2 Ram Air Turbine Pressure (PRESS) Light

[777-200/-300 Series - Passenger]

Illuminated (green) –

- the RAT is deployed
- center system primary flight control hydraulic pressure is greater than 1500 psi

3 Ram Air Turbine (UNLKD) Light

Illuminated (amber) – the RAT is not in the stowed position.

4 Left/Right Engine (L/R ENG) PRIMARY Pump Switches

ON – the engine–driven hydraulic pump pressurizes the related left or right hydraulic system when the engine rotates.

Off (ON not visible) – the engine–driven hydraulic pump is turned off and depressurized.

5 C1/C2 Electrical (C1/C2 ELEC) PRIMARY Pump Switches

ON –

- the electric motor–driven hydraulic pump operates
- pressurizes the center hydraulic system

Off (ON not visible) – the electric motor–driven hydraulic pump is turned off.

6 Primary Pump FAULT Lights

Illuminated (amber) –

- low primary pump pressure
- excessive primary pump fluid temperature, or
- pump selected OFF

7 DEMAND Pump Selectors

ON – the pump runs continuously.

AUTO – the pump operates when system and/or primary pump(s) pressure is low, or when control logic anticipates a large system demand.

OFF – the pump is off.

Note: If both air-driven pumps are selected to ON, only air-driven pump C1 operates. The two air-driven pumps cannot operate simultaneously when selected to ON.

8 Demand Pump FAULT Lights

Illuminated (amber) –

[777-200/-300 Series]

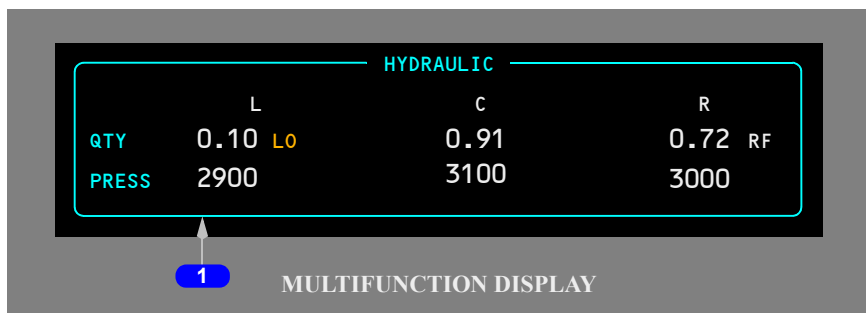
- low demand pump output pressure
- excessive demand pump fluid temperature, or
- demand pump is selected OFF

Hydraulic System Indications

[777-200/-300 Series - Passenger]

To view the status display, push the STAT display switch on the display select panel. To view the hydraulic synoptic, push the HYD synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

Status Display



1 Hydraulic Display

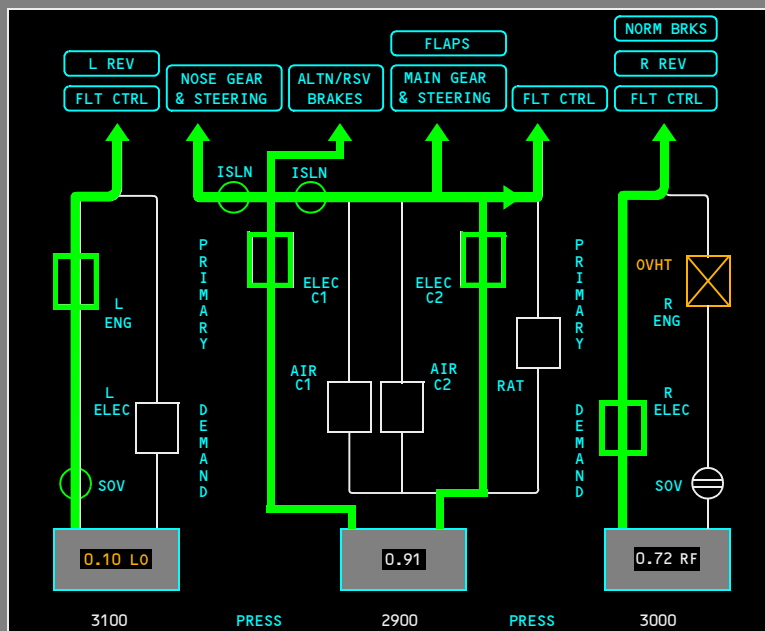
QTY –

- displays system reservoir quantity as a percentage of the normal service level (1.00 is the normal service level)
- LO (amber) – displayed when the reservoir quantity is low
- OF (white) – displayed when the reservoir is over-full (inhibited in flight)
- RF (white) – displayed when the reservoir requires refilling (inhibited in flight)

PRESS – displays hydraulic pressure in pounds per square inch of the pump with the highest pressure.

Hydraulic Synoptic Display

[777-200/-300 Series - Passenger]



MULTIFUNCTION DISPLAY

AIR – air-driven pump
ELEC – electric-driven pump
ENG – engine-driven pump
ISLN – isolation valve
LO – reservoir quantity low
OF – reservoir quantity over-full
OVHT – pump overheat indication

RAT – ram air turbine pump
RF – reservoir requires refilling
SOV – shutoff valve

Status of the hydraulic pumps, system valves and RAT are displayed as:

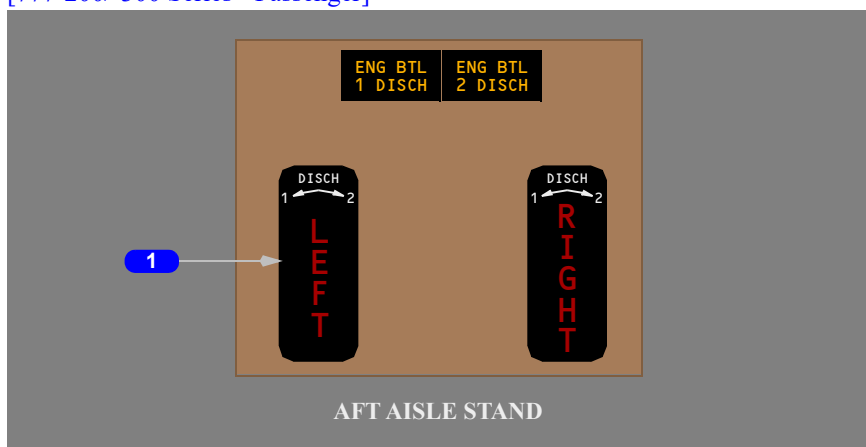
- pressurized - wide green line
- unpressurized - thin white line
- flow direction- green arrow head
- hydraulic system valves not in the commanded position-amber X in the circle
- hydraulic system valves with valve sensor data not valid - valve symbol is low intensity white

777 Flight Crew Operations Manual

- for hydraulic pumps that are commanded on and the pump pressure low-amber X in the box symbol
- for hydraulic pumps that are commanded on and the pump sensor indicates normal pressure - green flow line through the pump
- for the activated RAT and pressure low-amber X in the box
- for the activated RAT and pressure sensor data not valid - RAT symbol is low intensity white

Miscellaneous Hydraulic System Controls**Engine Fire Panel**

[777-200/-300 Series - Passenger]

**1 Engine Fire Switches**

Pull –

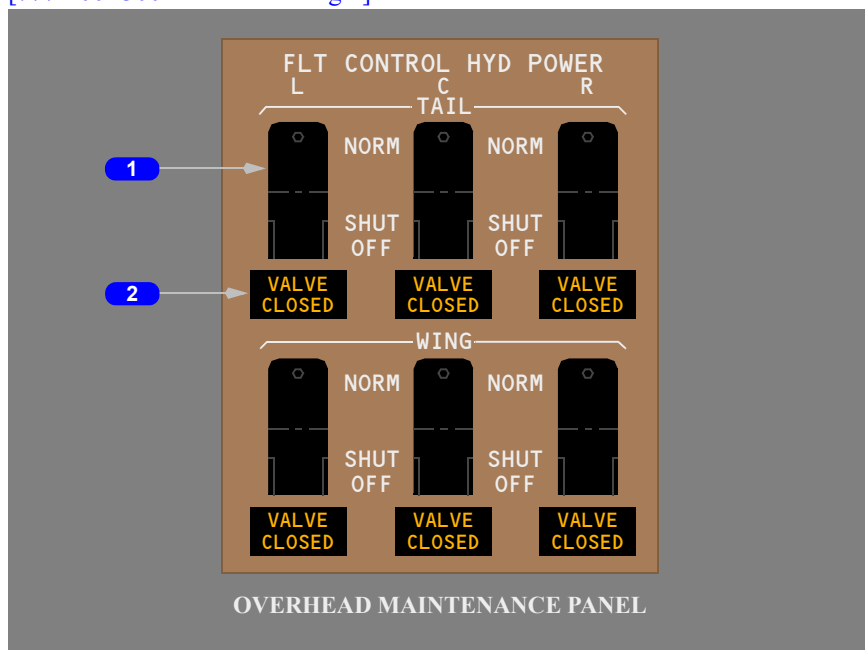
[777-200/-300 Series - Passenger]

- closes the engine-driven pump hydraulic supply shutoff valve
- depressurizes the engine-driven pump

Flight Control Hydraulic Power Switches

Note: No flight crew normal or non-normal procedures require operation of the flight control shutoff switches. These switches are for ground maintenance use only.

[777-200/-300 Series - Passenger]



1 Flight Control Hydraulic Power Shutoff Switches

NORM – hydraulic system power is available to the flight control actuators.

SHUT OFF – hydraulic system power to the flight control actuators is shut off.

Note: In flight, the center system flight control shut off valves are isolated from electrical power and cannot be closed.

2 Flight Control Hydraulic Power VALVE CLOSED Lights

Illuminated (amber) – any time the valves are not fully open.

Hydraulics System Description

Chapter 13 Section 20

Introduction

The airplane has three independent hydraulic systems: left, right, and center. The hydraulic systems power the:

- flight controls
- leading edge slats
- trailing edge flaps
- landing gear
- wheel brakes
- nose and main gear steering
- thrust reversers

Flight control system components are distributed so that any one hydraulic system can provide adequate airplane controllability.

Hydraulic fluid is supplied to each hydraulic pump from the associated system reservoir. The reservoirs are pressurized by the bleed air system.

Left and Right Hydraulic Systems

The left and right hydraulic systems are identical. They differ only in the components they power.

The left hydraulic system powers:

- flight controls
- the left engine thrust reverser

The right hydraulic system powers:

- flight controls
- normal brakes
- the right engine thrust reverser

Left and Right Hydraulic System Primary Pumps

[\[777-200/-300 Series - Passenger\]](#)

The left and right hydraulic systems each have a primary pump. The left and right primary pumps are engine-driven by the related left and right engines.

Left and Right Hydraulic System Demand Pumps

The left and right hydraulic systems each have a demand pump. The demand pumps are electric motor-driven. The demand pumps provide supplementary hydraulic power for periods of high system demand. The demand pumps also provide a backup hydraulic power source for the engine-driven primary pumps.

The pumps are controlled by the DEMAND L and R pump selectors. In the AUTO position, the L and R demand pumps operate for takeoff, landing, and when system or primary pump pressure is low. In the ON position, the demand pump runs continuously.

Center Hydraulic System

The center hydraulic system powers:

- flight controls
- leading edge slats
- trailing edge flaps
- landing gear actuation
- alternate brakes
- nose gear steering
- main gear steering

Center Hydraulic System Primary Pumps

Two electric motor-driven primary pumps are the primary hydraulic power sources for the center hydraulic system. The PRIMARY C1 and C2 pump switches control pump operation.

On the ground:

With only a single ground power source, including the APU, the C2 pump will not run if the C1 pump is selected. The pump will not be load shed if one engine generator is operating, or the following sources are operating:

- primary external power and secondary external power
or
- APU generator and primary external power

In flight:

The C2 pump may be load shed by the electrical load management system when the following conditions exist:

- all other electric pumps are running
- there is a single source of electrical power
- generator capacity is exceeded

The pump will start automatically when the conditions that shed the pump no longer exist.

Center Hydraulic System Demand Pumps

[777-200/-300 Series - Passenger]

The center hydraulic system has two air-driven demand pumps. The demand pumps provide supplementary hydraulic power for periods of high system demand. The demand pumps also provide a backup hydraulic power source for the center system electric motor-driven primary pumps.

[777-200/-300 Series - Passenger]

The pumps are controlled by the DEMAND C1 and C2 pump selectors. In the AUTO position, a demand pump operates when system and/or primary pumps pressure is low, or when system logic anticipates a large demand. In the ON position, the demand pump runs continuously. Selecting both demand pumps ON results in only pump C1 operating. Both pumps cannot operate simultaneously when ON is selected for both pumps.

Center Hydraulic System Non–Normal Operation

If center hydraulic system quantity is sensed to be low and airspeed is greater than 60 knots the:

- alternate brakes are isolated from the center system and remain operable using reserve fluid
- nose gear actuation and steering are isolated
- leading edge slats are isolated and not allowed to operate in the primary (hydraulic) mode

The leading edge slats are reconnected to the center hydraulic system and allowed to operate in primary mode when:

- center hydraulic fluid quantity recovers to normal for 5 seconds, and
- the system determines that both engines have been running for more than 30 seconds

Nose gear actuation and steering are reconnected when:

- airspeed decreases below 60 knots, or
- hydraulic pressure to the center system flight controls is low, or
- the landing gear is selected down, both engines are normal, and both engine–driven pumps are providing pressure

Ram Air Turbine (RAT)

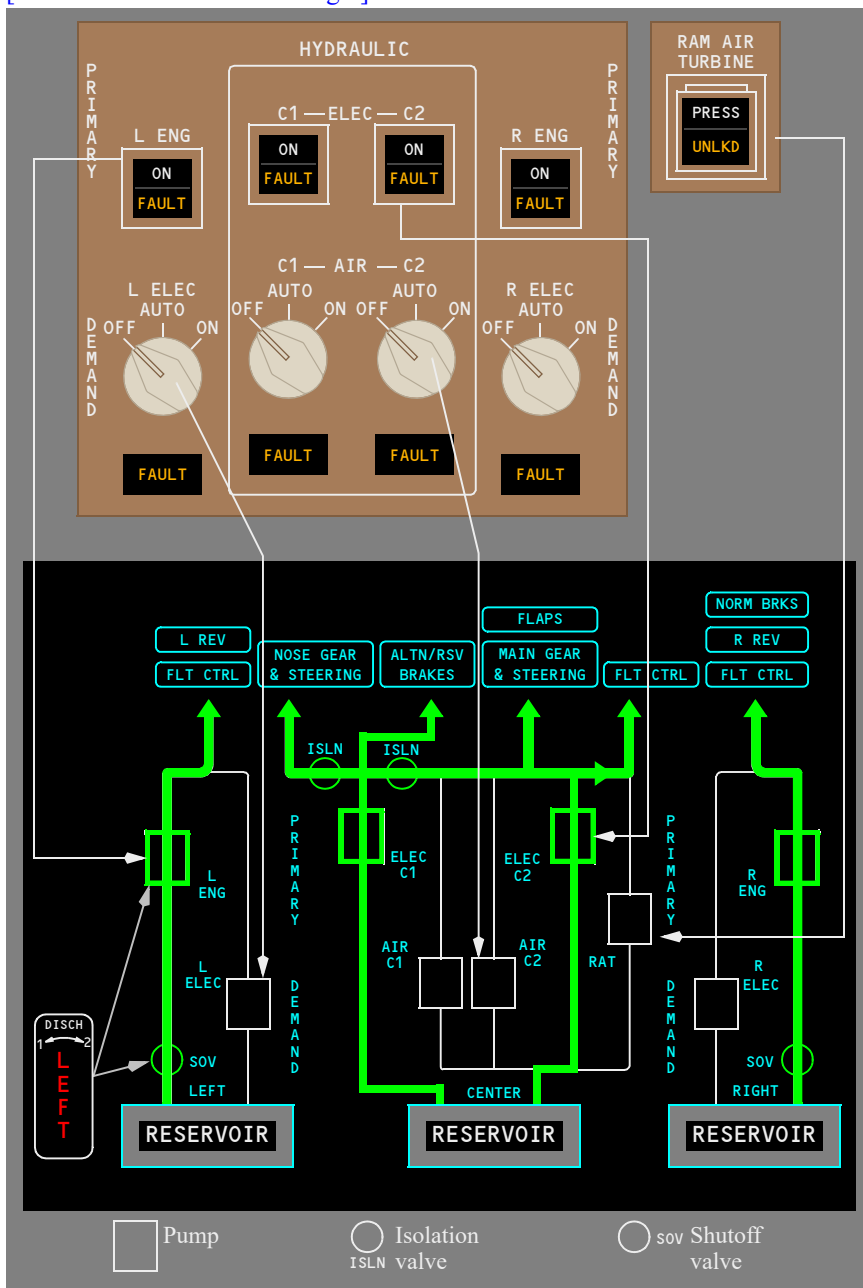
The RAT, when deployed, provides hydraulic power only to the primary flight control components connected to the center hydraulic system. The RAT provides hydraulic and electrical power throughout the flight envelope. In flight, the RAT deploys automatically if:

- both engines are failed and center system pressure is low, or
- both AC transfer busses are unpowered, or
- all three hydraulic system pressures are low

The RAT can be deployed manually by pushing the RAM AIR TURBINE switch. The hot battery or APU battery bus must be powered. The RAT is deployed by a compressed spring. Once deployed, the RAT cannot be stowed in flight.

Hydraulic Systems Schematic

[777-200/-300 Series - Passenger]



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Hydraulics
EICAS Messages**Chapter 13**
Section 30**EICAS Alert Messages**

Message	Level	Aural	Message Logic
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[\[777-200/-300 Series - Passenger\]](#)

HYD AUTO CONTROL C	Advisory		Both center demand pump AUTO functions and all center hydraulic system indications are inoperative.
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[\[777-200/-300 Series - Passenger\]](#)

HYD AUTO CONTROL L, R	Advisory		Demand pump AUTO function and all left or right system indications are inoperative.
--------------------------	----------	--	---

[\[777-200/-300 Series - Passenger\]](#)

HYD OVERHEAT DEM C1, C2, L, R	Advisory		Demand pump temperature is high.
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[\[777-200/-300 Series - Passenger\]](#)

HYD OVERHEAT PRI C1, C2, L, R	Advisory		Primary pump temperature is high.
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[\[777-200/-300 Series - Passenger\]](#)

HYD PRESS DEM C1, C2, L, R	Advisory		Demand pump output pressure is low when commanded on.
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[\[777-200/-300 Series - Passenger\]](#)

HYD PRESS PRI C1, C2	Advisory		Primary pump output pressure is low.
-------------------------	----------	--	--------------------------------------

Message	Level	Aural	Message Logic
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[777-200/-300 Series - Passenger]

HYD PRESS PRI L, R	Advisory		Primary pump output pressure is low.
-----------------------	----------	--	--------------------------------------

HYD PRESS SYS C	Caution	Beeper	Center hydraulic system pressure is low.
HYD PRESS SYS L	Caution	Beeper	Left hydraulic system pressure is low.
HYD PRESS SYS L+C	Caution	Beeper	Left and center hydraulic system pressures are low.
HYD PRESS SYS L+R	Caution	Beeper	Left and right hydraulic system pressures are low.
HYD PRESS SYS L+C+R	Caution	Beeper	All hydraulic system pressures are low.
HYD PRESS SYS R	Caution	Beeper	Right hydraulic system pressure is low.
HYD PRESS SYS R+C	Caution	Beeper	Right and center hydraulic system pressures are low.
HYD QTY LOW L, R, C	Advisory		Hydraulic quantity is low.

