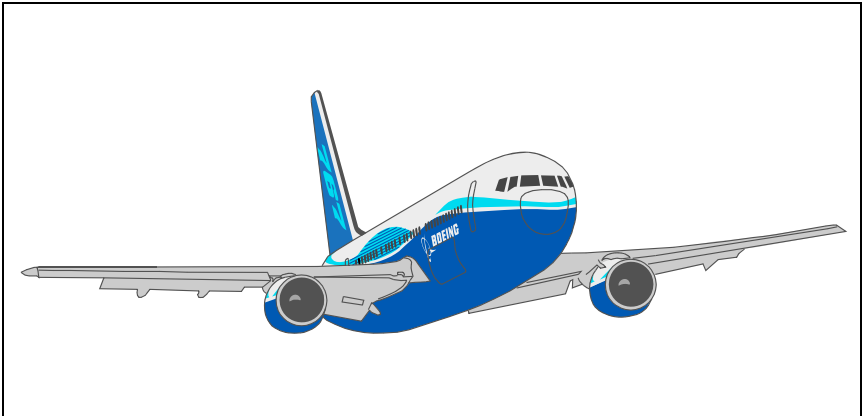




767-300

Flight Crew Operations Manual

Nordwind Airlines

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Preface

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General

The airplanes listed in the table below are covered in the Flight Crew Operations Manual (FCOM). The numbers are used to distinguish data peculiar to one or more, but not all of the airplanes. Where data applies to all airplanes listed, no reference is made to individual airplane numbers.

Use of the table below permits flight crew correlation of configuration differences by number 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 is supplied by the national regulatory agency. Serial and tabulation numbers are supplied by Boeing.

Revision changes to the table below, and the manual throughout, reflect the new registry number(s). The same changes are applicable to the Model ID table in the QRH.

Registry Number	Serial Number	Tabulation Number
VP-BDI	29618	VS217
VP-BMC	30301	VS208
VP-BOQ	28042	VL914
VP-BOY	29435	VS061
VP-BOZ	28111	VN174
VP-BRL	26328	VL941
VP-BWW	27959	VL896
VP-BWX	27960	VL897
VQ-BMQ	28098	VL895
VQ-BMU	27427	VN637
VQ-BOG	30342	VS392
VQ-BPT	27957	VL891
VQ-BRA	27310	VN421



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General

This Flight Crew Operations Manual (FCOM) has been prepared by The Boeing Company. The purpose of this manual is to:

- provide the operating limitations, procedures, performance, and systems information the flight crew needs to safely and efficiently operate the 767 airplane during all anticipated operations
- serve as a comprehensive reference for use during transition training for the 767 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 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.



767 Flight Crew Operations Manual

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 operations manual does not contain basic flight information that is considered prerequisite training.

Please send all correspondence regarding content or use of this manual, including bulletin status, to the 767 Manager, Flight Technical Data 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 operational limitations and normal procedures. All operating procedures are based on a thorough analysis of crew activity required to operate the airplane, and reflect the latest knowledge and experience available.
- Supplementary Procedures chapter covers those procedures accomplished as required rather than routinely on each flight.
- Performance Inflight chapter contains performance information necessary for inflight use.

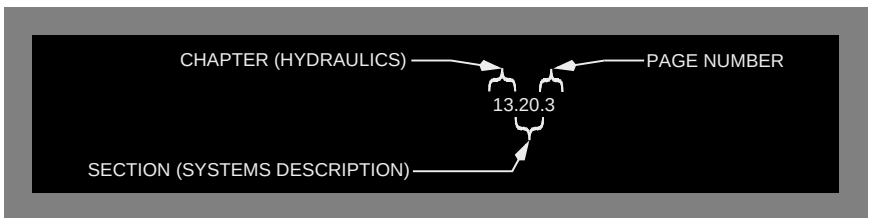
Volume 2 – Chapters 1 through 15 contain general airplane and systems information. These chapters are generally subdivided into sections covering controls and indicators and systems descriptions.

Quick Reference Handbook (QRH) – The QRH covers normal checklists, in-flight performance, non-normal checklists, and non-normal 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

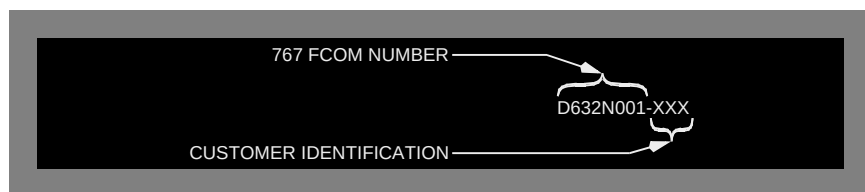


Page Identification

Each page is identified by a customer document number and a page date. The customer document number is composed of the general 767 FCOM, D632T001–, and is followed by the customer identification. The page date is the date of publication of the manual or the most recent revision date.

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Example Page Identification



Warnings, Cautions, and Notes

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

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:

1. Airplane effectivities are listed in alpha-numeric order. A range of airplanes is defined by the word “through”, e.g. **N601BC through N605BC** includes all N6xxBC series aircraft in order as listed on the model ID page. A comma in the the range, e.g. **N601BC through N603BC, N605BC** indicates that **N604BC** is excluded from the range.
2. Airplane effectivities apply only to the paragraph, illustration, operational note, procedural step, etc. and to subordinate items (if any).

Example (with subordinate items):

N601BC through N604BC

Right radio tuning panel.....Set
Verify that the OFF light is extinguished.

First officer’s audio control panel.....Set

In this example, the effectivity N601BC through N604BC applies to the first procedural step and further indented (subordinate) step only. The effectivity does not include the next equivalently indented step.

The first step (Right radio tuning panel) is effective for airplanes N601BC through N604BC, the second step (First officer’s audio control panel) is effective for all airplanes:

Example (without subordinate items):

N601BC through N602BC

Thrust reversers inoperative.

Autobrake system inoperative.

In this example, the effectivity N601BC through N602BC applies to the first operational note only. The effectivity does not apply to the next equivalently indented operational note.

The first operational note (Thrust reverser inoperative.) is effective for airplanes N601BC through N602BC only, the next operational note (Autobrake ...) is effective for all airplanes.

3. When airplane effectivities are stated immediately below a checklist title, the entire checklist applies to the listed airplanes only. In the following example, the OIL FILTER checklist is applicable to N601BC through N603BC only:



4. When Boeing has been notified airplanes are to be modified by service bulletin (SB), the effectivity statement will include 'Add' and 'Delete' versions, as appropriate, in parentheses. Depending upon the modification, there may not be both an 'Add' and an 'Delete' 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 ('Add' version):

**(SB Adds N604BC when Dual Oil Filters are installed)
The engine may be operated normally.**

"SB Adds N604BC" means the incorporation of the SB (i.e. installation of Dual Oil Filters in this example) is scheduled to begin for airplane N604BC. The words "SB Adds, when Dual Oil Filters are installed" indicate the associated operational note (The engine may be operated normally.) applies to N604BC when the SB has been incorporated.

Example ('Deletes' version):

**(SB Deletes N604BC when Dual Oil Filters are installed)
The engine must be operated at idle thrust.**

For airplane N604BC the SB (i.e. installation of Dual Oil Filters in this example) has not been incorporated. The associated operational note (The engine must be operated at idle thrust) applies N604BC.

"SB Deletes N604BC" means the incorporation of the SB (i.e. installation of Dual Oil Filters in this example) is scheduled to begin for airplane N604BC. The words "The engine must be operated at idle thrust " will apply to N604BC until the SB has been incorporated.

Disclaimer

VP-BOQ

This manual contains non Boeing Supplemental Type Certificate (STC) systems requested by the operator. This information may differ from Boeing recommended information. By including this information in the manual, Boeing is providing a publishing service ONLY. The Boeing Company does not in any way endorse or approve such information. The technical accuracy and validity of all such operator originated information, and its effect, if any, on other portions of this manual, is the sole responsibility of the operator.

All such information will be indicated by “dots” in the margin of the manual as indicated.



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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	
ABV	Above
AC	Alternating Current
ACARS	Aircraft Communications Addressing and Reporting System
ACP	Audio Control Panel
ACT	Active
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
ADIRS	Air Data Inertial Reference System
ADIRU	Air Data Inertial Reference Unit
AFDS	Autopilot Flight Director System
AFM	Airplane Flight Manual (FAA approved)
A/G	Air/Ground
AGL	Above Ground Level
AIL	Aileron
ALT	Altitude
ALTN	Alternate

AM	Amplitude Modulation
AMI	Airline Modifiable Information
ANP	Actual Navigational Performance
ANT	Antenna
AOA	Angle of Attack
AOC	Airline Operational Communication Data Link
A/P	Autopilot
APL	Airplane
APP	Approach
APU	Auxiliary Power Unit
ARINC	Aeronautical Radio, Incorporated
ARPT	Airport
ARR	Arrival
ASA	Autoland Status Annunciator
ASYM	Asymmetry
A/T	Autothrottle
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATT	Attitude

767 Flight Crew Operations Manual

AUTO- THROT	Autothrottle
AUTO	Automatic
AUX	Auxiliary
AVAIL	Available
B	
BARO	Barometric
BAT	Battery
B/CRS	Back Course
BFO	Beat Frequency Oscillator
BKR	Breaker
BLD	Bleed
BLW	Below
BRG	Bearing
BRT	Bright
BTL	Bottle
C	
C	Captain Celsius Center Cool
CANC	Cancel
CAP	Capture
CAPT	Captain
CB	Circuit Breaker
CDU	Control Display Unit
CG	Center of Gravity
CHR	Chronograph
CKT	Circuit
CL	Close
CLB	Climb

CLR	Clear
CMD	Command
CO	Company
COMM	Communication
COMP	Comparator
COMPT	Compartment
CON	Continuous
CONFIG	Configuration
CONT	Control
COOL	Cooling
CRS	Course
CRT	Cathode Ray Tube
CRZ	Cruise
CTL	Control
CTR	Center
CWS	Control Wheel Steering
D	
DA(H)	Decision Altitude (Height)
DC	Direct Current
DCU	Display Concentrator Unit
DDG	Dispatch Deviations Guide
DEL	Delete
DEP	Departure
DEPR	Depressurize
DES	Descent
DH	Decision Height
DIFF	Differential
DISC	Disconnect



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DISCH	Discharge
DK	Deck
DME	Distance Measuring Equipment
DN	Down
DSPL	Display
E	
E/D	End of Descent
E/E	Electrical/Electronic
EEC	Electronic Engine Control
EFI	Electronic Flight Instruments
EFIS	Electronic Flight Instrument System
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
ELEC	Electrical
ELEV	Elevator
EMER	Emergency
ENG	Engine
ENT	Entry
EO	Engine Out
EPR	Engine Pressure Ratio
EQPT or EQUIP	Equipment
ETOPS	Extended Range Operation with Twin Engine Airplanes
EVAC	Evacuation
EXEC	Execute

EXT	Extend or External
F	
F	Fahrenheit
FADEC	Full Authority Digital Engine Control
FCC	Flight Control Computer
FCOM	Flight Crew Operations Manual
FD, F/D or FLT DIR	Flight Director
FF	Fuel Flow
FILT	Filter
FL CH or FLCH	Flight Level Change
FLT	Flight
FMA	Flight Mode Annunciations
FMC	Flight Management Computer
FMS	Flight Management System
F/O or F O	First Officer
FPA	Flight Path Angle
FPV	Flight Path Vector
FPM	Feet Per Minute
FREQ	Frequency
F/S	Fast/Slow
FT	Feet
FWD	Forward
FWSOV	Fire Wall Shut Off Valve
G	
GA	Go-Around
GEN	Generator

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GMT	Greenwich Mean Time
GND	Ground
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
G/S	Glide Slope
GS	Ground Speed
H	
HDG	Heading
HF	High Frequency
HI	High
HLD	Hold
HPSOV	High Pressure Shut Off Valve
HSI	Horizontal Situation Indicator
HYD	Hydraulic
I	
IAS	Indicated Airspeed
IDENT	Identification
IGN	Ignition
IGS	Instrument Guidance System
IND LTS	Indicator Lights
INIT	Initialization
INSTR	Instrument
ILS	Instrument Landing System
INBD	Inboard
IND	Indicator
INOP	Inoperative

INT or INTPH	Interphone
INTC	Intercept
ISFD	Integrated Standby Flight Display
IRS	Inertial Reference System
ISA	International Standard Atmosphere
ISLN	Isolation
K	
K or KTS	Knots
KGS	Kilograms
L	
L	Left
LBS	Pounds
LD	Load
LDA	Localizer-type Directional Aid
LDG	Landing
LE	Leading Edge
LIM	Limit
LKD	Locked
L NAV or LNAV	Lateral Navigation
LOC	Localizer
LT	Light
LWR CTR	Lower Center
LWR DSPLY	Lower Display
M	
M	Mach
MAG	Magnetic

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MAN	Manual
MAX	Maximum
MCP	Mode Control Panel
MDA(H)	Minimum Descent Altitude (Height)
MEL	Minimum Equipment List
MIC	Microphone
MFD	Multifunction Display
MIN	Minimum
MLS	Microwave Landing System
MMO	Maximum Mach Operating Speed
MOD	Modify
MSG	Message
MTRS	Meters
N	
N	Normal
NAV	Navigation
ND	Navigation Display
NGS	Nitrogen Generation System
NM	Nautical Miles
NORM	Normal
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 DSPL	Outboard Display
OVHT	Overheat
OVRD	Override
OVSPD	Overspeed
OXY or O2	Oxygen
P	
PA	Passenger Address
PASS	Passenger
PCP	Pilot Call Panel
PERF	Performance
PES	Pitch Enhancement System
PF	Pilot Flying
PFD	Primary Flight Display
PM	Pilot Monitoring
PNL	Panel
POS	Position
PPOS	Present Position
PRES or PRESS	Pressure
PREV	Previous
P/RST	Push To Reset
PROX	Proximity

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PRV	Pressure Regulating Valve
PSI	Pounds Per Square Inch
PTH	Path
PTT	Push To Talk
PTU	Power Transfer Unit
PWR	Power
PWS	Predictive Windshear System
Q	
QFE	Local Station Pressure
QNH	Local Station Pressure Corrected to MSL
QTY	Quantity
R	
R	Right
RA	Radio Altitude Resolution Advisory
RAD	Radio
RAT	Ram Air Turbine
RDMI	Radio Distance Magnetic Indicator
REC	Recorder
RECIR or RECIRC	Recirculation
REF	Reference
REV	Reverse
RF	Refill
RMI	Radio Magnetic Indicator
RNP	Required Navigational Performance
RPM	Revolutions Per Minute
RST	Reset

RNV	Area Navigation (RNAV)
RSVR	Reservoir
R/T	Radio Transmit
RTE	Route
RTO	Rejected Takeoff
RUD	Rudder
RVSM	Reduced Vertical Separation Minimum
S	
SAT	Static Air Temperature Satellite
SB	Service Bulletin
S/C	Step Climb
SDF	Simplified Directional Facility
SEL	Select
SELCAL	Selective Calling
SENS	Sensitivity
SERV	Service
SPD	Speed
SPDBRK	Speedbrake
STAB	Stabilizer
STBY	Standby
SYS	System
T	
T or TRU	True
T or TK or TRK	Track
TA	Traffic Advisory
TAI	Thermal Anti-Ice
TAT	Total Air Temperature

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T/C	Top of Climb
TCAS	Traffic Alert and Collision Avoidance System
T/D	Top of Descent
TE	Trailing Edge
TEMP	Temperature
TERR	Terrain
TFC	Traffic
TFR	Transfer
THR	Throttle Thrust
TO or T/O	Takeoff
TO/GA	Takeoff/Go-Around
TURB	Turbine Turbulence
U	
UNLKD	Unlocked
UNSCHD or UNSCHED	Unscheduled
UPR DSPL	Upper Display
USB	Upper Side Band
UTC	Universal Time Coordinated
UTIL	Utility
V	
VA	Design maneuvering Speed
VAL	Valve
VERT	Vertical
VHF	Very High Frequency
VIB	Vibration

VLV	Valve
VMO	Maximum Operating Speed
V NAV or VNAV	Vertical Navigation
VOR	VHF Omnidirectional Range
VR	Rotation Speed
VREF	Reference Speed
VSI	Vertical Speed Indicator
V/S	Vertical Speed
VTK	Vertical Track
V1	Takeoff Decision Speed
V2	Takeoff Safety Speed
W	
W	Warm
WHL	Wheel
WPT	Waypoint
WXR	Weather Radar
X	
X-FEED	Crossfeed
XPDR or XPNDR	Transponder
XTK	Cross Track



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Preface

V1V2 Revision Record

Chapter 0

Section 4

Revision Transmittal Letter

To: All holders of Nordwind Airlines 767 Flight Crew Operations Manual (FCOM), Boeing Document Number D632T001-36NRW.

Subject: Flight Crew Operations Manual Revision.

CAUTION. Before inserting this FCOM revision check the Bulletin Record, Section 6, against the enclosed Flight Crew Operations Manual Bulletins (OMBs). If all OMBs listed in Section 6 are enclosed, this FCOM has been completely reprinted for customer convenience due to the large number of changed pages.

This revision reflects the most current information available to The Boeing Company 45 days prior to the subject revision date. The following revision highlights explain changes in this revision. The Revision Record page explains the use of revision bars to identify new or revised information.

Revision Record

No.	Revision Date	Date Filed
0	August 16, 2010	
2	March 2, 2011	
4	September 15, 2011	
6	August 14, 2012	
8	March 29, 2013	
10	February 20, 2014	
12	October 15, 2014	

No.	Revision Date	Date Filed
1	February 18, 2011	
3	August 15, 2011	
5	February 17, 2012	
7	February 15, 2013	
9	August 16, 2013	
11	August 14, 2014	

General

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

The revision date is the approximate date the manual is mailed to the customer and is effective upon receipt.

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

Pages containing revised material have revision bars and highlights associated with the changed text or illustration. Revision bars associated with revised effectivity due to additions, deletions of airplanes or changes to previous registration numbers will not have highlights.

The 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. The List of Effective Pages determines the correct content of the manual.

Revision Highlights

Highlights have page numbers; section and paragraph titles are provided.

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

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

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

Chapter 0 - Preface

Section 1 - Model Identification

0.1.1 - Revised to add/change an airplane entry.

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Chapter NP - Normal Procedures

Section 21 - Amplified Procedures

Preflight Procedure – First Officer

NP.21.20 - Added non standard location for First officers audio selector panel.

Chapter SP - Supplementary Procedures

Section 4 - Automatic Flight

Autoland Status Annunciator Reset

SP.4.11 - Added a note describing in-flight reset of a latched NO LAND 3 annunciation caused by turbulence.

Chapter PI - Performance Inflight

Section 40 - Table of Contents

PI.TOC.40.1 - 767-300 CF6-80C2B7F KG FAA CATC CATD EU-OPS TO1-10% TO2-20% was added as Section 40.

Section 40 - General

General

PI.40.1 - 767-300 CF6-80C2B7F KG FAA CATC CATD EU-OPS TO1-10% TO2-20% was added as Section 40.

Section 60 - Table of Contents

PI.TOC.60.1 - 767-300 PW4062 KG FT FAA CATC CATD EI was added as Section 60.

Section 60 - General

General

PI.60.1 - 767-300 PW4062 KG FT FAA CATC CATD EI was added as Section 60.

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

Section 40 - Systems Description

Exterior Lighting

1.40.2 - Adds information for two fixed taxi lights.

Exterior Lighting Locations

1.40.5 - Adds exterior lighting illustration for added aircraft.

Section 45 - Emergency Equipment

Emergency Equipment Locations

- 1.45.5 - Adds Emergency Equipment diagram.

Chapter 5 - Communications

Section 10 - Controls and Indicators

Audio Control Panel (ACP)

- 5.10.4 - Added audio control panel illustration and callouts.

VHF Communication Panel

- 5.10.14-15 - Added illustration and callouts for ACARS indications for airplanes with operational ACARS.

Printer

- 5.10.35 - Added illustration and callouts for airplanes with a flight deck printer.
- 5.10.35 - Added printer information to reflect fleet configuration.

Section 20 - System Description

Aircraft Communication Addressing and Reporting System (ACARS)

- 5.20.5 - Added description of VHF voice communication capabilities with ACARS active for airplanes with the VHF voice protection feature installed.

Manual ACARS Mode Selection

- 5.20.6 - Added reference to data mode selection for airplanes ACARS capable radios and operational ACARS.
- 5.20.6 - Added systems description for airplanes which provide for manual ACARS radio mode selection on the communication panels.

Chapter 7 - Engines, APU

Section 22 - Engine System Description (GE)

Thrust Management Computer (TMC)

- 7.22.5 - Added information for airplanes with assumed temperature takeoff entry via the datalink.

Assumed Temperature Takeoff

- 7.22.6 - Added information for airplanes with assumed temperature takeoff entry via the datalink.

EEC Alternate Mode

- 7.22.8 - Revised text to read N1.

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Section 42 - EICAS Messages (GE)

Engine

7.42.3 - Added information for airplanes with an EICAS advisory message of L or R ENG OIL PRESS.

Chapter 11 - Flight Management, Navigation

Section 40 - FMC Preflight

Takeoff Reference Page

11.40.73-74 - Added information to reflect fleet configuration.

Chapter 15 - Warning Systems

Section 10 - Controls and Indicators

EICAS Status Display

15.10.10 - Added EICAS Status Display information.

Section 20 - System Description

GPWS Voice Callouts

15.20.27 - Added table describing enhanced GPWS decision height voice callouts to reflect fleet configuration.



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Preface

Chapter 0

V1V2 List of Effective Pages

Section 5

Volume 1			
* Title Page 1-2	October 15, 2014	B.4.3	August 16, 2010
0.TOC.1-2	February 20, 2014	B.4.4	February 18, 2011
Model Identification		B.5.1	August 14, 2014
* 0.1.1-2	October 15, 2014	B.5.2	August 16, 2010
Introduction		B.5.3	August 16, 2010
0.2.1	August 16, 2010	B.5.4	August 16, 2010
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* 0.2.3	October 15, 2014	B.6.2	February 18, 2011
* 0.2.4	October 15, 2014	* B.7.1	October 15, 2014
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0.2.6	August 16, 2010	* B.8.1	October 15, 2014
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Abbreviations		B.9.2	February 18, 2011
0.3.1	August 16, 2010	B.10.1	February 18, 2011
0.3.2	August 16, 2010	* B.10.2	October 15, 2014
0.3.3	August 16, 2010	B.10.3	August 16, 2010
0.3.4	August 16, 2010	B.10.4	August 16, 2010
0.3.5	February 18, 2011	B.11.1	March 29, 2013
0.3.6	February 18, 2011	B.11.2	August 16, 2010
0.3.7	February 18, 2011	B.11.3	February 18, 2011
0.3.8	August 16, 2010	B.11.4	August 16, 2010
V1V2 Revision Record (tab)		* B.12.1	October 15, 2014
* 0.4.1-6	October 15, 2014	B.12.2	February 18, 2011
* 0.4.7-12	Deleted	B.13.1	August 16, 2010
V1V2 List of Effective Pages		B.13.2	February 18, 2011
* 0.5.1-24	October 15, 2014	B.14.1	August 14, 2014
Bulletins (tab)		B.14.2	August 14, 2014
* 0.6.1-4	October 15, 2014	B.16.1	February 18, 2011
* B.1.1	October 15, 2014	B.16.2	February 20, 2014
B.1.2	February 18, 2011	B.16.3	February 20, 2014
B.3.1	August 16, 2013	B.16.4	February 18, 2011
B.3.2	February 18, 2011	B.17.1	August 14, 2014
B.4.1	August 14, 2014	B.17.2	February 20, 2014
B.4.2	August 16, 2010	B.17.3	February 20, 2014
		B.17.4	August 15, 2011
		B.18.1	February 20, 2014
		B.18.2	February 20, 2014
		B.19.1	August 14, 2014
		B.19.2	February 15, 2013
		B.19.3	February 15, 2013
		B.19.4	February 15, 2013
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B.21.1	February 20, 2014	B.27.2	February 15, 2013
B.21.2	February 15, 2013	B.28.1	February 20, 2014
B.21.3	February 15, 2013	B.28.2	February 15, 2013
B.21.4	February 15, 2013	B.28.3	February 15, 2013
B.21.5	February 15, 2013	B.28.4	February 15, 2013
B.21.6	February 15, 2013	B.29.1	February 20, 2014
B.21.7	February 15, 2013	B.29.2	August 16, 2013
B.21.8	February 15, 2013	B.30.1	February 20, 2014
B.21.9	February 15, 2013	B.30.2	August 16, 2013
B.21.10	February 15, 2013	B.31.1	February 20, 2014
B.21.11	February 15, 2013	B.31.2	August 16, 2013
B.21.12	February 15, 2013	B.32.1	February 20, 2014
B.21.13	February 15, 2013	B.32.2	August 16, 2013
B.21.14	February 15, 2013	B.32.3	August 16, 2013
B.21.15	February 15, 2013	B.32.4	August 16, 2013
B.21.16	February 15, 2013	B.33.1	February 20, 2014
B.21.17	February 15, 2013	B.33.2	August 16, 2013
B.21.18	February 15, 2013	B.34.1	February 20, 2014
B.21.19	February 15, 2013	B.34.2	August 16, 2013
B.21.20	February 15, 2013	B.35.1	February 20, 2014
B.21.21	February 15, 2013	B.35.2	August 16, 2013
B.21.22	February 15, 2013	B.36.1	February 20, 2014
B.21.23	February 15, 2013	B.36.2	August 16, 2013
B.21.24	February 15, 2013	B.37.1	February 20, 2014
B.21.25	February 15, 2013	B.37.2	August 16, 2013
B.21.26	February 15, 2013	B.38.1	February 20, 2014
B.21.27	February 15, 2013	B.38.2	August 16, 2013
B.21.28	February 15, 2013	Limitations (tab)	
B.21.29	February 15, 2013	L.TOC.1-2	February 20, 2014
B.21.30	February 15, 2013	L.10.1	August 14, 2014
B.21.31	February 15, 2013	L.10.2	August 14, 2014
B.21.32	February 15, 2013	L.10.3	August 14, 2014
B.21.33	February 15, 2013	* L.10.4	October 15, 2014
B.21.34	February 15, 2013	* L.10.5	October 15, 2014
B.22.1	February 20, 2014	L.10.6	February 20, 2014
B.22.2	February 15, 2013	* L.10.7	October 15, 2014
B.23.1	February 20, 2014	* L.10.8	October 15, 2014
B.23.2	February 15, 2013	L.10.9	August 14, 2014
B.24.1	February 20, 2014	L.10.10	February 20, 2014
B.24.2	August 14, 2014	Normal Procedures (tab)	
B.24.3	August 14, 2014	* NP.TOC.1-2	October 15, 2014
B.24.4	February 15, 2013	NP.11.1	August 16, 2010
B.25.1	February 20, 2014	NP.11.2	August 16, 2013
B.25.2	February 20, 2014	NP.11.3	August 16, 2010
B.26.1	February 20, 2014	NP.11.4	August 16, 2010
B.26.2	February 15, 2013		
B.27.1	February 20, 2014		