[AIMS BP2005 or later]
777-200/-300

HYD QTY LOW L+C	Caution	Beeper	Left and center hydraulic system quantities are low.
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HYD QTY LOW L+C+R	Caution	Beeper	All three hydraulic system quantities are low.
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[AIMS BP2005 or later]
777-200/-300

HYD QTY LOW L+C+R	Caution	Beeper	All three hydraulic system quantities are low.
----------------------	---------	--------	--

HYD QTY LOW L+R	Caution	Beeper	Left and right system quantities are low.
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777 Flight Crew Operations Manual

Message	Level	Aural	Message Logic
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[AIMS BP2005 or later
777-200/-300

HYD QTY LOW R+C	Caution	Beeper	Right and center system quantities are low.
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RAT UNLOCKED	Advisory		RAT is not stowed and locked.
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**Landing Gear
Table of Contents****Chapter 14
Section TOC**

Controls and Indicators	14.10
Landing Gear Panel	14.10.1
Nose Wheel Steering Tiller	14.10.2
Brake System	14.10.3
Rudder/Brake Pedals	14.10.3
Parking Brake Lever	14.10.4
Brake Accumulator Pressure Indicator	14.10.4
Landing Gear System Indications	14.10.5
Landing Gear Position Indications	14.10.5
Gear Synoptic Display	14.10.6
System Description	14.20
Introduction	14.20.1
Air/Ground Sensing System	14.20.1
Landing Gear Operation	14.20.1
Landing Gear Retraction	14.20.2
Landing Gear Extension	14.20.2
Landing Gear Alternate Extension	14.20.3
Semi-Lever Gear	14.20.3
Nose Wheel and Main Gear Aft Axle Steering	14.20.3
Brake System	14.20.4
Normal Brake System	14.20.4
Alternate Brake System	14.20.4
Antiskid Protection	14.20.4
Autobrake System	14.20.5
Parking Brake	14.20.7
Brake Temperature Indication	14.20.7
Tire Pressure Indication	14.20.7
Brake System Schematic	14.20.8
Tail Skid	14.20.9

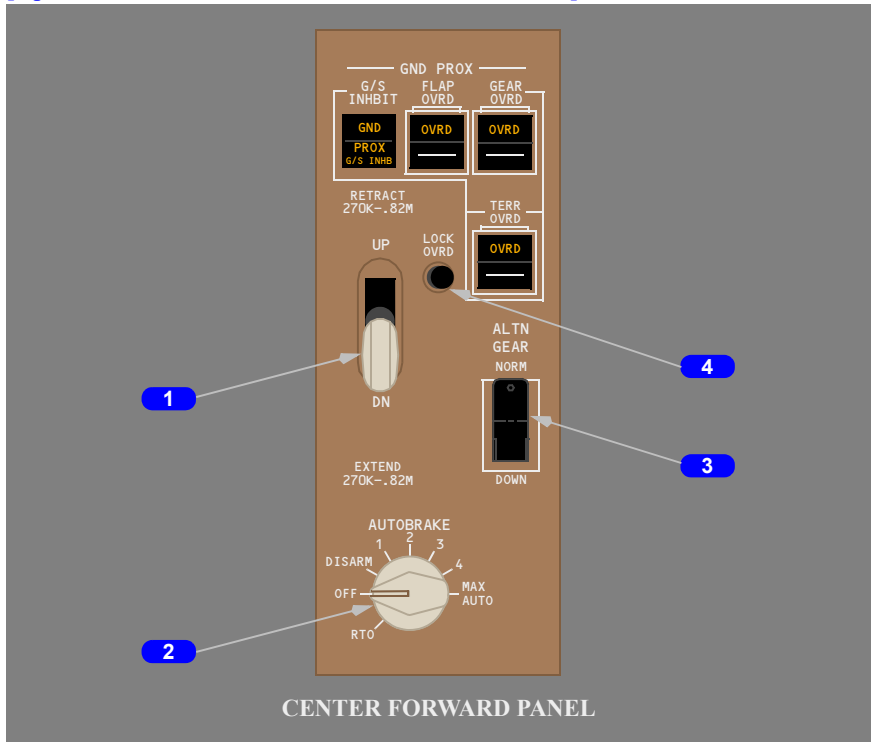
EICAS Messages	14.30
Landing Gear EICAS Messages	14.30.1
Brakes	14.30.1
Landing Gear	14.30.1
Tail Skid	14.30.2
Tires	14.30.2

Landing Gear Controls and Indicators

Chapter 14 Section 10

Landing Gear Panel

[Option - 777-200/-300 Series with enhanced GPWS]



1 Landing Gear Lever

UP – the landing gear retracts.

DN – the landing gear extends.

2 AUTOBRAKE Selector

OFF – deactivates and resets the autobrake system.

DISARM –

- disengages the autobrake system
- releases brake pressure

1, 2, 3, 4, MAX AUTO – selects the desired deceleration rate.

RTO – automatically applies maximum brake pressure when the thrust levers are retarded to idle above 85 knots.

3 Alternate Gear (ALTN GEAR) Switch

NORM – the landing gear lever operates normally.

DOWN – the landing gear extends by the alternate extension system.

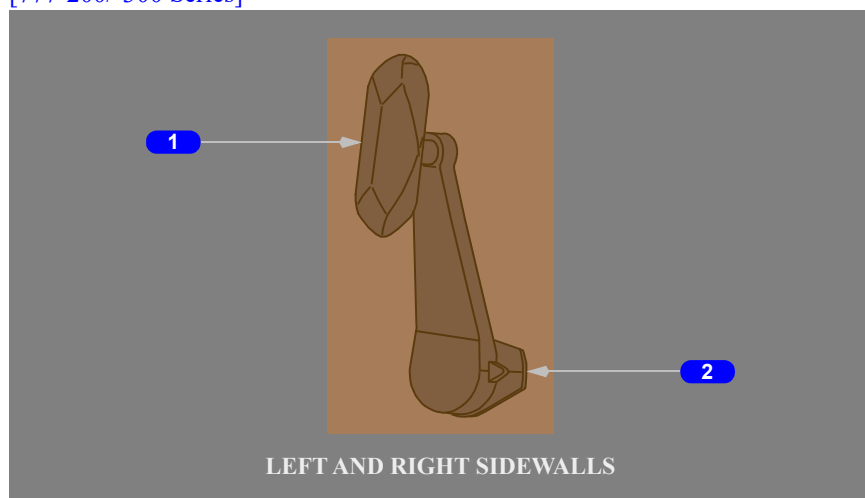
Note: Alternate extension may be selected with the landing gear lever in any position.

4 Landing Gear Lever Lock Override (LOCK OVRD) Switch

Push – releases the landing gear lever from down lock.

Nose Wheel Steering Tiller

[777-200/-300 Series]



1 Nose Wheel Steering Tiller

Rotate –

- turns the nose wheels up to 70 degrees in either direction
- overrides rudder pedal steering
- main gear aft axle steering is slaved to nose wheel steering

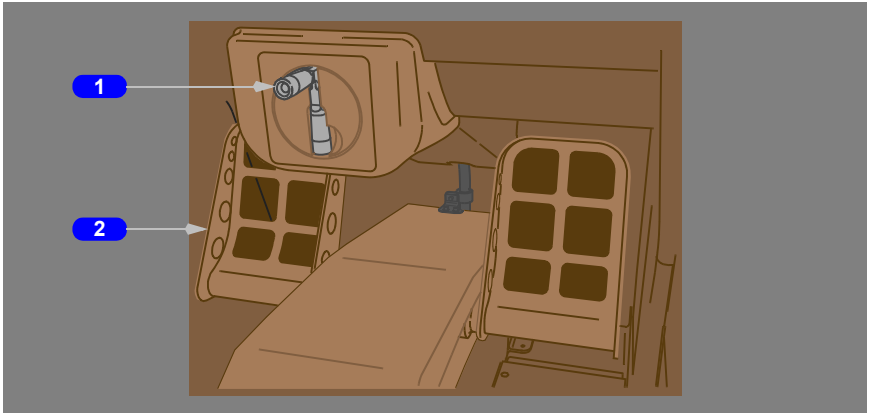
2 Tiller Position Indicator

Shows tiller displacement from the straight-ahead, neutral position.

Brake System

Rudder/Brake Pedals

[777-200/-300 Series]



1 Rudder Pedal Adjust Crank

Adjusts the rudder pedals forward or aft.

Note: To avoid inadvertent rudder pedal movement, the crank handle should be stowed when not in use.

2 Rudder/Brake Pedals

Push the full pedal –

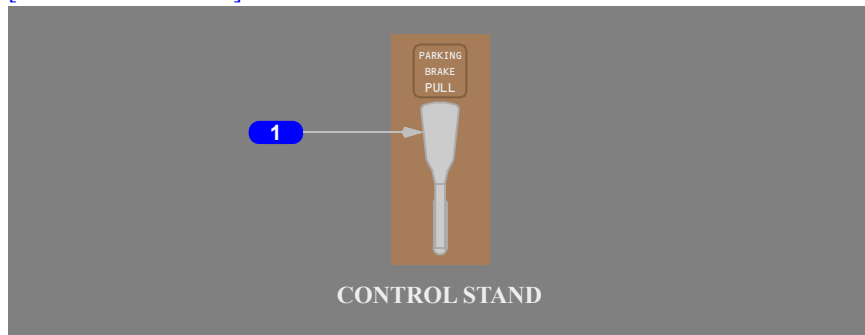
- turns the nose wheel up to 7 degrees in either direction
- does not activate main gear steering

Push the top of the pedals – actuates the wheel brakes.

Refer to Chapter 9, Flight Controls for the description of rudder operation.

Parking Brake Lever

[777-200/-300 Series]



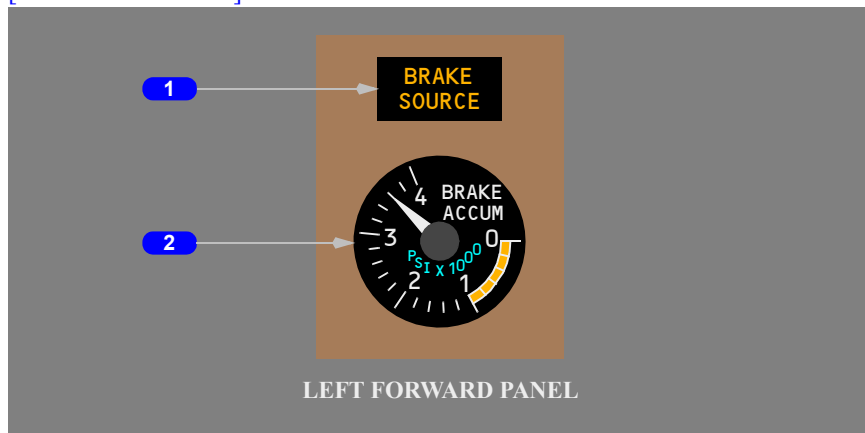
1 Parking Brake Lever

Pull – sets the parking brake when both brake pedals are simultaneously depressed.

Release – simultaneously depress both brake pedals.

Brake Accumulator Pressure Indicator

[777-200/-300 Series]



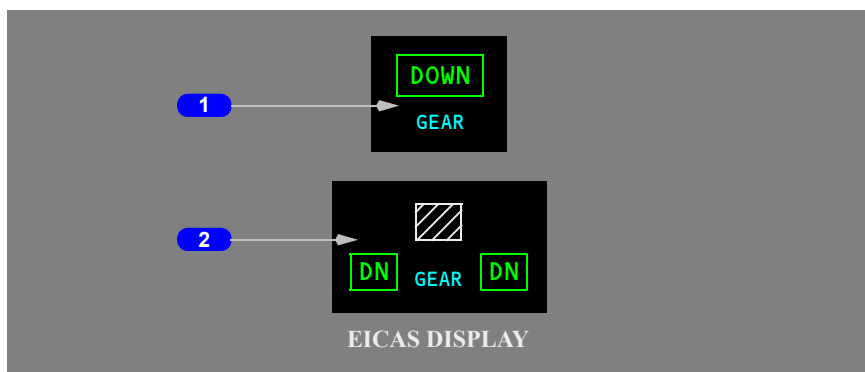
1 BRAKE SOURCE Light

Illuminated (amber) – both active brake hydraulic sources (right and center/reserve hydraulic systems) have low pressure.

2 BRAKE Accumulator (ACCUM) Pressure Indicator

Indicates brake accumulator pressure.

Amber Band - brake accumulator pressure is low.

Landing Gear System Indications**Landing Gear Position Indications****1 GEAR Position Indication (Normal Display)**

DOWN (green) – all landing gear are down and locked.

Crosshatched (white) – one or more landing gear are in transit.

UP (white) – all landing gear are up and locked (blanks after 10 seconds).

Empty box (white) – all landing gear position indicators are inoperative.

2 Expanded GEAR Position Indication (Non-Normal Display)

DN (green) – the associated landing gear is down and locked.

Crosshatched (white) – the associated landing gear is in transit.

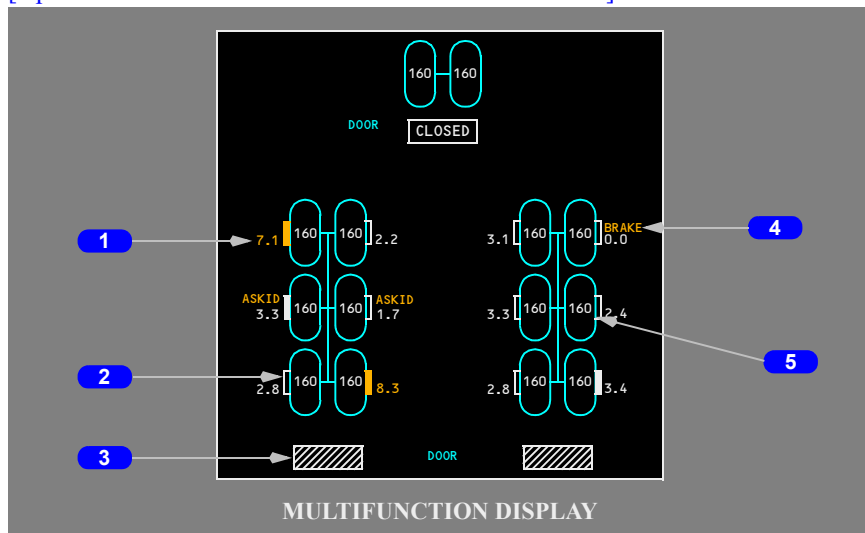
UP (white) – the associated landing gear is up and locked.

Empty box(es) (white) – the associated landing gear position indicators are inoperative.

Gear Synoptic Display

The landing gear synoptic is displayed by pushing the GEAR synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

[Option – 777-200/-300 Series -Tire Pressure Indication]



1 Brake Temperature

Indicates a relative value of wheel brake temperature:

- values range from 0.0 to 9.9
- white – normal range
- amber – high range

2 Brake Symbol

Blank box indicates any brake less than 3.0.

Solid white box indicates hottest brake on each main gear within range of 3.0 to 4.9.

Solid amber box indicates brake overheat condition on each wheel within range of 5.0 to 9.9.

3 Gear Door Status

Crosshatched – the door is not closed.

CLOSED (white) – the door is closed.

Empty box(es) (white) – the associated landing gear door position indicators are inoperative.

4 Fault Indication (amber)

BRAKE – indicates brake deactivation on the associated wheel.

ASKID – indicates antiskid fault on the associated wheel.

[Option – 777-200/-300 Series -Tire Pressure Indication]

5 Tire Pressure Indication

Displays individual tire pressures:

- white – normal range
- amber – abnormal high or low range

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**Landing Gear
System Description****Chapter 14
Section 20****Introduction**

The airplane has two main landing gear and a single nose gear. The nose gear is a conventional steerable two-wheel unit. Each main gear has six wheels in tandem pairs. To improve turning radius, the aft axle of each main gear is steerable.

[777-200/-300 Series]

Hydraulic power for retraction, extension, and steering is supplied by the center hydraulic system. An alternate extension system is also provided.

[Option – 777-200/-300 Series - Synoptic Tire Pressure Indication]

The normal brake system is powered by the right hydraulic system. The alternate brake system is powered by the center/reserve hydraulic system. Antiskid protection is provided with both systems, but the autobrake system is available only through the normal system. A brake temperature monitor system and tire pressure indication system displays each brake temperature and tire pressure on the GEAR synoptic display.

Air/Ground Sensing System

In-flight and ground operation of various airplane systems are controlled by the air/ground sensing system.

The system receives air/ground logic signals from sensors located on each main landing gear beam. These signals are used to configure the airplane systems to the appropriate air or ground status.

Landing Gear Operation

The landing gear are normally controlled by the landing gear lever. On the ground, the lever is held in the DN position by an automatic lever lock. The lever lock can be manually overridden by pushing and holding the landing gear lever LOCK OVERRIDE switch. In flight, the lever lock is automatically released through air/ground sensing.

Landing Gear Retraction

When the landing gear lever is moved to UP, the landing gear begins to retract. The landing gear doors open and the main gear wheels tilt to the retract position. The EICAS landing gear position indication display changes from a green DOWN indication to a white crosshatch in-transit indication as the landing gear retract into the wheel wells. After retraction, the landing gear are held up by uplocks. The EICAS landing gear position indication changes to UP for 10 seconds and then blanks. With the landing gear retracted and all doors closed, the landing gear hydraulic system is automatically depressurized.

If any gear is not up and locked up after the normal transit time, the EICAS caution message GEAR DISAGREE is displayed. The EICAS gear position indication changes to the expanded non-normal format, with the affected gear displayed as in-transit or down, if the gear never unlocked from the down position. The EICAS advisory message GEAR DOOR is displayed if any hydraulically actuated door is not closed after normal transit time.

Landing Gear Extension

When the landing gear lever is moved to DN, the landing gear doors open, the gear are unlocked, and the in-transit indication is displayed on the EICAS landing gear position indication.

The gear free-fall without hydraulic power to the down and locked position. The downlocks are powered to the locked position, all hydraulically actuated gear doors close, and the main gear trucks hydraulically tilt to the flight position. When all gear are down and locked, the EICAS gear position indication displays DOWN.

The EICAS caution message GEAR DISAGREE is displayed if any gear is not locked down (side and drag brace on the same main gear not locked, or nose gear drag brace not locked) after the normal transit time. The EICAS gear position indication changes to the expanded non-normal format, with the affected gear displayed as in transit (or UP if the gear never unlocked from the up position).

If only one brace on a main gear is locked (either drag or side brace not locked) after the normal transit time, the EICAS caution message MAIN GEAR BRACE L or R is displayed for the affected gear. The EICAS gear position indication changes to the expanded non-normal format, with the affected gear displayed as in transit. The EICAS advisory message GEAR DOOR displays if any hydraulically actuated door is not closed after the normal transit time.

Landing Gear Alternate Extension

The alternate landing gear extension system uses a dedicated DC powered electric hydraulic pump and center hydraulic system fluid to extend the landing gear. Selecting DOWN on the ALTERNATE GEAR switch releases all door and gear uplocks. The landing gear free-fall to the down and locked position. The landing gear lever position has no effect on landing gear alternate extension.

The EICAS landing gear position indication displays the expanded gear position indication when the alternate extension system is used. During alternate extension, the EICAS message GEAR DOOR is displayed because all the hydraulically powered gear doors remain open.

Following an alternate extension, the landing gear can be retracted and gear doors closed by the normal system, if it is operating. Select DN then UP to retract the landing gear using the normal system.

Semi-Lever Gear

[777-300ER]

The Semi-Lever Gear (SLG) consists of an additional hydraulic actuator that connects the forward end of each main gear truck to the shock strut. During takeoff, the actuator locks to restrict rotation of the main gear truck and allow takeoff rotation about the aft wheel axle, thereby improving airplane performance capability. During landing, the SLG hydraulic struts act as dampers to reduce the landing loads on the MLG and aircraft structure.

Nose Wheel and Main Gear Aft Axle Steering

The airplane is equipped with nose wheel steering and main gear aft axle steering. Nose wheel steering is powered by the center/reserve hydraulic system. Main gear aft axle steering is powered by the center hydraulic system.

Primary steering control is provided by a nose wheel steering tiller for each pilot. Limited steering control is available through the rudder pedals. The tillers can turn the nose wheels up to 70 degrees in either direction. A pointer on the tiller assembly shows tiller position relative to the neutral setting. The rudder pedals can be used to turn the nose wheels up to 7 degrees in either direction. Tiller inputs override rudder pedal inputs.