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NP.11.5	August 16, 2010	* NP.21.44	October 15, 2014
NP.11.6	August 16, 2010	* NP.21.45	October 15, 2014
NP.11.7	August 16, 2010	* NP.21.46	October 15, 2014
NP.11.8	August 16, 2010	* NP.21.47	October 15, 2014
NP.21.1	February 20, 2014	* NP.21.48	October 15, 2014
* NP.21.2	October 15, 2014	* NP.21.49	October 15, 2014
NP.21.3	August 15, 2011	* NP.21.50	October 15, 2014
NP.21.4	August 14, 2014	* NP.21.51	October 15, 2014
NP.21.5	August 14, 2012	* NP.21.52	October 15, 2014
NP.21.6	August 16, 2010	* NP.21.53	October 15, 2014
NP.21.7	February 20, 2014	* NP.21.54	October 15, 2014
NP.21.8	August 16, 2010	* NP.21.55	October 15, 2014
NP.21.9	February 20, 2014	* NP.21.56	October 15, 2014
NP.21.10	August 16, 2010	Supplementary Procedures (tab)	
* NP.21.11	October 15, 2014	SP.TOC.1-6	August 14, 2014
* NP.21.12	October 15, 2014	SP.05.1	August 16, 2010
* NP.21.13	October 15, 2014	SP.05.2	August 16, 2010
* NP.21.14	October 15, 2014	* SP.1.1	October 15, 2014
* NP.21.15	October 15, 2014	* SP.1.2	October 15, 2014
* NP.21.16	October 15, 2014	* SP.1.3	October 15, 2014
* NP.21.17	October 15, 2014	SP.1.4	March 2, 2011
* NP.21.18	October 15, 2014	* SP.1.5	October 15, 2014
* NP.21.19	October 15, 2014	SP.1.6	March 2, 2011
* NP.21.20	October 15, 2014	* SP.2.1	October 15, 2014
* NP.21.21	October 15, 2014	* SP.2.2	October 15, 2014
* NP.21.22	October 15, 2014	SP.3.1	August 14, 2014
* NP.21.23	October 15, 2014	SP.3.2	August 16, 2010
* NP.21.24	October 15, 2014	SP.4.1	August 14, 2014
* NP.21.25	October 15, 2014	* SP.4.2	October 15, 2014
* NP.21.26	October 15, 2014	SP.4.3	August 14, 2014
* NP.21.27	October 15, 2014	* SP.4.4	October 15, 2014
* NP.21.28	October 15, 2014	SP.4.5	February 18, 2011
* NP.21.29	October 15, 2014	* SP.4.6	October 15, 2014
* NP.21.30	October 15, 2014	* SP.4.7	October 15, 2014
* NP.21.31	October 15, 2014	SP.4.8	August 14, 2014
* NP.21.32	October 15, 2014	SP.4.9	August 14, 2014
* NP.21.33	October 15, 2014	SP.4.10	August 14, 2014
* NP.21.34	October 15, 2014	* SP.4.11	October 15, 2014
* NP.21.35	October 15, 2014	SP.4.12	August 14, 2014
* NP.21.36	October 15, 2014	* SP.5.1	October 15, 2014
* NP.21.37	October 15, 2014	* SP.5.2	October 15, 2014
* NP.21.38	October 15, 2014	* SP.6.1	October 15, 2014
* NP.21.39	October 15, 2014	SP.6.2	August 16, 2010
* NP.21.40	October 15, 2014	SP.6.3	August 16, 2010
* NP.21.41	October 15, 2014	* SP.6.4	October 15, 2014
* NP.21.42	October 15, 2014	SP.6.5	March 2, 2011
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SP.6.6	March 2, 2011	SP.16.17	August 14, 2014
SP.7.1	February 20, 2014	SP.16.18	August 14, 2014
* SP.7.2	October 15, 2014	SP.16.19	August 14, 2014
* SP.7.3	October 15, 2014	SP.16.20	August 14, 2014
* SP.7.4	October 15, 2014	SP.16.21	August 14, 2014
SP.8.1	August 16, 2010	SP.16.22	August 14, 2014
SP.8.2	August 16, 2010	SP.16.23	August 14, 2014
SP.10.1	February 15, 2013	* SP.16.24	October 15, 2014
SP.10.2	August 14, 2014	SP.16.25	August 14, 2014
* SP.11.1	October 15, 2014	* SP.16.26	October 15, 2014
* SP.11.2	October 15, 2014	SP.16.27	August 14, 2014
SP.11.3	September 15, 2011	SP.16.28	August 14, 2014
SP.11.4	September 15, 2011	Performance Inflight (tab)	
* SP.11.5	October 15, 2014	* PI.TOC.1-2	October 15, 2014
SP.11.6	February 20, 2014	767-300 CF6-80C2B6F KG FAA CATC CATD EI	
* SP.11.7	October 15, 2014	PI.TOC.10.1-2	August 14, 2014
SP.11.8	August 14, 2014	PI.10.1	August 14, 2014
SP.11.9	September 15, 2011	PI.10.2	August 14, 2014
SP.11.10	September 15, 2011	* PI.10.3	October 15, 2014
* SP.11.11	October 15, 2014	PI.10.4	August 14, 2014
SP.11.12	September 15, 2011	PI.10.5	August 14, 2014
* SP.11.13	October 15, 2014	PI.10.6	August 14, 2014
SP.11.14	September 15, 2011	PI.10.7	August 14, 2014
* SP.11.15	October 15, 2014	PI.10.8	August 14, 2014
SP.11.16	August 14, 2014	PI.10.9	August 14, 2014
SP.11.17	September 15, 2011	PI.10.10	August 14, 2014
SP.11.18	September 15, 2011	PI.10.11	August 14, 2014
SP.12.1	February 20, 2014	PI.10.12	August 14, 2014
SP.12.2	August 16, 2010	PI.10.13	August 14, 2014
SP.15.1	August 16, 2010	PI.10.14	August 14, 2014
SP.15.2	August 16, 2010	PI.10.15	August 14, 2014
* SP.16.1	October 15, 2014	PI.10.16	August 14, 2014
SP.16.2	August 14, 2014	PI.10.17	August 14, 2014
SP.16.3	August 14, 2014	PI.10.18	August 14, 2014
* SP.16.4	October 15, 2014	PI.10.19	August 14, 2014
SP.16.5	August 14, 2014	PI.10.20	August 14, 2014
SP.16.6	August 14, 2014	PI.11.1	August 14, 2014
* SP.16.7	October 15, 2014	PI.11.2	August 14, 2014
* SP.16.8	October 15, 2014	PI.11.3	August 14, 2014
* SP.16.9	October 15, 2014	PI.11.4	August 14, 2014
SP.16.10	August 16, 2013	PI.11.5	August 14, 2014
SP.16.11	September 15, 2011	PI.11.6	August 14, 2014
* SP.16.12	October 15, 2014	PI.11.7	August 14, 2014
SP.16.13	August 14, 2014	PI.11.8	August 14, 2014
SP.16.14	August 14, 2014	PI.12.1	August 14, 2014
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PI.12.4	August 14, 2014	PI.20.2	August 14, 2014
PI.12.5	August 14, 2014	* PI.20.3	October 15, 2014
PI.12.6	August 14, 2014	PI.20.4	August 14, 2014
PI.12.7	August 14, 2014	PI.20.5	August 14, 2014
PI.12.8	August 14, 2014	PI.20.6	August 14, 2014
PI.12.9	August 14, 2014	PI.20.7	August 14, 2014
PI.12.10	August 14, 2014	PI.20.8	August 14, 2014
PI.12.11	August 14, 2014	PI.20.9	August 14, 2014
PI.12.12	August 14, 2014	PI.20.10	August 14, 2014
PI.13.1	August 14, 2014	PI.20.11	August 14, 2014
PI.13.2	August 14, 2014	PI.20.12	August 14, 2014
PI.13.3	August 14, 2014	PI.20.13	August 14, 2014
PI.13.4	August 14, 2014	PI.20.14	August 14, 2014
PI.13.5	August 14, 2014	PI.20.15	August 14, 2014
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PI.13.7	August 14, 2014	PI.20.17	August 14, 2014
PI.13.8	August 14, 2014	PI.20.18	August 14, 2014
PI.13.9	August 14, 2014	PI.20.19	August 14, 2014
PI.13.10	August 14, 2014	PI.20.20	August 14, 2014
PI.14.1	August 14, 2014	PI.21.1	August 14, 2014
PI.14.2	August 14, 2014	PI.21.2	August 14, 2014
PI.14.3	August 14, 2014	PI.21.3	August 14, 2014
PI.14.4	August 14, 2014	PI.21.4	August 14, 2014
PI.14.5	August 14, 2014	PI.21.5	August 14, 2014
PI.14.6	August 14, 2014	PI.21.6	August 14, 2014
PI.15.1	August 14, 2014	PI.21.7	August 14, 2014
PI.15.2	August 14, 2014	PI.21.8	August 14, 2014
PI.15.3	August 14, 2014	PI.22.1	August 14, 2014
PI.15.4	August 14, 2014	PI.22.2	August 14, 2014
PI.15.5	August 14, 2014	PI.22.3	August 14, 2014
PI.15.6	August 14, 2014	PI.22.4	August 14, 2014
PI.16.1	August 14, 2014	PI.22.5	August 14, 2014
PI.16.2	August 14, 2014	PI.22.6	August 14, 2014
PI.16.3	August 14, 2014	PI.22.7	August 14, 2014
PI.16.4	August 14, 2014	PI.22.8	August 14, 2014
PI.16.5	August 14, 2014	PI.22.9	August 14, 2014
PI.16.6	August 14, 2014	PI.22.10	August 14, 2014
PI.16.7	August 14, 2014	PI.22.11	August 14, 2014
PI.16.8	August 14, 2014	PI.22.12	August 14, 2014
PI.16.9	August 14, 2014	PI.23.1	August 14, 2014
PI.16.10	August 14, 2014	PI.23.2	August 14, 2014
PI.16.11	August 14, 2014	PI.23.3	August 14, 2014
PI.16.12	August 14, 2014	PI.23.4	August 14, 2014
		PI.23.5	August 14, 2014
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EU-OPS		PI.23.7	August 14, 2014
PI.TOC.20.1-2	August 14, 2014		

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PI.23.9	August 14, 2014	PI.30.19	August 14, 2014
PI.23.10	August 14, 2014	PI.30.20	August 14, 2014
PI.24.1	August 14, 2014	PI.30.21	August 14, 2014
PI.24.2	August 14, 2014	PI.30.22	August 14, 2014
PI.24.3	August 14, 2014	PI.30.23	August 14, 2014
PI.24.4	August 14, 2014	PI.30.24	August 14, 2014
PI.24.5	August 14, 2014	PI.30.25	August 14, 2014
PI.24.6	August 14, 2014	PI.30.26	August 14, 2014
PI.25.1	August 14, 2014	PI.30.27	August 14, 2014
PI.25.2	August 14, 2014	PI.30.28	August 14, 2014
PI.25.3	August 14, 2014	PI.31.1	August 14, 2014
PI.25.4	August 14, 2014	PI.31.2	August 14, 2014
PI.25.5	August 14, 2014	PI.31.3	August 14, 2014
PI.25.6	August 14, 2014	PI.31.4	August 14, 2014
PI.26.1	August 14, 2014	PI.31.5	August 14, 2014
PI.26.2	August 14, 2014	PI.31.6	August 14, 2014
PI.26.3	August 14, 2014	PI.31.7	August 14, 2014
PI.26.4	August 14, 2014	PI.31.8	August 14, 2014
PI.26.5	August 14, 2014	PI.32.1	August 14, 2014
PI.26.6	August 14, 2014	PI.32.2	August 14, 2014
PI.26.7	August 14, 2014	PI.32.3	August 14, 2014
PI.26.8	August 14, 2014	PI.32.4	August 14, 2014
PI.26.9	August 14, 2014	PI.32.5	August 14, 2014
PI.26.10	August 14, 2014	PI.32.6	August 14, 2014
PI.26.11	August 14, 2014	PI.32.7	August 14, 2014
PI.26.12	August 14, 2014	PI.32.8	August 14, 2014
767-300 CF6-80C2B6F KG FAA CATC CATD		PI.32.9	August 14, 2014
EU-OPS TO1-10% TO2-20%		PI.32.10	August 14, 2014
PI.TOC.30.1-4	August 14, 2014	PI.32.11	August 14, 2014
PI.30.1	August 14, 2014	PI.32.12	August 14, 2014
PI.30.2	August 14, 2014	PI.33.1	August 14, 2014
* PI.30.3	October 15, 2014	PI.33.2	August 14, 2014
PI.30.4	August 14, 2014	PI.33.3	August 14, 2014
PI.30.5	August 14, 2014	PI.33.4	August 14, 2014
PI.30.6	August 14, 2014	PI.33.5	August 14, 2014
PI.30.7	August 14, 2014	PI.33.6	August 14, 2014
PI.30.8	August 14, 2014	PI.33.7	August 14, 2014
PI.30.9	August 14, 2014	PI.33.8	August 14, 2014
PI.30.10	August 14, 2014	PI.33.9	August 14, 2014
PI.30.11	August 14, 2014	PI.33.10	August 14, 2014
PI.30.12	August 14, 2014	PI.34.1	August 14, 2014
PI.30.13	August 14, 2014	PI.34.2	August 14, 2014
PI.30.14	August 14, 2014	PI.34.3	August 14, 2014
PI.30.15	August 14, 2014	PI.34.4	August 14, 2014
PI.30.16	August 14, 2014	PI.34.5	August 14, 2014
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PI.35.2	August 14, 2014	* PI.40.10	October 15, 2014
PI.35.3	August 14, 2014	* PI.40.11	October 15, 2014
PI.35.4	August 14, 2014	* PI.40.12	October 15, 2014
PI.35.5	August 14, 2014	* PI.40.13	October 15, 2014
PI.35.6	August 14, 2014	* PI.40.14	October 15, 2014
PI.36.1	August 14, 2014	* PI.40.15	October 15, 2014
PI.36.2	August 14, 2014	* PI.40.16	October 15, 2014
PI.36.3	August 14, 2014	* PI.40.17	October 15, 2014
PI.36.4	August 14, 2014	* PI.40.18	October 15, 2014
PI.36.5	August 14, 2014	* PI.40.19	October 15, 2014
PI.36.6	August 14, 2014	* PI.40.20	October 15, 2014
PI.36.7	August 14, 2014	* PI.40.21	October 15, 2014
PI.36.8	August 14, 2014	* PI.40.22	October 15, 2014
PI.36.9	August 14, 2014	* PI.40.23	October 15, 2014
PI.36.10	August 14, 2014	* PI.40.24	October 15, 2014
PI.36.11	August 14, 2014	* PI.40.25	October 15, 2014
PI.36.12	August 14, 2014	* PI.40.26	October 15, 2014
* PI.TOC.40.1-4	Deleted	* PI.40.27	October 15, 2014
* PI.40.1-2	Deleted	* PI.40.28	October 15, 2014
* PI.40.3	Deleted	* PI.41.1	October 15, 2014
* PI.40.4	Deleted	* PI.41.2	October 15, 2014
* PI.40.5	Deleted	* PI.41.3	October 15, 2014
* PI.40.6-13	Deleted	* PI.41.4	October 15, 2014
* PI.40.14	Deleted	* PI.41.5	October 15, 2014
* PI.40.15-16	Deleted	* PI.41.6	October 15, 2014
* PI.40.17-26	Deleted	* PI.41.7	October 15, 2014
* PI.40.27	Deleted	* PI.41.8	October 15, 2014
* PI.40.28	Deleted	* PI.42.1	October 15, 2014
* PI.40.29-30	Deleted	* PI.42.2	October 15, 2014
* PI.41.1-8	Deleted	* PI.42.3	October 15, 2014
* PI.42.1-12	Deleted	* PI.42.4	October 15, 2014
* PI.43.1-10	Deleted	* PI.42.5	October 15, 2014
* PI.44.1-6	Deleted	* PI.42.6	October 15, 2014
* PI.45.1-6	Deleted	* PI.42.7	October 15, 2014
* PI.46.1-12	Deleted	* PI.42.8	October 15, 2014
767-300 CF6-80C2B7F KG FAA CATC CATD		* PI.42.9	October 15, 2014
EU-OPS TO1-10% TO2-20%		* PI.42.10	October 15, 2014
* PI.TOC.40.1-4	October 15, 2014	* PI.42.11	October 15, 2014
* PI.40.1	October 15, 2014	* PI.42.12	October 15, 2014
* PI.40.2	October 15, 2014	* PI.43.1	October 15, 2014
* PI.40.3	October 15, 2014	* PI.43.2	October 15, 2014
* PI.40.4	October 15, 2014	* PI.43.3	October 15, 2014
* PI.40.5	October 15, 2014	* PI.43.4	October 15, 2014
* PI.40.6	October 15, 2014	* PI.43.5	October 15, 2014
* PI.40.7	October 15, 2014	* PI.43.6	October 15, 2014
* PI.40.8	October 15, 2014	* PI.43.7	October 15, 2014

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* PI.43.8	October 15, 2014	PI.50.18	August 14, 2014
* PI.43.9	October 15, 2014	PI.50.19	August 14, 2014
* PI.43.10	October 15, 2014	PI.50.20	August 14, 2014
* PI.44.1	October 15, 2014	PI.51.1	August 14, 2014
* PI.44.2	October 15, 2014	PI.51.2	August 14, 2014
* PI.44.3	October 15, 2014	PI.51.3	August 14, 2014
* PI.44.4	October 15, 2014	PI.51.4	August 14, 2014
* PI.44.5	October 15, 2014	PI.51.5	August 14, 2014
* PI.44.6	October 15, 2014	PI.51.6	August 14, 2014
* PI.45.1	October 15, 2014	PI.51.7	August 14, 2014
* PI.45.2	October 15, 2014	PI.51.8	August 14, 2014
* PI.45.3	October 15, 2014	PI.52.1	August 14, 2014
* PI.45.4	October 15, 2014	PI.52.2	August 14, 2014
* PI.45.5	October 15, 2014	PI.52.3	August 14, 2014
* PI.45.6	October 15, 2014	PI.52.4	August 14, 2014
* PI.46.1	October 15, 2014	PI.52.5	August 14, 2014
* PI.46.2	October 15, 2014	PI.52.6	August 14, 2014
* PI.46.3	October 15, 2014	PI.52.7	August 14, 2014
* PI.46.4	October 15, 2014	PI.52.8	August 14, 2014
* PI.46.5	October 15, 2014	PI.52.9	August 14, 2014
* PI.46.6	October 15, 2014	PI.52.10	August 14, 2014
* PI.46.7	October 15, 2014	PI.52.11	August 14, 2014
* PI.46.8	October 15, 2014	PI.52.12	August 14, 2014
* PI.46.9	October 15, 2014	PI.53.1	August 14, 2014
* PI.46.10	October 15, 2014	PI.53.2	August 14, 2014
* PI.46.11	October 15, 2014	PI.53.3	August 14, 2014
* PI.46.12	October 15, 2014	PI.53.4	August 14, 2014
767-300 PW4060 KG FAA CATC CATD		PI.53.5	August 14, 2014
PI.TOC.50.1-4	August 14, 2014	PI.53.6	August 14, 2014
PI.50.1	August 14, 2014	PI.53.7	August 14, 2014
PI.50.2	August 14, 2014	PI.53.8	August 14, 2014
* PI.50.3	October 15, 2014	PI.53.9	August 14, 2014
PI.50.4	August 14, 2014	PI.53.10	August 14, 2014
PI.50.5	August 14, 2014	PI.54.1	August 14, 2014
PI.50.6	August 14, 2014	PI.54.2	August 14, 2014
PI.50.7	August 14, 2014	PI.54.3	August 14, 2014
PI.50.8	August 14, 2014	PI.54.4	August 14, 2014
PI.50.9	August 14, 2014	PI.54.5	August 14, 2014
PI.50.10	August 14, 2014	PI.54.6	August 14, 2014
PI.50.11	August 14, 2014	PI.54.7	August 14, 2014
PI.50.12	August 14, 2014	PI.54.8	August 14, 2014
PI.50.13	August 14, 2014	PI.55.1	August 14, 2014
PI.50.14	August 14, 2014	PI.55.2	August 14, 2014
PI.50.15	August 14, 2014	PI.55.3	August 14, 2014
PI.50.16	August 14, 2014	PI.55.4	August 14, 2014
PI.50.17	August 14, 2014	PI.55.5	August 14, 2014
		PI.55.6	August 14, 2014

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PI.56.1	August 14, 2014	* PI.61.5	October 15, 2014
PI.56.2	August 14, 2014	* PI.61.6	October 15, 2014
PI.56.3	August 14, 2014	* PI.61.7	October 15, 2014
PI.56.4	August 14, 2014	* PI.61.8	October 15, 2014
PI.56.5	August 14, 2014	* PI.62.1	October 15, 2014
PI.56.6	August 14, 2014	* PI.62.2	October 15, 2014
PI.57.1	August 14, 2014	* PI.62.3	October 15, 2014
PI.57.2	August 14, 2014	* PI.62.4	October 15, 2014
PI.57.3	August 14, 2014	* PI.62.5	October 15, 2014
PI.57.4	August 14, 2014	* PI.62.6	October 15, 2014
PI.57.5	August 14, 2014	* PI.62.7	October 15, 2014
PI.57.6	August 14, 2014	* PI.62.8	October 15, 2014
PI.57.7	August 14, 2014	* PI.62.9	October 15, 2014
PI.57.8	August 14, 2014	* PI.62.10	October 15, 2014
PI.57.9	August 14, 2014	* PI.62.11	October 15, 2014
PI.57.10	August 14, 2014	* PI.62.12	October 15, 2014
PI.57.11	August 14, 2014	* PI.63.1	October 15, 2014
PI.57.12	August 14, 2014	* PI.63.2	October 15, 2014
PI.57.13	August 14, 2014	* PI.63.3	October 15, 2014
PI.57.14	August 14, 2014	* PI.63.4	October 15, 2014
767-300 PW4062 KG FT FAA CATC CATD EI		* PI.63.5	October 15, 2014
PI.TOC.60.1-4	August 14, 2014	* PI.63.6	October 15, 2014
* PI.60.1	October 15, 2014	* PI.63.7	October 15, 2014
* PI.60.2	October 15, 2014	* PI.63.8	October 15, 2014
* PI.60.3	October 15, 2014	* PI.63.9	October 15, 2014
* PI.60.4	October 15, 2014	* PI.63.10	October 15, 2014
* PI.60.5	October 15, 2014	* PI.64.1	October 15, 2014
* PI.60.6	October 15, 2014	* PI.64.2	October 15, 2014
* PI.60.7	October 15, 2014	* PI.64.3	October 15, 2014
* PI.60.8	October 15, 2014	* PI.64.4	October 15, 2014
* PI.60.9	October 15, 2014	* PI.64.5	October 15, 2014
* PI.60.10	October 15, 2014	* PI.64.6	October 15, 2014
* PI.60.11	October 15, 2014	* PI.64.7	October 15, 2014
* PI.60.12	October 15, 2014	* PI.64.8	October 15, 2014
* PI.60.13	October 15, 2014	* PI.65.1	October 15, 2014
* PI.60.14	October 15, 2014	* PI.65.2	October 15, 2014
* PI.60.15	October 15, 2014	* PI.65.3	October 15, 2014
* PI.60.16	October 15, 2014	* PI.65.4	October 15, 2014
* PI.60.17	October 15, 2014	* PI.65.5	October 15, 2014
* PI.60.18	October 15, 2014	* PI.65.6	October 15, 2014
* PI.60.19	October 15, 2014	* PI.66.1	October 15, 2014
* PI.60.20	October 15, 2014	* PI.66.2	October 15, 2014
* PI.61.1	October 15, 2014	* PI.66.3	October 15, 2014
* PI.61.2	October 15, 2014	* PI.66.4	October 15, 2014
* PI.61.3	October 15, 2014	* PI.66.5	October 15, 2014
* PI.61.4	October 15, 2014	* PI.66.6	October 15, 2014
		* PI.67.1	October 15, 2014

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* PI.67.2	October 15, 2014	PI.71.3	August 14, 2014
* PI.67.3	October 15, 2014	PI.71.4	August 14, 2014
* PI.67.4	October 15, 2014	PI.71.5	August 14, 2014
* PI.67.5	October 15, 2014	PI.71.6	August 14, 2014
* PI.67.6	October 15, 2014	PI.71.7	August 14, 2014
* PI.67.7	October 15, 2014	PI.71.8	August 14, 2014
* PI.67.8	October 15, 2014	PI.72.1	August 14, 2014
* PI.67.9	October 15, 2014	PI.72.2	August 14, 2014
* PI.67.10	October 15, 2014	PI.72.3	August 14, 2014
* PI.67.11	October 15, 2014	PI.72.4	August 14, 2014
* PI.67.12	October 15, 2014	PI.72.5	August 14, 2014
* PI.67.13	October 15, 2014	PI.72.6	August 14, 2014
* PI.67.14	October 15, 2014	PI.72.7	August 14, 2014
767-300W CF6-80C2B7F KG FAA CATC CATD		PI.72.8	August 14, 2014
EU-OPS TO1-10% TO2-20%		PI.72.9	August 14, 2014
* PI.TOC.70.1-4	October 15, 2014	PI.72.10	August 14, 2014
PI.70.1	August 14, 2014	PI.72.11	August 14, 2014
PI.70.2	August 14, 2014	PI.72.12	August 14, 2014
* PI.70.3	October 15, 2014	PI.73.1	August 14, 2014
PI.70.4	August 14, 2014	PI.73.2	August 14, 2014
PI.70.5	August 14, 2014	PI.73.3	August 14, 2014
PI.70.6	August 14, 2014	PI.73.4	August 14, 2014
PI.70.7	August 14, 2014	PI.73.5	August 14, 2014
PI.70.8	August 14, 2014	PI.73.6	August 14, 2014
PI.70.9	August 14, 2014	PI.73.7	August 14, 2014
PI.70.10	August 14, 2014	PI.73.8	August 14, 2014
PI.70.11	August 14, 2014	PI.73.9	August 14, 2014
PI.70.12	August 14, 2014	PI.73.10	August 14, 2014
PI.70.13	August 14, 2014	PI.74.1	August 14, 2014
PI.70.14	August 14, 2014	PI.74.2	August 14, 2014
PI.70.15	August 14, 2014	PI.74.3	August 14, 2014
PI.70.16	August 14, 2014	PI.74.4	August 14, 2014
PI.70.17	August 14, 2014	PI.74.5	August 14, 2014
PI.70.18	August 14, 2014	PI.74.6	August 14, 2014
PI.70.19	August 14, 2014	PI.75.1	August 14, 2014
* PI.70.20	October 15, 2014	PI.75.2	August 14, 2014
* PI.70.21	October 15, 2014	PI.75.3	August 14, 2014
* PI.70.22	October 15, 2014	PI.75.4	August 14, 2014
* PI.70.23	October 15, 2014	PI.75.5	August 14, 2014
* PI.70.24	October 15, 2014	PI.75.6	August 14, 2014
* PI.70.25	October 15, 2014	PI.76.1	August 14, 2014
* PI.70.26	October 15, 2014	PI.76.2	August 14, 2014
* PI.70.27	October 15, 2014	PI.76.3	August 14, 2014
* PI.70.28	October 15, 2014	PI.76.4	August 14, 2014
* PI.70.29-30	Deleted	PI.76.5	August 14, 2014
PI.71.1	August 14, 2014	PI.76.6	August 14, 2014
PI.71.2	August 14, 2014	PI.76.7	August 14, 2014

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PI.76.8	August 14, 2014	* 1.30.16	October 15, 2014
PI.76.9	August 14, 2014	1.30.17	August 16, 2013
PI.76.10	August 14, 2014	1.30.18	August 14, 2014
PI.76.11	August 14, 2014	* 1.30.19	October 15, 2014
PI.76.12	August 14, 2014	* 1.30.20	October 15, 2014
(blank tab)		* 1.30.21	October 15, 2014
		1.30.22	August 16, 2013
		* 1.30.23	October 15, 2014
		* 1.30.24	October 15, 2014
		* 1.30.25	October 15, 2014
		1.30.26	August 16, 2013
		1.30.27	August 16, 2013
		1.30.28	August 16, 2013
		1.30.29	August 16, 2013
		1.30.30	August 16, 2013
		1.30.31	August 16, 2013
		1.30.32	August 16, 2013
		1.30.33	August 16, 2013
		1.30.34	August 14, 2014
		1.30.35	August 16, 2013
		1.30.36	August 16, 2013
		* 1.30.37	October 15, 2014
		1.30.38	August 16, 2013
		1.30.39	August 16, 2013
		1.30.40	August 14, 2014
		* 1.40.1	October 15, 2014
		* 1.40.2	October 15, 2014
		1.40.3	February 20, 2014
		* 1.40.4	October 15, 2014
		* 1.40.5	October 15, 2014
		* 1.40.6	October 15, 2014
		* 1.40.7	October 15, 2014
		* 1.40.8	October 15, 2014
		* 1.40.9	October 15, 2014
		* 1.40.10	October 15, 2014
		* 1.40.11	October 15, 2014
		* 1.40.12	October 15, 2014
		* 1.40.13	October 15, 2014
		* 1.40.14	October 15, 2014
		* 1.40.15	October 15, 2014
		* 1.40.16	October 15, 2014
		* 1.40.17	October 15, 2014
		* 1.40.18	October 15, 2014
		* 1.40.19	October 15, 2014
		* 1.40.20	October 15, 2014
		* 1.40.21	October 15, 2014
		* 1.40.22	October 15, 2014

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1.45.1	August 14, 2014	* 2.40.1	October 15, 2014
* 1.45.2	October 15, 2014	* 2.40.2	October 15, 2014
1.45.3	February 20, 2014	2.40.3	February 15, 2013
1.45.4	August 14, 2014	2.40.4	August 14, 2014
* 1.45.5	October 15, 2014	2.40.5	February 20, 2014
1.45.6	February 15, 2013	2.40.6	February 15, 2013
1.45.7	March 29, 2013	2.50.1	February 15, 2013
1.45.8	February 20, 2014	* 2.50.2	October 15, 2014
* 1.45.9	October 15, 2014	* 2.50.3	October 15, 2014
1.45.10	February 20, 2014	* 2.50.4	October 15, 2014
1.45.11	August 16, 2013	2.50.5	February 15, 2013
1.45.12	August 14, 2014	2.50.6	February 15, 2013
1.45.13	August 14, 2014		
1.45.14	August 14, 2014		
1.50.1	February 15, 2013		
* 1.50.2	October 15, 2014		
* 1.50.3	October 15, 2014		
1.50.4	August 14, 2014		
2 Air Systems (tab)		3 Anti-Ice, Rain (tab)	
2.TOC.1-2	August 14, 2014	3.TOC.1-2	February 20, 2014
2.10.1	February 20, 2014	* 3.10.1	October 15, 2014
2.10.2	August 14, 2014	* 3.10.2	October 15, 2014
2.10.3	August 14, 2014	3.10.3	March 2, 2011
2.10.4	August 14, 2014	3.10.4	February 20, 2014
2.10.5	August 14, 2014	* 3.10.5	October 15, 2014
2.10.6	August 14, 2014	3.10.6	February 15, 2013
2.10.7	August 14, 2014	3.20.1	August 14, 2014
2.10.8	August 14, 2014	* 3.20.2	October 15, 2014
* 2.10.9	October 15, 2014	3.20.3	February 20, 2014
2.10.10	August 14, 2014	* 3.20.4	October 15, 2014
2.10.11	August 14, 2014	3.20.5	March 2, 2011
2.10.12	August 14, 2014	3.20.6	February 15, 2013
2.10.13	August 14, 2014	* 3.20.7	October 15, 2014
2.10.14	August 14, 2014	3.20.8	February 20, 2014
2.10.15	August 14, 2014	* 3.30.1	October 15, 2014
2.10.16	August 14, 2014	3.30.2	August 16, 2013
2.20.1	August 16, 2010		
2.20.2	August 16, 2010		
2.20.3	August 14, 2014		
2.20.4	August 14, 2014		
2.20.5	February 15, 2013		
2.20.6	February 15, 2013		
* 2.20.7	October 15, 2014		
2.20.8	February 15, 2013		
2.30.1	August 16, 2010		
2.30.2	August 14, 2014		
		4 Automatic Flight (tab)	
		4.TOC.1-2	February 20, 2014
		4.10.1	February 20, 2014
		* 4.10.2	October 15, 2014
		4.10.3	August 14, 2014
		* 4.10.4	October 15, 2014
		* 4.10.5	October 15, 2014
		* 4.10.6	October 15, 2014
		* 4.10.7	October 15, 2014
		* 4.10.8	October 15, 2014
		4.10.9	August 16, 2013
		* 4.10.10	October 15, 2014
		* 4.10.11	October 15, 2014
		4.10.12	August 16, 2013
		4.10.13	August 16, 2013

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* 4.10.14	October 15, 2014	* 5.10.6	October 15, 2014
* 4.10.15	October 15, 2014	* 5.10.7	October 15, 2014
4.10.16	August 14, 2014	* 5.10.8	October 15, 2014
* 4.10.17	October 15, 2014	* 5.10.9	October 15, 2014
4.10.18	August 16, 2013	* 5.10.10	October 15, 2014
* 4.10.19	October 15, 2014	5.10.11	August 14, 2014
* 4.10.20	October 15, 2014	5.10.12	August 14, 2014
* 4.10.21	October 15, 2014	* 5.10.13	October 15, 2014
4.10.22	February 20, 2014	* 5.10.14	October 15, 2014
4.10.23	February 20, 2014	* 5.10.15	October 15, 2014
4.10.24	August 16, 2013	* 5.10.16	October 15, 2014
4.10.25	August 16, 2013	* 5.10.17	October 15, 2014
4.10.26	August 16, 2013	* 5.10.18	October 15, 2014
4.20.1	August 16, 2010	* 5.10.19	October 15, 2014
* 4.20.2	October 15, 2014	* 5.10.20	October 15, 2014
4.20.3	February 15, 2013	* 5.10.21	October 15, 2014
4.20.4	March 29, 2013	* 5.10.22	October 15, 2014
4.20.5	August 14, 2014	* 5.10.23	October 15, 2014
* 4.20.6	October 15, 2014	* 5.10.24	October 15, 2014
* 4.20.7	October 15, 2014	* 5.10.25	October 15, 2014
* 4.20.8	October 15, 2014	* 5.10.26	October 15, 2014
* 4.20.9	October 15, 2014	* 5.10.27	October 15, 2014
4.20.10	February 15, 2013	* 5.10.28	October 15, 2014
* 4.20.11	October 15, 2014	* 5.10.29	October 15, 2014
4.20.12	August 16, 2013	* 5.10.30	October 15, 2014
* 4.20.13	October 15, 2014	* 5.10.31	October 15, 2014
4.20.14	February 20, 2014	* 5.10.32	October 15, 2014
4.20.15	February 15, 2013	* 5.10.33	October 15, 2014
* 4.20.16	October 15, 2014	* 5.10.34	October 15, 2014
* 4.20.17	October 15, 2014	* 5.10.35	October 15, 2014
4.20.18	February 15, 2013	* 5.10.36	October 15, 2014
* 4.20.19	October 15, 2014	* 5.10.37	October 15, 2014
4.20.20	February 20, 2014	* 5.10.38	October 15, 2014
4.20.21	August 14, 2014	* 5.20.1	October 15, 2014
4.20.22	February 15, 2013	* 5.20.2	October 15, 2014
* 4.20.23	October 15, 2014	* 5.20.3	October 15, 2014
4.20.24	February 15, 2013	* 5.20.4	October 15, 2014
* 4.30.1	October 15, 2014	* 5.20.5	October 15, 2014
4.30.2	August 16, 2010	* 5.20.6	October 15, 2014
5 Communications (tab)		* 5.20.7	October 15, 2014
* 5.TOC.1-4	October 15, 2014	5.20.8	February 20, 2014
5.10.1	August 14, 2014	* 5.30.1	October 15, 2014
5.10.2	August 14, 2014	* 5.30.2	October 15, 2014
5.10.3	August 14, 2014	* 5.30.3	October 15, 2014
* 5.10.4	October 15, 2014	* 5.30.4	October 15, 2014
* 5.10.5	October 15, 2014	* 5.40.1	October 15, 2014
		* 5.40.2	October 15, 2014

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5.40.3	August 16, 2013	6 Electrical (tab)	
* 5.40.4	October 15, 2014	6.TOC.1-2	February 20, 2014
* 5.40.5	October 15, 2014	6.10.1	August 16, 2010
* 5.40.6	October 15, 2014	6.10.2	February 18, 2011
* 5.45.1	October 15, 2014	6.10.3	August 14, 2014
5.45.2	February 15, 2013	* 6.10.4	October 15, 2014
5.45.3	February 15, 2013	6.10.5	February 15, 2013
5.45.4	February 15, 2013	6.10.6	February 15, 2013
5.45.5	February 15, 2013	* 6.20.1	October 15, 2014
5.45.6	February 15, 2013	* 6.20.2	October 15, 2014
5.45.7	February 15, 2013	6.20.3	February 15, 2013
5.45.8	February 15, 2013	6.20.4	February 15, 2013
5.45.9	February 15, 2013	6.20.5	February 15, 2013
5.45.10	February 15, 2013	6.20.6	February 18, 2011
5.45.11	February 15, 2013	6.20.7	February 18, 2011
5.45.12	February 15, 2013	6.20.8	August 16, 2010
5.45.13	February 15, 2013	* 6.20.9	October 15, 2014
5.45.14	February 15, 2013	* 6.20.10	October 15, 2014
5.45.15	February 15, 2013	6.20.11	February 15, 2013
5.45.16	February 15, 2013	6.20.12	August 14, 2014
5.45.17	February 15, 2013	* 6.20.13	October 15, 2014
5.45.18	February 15, 2013	* 6.20.14	October 15, 2014
5.45.19	February 15, 2013	* 6.20.15	October 15, 2014
5.45.20	February 15, 2013	6.20.16	August 14, 2014
5.45.21	February 15, 2013	* 6.30.1	October 15, 2014
5.45.22	February 15, 2013	* 6.30.2	October 15, 2014
5.45.23	February 15, 2013	7 Engines, APU (tab)	
5.45.24	February 15, 2013	7.TOC.1-4	August 14, 2014
5.45.25	February 15, 2013	7.11.1	February 20, 2014
5.45.26	February 15, 2013	7.11.2	August 16, 2013
5.45.27	February 15, 2013	7.11.3	August 16, 2013
5.45.28	February 15, 2013	7.11.4	February 15, 2013
* 5.45.29	October 15, 2014	7.11.5	February 15, 2013
* 5.45.30	October 15, 2014	7.11.6	February 20, 2014
5.45.31	August 14, 2014	7.11.7	February 15, 2013
5.45.32	August 14, 2014	7.11.8	February 15, 2013
5.45.33	August 14, 2014	7.11.9	February 15, 2013
5.45.34	August 14, 2014	7.11.10	February 20, 2014
5.45.35	August 14, 2014	7.11.11	February 20, 2014
5.45.36	August 14, 2014	7.11.12	February 20, 2014
5.45.37	August 14, 2014	7.11.13	February 20, 2014
5.45.38	August 14, 2014	7.11.14	February 20, 2014
* 5.50.1	October 15, 2014	7.11.15	February 20, 2014
* 5.50.2	October 15, 2014	7.11.16	February 20, 2014
* 5.50.3	October 15, 2014	7.11.17	February 20, 2014
5.50.4	March 2, 2011		

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7.11.18	February 20, 2014	7.22.1	August 14, 2014
7.11.19	February 20, 2014	7.22.2	August 14, 2014
7.11.20	February 20, 2014	7.22.3	August 16, 2013
7.11.21	February 20, 2014	* 7.22.4	October 15, 2014
7.11.22	February 20, 2014	* 7.22.5	October 15, 2014
7.12.1	August 14, 2014	* 7.22.6	October 15, 2014
* 7.12.2	October 15, 2014	* 7.22.7	October 15, 2014
7.12.3	February 20, 2014	* 7.22.8	October 15, 2014
7.12.4	September 15, 2011	7.22.9	August 14, 2014
7.12.5	February 15, 2013	7.22.10	February 15, 2013
7.12.6	August 14, 2014	7.22.11	February 17, 2012
7.12.7	September 15, 2011	7.22.12	September 15, 2011
7.12.8	September 15, 2011	7.22.13	March 29, 2013
7.12.9	September 15, 2011	7.22.14	March 29, 2013
7.12.10	September 15, 2011	7.22.15	September 15, 2011
7.12.11	February 15, 2013	7.22.16	September 15, 2011
7.12.12	February 15, 2013	7.22.17	February 15, 2013
7.12.13	February 15, 2013	7.22.18	September 15, 2011
7.12.14	February 15, 2013	7.22.19	August 16, 2013
7.12.15	September 15, 2011	7.22.20	September 15, 2011
7.12.16	September 15, 2011	7.30.1	August 14, 2014
7.12.17	September 15, 2011	7.30.2	August 14, 2014
7.12.18	September 15, 2011	7.41.1	February 20, 2014
7.12.19	August 14, 2014	7.41.2	August 16, 2013
* 7.12.20	October 15, 2014	7.41.3	August 16, 2013
* 7.12.21	October 15, 2014	7.41.4	February 15, 2013
* 7.12.22	October 15, 2014	7.42.1	August 14, 2014
7.15.1	February 20, 2014	7.42.2	March 29, 2013
* 7.15.2	October 15, 2014	* 7.42.3	October 15, 2014
7.21.1	February 20, 2014	7.42.4	August 16, 2010
7.21.2	August 16, 2013	8 Fire Protection (tab)	
7.21.3	August 16, 2013	8.TOC.1-2	February 20, 2014
7.21.4	August 16, 2013	8.10.1	August 16, 2010
7.21.5	February 20, 2014	8.10.2	August 16, 2010
7.21.6	February 20, 2014	8.10.3	February 15, 2013
7.21.7	August 16, 2013	8.10.4	February 20, 2014
7.21.8	August 16, 2013	8.10.5	August 16, 2013
7.21.9	August 16, 2013	8.10.6	August 16, 2013
7.21.10	August 16, 2013	8.10.7	August 16, 2013
7.21.11	February 15, 2013	8.10.8	August 16, 2013
7.21.12	February 15, 2013	8.20.1	August 16, 2010
7.21.13	February 15, 2013	8.20.2	August 16, 2010
7.21.14	February 15, 2013	8.20.3	February 15, 2013
7.21.15	February 15, 2013	8.20.4	August 16, 2013
7.21.16	February 15, 2013	8.20.5	February 15, 2013
7.21.17	February 15, 2013	8.20.6	August 14, 2014
7.21.18	February 15, 2013		

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8.30.1	August 16, 2013	10.10.14	February 20, 2014
8.30.2	February 20, 2014	10.10.15	August 16, 2013
9 Flight Controls (tab)		* 10.10.16	October 15, 2014
9.TOC.1-2	February 20, 2014	* 10.10.17	October 15, 2014
9.10.1	August 16, 2010	10.10.18	August 16, 2013
9.10.2	August 16, 2010	* 10.10.19	October 15, 2014
9.10.3	August 16, 2010	* 10.10.20	October 15, 2014
9.10.4	August 16, 2010	* 10.10.21	October 15, 2014
* 9.10.5	October 15, 2014	10.10.22	August 14, 2014
* 9.10.6	October 15, 2014	10.10.23	August 14, 2014
9.10.7	August 14, 2014	* 10.10.24	October 15, 2014
9.10.8	August 14, 2014	10.10.25	August 16, 2013
9.10.9	February 20, 2014	10.10.26	August 16, 2013
9.10.10	August 16, 2013	10.10.27	August 16, 2013
9.10.11	August 16, 2013	* 10.10.28	October 15, 2014
9.10.12	August 16, 2013	10.10.29	August 16, 2013
9.20.1	August 16, 2010	10.10.30	February 20, 2014
9.20.2	February 15, 2013	10.10.31	August 16, 2013
9.20.3	August 16, 2010	* 10.10.32	October 15, 2014
9.20.4	February 17, 2012	10.10.33	August 16, 2013
9.20.5	February 17, 2012	10.10.34	August 14, 2014
9.20.6	August 16, 2010	10.10.35	August 14, 2014
9.20.7	August 16, 2010	10.10.36	August 14, 2014
9.20.8	February 20, 2014	10.10.37	August 14, 2014
9.20.9	February 20, 2014	10.10.38	August 14, 2014
9.20.10	February 20, 2014	10.10.39	August 14, 2014
9.20.11	August 16, 2013	10.10.40	August 14, 2014
9.20.12	August 16, 2013	10.10.41	August 14, 2014
9.30.1	February 15, 2013	10.10.42	August 14, 2014
9.30.2	February 15, 2013	10.10.43	August 14, 2014
10 Flight Instruments, Displays (tab)		10.10.44	August 14, 2014
10.TOC.1-4	August 14, 2014	10.10.45	August 14, 2014
10.10.1	February 18, 2011	* 10.10.46	October 15, 2014
10.10.2	February 20, 2014	10.10.47	August 14, 2014
10.10.3	August 16, 2013	10.10.48	August 14, 2014
10.10.4	August 16, 2013	10.10.49	August 14, 2014
10.10.5	August 16, 2013	10.10.50	August 14, 2014
10.10.6	August 16, 2013	10.10.51	August 14, 2014
10.10.7	August 16, 2013	10.10.52	August 14, 2014
10.10.8	August 16, 2013	10.10.53	August 14, 2014
10.10.9	August 16, 2013	* 10.10.54	October 15, 2014
10.10.10	August 16, 2013	10.10.55	August 14, 2014
10.10.11	August 16, 2013	10.10.56	August 14, 2014
* 10.10.12	October 15, 2014	10.10.57	August 14, 2014
10.10.13	August 16, 2013	10.10.58	August 14, 2014
		10.10.59	August 14, 2014
		10.10.60	August 14, 2014

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10.10.61	August 14, 2014	* 10.10.108	October 15, 2014
10.10.62	August 14, 2014	* 10.10.109	October 15, 2014
10.10.63	August 14, 2014	* 10.10.110	October 15, 2014
10.10.64	August 14, 2014	* 10.10.111	October 15, 2014
10.10.65	August 14, 2014	* 10.10.112	October 15, 2014
10.10.66	August 14, 2014	10.10.113	August 14, 2014
10.10.67	August 14, 2014	10.10.114	August 14, 2014
10.10.68	August 14, 2014	* 10.10.115	October 15, 2014
10.10.69	August 14, 2014	10.10.116	August 14, 2014
* 10.10.70	October 15, 2014	* 10.10.117	October 15, 2014
10.10.71	August 14, 2014	10.10.118	August 14, 2014
10.10.72	August 14, 2014	10.10.119	August 14, 2014
10.10.73	August 14, 2014	10.10.120	August 14, 2014
10.10.74	August 14, 2014	10.10.121	August 14, 2014
10.10.75	August 14, 2014	10.10.122	August 14, 2014
10.10.76	August 14, 2014	10.10.123	August 14, 2014
10.10.77	August 14, 2014	10.10.124	August 14, 2014
10.10.78	August 14, 2014	10.10.125	August 14, 2014
10.10.79	August 14, 2014	10.10.126	August 14, 2014
10.10.80	August 14, 2014	* 10.10.127	October 15, 2014
10.10.81	August 14, 2014	10.10.128	August 14, 2014
10.10.82	August 14, 2014	10.10.129	August 14, 2014
10.10.83	August 14, 2014	10.10.130	August 14, 2014
* 10.10.84	October 15, 2014	10.10.131	August 14, 2014
10.10.85	August 14, 2014	10.10.132	August 14, 2014
10.10.86	August 14, 2014	10.10.133	August 14, 2014
10.10.87	August 14, 2014	10.10.134	August 14, 2014
* 10.10.88	October 15, 2014	10.20.1	August 15, 2011
* 10.10.89	October 15, 2014	* 10.20.2	October 15, 2014
* 10.10.90	October 15, 2014	* 10.20.3	October 15, 2014
10.10.91	August 14, 2014	* 10.20.4	October 15, 2014
* 10.10.92	October 15, 2014	* 10.20.5	October 15, 2014
10.10.93	August 14, 2014	10.20.6	August 14, 2014
10.10.94	August 14, 2014	* 10.20.7	October 15, 2014
* 10.10.95	October 15, 2014	10.20.8	August 16, 2013
10.10.96	August 14, 2014	* 10.30.1	October 15, 2014
10.10.97	August 14, 2014	10.30.2	August 14, 2014
10.10.98	August 14, 2014	* 10.30.3	October 15, 2014
10.10.99	August 14, 2014	10.30.4	August 16, 2013
10.10.100	August 14, 2014	* 10.30.5	October 15, 2014
10.10.101	August 14, 2014	* 10.30.6	October 15, 2014
10.10.102	August 14, 2014	10.30.7	August 16, 2013
10.10.103	August 14, 2014	* 10.30.8	October 15, 2014
* 10.10.104	October 15, 2014	10.30.9	February 20, 2014
10.10.105	August 14, 2014	10.30.10	August 16, 2013
10.10.106	August 14, 2014	10.30.11	August 16, 2013
* 10.10.107	October 15, 2014	10.30.12	August 14, 2014

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10.30.13	August 16, 2013	11.10.25	August 14, 2014
10.30.14	February 20, 2014	11.10.26	August 14, 2014
10.30.15	August 16, 2013	11.10.27	August 16, 2013
10.30.16	August 16, 2013	* 11.10.28	October 15, 2014
10.30.17	February 20, 2014	11.10.29	February 20, 2014
10.30.18	August 16, 2013	11.10.30	August 14, 2014
10.30.19	August 14, 2014	11.10.31	February 20, 2014
10.30.20	August 14, 2014	11.10.32	August 16, 2013
10.30.21	August 16, 2013	11.20.1	August 14, 2014
10.30.22	August 16, 2013	* 11.20.2	October 15, 2014
* 10.40.1	October 15, 2014	11.20.3	February 15, 2013
10.40.2	August 14, 2014	* 11.20.4	October 15, 2014
10.40.3	August 14, 2014	* 11.20.5	October 15, 2014
10.40.4	February 20, 2014	* 11.20.6	October 15, 2014
10.40.5	August 14, 2014	11.20.7	February 20, 2014
10.40.6	February 20, 2014	11.20.8	February 20, 2014
10.40.7	August 16, 2013	* 11.20.9	October 15, 2014
10.40.8	August 16, 2013	* 11.20.10	October 15, 2014
10.50.1	March 29, 2013	11.30.1	August 16, 2013
10.50.2	August 16, 2010	11.30.2	August 14, 2014
11 Flight Management, Navigation (tab)		* 11.31.1	October 15, 2014
11.TOC.1-8	February 20, 2014	11.31.2	February 15, 2013
11.10.1	March 29, 2013	11.31.3	September 15, 2011
* 11.10.2	October 15, 2014	11.31.4	August 14, 2014
* 11.10.3	October 15, 2014	11.31.5	August 14, 2014
* 11.10.4	October 15, 2014	11.31.6	August 14, 2014
* 11.10.5	October 15, 2014	* 11.31.7	October 15, 2014
* 11.10.6	October 15, 2014	11.31.8	August 14, 2014
11.10.7	February 20, 2014	11.31.9	August 14, 2014
11.10.8	August 14, 2014	11.31.10	February 15, 2013
11.10.9	February 15, 2013	11.31.11	February 15, 2013
11.10.10	February 15, 2013	11.31.12	February 15, 2013
11.10.11	February 15, 2013	11.31.13	February 15, 2013
11.10.12	February 15, 2013	11.31.14	February 15, 2013
11.10.13	February 15, 2013	11.31.15	February 15, 2013
11.10.14	August 14, 2014	11.31.16	February 15, 2013
11.10.15	February 20, 2014	11.31.17	February 15, 2013
11.10.16	August 16, 2013	11.31.18	February 15, 2013
* 11.10.17	October 15, 2014	11.31.19	February 15, 2013
* 11.10.18	October 15, 2014	11.31.20	February 15, 2013
11.10.19	February 20, 2014	* 11.31.21	October 15, 2014
11.10.20	August 16, 2013	11.31.22	August 14, 2014
11.10.21	August 16, 2013	* 11.31.23	October 15, 2014
11.10.22	August 16, 2013	11.31.24	February 15, 2013
11.10.23	August 16, 2013	* 11.31.25	October 15, 2014
11.10.24	February 20, 2014	11.31.26	February 15, 2013
		* 11.31.27	October 15, 2014

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11.31.28	February 15, 2013	11.40.17	August 16, 2013
11.31.29	August 14, 2014	11.40.18	February 20, 2014
11.31.30	February 15, 2013	11.40.19	August 16, 2013
11.31.31	February 15, 2013	11.40.20	August 14, 2014
11.31.32	August 14, 2014	11.40.21	August 16, 2013
11.31.33	August 14, 2014	11.40.22	August 16, 2013
11.31.34	August 14, 2014	11.40.23	August 14, 2014
11.31.35	February 20, 2014	11.40.24	August 16, 2013
* 11.31.36	October 15, 2014	11.40.25	February 20, 2014
11.31.37	February 15, 2013	11.40.26	August 16, 2013
11.31.38	February 15, 2013	11.40.27	August 14, 2014
11.32.1	August 14, 2014	11.40.28	August 16, 2013
11.32.2	August 14, 2014	11.40.29	February 20, 2014
11.32.3	August 14, 2014	11.40.30	August 16, 2013
11.32.4	August 14, 2014	11.40.31	February 20, 2014
* 11.33.1	October 15, 2014	11.40.32	August 16, 2013
11.33.2	March 2, 2011	11.40.33	August 16, 2013
* 11.34.1	October 15, 2014	* 11.40.34	October 15, 2014
11.34.2	February 15, 2013	11.40.35	August 16, 2013
11.34.3	February 15, 2013	* 11.40.36	October 15, 2014
* 11.34.4	October 15, 2014	11.40.37	February 20, 2014
* 11.34.5	October 15, 2014	11.40.38	August 16, 2013
* 11.34.6	October 15, 2014	11.40.39	August 14, 2014
* 11.34.7	October 15, 2014	* 11.40.40	October 15, 2014
11.34.8	August 14, 2014	11.40.41	February 20, 2014
* 11.34.9	October 15, 2014	11.40.42	August 16, 2013
* 11.34.10	October 15, 2014	* 11.40.43	October 15, 2014
11.34.11	August 14, 2014	11.40.44	August 16, 2013
11.34.12	March 29, 2013	11.40.45	August 16, 2013
11.34.13	March 29, 2013	11.40.46	August 16, 2013
11.34.14	March 29, 2013	11.40.47	August 16, 2013
* 11.40.1	October 15, 2014	11.40.48	August 16, 2013
11.40.2	February 17, 2012	11.40.49	August 16, 2013
11.40.3	August 14, 2014	11.40.50	August 16, 2013
* 11.40.4	October 15, 2014	* 11.40.51	October 15, 2014
11.40.5	February 20, 2014	11.40.52	February 20, 2014
* 11.40.6	October 15, 2014	11.40.53	August 16, 2013
* 11.40.7	October 15, 2014	11.40.54	August 14, 2014
11.40.8	August 14, 2014	11.40.55	August 16, 2013
11.40.9	August 14, 2014	11.40.56	August 14, 2014
11.40.10	February 20, 2014	* 11.40.57	October 15, 2014
11.40.11	August 16, 2013	11.40.58	August 14, 2014
11.40.12	August 16, 2013	* 11.40.59	October 15, 2014
11.40.13	August 14, 2014	11.40.60	February 20, 2014
11.40.14	August 16, 2013	11.40.61	February 20, 2014
11.40.15	August 16, 2013	11.40.62	February 20, 2014
11.40.16	February 20, 2014	11.40.63	February 20, 2014

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11.40.64	February 20, 2014	11.42.19	February 20, 2014
11.40.65	February 20, 2014	* 11.42.20	October 15, 2014
11.40.66	February 20, 2014	11.42.21	February 20, 2014
11.40.67	February 20, 2014	* 11.42.22	October 15, 2014
* 11.40.68	October 15, 2014	11.42.23	August 16, 2013
11.40.69	February 20, 2014	11.42.24	August 14, 2014
11.40.70	August 14, 2014	* 11.42.25	October 15, 2014
* 11.40.71	October 15, 2014	11.42.26	February 20, 2014
* 11.40.72	October 15, 2014	11.42.27	August 14, 2014
* 11.40.73	October 15, 2014	11.42.28	August 14, 2014
* 11.40.74	October 15, 2014	* 11.42.29	October 15, 2014
* 11.40.75	October 15, 2014	11.42.30	February 20, 2014
* 11.40.76	October 15, 2014	11.42.31	February 20, 2014
11.40.77	August 14, 2014	11.42.32	August 14, 2014
* 11.40.78	October 15, 2014	11.42.33	August 14, 2014
11.40.79	February 20, 2014	11.42.34	August 14, 2014
* 11.40.80	October 15, 2014	11.42.35	August 16, 2013
11.41.1	August 14, 2014	11.42.36	August 14, 2014
* 11.41.2	October 15, 2014	* 11.42.37	October 15, 2014
* 11.41.3	October 15, 2014	* 11.42.38	October 15, 2014
* 11.41.4	October 15, 2014	11.42.39	August 16, 2013
11.41.5	February 15, 2013	11.42.40	August 14, 2014
11.41.6	February 15, 2013	11.42.41	February 20, 2014
11.41.7	February 15, 2013	11.42.42	August 14, 2014
11.41.8	February 15, 2013	11.42.43	February 20, 2014
11.41.9	February 15, 2013	11.42.44	August 16, 2013
11.41.10	February 15, 2013	11.42.45	August 16, 2013
11.41.11	February 15, 2013	11.42.46	August 14, 2014
11.41.12	February 15, 2013	11.42.47	August 16, 2013
11.42.1	August 16, 2010	11.42.48	February 20, 2014
11.42.2	February 18, 2011	* 11.42.49	October 15, 2014
11.42.3	February 18, 2011	11.42.50	February 20, 2014
11.42.4	February 15, 2013	11.42.51	August 16, 2013
11.42.5	February 15, 2013	11.42.52	August 16, 2013
11.42.6	February 15, 2013	11.42.53	August 16, 2013
11.42.7	August 15, 2011	* 11.42.54	October 15, 2014
* 11.42.8	October 15, 2014	11.42.55	February 20, 2014
11.42.9	August 16, 2010	11.42.56	August 16, 2013
11.42.10	August 14, 2014	* 11.42.57	October 15, 2014
11.42.11	February 15, 2013	11.42.58	August 16, 2013
11.42.12	February 15, 2013	* 11.42.59	October 15, 2014
11.42.13	February 15, 2013	11.42.60	August 16, 2013
11.42.14	August 14, 2014	11.42.61	August 16, 2013
11.42.15	February 15, 2013	* 11.42.62	October 15, 2014
11.42.16	February 15, 2013	* 11.42.63	October 15, 2014
11.42.17	February 15, 2013	11.42.64	August 16, 2013
11.42.18	February 15, 2013	* 11.42.65	October 15, 2014