Main gear aft axle steering is automatically enabled when the nose gear steering angle exceeds 13 degrees. The main gear aft axles turn proportionally in the opposite direction to reduce turn radius and tire scrubbing.

The EICAS warning message CONFIG GEAR STEERING, accompanied by the takeoff configuration aural alert, is displayed if the main gear aft axles are not centered and locked when takeoff thrust is applied. The EICAS advisory message MAIN GEAR STEERING is displayed if the main gear steering actuators are not locked in the centered position when commanded to the center position.

Brake System

The airplane has two brake systems: normal and alternate. Each main gear wheel has a multiple disc carbon brake operated by either system. The nose wheels have no brakes.

The brake systems use the right and center/reserve hydraulic systems. The EICAS advisory message BRAKE SOURCE displays and the BRAKE SOURCE light illuminates if both the right and center/reserve hydraulic system pressures are low.

Normal Brake System

The normal brake system is powered by the right hydraulic system. The brake pedals provide independent control of the left and right brakes.

Brake Accumulator

The brake accumulator is located in the normal brake system. The brake accumulator extends parking brake holding time, stabilizes normal brake hydraulic system pressure during initial application and antiskid cycling, and supplies hydraulic pressure for several braking applications or parking brake application if right and center hydraulic systems are lost.

The brake accumulator is pressurized by the right hydraulic system. Accumulator pressure is shown on the Brake Accumulator Pressure indicator.

Alternate Brake System

Alternate brake system selection is automatic. If the right hydraulic system pressure is low, the center hydraulic system automatically supplies pressure to the alternate brake system.

Reserve Brakes and Steering

The fluid below the standpipe in the center hydraulic reservoir is used by the primary C1 pump as a reserve hydraulic source to power the alternate brakes and nose wheel steering.

Antiskid Protection

Antiskid protection is provided in the normal and alternate brake systems. Antiskid protection is also provided when the brake system is being supplied pressure only from the brake accumulator.

The normal brake system provides each main gear wheel with individual antiskid protection. When a wheel speed sensor detects a skid, the associated antiskid valve reduces brake pressure until skidding stops.

The alternate brake system provides antiskid protection to tandem wheel pairs for the forward and middle axle wheels. The aft axle wheels remain individually controlled.

Touchdown and hydroplaning protection is provided using airplane inertial ground speed. Locked wheel protection is provided using a comparison with other wheel speeds.

The EICAS advisory message ANTISKID is displayed if an antiskid fault affecting the brake system in use is detected, the parking brake valve is not fully open with the parking brake released, or the system is completely inoperative.

Autobrake System

The autobrake system provides automatic braking at preselected deceleration rates for landing and full pressure for rejected takeoff. The system operates only when the normal brake system is functioning. Antiskid system protection is provided during autobrake operation.

EICAS memo messages display the selected autobrake settings:

- AUTOBRAKE 1 through 4
- AUTOBRAKE MAX
- AUTOBRAKE RTO

The EICAS advisory message AUTOBRAKE is displayed if the autobrake system is disarmed or inoperative, or autobrake solenoid valve pressure is high when not commanded on.

Rejected Takeoff

Selecting RTO (rejected takeoff) prior to takeoff arms the autobrake system. The RTO mode can be selected only on the ground. The RTO autobrake setting commands maximum braking pressure if:

- the airplane is on the ground
- groundspeed is above 85 knots, and
- both thrust levers are retarded to idle

Maximum braking is obtained in this mode. If an RTO is initiated below 85 knots, the RTO autobrake function does not operate.

Taxi Brake Release

During each taxi brake application, the antiskid system releases the brakes of one axle pair of each main landing gear (if wheel speeds are less than 45 knots). The system sequences through the axle pairs at each brake application, thereby reducing the number of brake applications by each brake. This extends service life and reduces brake sensitivity during taxi.

All active brakes are applied for a heavy brake application, landing rollout, RTO, or when setting the parking brake.

The taxi brake release system operates only with the normal brake system.

Landing

Five 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 thrust levers are retarded to idle, and
- the wheels have spun up.

Autobrake application occurs slightly after main gear touchdown. If MAX AUTO is selected, deceleration is limited to the AUTOBRAKE 4 level until pitch angle is less than one degree, then deceleration is increased to the MAX AUTO level. The deceleration level can be changed (without disarming the system) by rotating the selector.

To maintain the selected airplane deceleration rate, autobrake pressure is reduced as other controls, such as thrust reversers and spoilers, contribute to total deceleration. The system provides braking to a complete stop or until it is disarmed.

Autobrake – Disarm

The autobrake system disarms and the EICAS advisory message AUTOBRAKE is displayed if any of the following occur:

- pedal braking applied
- either thrust lever advanced after landing
- speedbrake lever is moved to the DOWN detent after the speedbrakes have deployed on the ground
- DISARM or OFF position selected on the AUTOBRAKE selector
- autobrake fault
- normal antiskid system fault
- loss of inertial data from the ADIRU
- the autobrake is applied after loss of normal brake hydraulic pressure

When the autobrake system disarms after landing, the AUTOBRAKE selector automatically moves to the DISARM position, and removes power from the autobrake system.

When the autobrake system disarms during takeoff, the AUTOBRAKE selector remains in the RTO position, but automatically moves to OFF after takeoff.

Parking Brake

The parking brake can be set with the normal or alternate brake system pressurized. If the normal and alternate brake systems are not pressurized, parking brake pressure is maintained by the brake accumulator.

The parking brake is set by fully depressing both brake pedals, pulling the parking brake lever up, then releasing the pedals. 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.

When the parking brake is set, the EICAS memo message PARKING BRAKE SET is displayed. If the parking brake is set and either engine is set to takeoff thrust, the takeoff configuration aural alert sounds and the EICAS warning message CONFIG PARKING BRAKE is displayed.

Brake Temperature Indication

Wheel brake temperatures are displayed on the GEAR synoptic display.

Numerical values related to wheel brake temperature are displayed adjacent to each wheel/brake symbol. These values range from 0.0 to 9.9 in increments of 0.1. The values tend to increase after the brakes are used.

Normal range values of 0 to 4.9 are white. For values of 3.0 to 4.9, the brake symbol for the hottest brake becomes solid white. Values of 5.0 and above are amber. For values of 5.0 and above, the EICAS advisory message BRAKE TEMP is displayed.

Tire Pressure Indication

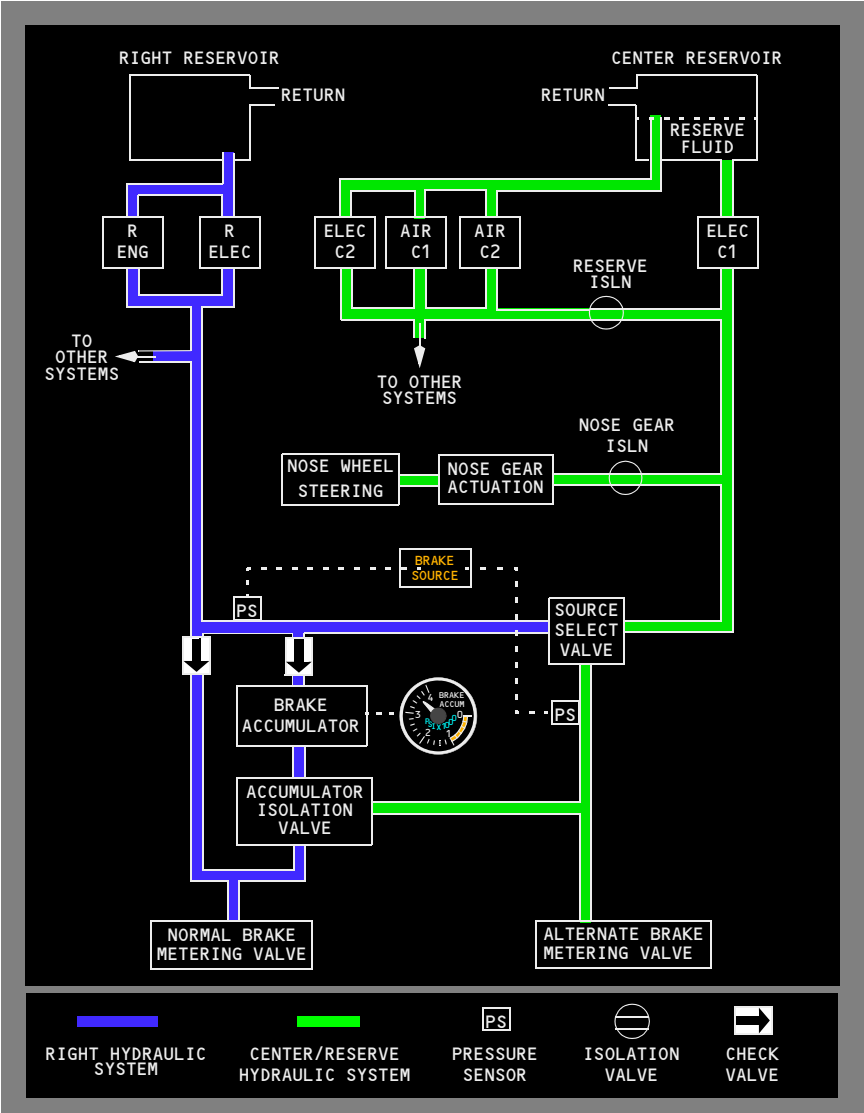
[\[Option - 777-200/-300 Series - Tire Pressure\]](#)

Individual tire pressures, from 0 to 400 PSI, are displayed inside the individual wheel symbols on the GEAR synoptic display.

The EICAS advisory message TIRE PRESS is displayed if any tire pressure is above or below the normal range, or there is an excessive pressure difference between two tires on the same axle.

Brake System Schematic

[777-200/-300 Series]



Tail Skid

[\[777-300 and 777-300ER with tail skid installed\]](#)

The airplane is equipped with a tail skid system. The tail skid extends for takeoff and landing and retracts during flight. It helps protect the pressurized part of the airplane from contact with the runway. The tail skid uses the main landing gear actuation system.

The EICAS advisory message TAIL SKID is displayed when the tail skid is not in the correct position.

Intentionally
Blank

**Landing Gear
EICAS Messages****Chapter 14
Section 30****Landing Gear EICAS Messages**

The following EICAS messages can be displayed.

Note: Configuration warning messages are covered in Chapter 15, Warning Systems.

Brakes

Message	Level	Aural	Message Logic
ANTISKID	Advisory		A fault is detected in the antiskid system.
AUTOBRAKE	Advisory		Autobrake is disarmed or inoperative.
AUTOBRAKE 1, 2, 3, 4, MAX, RTO	Memo		Indicates selected autobrake level.
BRAKE SOURCE	Advisory		Normal and alternate brake system pressures are low, and reserve hydraulic source for alternate brake system is low.
BRAKE TEMP	Advisory		Temperature of one or more brakes is excessive.
PARKING BRAKE SET	Memo		The parking brake lever is up and the parking brake valve is closed

[777-200/-300]

RESERVE BRAKES/STRG	Advisory		Alternate brakes from the reserve hydraulic source, normal nose gear extension, or nose wheel steering may not be available.
------------------------	----------	--	--

Landing Gear

Message	Level	Aural	Message Logic
GEAR DISAGREE	Caution	Beeper	Gear position disagrees with landing gear lever position.
GEAR DOOR	Advisory		One or more gear doors are not closed.

Message	Level	Aural	Message Logic
MAIN GEAR BRACE L, R	Caution	Beeper	Affected main gear is down with one brace unlocked.
MAIN GEAR STEERING	Advisory		Main gear steering is unlocked when centered.

Tail Skid

[777-300/300ER with tail skid installed; @ Line # 1163, 300ERs no longer have tailskid]

Message	Level	Aural	Message Logic
TAIL SKID	Advisory		Tail skid position disagrees with landing gear lever position.

Tires

[Option - 777-200/-300 Series]

Message	Level	Aural	Message Logic
TIRE PRESS	Advisory		One or more tire pressures are not normal.

Warning Systems**Chapter 15****Table of Contents****Section TOC**

Controls and Indicators	15.10
Engine Indication and Crew Alerting System (EICAS).....	15.10.1
EICAS Messages	15.10.1
EICAS Event Record Switch.....	15.10.3
Display Select Panel (DSP)	15.10.3
Status Display Switch.....	15.10.4
Alerts on PFD.....	15.10.6
Master WARNING/CAUTION Reset Switches and Lights	15.10.6
Traffic Alert and Collision Avoidance System (TCAS)	15.10.7
TCAS Controls (Tuning and Control Panel)	15.10.7
TCAS Controls (Transponder Panel)	15.10.7
TCAS Controls (EFIS Control Panel)	15.10.10
TCAS Traffic and TCAS Alert Message TRAFFIC Display	15.10.11
TCAS Traffic and Alert Message TRAFFIC Display	15.10.11
TCAS PFD Vertical Guidance	15.10.13
Ground Proximity Warning System (GPWS) Controls.....	15.10.14
RAAS Runway Override Control.....	15.10.14
Ground Proximity Panel	15.10.15
Radio Altitude/Barometric Altitude Control	15.10.17
GPWS Look-Ahead Terrain Alerting Display and Annunciations	15.10.18
Predictive Windshear (PWS) Display and Annunciations	15.10.22
System Description	15.20
Introduction	15.20.1
Engine Indication and Crew Alerting System (EICAS).....	15.20.1
Crew Alerting and EICAS Message Design Philosophy	15.20.1

EICAS Messages	15.20.2
Aurals, Master WARNING/CAUTION Switches and Lights, and GND PROX Light	15.20.4
Flight Deck Panel Annunciator Lights	15.20.10
Airspeed Voice Annunciations and Alerts	15.20.11
Takeoff V1 Airspeed	15.20.11
Stall Warning	15.20.11
Airspeed Low	15.20.11
Overspeed Warning	15.20.11
Tail Strike Detection System	15.20.11
Takeoff And Landing Configuration Warning System	15.20.11
Takeoff Configuration Warnings	15.20.11
Landing Configuration Warning	15.20.12
Speedbrake Lever Extend Beyond ARM During Climb.	15.20.12
Configuration Warning System Non-normal Operation	15.20.12
MCP Selected Altitude Alert	15.20.13
Approaching MCP Selected Altitude	15.20.13
Departing MCP Selected Altitude	15.20.13
Departing MCP Selected Altitude Alert Inhibits	15.20.13
Crew Alertness Monitor	15.20.13
Traffic Alert and Collision Avoidance System (TCAS).	15.20.14
Resolution Advisories (RA) and Display	15.20.14
Traffic Advisories (TA) and Display	15.20.15
Proximate Traffic Display	15.20.15
Other Traffic Display	15.20.16
TCAS PFD Vertical Guidance	15.20.16
TCAS ND Messages	15.20.16
TCAS Voice Annunciations	15.20.18
TCAS Normal Operation	15.20.21
TCAS Non-Normal Operation	15.20.21

Ground Proximity Warning System (GPWS) and Predictive Windshear (PWS)	15.20.21
Introduction	15.20.21
Runway Awareness and Advisory System (RAAS).....	15.20.22
Look-ahead Obstacles and Peaks Terrain Alerting System	15.20.26
Predictive Wind Shear (PWS) and Immediate Windshear Alerting Systems	15.20.28
Bank Angle Voice Annunciations	15.20.32
Immediate Alerting System	15.20.32
Altitude Voice Annunciations During Approach.....	15.20.33
GPWS Non-Normal Operation.....	15.20.34
Alert Inhibits	15.20.35
Alert Messages Inhibited During Normal System Operation	15.20.35
Alert Messages Inhibited By Other Alert Messages	15.20.35
Voice Annunciation Inhibits.....	15.20.35
ND Display Alert Inhibits and Automatic Display	15.20.35
Alerts Inhibited Before Engine Start and After Shutdown	15.20.37
Alerts Inhibited During Engine Start	15.20.38
Alerts Inhibited During Takeoff.....	15.20.39
Alerts Inhibited During Landing	15.20.43
EICAS Event Record.....	15.20.45
EICAS Messages.....	15.30
EICAS Alert Messages	15.30.1
EICAS Memo Messages	15.30.3

Intentionally
Blank

Warning Systems

Controls and Indicators

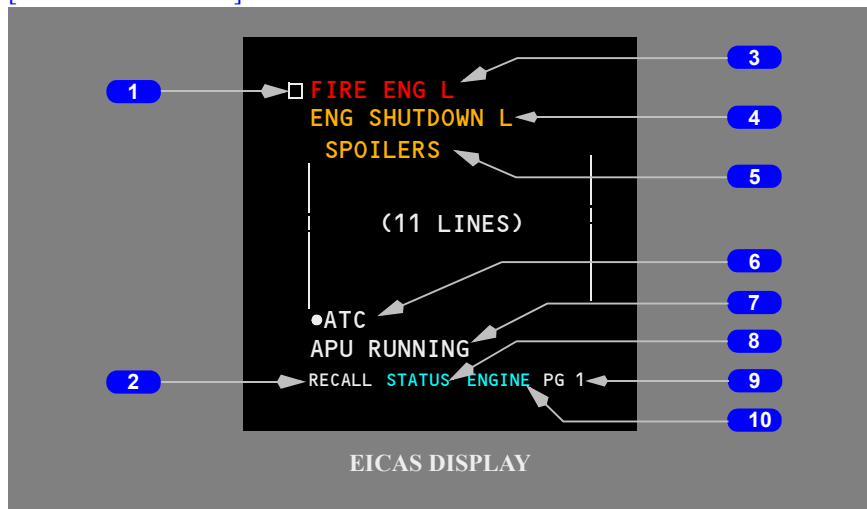
Chapter 15

Section 10

Engine Indication and Crew Alerting System (EICAS)

EICAS Messages

[777-200/-300 Series]



1 Checklist Icon

Displayed (white) –

- when checklist with procedural steps, notes, or other information of which the crew must be made aware exists for respective message
- no longer displayed when checklist complete

[AIMS Software Upgrade 5]

- no longer displayed when inhibited by checklist of another message

2 RECALL Indication

Displayed (white) –

- when CANC/RCL switch pushed
- remains displayed for one second after switch released

3 Warning Messages

Displayed (red) –

- highest priority alert messages
- red alert messages remain displayed and cannot be canceled by pushing the CANC/RCL switch.

4 Caution Messages

Displayed (amber) –

- next highest priority alert messages after warning messages
- amber alert messages can be canceled or recalled by pushing the CANC/RCL switch

5 Advisory Messages

Displayed (amber) –

- lowest priority alert messages; indented one space
- amber alert messages can be canceled or recalled by pushing the CANC/RCL switch

6 Communication Messages

Displayed (white) –

- prefaced with white dot
- COMM low messages indented one space
- cannot be canceled by pushing the CANC/RCL switch

7 Memo Messages

Displayed (white) –

- reminder of selected state of controls or systems
- cannot be canceled by pushing the CANC/RCL switch
- EICAS alert messages have display priority over memo messages; some or all memo messages not displayed on current EICAS message page if insufficient message lines are available below alert messages

8 STATUS Cue

Displayed (cyan) –

- new status message exists
- no longer displayed when status display selected

[Option - first engine start until 30 minutes after lift-off]

- inhibited from beginning of first engine start until 30 minutes after lift-off

9 Page (PG) Number

Displayed (white) –

- more than one page of alert or memo messages exists
- indicates number of page selected

[777-200/-300 Series]

10 ENGINE Exceedance Cue

Displayed (cyan) –

- engine parameter on secondary engine display is exceeded
- displayed until displayed parameter returns to normal operating range

EICAS Event Record Switch

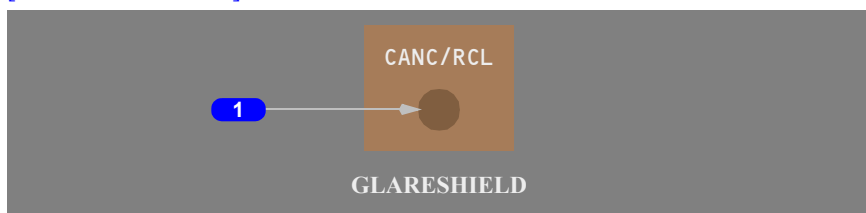
[777-200/-300 Series]

**1 EICAS EVENT Record (RCD) Switch**

Push – records up to five EICAS events into memory.

Display Select Panel (DSP)

[777-200/-300 Series]

**1 Cancel/Recall (CANC/RCL) Switch**

Push (when EICAS caution or advisory messages displayed) –

- displays the next page of EICAS messages when additional pages exist
- cancels caution and advisory messages when last page displayed; warning, memo, and communications messages remain displayed
- cancels red box for any engine parameter previously exceeded when displayed parameter no longer exceeds the limit

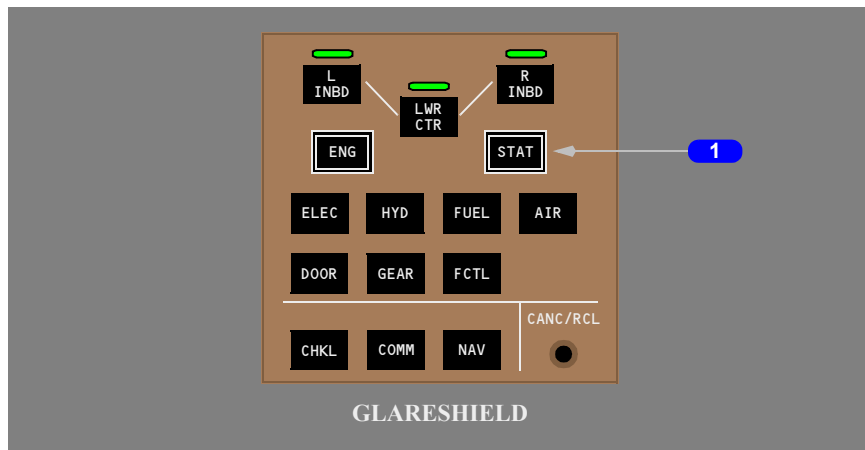
Boeing Proprietary. Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details.

Push (when no EICAS caution or advisory messages displayed) –

- redispays all caution and advisory EICAS messages, when non-normal condition exists
- displays first page of messages when multiple pages exist
- redispays red box for parameters previously exceeded

Status Display Switch

[777-200/-300 Series]

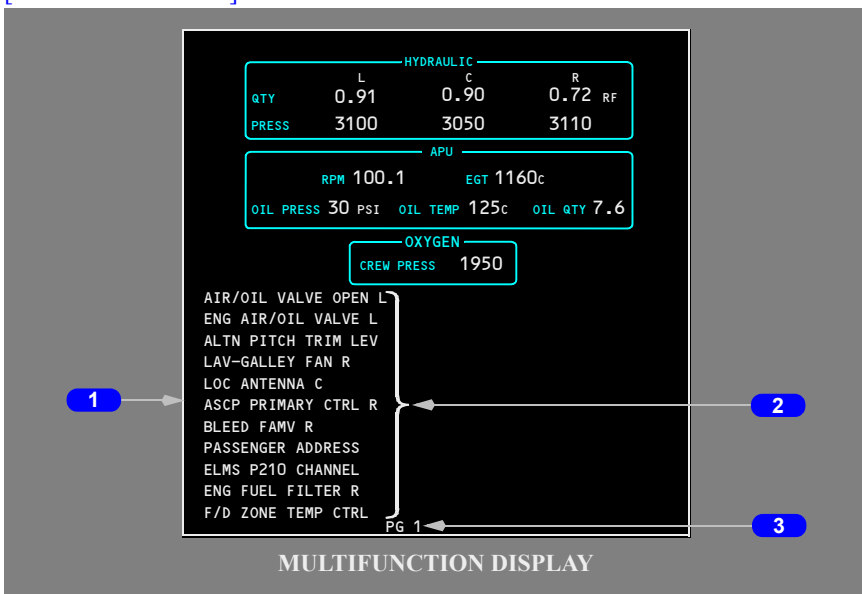


1 Status (STAT) Display Switch

Push – displays status display on selected MFD.

Subsequent pushes –

- displays next page of status messages when additional pages exist
- lower center MFD blanks when last page of status messages displayed
- inboard MFDs return to NAV display after last page of status messages displayed

777 Flight Crew Operations Manual[\[777-200/-300 Series\]](#)**1 Status Display**

Displays hydraulic, APU, and oxygen system indications and status messages.

2 Status Messages

Status messages indicate equipment faults requiring MEL reference for dispatch.

3 Page (PG) Number

Displayed –

- additional pages of status messages exist
- displays number of page selected

Alerts on PFD

[777-200/-300 Series]



[777-200/-300 Series]

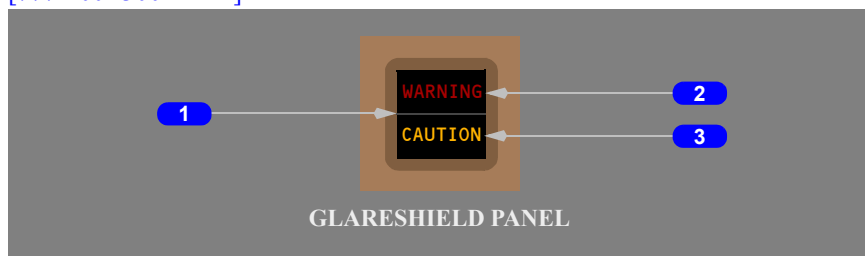
1 Alert

The following crew alert messages are displayed in red:

- ENG FAIL
- PULL UP
- WINDSHEAR

Master WARNING/CAUTION Reset Switches and Lights

[777-200/-300 Series]



1 Master WARNING/CAUTION Reset Switch

Push –

- extinguishes master WARNING lights
- extinguishes master CAUTION lights
- silences the aural that accompanies the EICAS warning messages:
 - CABIN ALTITUDE
 - CONFIG GEAR, if displayed because landing gear not down and locked, any thrust lever below thrust required for level flight, and radio altitude less than 800 feet
 - FIRE

[777-200/-300 Series - Option]

- PILOT RESPONSE (as configured by the airline)
- STABILIZER

2 Master WARNING Light

Illuminated (red) –

- new EICAS warning message displayed, or
- ENGINE FAIL, PULL UP, or WINDSHEAR alert displayed on PFD

3 Master CAUTION Light

Illuminated (amber) – new EICAS caution message displayed

Traffic Alert and Collision Avoidance System (TCAS) TCAS Controls (Tuning and Control Panel)

TCAS Controls (Transponder Panel)

[777-200/-300 Series - Options – Bendix 071-01503-2901]



1 Transponder Mode Selector

TA ONLY (traffic advisory) –

- transponder and TCAS TA modes enabled
- all aircraft that would have been predicted as a RA are predicted as a TA

TA/RA (traffic advisory/resolution advisory) – transponder and TCAS TA and RA modes enable.

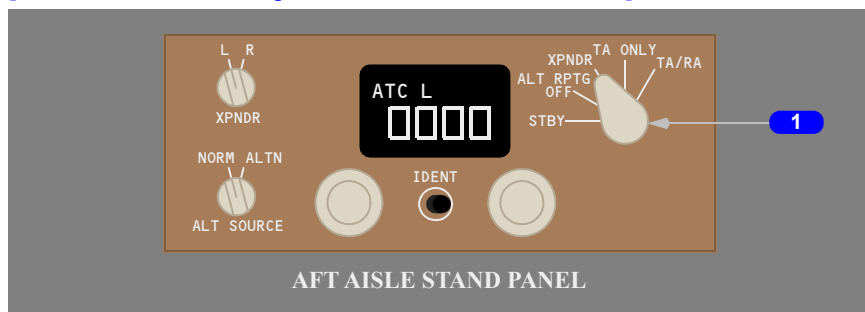
2 TCAS Airspace Switch

ABOVE – altitude reporting traffic from 2,700 feet below to 9,000 feet above current altitude displayed.

NORM (normal) – altitude reporting traffic from 2,700 feet below to 2,700 feet above current altitude displayed.

BELOW – altitude reporting traffic 9,000 feet below to 2,700 feet above current altitude displayed.

[777-200/-300 Series - Options – Gables G7131-01 & -02]



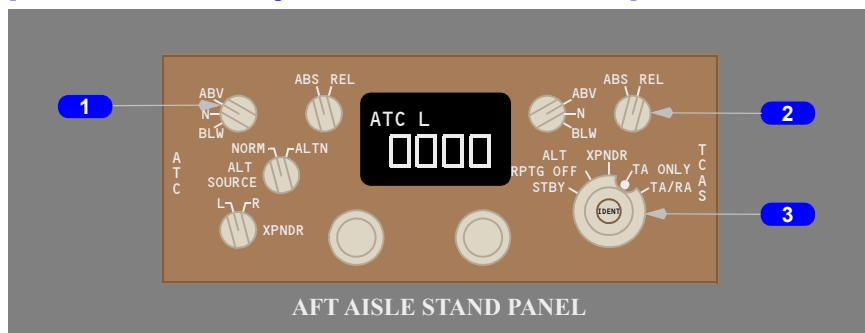
1 Transponder Mode Selector

TA ONLY (traffic advisory) –

- transponder and TCAS TA modes enabled
- all aircraft that would have been predicted as a RA are predicted as a TA

TA/RA (traffic advisory/resolution advisory) – transponder and TCAS TA and RA modes enable.

[777-200/-300 Series - Options – Gables G7131-03 & -04]



1 TCAS Airspace Selector

Left switch controls Captain TCAS display. Right switch controls First Officer TCAS display.

ABV (above) – altitude reporting traffic from 2,700 feet below to 7,000 feet above current altitude displayed.

N (normal) – altitude reporting traffic from 2,700 feet below to 2,700 feet above current altitude displayed.

777 Flight Crew Operations Manual

BLW (below) – altitude reporting traffic 7,000 feet below to 2,700 feet above current altitude displayed.

2 TCAS Absolute/Relative (ABS/REL) Altitude Selector

Left switch controls Captain TCAS display. Right switch controls First Officer TCAS display.

ABS (absolute) – absolute altitude displayed in TCAS traffic symbol data tags.

REL (relative) – relative altitude displayed in TCAS traffic symbol data tags.

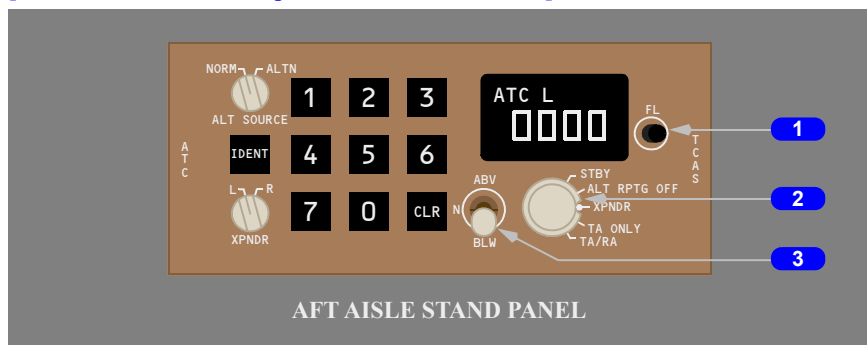
3 Transponder Mode Selector

TA ONLY (traffic advisory) –

- transponder and TCAS TA modes enabled
- all aircraft that would have been predicted as a RA are predicted as a TA

TA/RA (traffic advisory/resolution advisory) – transponder and TCAS TA and RA modes enable.

[777-200/-300 Series - Option – Gables G7156-01]

**1 TCAS Flight Level (FL) Switch**

Push and hold – absolute altitude displayed in TCAS traffic symbol data tags on both NDs.

2 Transponder Mode Selector

TA ONLY (traffic advisory) –

- transponder and TCAS TA modes enabled
- all aircraft that would have been predicted as a RA are predicted as a TA

TA/RA (traffic advisory/resolution advisory) – transponder and TCAS TA and RA modes enable.

3 TCAS Airspace Switch

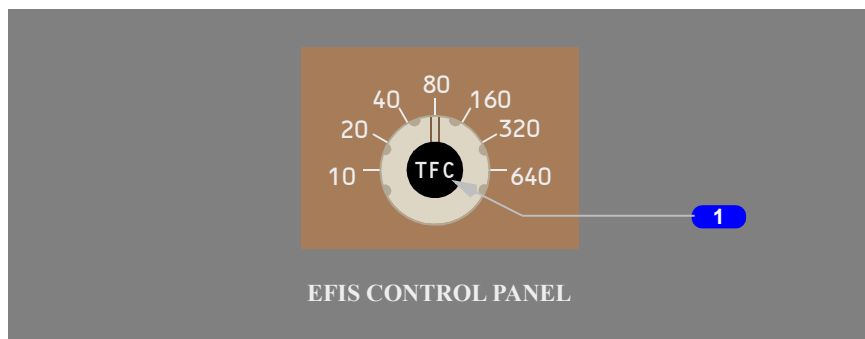
ABV (above) – altitude reporting traffic from 2,700 feet below to 7,000 feet above current altitude displayed.

N (normal) – altitude reporting traffic from 2,700 feet below to 2,700 feet above current altitude displayed.

BLW (below) – altitude reporting traffic 7,000 feet below to 2,700 feet above current altitude displayed.

TCAS Controls (EFIS Control Panel)

[777-200/-300 Series]



1 ND Traffic (TFC) Switch (inner)

Push –

- TCAS traffic displayed on ND
- range information displayed when in the expanded APP or VOR modes

TCAS Traffic and TCAS Alert Message TRAFFIC Display

TCAS Traffic and Alert Message TRAFFIC Display

[777-200/-300 Series]

Displayed when TFC selected and respective ND is in MAP, MAP CTR, VOR, or APP mode.

Displayed automatically when:

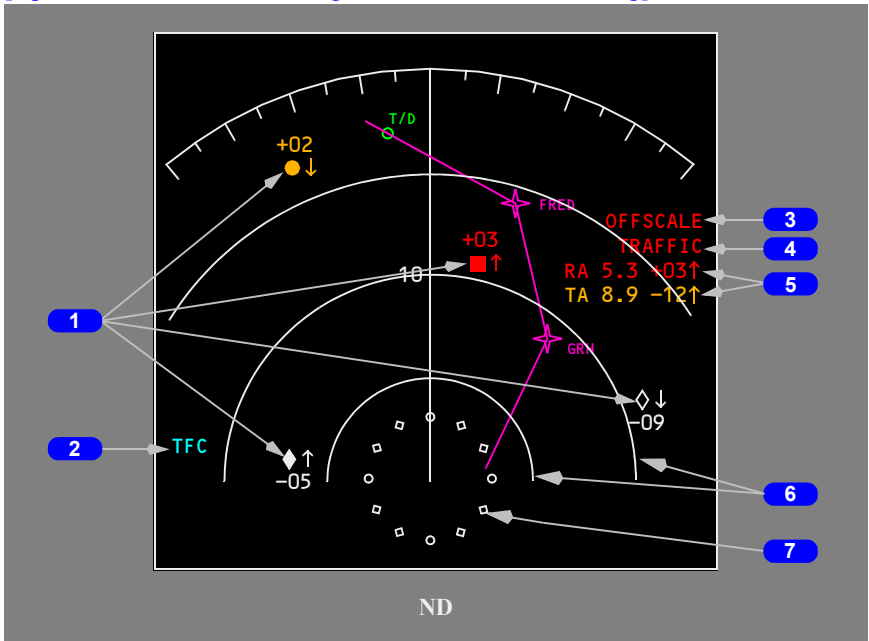
- a RA or TA is occurring, and
- TFC not selected on either ND, and

[777-200/-300 Series]

- respective ND is in MAP, MAP CTR, VOR or APP mode

[777-200/-300 Series]

[Options - Weather Radar Range Arcs and Three Mile Ring]



1 Traffic Targets

Indicates relative position of traffic.

- filled red square indicates a resolution advisory (RA)
- filled amber circle indicates a traffic advisory (TA)
- filled white diamond indicates proximate traffic
- unfilled white diamond indicates other traffic

- number is relative or absolute altitude of traffic in hundreds and thousands of feet; not displayed when altitude unknown
- vertical motion arrow indicates traffic climbing or descending at 500 feet per minute or greater; not displayed for vertical motion less than 500 feet per minute

2 TCAS Mode Annunciations

TFC (cyan) –

- TCAS traffic display enabled

[\[777-200/-300 Series\]](#)

- TCAS traffic displayed in MAP, MAP CTR, APP, and VOR modes

TA ONLY (cyan) –

- TCAS cannot provide RAs
- all traffic that would have been RAs are predicted as TAs

3 OFFSCALE Message

Displayed (red) – RA is beyond selected map range

Displayed (amber) – TA is beyond selected map range

4 TRAFFIC Alert Message

Displayed: (red) – RA is occurring.

Displayed: (amber) – TA is occurring, and RA is not occurring.

5 TCAS No Bearing Messages

RA (red) – data tag displayed for no-bearing RA.

TA (amber) – data tag displayed for no-bearing TA.

Data tag contains distance, altitude, and vertical motion arrow.

6 TCAS/Weather Radar Range Arcs

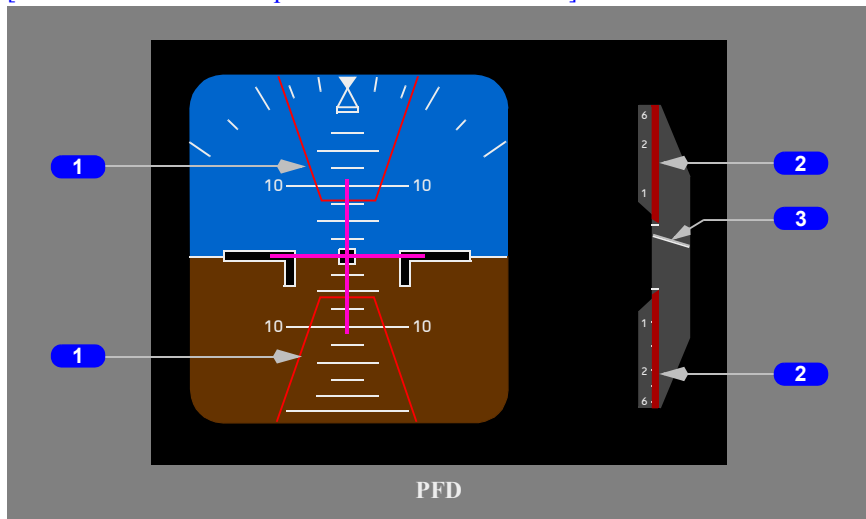
Displayed when TCAS or weather radar selected; replace range scale tics.

7 TCAS Three Mile Ring

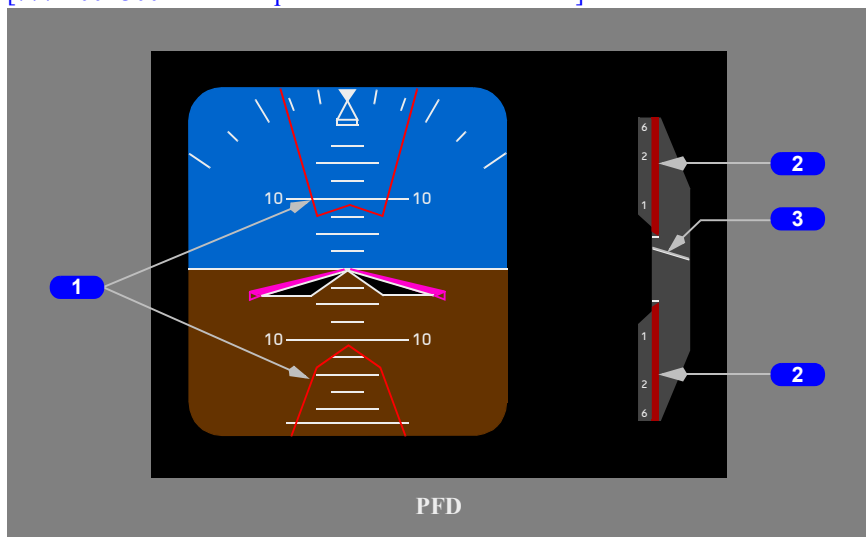
Displayed when TCAS selected and range selected is less than 80 miles.