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11.42.66	August 16, 2013	11.50.1	August 14, 2014
11.42.67	August 16, 2013	11.50.2	February 15, 2013
* 11.42.68	October 15, 2014	11.50.3	August 16, 2010
* 11.42.69	October 15, 2014	11.50.4	August 16, 2010
* 11.42.70	October 15, 2014	11.50.5	August 16, 2010
11.42.71	February 20, 2014	11.50.6	August 16, 2010
11.42.72	August 16, 2013	* 11.60.1	October 15, 2014
11.43.1	August 14, 2014	* 11.60.2	October 15, 2014
* 11.43.2	October 15, 2014	* 11.60.3	October 15, 2014
* 11.43.3	October 15, 2014	* 11.60.4	October 15, 2014
11.43.4	August 14, 2012	* 11.60.5	October 15, 2014
11.43.5	February 15, 2013	* 11.60.6	October 15, 2014
* 11.43.6	October 15, 2014	* 11.60.7	October 15, 2014
11.43.7	February 20, 2014	* 11.60.8	October 15, 2014
11.43.8	February 15, 2013	* 11.60.9	October 15, 2014
11.43.9	August 14, 2014	* 11.60.10	October 15, 2014
11.43.10	February 20, 2014	11.60.11	August 16, 2013
11.43.11	March 29, 2013	11.60.12	March 2, 2011
11.43.12	August 14, 2014	12 Fuel (tab)	
* 11.43.13	October 15, 2014	12.TOC.1-2	February 20, 2014
11.43.14	February 20, 2014	12.10.1	August 16, 2010
11.43.15	August 14, 2014	12.10.2	February 20, 2014
11.43.16	August 14, 2014	12.10.3	February 20, 2014
11.43.17	February 15, 2013	12.10.4	February 20, 2014
11.43.18	February 15, 2013	12.20.1	February 20, 2014
11.43.19	February 15, 2013	* 12.20.2	October 15, 2014
* 11.43.20	October 15, 2014	12.20.3	February 20, 2014
* 11.43.21	October 15, 2014	12.20.4	February 20, 2014
* 11.43.22	October 15, 2014	12.20.5	August 14, 2014
11.43.23	February 20, 2014	12.20.6	February 15, 2013
11.43.24	February 20, 2014	* 12.20.7	October 15, 2014
* 11.43.25	October 15, 2014	12.20.8	August 14, 2014
11.43.26	February 15, 2013	12.20.9	February 20, 2014
11.43.27	August 16, 2013	12.20.10	February 15, 2013
* 11.43.28	October 15, 2014	12.30.1	August 16, 2013
11.43.29	February 15, 2013	12.30.2	August 16, 2013
11.43.30	February 15, 2013	13 Hydraulics (tab)	
11.43.31	February 15, 2013	13.TOC.1-2	August 14, 2014
11.43.32	February 15, 2013	13.10.1	August 14, 2014
11.43.33	February 20, 2014	13.10.2	August 14, 2014
11.43.34	August 14, 2014	13.10.3	August 14, 2014
11.43.35	February 15, 2013	13.10.4	August 14, 2014
11.43.36	February 15, 2013	13.10.5	August 16, 2013
11.43.37	February 15, 2013	13.10.6	August 16, 2013
11.43.38	February 15, 2013	13.20.1	August 14, 2014
11.43.39	August 14, 2014		
11.43.40	February 15, 2013		

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13.20.2	February 15, 2013	* 15.10.13	October 15, 2014
13.20.3	August 14, 2014	* 15.10.14	October 15, 2014
13.20.4	February 20, 2014	* 15.10.15	October 15, 2014
13.20.5	August 14, 2014	15.10.16	August 16, 2013
13.20.6	August 14, 2014	* 15.10.17	October 15, 2014
13.20.7	August 14, 2014	15.10.18	August 14, 2014
13.20.8	August 14, 2014	15.10.19	August 14, 2014
13.30.1	August 14, 2014	15.10.20	August 14, 2014
13.30.2	August 16, 2013	* 15.10.21	October 15, 2014
14 Landing Gear (tab)		15.10.22	August 16, 2013
14.TOC.1-2	February 20, 2014	* 15.10.23	October 15, 2014
14.10.1	August 14, 2014	15.10.24	August 14, 2014
14.10.2	February 15, 2013	15.10.25	August 16, 2013
14.10.3	February 18, 2011	15.10.26	August 16, 2013
* 14.10.4	October 15, 2014	15.10.27	February 20, 2014
14.10.5	February 15, 2013	15.10.28	August 16, 2013
14.10.6	February 15, 2013	15.10.29	August 16, 2013
14.10.7	February 20, 2014	15.10.30	August 16, 2013
* 14.10.8	October 15, 2014	15.10.31	August 16, 2013
14.10.9	August 16, 2013	15.10.32	August 16, 2013
14.10.10	August 16, 2013	* 15.10.33	October 15, 2014
* 14.20.1	October 15, 2014	15.10.34	August 14, 2014
14.20.2	March 2, 2011	15.10.35	February 20, 2014
14.20.3	February 18, 2011	* 15.10.36	October 15, 2014
14.20.4	August 14, 2014	15.10.37	August 16, 2013
14.20.5	August 16, 2013	* 15.10.38	October 15, 2014
14.20.6	February 20, 2014	15.10.39	February 20, 2014
14.20.7	August 16, 2013	15.10.40	August 14, 2014
14.20.8	February 18, 2011	15.10.41	August 16, 2013
14.30.1	August 14, 2014	15.10.42	August 16, 2013
14.30.2	August 16, 2013	15.10.43	August 16, 2013
15 Warning Systems (tab)		15.10.44	August 16, 2013
* 15.TOC.1-4	October 15, 2014	15.10.45	August 16, 2013
15.10.1	February 20, 2014	15.10.46	February 20, 2014
15.10.2	August 14, 2014	15.10.47	August 14, 2014
15.10.3	February 20, 2014	15.10.48	August 16, 2013
15.10.4	August 14, 2014	15.10.49	August 16, 2013
15.10.5	February 20, 2014	15.10.50	August 16, 2013
15.10.6	August 14, 2014	15.10.51	August 16, 2013
15.10.7	February 20, 2014	15.10.52	August 14, 2014
15.10.8	August 14, 2014	15.10.53	February 20, 2014
15.10.9	August 16, 2013	15.10.54	August 16, 2013
* 15.10.10	October 15, 2014	15.10.55	August 14, 2014
* 15.10.11	October 15, 2014	15.10.56	August 16, 2013
* 15.10.12	October 15, 2014	15.10.57	August 14, 2014
		15.10.58	August 14, 2014
		15.10.59	August 16, 2013

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15.10.60	August 16, 2013	* 15.20.47	October 15, 2014
15.20.1	August 16, 2013	* 15.20.48	October 15, 2014
15.20.2	August 16, 2013	* 15.20.49	October 15, 2014
* 15.20.3	October 15, 2014	* 15.20.50	October 15, 2014
* 15.20.4	October 15, 2014	* 15.20.51	October 15, 2014
* 15.20.5	October 15, 2014	* 15.20.52	October 15, 2014
15.20.6	August 16, 2013	* 15.20.53	October 15, 2014
* 15.20.7	October 15, 2014	* 15.20.54	October 15, 2014
* 15.20.8	October 15, 2014	* 15.20.55	October 15, 2014
15.20.9	February 20, 2014	* 15.20.56	October 15, 2014
* 15.20.10	October 15, 2014	15.30.1	August 14, 2014
* 15.20.11	October 15, 2014	* 15.30.2	October 15, 2014
15.20.12	February 20, 2014	* 15.30.3	October 15, 2014
* 15.20.13	October 15, 2014	15.30.4	March 2, 2011
* 15.20.14	October 15, 2014	(blank tab)	
15.20.15	February 20, 2014		
15.20.16	March 29, 2013		
* 15.20.17	October 15, 2014		
* 15.20.18	October 15, 2014		
15.20.19	August 14, 2014		
* 15.20.20	October 15, 2014		
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* 15.20.25	October 15, 2014		
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* 15.20.40	October 15, 2014		
* 15.20.41	October 15, 2014		
* 15.20.42	October 15, 2014		
* 15.20.43	October 15, 2014		
* 15.20.44	October 15, 2014		
* 15.20.45	October 15, 2014		
* 15.20.46	October 15, 2014		

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**Preface**
Bulletin Record**Chapter 0**
Section 6**General**

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

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

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
NRW-1	Cabin Pressurization Control System (CPCS) Anomaly	August 16, 2010	IE
NRW-3	Electronic Engine Control (EEC) Software Anomaly	August 16, 2010	IE
NRW-4	Fuel System Imbalance Anomaly	August 16, 2010	IE
NRW-5	General Electric (GE) CF6-80C2 Engine Flameout Mitigation	August 16, 2010	IE



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Number	Subject	Date	Status
NRW-6	Honeywell Flight Management Computer (FMC) Anomaly	August 16, 2010	IE
NRW-7	Packs Off Takeoff	August 16, 2010	INC
NRW-8	Pegasus Flight Management Computer (FMC) Departure Routing Anomaly	August 16, 2010	IE
NRW-9	Performance Predictions Anomaly in Flight Management Computer (FMC) Product Improvement Package (PIP) and Pegasus Software Versions	August 16, 2010	IE
NRW-10	Replacement of STANDBY BUS OFF Quick Reference Handbook (QRH) Checklist.	August 16, 2010	INC
NRW-11	Uncommanded Autopilot Engagement, Flight Mode Changes, And IAS/MACH Window Speed Changes	August 16, 2010	IE
NRW-12	Uncommanded Autopilot Engagements Or Uncommanded Autoflight Mode Changes	August 16, 2010	IE
NRW-13	Uncommanded Auxiliary Power Unit (APU) Shutdown Prior to Engine Start	August 16, 2010	IE
NRW-14 R1	Uncommanded Turns When LNAV is in Use	August 14, 2014	IE
NRW-16	CF6-80C2 FADEC Engine Operation In Heavy Rain Or Hail	February 18, 2011	IE
NRW-17	Pegasus Flight Management Computer (FMC) Lock-Up Anomaly Due to Data-Bus Communications Failure	August 15, 2011	IE
NRW-18	Incorrect Turn Direction During a Standard Instrument Departure (SID)	September 15, 2011	IE
NRW-19	FMC Distance to Waypoint Anomaly	November 2, 2012	IE



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Number	Subject	Date	Status
NRW-20	Incorrect Turn During Intercept Leg (INTC) in a Standard Instrument Departure (SID)	November 2, 2012	IE
NRW-21	Consecutive Conditional Altitude Waypoints Map Anomaly	February 15, 2013	IE
NRW-22	Flight Management Computer (FMC) Anomaly During Descent Phase of Flight	February 15, 2013	IE
NRW-23	Flight Management Computer (FMC) Anomaly of Engine Indicating and Crew Alerting System (EICAS) Alert	February 15, 2013	IE
NRW-24	Installation of Pratt & Whitney PW4000 Engines with Ring-Case Compressor (RCC)	February 15, 2013	INC
NRW-25	Pegasus-FMC Control and Display Unit (CDU) Anomaly	February 15, 2013	IE
NRW-26	Pegasus FMC HSI Map Display Anomaly	February 15, 2013	IE
NRW-27	Pegasus Flight Management Computer (FMC) VNAV Level Off Anomaly	February 15, 2013	IE
NRW-28	Performance Adjustments for Thrust Shortfall of PW4000 Series Powered Airplanes with FB2B and FB2T Fans Installed	February 15, 2013	IE
NRW-29	FMC Alternate Airport Anomaly	August 16, 2013	IE
NRW-30	FMC Altitude Display Anomaly	August 16, 2013	IE
NRW-31	FMC Assumed Temperature Derate Anomaly	August 16, 2013	IE
NRW-32	FMC CDU Scratchpad Message "Enter IRS Position"	August 16, 2013	IE
NRW-33	FMC Engine Out (E/O) Standard Instrument Departure (SID)	August 16, 2013	IE
NRW-34	Flight Management Computer (FMC) Lockup Resulting from Internal Timer Anomaly	August 16, 2013	IE



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Number	Subject	Date	Status
NRW-35	Flight Management Computer (FMC) Lockup Resulting from Flight Plan Route Uplink	August 16, 2013	IE
NRW-36	Incorrect Display of VREF On The ADI Speed Tape	August 16, 2013	IE
NRW-37	Uncommanded CDU Page Changes	August 16, 2013	IE
NRW-38	VNAV Descent to Holding Altitude	August 16, 2013	IE



Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-1

IssueDate: August 16, 2010

Airplane Effectivity: VQ-BMQ, VQ-BOG, VQ-BPT (SB Deletes VP-BDI, VP-BMC, VP-BOY through VP-BRL, VQ-BRA)

Subject: Cabin Pressurization Control System (CPCS) Anomaly

Reason: To inform flight crews of a Cabin Pressurization Control System anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An anomaly has been discovered with the Cabin Pressurization Control System (CPCS). A recent software change in the CPCS may result in the outflow valve closing and the airplane pressurizing on the ground. In some cases, this has resulted in the inability to open the passenger entry doors.

Boeing has discovered this anomaly was introduced in a recent software change in the Cabin Pressurization Controllers (CPC). Specifically, airplane pressurization can occur after an electrical power transfer is accomplished. This includes, but is not limited to, electrical power transfers as a result of normal engine start and shutdown operations.

The affected Honeywell CPC software is:

2117388-11

2117388-12 and,

2117388-13.

Operating Instructions

The following highlighted procedural steps should be executed as shown below immediately after the “Fuel Control switches” step as published in the Normal Procedures section of The Boeing Company Operations Manual, Volume I:

FUEL CONTROL switches CUT OFF C
Verify ENG VALVE and SPAR VALVE lights extinguished.

CABIN ALTITUDE MODE SELECTOR MAN F/O

If outflow valve not fully open:

CABIN ALTITUDE MANUAL CONTROL CLIMB F/O
Position outflow valve fully open.

The above highlighted procedural steps should be accomplished during all shutdown operations. This will preclude the CPC anomaly from inadvertently pressurizing the cabin. Proper execution of the “Preflight Procedure – First Officer” during the subsequent flight will ensure the pressurization system is properly configured for flight.

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 NRW-1 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-21-0166 or 767-21-0168. This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operator’s fleet have been modified.

Boeing Maintenance Tip 21-017 is related to this Operations Manual Bulletin.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

Boeing Commercial Airplanes
Commercial Aviation Services
Attn: 767 Manager, Flight Technical Data
P.O. Box 3707, M/C 20-89
Seattle, Washington, 98124-2207 USA
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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-3

IssueDate: August 16, 2010

Airplane Effectivity: VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

Subject: Electronic Engine Control (EEC) Software Anomaly

Reason: To inform flight crews of an EEC software anomaly that may prevent display of EICAS messages IDLE DISAGREE or ENG LOW IDLE.

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 EEC sets minimum or approach idle automatically. Minimum idle is selected for most ground and flight operations. Approach idle, set at a slightly higher thrust setting than minimum idle, is selected when any of the following conditions exist:

- flaps not up, or
- engine anti-ice ON, or
- engine start selector CONT (airplanes modified by SB 767-73-0043)

EICAS advisory message IDLE DISAGREE and ENG LOW IDLE alert the crew of incorrect engine idle settings.

Boeing has received operator reports of incorrect idle settings without display of the appropriate EICAS message. Engineering investigation has determined an EEC software anomaly is responsible. Updated EEC software (Version 8.2.O) corrects the anomaly and restores EICAS alert of idle control system faults.

Operating Instructions

This bulletin does not apply to airplanes modified by GE Service Bulletin 73-0250 REV 2 (EEC software Version 8.2.O).

When operating at idle thrust under conditions requiring approach idle, verify both engines are at approach idle. If one engine is not at approach idle, advance thrust lever on the affected engine until thrust matches the engine operating at approach idle.

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 NRW-3 "In Effect" (IE).

This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified by GE Service Bulletin 73-0250 REV 2.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Commercial Aviation Services
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P.O. Box 3707, M/C 20-89
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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-4

IssueDate: August 16, 2010

Airplane Effectivity: VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

Subject: Fuel System Imbalance Anomaly

Reason: To provide information regarding a fuel system imbalance anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received several operator reports of an imbalance anomaly pertaining to the 767 Fuel System. All operator reports describe simultaneous fuel consumption from the center fuel tank and either the left or right main fuel tank, or simultaneous fuel consumption between the center fuel tank and both left and right main fuel tanks.

Boeing analysis has determined this simultaneous fuel tank consumption anomaly is a result of the center fuel tank pumps not producing adequate pressure to override the main tank fuel pumps. With exception of an empty center fuel tank, the occurrence of the anomaly cannot be accurately predicted for any given flight or any given flight condition.

Boeing is continuing investigation of this anomaly. Several modifications have been made to the center fuel tank override pumps as directed by Federal Aviation Administration (FAA) Airworthiness Directive (AD) 2001-15-08, Amendment 39-12342, effective September 4, 2001, which may be responsible for the imbalance characteristic. FAA AD 2001-15-08 supersedes FAA AD 97-19-15, which is no longer in effect. Therefore, flight crews should be advised of this simultaneous fuel consumption anomaly and provided with recommended operating instructions as temporary corrective action.

The recommended operating instructions contained in this Operations Manual Bulletin have demonstrated in service to both terminate the simultaneous fuel consumption characteristic as well as prevent re-occurrence of the characteristic for the remainder of flight.

There are two means for the flight crew to determine if fuel is simultaneously being consumed from the center fuel tank and either or both main fuel tanks. These are:

1. Flight crew observance of Fuel Quantity Indicating System (FQIS) quantity indicators simultaneously decreasing from the center fuel tank and either or both left and right main fuel tanks without receiving an EICAS fuel system alert; or,
2. Flight crew observance of FQIS quantity indicators simultaneously decreasing from the center fuel tank and either or both left and right main fuel tanks after receiving an EICAS fuel system alert.

Operating Instructions

1. If the flight crew observes FQIS quantity indicators simultaneously decreasing from the center tank and either the left or right main fuel tank without the “FUEL CONFIG” advisory-level EICAS alert displayed and FUEL CONFIG light illuminated, accomplish the FUEL BALANCING supplementary procedure.

Note: Accomplishing the FUEL BALANCING supplementary procedure allows the center tank fuel pump on the low main fuel tank side to resume override pressure. The left and right main fuel tanks will remain unbalanced at the amount at which the low main fuel tank pumps are selected OFF. When center tank fuel is depleted, the main tanks will begin balancing.

2. If the EICAS advisory-level “FUEL CONFIG” alert displays accompanied by the FUEL CONFIG light, and the flight crew observes FQIS quantity indicators simultaneously decreasing from the center tank and either the left or right main fuel tank, accomplish the FUEL CONFIGURATION non-normal checklist.

Note: Accomplishing the FUEL CONFIGURATION non-normal checklist allows the center tank fuel pump on the low main fuel tank side to resume override pressure. The left and right main fuel tanks will remain unbalanced at the amount at which the low main fuel tank pumps are selected OFF. When center tank fuel is depleted, the main tanks will begin balancing.

3. If the flight crew observes FQIS quantity indicators simultaneously decreasing from the center tank and both the left and right main fuel tanks without the “LOW FUEL” caution-level EICAS alert displayed, continue normal operation.

Note: Operator in-service reports have indicated a higher rate of fuel consumption from the center fuel tank being observed in comparison to the rate of fuel consumption from the left and right main fuel tanks. In addition, Boeing analysis has determined that the center fuel tank will empty before the main fuel tank quantities are reduced by an appreciable amount.

4. If the EICAS caution-level “LOW FUEL” alert displays accompanied by the FUEL CONFIG light, accomplish the LOW FUEL non-normal checklist.

Note: In-service reports have indicated a higher rate of fuel consumption from the center fuel tank in comparison to the rate of fuel consumption from the left and right main fuel tanks. In addition, subsequent Boeing analysis has determined that the center fuel tank will empty before the main fuel tank quantities are reduced by an appreciable amount. Therefore, the “LOW FUEL” alert should be treated with all due vigilance, and the LOW FUEL non-normal checklist accomplished.

5. If the flight crew suspects a fuel leak may exist, accomplish the ENGINE FUEL LEAK non-normal checklist.

Note: Accomplishing the ENGINE FUEL LEAK non-normal checklist is appropriate if the flight crew suspects or confirms a fuel leak exists. One or more of the following may be evidence of a fuel leak:

1. Visual observation of fuel spray from strut or engine;
 2. Excessive engine fuel flow;
 3. Total fuel quantity decreasing at an abnormal rate;
 4. “FUEL CONFIG” message on EICAS;
 5. “LOW FUEL” message on EICAS
 6. FUEL DISAGREE – PROG 2 or FUEL QTY ERROR – PROG 2 message on the CDU scratchpad;
 7. INSUFFICIENT FUEL message on the CDU scratchpad.
6. If fuel jettison operation is required, accomplish the FUEL JETTISON non-normal checklist.

Note: Accomplishing the FUEL JETTISON non-normal checklist will exclusively isolate the center tank fuel for fuel jettison operation.

As a reminder, Auxiliary Power Unit (APU) operation on the ground or in flight may result in depletion of fuel from the left main fuel tank. Therefore, flight crews should be reminded that a left and right main fuel tank unbalance condition might be a result of APU operation.

Master Minimum Equipment List (MMEL) Item 28-41-1 allows airplane dispatch with an FQIS quantity indicator inoperative if the associated provisos are complied with. Boeing recommends not dispatching an airplane under MMEL Item 28-41-1, if the airplane has been modified by Service Bulletins 767-28-0052 or 767-28-0062, or production equivalents, and center tank fuel is loaded. With a main fuel tank FQIS quantity indicator inoperative, flight crew confusion can result in determining whether the fuel system anomaly described above is occurring or if a suspected engine fuel leak condition exists.

Boeing further recommends if a main fuel tank FQIS quantity indicator failure occurs after dispatch on an airplane modified by Service Bulletin 767-28-0052 or 767-28-0062 with center tank fuel loaded, the flight be terminated by taxiing back to parking or landing at the nearest suitable airport.

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 NRW-4 "In Effect" (IE).

This condition is under investigation. This bulletin will be revised to include Service Bulletin information when available.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-5

IssueDate: August 16, 2010

Airplane Effectivity: VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Subject: General Electric (GE) CF6-80C2 Engine Flameout Mitigation

Reason: To provide flight crews with updated background information on engine flameout events in visible moisture with TAT at or below 10°C in the vicinity of convective weather systems; and to provide revised operating instructions.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing and General Electric (GE) are investigating several CF6-80C2 engine flameout events which have occurred on various airplane models since 1991. Investigation of weather, flight data, and pilot reports associated with these events suggest the flameout events have occurred at altitudes with Static Air Temperature (SAT) above 0°C in the vicinity of convective weather systems. Boeing and GE believe ice accumulated aft of the fan during a descent or deceleration may have been shed and ingested into the engine when the thrust levers were subsequently advanced.

Boeing and GE investigations conclude the airplanes most likely encountered ice crystals lifted by convective activity prior to the engine flameout. At very cold temperatures near thunderstorms the airplane can encounter visible moisture made up of high concentrations of small ice crystals. These ice crystals do not cause weather radar returns. Flight crews have reported deviating around strong weather radar returns when the flameout events have occurred. Flight crews have also reported rain on the windshield when the outside air temperature was too cold for liquid water to exist. Boeing attributes this to ice crystals that melt upon impact with the heated windshield, giving the appearance of rain. These types of ice crystals do not accumulate on cold aircraft surfaces.

Flight crew reports and airplane data have shown the airplane TAT indication may often erroneously indicate 0°C for a period of time just prior to engine flameout events. This anomalous behavior is due to ice crystals partially blocking the probe and is not a cause for the engine flameout but is confirmation that ice crystals were present.

The Operating Instructions contained in this bulletin use engine anti-ice and wing anti-ice. Increased bleed air extraction from the engine causes the combustor to operate at a higher fuel-to-air ratio. This reduces the probability of flameout. In some engine flameout events, engine anti-ice was previously selected on. Boeing and GE understand that the Operating Instructions contained in this bulletin may not prevent all flameout events. However, increased engine bleed air extraction does provide a large increase in the margin to flameout.

These engine flameout events typically occur when the airplane is leveling off at an intermediate altitude. ATC permitting, make a continuous descent at idle thrust. This decreases the exposure time to the ice crystal condition and a potential engine flameout.

If an engine flameout occurs on an airplane equipped with Full Authority Digital Engine Control (FADEC) engines, the Electronic Engine Control (EEC) attempts to relight the engine when it detects N2 below 50% or a rapid decrease in N2. Engines accelerate to idle very slowly at high altitudes. In some of these events, it has taken 120 seconds or more to reach commanded thrust levels. This may be incorrectly interpreted by the flight crew as an engine that is still flamed out instead of an engine already in the process of relighting. If N2 is steadily increasing and EGT remains within limits, the start is progressing normally. In all events investigated, the affected engines successfully started, including some outside the in-flight start envelope. If N2 is steadily increasing and EGT remains within limits following a single engine flameout, the flight crew need not accomplish the ENGINE FAILURE OR SHUTDOWN followed by the ENGINE IN-FLIGHT START checklist. The DUAL ENGINE FAILURE checklist should be accomplished for dual engine flameout events.

Use of wing anti-ice at altitudes above 22,000 feet has not been included in the Operating Instructions to ensure no adverse impact on airplane systems which use engine bleed air.

Entering the TAI/ON ALT on the DESCENT FORECAST page of the FMC adjusts the VNAV path calculation for approach idle conditions with engine anti-ice ON.

Operating Instructions

When TAT is at or below 10°C in visible moisture with engine thrust reduced for a descent or a speed reduction even with SAT less than -40°C:

CAUTION: Do not use engine or wing anti-ice when TAT is above 10°C.

ENGINE ANTI-ICE switches / selectors ON
[Increases bleed air extraction to improve engine flameout margin.]

At or below 22,000 feet:

WING ANTI-ICE switch / selector ON
[Increases bleed air extraction to improve engine flameout margin.]

During flight in Instrument Meteorological Conditions (IMC), avoid flying directly over significant amber or red depicted map weather radar regions. Use of the weather radar gain and tilt functions are recommended to assess weather radar return reflectivity.

During airplane descent and ATC permitting, attempt a continuous descent at idle thrust to decrease exposure to ice crystal conditions.

Engine and wing anti-ice may be selected OFF (or AUTO, as installed) when the conditions described above no longer exist and are not required for existing flight conditions.

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 NRW-5 "In Effect" (IE).

This condition is under investigation. This Flight Crew Operations Manual bulletin remains in effect until further notice.

This bulletin supersedes the bulletin titled "Engine Flameout Protection GE CF6-80C2 Engines".

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-6

IssueDate: August 16, 2010

Airplane Effectivity: VP-BMC, VP-BOY, VP-BOZ, VQ-BMQ, VQ-BMU,
VQ-BPT, VQ-BRA (SB Deletes VP-BDI)

Subject: Honeywell Flight Management Computer (FMC) Anomaly

Reason: To inform flight crews of a Honeywell FMC anomaly that incorrectly deletes a speed constraint.

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.

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.

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October 15, 2014

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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 NRW-6 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-34-0566.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-7

IssueDate: August 16, 2010

Airplane Effectivity: VQ-BMU, VQ-BPT, VQ-BRA

Subject: Packs Off Takeoff

Reason: This bulletin provides information informing flight crews of an interim procedure to prevent possible jamming of the outflow valve during a packs off takeoff. The Packs Off Takeoff supplementary normal procedure now incorporates this bulletin.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

There have been a few reports of uncontrollable cabin pressurization when the packs were turned on following a packs off takeoff, with subsequent inability to depressurize the airplane normally after landing. This has sometimes resulted in inability to open the cabin doors for several minutes. Boeing has verified that it is possible for the outflow valve to jam in the closed position when the airplane is configured for a packs off takeoff. This can be prevented by using the manual system to position the outflow valve approximately three-quarters open prior to takeoff.

Operating Instructions

If a packs off takeoff is desired, accomplish the “Packs Off Takeoff” supplementary normal procedure. This procedure incorporates the interim steps necessary until the system is modified.

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 NRW-7 "Incorporated" (INC).

This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified by Boeing Service Letter SL 767-21-047C and Allied Signal Service Bulletins 2117388-21-2655 and 606832-21-2661.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

Boeing Commercial Airplanes
Commercial Aviation Services
Attn: 767 Manager, Flight Technical Data
P.O. Box 3707, M/C 20-89
Seattle, Washington, 98124-2207 USA
Telephone: (206) 662-4000
Fax: (206) 662-4743



Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-8

IssueDate: August 16, 2010

Airplane Effectivity: VP-BMC, VP-BOY, VQ-BMQ, VQ-BMU, VQ-BPT (SB
Deletes VP-BDI)

Subject: Pegasus Flight Management Computer (FMC) Departure Routing
Anomaly

Reason: To inform flight crews of a Pegasus-FMC anomaly regarding route
discontinuity removal between a selected departure and the active route.

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 Pegasus-FMC anomaly related to removal of a route discontinuity between a selected departure and the active route. Boeing engineering has confirmed this software anomaly may occur if a route discontinuity is removed using the RTE page 2 instead of using the RTE LEGS page. Some operator reports indicate the waypoint identifier disappears from the scratch pad when line-selected into the discontinuity boxes, but the RTE page title never indicates the route modification, hence the entry attempt is not successful. And in some cases, a subsequent FMC lockup may result.

Honeywell is aware of this Pegasus-FMC anomaly. The planned fix to the problem is under investigation.

Operating Instructions

To prevent the occurrence of this anomaly, removal of route discontinuities between a selected departure and the active route using the RTE LEGS page instead of RTE page 2 is recommended.

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 NRW-8 "In Effect" (IE).