TCAS PFD Vertical Guidance

[777-200/-300 Series - Option -VSI TCAS RA Band]



[777-200/-300 Series - Option - VSI TCAS RA Band]



1 RA Pitch Region To Avoid (red outlined)

Displayed: (red) - RA is occurring.

Note: For a single RA, only one red outlined RA pitch region, either above or below, is displayed at a time. For two or more RAs, two red outlined RA pitch regions may be displayed.

To ensure vertical separation, the center of the airplane symbol must be outside the red outlined RA pitch regions to avoid.

2 RA Vertical Speed Region to Avoid (red)

To ensure vertical separation, vertical speed must be outside the red RA vertical speed region to avoid.

3 Vertical Speed Pointer

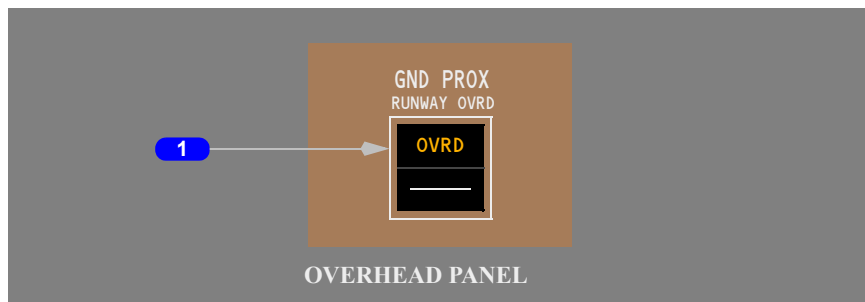
Red – present vertical speed does not ensure RA traffic is avoided.

White – present vertical speed ensures RA traffic is avoided.

Ground Proximity Warning System (GPWS) Controls

RAAS Runway Override Control

[777-200/-300 Series]



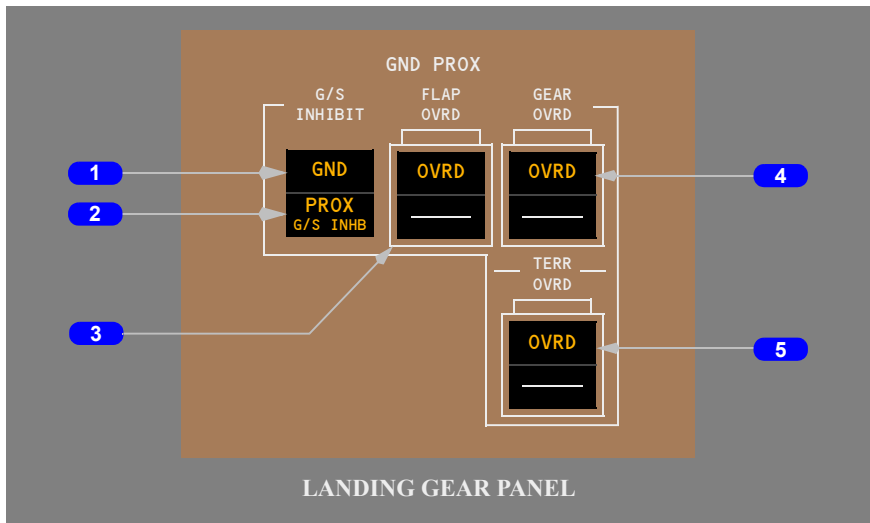
1 RAAS RUNWAY Override (OVRD) Switch

Push (OVRD illuminated) – inhibits RAAS.

Ground Proximity Panel

[777-200/-300 Series]

[Option – Glideslope Inhibit Below 1000 Feet, Basic]



1 Ground Proximity (GND PROX) Glideslope (G/S) INHIBIT (INHIB) Switch

Push – inhibits GLIDE SLOPE alert when pushed below 1,000 feet radio altitude.

2 Ground Proximity (GND PROX) Light

Illuminated (amber) –

- GPWS DON'T SINK, GLIDE SLOPE, SINKRATE, TERRAIN, TOO LOW FLAPS, TOO LOW GEAR, TOO LOW TERRAIN immediate alert is occurring
- inhibited for GLIDE SLOPE, or TOO LOW FLAPS, or TOO LOW GEAR alert when respective inhibit or override switch is pushed

3 Ground Proximity (GND PROX) FLAP Override (OVRD) Switch

Push (OVRD visible) –

- inhibits TOO LOW FLAPS alert
- EICAS advisory message GND PROX SYS will be displayed when airspeed greater than 250 knots for more than 60 seconds

4 Ground Proximity (GND PROX) GEAR Override (OVRD) Switch

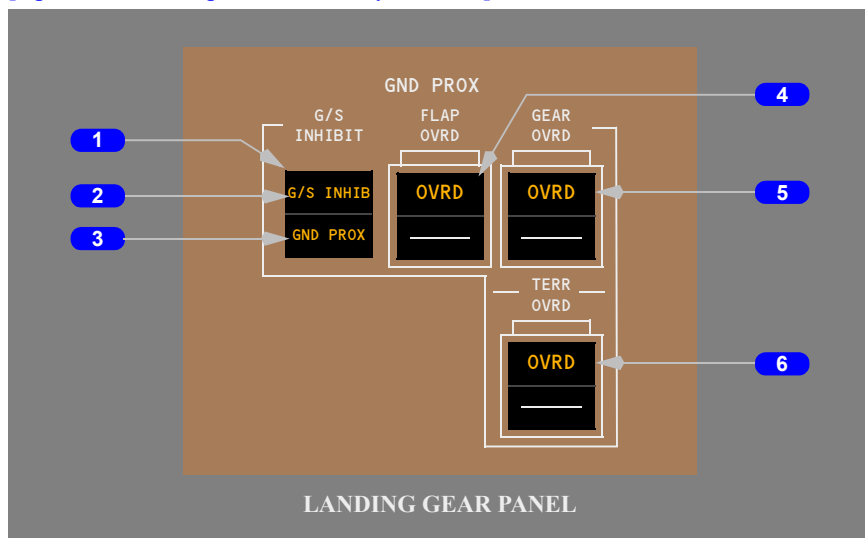
Push (OVRD visible) –

- inhibits TOO LOW GEAR alert
- inhibits CONFIG GEAR alert
- EICAS advisory message GND PROX SYS will be displayed when airspeed greater than 290 knots for more than 60 seconds

5 Ground Proximity (GND PROX) Terrain (TERR) Override (OVRD) Switch

Push (OVRD visible) – inhibits look-ahead obstacle and terrain alerts and display.

[Option – Glideslope Inhibit at Any Altitude]



1 Ground Proximity (GND PROX) Glideslope (G/S) Inhibit Switch

Push – inhibits GLIDE SLOPE alert.

Second push (after five seconds) – enables GLIDE SLOPE alert.

2 Ground Proximity (GND PROX) Glideslope (G/S) Inhibit Light

Illuminated (white) – GLIDE SLOPE alert inhibited.

3 Ground Proximity (GND PROX) Light

Illuminated (amber) –

- GPWS DON'T SINK, GLIDE SLOPE, SINKRATE, TERRAIN, TOO LOW FLAPS, TOO LOW GEAR, TOO LOW TERRAIN immediate alert is occurring
- Inhibited for GLIDE SLOPE, or TOO LOW FLAPS, or TOO LOW GEAR alert when respective inhibit or override switch is pushed

4 Ground Proximity (GND PROX) FLAP Override (OVRD) Switch

Push (OVRD visible) –

- inhibits TOO LOW FLAPS alert
- EICAS advisory message GND PROX SYS will be displayed when airspeed greater than 250 knots for more than 60 seconds

5 Ground Proximity (GND PROX) GEAR Override (OVRD) Switch

Push (OVRD visible) –

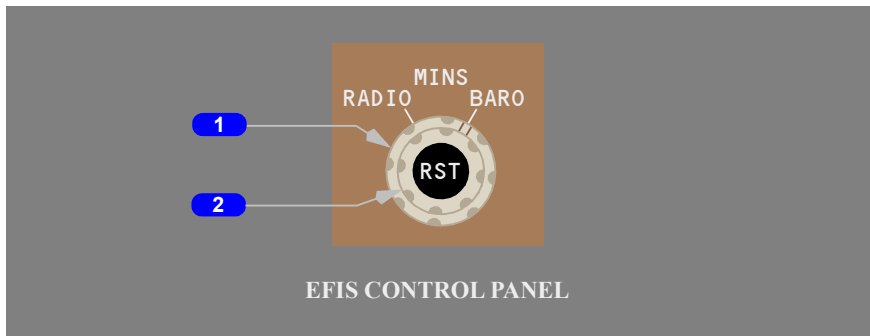
- inhibits TOO LOW GEAR alert
- inhibits CONFIG GEAR alert
- EICAS advisory message GND PROX SYS will be displayed when airspeed greater than 290 knots for more than 60 seconds

6 Ground Proximity (GND PROX) Terrain (TERR) Override (OVRD) Switch

Push (OVRD visible) – inhibits look-ahead obstacle and terrain alerts and display.

Radio Altitude/Barometric Altitude Control

[\[777-200/-300 Series\]](#)

**1 Minimums (MINS) Selector (outer)**

RADIO – sets RADIO display on PFD and Captain's control sets RADIO reference for GPWS minimums voice annunciation; BARO not displayed.

BARO – sets BARO pointer and BARO display on PFD and Captain’s control sets BARO reference for GPWS minimums voice annunciation; RADIO not displayed.

2 RADIO Altitude/Barometric (BARO) Altitude Control (middle)

Rotate –

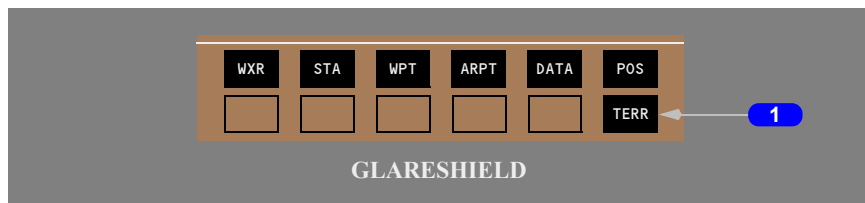
- when RADIO selected on MINS selector, sets RADIO altitude displayed on PFD
- When BARO selected on MINS selector, sets BARO pointer and BARO display on PFD
- Captain’s control sets radio or barometric altitude reference for GPWS minimums voice annunciation

GPWS Look-Ahead Terrain Alerting Display and Annunciations

GPWS Terrain Display Selection

GPWS Terrain Display Select Switch

[777-200/-300 Series - Option -Look -Ahead Terrain Alerting]



1 Terrain (TERR) Display Select Switch

Push –

[Option - with RAAS Caution displayed on ND]

- terrain data and RAAS annunciations are displayed in MAP, MAP CTR, VOR, and APP modes

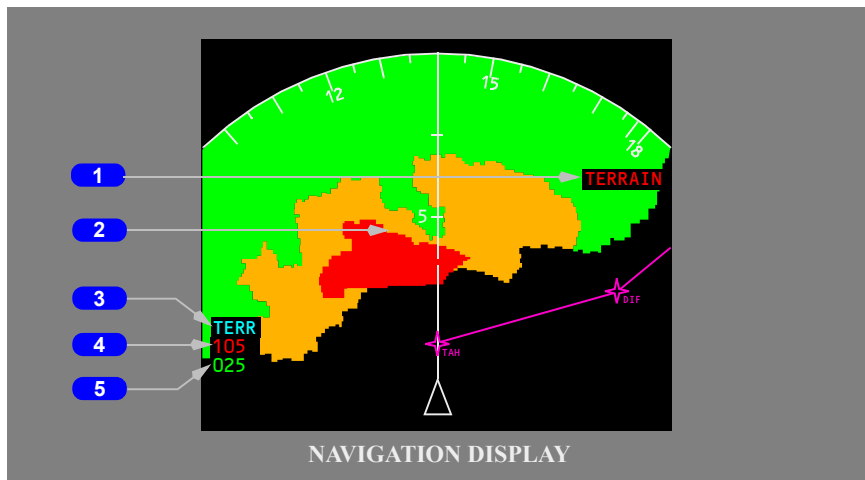
[Option - without RAAS Caution displayed on ND]

- terrain data displayed in MAP, MAP CTR, VOR, and APP modes
- deselects weather radar display regardless of switch position

Second push – deselects terrain data display.

RAAS and Terrain Display

Terrain Display



1 OBSTACLE, RAAS, and TERRAIN Annunciation

OBSTACLE (amber) – obstacle caution alert is occurring.

OBSTACLE (red) – obstacle warning alert is occurring.

ON TAXIWAY (amber) - RAAS message.

SHORT RUNWAY (amber) - RAAS message.

TERRAIN (amber) – look-ahead terrain caution alert is occurring.

TERRAIN (red) – look-ahead terrain warning alert is occurring.

Displayed in all ND display modes.

1 OBSTACLE and TERRAIN Annunciation

OBSTACLE (amber) – obstacle caution alert is occurring.

OBSTACLE (red) – obstacle warning alert is occurring.

TERRAIN (amber) – look-ahead terrain caution alert is occurring.

TERRAIN (red) – look-ahead terrain warning alert is occurring.

Displayed in all ND display modes.

2 Obstacle and Terrain Display

When airplane is higher than 2,000 feet above terrain, density based on obstacle height, peaks height, and airplane altitude:

- solid green – highest obstacles or peaks displayed
- high density green – intermediate height obstacles or terrain peaks displayed
- low density green – lowest obstacles or terrain peaks displayed

When airplane is lower than 2,000 feet above terrain, color and density based on obstacle height, terrain height, and airplane altitude:

- dotted green – obstacles or terrain from 2,000 feet below to 500 feet (250 feet with gear down) below airplane altitude
- dotted amber – obstacles or terrain 500 feet (250 feet with gear down) below to 2,000 feet above airplane altitude
- dotted red – obstacles or terrain more than 2,000 feet above airplane altitude
- dotted magenta – no terrain data available
- solid amber – look-ahead terrain caution alert is occurring
- solid red – look-ahead terrain warning alert is occurring

Note: In areas without obstacle or terrain data, look-ahead terrain alerting and display functions not available. GPWS immediate alerts function normally.

Note: Terrain within 400 feet of the nearest airport runway elevation is not displayed.

Displayed automatically when:

- a look-ahead obstacle or terrain alert occurs, and
- TERR not selected on either ND, and
- respective ND is in MAP, MAP CTR, VOR, or APP mode

Display updates with a display sweep similar to weather radar display.

3 Terrain Mode Annunciation

TERR (cyan) – terrain display enabled.

4 Highest Elevation of Obstacle or Terrain Displayed

Color (amber, green, or red) same as color of corresponding obstacle or terrain displayed.

5 Lowest Elevation of Obstacle or Terrain Displayed

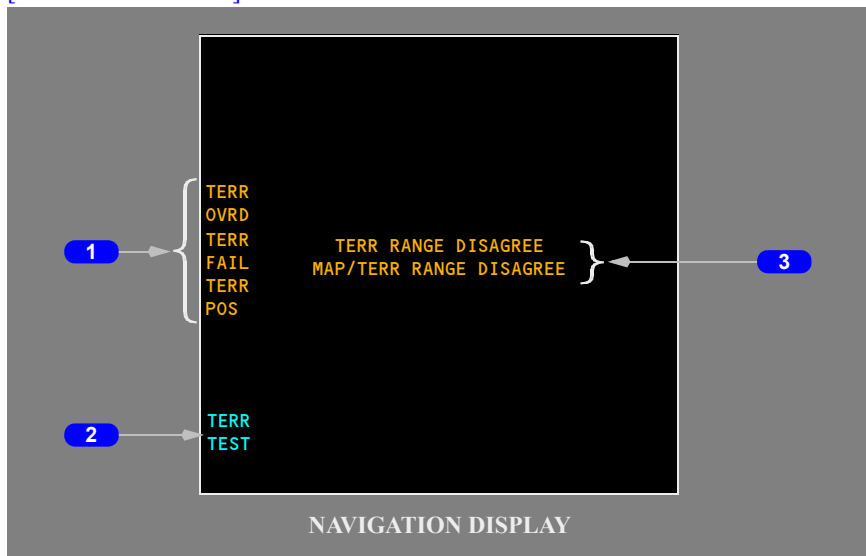
Color (amber, green, or red) same as color of corresponding obstacle or terrain displayed.

777 Flight Crew Operations Manual

The highest and lowest elevations of the obstacles and terrain displayed are inhibited for obstacles and terrain further than 320 nm. The highest and lowest elevations of obstacles and terrain displayed are also inhibited for some obstacles and terrain that are directly abeam of the airplane heading and closer than 320 nm.

Terrain Navigation Display Annunciations

[777-200/-300 Series]

**1 Terrain Status Annunciation**

TERR FAIL (amber) – Look-ahead terrain alerting and display failed.

TERR OVRD (amber) – TERR OVRD switch pushed.

TERR POS (amber) – Look-ahead terrain alerting and display unavailable due to GPS position uncertainty. During time between GPS position failure and display of TERR POS message, ADIRS provides position for look-ahead terrain alerting and display.

2 Terrain Mode Annunciation

TERR TEST (cyan) – GPWS operating in self-test mode.

3 Terrain Range Status Annunciation

TERR RANGE DISAGREE (amber) –

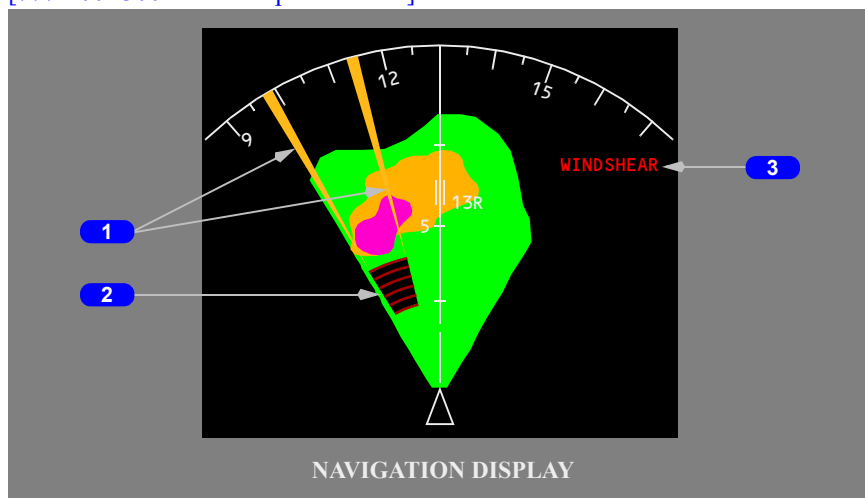
- terrain display enabled, and
- terrain output range disagrees with range selected by EFIS control panel

MAP/TERR RANGE DISAGREE (amber) –

- terrain display enabled, and
- terrain output range disagrees with range selected by EFIS control panel, and
- map display output range disagrees with range selected by EFIS control panel

Predictive Windshear (PWS) Display and Annunciations

[777-200/-300 Series - Option - PWS]



1 PWS Radials

Displayed (amber) –

- PWS alert is occurring
- extend from PWS symbol to help locate windshear event

2 PWS Symbol

Displayed (red and black) –

- PWS alert is occurring
- displays windshear location and approximate geometric size (width and depth)

Symbol, radials, and weather radar returns displayed automatically when:

- PWS alert occurs, and
- WXR is not selected on either ND, and
- respective ND is in MAP, MAP CTR, VOR, or APP mode

When terrain display is selected and PWS alert occurs, weather radar display replaces terrain display.

3 WINDSHEAR Annunciation

WINDSHEAR (amber) – PWS caution alert is occurring.

WINDSHEAR (red) – PWS warning alert is occurring.

Displayed in all navigation display modes.

Intentionally
Blank

Warning Systems
System Description**Chapter 15**
Section 20**Introduction**

Warning systems consist of:

- engine indication and crew alerting system (EICAS)
- airspeed alerts
- tail strike detection system
- takeoff and landing configuration warning system
- MCP selected altitude alerts
- crew alertness monitor
- traffic alert and collision avoidance system (TCAS)
- windshear alerts
- ground proximity warning system (GPWS)

Engine Indication and Crew Alerting System (EICAS)

EICAS consolidates engine and airplane system indications and is the primary means of displaying system indications and alerts to the flight crew.