This Flight Crew Operations Manual Bulletin will be revised to include service bulletin information when available.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-9

IssueDate: August 16, 2010

Airplane Effectivity: VP-BMC, VP-BOY, VP-BOZ, VQ-BMQ, VQ-BMU,
VQ-BPT, VQ-BRA (SB Deletes VP-BDI)

Subject: Performance Predictions Anomaly in Flight Management Computer (FMC) Product Improvement Package (PIP) and Pegasus Software Versions

Reason: To inform flight crews of a performance prediction anomaly on FMC-PIP and Pegasus-FMC software versions.

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 regarding erroneous performance predictions following execution of the ABEAM PTS function on the LEGS page of the FMC-Product Improvement Package (PIP) and Pegasus-FMC software versions. When OAT values have been previously entered in the ALT/OAT field of line-select key 5R on a waypoint WIND page, and the ABEAM PTS function is subsequently selected after a "direct-to" flight plan modification, the OAT value on the WIND page erroneously changes to 0-degrees. After execution, fuel predictions are erroneously recalculated based upon 0-degrees instead of the previously entered value for the respective cruise altitude. Operators have reported display of the INSUFFICIENT FUEL alert-level scratch pad message with the fuel prediction values being much lower than originally planned. Additionally, there are no flight deck annunciations or alerts to indicate an OAT value on the WIND page has erroneously changed.

This Flight Crew Operations Manual Bulletin is only applicable to the FMC-Product Improvement Package (PIP) and Pegasus-FMC software versions. Previous FMC software versions do not include the ABEAM PTS function, the ALT/OAT field entry, or individual waypoint WIND pages, and therefore, are not affected.

Operating Instructions

Following selection and prior to executing the ABEAM PTS function, verify the OAT value on the respective WIND page. If necessary, enter the airplane altitude and the indicated Static Air Temperature (SAT) value from PROGRESS page 2 into the ALT/OAT field for the next route waypoint. This OAT entry will propagate to all down-track waypoints. Following entry of the SAT value into the ALT/OAT field and execution of the route modification, the FMC fuel predictions should be near those obtained from the flight plan.

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 NRW-9 "In Effect" (IE).

The corrective action for the anomaly described in this Flight Crew Operations Manual Bulletin is still under investigation. This bulletin will be revised to include Service Bulletin information when available.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-10

IssueDate: August 16, 2010

Airplane Effectivity: All Airplanes

Subject: Replacement of STANDBY BUS OFF Quick Reference Handbook (QRH) Checklist.

Reason: To provide a revised "STANDBY BUS OFF" procedure (Chapter NNC - Section 6) for the Quick Reference Handbook (QRH).

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 electrical system failure event was recently confirmed by Boeing, the National Transportation Safety Board (NTSB), and the Federal Aviation Administration (FAA) regarding the partial loss of the DC-powered electrical bus system on a 757 airplane. The information provided by this Flight Crew Operations Manual Bulletin (FCOMB) is related to FAA Safety Alert Flight Operations (SAFO) 09001, Subject: Effects of Electrical Faults Resulting in Main Battery Depletion, Dated: January 13, 2009.

The failure event resulted in the loss of all equipment solely powered by the main airplane battery even though power to both AC buses was available. Boeing and the FAA have determined interim corrective action is needed for all 767 airplanes to mitigate the occurrence of this specific failure event.

During normal operation with the Standby Power selector in the AUTO position, the AC buses supply power to the battery and standby DC buses through a transformer rectifier unit and to the standby AC bus. The main battery charger, powered by the ground service bus, provides DC power to the hot battery bus. If the Standby Power selector is in the BAT position, the battery charger is disabled and the main battery becomes the sole source of electrical power to all equipment powered from the hot battery bus, the battery bus, the standby DC bus, and the standby AC bus. On some airplanes, the APU battery is paralleled to the main battery, which provides increased time these buses can be powered with the Standby Power selector in the BAT position.

The Quick Reference Handbook (QRH) replacement pages provided by this FCOMB provide a revised STANDBY BUS OFF checklist. This STANDBY BUS OFF checklist contains the recommend flight crew guidance in the event the STANDBY BUS OFF advisory-level alert message is shown on EICAS.

Boeing will be issuing Service Bulletin 767-24-0200 during or before 3rd-quarter 2010. This service bulletin will be applicable to all 767 variant airplanes delivered prior to March 2010 and will provide an FAA-approved retrofit kit of parts to bypass the battery-charger cutout with the Standby Power selector in the BAT position during flight. All airplanes delivered during or after March 2010 will have a production revision incorporated to provide the identical battery-charger-cutout configuration provided by the service bulletin.

The QRH replacement pages provided by this FCOMB are valid for use on airplane configurations both unmodified and modified by this service bulletin in a mixed-fleet configuration. When an operator reports to Boeing that all 767 airplanes have been modified by Service Bulletin 767-24-0200, a final revised STANDBY BUS OFF checklist will be issued to the operator's Boeing-published QRH that is compatible to a pure-fleet, SB-modified 767 configuration. This eliminates FAA and Boeing concerns of two STANDBY BUS OFF checklists being contained within an operators QRH, or operator equivalent, and the flight crew potential of erroneously accomplishing a STANDBY BUS OFF checklist not compatible with the airplane wiring configuration.

IMPORTANT: All operators are reminded to properly report all Service Bulletin incorporation to Boeing in a timely manner. This will ensure proper manual pages are provided commensurate with the reported airplane fleet configuration.

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 NRW-10 "Incorporated" (INC).

This affects of this Flight Crew Operations Manual Bulletin (FCOMB) are further modified by pure-fleet incorporation within an operator's fleet of Boeing Service Bulletin 767-24-0200. This Flight Crew Operations Manual Bulletin will be "CANCELLED" (CANC) upon operator notification to Boeing that all affected airplanes covered in this Flight Crew Operations Manual have been modified by Boeing Service Bulletin 767-24-0200.

Please send all correspondence regarding Operations Manual Bulletin status to the following address:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-11

IssueDate: August 16, 2010

Airplane Effectivity: VQ-BPT (SB Deletes VQ-BRA)

Subject: Uncommanded Autopilot Engagement, Flight Mode Changes, And IAS/MACH Window Speed Changes

Reason: To advise flight crews of the possibility of uncommanded autopilot engagement, flight mode changes, and IAS/Mach Window speed changes, and provide recommended temporary instructions for these situations.

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

UNCOMMANDED AUTOPILOT ENGAGEMENT AND FLIGHT MODE CHANGES

Boeing has received reports from operators of uncommanded autopilot engagement and flight mode changes. The reports document at least one rejected takeoff and one undesired heading change. Engineering investigation has determined these anomalies are caused by faulty MCP push-button switches installed during production or subsequent component repair. Intermittent switch malfunction can cause this anomaly without pilot action. The normal means for disengaging the autopilot, Autopilot Disengage Switches and the Autopilot Disengage Bar, are unaffected by this anomaly and operate normally.

Alert Service Bulletin SB 767-22A0092 corrects these anomalies.

UNCOMMANDED IAS/MACH WINDOW SELECTED SPEED CHANGES

Boeing has also received reports from operators of unexpected transition from selected speed to 0.80 Mach upon multiple channel autopilot engagement during automatic approach, and upon autopilot disengagement. Under these conditions, the selected IAS/MACH Window speed changes to 0.80 Mach, requiring pilot intervention to regain airspeed control. Investigation has determined these anomalies occur only with older flight control computers (FCC S241T100-101 thru 109 and S241T100-131 thru 133).

Alert Service Bulletin SB 767-22A0092 corrects these anomalies.

Operating Instructions

UNCOMMANDED AUTOPILOT ENGAGEMENT

Flight crews should closely monitor ADI flight mode annunciations for autopilot status, and be prepared to respond to uncommanded autopilot engagement during critical phases of flight, including takeoff. Uncommanded autopilot engagement can be corrected by disengaging the autopilot.

UNCOMMANDED FLIGHT MODE CHANGES

Flight crews should closely monitor ADI flight mode annunciations for autothrottle, roll, and pitch status, and be prepared to respond to uncommanded mode changes during critical phases of flight, including takeoff. Uncommanded flight mode changes can be corrected by selecting the desired mode on the MCP.

UNCOMMANDED IAS/MACH WINDOW SPEED CHANGES

Flight crews should closely monitor command speed bug and be prepared to respond to uncommanded changes to 0.80 Mach under the following conditions:

- multiple channel autopilot engagement during automatic approach
- autopilot disengagement.

If the command speed changes to 0.80 Mach under either condition; disconnect the autothrottle, push the IAS/MACH Select Switch to change IAS/MACH Window display to IAS, then set desired speed in the IAS/MACH Window. After resetting speed, the autothrottle may be reconnected.

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 NRW-11 "In Effect" (IE).

This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified by Boeing Alert Service Bulletin SB 767-22A0092.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

Boeing Commercial Airplanes
Commercial Aviation Services
Attn: 767 Manager, Flight Technical Data
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Seattle, Washington, 98124-2207 USA
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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-12

IssueDate: August 16, 2010

Airplane Effectivity: VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

Subject: Uncommanded Autopilot Engagements Or Uncommanded Autoflight Mode Changes

Reason: This bulletin provides information informing flight crews of temporary recommended procedures in the event of uncommanded autopilot engagement or autoflight mode changes.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing flight tests have encountered a condition that can cause uncommanded autopilot engagement or mode changes of the autopilot or flight director. This condition may occur at any time or altitude except when multiple autopilots are engaged for approach.

This condition is caused by faulty Mode Control Panel push button switches installed during production or repair. The condition affects the left and center Flight Control Computers. These Flight Control Computers normally provide commands for the left and center autopilots and flight directors.

The normal means for disconnecting the autopilot (autopilot disengage switch, autopilot disengage bar, and control wheel stabilizer trim switches) are not affected by this problem.

Boeing and Collins are working aggressively to facilitate the modification of affected units by mid summer, 1993. To date, no in service events have been reported to Boeing.

Operating Instructions

Flight crews should be prepared to disengage the autopilot during critical phases of flight including takeoff. Flight Mode Displays must be closely monitored. An uncommanded mode change or autopilot engagement can be corrected by selecting the desired mode or disconnecting the autopilot.

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 NRW-12 "In Effect" (IE).

This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified by Collins Component Service Bulletin MCP-701-22-19, dated April 23, 1993 or Collins Component Service Bulletin MCP-704-22-10, dated April 23, 1993. Additional details and specific applicability of the Service Bulletins are contained in Boeing All-operator telex M-7272-93-2738, dated May 10, 1993.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Seattle, Washington, 98124-2207 USA
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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-13

IssueDate: August 16, 2010

Airplane Effectivity: All Airplanes

Subject: Uncommanded Auxiliary Power Unit (APU) Shutdown Prior to Engine Start

Reason: To inform flight crews of an uncommanded APU shutdown fault prior to engine start and provide temporary operating instructions.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received operator reports of a fault pertaining to an uncommanded Auxiliary Power Unit (APU) shutdown on the ground prior to engine start. Boeing has confirmed the shutdown fault occurs randomly and is a result of pneumatic air reverse flow when either or both Pack Control Selectors are positioned OFF. The uncommanded APU shutdown occurs when the APU Electronic Control Unit (ECU) is unable to compensate for the pneumatic pressure pulse when either or both pack control valve(s) close. Boeing has confirmed the shutdown fault may occur under the following conditions:

- Both engines shutdown;
- APU running;
- APU Bleed Air switch ON; and,
- A Pack Control selector positioned OFF.

Therefore, flight crew recognition of this fault is primarily noticeable when accomplishing the normal “Before Engine Start” procedure after positioning the Pack Control Selectors OFF in preparation for the initial engine start. If the fault is active and an uncommanded APU shutdown occurs, the APU can be restarted without delay without any required time consideration for cool down.

Boeing has confirmed the fault can only occur upon positioning either or both Pack Control Selectors OFF with the APU as the sole source of pneumatic power. Therefore, exposure to the fault described above is isolated to ground operations and specific to APU bleed air supply for initial engine start.

Operating Instructions

For operators experiencing in-service interruption due to uncommanded APU shutdown prior to engine start, the following temporary operating instructions are recommended:

Prior to positioning the Pack Control Selectors OFF when accomplishing the “Before Start Procedure”, select the APU Bleed Air switch OFF and allow the APU Bleed Air VALVE transition light to momentarily illuminate and extinguish. Then, position the left and right Pack Control Selectors OFF and allow the PACK OFF lights to illuminate. Finally, select the APU Bleed Air switch ON to restore pneumatic air to each engine’s starter, and accomplish a normal engine start.

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 NRW-13 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-21-0230.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-14 R1

IssueDate: August 14, 2014

Airplane Effectivity: All Airplanes

Subject: Uncommanded Turns When LNAV is in Use

Reason: To inform flight crews of the possibility of the airplane turning prior to the active waypoint when LNAV is in use.

This FCOM bulletin has been revised to include additional Operating Instructions.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received several reports of uncommanded turns when LNAV is in use. This condition has been reported on 757, 767, 747-400 and 777 airplanes. When an uncommanded turn occurs, the TO (active) waypoint was observed on the FMC CDU to have prematurely sequenced. In some cases, the ND correctly showed the TO waypoint in front of the airplane, but the waypoint symbol's color was white (indicating inactive) instead of magenta (indicating active). No inputs to the FMC were reported to have been in progress at the time of the turns. This condition was usually resolved by performing a DIRECT TO to the waypoint that had prematurely sequenced.

Operating Instructions

Improper sequencing may occur when attempting route modifications when approaching within 1 NM of the active waypoint for small route modifications, or within 4 NM of the active waypoint for modifications involving a large turn.

The following actions will limit incorrect waypoint sequencing:

- Avoid executing lateral OFFSET when approaching an active waypoint
- Avoid entry of a vertical or lateral flight planning change when approaching an active waypoint.
- Avoid executing DIR-TO with ABEAM selected when approaching an active waypoint.

If a premature waypoint sequence in the flight plan is observed prior to Executing the flight plan mod, the mod can be Erased and the waypoint sequence and associated uncommanded turn will not occur.

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 had prematurely sequenced. Reengage LNAV as desired.

Administrative Information

This bulletin replaces bulletin NRW-14 , dated September 1, 2014. Revise the Bulletin Record Page to show bulletin NRW-14 as “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 NRW-14 R1 "In Effect" (IE).

This condition is under investigation. This bulletin remains in effect until further notice.

This bulletin will be revised to include information about the service bulletin that resolves the condition when that information becomes available.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status to the 767 Manager, Flight Technical Data through the Service Requests Application (SR App) on the MyBoeingFleet home page.



Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-16

IssueDate: February 18, 2011

Airplane Effectivity: (SB Deletes VQ-BRA)

Subject: CF6-80C2 FADEC Engine Operation In Heavy Rain Or Hail

Reason: This bulletin provides information informing flight crews of temporary recommended procedures for maintaining a minimum thrust setting of approach idle if heavy rain or hail is encountered or anticipated.

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

GE Aircraft Engines has conducted hail ingestion testing to determine the capability of the CF6-80C2 engine to meet ingestion criterion recommended by the Aerospace Industries Association following their "Investigation of Power Loss and Instability in Inclement Weather." Based upon this testing, GE has concluded that the Power Management Control (PMC) equipped engines have sufficient capability under all conditions; however, the FADEC equipped engines, because of their lower minimum idle speed in flight, and different Variable Bypass Valve (VBV) schedules, may have less than the desired capability at engine speeds below approach idle.

Flights through clouds, drizzle, light rain or snow will have no effect on engine operation assuming current procedures for these conditions are observed. However, flight through heavy rain or hail can cause engine spool down or flame out if thrust settings are below approach idle. To clarify weather conditions of concern, very heavy precipitation is rarely encountered except in thunderstorms.

An airplane modification is planned to automatically set a minimum thrust setting of approach idle when ignition is selected to CONT. In the interim, Boeing recommends that the flight crew procedures be modified to maintain a minimum of approach idle in conditions likely to result in very heavy rain or hail encounter. Increasing engine RPM to approach idle will assure satisfactory engine operation in the worst case conditions.

Operating Instructions

Flights should be conducted to avoid thunderstorm activity by over flight or circumnavigation. To the maximum extent possible, heavy rain or hail should also be avoided. Weather radar, pilot reports, and flight crew observations may be used by the flight crew to determine when heavy rain or hail is anticipated. Should flight in heavy rain or hail be encountered or anticipated, accomplish the following procedure:

CF6-80C2 SERIES FADEC ENGINE OPERATION IN HEAVY RAIN OR HAIL

Condition: Heavy rain or hail encountered or anticipated.

ENGINE START SELECTORS. CONT
[Provides flameout protection.]

If TAT is 10 degrees C or below:

ENGINE ANTI-ICE..... ON

[Maintains a minimum thrust setting of approach idle and provides continuous ignition.]

If TAT is above 10 degrees C:

AUTOTHROTTLE (If engaged) DISENGAGE
 Autothrottle may remain engaged during takeoff, climb and cruise.
 [Prevents autothrottle thrust reduction below desired setting during
 descent.]

THRUST LEVERS SET

Set a minimum of 50% N1 at or above 10,000 ft, 45% N1 below 10,000 ft except for landing.

Note: In heavy precipitation, engine parameter fluctuations may occur, particularly a noticeable drop in EGT. Engine parameters will return to normal immediately upon leaving the area of heavy precipitation.

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 NRW-16 "In Effect" (IE).

This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified by Boeing Service Bulletin 767-73-0043.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-17

IssueDate: August 15, 2011

Airplane Effectivity: VP-BMC, VP-BOY, VQ-BMQ, VQ-BPT (SB Deletes VP-BDI)

Subject: Pegasus Flight Management Computer (FMC) Lock-Up Anomaly Due to Data-Bus Communications Failure

Reason: To inform flight crews of a Pegasus-FMC anomaly resulting in the lock up of one or both FMCs and to provide temporary operating instructions for lock-up resolution.

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 in-service single and dual Pegasus-FMC lock-up events resulting from a data-bus communications anomaly. When the anomaly occurs, one or both FMCs may lock up preventing normal CDU access and control of the FMC(s). This lock-up anomaly and the information and recommended operating instructions contained in this Operations Manual Bulletin are only applicable to Pegasus-FMC software versions.

Operator reports indicate the most common lock-up event involves a single FMC; however, dual FMC lock-up events have also been reported. An FMC lock up is indicated by the continuous display of the "SINGLE FMC OPERATION" scratch-pad message with no response to CDU function or line-select keys and may be accompanied by display of the "L,R FMC FAIL" advisory-level EICAS alert message(s), illumination of the amber FAIL light on the CDU(s), and the amber "MAP" flag on the associated HSI display(s). In some cases, both FMCs may continue to operate normally, but no data communication or data comparison occurs between the master FMC and the spare FMC.

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August 14, 2014

D632T001-36NRW

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Honeywell is aware of this Pegasus-FMC anomaly. The planned fix to the problem is under investigation.

Operating Instructions

If the "SINGLE FMC OPERATION" scratch-pad message displays on the ground on either CDU, or both FMCs lock up as described above on the ground or in-flight, a single attempt at cycling both FMC circuit breakers can be accomplished, flight conditions permitting, as follows:

Note: If in-flight, Boeing recommends the following procedure be accomplished with an autopilot and the autothrottle engaged due to the requirement of a flight crew member leaving his/her station to achieve access to the overhead circuit breaker panel.

Do not use LNAV or VNAV while attempting the following procedure.

L "FMCS CMPTR" circuit breaker (Location E9). PULL

R "FMCS CMPTR" circuit breaker (Location E30) PULL

Wait 20 seconds.

L "FMCS CMPTR" circuit breaker (Location E9) PUSH

R "FMCS CMPTR" circuit breaker (Location E30) PUSH

Wait until MENU page reappears with the "< FMC" prompt at line-select key 1L., then select the prompt by pushing line-select key 1L.

FMC ROUTE ENTER

Begin route entry by re-entering ORIGIN airport identifier to ensure previous route is initially deleted.

FMC PERFORMANCE DATA ENTER

If normal FMC operation is restored, LNAV and/or VNAV may be engaged, as needed.

The temporary procedural steps provided above should restore normal FMC operation; however, some FMC faults may preclude normal operation. If the above procedure does not restore normal FMC operation, DO NOT accomplish a second attempt as this may result in further systems' degradation.

If the "SINGLE FMC OPERATION" scratch-pad message displays during flight, accomplish the FMC FAIL checklist as published in the Boeing Quick Reference Handbook (QRH), or operator equivalent.

Accomplishing the checklist steps contained in the FMC FAIL checklist will configure the airplane systems for single FMC operation. For Pegasus-FMC equipped airplanes which interface with CDUs equipped with the "MENU" mode-select key, continued ETOPS operation should not be compromised due to the alternate navigation functionality.

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 NRW-17 "In Effect" (IE).

This Operations Manual Bulletin will be revised to include service bulletin information when available.

Boeing Maintenance Tip 767 MT 34-047 is related to this Operations Manual Bulletin.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

Boeing Commercial Airplanes

Commercial Aviation Services

Attn: 767 Manager, Flight Technical Data

P.O. Box 3707, M/C 20-89

Seattle, Washington, 98124-2207 USA

Telephone: (206) 662-4000

Fax: (206) 662-4743

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-18

IssueDate: September 15, 2011

Airplane Effectivity: VP-BMC, VP-BOY, VQ-BMQ

Subject: Incorrect Turn Direction During a Standard Instrument Departure (SID)

Reason: To inform pilots of a Pegasus Flight Management Computer System anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator has reported cases of the Pegasus-FMC commanding a turn opposite to that expected and displayed on the map during a SID. Each of the reported occurrences involves a SID with a course reversal shortly after takeoff. In these cases, a right turn was correctly displayed on the map but the FMC commanded a left turn when certain criteria existed. Specifically, when the airplane has a steep initial climb, the airplane may reach an altitude constraint with the airplane in a position to immediately sequence the next leg. For example, many SIDs are coded with an initial "runway heading" leg (VA leg type) that climbs to a specified altitude. In some procedures, the SID also has a "heading to an intercept" leg (VI leg type) with an associated turn direction following the VA leg.

When this anomaly occurs, the airplane may reach the specified altitude in a position to immediately sequence the next (VI) leg. Should this simultaneous sequence occur, the VI leg with the turn direction is no longer in the route. Since the turn direction is no longer in the route, the FMC will revert to normal turn logic and command a turn in the shortest direction to the new course. The shortest turn direction may be in the opposite direction from that depicted for the departure. When this anomaly occurs, the map will continue to display the correct magenta path but the airplane may turn in the opposite direction.

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The only reported occurrence of this anomaly has been on the RW34 departures at Fukuoka, Japan. However, the software anomaly could cause a similar problem at other airports.

The information and operating instructions contained in this Flight Crew Operations Manual Bulletin are only applicable to Pegasus-FMC software versions.

Operating Instructions

During a SID, should the FD or autopilot begin a turn opposite to that displayed on the map or described in the SID description, use HDG SEL to fly the correct chart course to complete the turn in the correct direction. Following completion of the turn, LNAV may be re-engaged and FD guidance may be followed or the autopilot may be engaged normally.

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 NRW-18 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-34-0471. This Flight Crew Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operator's fleet have been modified.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-19

IssueDate: November 2, 2012

Airplane Effectivity: VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Subject: FMC Distance to Waypoint Anomaly

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

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. Subsequently selecting a SID where the last waypoint of the SID is the same waypoint as 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 runway 36 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. LNAV will fly-over instead of fly-by waypoint TOL.

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.

Departure 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

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 NRW-19 "In Effect" (IE).

This condition is under investigation. This Flight Crew Operations Manual Bulletin remains in effect until further notice and will be revised to include service bulletin information when available.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-20

IssueDate: November 2, 2012

Airplane Effectivity: VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Subject: Incorrect Turn During Intercept Leg (INTC) in a Standard Instrument Departure (SID)

Reason: To inform flight crews of a Pegasus Flight Management Computer anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

A Previous bulletin was issued for a similar problem. Pegasus version 09 was expected to correct this anomaly but it did not.

An operator has reported cases of the Pegasus-FMC commanding a turn opposite to that expected and shown on the map during a SID. Each of the reported cases involves a SID with a 270 degree turn after takeoff. In these cases a left turn was correctly shown on the map for the leg.

When this anomaly occurs, the airplane initially starts to turn in the correct direction but then the FMC loses the turn direction, reverts to normal turn logic and commands a turn in the shortest direction to the new course. The shortest turn direction may be in the opposite direction from that shown for the departure. The active leg at the time was a VI or heading to (INTC) leg.

The only reported occurrences of this anomaly have been on runway 16L and 16R departures at Haneda airport, Tokyo, Japan. However, the software anomaly could cause a similar problem at other airports.

The information and operating instructions contained in this Flight Crew Operations Manual Bulletin are only applicable to Pegasus-FMC software.

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August 14, 2014

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Operating Instructions

During a SID, should the FD or autopilot begin in a turn opposite to that shown on the map or described in the SID description, use HDG SEL to fly the correct chart course to complete the turn in the correct direction. Following completion of the turn, LNAV may be re-engaged and FD guidance may be followed or the autopilot may be engaged.

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 NRW-20 "In Effect" (IE).

This condition is under investigation. This Flight Crew Operations Manual Bulletin remains in effect until further notice and will be revised to include service bulletin information when available.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-21

IssueDate: February 15, 2013

Airplane Effectivity: (SB Deletes VP-BMC, VP-BOY)

Subject: Consecutive Conditional Altitude Waypoints Map Anomaly

Reason: To inform flight crews of an HSI Map display anomaly associated with routes containing two consecutive conditional altitude waypoints.

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

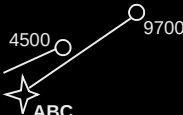
Background Information

During flight test, a Boeing flight crew experienced an HSI Map display anomaly. Simulator and lab tests show that when two consecutive conditional altitude waypoints exist in a procedure, the Map display of the magenta line does not reflect the intended path on the active leg for the conditional altitude waypoint. The displayed magenta line may erroneously indicate a turn prior to the airplane satisfying the required altitude for the turn. Conditional altitude waypoints are depicted as a small circle along with the altitude on the HSI Map display and their location depends on the airplane satisfying the altitude associated with the leg.

Consecutive conditional altitude waypoints may appear in Standard Instrument Departures (SID) and Missed Approach procedures and are automatically entered into the route when a procedure is selected from the FMC DEPARTURES or ARRIVALS page. Procedures which use this combination of two consecutive altitude waypoints usually require a climb to a specified altitude followed by a small turn to intercept a VOR radial while climbing to a higher altitude. Approximately 400 procedures worldwide are affected by this anomaly.

Honeywell and Boeing are investigating this anomaly.

The typical HSI Map display and corresponding RTE LEGS page display for conditional altitude waypoints are shown below:

Description	ND Map Display	CDU LEGS Page Display
Constant Heading to an Altitude		070° HDG (4500)
Constant Course to an Altitude		070° TRK (4500)
Outbound Radial to an Altitude		070° (9700)
Consecutive Course to an Altitude Followed by Outbound Radial to an Altitude		070° TRK (4500) 063° (9700)

Operating Instructions

When flying a SID or missed approach procedure containing consecutive conditional altitude waypoints, the active route shown on the HSI Map is incorrect; however, LNAV guidance is reliable and may be flown using either the flight director or autopilot. Monitor LNAV progress and insure all altitudes and turn points are consistent with the procedure and available raw data.

Three different vendors (Jeppesen, Swissair and Racal) supply navigation data bases for the FMC. Currently affected procedures for each vendor's navigation data base are contained in the original bulletin and are not reissued with this bulletin. To determine which vendor supplies your data base, check the Navigation Data Line on the FMC IDENT page. The navigation data base identifier begins with a three letter code. Use the Navigation Data Base vs. Vendor Reference Table (A) to determine the vendor associated with the three letter navigation data base identifier. Then locate the vendor tables (B1, B2 and B3) to determine the affected procedures.