[\[777-200/-300 Series\]](#)

EICAS is normally displayed on the upper center display.

Crew Alerting and EICAS Message Design Philosophy
Time Critical Warning

Time critical warnings alert the flight crew to a non-normal operational condition requiring immediate crew awareness and immediate corrective action. Time critical alerts include aural alerts, messages and indications on the PFD, Master WARNING/CAUTION lights, voice annunciation alerts, and stick shakers.

Warnings

Warnings alert the flight crew to a non-normal operational or system condition requiring immediate crew awareness and corrective action.

Cautions

Cautions alert the flight crew to a non-normal operational or system condition requiring immediate crew awareness. Corrective action may be required.

Advisories

Advisories alert the flight crew to a non-normal operational or system condition requiring routine crew awareness. Corrective action may be required.

EICAS Messages



Systems conditions and configuration information is provided to the crew by four types of EICAS messages:

- EICAS alert messages are the primary method to alert the crew to non-normal conditions
- EICAS communication messages direct the crew to normal communication conditions and messages
- EICAS memo messages are crew reminders of certain flight crew selected normal conditions
- EICAS status messages indicate equipment faults which may affect airplane dispatch capability

An EICAS alert, communications, or memo message is no longer displayed when the respective condition no longer exists.

EICAS Alert Messages

From after engine start until engine shut down, EICAS alert messages are the primary means to alert the crew to non-normal conditions which may impact other operations during the flight.

There is a non-normal procedure for each EICAS alert message. The procedure for every EICAS alert message is included as a checklist in the QRH. Procedures for some EICAS alert messages have steps to reconfigure airplane systems. A rectangular symbol  prefaces an alert message that has procedural steps. The rectangular symbol  also prefaces EICAS alert messages for checklists that have notes or information of which the crew must be made aware.

EICAS alert messages are grouped into three priority levels: warning, caution, and advisory. Prioritization is an aid to flight crew decision making when more than one EICAS alert message is displayed.

EICAS warning messages are displayed red and EICAS caution and advisory messages are displayed amber. Red EICAS alert messages remain displayed and cannot be canceled by pushing the CANC/RCL switch. Amber EICAS alert messages can be canceled and recalled by pushing the CANC/RCL switch.

EICAS Communication Messages

EICAS communication messages direct crew attention to normal communication conditions which may require crew attention. There is a crew action for each EICAS communications message.

EICAS communications messages are grouped into three priority levels: high, medium, and low. Prioritization is an aid to flight crew decision making when more than one message is displayed.

EICAS communications messages are displayed in white below EICAS alert messages. Communication messages can not be cancelled by pushing the CANC/RCL switch.

EICAS Memo Messages

EICAS memo messages are crew reminders of certain flight crew selected normal conditions. They are displayed in white at the bottom of the last page of EICAS alert messages on the primary EICAS display.

Pushing the CANC/RCL switch when the last page of EICAS alert messages is displayed ensures all current memo messages have been displayed.

EICAS Status Messages

All EICAS status messages are listed in the Dispatch Deviation Guide (DDG) or airline equivalent and provide a cross reference to the Minimum Equipment List (MEL) for dispatch capability.

Display and Manipulation of EICAS Messages

If more than one EICAS alert message is displayed, the messages are displayed in a list which is grouped by priority level. EICAS warning messages are displayed in red at the top of the message list.

EICAS caution messages are displayed in amber below the lowest warning message. EICAS advisory messages are displayed in amber below the lowest caution message and are indented one character so they may be distinguished from EICAS caution messages.

The most recent EICAS alert message is displayed at the top of its priority group and all messages move down one display line. If a message is no longer displayed because the respective system non-normal condition no longer exists, all messages previously displayed move up one display line.

If there are more messages in the list than can be displayed on one page, multiple pages are created and numbered sequentially. The page number is normally displayed at the bottom of each list. Multiple pages of EICAS caution and advisory messages can be displayed one page at a time by pushing the CANC/RCL switch. If there are more EICAS warning messages in the list than can be displayed on one page, no page number is displayed and it is not possible to display other pages. In all other cases, pushing the CANC/RCL switch displays the next page of EICAS caution and advisory messages. EICAS warning messages are displayed at the top of each page.

Pushing the CANC/RCL switch when the last page of the list is displayed causes all EICAS caution and advisory messages to be no longer displayed.

EICAS alert messages for new system non-normal conditions are displayed on the page being viewed.

For example, if page three is displayed and an EICAS caution message is displayed because a new system non-normal occurs, the message is displayed immediately below any EICAS warning messages. If the CANC/RCL switch is subsequently pushed to redisplay page one, the message is displayed as the first EICAS caution message on page one.

When no EICAS caution or advisory messages are displayed, pushing the CANC/RCL switch redisplay page one of the EICAS caution and advisory messages for all system non-normal conditions and the RECALL message is displayed briefly.

The most recent EICAS communication message is displayed at the top of its priority group and all messages move down one display line. If a message is no longer displayed because the respective communication condition no longer exists, all messages previously displayed move up one display line.

The most recent EICAS memo message is displayed at the top of the memo messages.

The STATUS cue is displayed on primary EICAS when a new EICAS status message is displayed. When the STAT switch is pushed, the status display is displayed on the secondary EICAS display. The most recent status message is displayed at the top of the message list.

The STAT switch controls the display of single and multiple pages of status messages in a manner similar to the way the CANC/RCL switch controls the display of EICAS alert messages.

Aurals, Master WARNING/CAUTION Switches and Lights, and GND PROX Light

[777-200/-300 Series]

Aurals, two master WARNING and CAUTION lights, and the GND PROX light call attention to the following alerts:

- in the following table, parentheses () describe crew action to silence the aural or extinguished the light while the alert is occurring.

Aural	Light	Calls Attention To:
Bell (Silence by pushing Master WARNING/CAUTION Reset switch)	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message: FIRE APU FIRE CARGO AFT, FWD FIRE ENG L, R FIRE WHEEL WELL

777 Flight Crew Operations Manual

Aural	Light	Calls Attention To:
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[Option - 777-200/-300 Series with Siren not resettable]

Siren	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message: AUTOPILOT DISC CONFIG DOORS CONFIG FLAPS CONFIG GEAR STEERING CONFIG PARKING BRAKE CONFIG RUDDER CONFIG SPOILERS CONFIG STABILIZER OVERSPEED
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[Option - 777-200/-300 Series with Overspeed Siren not Resettable by Master WARNING/CAUTION switch]

Siren (Silence by pushing Master WARNING/CAUTION Reset switch)	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message: CABIN ALTITUDE PILOT RESPONSE STABILIZER
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Voice annunciation VEE ONE	None	Airspeed at V1 during takeoff
Voice annunciation ENGINE FAIL	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red ENG FAIL on both PFDs

Aural	Light	Calls Attention To:
Beeper	Master CAUTION lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	New EICAS caution message, except: ENG SHUTDOWN ENG SHUTDOWN L ENG SHUTDOWN R
High-low chime	None	New EICAS medium level communication message
Voice annunciation: DON'T SINK, DON'T SINK TOO LOW, TERRAIN	GND PROX light	GPWS immediate alert.
Voice annunciation TRAFFIC, TRAFFIC	None	Amber TRAFFIC message and TCAS TA traffic display on ND

Aural	Light	Calls Attention To:
[Option - 777-200/-300 Series with TCAS Version 7.1]		
Voice annunciation: CLIMB, CLIMB CLIMB, CLIMB NOW, CLIMB, CLIMB NOW CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB DESCEND, DESCEND DESCEND, DESCEND NOW, DESCEND, DESCEND NOW DESCEND, CROSSING DESCEND, DESCEND, CROSSING DESCEND INCREASE CLIMB, INCREASE CLIMB INCREASE DESCENT, INCREASE DESCENT LEVEL OFF, LEVEL OFF MAINTAIN VERTICAL SPEED, MAINTAIN MAINTAIN VERTICAL SPEED CROSSING, MAINTAIN MONITOR VERTICAL SPEED	None	Red regions to avoid on PFD Red TRAFFIC message and TCAS RA traffic display on ND

Aural	Light	Calls Attention To:
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[Option - 777-200/-300 Series with TCAS Version 7.0\]](#)

Voice annunciation: ADJUST VERTICAL SPEED, ADJUST CLIMB, CLIMB CLIMB, CLIMB NOW, CLIMB, CLIMB NOW CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB DESCEND, DESCEND DESCEND, DESCEND NOW, DESCEND, DESCEND NOW DESCEND, CROSSING DESCEND, DESCEND, CROSSING DESCEND INCREASE CLIMB, INCREASE CLIMB INCREASE DESCENT, INCREASE DESCENT MAINTAIN VERTICAL SPEED, MAINTAIN MAINTAIN VERTICAL SPEED CROSSING, MAINTAIN MONITOR VERTICAL SPEED	None	Red regions to avoid on PFD Red TRAFFIC message and TCAS RA traffic display on ND
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Aural	Light	Calls Attention To:
Voice annunciation CLEAR OF CONFLICT	None	Red regions to avoid on PFD, Red TRAFFIC message, and TCAS RA traffic display on ND are no longer displayed.
Voice annunciation: OBSTACLE, OBSTACLE, PULL UP TERRAIN, TERRAIN, PULL UP	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red PULL UP on both PFDs Red OBSTACLE or TERRAIN message and obstacle or terrain display on ND
Voice annunciation: CAUTION OBSTACLE CAUTION TERRAIN	GND PROX light	Amber OBSTACLE or TERRAIN message and obstacle or terrain display on ND
Voice annunciation: WINDSHEAR AHEAD GO AROUND, WINDSHEAR AHEAD	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red WINDSHEAR on both PFDs Red WINDSHEAR message and PWS display on ND
Voice annunciation MONITOR RADAR DISPLAY	None	Amber WINDSHEAR message and PWS display on ND
Siren, followed by voice annunciation WINDSHEAR, WINDSHEAR, WINDSHEAR	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red WINDSHEAR on both PFDs

Aural	Light	Calls Attention To:
Voice annunciation PULL UP	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red PULL UP on both PFDs
Siren (If caused by Thrust lever at idle, silence by pushing Master WARNING/CAUTION Reset switch)	Master WARNING lights (If caused by Thrust lever at idle, extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message CONFIG GEAR for: <ul style="list-style-type: none"> • Thrust lever at idle, and • radio altitude less than 800 feet, and • gear not down and locked.
Voice annunciation: SINK RATE TERRAIN	GND PROX light	GPWS immediate alert
Voice annunciation: GLIDE SLOPE TOO LOW, FLAPS TOO LOW, GEAR	GND PROX light (Inhibited by pushing the respective GND PROX OVRD switch)	GPWS immediate alert
Altitude voice annunciations	None	Altitude voice annunciations during approach

Flight Deck Panel Annunciator Lights

Flight deck panel annunciator lights are used with EICAS messages to:

- help locate and identify affected systems and controls
- reduce potential for error

Airspeed Voice Annunciations and Alerts

Takeoff V1 Airspeed

The voice annunciation VEE ONE sounds when airspeed reaches V1 during takeoff.

Stall Warning

Warning of an impending stall is provided by left and right stick shakers, which independently vibrate the left and right control columns.

Airspeed Low

The EICAS caution message AIRSPEED LOW is displayed and the box around the current airspeed indication on the PFD is highlighted amber if airspeed is below minimum maneuvering speed.

Overspeed Warning

The EICAS warning message OVERSPEED is displayed if airspeed is greater than VMO/MMO. The message remains displayed until airspeed is reduced below VMO/MMO.

Tail Strike Detection System

The tail strike alert system detects ground contact which could damage the airplane pressure hull. A two inch blade target and two proximity sensors are installed on the aft body of the airplane. The EICAS caution message TAIL STRIKE is displayed when a tail strike is detected.

Takeoff And Landing Configuration Warning System

The takeoff and landing configuration warning system alerts the crew that the airplane is not configured for normal takeoff or normal landing.

Takeoff Configuration Warnings

The respective EICAS warning message CONFIG is displayed if:

- airplane is on the ground, and
- FUEL CONTROL switches are in RUN position, and
- either engine thrust is in takeoff range, and
- airspeed is less than V1, and
- any of the following configurations exist;
 - an entry, forward cargo, or aft cargo door not closed, latched, and locked, or
 - flaps or slats not in takeoff position, or

- main gear steering not locked, or
- parking brake set, or
- rudder trim not centered, or
- SPEED BRAKE lever not in DOWN detent, or
- stabilizer trim not in green band

If thrust is decreased below takeoff range and airspeed is less than V1 but the airplane is still not configured for takeoff, the Master WARNING lights are extinguished and the siren is silenced. The CONFIG message remains displayed until airspeed is less than V1 and for 10 seconds.

Landing Configuration Warning

The landing configuration warning system alerts the crew the landing gear is not extended for landing. The EICAS warning message CONFIG GEAR is displayed if:

- the airplane is in flight, and
- any landing gear is not down and locked, and
- any of the following configurations exist:
 - either thrust lever below a nominal glideslope thrust, and below 800 feet, or
 - FLAP lever in landing position

If the message is displayed because a thrust lever below a nominal glideslope thrust at low radio altitudes, the message remains displayed until the Thrust levers are advanced or landing gear is down and locked.

If the message is displayed because the FLAP lever is in landing position, the message remains displayed until the landing gear is down and locked.

Speedbrake Lever Extend Beyond ARM During Climb

[\[777-200/-300 Series - After PRR 63003\]](#)

In flight, the EICAS warning message CONFIG SPOILERS is displayed if:

- the SPEEDBRAKE lever is extended beyond ARMED, and
- climb or higher thrust is set on either thrust levers

The message remains displayed until:

- the SPEEDBRAKE lever is DOWN or at ARMED, or
- both thrust levers are set below climb thrust

Configuration Warning System Non-normal Operation

If the takeoff and landing warning system fails, the EICAS advisory message CONFIG WARN SYS will be displayed. If the takeoff and landing configuration system fails, CONFIG messages may or may not be displayed. If the messages are displayed with the CONFIG WARN SYS message, the CONFIG messages may not be correct.

MCP Selected Altitude Alert

Altitude alerting is provided when approaching or departing the altitude selected in the MCP altitude window.

Approaching MCP Selected Altitude

[BASIC]

At 900 feet prior to reaching the selected altitude a highlighted white box is displayed around the selected altitude and the current altitude on the PFD. The highlights are no longer displayed when within 200 feet of the selected altitude.

Departing MCP Selected Altitude

[BASIC]

When departing the selected altitude by 200 feet, the EICAS alert message ALTITUDE ALERT is displayed, and a highlighted amber box is displayed around the current altitude. The message and amber highlight is no longer displayed when:

- subsequently reapproaching to within 200 feet of the selected altitude, or
- a new MCP altitude is selected, or
- departing more than 900 feet from the selected altitude.

Departing MCP Selected Altitude Alert Inhibits

Departing MCP selected altitude alerts are inhibited when:

- glideslope captured, or
- landing flaps selected and landing gear down and locked.

Crew Alertness Monitor

[Airline selectable option]

The FMC continuously monitors switch action on the MCP, EFIS control panel, display select panel, CDUs, and radio transmitter microphone switches. When a predefined time elapses after the last switch action was detected, the EICAS alert message PILOT RESPONSE is displayed.

The message is inhibited:

- below 20,000 feet, during climb, and
- when flaps are not up

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 TCAS ND messages, voice annunciations, PFD vertical flight path guidance, and traffic displays of the other airplanes to the flight crew. Neither ND messages, voice annunciations, PFD vertical guidance, nor traffic display is provided for other airplanes that do not have operating transponders. TCAS operation is independent of ground-based air traffic control.

TCAS identifies a three-dimensional airspace around the airplane where a high likelihood of traffic conflict exists. The dimensions of this airspace are contingent upon the closure rate with conflicting traffic.

TCAS provides:

- resolution advisory (RA) and display
- traffic advisory (TA) and display
- proximate traffic display
- other traffic display.

[\[777-200/-300 Series\]](#)

TCAS messages and TCAS traffic symbols can be displayed on the ND in the map, map centered, VOR, and approach modes. TCAS messages and TCAS traffic symbols cannot be displayed on the ND in the VOR-centered, approach-centered, or plan modes.

[\[Before ADS-B \(In\)\]](#)

TCAS messages TRAFFIC, TA ONLY, and TCAS TEST may be displayed in all ND modes.

TCAS processing priorities may reduce display of certain air traffic on the ND. Reduced display of air traffic does not affect system collision avoidance alerting capability.

Resolution Advisories (RA) and Display

An RA is a prediction that another airplane will enter the TCAS conflict airspace within approximately 15 to 35 seconds. If altitude data from the other airplane is not available, no RA can be provided.

When TCAS predicts an RA:

- the TCAS red message TRAFFIC is displayed on the ND
- a TCAS voice annunciation sounds
- TCAS PFD vertical guidance is displayed

[Before ADS-B (In)]

When the TCAS cyan message TFC is displayed on the ND, and the RA is within the display range of the ND, the TCAS RA Traffic aircraft symbol and its accompanying data tag are displayed on the ND.

[Before ADS-B (In)]

The TCAS RA Traffic aircraft symbol is a filled red square. The RA data tag contains the altitude and the vertical motion arrow.

For no-bearing RAs, the red RA label is displayed below the red message, TRAFFIC, and the RA data tag information is displayed to the right of the label. The RA red data tag contains the distance, altitude, and the vertical motion arrow.

When the RA is further from the airplane than the ND range currently displayed, the TCAS red message OFFSCALE is displayed on the ND.

Traffic Advisories (TA) and Display

A TA is a prediction another aircraft will enter the conflict airspace in 20 to 48 seconds. TAs assist the flight crew in establishing visual contact with the other aircraft.

When TCAS predicts a TA:

- the TCAS amber message TRAFFIC is displayed on the ND
- the TCAS voice annunciation TRAFFIC, TRAFFIC sounds once

[Before ADS-B (In)]

When the TCAS cyan message TFC is displayed on the ND and the TA is within the display range of the ND, the TCAS TA Traffic aircraft symbol and its accompanying data tag are displayed on the ND.

[Before ADS-B (In)]

The TA Traffic aircraft symbol is a filled amber circle. The TA data tag contains the altitude and vertical motion arrow.

For no-bearing TAs, the amber TA label is displayed below the TRAFFIC message, and the TA data tag information is displayed to the right of the label. The TA labels are displayed below the RA labels. The TA data tag contains the distance, altitude, and vertical motion arrow.

When the TA is further from the airplane than the ND range currently displayed, the TCAS amber message OFFSCALE is displayed on the ND.

Proximate Traffic Display

Proximate traffic is another airplane that is neither an RA or a TA but is within:

- six miles
- 1,200 feet vertically.

[Before ADS-B (In)]

When the TCAS cyan message TFC is displayed on the ND, and the Proximate Traffic aircraft is within the ND display range, the TCAS Proximate Traffic aircraft symbol is displayed on the ND.

[Before ADS-B (In)]

The TCAS Proximate Traffic aircraft symbol is a filled white diamond. When TCAS is receiving and processing altitude data from the Proximate Traffic aircraft, the proximate traffic data tag is displayed on the ND. The proximate traffic data tag contains the altitude and vertical motion arrow.

Other Traffic Display

[ADS-B (In)]

Other Traffic aircraft are an aircraft that are within the ND display limits but neither a RA, a TA, nor proximate traffic aircraft. When TCAS is not receiving and processing altitude data from the Other Traffic aircraft, the Other Traffic aircraft becomes Proximate Traffic aircraft automatically when within six miles.

When the TCAS cyan message TFC is displayed on the ND and the Other Traffic aircraft are within the ND display range, the TCAS Other Traffic symbol is displayed on the ND.

The TCAS Other Traffic symbol is a hollow white diamond. When TCAS is receiving and processing altitude data from the Other Traffic aircraft, a data tag like that described in Proximate Traffic Display is displayed.

TCAS PFD Vertical Guidance

When TCAS predicts an RA, TCAS vertical guidance is displayed on the PFD for a maneuver to ensure vertical separation. Traffic avoidance is ensured by adjusting or maintaining a pitch attitude and vertical speed outside the red RA regions.

If the traffic airplane also has TCAS and a mode S transponder, TCAS vertical guidance is coordinated with the traffic aircraft TCAS.

TCAS ND Messages

ND Message	Color	Description
TFC	Cyan	TCAS traffic display enabled. Inhibited if following TCAS messages are displayed: TCAS FAIL, TCAS OFF, TCAS TEST
TRAFFIC	Amber	TA is occurring.

ND Message	Color	Description
OFFSCALE	Amber	TA is occurring at range greater than current ND range. Replaced by red OFFSCALE when RA is also occurring at range greater than current ND range.
TRAFFIC	Red	RA is occurring.
OFFSCALE	Red	RA is occurring at range greater than current ND range.
TA ONLY	Cyan	TCAS can not provide RAs. All traffic that would have been RAs are predicted as TAs.
TCAS FAIL	Amber	TCAS failed, or TCAS information cannot be displayed on ND.
TCAS OFF	Amber	TFC switch pushed to display traffic but TCAS not selected on transponder panel.
TCAS TEST	Cyan	TCAS in test mode. Message is displayed on all ND modes and ranges.

TCAS Voice Annunciations

[Option - TCAS Version 7, TCAS on VSI]

Voice Annunciation	Condition	Response
TRAFFIC, TRAFFIC	New TA, initial voice annunciation.	Attempt to visually locate the traffic.
MONITOR VERTICAL SPEED	New RA, initial voice annunciation. Present pitch attitude and vertical speed are outside the red RA regions.	Continue to keep pitch attitude and vertical speed outside the red RA regions.
MAINTAIN VERTICAL SPEED, MAINTAIN	New RA, initial voice annunciation. Present pitch attitude and vertical speed are outside the red RA regions.	
MAINTAIN VERTICAL SPEED CROSSING, MAINTAIN	New RA, initial voice annunciation. Present pitch attitude and vertical speed are outside the red RA regions. Airplane will pass through the altitude of the traffic.	
CLIMB, CLIMB	New RA, initial voice annunciation. Present pitch attitude and vertical speed are within the red RA regions.	
CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB	New RA, initial voice annunciation. Present pitch attitude and vertical speed are within the red RA regions. Airplane will climb through the altitude of the traffic.	Increase pitch attitude and vertical speed to remain outside the red RA regions.

Voice Annunciation	Condition	Response
DESCEND, DESCEND	New RA, initial voice annunciation. Present pitch attitude and vertical speed are within the red RA regions.	Decrease pitch attitude and vertical speed to remain outside the red RA regions.
DESCEND, CROSSING DESCEND DESCEND, CROSSING DESCEND	New RA, initial voice annunciation. Present pitch attitude and vertical speed are within the red RA regions. Airplane will descend through the altitude of the traffic.	

[Option - 777-200/-300 Series TCAS Version 7.1]

LEVEL OFF, LEVEL OFF	Present pitch attitude and vertical speed are within the red RA regions.	Reduce vertical speed to zero. Adjust pitch attitude and vertical speed to remain outside the red RA regions.
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INCREASE CLIMB, INCREASE CLIMB	Existing RA, TCAS requires change in vertical rate.	Adjust pitch attitude and vertical speed to remain outside the red RA regions.
INCREASE DESCENT, INCREASE DESCENT	Present pitch attitude and vertical speed are within the red RA regions.	

Voice Annunciation	Condition	Response
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[Option - 777-200/-300 Series TCAS Version 7.0]

ADJUST VERTICAL SPEED, ADJUST	Existing RA, minimum vertical speed required to ensure separation has decreased, present pitch attitude and vertical speed are outside the red RA regions, or, new RA, initial voice annunciation. Present pitch attitude and vertical speed are within the red RA regions.	Continue to keep pitch attitude and vertical speed outside the red RA regions. Vertical speed may be decreased, or, change pitch attitude and vertical speed to remain outside the red RA regions.
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DESCEND, DESCEND NOW, DESCEND, DESCEND NOW	Existing RA, previous TCAS vertical guidance was to climb. Present pitch attitude and vertical speed are within the red RA regions.	Decrease pitch attitude and vertical speed to remain outside the red RA regions.
CLIMB, CLIMB NOW, CLIMB, CLIMB NOW	Existing RA, previous TCAS vertical guidance was to descend. Present pitch attitude and vertical speed are within the red RA regions.	Increase pitch attitude and vertical speed to remain outside the red RA regions.

Voice Annunciation	Condition	Response
CLEAR OF CONFLICT	TCAS PFD vertical guidance is no longer displayed and traffic changes to a TA symbol. Separation is increasing and the RA will not occur. However, the voice annunciation will not sound if TCAS can no longer predict the track of the RA aircraft.	Attempt to visually locate the traffic.

TCAS Normal Operation

TCAS is controlled from the transponder panel. TA/RA is normally selected. However, it is sometimes necessary to select TA ONLY to prevent nuisance RAs. TA ONLY is selected during engine out operations to prevent RAs when adequate thrust is not available to follow the RA commands.

TCAS Non–Normal Operation

The EICAS advisory message TCAS is displayed and the amber TCAS FAIL message is displayed on both NDs if TCAS is failed.

The EICAS advisory message TCAS OFF is displayed and the amber TCAS OFF message is displayed on both NDs if the TFC switch is pushed when the airplane is below 400 feet radio altitude. TCAS remains in standby mode.

The respective EICAS advisory message TCAS RA CAPTAIN or TCAS RA F/O is displayed if RA guidance cannot be displayed on the respective PFD. The ND traffic displays and voice alerts are unaffected.

Ground Proximity Warning System (GPWS) and Predictive Windshear (PWS)

Introduction

GPWS and PWS provide:

- runway awareness and advisory system annunciations and ND messages on the ground and in flight
- look-ahead obstacle and terrain alerts for potentially hazardous flight conditions involving impact with the obstacles and the ground
- predictive windshear alerts and immediate windshear alerts

- bank angle voice alerts
- altitude voice annunciations during approach

Runway Awareness and Advisory System (RAAS)

In flight RAAS voice annunciations and ND messages are enabled or inhibited 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.

The RAAS provides voice annunciations and ND messages to assist flight crew awareness of airplane position during ground operations, approach to landing, and go-around. The airports in the RAAS airport database include details for every runway on the airport.

Note: RAAS voice annunciations and ND messages are based upon RAAS database runway details. RAAS voice annunciations and ND messages are not based upon the runway intended or planned. RAAS voice annunciations and ND messages do not take into account airplane performance factors such as airplane weight, wind, runway condition, slope, air temperature, or airport altitude. The absence of RAAS voice annunciations and ND messages does not ensure that a runway is appropriate for takeoff or landing. RAAS voice annunciations and ND messages do not ensure that a runway is inappropriate for takeoff or landing. Flight crew is responsible to use other means available to ensure correct runway selection and the performance calculations are accurate for the conditions.

When the GPWS Terrain switch is pushed on, the TERR symbol is displayed and RAAS messages will be displayed on the ND.

Voice Annunciations and ND Messages During Taxi and Takeoff on RAAS Airports

[Options – Each voice annunciation is a selectable option.]

Voice Annunciation and ND Message	Description
Voice annunciation: CAUTION ON TAXIWAY, ON TAXIWAY ND amber message: ON TAXIWAY	Sounds once each time the airplane: <ul style="list-style-type: none">• is on a surface other than a runway, and• ground speed is greater than 40 knots

Voice Annunciation and ND Message	Description
APPROACHING (RUNWAY IDENTIFIER of runway end closest to airplane position)	Sounds once each time the airplane: <ul style="list-style-type: none"> • approaches a runway, and • ground speed is less than 40 knots
APPROACHING RUNWAYS	Sounds once each time the airplane: <ul style="list-style-type: none"> • approaches two runways within 20 degrees of each other, and • ground speed is less than 40 knots
ON RUNWAY (RUNWAY IDENTIFIER)	Sounds once when the airplane:: <ul style="list-style-type: none"> • enters a runway, and • heading is within 20 degrees of the runway heading
ON RUNWAY (RUNWAY IDENTIFIER) (LENGTH) REMAINING	Sounds once when the airplane:: <ul style="list-style-type: none"> • 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)	Sounds when the airplane: <ul style="list-style-type: none"> • 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	Sounds once when the airplane:: <ul style="list-style-type: none"> • 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

**Voice Annunciations and ND Messages During Approach, Landing,
Go-Around, and RTO on RAAS Airports**

Voice Annunciation and ND Message	Description
APPROACHING (RUNWAY IDENTIFIER)	<p>Sounds once each time the airplane:</p> <ul style="list-style-type: none">• 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 above field elevation <p>The voice annunciation is delayed and sounds at 450 feet altitude if the voice annunciation would have sounded when the airplane was between 550 feet and 450 feet above field elevation.</p>
APPROACHING RUNWAYS	<p>Sounds once each time the description is met while approaching two runways</p>
APPROACHING (RUNWAY IDENTIFIER) (FEET) AVAILABLE	<p>Sounds once each time the airplane:</p> <ul style="list-style-type: none">• 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 above field elevation <p>The voice annunciation is delayed and sounds at 450 feet altitude if the voice annunciation would have sounded when the airplane was between 550 feet and 450 feet above field elevation.</p>

Voice Annunciation and ND Message	Description
Voice annunciation: CAUTION SHORT RUNWAY, SHORT RUNWAY ND amber message: SHORT RUNWAY	Sounds once each time the airplane: <ul style="list-style-type: none">• 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 and 300 feet above field elevation
(FEET) REMAINING	Sounds once each time the airplane is on the ground:: <ul style="list-style-type: none">• with ground speed greater than 40 knots, and• is on a defined minimum length from the runway end• during rejected takeoff, when ground speed during takeoff decreases by seven knots from the maximum ground speed achieved
	Sounds once each time the airplane is in the air: <ul style="list-style-type: none">• less than 100 feet above the runway, and• is over a defined minimum length from the runway end• during go-around after the voice annunciation REMAINING sounds, the voice annunciations continue to sound until the airplane is:<ul style="list-style-type: none">• higher than 100 feet above the runway, or• rate of climb is greater than 450 feet per minute
ONE HUNDRED REMAINING	Sounds once each time the airplane: <ul style="list-style-type: none">• 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

Look-ahead Obstacles and Peaks Terrain Alerting System

Look-ahead obstacles and peaks terrain alerts are provided by monitoring obstacle and terrain proximity using a world-wide terrain data base and an obstacle data base. The obstacle data base is not yet world-wide. Terrain data is not designed to be an independent navigation aid.

Proximate obstacle and terrain data may be displayed on the ND. If there is a potential obstacle or terrain hazard, look-ahead alerts are provided based on estimated time to impact.

Estimated time to impact is based on airplane position, altitude, present track, vertical path, and ground speed. FMC VNAV and LNAV path is not considered in the estimated time to impact.

Altitude used for look-ahead terrain mode alerts are a weighted combination of radio altitude, barometric altitude, GPS, and previous flight path. Weighting is reduced for an altitude source which becomes less reliable.

Note: Obstacles or terrain ahead of the airplane may exceed available climb performance. A GPWS caution or warning does not guarantee obstacle or terrain clearance.

When the TERR switch is pushed on, the TERR symbol is displayed on the ND and obstacle and terrain contours may be displayed.

When obstacle and terrain contours are displayed, the altitudes of the highest and lowest displayed obstacle or terrain are displayed below the TERR symbol. The color of each altitude corresponds to the altitude of the respective contour.

The highest and lowest elevations of the obstacles and terrain displayed are inhibited for obstacles and terrain further than 320 nm. The highest and lowest elevations of obstacles and terrain displayed are also inhibited for some obstacles and terrain that are directly abeam of the airplane heading and closer than 320 nm.

When the airplane is higher than 2,000 feet above the terrain, obstacles and terrain peaks are displayed using solid, high density, and low density contours of green. The highest obstacles or terrain is represented by solid green, and the lowest obstacles or terrain displayed is represented by low density green.

When the airplane is lower than 2,000 feet above the terrain, all obstacles and terrain within 2,000 feet of airplane barometric altitude is displayed on the navigation display.

When an obstacle or terrain alert occurs, the respective message is displayed on the ND. When an OBSTACLE alert occurs while a TERRAIN alert message is displayed, the OBSTACLE alert message replaces the TERRAIN alert message. Both messages will not be displayed at the same time.

777 Flight Crew Operations Manual

The terrain display is correlated to GPS position, or to ADIRU position if GPS position is intermittently unavailable.

Terrain and weather radar cannot be simultaneously displayed on the ND. When one pilot selects terrain and the other pilot selects weather radar, each display updates on alternating sweeps.

GPWS Look-Ahead Obstacle and Peaks Terrain Alerts

Voice Annunciation	PFD and ND Display and Light	Description
OBSTACLE, OBSTACLE, PULL UP	Red PULL UP on both PFDs Master WARNING lights Red OBSTACLE message on both NDs Solid red obstacle on ND	20 to 30 seconds from projected impact with obstacle. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.
TERRAIN, TERRAIN, PULL UP	Red PULL UP on both PFDs Master WARNING lights Red TERRAIN message on both NDs Solid red terrain on ND	20 to 30 seconds from projected impact with terrain. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.
CAUTION OBSTACLE	Amber OBSTACLE message on both NDs Solid amber obstacle on ND GND PROX light	40 to 60 seconds from projected impact with obstacle. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.

Voice Annunciation	PFD and ND Display and Light	Description
CAUTION TERRAIN	Amber TERRAIN message on both NDs Solid amber terrain on ND GND PROX light	40 to 60 seconds from projected impact with terrain. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.
TOO LOW, TERRAIN	Amber TERRAIN message on both NDs GND PROX light	Descent below unsafe altitude while too far from any airport in the terrain database. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.

Predictive Wind Shear (PWS) and Immediate Windshear
Alerting Systems

Windshear alerts are enabled during takeoff, approach, and landing:

- PWS provides windshear alerts when an excessive windshear condition is detected ahead of the airplane
- immediate windshear alerts are provided when an excessive downdraft or tailwind is occurring

PWS Alerting System

The weather radar scans for windshear when the airplane is on the ground and in flight. Weather radar uses radar imaging to detect disturbed air ahead of the airplane. When weather radar scans for windshear, the weather radar antenna scan sweep is reduced.

Prior to takeoff, PWS alerts can be enabled by selecting WXR for display on either EFIS control panel. However, windshear scanning and PWS alerts are enabled even when WXR is not selected for display.

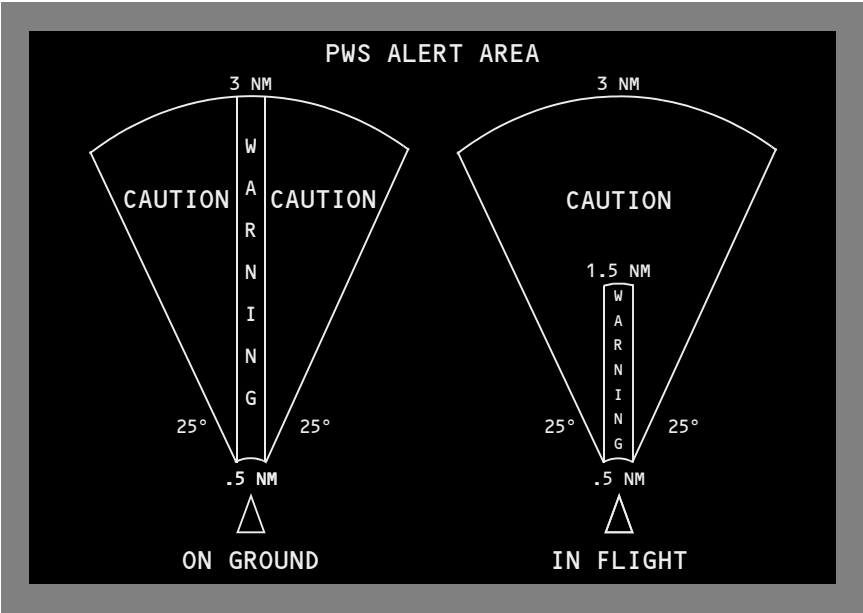
Weather Radar and PWS

WXR Display State	Airplane on ground	Airplane in air
WXR selected for display	Scans for windshear; PWS alerts enabled.	Scans for windshear below 2300 feet radio altitude; PWS alerts only provided below 1200 feet radio altitude.
WXR not selected for display	Scans for windshear when thrust levers advanced for takeoff and any thrust reverser is not locked or deployed; PWS alerts enabled.	Scans for windshear below 2300 feet radio altitude; PWS alerts only provided below 1200 feet radio altitude.

WXR selected for display	Scans for windshear; PWS alerts enabled.	Scans for windshear below 1800 feet radio altitude; PWS alerts only provided below 1200 feet radio altitude.
WXR not selected for display	Scans for windshear when thrust levers advanced for takeoff and any thrust reverser is not locked or deployed; PWS alerts enabled.	Scans for windshear below 1800 feet radio altitude; PWS alerts only provided below 1200 feet radio altitude.

Note: PWS is enabled to provide windshear alerts 12 seconds after weather radar begins scanning for windshear.

When windshear is not predicted, weather radar returns are displayed only when WXR is selected for display.



PWS Alerts

Voice Annunciation	PFD and ND Display and Light	Description
WINDSHEAR AHEAD, WINDSHEAR AHEAD	Red WINDSHEAR on both PFDs Master WARNING lights Red WINDSHEAR message on both NDs RED windshear symbol on ND	Windshear predicted close to and directly ahead of airplane. Enabled during takeoff, below 1,200 feet radio altitude. Windshear position displayed by PWS symbol on the ND in MAP, MAP CTR, VOR, or APP modes only.

Voice Annunciation	PFD and ND Display and Light	Description
GO AROUND, WINDSHEAR AHEAD	Red WINDSHEAR on both PFDs Master WARNING lights Red WINDSHEAR message on both NDs RED windshear symbol on ND	Windshear predicted within 1.5 miles and directly ahead of the airplane. Enabled during approach, below 1,200 feet radio altitude. Windshear position displayed by PWS symbol on the ND in MAP, MAP CTR, VOR, or APP modes only.
MONITOR RADAR DISPLAY	Amber WINDSHEAR message on both NDs RED windshear symbol on ND	Windshear predicted within 3 miles and ahead of the airplane. Enabled during takeoff and approach, below 1,200 feet radio altitude. Windshear position displayed on PWS on ND in MAP, MAP CTR, VOR, or APP modes only.

Note: Weather radar provides windshear alerts for windshear events containing some level of moisture or particulate matter.

Note: Weather radar detects microbursts and other windshears with similar characteristics. Weather radar does not provide alerting for all types of windshear. The flight crew must continue to rely on traditional windshear avoidance methods.

Immediate Windshear Alerts

Voice Annunciation	PFD Display and Light	Description
(Siren) WINDSHEAR, WINDSHEAR, WINDSHEAR	Red WINDSHEAR on both PFDs Master WARNING lights	Excessive windshear detected by GPWS. Enabled below 1,500 feet radio altitude. GPWS windshear detection begins at rotation.

Bank Angle Voice Annunciations[\[Option - Bank Angle\]](#)

The voice alert BANK ANGLE sounds if bank angle exceeds 35°, 40°, and 45°.