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 NRW-21 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-34-0291 or 767-34-0301 or 767-34-0302 or 767-34-0303 or 767-34-0304. Refer to individual Service Bulletin for applicability.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table A Navigation Data Base vs. Vendor Reference Table							
Nav. ID	Vendor	Nav. ID	Vendor	Nav. ID	Vendor	Nav. ID	Vendor*
AA7	J	BA1	J	CI4	J	ET2	J
AC1	J	BB2	S	CI5	J	ET3	J
AC3	J	BE0	J	CJ1	J	ET4	J
AC4	J	BE3	J	CM2	J	ET6	J
AE1	S	BE4	J	CM3	J	EZ1	S
AE2	S	BE6	J	CO1	J	EZ2	S
AE3	S	BE7	J	CP1	J	FA1	J
AF4	S	BE8	J	CP4	J	FA2	J
AH3	J	BE9	J	CP9	J	FI1	J
AH6	J	BI1	J	CV1	S	FS1	J
AI4	J	BI6	J	CX4	J	FX1	J
AJ1	J	BI7	J	CZ5	J	GA5	S
AM1	J	BK1	J	CZ6	J	GB1	J
AM6	J	BK1	J	DL1	J	GB2	J
AN6	A	BO1	J	DL2	J	GD1	J
AR1	J	BO4	J	DL3	J	GF1	J
AR5	J	BR1	J	DL3	J	GF2	J
AT1	J	BR2	J	DL4	J	GF5	J
AT2	J	BY1	R	DL5	J	GG1	J
AT4	J	BY2	R	DP1	J	GS1	J
AV1	J	BY3	R	DP5	J	HE4	J
AW1	J	BY4	R	DP8	J	HP5	J
AW2	J	BY6	R	EE1	J	HV2	S
AY1	J	CA2	J	EK2	S	HV5	S
AY8	J	CA4	J	ER1	J	HV6	S
AZ8	S	CB2	J	ET1	J	HY6	S
AZ8	S	CB2	J	ET1	J	HY6	S
*J = Jeppesen (Table B1) S = Swissair (Table B2) R = Racal (Table B3)							

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table A Navigation Data Base vs. Vendor Reference Table							
Nav. ID	Vendor	Nav. ID	Vendor	Nav. ID	Vendor	Nav. ID	Vendor*
IB1	S	LA2	J	MS5	J	PT4	R
IB3	S	LA6	J	MS6	J	PT5	R
IL5	J	LH4	S	MT1	J	PT6	R
IL6	J	LH5	S	MU1	J	QF1	J
JD7	J	LO1	J	MX1	J	QF4	J
JD9	J	LO6	J	MX4	J	QN2	J
JG4	J	LU1	S	NG6	J	QN3	J
JK1	S	LU3	S	NH1	J	QQ2	J
JK3	S	LU4	S	NH2	J	RA1	J
JL1	J	LU5	S	NH4	J	RG1	J
JL2	J	LU6	S	NH6	J	RG2	J
JL4	J	LU7	S	NS1	J	RS6	J
JL6	J	LY2	J	NS2	J	SA4	J
KE2	J	LY3	J	NS3	J	SA6	J
KE4	J	LY7	J	NU1	J	SE1	J
KF1	J	MA6	J	NW1	J	SI1	J
KF2	J	MD0	J	NW4	J	SK4	S
KF3	J	MD1	J	OZ1	J	SK5	S
KF4	J	MD2	J	OZ2	J	SK6	S
KL4	S	MD3	J	OZ4	J	SN7	S
KL5	S	MH1	S	PA1	S	SQ4	J
KL7	S	MH4	J	PL1	J	SR4	S
KT1	J	MJ1	J	PL2	J	SR5	S
KT2	J	MK1	J	PR4	J	ST1	J
KT6	J	MP2	S	PT1	J	SU6	J
KU6	S	MP5	S	PT2	J	SV5	J
LA1	J	MS1	J	PT3	J	TA1	J
*J = Jeppesen (Table B1) S = Swissair (Table B2) R = Racal (Table B3)							

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table A Navigation Data Base vs. Vendor Reference Table							
Nav. ID	Vendor	Nav. ID	Vendor	Nav. ID	Vendor	Nav. ID	Vendor*
TA5	J	UK3	R	WE1	J		
TE4	J	UK6	S	WO2	J		
TE6	J	UN1	S	XG1	J		
TE7	J	UN2	S	XO2	S		
TG5	S	UN5	S	XO5	J		
TK2	J	UP1	J	XY1	S		
TQ2	S	UP3	J	YK1	J		
TQ3	S	UP5	J	YN1	J		
TR1	J	UP6	J	YX1	J		
TR2	J	US5	J	ZB1	R		
TR3	J	US6	J	ZB2	R		
TS1	J	UX1	J	ZB3	R		
TS2	J	UX2	J	ZB4	R		
TW1	J	UX3	J	ZO1	J		
TW2	J	VE1	J				
TW3	J	VE2	S				
TW4	J	VO1	S				
TZ1	J	VO3	S				
TZ2	J	VP1	S				
TZ3	J	VR1	J				
TZ4	J	VS4	S				
UA1	J	VZ1	J				
UA2	J	VZ2	J				
UA4	J	VZ4	J				
UC1	J	VZ5	J				
UD1	J	VZ6	J				
*J = Jeppesen (Table B1) S = Swissair (Table B2) R = Racal (Table B3)							

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B1 Jeppesen Navigation Data Base - Standard Instrument Departures			
ICAO ID	Airport	Departure	Runway
EDFH	Hahn, Germany	RUWE1E	RW03
EHAM	Amsterdam,Schipol, Netherlands	EO01L	RW01L
EHAM	Amsterdam,Schipol, Netherlands	EO09L	RW09L
EHAM	Amsterdam,Schipol, Netherlands	EO27L	RW27L
ENBO	Bodo, Norway	GLOM2B	RW26
ENBO	Bodo, Norway	STOB1B	RW26
ENDU	Bardufoss, Norway	BDF2	RW11
ENDU	Bardufoss, Norway	LAVN2A	RW11
ENDU	Bardufoss, Norway	TULD2A	RW11
ENZV	Stavanger/Sola, Norway	BANK1D	RW29
ENZV	Stavanger/Sola, Norway	DOGI1D	RW11
ENZV	Stavanger/Sola, Norway	DOLF1D	RW29
ENZV	Stavanger/Sola, Norway	FUND1D	RW29
ENZV	Stavanger/Sola, Norway	GRAM1D	RW11
ENZV	Stavanger/Sola, Norway	LUCK1D	RW29
ENZV	Stavanger/Sola, Norway	MADY1D	RW11
ENZV	Stavanger/Sola, Norway	OKLA1D	RW11
ENZV	Stavanger/Sola, Norway	SIRD1D	RW11
ENZV	Stavanger/Sola, Norway	STON1D	RW29
ESNN	Sundsvall-Harnosand, Sweden	LUE1C	RW34
ESNN	Sundsvall-Harnosand, Sweden	STEW2C	RW34
FACT	Cape Town, South Africa	OKTE2B	RW19
FACT	Cape Town, South Africa	PARI2B	RW19
GCFV	Fuerteventura, Canary Is	KORA1R	RW19
GCFV	Fuerteventura, Canary Is	LPC2R	RW19
GCFV	Fuerteventura, Canary Is	LT1R	RW19
GCFV	Fuerteventura, Canary Is	SAMA1R	RW19
GCFV	Fuerteventura, Canary Is	TFN1R	RW19

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B1 Jeppesen Navigation Data Base - Standard Instrument Departures			
ICAO ID	Airport	Departure	Runway
GCFV	Fuerteventura, Canary Is	TFS2R	RW19
GCFV	Fuerteventura, Canary Is	VAST1R	RW19
KBZN	Boseman/Gallatin, MT	BZN365	RW30
KBZN	Boseman/Gallatin, MT	BZN86S	RW30
KBZN	Boseman/Gallatin, MT	BZN86W	RW30
KCGZ	Casa-Grande, AZ	UCZKJ1	RW05
KHLN	Helena, MT	HLN2	RW05
KHLN	Helena, MT	HLN2	RW09
KINW	Winslow, AZ	HLN1	RW29
KLAX	Los Angeles, CA	BEVAN1	ALL
KMSO	Missoula, MT	MSOEAS	RW29
KPHX	Phoenix/Sky Harbor, AZ	MISSY2	RW26B
KSJC	San Jose, CA	SUNOL5	RW12
KSTS	Santa Rosa/Sonoma Co, CA	STS5	RW01
KSTS	Santa Rosa/Sonoma Co, CA	STS5	RW14
KSTS	Santa Rosa/Sonoma Co, CA	STS5	RW19
KSTS	Santa Rosa/Sonoma Co, CA	STS5	RW32
LEAS	Asturias, Spain	ARPO1B	RW11
LEAS	Asturias, Spain	LURI1B	RW11
LEAS	Asturias, Spain	MUSI1B	RW11
LEAS	Asturias, Spain	RATP1B	RW11
LEIB	Ibza, Spain	MHN1E	RW24
LEIB	Ibza, Spain	MJV1E	RW24
LEPA	Palma de Mallorca, Spain	MEBU1A	RW24
LEPA	Palma de Mallorca, Spain	MHN1A	RW24
LEPA	Palma de Mallorca, Spain	MJV1B	RW06
LEPA	Palma de Mallorca, Spain	OSGA1A	RW24
LFMI	Istres/Le Tube, France	LUC6D	RW15

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B1 Jeppesen Navigation Data Base - Standard Instrument Departures			
ICAO ID	Airport	Departure	Runway
LGAT	Athens, Greece	FALC1F	RW15
LGAT	Athens, Greece	KOR1F	RW15
LGAT	Athens, Greece	KRS1F	RW15
LGAT	Athens, Greece	TNG1F	RW15
LGAT	Athens, Greece	VIL11F	RW15
LGKL	Kalamata, Greece	KLM1V	RW17
LGKL	Kalamata, Greece	KLM1Y	RW17
LGKP	Karpathos, Greece	KRC1A	RW30
LGKP	Karpathos, Greece	KRC1B	RW12
LGKV	Kavala/Megas Alexandros, Greece	ALX3A	RW05
LGKV	Kavala/Megas Alexandros, Greece	ALX3B	RW23
LGKV	Kavala/Megas Alexandros, Greece	LMO3A	RW05
LGKV	Kavala/Megas Alexandros, Greece	LMO3B	RW23
LGKV	Kavala/Megas Alexandros, Greece	PERE3A	RW05
LGKV	Kavala/Megas Alexandros, Greece	RODO1A	RW05
LGKV	Kavala/Megas Alexandros, Greece	RODO1B	RW23
LGMK	Mikonos, Greece	RIPL1A	RW34
LGMK	Mikonos, Greece	RIPL1B	RW16
LGMT	Mitilini, Greece	LSV1A	RW33
LGRX	Araxos, Greece	ALAK1M	RW36
LGRX	Araxos, Greece	ARGU1M	RW36
LGRX	Araxos, Greece	IXON1M	RW36
LGRX	Araxos, Greece	KESA1M	RW36
LGRX	Araxos, Greece	KOR1M	RW36
LGRX	Araxos, Greece	KRK1M	RW36
LGRX	Araxos, Greece	TRL1M	RW36
LGSR	Santorini, Greece	AST11E	RW16
LGSR	Santorini, Greece	ATLA1B	RW34

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B1 Jeppesen Navigation Data Base - Standard Instrument Departures			
ICAO ID	Airport	Departure	Runway
LGSR	Santorini, Greece	ATLA1C	RW16
LGSR	Santorini, Greece	MIL1E	RW34
LGSR	Santorini, Greece	MIL1F	RW34
LGSR	Santorini, Greece	MIL1G	RW16
LGSR	Santorini, Greece	MIL1H	RW16
LGTG	Tanagra, Greece	AGH1C	RW28
LGTG	Tanagra, Greece	AGH1D	RW10
LGTG	Tanagra, Greece	ATH1C	RW28
LGTG	Tanagra, Greece	ATH1D	RW10
LGTG	Tanagra, Greece	IXON1C	RW28
LGTG	Tanagra, Greece	IXON1D	RW10
LGTG	Tanagra, Greece	OLID1C	RW28
LGTG	Tanagra, Greece	OLID1D	RW10
LGTG	Tanagra, Greece	SKL1F	RW28
LGTG	Tanagra, Greece	SKL1G	RW10
LGTS	Thessaloniki/Makedonia, Greece	ARNA1E	RW28
LGTS	Thessaloniki/Makedonia, Greece	FSK1E	RW28
LGTS	Thessaloniki/Makedonia, Greece	LAMB1E	RW28
LGTS	Thessaloniki/Makedonia, Greece	LOPO1E	RW28
LGTS	Thessaloniki/Makedonia, Greece	SKL1E	RW28
LGTS	Thessaloniki/Makedonia, Greece	TSL1F	RW28
LIBC	Crotone, Italy	CDC5A	RW35
LIBC	Crotone, Italy	CDC5B	RW17
LIMP	Parma, Italy	PAR5V	RW02
LIPZ	Venezia/Tessera, Italy	CHI5H	RW22
LIPZ	Venezia/Tessera, Italy	RON5H	RW22
LIPZ	Venezia/Tessera, Italy	ROTA5H	RW22
LIRQ	Florence, Italy	PIS5A	RW23

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Table B1 Jeppesen Navigation Data Base - Standard Instrument Departures			
ICAO ID	Airport	Departure	Runway
LSGC	Les Eplatures, Switzerland	FRI1B	RW24
LSGC	Les Eplatures, Switzerland	HOC1A	RW24
LSGC	Les Eplatures, Switzerland	HOC1B	RW24
LSGC	Les Eplatures, Switzerland	SPR1B	RW24
LSZG	Grenchen, Switzerland	SHU2T	RW25
LSZG	Grenchen, Switzerland	WIL2T	RW25
MGGT	Guatemala/La Aurora, Guatemala	SJOB	RW01
MGGT	Guatemala/La Aurora, Guatemala	PALEN	RW01
MKJP	Kingston/Norman Manley, Jamaica	MLY1	RW12
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	CAOBA2	RW09
NFNA	Nausori, Fiji	ALFA	RW10
NFNA	Nausori, Fiji	BRAVO	RW10
NFNA	Nausori, Fiji	BRAVO	RW28
NFNA	Nausori, Fiji	CHARLI	RW10
NSFA	Apia/Faleolo, Samoa	ALFA	RW26
NTAA	Tahiti, Tahiti	EMIR1A	RW04
NTAA	Tahiti, Tahiti	KAIN1A	RW04
NTAA	Tahiti, Tahiti	METU1A	RW04
OIAW	Ahwaz, Iran	GABK1B	RW30
OIAW	Ahwaz, Iran	GABK1H	RW12
OIAW	Ahwaz, Iran	MIS1B	RW30
OIAW	Ahwaz, Iran	MIS1H	RW12
OIBB	Bushehr, Iran	KUGV1A	RW31
OIBB	Bushehr, Iran	KUGV1B	RW13
OIBB	Bushehr, Iran	KUGV1C	RW31
OICC	Kermanshah, iran	RULI1D	RW11
OIGG	Rasht, Iran	RALG1A	RW27
OIGG	Rasht, Iran	RALG1B	RW09

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Table B1 Jeppesen Navigation Data Base - Standard Instrument Departures			
ICAO ID	Airport	Departure	Runway
OIGG	Rasht, Iran	RART1A	RW27
OIGG	Rasht, Iran	RART1B	RW09
OIKB	Bandar Abbass, Iran	TAVN2A	RW03
OIKK	Kerman, Iran	ALGU2B	RW34
OIKK	Kerman, Iran	ALGU2D	RW34
OIKK	Kerman, Iran	ALGU2E	RW34
OIKK	Kerman, Iran	ALGU3A	RW34
OIKK	Kerman, Iran	ALGU3C	RW16
OIKK	Kerman, Iran	ALKE2C	RW34
OIKK	Kerman, Iran	ALKE3A	RW34
OIKK	Kerman, Iran	ALKE3B	RW16
OIKK	Kerman, Iran	ALKU2D	RW34
OIKK	Kerman, Iran	ALKU2E	RW16
OIKK	Kerman, Iran	ALKU3A	RW34
OIKK	Kerman, Iran	ALKU3B	RW16
OIKK	Kerman, Iran	ALKU3C	RW16
OIKK	Kerman, Iran	ALME2D	RW34
OIKK	Kerman, Iran	ALME3A	RW34
OIKK	Kerman, Iran	ALME3C	RW16
OIKK	Kerman, Iran	ALMI2A	RW34
OIKK	Kerman, Iran	ALMI2B	RW16
OIKK	Kerman, Iran	ALMI2C	RW16
OIKK	Kerman, Iran	ALMI2D	RW34
OIKK	Kerman, Iran	ALMO1A	RW34
OIKK	Kerman, Iran	ALMO2B	RW34
OIKK	Kerman, Iran	ALMO2C	RW16
OIKK	Kerman, Iran	ALMO2D	RW34
OIKK	Kerman, Iran	ALMO2E	RW34

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Table B1 Jeppesen Navigation Data Base - Standard Instrument Departures			
ICAO ID	Airport	Departure	Runway
OIMM	Mashhad, Iran	METK2A	RW13
OIMM	Mashhad, Iran	METK2B	RW31
OIMM	Mashhad, Iran	METK2C	RW31
OIMM	Mashhad, Iran	MIDM1A	RW13
OIMM	Mashhad, Iran	MIDM1B	RW31
OIMM	Mashhad, Iran	NOTS2A	RW13
OIMM	Mashhad, Iran	NOTS2B	RW13
OIMM	Mashhad, Iran	NOTS2C	RW31
OIMM	Mashhad, Iran	RAMI2A	RW13
OIMM	Mashhad, Iran	RAMI2B	RW31
OISS	Shiraz, Iran	KISE1B	RW11
OITR	Uromiyeh, Iran	BONA1B	RW21
OITR	Uromiyeh, Iran	ZAJ1B	RW21
OITT	Tabriz, Iran	RUDA1B	RW12
OITT	Tabriz, Iran	RUDA1D	RW12
OIZH	Zaheadan, Iran	DANO2B	RW17
OLBA	Beirut, Lebanon	KAD1C	RW18
OLBA	Beirut, Lebanon	KAD1C	RW21
RJCH	Hakodate, Japan	HWE2R	RW12
RJCN	Nakashibetsu, Japan	NSE2R	RW26
RJFE	Fukue, Japan	FUER1	RW21
RJFE	Fukue, Japan	JB2	RW03
RJFE	Fukue, Japan	OLE2	RW03
RJFY	Kanoya, Japan	EASTRE	RW08
RJFY	Kanoya, Japan	WESTRE	RW26
RJKA	Amami, Japan	AME1R	RW03
RJKA	Amami, Japan	AME1R	RW21
RJOB	Okayama, Japan	OKC2	RW07

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Table B1 Jeppesen Navigation Data Base - Standard Instrument Departures			
ICAO ID	Airport	Departure	Runway
RJOB	Okayama, Japan	OYE2R	RW07
RJOB	Okayama, Japan	WASYU1	RW07
RJOC	Izumo, Japan	OIE2	RW07
RJOC	Izumo, Japan	TRE4	RW07
RJOC	Izumo, Japan	XZE1R	RW07
RJOC	Izumo, Japan	XZE3E	RW07
RJOW	Iwami, Japan	IME1R	RW29
RJSA	Aomori, Japan	MRE1R	RW06
RJSA	Aomori, Japan	MRE1R	RW24
RJSF	Fukushima, Japan	GTC1	RW19
RJSF	Fukushima, Japan	SDE1	RW19
RJSF	Fukushima, Japan	YTE1	RW19
RJSY	Shonai, Japan	YSE1R	RW27
RJTH	Hachliojima, Japan	HCE1R	RW25
RJTH	Hachliojima, Japan	HCE2W	RW25
RJTO	Oshima, Japan	MJ1	RW21
RJTO	Oshima, Japan	SPENS2	RW03
RKJY	Yeosu, Korea	GOSB1A	RW17
RKJY	Yeosu, Korea	NIKE1A	RW17
ROAH	Naha, Japan	NHC2SR	RW18
RPMD	Davao/Francisco Bangoy, Phillipines	SID1B	RW23
RPMD	Davao/Francisco Bangoy, Phillipines	SID2	RW23
RPMD	Davao/Francisco Bangoy, Phillipines	SID3	RW23
RPMD	Davao/Francisco Bangoy, Phillipines	SID4	RW23
RPMZ	Zamboanga, Phillipines	SID1	RW09
RPMZ	Zamboanga, Phillipines	SID1	RW27
RPMZ	Zamboanga, Phillipines	SID2	RW09
RPMZ	Zamboanga, Phillipines	SID2	RW27

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Table B1 Jeppesen Navigation Data Base - Standard Instrument Departures			
ICAO ID	Airport	Departure	Runway
RPMZ	Zamboanga, Phillipines	SID7	RW09
RPMZ	Zamboanga, Phillipines	SID7	RW27
RPVM	Lapu-Lapu/Mactan, Phillipines	SID15	RW04
RPVM	Lapu-Lapu/Mactan, Phillipines	SID15A	RW04
RPVM	Lapu-Lapu/Mactan, Phillipines	SID16	RW04
SCFA	Antofagasta, Chile	ANCLA2	RW18
SCFA	Antofagasta, Chile	ANCLA3	RW19
SCFA	Antofagasta, Chile	COLOSB	RW18
SCFA	Antofagasta, Chile	COLOSC	RW19
SCFA	Antofagasta, Chile	MOREK1	RW18
SCFA	Antofagasta, Chile	MOREK2	RW19
SCIE	Concepcion/Carriel, Chile	CORNL4	RW20
SCSE	La Serena/La Florida, Chile	LILEN1	RW29
SVCS	Charallave/Oscar Machado Zuoloaga, Venezuela	3NOL10	RW10
ZYTL	Dalian, China	D15T	RW28

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Table B1 Jeppesen Navigation Data Base - Approaches/Missed Approaches		
ICAO ID	Airport	Approach
CYDN	Dauphin, Manitoba, Canada	VOR14
CYXE	Saskatoon, Sask., Canada	VOR33
CYYB	North Bay, Ontario, Canada	VOR18
ENAT	Alta, Norway	ILS12
ENBO	Bodo, Norway	ILS08
ENKB	Kristiansund/Kvernberget, Norway	VOR25
FADN	Durban/Louis Botha, South Africa	VOR23
FYWH	Windhoek/Lughawe, Nambia	VOR26
GCCR	Arrecife/Lanzarote, Canary Is.	ILS04
KAHN	Athens/Ben Epps, GA	VOR02
KALW	Walla Walla, WA	VOR02
KBKE	Baker, OR	VOR12
KBLH	Blythe, CA	VOR26
KBOI	Boise, ID	VOR10R
KBOI	Boise, ID	ILS10R
KBPI	Big Piney/Marbleton, WY	VOR31
KCEC	Crescent City, CA	VOR11
KCEC	Crescent City, CA	ILS11
KCEC	Crescent City, CA	VOR11
KCMA	Camarillo, CA	VOR26
KCOE	Coeur D'alene, ID	VOR01
KCOE	Coeur D'alene, ID	ILS05
KDLF	Del Rio, TX	VOR13C
KDLF	Del Rio, TX	VOR31C
KDRO	Durango/La Plata Co., CO	VOR02
KDRO	Durango/La Plata Co., CO	ILS02
KEEO	Meeker, CO	RNV03
KFLG	Flagstaff, Puliam, AZ	VOR21

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Table B1 Jeppesen Navigation Data Base - Approaches/Missed Approaches		
ICAO ID	Airport	Approach
KGFK	Grand Forks, ND	VOR17R
KGFK	Grand Forks, ND	VOR35L
KHVR	Havre City-Co, MT	VOR07
KHYS	Hays, KS	VOR16
KHYS	Hays, KS	VOR34
KHYS	Hays, KS	VOR16
KHYS	Hays, KS	VOR34
KIGM	Kingman, AZ	VOR21
KJAC	Jackson Hole, WY	ILS18
KLMT	Klamath Falls, OR	VOR32
KLMT	Klamath Falls, OR	ILS32
KNGP	Corpus Christi, TX	VOR13R
KNQX	Key West, FL	VOR07
KONA	Winona Muni/Max Conrad, MN	VOR29
KOTH	North Bend Muni, OR	VOR04
KPMD	Palmdale, CA	VOR25
KPMD	Palmdale, CA	ILS25
KPNE	North Philadelphia, PA	VOR24
KPUC	Price/Carbon Co, UT	VOR36
KRWL	Rawlins Muni, WY	VOR22
KSBM	Sheboygan Co, WI	VOR03
KSBY	Salisbury/Wicomico Co., MD	ILS32
KSBY	Salisbury/Wicomico Co., MD	VOR14
KSBY	Salisbury/Wicomico Co., MD	VOR32
KSVC	Silver City/Grant Co, NM	LOC26
KSVN	Savannah/Hunter, GA	VOR28
KTMA	Tifton, GA	VOR27
KTMA	Tifton, GA	VOR33

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Table B1		
Jeppesen Navigation Data Base - Approaches/Missed Approaches		
ICAO ID	Airport	Approach
KTRM	Palm Springs Thermal, CA	VOR30
KTVF	Thief River Falls, MN	VOR31
KTWF	Twin Falls/Sun Valley, ID	VOR07
LEBL	Barcelona, Spain	VOR02
LEBL	Barcelona, Spain	ILS07
LGKO	Marathon/Kotroni, Greece	VOR15
LGKO	Marathon/Kotroni, Greece	VOR33
LIPE	Bologna/Borgo Panigale, Italy	VOR12
LIPE	Bologna/Borgo Panigale, Italy	ILS12
LTAQ	Samsun, Turkey	VOR21
MDBH	Barahona, Dominican Republic	VOR12
MDBH	Barahona, Dominican Republic	VOR30
MDPP	Puerto Plata, Dominican Republic	VOR26
MDSD	Santo Domingo/De Las Americas, Dominican Republic	VOR17
MDSD	Santo Domingo/De Las Americas, Dominican Republic	VOR35
MHTG	Tegucigalpa/Toncontin, Honduras	VOR01
MPDA	David/Enrique Malek, Panama	VOR04
MPTO	Panama/Tocumen, Panama	VOR03L
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	ILS09
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	LOC09
NCRG	Avarua/Rarotonga, Cook Is.	ILS08
NCRG	Avarua/Rarotonga, Cook Is.	ILS26
NSFA	Faleolo, Samoa	ILS08
NZNR	Napier, New Zealand	VOR16
OEBH	Bisha, Saudi Arabia	ILS18
OEDR	Dhahran, Saudi Arabia	VOR34L
OEDR	Dhahran, Saudi Arabia	ILS34L

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Table B1 Jeppesen Navigation Data Base - Approaches/Missed Approaches		
ICAO ID	Airport	Approach
OIBJ	Jam Tohid, Iran	VOR11
OIBJ	Jam Tohid, Iran	ILS11
OIFM	Esfahan, Iran	VOR26L
OIFM	Esfahan, Iran	VOR26R
PABI	Delta Junction, AK	VOR18
PAMC	McGrath, AK	VOR16
PAYA	Yakutat, AK	VOR11
PAYA	Yakutat, AK	VOR29
PHTO	Hilo, Hawaii	ILS26
RJBD	Nanki-Shirahama, Japan	VOR15
RJBD	Nanki-Shirahama, Japan	LOC15
RJCB	Obhiro, Japan	ILS35
RJCH	Hakodate, Japan	VOR12
RJCH	Hakodate, Japan	ILS12
RJCH	Hakodate, Japan	LOC12
RJCM	Memanbetsu, Japan	ILS18
RJDC	Yamaguchi-Ubi/Honshu Is., Japan	VOR07
RJDT	Tsushima, Japan	LOC32
RJDT	Tsushima, Japan	VOR32
RJFK	Kagoshima, Japan	VOR34
RJFK	Kagoshima, Japan	ILS34
RJKB	Okierabu, Japan	VOR22
RJKN	Tokunoshima Is., Japan	VOR01
RJNT	Toyama, Japan	LOC20
RJOB	Okayama, Japan	ILS07
RJOM	Matsuyama, Japan	ILS14
RJOR	Tottori, Japan	ILS10
RJOS	Tokushima, Japan	VOR29

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Table B1		
Jeppesen Navigation Data Base - Approaches/Missed Approaches		
ICAO ID	Airport	Approach
RJSF	Fukushima, Japan	ILS01
RJSF	Fukushima, Japan	VOR01
RJSF	Fukushima, Japan	VOR19
RJSN	Nigata, Japan	VOR10
RJSN	Nigata, Japan	VOR28
RJSN	Nigata, Japan	ILS28
RJSY	Shonai, Japan	VOR27
RJSY	Shonai, Japan	VOR09
RKPK	Kimhae, Korea	VOR36
ROMY	Miyako, Japan	ILS22
ROMY	Miyako, Japan	VOR04
ROMY	Miyako, Japan	VOR22
RORY	Yoron, Japan	VOR14
RORY	Yoron, Japan	VOR32
RPLL	Manila, Phillipines	VOR06
RPLL	Manila, Phillipines	ILS06
RPMD	Davao/Francisco Bangoy, Phillipines	VOR23
RPMD	Davao/Francisco Bangoy, Phillipines	VOR05
RPVA	Tacloban/Daniel Z. Romualdez, Phillipines	VOR36
RPVB	Bacolod Negros Occidental, Phillipines	VOR04
SBFL	Florianopolis/Hercilioluz, Brazil	VOR32
SBUP	Castilho/Urubupunga, Brazil	VOR29
SLVR	Viru Viru, Bolivia	ILS33
SPIM	Lima-Callao, Peru	VOR33
TGPY	Point Salines, GranaVORa	VOR10
VAGO	Goa, India	VOR08
VOMM	Madras, India	VOR12
VOMM	Madras, India	VOR30

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Table B1		
Jeppesen Navigation Data Base - Approaches/Missed Approaches		
ICAO ID	Airport	Approach
VTBU	Rayong/Utapao, Thailand	VOR18
VTSB	Surat Thani, Thailand	VOR22
VTUW	Nakon Phanom, Thailand	VOR15
WAAU	Kendari/Wolter Monginsidi, Indonesia	VOR26
WAMM	Manado/Sam Ratulangi, India	ILS36
WAPP	Ambon/Patimura, Indonesia	ILS04
WRLI	Balikpapan/Sepinggan, Indonesia	ILS25
YMAY	Albury, Australia	VOR07
ZGNN	Nanning/Wuxu, China	VOR23