Immediate Alerting System

Voice Annunciation	PFD and ND Display and Light	Description
DON'T SINK	GND PROX light	Altitude loss with flaps and/or gear up after takeoff or go-around.
GLIDE SLOPE	GND PROX light	Excessive deviation below glide slope. Volume and repetition rate increase as deviation increases. Pushing the GND PROX G/S INHIB switch inhibits the alert.
DON'T SINK	GND PROX light	Altitude loss with flaps and/or gear up after takeoff or go-around.
GLIDE SLOPE	GND PROX light	Excessive deviation below glide slope. Volume and repetition rate increase as deviation increases. Pushing the GND PROX G/S INHIB switch inhibits the alert when pushed below 1,000 feet radio altitude.
PULL UP	Red PULL UP message on both PFDs Master WARNING lights	Follows SINK RATE alert when descent rate becomes severe, or follows TERRAIN alert with flaps and/or gear not in landing configuration when excessive terrain closing rate continues.
SINK RATE	GND PROX light	Excessive descent rate.
TERRAIN	GND PROX light	Excessive terrain closing rate.
TOO LOW, FLAPS	GND PROX light	Unsafe terrain clearance with flaps not in landing configuration at low altitude and airspeed. Pushing the GRND PROX FLAP OVRD switch to OVRD inhibits the alert.

Voice Annunciation	PFD and ND Display and Light	Description
TOO LOW, GEAR	GND PROX light	<p>Unsafe terrain clearance with gear not in landing configuration at low altitude and airspeed with gear not down.</p> <p>Pushing the GRND PROX GEAR OVRD switch to OVRD inhibits the alert.</p>
TOO LOW, TERRAIN	GND PROX light	<p>Follows DON'T SINK alert with gear and/or flaps up after takeoff or go-around for altitude loss at low altitude, or unsafe terrain clearance with gear and/or flaps not in landing configuration at low altitude and airspeed.</p> <p>Pushing the GRND PROX FLAP OVRD switch to OVRD inhibits the alert, when the alert is due to flaps not in landing position.</p> <p>Pushing the GRND PROX GEAR OVRD switch to OVRD inhibits the alert, when the alert is due to gear not down.</p>

Altitude Voice Annunciations During Approach

GPWS provides altitude voice annunciations during approach:

[Option - Smart 500 Voice Annunciation]

- 500 feet – FIVE HUNDRED, when glideslope or localizer not received, or glideslope or localizer deviation greater than two dots
- 50 feet – FIFTY
- 40 feet – FORTY
- 30 feet – THIRTY
- 20 feet – TWENTY
- 10 feet – TEN

[Basic - without Smart 500 Voice Annunciation]

- 50 feet – FIFTY
- 40 feet – FORTY
- 30 feet – THIRTY

- 20 feet – TWENTY
- 10 feet – TEN

Minimums Voice Annunciation

GPWS provides the voice annunciation PLUS HUNDRED at 100 feet above the altitude set by the Captain's MINS selector on the EFIS Control Panel and the voice annunciation MINIMUM at the altitude set.

GPWS Non-Normal Operation

Altitude Voice Annunciations During Approach Non-Normal Operation

If there is a fault in voice annunciations during the approach system, the EICAS advisory message ALT CALLOUTS is displayed and GPWS annunciations during the approach are inhibited.

RAAS Non-Normal Operation

If the RAAS Runway Override switch is in OVRD, the EICAS advisory message RUNWAY OVRD is displayed and RAAS voice annunciations and ND messages are inhibited.

If GPS position is uncertain, the EICAS advisory message RUNWAY POS is displayed and RAAS voice annunciations and ND messages are inhibited.

If there is a fault in RAAS or the airport is not in the GPWS RAAS database, the EICAS advisory message RUNWAY SYS is displayed and RAAS voice annunciations and ND messages are inhibited.

Windshear Alert Non-Normal Operation

If there is a fault in the immediate windshear system or in the PWS system, the EICAS advisory message WINDSHEAR SYS is displayed and the voice alert WINDSHEAR and the PFD alert WINDSHEAR are inhibited.

Look-Ahead Alert Non-Normal Operation

If there is a fault in look-ahead terrain alert, the respective terrain status annunciation TERR is displayed.

Immediate Alert Non-Normal Operation

If there is a fault in any immediate alert, the respective alert is inhibited. If a fault occurs in any immediate alert other than windshear, there is no indication to the flight crew of which alerts are inhibited. GPWS will continue to provide immediate alerts for which no fault has occurred.

Alert Inhibits

Alerts are inhibited when they are operationally unnecessary or inappropriate. Alerts are inhibited during normal system operation, and during part of the takeoff and landing to prevent distracting the crew.

GPWS immediate windshear alert inhibits all PWS, TCAS, and other GPWS alerts.

When TA/RA is selected on the transponder panel and a GPWS or PWS warning alert occurs, TCAS automatically inhibits RA mode. During the inhibit, all aircraft that would have been predicted as an RA are predicted as a TA. When GPWS and PWS warning alerts are no longer occurring, the RA mode inhibit ends.

Alert Messages Inhibited During Normal System Operation

Certain EICAS alert messages are time delayed, even though related flight deck panel annunciator lights are illuminated. Time delay inhibits prevent normal in-transit indications from being displayed as EICAS alert messages. For example, valves are generally only sensed open or closed, not in-transit. When a valve is in-transit, the message indicating the valve has failed to open or close is inhibited to allow the valve time to move to the commanded position. If the valve is not in the commanded position at the end of the inhibit time delay, the respective EICAS alert message is displayed.

Alert Messages Inhibited By Other Alert Messages

Some EICAS alert messages are inhibited if another related alert message is displayed. For example, individual hydraulic pump pressure messages are inhibited if a hydraulic system pressure message is displayed.

Voice Annunciation Inhibits

Voice annunciations for warning alerts inhibit new voice annunciations for caution alerts.

All voice annunciations are prioritized to aid flight crew decision making when more than one alert could occur.

Altitude voice annunciations during approach inhibit RAAS voice annunciations.

ND Display Alert Inhibits and Automatic Display

Alert displays on the NDs are prioritized to aid flight crew decision making when more than one alert occurs. The displays are also prioritized when neither ND is in MAP, MAP CTR, VOR, or APP mode.

Immediate windshear alert inhibits the automatic display of a new TCAS, look-ahead terrain, or PWS alerts.

TCAS traffic can be displayed concurrently with either TERR and WXR display.

New TCAS TRAFFIC TA or RA alerts:

- When both NDs are in MAP, MAP CTR, VOR, or APP mode and a new TCAS TA or RA alert occurs, TFC is selected automatically for both NDs and TCAS traffic is displayed on both NDs.
- When only one ND is in MAP, MAP CTR, VOR, or APP mode and a new TCAS TA or RA alert occurs, TFC is selected automatically for that ND and TCAS traffic is displayed. The ND not in MAP, MAP CTR, VOR, or APP mode is armed for TCAS display and TFC will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected.
- When neither ND is in MAP, MAP CTR, VOR, or APP mode and a new TCAS TA or RA alert occurs, both NDs are armed for TCAS display and TFC will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected.

New look-ahead terrain alerts:

- When both NDs are in MAP, MAP CTR, VOR, or APP mode and a new look-ahead terrain alert occurs, TERR is selected automatically for both NDs.
- When only one ND is in MAP, MAP CTR, VOR, or APP mode and a new look-ahead terrain alert occurs, TERR is selected automatically for that ND. The ND not in MAP, MAP CTR, VOR, or APP mode is armed for TERR display and TERR will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected. TERR is disarmed by selecting WXR prior to selecting MAP, MAP CTR, VOR, or APP mode.
- When neither ND is in MAP, MAP CTR, VOR, or APP mode and a new look-ahead terrain alert occurs, both NDs are armed for TERR display and TERR will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected. TERR is disarmed for either ND by selecting WXR prior to selecting MAP, MAP CTR, VOR, or APP mode on the respective ND.
- When a RAAS SHORT RUNWAY alert occurs and a GPWS TERRAIN alert occurs the ND message SHORT RUNWAY is inhibited and is replaced by the ND message TERRAIN.

New PWS alerts:

- When both NDs are in MAP, MAP CTR, VOR, or APP mode and a new PWS alert occurs, WXR is selected automatically for both NDs.
- When only one ND is in MAP, MAP CTR, VOR, or APP mode and a new PWS alert occurs, WXR is selected automatically for that ND. The ND not in MAP, MAP CTR, VOR, or APP mode is armed for WXR display and WXR will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected. WXR is disarmed by selecting TERR prior to selecting MAP, MAP CTR, VOR, or APP mode.
- When neither ND is in MAP, MAP CTR, VOR, or APP mode and a new PWS alert occurs, both NDs are armed for WXR display and WXR will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected. WXR is disarmed by selecting TERR prior to selecting MAP, MAP CTR, VOR, or APP mode.

Alerts Inhibited Before Engine Start and After Shutdown

Alert Inhibited	For Message	Inhibit Occurs
Master CAUTION lights Beeper	For all EICAS caution messages	On the ground, and both FUEL CONTROL switches in CUTOFF
Respective EICAS messages: BLEED OFF ELEC BACKUP GEN ELEC DRIVE, ELEC GEN OFF ENG OIL PRESS HYD PRESS PRI	For EICAS caution messages: ENG SHUTDOWN L ENG SHUTDOWN R ENG SHUTDOWN	On the ground, and both FUEL CONTROL switches in CUTOFF

Alerts Inhibited During Engine Start

[777-200/-300 Series - GE Engines with CON position, PW Engines]

Alert Inhibited	Inhibit Begins	Inhibit Ends
All new EICAS caution and advisory messages, except: APU LIMIT APU SHUTDOWN ENG AUTOSTART ENG FUEL VALVE ENG SHUTDOWN ENG START VALVE ENG STARTER CUTOUT OVERHEAT ENG	ENGINE START /IGNITION selector to START	Engine reaches idle RPM, or start is aborted, or five minutes elapse.

[777-200/-300 Series - GE Engines without CON position, RR Engines]

Alert Inhibited	Inhibit Begins	Inhibit Ends
All new EICAS caution and advisory messages, except: APU LIMIT APU SHUTDOWN ENG AUTOSTART ENG FUEL VALVE ENG SHUTDOWN ENG START VALVE ENG STARTER CUTOUT OVERHEAT ENG	ENGINE START selector to START	Engine reaches idle RPM, or start is aborted, or five minutes elapse.

Alerts Inhibited During Takeoff

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
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[Option - TCAS Version 7]

EICAS advisory message TCAS OFF	Messages are inhibited	On ground	400 feet radio altitude
TCAS TA voice alerts	TCAS TAs		Approximately 500 feet radio altitude
All TCAS RAs	TCAS RAs are inhibited When RA selected on panel, TCAS switches automatically to TA only mode and TCAS message TA ONLY is displayed on ND.		Approximately 1,000 feet radio altitude
TCAS DESCEND RAs	Alerts are inhibited		Approximately 1,100 feet radio altitude

Red ENG FAIL on PFD	Engines not producing commanded thrust and rate of thrust increase insufficient; same condition as EICAS messages ENG THRUST L, R	Engine start	65 knots airspeed
EICAS caution message ENG THRUST L, R	Messages are inhibited		Six knots before V1
STATUS cue	All EICAS status messages		30 minutes after lift-off.

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
All EICAS communication messages except: CABIN ALERT Hi-Lo Chime	Messages are inhibited	Either engine in takeoff thrust range	400 feet radio altitude or 20 seconds after lift-off, whichever occurs first, or on the ground and thrust on both engines reduced below takeoff thrust range
All EICAS communication messages	Messages are inhibited	Either engine in takeoff thrust range	400 feet radio altitude or 20 seconds after lift-off, whichever occurs first, or on the ground and thrust on both engines reduced below takeoff thrust range

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
<p>Master CAUTION lights Beeper</p> <p>If the Master CAUTION lights illuminate before reaching 80 knots airspeed, they continue to be illuminated when 80 knots airspeed is exceeded and cannot be extinguished until the inhibit ends.</p> <p>If new EICAS caution messages are displayed during the inhibit, the beeper will sound when the inhibit ends.</p>	New EICAS caution messages displayed during inhibit.	80 knots airspeed	<p>400 feet radio altitude or 20 seconds after lift-off, whichever occurs first.</p> <p>If rejected takeoff initiated above 80 knots, inhibit continues until airspeed is less than 75 knots.</p>
All EICAS advisory messages	Messages are inhibited		<p>400 feet radio altitude or 20 seconds after lift-off, whichever occurs first, or if takeoff thrust not selected on both engines.</p> <p>If rejected takeoff initiated above 80 knots, inhibit continues until airspeed is less than 75 knots.</p>
New PWS caution alerts	Messages are inhibited	80 knots airspeed	400 feet radio altitude
New PWS warning alerts	Messages are inhibited	100 knots airspeed	50 feet radio altitude
New red ENG FAIL on PFD	EICAS caution message ENG THRUST L, R	Six knots before V1	Landing

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
<p>Master WARNING lights Bell</p> <p>If the Master WARNING lights illuminate and fire bell sounds before reaching V1, they continue to be illuminated and sound when V1 is exceeded.</p> <p>If new FIRE messages are displayed during the inhibit, the bell will sound when the inhibit ends.</p>	<p>New EICAS warning messages FIRE displayed during inhibit.</p>	<p>V1 or rotation, whichever occurs first.</p>	<p>400 feet radio altitude or 25 seconds after inhibit began, whichever occurs first.</p>
<p>Master WARNING lights Siren</p> <p>If the Master WARNING lights illuminate and siren sounds before reaching V1, they continue to be illuminated and sound when V1 is exceeded</p> <p>If new EICAS warning messages are displayed during the inhibit, the siren will sound when the inhibit ends.</p>	<p>New EICAS warning messages displayed during inhibit, except FIRE</p>		
<p>EICAS warning messages CONFIG for takeoff configuration warnings</p>	<p>Messages are inhibited</p>		<p>Landing</p>
<p>Master WARNING lights Siren</p>	<p>EICAS warning message CONFIG GEAR</p>	<p>Gear unlock for retraction</p>	<p>825 feet radio altitude or 150 seconds after inhibit began, whichever occurs first.</p>
<p>All PWS alerts</p>	<p>Messages are inhibited</p>	<p>1,200 feet radio altitude</p>	<p>Approach</p>

Alerts Inhibited During Landing

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
All PWS alerts	Alerts are inhibited	2,300 feet radio altitude	1,200 feet radio altitude
TCAS INCREASE DESCENT RAs		Approximately 1,500 feet radio altitude	Go-around at approximately 1,500 feet radio altitude
TCAS DESCEND RAs		Approximately 1,100 feet radio altitude	Go-around at approximately 1,100 feet radio altitude

[Option - TCAS Version 7]

All TCAS RAs	Alerts are inhibited When RA selected on panel, TCAS switches automatically to TA only mode and TCAS message TA ONLY is displayed on ND	Approximately 1,000 feet radio altitude	Go-around at approximately 1,000 feet radio altitude
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All EICAS communication messages, except: CABIN ALERT	Messages are inhibited	800 feet radio altitude	75 knots airspeed
STATUS cue	All EICAS status messages		
All EICAS communication messages	Messages are inhibited	800 feet radio altitude	75 knots airspeed
STATUS cue	All EICAS status messages		

[Option - TCAS Version 7]

TCAS voice alerts	TCAS TAs	Approximately 500 feet radio altitude	Go-around at approximately 500 feet radio altitude
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Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
New PWS caution alerts	Alerts are inhibited	400 feet radio altitude	80 knots airspeed
EICAS alert message WINDSHEAR SYS	Message is inhibited		
EICAS advisory message TCAS OFF			Go-around at 400 feet radio altitude
RAAS voice annunciations except: CAUTION SHORT RUNWAY, SHORT RUNWAY	Voice annunciations are inhibited	300 feet above field elevation	750 feet above field elevation on approach
RAAS voice annunciation CAUTION SHORT RUNWAY, SHORT RUNWAY			450 feet above field elevation on approach
RAAS amber message on ND SHORT RUNWAY	Message is inhibited		
Master CAUTION lights Beeper	All EICAS caution messages, except: AUTOPILOT AUTOTHROTTLE DISC NO AUTOLAND SPEEDBRAKE EXTENDED	LAND 2 or LAND 3 displayed on PFD, and 200 feet radio altitude	80 knots ground speed, or 40 seconds elapse, or 800 feet radio altitude

[777-200/-300 Series - Option - With PWS]

New PWS warning alerts	Alerts are inhibited	50 feet radio altitude	100 knots airspeed
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EICAS Event Record

Pushing the EICAS EVENT RCD switch records currently displayed engine indications and additional EICAS maintenance information. Up to five events may be recorded by the first five pushes. The system also records out of limit parameters and related conditions automatically when a system parameter is exceeded.

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Warning Systems**EICAS Messages****Chapter 15****Section 30****EICAS Alert Messages**

Message	Level	Aural	Message Logic
AIRSPPEED LOW	Caution	Beeper	Airspeed is below minimum maneuvering speed.
ALTITUDE ALERT	Caution	Beeper	Airplane has deviated from MCP selected altitude.
ALTITUDE CALLOUTS	Advisory		Altitude and minimums voice annunciations during approach are no longer provided.
CONFIG DOORS	Warning	Siren	Passenger entry, service exit, forward cargo, or aft cargo door is not closed, not latched, and not locked when either engine's thrust is in the takeoff range on the ground.
CONFIG DOORS	Warning	Siren	An entry, forward cargo, main deck cargo, or aft cargo door is not closed, latched, and locked when either engine's thrust is in the takeoff range on the ground.
CONFIG FLAPS	Warning	Siren	Flaps or slats are not in a takeoff position when either engine's thrust is in the takeoff range on the ground.
CONFIG GEAR	Warning	Siren	Any landing gear is not down and locked when either thrust lever is closed below 800 feet radio altitude or when flaps are in a landing position.
CONFIG GEAR STEERING	Warning	Siren	Main gear steering is unlocked when either engine's thrust is in the takeoff range on the ground.
CONFIG PARKING BRAKE	Warning	Siren	Parking brake is set when either engine's thrust is in the takeoff range on the ground.

Message	Level	Aural	Message Logic
CONFIG RUDDER	Warning	Siren	Rudder trim is not centered when either engine's thrust is in the takeoff range on the ground.

[After PRR 63003]

CONFIG SPOILERS	Warning	Siren	Speedbrake lever is not DOWN when either engine's thrust is in the takeoff range on the ground; or, speedbrake lever extended beyond ARMED in flight, and climb thrust or greater set on either thrust lever.
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[Before PRR 63003]

CONFIG SPOILERS	Warning	Siren	Speedbrake lever not DOWN when either engine's thrust is in the takeoff range on the ground.
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CONFIG STABILIZER	Warning	Siren	Stabilizer is not within the greenband when either engine's thrust is in the takeoff range on the ground.
CONFIG WARNING SYS	Advisory		A fault is detected in the configuration warning system.
GND PROX SYS	Advisory		Ground proximity alerts are no longer provided.
OVERSPEED	Warning	Siren	Airspeed has exceeded Vmo/Mmo.
PILOT RESPONSE	Warning	Siren	After caution message PILOT RESPONSE displayed, FMC does not detect crew activity in monitored area within a specified time.
PILOT RESPONSE	Caution	Beeper	After advisory message PILOT RESPONSE displayed, FMC does not detect crew activity in monitored area within a specified time.
PILOT RESPONSE	Advisory		FMC does not detect crew activity in monitored area within a specific time.

777 Flight Crew Operations Manual

Message	Level	Aural	Message Logic
RUNWAY OVRD	Advisory		Runway Override switch is in OVRD.
RUNWAY POS	Advisory		RAAS not operating because GPS position accuracy is inadequate.
RUNWAY SYS	Advisory		RAAS failed, or RAAS unavailable because airport is not in the RAAS database.
TAIL STRIKE	Caution	Beeper	A tail strike has been detected.
TCAS	Advisory		TCAS has failed.
TCAS OFF	Advisory		TCAS is in standby mode.
TCAS RA CAPTAIN, F/O	Advisory		TCAS cannot display RA guidance on the affected PFD.
TERR OVRD	Advisory		Ground proximity terrain override switch is in OVRD.
TERR POS	Advisory		Terrain position data has been lost. Look-ahead terrain alerting and display unavailable because GPS has failed. During time between GPS failure and display of TERR POS message, IRS provides position for look-ahead alerting and display.
WINDSHEAR SYS	Advisory		Windshear alerts may not be provided.

EICAS Memo Messages

Message	Level	Aural	Message Logic
VMO GEAR DOWN	Memo		GEAR DOWN is selected on the Misc System Controls (MSC) maintenance page.

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