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Table B2 Swissair Navigation Data Base - Standard Instrument Departures			
Origin Airport	Airport Name	FMC-CDU Departure	FMC-CDU Runway
EDFH	Hahn, Germany	RUWE1E	RW03
GCFV	Fuerteventura, Canary Is	KORA1R	RW19
GCFV	Fuerteventura, Canary Is	LPC1R	RW19
GCFV	Fuerteventura, Canary Is	LPC2R	RW19
GCFV	Fuerteventura, Canary Is	LT1R	RW19
GCFV	Fuerteventura, Canary Is	SAMA1R	RW19
GCFV	Fuerteventura, Canary Is	TFN1R	RW19
GCFV	Fuerteventura, Canary Is	TFS2R	RW19
GCFV	Fuerteventura, Canary Is	VAST1R	RW19
HKJK	Nairobi/Jomo Kenyatta, Kenya	LADANC	RW06
KHLN	Helena, MT	HLN2	RW05
KHLN	Helena, MT	HLN2	RW09
KSJC	San Jose, CA	ALTAM6	RW12
KSJC	San Jose, CA	SUNOL5	RW12
LEAS	Asturias, Spain	ARPO1A	RW29
LEAS	Asturias, Spain	ARPO1B	RW11
LEAS	Asturias, Spain	LURI1A	RW29
LEAS	Asturias, Spain	LURI1B	RW11
LEAS	Asturias, Spain	MUSI1A	RW29
LEAS	Asturias, Spain	MUSI1B	RW11
LEAS	Asturias, Spain	RATP1A	RW29
LEAS	Asturias, Spain	RATP1B	RW11
LEIB	Ibza, Spain	EO24	RW24
LEIB	Ibza, Spain	MHN1E	RW24
LEIB	Ibza, Spain	MJV1E	RW24
LEPA	Palma de Mallorca, Spain	MEBU1A	RW24
LEPA	Palma de Mallorca, Spain	MHN1A	RW24

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Table B2			
Swissair Navigation Data Base - Standard Instrument Departures			
Origin Airport	Airport Name	FMC-CDU Departure	FMC-CDU Runway
LEPA	Palma de Mallorca, Spain	MJV1B	RW06
LEPA	Palma de Mallorca, Spain	OSGA1A	RW24
LGAT	Athens, Greece	KEA1D	RW33
LGAT	Athens, Greece	KRS1D	RW33
LGAT	Athens, Greece	TNG1D	RW33
LGAT	Athens, Greece	VIL1F	RW15
LGSK	Skiathos, Greece	AGH1A	RW20
LGSK	Skiathos, Greece	AGH1B	RW02
LGSK	Skiathos, Greece	KORS1A	RW20
LGSK	Skiathos, Greece	KORS1B	RW02
LGSK	Skiathos, Greece	TNG1A	RW20
LGSK	Skiathos, Greece	TNG1B	RW02
LGSK	Skiathos, Greece	TSL1A	RW20
LGSK	Skiathos, Greece	TSL1B	RW02
LGTG	Tanagra, Greece	AGH1C	RW28
LGTG	Tanagra, Greece	AGH1D	RW10
LGTG	Tanagra, Greece	ATH1C	RW28
LGTG	Tanagra, Greece	ATH1D	RW10
LGTG	Tanagra, Greece	IXON1C	RW28
LGTG	Tanagra, Greece	IXON1D	RW10
LGTG	Tanagra, Greece	OLID1C	RW28
LGTG	Tanagra, Greece	OLID1D	RW10
LGTG	Tanagra, Greece	SKL1F	RW28
LGTG	Tanagra, Greece	SKL1G	RW10
LGTS	Thessaloniki/Makedonia, Greece	EO28	RW28
LGTS	Thessaloniki/Makedonia, Greece	EO34	RW34
LGTS	Thessaloniki/Makedonia, Greece	TSL1F	RW28
LIBC	Crotone, Italy	CDC5A	RW35

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Table B2			
Swissair Navigation Data Base - Standard Instrument Departures			
Origin Airport	Airport Name	FMC-CDU Departure	FMC-CDU Runway
LIBC	Crotone, Italy	CDC5B	RW17
LIPZ	Venezia/Tessera, Italy	CHI5H	RW22
LIPZ	Venezia/Tessera, Italy	RON5H	RW22
LIPZ	Venezia/Tessera, Italy	ROTA5H	RW22
LIRQ	Florence, Italy	PIS5A	RW23
LLBG	Tel Aviv/D. Ben Gurion, Israel	IRM2E	RW26
LLBG	Tel Aviv/D. Ben Gurion, Israel	IRM2F	RW30
LLBG	Tel Aviv/D. Ben Gurion, Israel	NAT3E	RW26
LLBG	Tel Aviv/D. Ben Gurion, Israel	SALA2E	RW26
LLBG	Tel Aviv/D. Ben Gurion, Israel	SALA2F	RW30
LLBG	Tel Aviv/D. Ben Gurion, Israel	SOL3E	RW26
LLBG	Tel Aviv/D. Ben Gurion, Israel	TALM2E	RW26
MGGT	Guatemala/La Aurora, Guatemala	SJOB	RW01
MKJP	Kingston/Norman Manley, Jamaica	ENKA3	RW30
MKJP	Kingston/Norman Manley, Jamaica	LETUM3	RW30
MKJP	Kingston/Norman Manley, Jamaica	NORAN3	RW30
MKJP	Kingston/Norman Manley, Jamaica	OSTER3	RW30
MKJP	Kingston/Norman Manley, Jamaica	OZARK3	RW30
MKJP	Kingston/Norman Manley, Jamaica	TIGON1	RW30
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	CAOBA2	RW09
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	SANTO3	RW09

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Table B2			
Swissair Navigation Data Base - Standard Instrument Departures			
Origin Airport	Airport Name	FMC-CDU Departure	FMC-CDU Runway
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	SANTO3	RW27
NSFA	Apia/Faleolo, Samoa	ALFA	RW08
NSFA	Apia/Faleolo, Samoa	BRAVO	RW08
NSFA	Apia/Faleolo, Samoa	SALA	RW08
NSFA	Apia/Faleolo, Samoa	TELE	RW08
NSFA	Apia/Faleolo, Samoa	VASA	RW08
OIBB	Bushehr, Iran	KUGV1A	RW31
OIBB	Bushehr, Iran	KUGV1B	RW13
OIBB	Bushehr, Iran	KUGV1C	RW31
OIBB	Bushehr, Iran	KUGV1D	RW13
OICC	Kermanshah, Iran	RUL11D	RW11
OIFM	Esfahan, Iran	LABT1A	RW26
OIFM	Esfahan, Iran	LADA1A	RW26
OIFM	Esfahan, Iran	LADA2C	RW26
OIFM	Esfahan, Iran	LADA2D	RW08
OIFM	Esfahan, Iran	LADL1A	RW26
OIFM	Esfahan, Iran	LADL2C	RW26
OIFM	Esfahan, Iran	LADL2D	RW08
OIFM	Esfahan, Iran	LARB1A	RW26
OIGG	Rasht, Iran	RALG1A	RW27
OIGG	Rasht, Iran	RALG1B	RW09
OIGG	Rasht, Iran	RART1A	RW27
OIGG	Rasht, Iran	RART1B	RW09
OIKB	Bandar Abbass, Iran	MOBO1B	RW21
OIKB	Bandar Abbass, Iran	MOBO2C	RW03
OIKB	Bandar Abbass, Iran	TAVN2A	RW03
OIKB	Bandar Abbass, Iran	TAVN2E	RW03

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Table B2			
Swissair Navigation Data Base - Standard Instrument Departures			
Origin Airport	Airport Name	FMC-CDU Departure	FMC-CDU Runway
OIKK	Kerman, Iran	ALGU2B	RW34
OIKK	Kerman, Iran	ALGU2D	RW34
OIKK	Kerman, Iran	ALGU2E	RW34
OIKK	Kerman, Iran	ALGU2F	RW16
OIKK	Kerman, Iran	ALGU3A	RW34
OIKK	Kerman, Iran	ALGU3C	RW16
OIKK	Kerman, Iran	ALKE2C	RW34
OIKK	Kerman, Iran	ALKE2D	RW16
OIKK	Kerman, Iran	ALKE3A	RW34
OIKK	Kerman, Iran	ALKE3B	RW16
OIKK	Kerman, Iran	ALKU2D	RW34
OIKK	Kerman, Iran	ALKU2E	RW16
OIKK	Kerman, Iran	ALKU2F	RW16
OIKK	Kerman, Iran	ALKU3A	RW34
OIKK	Kerman, Iran	ALKU3B	RW16
OIKK	Kerman, Iran	ALKU3C	RW16
OIKK	Kerman, Iran	ALME2D	RW34
OIKK	Kerman, Iran	ALME2F	RW16
OIKK	Kerman, Iran	ALME3A	RW34
OIKK	Kerman, Iran	ALME3C	RW16
OIKK	Kerman, Iran	ALMI2A	RW34
OIKK	Kerman, Iran	ALMI2B	RW16
OIKK	Kerman, Iran	ALMI2C	RW16
OIKK	Kerman, Iran	ALMI2D	RW34
OIKK	Kerman, Iran	ALMI2E	RW16
OIKK	Kerman, Iran	ALMI2F	RW16
OIKK	Kerman, Iran	ALMO1A	RW34
OIKK	Kerman, Iran	ALMO2B	RW34

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Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B2			
Swissair Navigation Data Base - Standard Instrument Departures			
Origin Airport	Airport Name	FMC-CDU Departure	FMC-CDU Runway
OIKK	Kerman, Iran	ALMO2C	RW16
OIKK	Kerman, Iran	ALMO2D	RW34
OIKK	Kerman, Iran	ALMO2E	RW34
OIKK	Kerman, Iran	ALMO2F	RW16
OIMM	Mashhad, Iran	METK2A	RW13
OIMM	Mashhad, Iran	METK2B	RW31
OIMM	Mashhad, Iran	METK2C	RW31
OIMM	Mashhad, Iran	MIDM1A	RW13
OIMM	Mashhad, Iran	MIDM1B	RW31
OIMM	Mashhad, Iran	NOTS2A	RW13
OIMM	Mashhad, Iran	NOTS2B	RW13
OIMM	Mashhad, Iran	NOTS2C	RW31
OIMM	Mashhad, Iran	RAMI2A	RW13
OIMM	Mashhad, Iran	RAMI2B	RW31
OITR	Uromiyeh, Iran	ZAJ1B	RW21
OITT	Tabriz, Iran	RUDA1B	RW12
OITT	Tabriz, Iran	RUDA1D	RW12
OIZH	Zaheadan, Iran	DANO2B	RW17
OIYY	Yazd, Iran	BOMI1D	RW13
OIYY	Yazd, Iran	BONE1D	RW13
OIYY	Yazd, Iran	BONI1D	RW13
OIYY	Yazd, Iran	BONO1D	RW13
OIZH	Zahedan, Iran	DANO2B	RW17
OLBA	Beirut, Lebanon	KAD1C	RW18
OLBA	Beirut, Lebanon	KAD1C	RW21
OLBA	Beirut, Lebanon	KAD1D	RW03
OLBA	Beirut, Lebanon	KAD1D	RW36
ROAH	Naha, Japan	NHC2SR	RW18

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B2 Swissair Navigation Data Base - Standard Instrument Departures			
Origin Airport	Airport Name	FMC-CDU Departure	FMC-CDU Runway
RPVB	Bacolod Negros Occidental, Philippines	SID 2	RW22
RPVM	Lapu-Lapu/Mactan, Phillipines	SID15	RW04
RPVM	Lapu-Lapu/Mactan, Phillipines	SID15A	RW04
RPVM	Lapu-Lapu/Mactan, Phillipines	SID16	RW04
SCIE	Concepcion/Carriel, Chile	CO4TCO	RW20
SCIE	Concepcion/Carriel, Chile	CO4VLD	RW20

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B2 Swissair Navigation Data Base - Approaches/Missed Approaches		
Destination Airport	Airport Name	Approach
EGPB	Sumburgh, UK	ILS27
ENBR	Fergen/Flesland, Norway	ILS35
FCBB	Brazzaville/Maya-Maya, Congo	ILS06
FMCH	Moroni/Hahaia, Comores	ILS02
GCRR	Arrecife/Lanzarote, Canary Is.	ILS04
HAAB	Addis Ababa/Bole, Ethiopia	ILS25
HAAB	Addis Ababa/Bole, Ethiopia	VOR25
HADR	Dire Dawa/Abba Tenna Dejazmatch Yilma, Ethiopia	VOR15
HESH	Sharm-El-Shiekh, Egypt	ILS04
KMCC	Kansas City/Downtown, KS	ILS03
KPMD	Palmdale, CA	ILS25
LEAM	Almeria, Spain	NDB08
LEBL	Barcelona, Spain	VOR02
LEBL	Barcelona, Spain	ILS07
LEBL	Barcelona, Spain	ILS25
LFLC	Clermont-Ferrand/Aulnat, France	ILS26
LGKO	Marathon/Kotroni, Greece	VOR15
LGKO	Marathon/Kotroni, Greece	VOR33
LIPE	Bologna/Borgo Panigale, Italy	ILS12
LIRZ	Perugia, Italy	VOR01
LPLA	Lajes-Terceira, Is, Portugal	ILS15
LTCG	Trabzon, Turkey	ILS11
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	ILS09
NWWW	Noumea/La Tontouta, New Caledonia	ILS11
OEDR	Dhahran, Saudi Arabia	ILS34L
OIBJ	Jam Tohid, Iran	VOR11

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B2 Swissair Navigation Data Base - Approaches/Missed Approaches		
Destination Airport	Airport Name	Approach
OIBJ	Jam Tohid, Iran	ILS11
OINR	Ramsar, Iran	NDB31
PAYA	Yakutat, AK	VOR02
RJCH	Hakodate, Japan	ILS12
RJCH	Hakodate, Japan	LOC12
RJFK	Kagoshima, Japan	ILS34
RJNK	Kanazawa/Komatsu, Japan	ILS06
RJNN	Najoya, Japan	VOR34
RJNN	Najoya, Japan	ILS34
RJSA	Aomori, Japan	ILS24
RJSN	Nigata, Japan	ILS28
RJSS	Sendai, Japan	ILS27
RKPK	Kimhae, Korea	ILS36
RKPK	Kimhae, Korea	LOC36
ROAH	Naha, Japan	VOR18
RPLL	Manila/Ninoy Aquino, Phillipines	VOR06
RPVB	Bacolod Negros Occidental, Phillipines	VOR04
VOMM	Madras, India	VOR25
VTUW	Nakon Phanom, Thailand	VOR15
WAPP	Ambon/Patimura, Indonesia	ILS04

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B3 Racal Navigation Data Base - Standard Instrument Departures			
Origin Airport	Airport Name	FMC-CDU Departure	FMC-CDU Runway
ESNN	Sundsvall-Harnosand, Sweden	LUE1C	RW34
FACT	Cape Town, South Africa	OKTE2B	RW19
FACT	Cape Town, South Africa	PARI2B	RW19
GCFV	Fuerteventura, Canary Is	KORA1R	RW19
GCFV	Fuerteventura, Canary Is	LPC2R	RW19
GCFV	Fuerteventura, Canary Is	LT1R	RW19
GCFV	Fuerteventura, Canary Is	SAMA1R	RW19
GCFV	Fuerteventura, Canary Is	TFN1R	RW19
GCFV	Fuerteventura, Canary Is	TFS2R	RW19
GCFV	Fuerteventura, Canary Is	VAST1R	RW19
LEIB	Ibza, Spain	MHN1E	RW24
LEIB	Ibza, Spain	MJV1E	RW24
LEPA	Palma de Mallorca, Spain	MEBU1A	RW24
LEPA	Palma de Mallorca, Spain	MHN1A	RW24
LEPA	Palma de Mallorca, Spain	MJV1B	RW06
LEPA	Palma de Mallorca, Spain	OSGA1A	RW24
LGMT	Mitilini, Greece	LSV1A	RW33
LIMP	Parma, Italy	PAR5V	RW02
LIMP	Parma, Italy	PAR5Y	RW20
MGGT	Guatemala/La Aurora, Guatemala	PALEN	RW01
MKJP	Kingston/Norman Manley, Jamaica	ENKA3	RW30
MKJP	Kingston/Norman Manley, Jamaica	MLY1	RW12
MKJP	Kingston/Norman Manley, Jamaica	NORAN3	RW30
MKJP	Kingston/Norman Manley, Jamaica	TIGON1	RW30

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B3 Racal Navigation Data Base - Standard Instrument Departures			
Origin Airport	Airport Name	FMC-CDU Departure	FMC-CDU Runway
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	CAOBA2	RW09
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	SANTO3	RW09
MUCU	Santiago de Cuba/Antonio Maceo, Cuba	SANTO3	RW27
OLBA	Beirut, Lebanon	KAD1C	RW18
OLBA	Beirut, Lebanon	KAD1C	RW21

Operations Manual Bulletin Attachment
Consecutive Conditional Altitude Waypoints Map Anomaly

Table B3 Racal Navigation Data Base - Approaches/Missed Approache		
Destination Airport	Airport Name	Approach
DTTX	Sfax/El Maou, Tunisia	VOR15
DTTX	Sfax/El Maou, Tunisia	VOR33
EGPE	Inverness, UK	VOR06
EGPE	Inverness, UK	VOR24
ENBO	Bodo, Norway	ILS08
GCCR	Arrecife/Lanzarote, Canary Is.	VOR04
HEAX	Alexandria, Egypt	VOR04
HEAX	Alexandria, Egypt	VOR36
KDRO	Durango/La Plata Co., CO	ILS02
LIPE	Bologna/Borgo Panigale, Italy	VOR12
LTCG	Trabzon, Turkey	VOR11
MDPP	Puerto Plata, Dominican Republic	VOR26
MDSD	Santo Domingo/De Las Americas, Dominican Republic	VOR35
NSFA	Faleolo, Samoa	ILS08
NWWW	Noumea/La Tontouta, New Caledonia	ILS11
OEDR	Dhahran, Saudi Arabia	ILS34L
RJCH	Hakodate, Japan	ILS12
RJOM	Matsuyama, Japan	ILS14
RPLL	Manila, Phillipines	ILS06
SLVR	Viru Viru, Bolivia	ILS33
SPIM	Lima-Callao, Peru	VOR33
TFFF	Forte-de-France/Le Lamentin Martinique, France	VOR27
WMKL	Pulau/Langkawi, Malaysia	VOR03

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-22

IssueDate: February 15, 2013

Airplane Effectivity: VP-BOY (SB Deletes VP-BMC)

Subject: Flight Management Computer (FMC) Anomaly During Descent Phase of Flight

Reason: To inform flight crews of a Pegasus-FMC anomaly during the descent phase of flight.

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 Pegasus-FMC anomaly exists which may result in different Flight Mode Annunciation (FMA) pitch mode displays between the Attitude Direction Indicators (ADI) and accompanied by inconsistent flight path deviation indications on the Horizontal Situation Indicators (HSI). This anomaly may occur if any flight plan modification is entered and executed near the top of descent point or during the descent or approach phases of flight. When the anomaly occurs, the FMA pitch mode annunciations “VNAV SPD” and “VNAV PATH” (“VNAV PTH”, as installed) simultaneously display between the captain’s and first officer’s ADIs. The HSI track deviation scale pointers may also indicate different vertical path deviations and may even result in one or both vertical path deviation scales not being displayed.

Boeing has confirmed this anomaly exists in all Pegasus-FMC software. Pegasus-FMC software is identified by either of the following OP PROGRAM part numbers located on the IDENT page:

- 3413-HNP-02C-03
- 3414-HNP-02C-04.

Operating Instructions

If continued VNAV mode use is desired, perform a “Direct-To” entry to the active waypoint. This action may result in the correct display of consistent FMA pitch modes associated with VNAV operation. If this action does not result in the correct display of consistent FMA pitch modes, and continued flight director and/or autopilot use is desired, select another appropriate Mode Control Panel (MCP) pitch mode.

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 NRW-22 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-34-0317.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

Boeing Commercial Airplanes

Commercial Aviation Services

Attn: 767 Manager, Flight Technical Data

P.O. Box 3707, M/C 20-89

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-23

IssueDate: February 15, 2013

Airplane Effectivity: VP-BOY (SB Deletes VP-BMC)

Subject: Flight Management Computer (FMC) Anomaly of Engine Indicating and Crew Alerting System (EICAS) Alert

Reason: To inform flight crews of a Pegasus-FMC alerting anomaly following an FMC failure and associated corrective action.

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 Pegasus-FMC anomaly exists, which may not result in the display of the associated EICAS advisory-level “L FMC FAIL” or “R FMC FAIL” alerts. This anomaly occurs when an FMC experiences specific internal faults that inhibit the transmission of the FMC-failure signal to the EICAS computers. However, the secondary discrete alerting lights and indications associated with an FMC failure will correctly illuminate to provide the necessary flight crew awareness of an FMC failure condition.

The secondary discrete alerting lights and indications, which are always associated with an FMC failure, are:

1. Illumination of the amber Control and Display Unit (CDU) “FAIL” light;
2. Display of the amber Horizontal Situation Indicator (HSI) “MAP” flag with the associated FMC Instrument Source Selector positioned to the failed FMC detent; and,
3. Display of the “SINGLE FMC [L,R] OPERATION” scratch-pad message on the operable FMC CDU.

Boeing has confirmed this anomaly exists in all Pegasus-FMC software. Pegasus-FMC software is identified by either of the following OP PROGRAM part numbers located on the IDENT page:

- 3413-HNP-02C-03
- 3414-HNP-02C-04.

Operating Instructions

If the CDU “FAIL” light illuminates accompanied by the display of the “MAP” flag on the associated HSI and the CDU scratch-pad message “SINGLE FMC [L,R] OPERATION”, the associated FMC should be considered failed. Therefore, the non-normal FMC FAIL checklist should be accomplished.

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 NRW-23 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-34-0317.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-24

IssueDate: February 15, 2013

Airplane Effectivity: VP-BMC, VP-BOY, VP-BOZ

Subject: Installation of Pratt & Whitney PW4000 Engines with Ring-Case Compressor (RCC)

Reason: To inform flight crews of operational effects of PW4000 engines equipped with Ring-Case Compressor (RCC) 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 and Pratt & Whitney are introducing the Ring-Case Compressor (RCC) modification to correct high power surge problems experienced with the PW4000 series engine. High power surging is the subject of Boeing Service Related Problem (SRP) 72-0024. The modification includes replacement of the basic segmented high-pressure compressor case with a new ring-style case designed to improve compressor blade tip clearance. Boeing estimates RCC-equipped engines will be intermixed with non-RCC engines in the 767 fleet for a period of four years.

Electronic Engine Control (EEC) software version SCN13 is required to optimize the engine operating characteristics of the new RCC design. The SCN13 EEC software incorporates new control logic that varies stator vane schedules and acceleration rates, but only when installed on an RCC-equipped engine. The new control logic will not be activated when SCN13 EEC software is installed on non-RCC engines and is not present in previous EEC software versions.

Due to the SCN13 EEC software control logic, noticeable differences in acceleration time between RCC and non-RCC engines can occur. Thrust asymmetry levels can be reached, which can create low airspeed directional control difficulties. However, the problem is only significant if engines are accelerated directly to the takeoff thrust setting from idle. Per the Boeing-recommended normal takeoff procedure, if engines are stabilized at approximately 1.10 EPR prior to setting takeoff thrust, asymmetry levels will be minimized and directional control problems avoided.

In addition, engines equipped with SCN13 EEC software installed exhibits reduced bleed air supply pressure. This reduction in bleed air pressure does not affect airplane systems operation with exception of responding to a forward or aft cargo compartment fire warning above 35,000 feet. If a cargo compartment fire warning occurs at airplane altitudes above 35,000 feet, the CARGO FIRE checklist contained in the QRH is revised by this Operations Manual Bulletin to include flight crew guidance to accomplish a descent to 35,000 feet or below. This will ensure sufficient bleed air supply to comply with cargo compartment smoke penetration requirements set forth under Federal Aviation Regulations.

Operating Instructions

Flight crews are reminded to follow the takeoff thrust setting practice contained in the normal Takeoff Procedure as published in Volume I of the Boeing 767 Operations Manual:

Advance thrust levers to approximately 1.10 EPR. Push EPR (THR, as installed) switch.

Stabilization at 1.10 EPR will minimize thrust asymmetry and directional control problems, which might occur during operation with an airplane intermix of RCC and non-RCC equipped engines.

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 NRW-24 "Incorporated" (INC).

This Operations Manual Bulletin will be canceled upon operator notification of pure-fleet incorporation of Boeing Service Bulletin 767-71-0108.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-25

IssueDate: February 15, 2013

Airplane Effectivity: (SB Deletes VP-BMC)

Subject: Pegasus-FMC Control and Display Unit (CDU) Anomaly

Reason: To inform flight crews of a Pegasus-FMC CDU anomaly and associated corrective actions.

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 anomaly has been discovered, which may cause a CDU keyboard to not respond to any CDU function and mode key selections with the exception of the “MENU” function and mode key. This CDU anomaly may cause a CDU to reset to a non-responsive state following one or multiple power transfers. This could occur during a normal engine start sequence or at any time power transfers from one generator source to another. This anomaly occurs only during CDU resets after power interrupts.

This anomaly appears on airplanes with the PEGASUS FMC installed. The PEGASUS FMC can be identified by a “VNAV” mode key on the CDU.

Operations Manual Information

There are two flight crew actions, either of which return the CDU to normal operation in the event a CDU does not respond to function and mode key selections. They are:

1. Push the “MENU” key on the affected CDU keyboard. This action will display the MENU page with the FMC prompt at line-select key 1L. Then, push line-select key 1L.

Or,

2. Rotate the Nav Instrument Source Selector on the affected side to the offside FMC detent, then return the selector to the respective FMC position.

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 NRW-25 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-34-0295.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-26

IssueDate: February 15, 2013

Airplane Effectivity: VP-BOY (SB Deletes VP-BMC)

Subject: Pegasus FMC HSI Map Display Anomaly

Reason: This bulletin provides information for flight crews regarding an FMC anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Data search function. At initial power up, the FMC searches the navigation database for all nav aids, airports, and waypoints within a 700NM radius and loads them into memory. The data search function requires approximately 25 seconds and is done in background (not visible to the pilot). The search is also initiated when any function on the HSI control panel is changed (e.g. range scale, mode, or map switches). If a “power transition” occurs while the search is in progress, the search function will not operate again until power is removed from the FMC’s. Removing FMC power resets the search function.

Problem. Operators have reported several in-service occurrences of an HSI display anomaly in which nav aids, airports, and waypoints were not displayed when the respective switch on the HSI control panel was selected. The anomaly is caused by the occurrence of an airplane power transition (e.g. during engine start) while the FMC’s EFIS data search function is in progress.

This anomaly may not be detectable by the crew until the airplane is more than 700NM from the departure airport because it is likely that a successful search occurred at power up prior to any failure. In this case, the map data may appear correct until exceeding the 700NM radius. Beyond that radius, map background data may not be displayed. Tuned nav aids, alternate airports (as shown on the ALTN page) and entries on the FIX page will be displayed as expected.

This anomaly appears on airplanes with the PEGASUS FMC installed. The PEGASUS FMC can be identified by the OP PROGRAM part numbers, either 3413-HNP-02C-03 or 3414-HNP-02C-04, displayed on the IDENT page.

Operating Instructions

1. Avoid making switch selections on the HSI control panel within approximately 30 seconds of an anticipated power transfer (e.g. ground to APU, APU to engine generator).
2. If preflight data has already been entered and the anomaly is suspected (e.g. an unanticipated power transfer occurred), normal operation can be restored by maintenance personnel as advised in the Boeing maintenance TIP sheets 757 MT 34-032 and 767 MT 34-036 dated 06 Aug 99.
3. If this occurs while airborne, the discrepancy should be documented for maintenance action.

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 NRW-26 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-34-0317.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-27

IssueDate: February 15, 2013

Airplane Effectivity: VP-BOY (SB Deletes VP-BMC)

Subject: Pegasus Flight Management Computer (FMC) VNAV Level Off Anomaly

Reason: This bulletin provides information for flight crews regarding FMC anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Several in-service occurrences of an anomaly at high altitude have been reported on airplanes equipped with the Pegasus FMC. During a normal cruise altitude capture, VNAV SPD transitions to VNAV PATH. If the cruise altitude is near Cruise Thrust Limit Altitude and the airplane climb speed is slightly below target cruise speed when altitude capture is initiated, the airplane may pitch down and descend attempting to accelerate to the target speed. Also, some occurrences have been accompanied by a thrust lever reduction concurrent with the descent.

This anomaly appears on airplanes with the PEGASUS FMC installed. The PEGASUS FMC can be identified by the OP PROGRAM part number displayed on the IDENT page:

- 3413-HNP-02C-03 or
- 3414-HNP-02C-04

Operating Instructions

Normal pilot action is appropriate. The Boeing Fight Crew Training Manual and Operations Manual recommend that for any unsatisfactory automatic system performance that the pilot intervenes. Should this anomaly occur at high altitude, the pilot should ensure proper thrust is set and complete the level-off.

Any operator observing this condition, especially where the condition also results in a thrust lever reduction, is requested to provide flight profile data such as:

- summary of pilot actions (CDU entries, flight mode changes, such as autopilot flight level change to VNAV engagement or use of VNAV during climb)
- VNAV mode displayed (VNAV PATH or VNAV SPD)
- autothrottle mode displayed (EPR/N1, SPD, IDLE etc...)
- TMC mode displayed (CLB, CRZ etc...)
- airplane state (altitude, climb rate, speed, and speed target).

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 NRW-27 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 767-34-0317.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-28

IssueDate: February 15, 2013

Airplane Effectivity: VP-BMC (SB Deletes VP-BOZ)

Subject: Performance Adjustments for Thrust Shortfall of PW4000 Series
Powered Airplanes with FB2B and FB2T Fans Installed

Reason: To provide subject adjustments for Operations Manual (OM)
Performance Inflight (PI) chapter in accordance with 767 Airworthiness
Directive AD 2001-01-10.

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 advises operators of revised performance information applicable to the 767 with Pratt & Whitney PW4000 series engines equipped with FB2B or FB2T fans. Engines equipped with FB2B/FB2T (Phase 0/1) fans have been found to be subject to a shortfall in thrust at high EPR due to fan blade leading edge erosion which occurs normally in service. Engines equipped with FB2C (Phase 3) fans have been shown to be free from thrust degradation and have no shortfall in rated thrust. All PW4062 engines are equipped with FB2C (Phase 3) fans and therefore are not affected by this bulletin.

Engine Identification:

On each airplane, each engine's model designation must be established. Listed below are the model designations as they appear on the dataplate for engines with a hardware configuration that includes an FB2C (Phase 3) fan. Unless all engines on a particular airplane have been confirmed to have FB2C (Phase 3) fans, the performance adjustments will apply.

PW4000 Engine Dataplate Model Designations For Engines With FB2C (Phase 3) Fans which are **NOT** Affected by the Thrust Shortfall:

PW4052 (-3)	PW4052 (-1C)
PW4056 (-3)	PW4056 (-1C)
PW4060 (-3)	PW4060 (-1C)
PW4060A (-3)	PW4060A (-1C)
PW4060C (-3)	PW4060C (-1C)
PW4062 (-3)	PW4062 (-1C)

Operating Instructions

The following airplane performance adjustments apply when operating with one or both engines which are not equipped with FB2C (Phase 3) fans.

Reduce Long Range Cruise Maximum Operating Altitude by 800 ft.

Reduce Engine Inoperative Altitude Capability for all speeds by 1500 ft.

Reduce Gear Down Long Range Cruise Altitude Capability by 1400 ft.

Reduce Engine Inoperative Gear Down Long Range Cruise Altitude Capability by 2000 ft.

Increase Driftdown/LRC Cruise Range Capability fuel required by 2%.

Operations Manual Performance Inflight (PI) Chapter and FMC performance numbers should be adjusted accordingly.

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 NRW-28 "In Effect" (IE).

This Operations Manual Bulletin will remain in effect as long as 767 Airworthiness Directive AD 2001-01-10 is effective. Application of the information contained herein may change if and when alternate means of compliance with the AD are granted.

Please send all correspondence regarding Operations Manual Bulletins status to one of the following addresses:

Boeing Commercial Airplanes
Commercial Aviation Services
Attn: 767 Manager, Flight Technical Data
P.O. Box 3707, M/C 20-89
Seattle, Washington, 98124-2207 USA
Telephone: (206) 662-4000
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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-29

IssueDate: August 16, 2013

Airplane Effectivity: (SB Deletes VP-BOY)

Subject: FMC Alternate Airport Anomaly

Reason: This bulletin provides information for flight crews regarding FMC anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

When the ALTN CDU page is selected, the displayed alternate airports may contain only three airports because one airport is duplicated.

This anomaly appears on airplanes with an earlier version of the PEGASUS FMC installed. The earlier version can be identified by the OP PROGRAM part number displayed on the IDENT page:

- 3413-HNP-02C-03

Operating Instructions

If necessary, select or enter the appropriate alternate airport.

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 NRW-29 "In Effect" (IE).

This anomaly will be corrected by Boeing Service Bulletin 767-34-0291 scheduled to be available April 1, 1999. This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified.

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-30

IssueDate: August 16, 2013

Airplane Effectivity: (SB Deletes VP-BOY)

Subject: FMC Altitude Display Anomaly

Reason: This bulletin provides information for flight crews regarding FMC anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During descent, the HSI and CDU LEGS page may display “altitudes” instead of “flight levels” when above the destination airport’s transition level or may display “flight levels” instead of “altitudes” when below the destination airport’s transition level. This anomaly should not affect crew checklist procedures which require altimeter change at the transition level for the local area.

This anomaly appears on airplanes with an earlier version of the PEGASUS FMC installed. The earlier version can be identified by the OP PROGRAM part number displayed on the IDENT page:

- 3413-HNP-02C-03

Operating Instructions

Ensure that the appropriate altimeter setting for the local area is set at transition level.

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 NRW-30 "In Effect" (IE).

This anomaly will be corrected by Boeing Service Bulletin 767-34-0291 scheduled to be available April 1, 1999. This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified.

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-31

IssueDate: August 16, 2013

Airplane Effectivity: (SB Deletes VP-BOY)

Subject: FMC Assumed Temperature Derate Anomaly

Reason: This bulletin provides information for flight crews regarding FMC anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Re-entering the previously entered assumed temperature on the CDU TAKEOFF REF page may not be accepted by the FMC. Assumed temperature entries selected via the Thrust Mode Select Panel (TMSP) are accepted by the FMC.

This anomaly appears on airplanes with an earlier version of the PEGASUS FMC installed. The earlier version can be identified by the OP PROGRAM part number displayed on the IDENT page:

- 3413-HNP-02C-03

Operating Instructions

Enter assumed temperature using the TMSP if the FMC assumed temperature entry is not accepted.

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 NRW-31 "In Effect" (IE).

This anomaly will be corrected by Boeing Service Bulletin 767-34-0291 scheduled to be available April 1, 1999. This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified.

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-32

IssueDate: August 16, 2013

Airplane Effectivity: (SB Deletes VP-BOY)

Subject: FMC CDU Scratchpad Message "Enter IRS Position"

Reason: To inform flight crews the FMC CDU scratchpad message ENTER IRS POSITION may not display when an incorrect present position is entered for IRS alignment.

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 FMC CDU scratchpad message ENTER IRS POSITION indicates the flight crew-entered present position did not pass an IRS comparison check, or the IRS is ready to enter the navigation mode and a present position has not been entered. Operators have reported isolated incidents of IRS alignment without display of the ENTER IRS POSITION message when an incorrect present position has been entered during preflight. As a result, airplanes have inadvertently dispatched with unreliable IRS position information. Engineering analysis indicates the anomaly is the result of a timing problem between the FMCs.

Engaging the autothrottle for takeoff (GPS not available) does not correct the error. If the error is sufficiently large, FMC radio position updating will be locked out in flight. GPS position updating (if available) will function and slowly correct the position error at a rate of 4 NM per minute.

In addition, large initial position errors can cause IRS magnetic variation errors affecting the accuracy of magnetic heading and track. Excessive magnetic track errors can cause AFDS localizer mode failure and subsequent inhibiting of automatic approaches. Complete correction of the FMC/IRS position error requires landing and full realignment in the navigation mode.

The flight crew can detect a large FMC position error by comparing relative positions of the airplane and runway symbols on the HSI. On the POS REF page, individual IRS positions should be compared to the required alignment position (gate coordinates, etc.). If an initial position error is discovered before takeoff, a fast alignment with a correct position entry may not resolve the problem. A full alignment must be accomplished by rotating the IRS Mode Selectors to OFF, then to NAV, and entering the correct present position in the SET IRS POSITION line on the POS INIT page.

Also, due to an unrelated anomaly, the use of LAST POS for IRS alignment has not always resulted in correct IRS alignment. If the last positions stored in the FMCs differ, using either for IRS alignment may result in an incorrect alignment position.

This anomaly exists only in PIP FMC and Pegasus FMC. Following are the affected software part numbers:

- Pegasus: 3413-HNP-02C-03.
- PIP: PS4052970-952, -953, -954, -955, -956

Operating Instructions

During preflight, after entering present position on SET IRS POS line, select the POS REF page and verify L, C, and R IRS position coordinates are correct.

If an incorrect initial position is discovered in flight, the situation cannot be corrected without full IRS realignment on the ground.

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 NRW-32 "In Effect" (IE).

The PEGASUS FMC anomaly will be corrected by Boeing Service Bulletin 767-34-0291. Other FMC's are corrected by Boeing Service Bulletin 767-34-0301 or 767-34-0302 or 767-34-0303 or 767-34-0304. Refer to individual Service Bulletin for applicability.

This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified.

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-33

IssueDate: August 16, 2013

Airplane Effectivity: (SB Deletes VP-BOY)

Subject: FMC Engine Out (E/O) Standard Instrument Departure (SID)

Reason: This bulletin provides information for flight crews regarding engine out FMC anomaly after takeoff.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

On flights such as training flights where multiple takeoffs and landings occur, the Engine Out Standard Instrument Departure (E/O SID) will not automatically load with loss of an engine after takeoff. The E/O SID can still be manually selected by the crew.

This anomaly appears on airplanes with an earlier version of the PEGASUS FMC installed. The earlier version can be identified by the OP PROGRAM part number displayed on the IDENT page:

- 3413-HNP-02C-03

Operations Manual Information

Ensure the departure runway is re-selected prior to each takeoff if the engines have not been shutdown.

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 NRW-33 "In Effect" (IE).

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February 20, 2014

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This anomaly will be corrected by Boeing Service Bulletin 767-34-0291 scheduled to be available April 1, 1999. This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified.

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-34

IssueDate: August 16, 2013

Airplane Effectivity: (SB Deletes VP-BOY)

Subject: Flight Management Computer (FMC) Lockup Resulting from Internal Timer Anomaly

Reason: To inform flight crews of a Pegasus-FMC Timer anomaly and associated corrective action.

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 Pegasus-FMC internal software timer anomaly has been discovered, which may result in a single or dual FMC to lockup during power transfers on the ground. This anomaly has been identified to have a timing cycle of approximately 12.5 hours. If a power transfer resulting in an FMC power interrupt occurs during the last 5-minutes of the 12.5-hour timer cycle, a single or dual FMC lockup can occur. This anomaly has not been reported to occur in service while airborne.

767 Maintenance Tip MT34-028, dated July, 15 1998, was issued by The Boeing Company to provide airline maintenance personnel, or equivalent, the necessary information to prevent the FMC software clock timer-induced lockup.

The recommended action specified in this Boeing Maintenance Tip is as follows:

“To prevent occurrence of an FMC [lockup], cycle the left FMC circuit breaker for at least 10 seconds. Wait for at least 5 minutes after returning power to the left FMC and then cycle the right FMC circuit breaker for at least 10 seconds. Perform this action daily and before any flight operation that will exceed 12.5 hours. If an FMC [lockup] occurs, the FMC can be recovered by performing the aforementioned recommended action.”

Operating Instructions

On the ground before each flight, verify maintenance personnel, or equivalent, have complied with 767 Maintenance Tip MT34-028, dated July 15, 1998:

- If maintenance personnel have complied, then no flight crew action is required.
- If maintenance personnel is not available at your location, the flight crew should perform the recommended action specified in MT34-028, dated July 15, 1998.

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 NRW-34 "In Effect" (IE).

This anomaly will be corrected by Boeing Service Bulletin 767-34-0291 scheduled to be available April 1, 1999. This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified.

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-35

IssueDate: August 16, 2013

Airplane Effectivity: (SB Deletes VP-BOY)

Subject: Flight Management Computer (FMC) Lockup Resulting from Flight Plan Route Uplink

Reason: This bulletin describes a Pegasus-FMC Datalink anomaly and associated corrective actions.

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 Pegasus-FMC software anomaly exists, which may result in the lock up of both the left and right FMC when repeated attempts to load a route uplink are accomplished. When a route uplink is received and the scratchpad message, "ROUTE 1 UPLINK READY" or "ROUTE 2 UPLINK READY" displays, the flight crew normally loads the route by pushing line-select key 4L adjacent to the "< LOAD" prompt on the RTE 1/X page. If the "< LOAD" prompt is selected and the software anomaly is in effect, the route will not load and the "< LOAD" prompt will continue to display at line-select key 4L. Furthermore, repeated attempts to load the route uplink may result in a single or dual FMC lockup. If an FMC lockup occurs, pulling an FMC circuit breaker(s) to remove power will not return either FMC to normal operation. To resolve the lockup, maintenance personnel, or equivalent, must software load an earlier edition of the navigation database. Line selecting the out-of-date navigation data base on the IDENT page will not correct the lockup.

Note: This Pegasus-FMC software anomaly occurs randomly and does not affect all route uplinks.

Operating Instructions

On ground:

When the “ROUTE 1 UPLINK READY” or “ROUTE 2 UPLINK READY” scratchpad message displays, push line-select key 4L adjacent to the “< LOAD” prompt on the RTE 1/X page only once. Verify the “< LOAD” prompt at line-select key 4L on the RTE page disappears. If the “< LOAD” prompt at line-select key 4L remains displayed, do not re-select.

If the route is INACTIVE, select the “PURGE >” prompt at line-select key 4R. The route uplink will purge normally and the FMC will continue normal operation. Subsequent uplinks may be attempted.

If the route is ACTIVE, manually enter a new flight plan, if required. Do not attempt a subsequent load of the failed route uplink. If the aircraft is on the ground, maintenance personnel, or equivalent, may pull both FMC circuit breakers for approximately 10 seconds, then reset both FMC circuit breakers to clear the anomaly.

In flight:

Do not load a route uplink via the “< LOAD” prompt adjacent to line-select key 4L on the RTE 1/X page.

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 NRW-35 "In Effect" (IE).

This anomaly will be corrected by Boeing Service Bulletin 767-34-0291 scheduled to be available April 1, 1999. This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified.

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

The Boeing Company
Seattle, Washington 98124-2207



Number: NRW-36

IssueDate: August 16, 2013

Airplane Effectivity: (SB Deletes VP-BOY)

Subject: Incorrect Display of VREF On The ADI Speed Tape

Reason: This bulletin provides information for flight crews regarding FMC anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Flight test has discovered an anomaly in the Pegasus FMC which may cause the display of incorrect Vref information on one of the two ADI Speed Tapes. When a manual “speed-only” Vref change is made to a previously entered Vref on the APPROACH REF page, the new value will be displayed correctly on one Speed Tape, but the other Speed Tape will remain at the previously entered speed value. This anomaly occurs only when a speed scratchpad entry (/ XXX) is line-selected into 4R on the APPROACH REF page.

Example 1, no anomaly: During the Approach check, the Captain downselects line 3R (30 O/ 133 KT) and then enters it into 4R. The 133 KT Vref speed bug will be correctly displayed on both sides.v

Example 2, with anomaly: The Captain directs a Vref speed change to 140 KT and “ / 140 ” is entered into 4R on the APPROACH REF page. In this case, the Vref bug will be displayed at 140 on one speed tape, but the previously entered value (133) is displayed on the other speed tape. The speed tape displaying the correct value is on the side of the master FMC and does not depend on which CDU is used to make the input.

This anomaly only occurs when a speed-only format entry is made. This anomaly appears on airplanes with the PEGASUS FMC installed. The PEGASUS FMC can be identified by the OP PROGRAM part number displayed on the IDENT page:

- 3413-HNP-02C-03

Operating Instructions

When a previous Vref entry requires a speed alteration, ensure that the entry into 4R includes both the desired flap setting and the new Vref speed (e.g. 30° / 134). The FMC computed speeds in 1R, 2R, or 3R may also be downselected and then entered into 4R for display on both speed tapes.

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 NRW-36 "In Effect" (IE).

This anomaly will be corrected by Boeing Service Bulletin 767-34-0291 scheduled to be available April 1, 1999. This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified.

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Flight Crew Operations Manual Bulletin for Nordwind Airlines

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Seattle, Washington 98124-2207



Number: NRW-37

IssueDate: August 16, 2013

Airplane Effectivity: (SB Deletes VP-BOY)

Subject: Uncommanded CDU Page Changes

Reason: This bulletin provides information for flight crews regarding FMC anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

On airplanes with PEGASUS FMC installed, crews may experience an uncommanded page change on the CDU.

This anomaly appears on airplanes with an earlier version of the PEGASUS FMC installed. The earlier version can be identified by the OP PROGRAM part number displayed on the IDENT page:

- 3413-HNP-02C-03

Operating Instructions

Select the desired page appropriate for phase of flight.

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 NRW-37 "In Effect" (IE).

This anomaly will be corrected by Boeing Service Bulletin 767-34-0291 scheduled to be available April 1, 1999. This Operations Manual Bulletin will be canceled after Boeing is notified that all affected airplanes in the operators fleet have been modified.

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Number: NRW-38

IssueDate: August 16, 2013

Airplane Effectivity: VP-BOY (SB Deletes VP-BOZ)

Subject: VNAV Descent to Holding Altitude

Reason: This bulletin provides information for flight crews regarding an FMC anomaly.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator has reported incidents of VNAV incorrectly allowing descent through the selected MCP altitude. This may occur while descending enroute to a holding pattern. When a VNAV descent is in progress and an altitude constraint is entered in 1R on the HOLD page, the altitude constraint will be displayed in large font on the respective HOLD AT line on the LEGS page. This condition results in the altitude constraint being placed on the HOLD, not necessarily on the waypoint. In some cases, VNAV may allow the airplane to descend below the constraint / HOLD altitude, even if the MCP window is set at the HOLD altitude.

A corresponding anomaly does not exist while the airplane is in a climb. While performing a VNAV climb to a holding pattern, the airplane will not climb through the MCP altitude.

This anomaly has been verified by Boeing and exists in the 200K, 700K, 1-Meg Non PIP FMCs. The anomaly will not occur on those FMCs which incorporate the VNAV ALT mode.

The pilot can identify the applicable FMC by reference to Line 5 on the IDENT page. The applicable FMC will show DRAG FACTOR on Line 5L and F-F Factor (fuel flow factor) on Line 5R.

For information purposes, the non-applicable FMCs will show DRAG/FF (drag and fuel flow factor) on Line 5L and CO DATA on Line 5R (PIP FMC) or OPC on Line 5L and DRAG/FF on Line 5R (PEGASUS). The installed CDU does not provide a reliable indication of the installed FMC because some airplanes have been retrofitted with PIP or PEGASUS FMCs while retaining the basic CDU.

Operating Instructions

When directed to descend and hold at a specified altitude at a waypoint in the route, enter the altitude constraint on the LEGS page. This can be done prior to or after creating the HOLD but must be done on the LEGS page.

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 NRW-38 "In Effect" (IE).

This anomaly will be corrected by Boeing Service Bulletin 767-34-0301 or 767-34-0302 or 767-34-0303. Refer to individual Service Bulletin for applicability.

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Limitations

Operating Limitations

Chapter L

Section 10

General

This chapter contains:

- Airplane Flight Manual (AFM) operational information
- Non-AFM operational information.

Information is included if it is:

- operationally significant
- required by FAA Airworthiness Directive
- required by another regulatory requirement

Information is not included if it is:

- incorporated into FCOM normal, supplementary, or non-normal procedures, with a few exceptions
- shown on a placard, display, or other marking

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.

Airplane General, Emergency Equipment, Doors, Windows

Operational Limitations

Runway slope	$\pm 2\%$
Maximum Operating Altitude	43,100 feet pressure altitude
Maximum Takeoff and Landing Altitude	8,400 feet pressure altitude

VP-BDI, VP-BMC, VP-BOY, VP-BOZ

# Maximum Takeoff and Landing Tailwind Component	10 knots

VP-BOQ, VP-BRL through VQ-BRA

# Maximum Takeoff and Landing Tailwind Component	15 knots

Precipitation on the Runway

VP-BOQ

The maximum precipitation depth allowable on the runway for Takeoff:

- Dry Snow – 6 cm
- Standing water, wet snow, or slush – 15 mm

Bird Strike Protection

VP-BOQ

To provide bird strike protection, do not exceed 313 KIAS below 8,000 ft.

Non-AFM Operational Information

Note: The following items are not AFM limitations, but are provided for flight crew information.

Turbulent air penetration speed is: 290 KIAS/.78 Mach, whichever is lower.

The navigation and display system does not support operations at latitudes greater than 87° North or South.

Do not operate HF radios during refueling operations.

The APU starter duty cycle is a maximum of three consecutive starts or attempts within a sixty minute period.

VP-BOQ

Maximum demonstrated takeoff and landing crosswind is 33 knots (not limiting).

RVSM Altimeter Cross Check Limits

Standby altimeters do not meet altimeter accuracy requirements of RVSM.

The maximum allowable in-flight difference between Captain and First Officer altitude displays for RVSM operation is 200 feet.

The maximum allowable on-the-ground differences between Captain and First Officer altitude displays for RVSM operation are:

Field Elevation	Max Difference Between Captain & F/O	Max Difference Between Captain or F/O & Field Elevation
SEA LEVEL	40 feet	75 feet
5,000 feet	45 feet	75 feet
10,000 feet	50 feet	75 feet

Weather Radar

Do not operate the weather radar in a hangar or within 50 feet of any fuel spill.

Note: The hangar and personnel restrictions do not apply to the weather radar test mode.

Flight Deck Security Door

**VP-BMC, VP-BOQ, VP-BOZ through VQ-BPT
(SB Adds VP-BDI, VP-BOY, VQ-BRA when flight deck security door is installed.)**

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

Door Mounted Escape Slides

Entry door evacuation slide systems must be armed and engagement of the girt bar with door sill verified prior to taxi, takeoff, or landing whenever passengers are carried.

Maximum Weight Limitations

Maximum Taxi Weight

| VP-BDI, VP-BOQ through VP-BOZ, VQ-BOG, VQ-BPT

187,333 Kilograms

VP-BMC, VP-BRL through VP-BWX, VQ-BMU, VQ-BRA

185,519 Kilograms

VQ-BMQ

181,890 Kilograms

Maximum Takeoff Weight

| VP-BDI, VP-BOQ through VP-BOZ, VQ-BOG, VQ-BPT

186,880 Kilograms

VP-BMC

185,065 Kilograms

VP-BRL through VP-BWX, VQ-BMU, VQ-BRA

184,612 Kilograms

VQ-BMQ

181,436 Kilograms

Maximum Landing Weight

VP-BDI through VP-BRL, VQ-BMU through VQ-BRA

145,149 Kilograms

VP-BWW through VQ-BMQ

137,892 Kilograms

Maximum Zero Fuel Weight

VP-BOQ

135,306 Kilograms

VP-BMC, VP-BOY, VP-BOZ, VQ-BOG

133,809 Kilograms

VP-BDI, VP-BRL through VQ-BMU, VQ-BPT, VQ-BRA

130,634 Kilograms

Note: Airplane weights may be further restricted by field length limits, climb limits, tire speed limits, brake energy limits, obstacle clearance, or enroute and landing requirements.

Auto Flight

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

After takeoff, the autopilot must not be engaged below 200 feet AGL.

VP-BOQ

After takeoff, the autopilot must not be engaged below 500 feet AGL.

Use of aileron trim with the autopilot engaged is prohibited.

Maximum allowable wind speeds when landing weather minima are predicated on autoland operations:

VP-BDI, VP-BMC, VP-BOY, VP-BOZ

# Headwind	25 knots
# Crosswind	25 knots
# Tailwind	10 knots

VP-BOQ, VP-BRL through VQ-BRA

# Headwind	25 knots
# Crosswind	25 knots
# Tailwind	15 knots

VP-BOQ

LNAV and VNAV modes must not be used for final approach. In an approach using V/S mode, the autopilot must be disengaged at or above 250 feet ARTE (above runway threshold elevation)

VP-BOQ

On a single channel ILS approach, disengage the autopilot at not less than 150 feet ARTE. (above runway threshold elevation)

General Limitations for Auto Flight

VP-BOQ

- # The autopilot must be disengaged in severe turbulence unless CWS is installed and selected.
- The flight director has not been assessed in any abnormal configuration except that used in a single engine approach. It may be used in this configuration but must be closely monitored.

Automatic Landing

VP-BOQ

- # The maximum and minimum glide slope angles for automatic landing are 3.1° and 2.5° respectively.
- # Automatic landings may be made with flaps 25 or 30 only.
- # All three hydraulic systems must be operating.
- # Two electrical systems must be operating. (The APU generator may be used to power one system.)
- # The inertial reference systems associated with the engaged autopilots must be in NAV mode.
- # At least two autopilots must be engaged and the autoland status annunciators must show "LAND 2" or "LAND 3" at and below 600 feet.

DH Below 200 Feet but not less than 100 feet

VP-BOQ

- The automatic landing limitations must be observed whether the landing is to be completed manually or automatically.
- The autopilot must be coupled to an ILS which conforms to the requirements of ECAC Document 17 for Category II operations.
- The decision height must be identified by reference to radio altitude and must not be less than OCA/H (obstacle clearance altitude / height). Where an OCA/H is not promulgated, the decision height may be determined by an alternative method acceptable to the CAA.

DH Below 100 Feet but not less than 50 feet

VP-BOQ

- The automatic landing limitations must be observed.
- The autopilot must be coupled to an ILS which conforms to the requirements of ECAC Document 17 for automatic landing with a decision height down to 50 feet.
- The decision height must be identified by reference to radio altitude.

DH Less than 50 Feet or no Decision Height

VP-BOQ

- The first six automatic landing limitations must be observed.
- All three autopilots must be engaged and the autoland status annunciators must show "LAND 3" at and below 600 feet.
- The autopilot must be coupled to an ILS which conforms to the requirements of ECAC Document 17 Category III operations.

Autothrottle

VP-BOQ

- # The autothrottle must not be used in a single engine approach.

Aircraft Communications Addressing and Reporting System (ACARS)

VP-BDI through VP-BOQ, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

The ACARS is limited to the transmission and receipt of messages which will not create an unsafe condition if the message is improperly received, such as the following conditions:

- the message or parts of the message are delayed or not received,
- the message is delivered to the wrong recipient, or
- the message content may be frequently corrupted.

However, Pre-Departure, Digital Automatic Terminal Information Service, Oceanic Clearances, Weight and Balance and Takeoff Data messages can be transmitted and received over ACARS if they are verified per approved operational procedures.

Engines, APU

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

Flight crew shall not blank engine vibration display during takeoff.

Engine Fuel System

The minimum inflight fuel tank temperature is 3°C (5°F) above the freeze point of the fuel being used.

The maximum fuel temperature is 49°C (120°F) {Jet B/ JP-4: 43°C (109°F)}

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The center tank may contain up to 10,000 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.

Reverse Thrust

Reverse thrust is for ground use only.

VP-BMC, VP-BOY, VP-BOZ

Backing the airplane with use of reverse thrust is prohibited.

Fire Protection

VP-BOQ

The cabin pressurization system must be operable at takeoff whenever cargo is carried in the lower cargo compartment.

Flight Controls

The maximum altitude for flap extension is 20,000 ft.

Avoid rapid and large alternating control inputs, especially in combination with large changes in pitch, roll, or yaw (e.g. large side slip angles) as they may result in structural failure at any speed, including below VA.

VP-BOQ

Speedbrakes: Do not extend in flight when wing flaps are at position 25 or 30.

VQ-BPT

Speedbrakes: Do not extend in flight below 800 ft. AGL.

Navigation

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Do not operate under IFR or at night into airports north of 73° North or south of 60° South Latitude whose navigation aids are referenced to magnetic north.

ILS approaches

VP-BDI, VP-BOQ

The airplane is approved only for the following kinds of ILS approach and landing:

Decision height 200 feet or more:

- Manual approach with or without flight director.
- Single, dual, or triple channel automatic approach and manual landing.
- Dual or triple channel automatic approach and landing.

Decision height below 200 feet but not less than 100 feet:

- Dual or triple channel automatic approach and manual landing.
- Dual or triple channel automatic approach and landing.

767 Flight Crew Operations Manual

Decision height below 100 feet but not less than 50 feet:

- Dual or triple channel automatic approach and landing.

Decision height 50 feet or less:

- Triple channel automatic approach and landing.

No decision height:

- Triple channel automatic approach and landing.
-

Ground Proximity Warning System (GPWS) Look-Ahead Alerting

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

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 not contained in the GPWS terrain database. Refer to Honeywell Document 060-4267-000 for airports and runways contained in the installed GPWS terrain database.

(SB Deletes VP-BDI Enhanced Ground Proximity Warning System limitations.)

The use of look-ahead terrain alerting and terrain display functions is prohibited during QFE operations.

Ground Proximity Warning System (GPWS) Look-Ahead Alerting

VP-BOQ

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 not contained in the GPWS terrain database. Refer to Honeywell Document 060-4267-000 for airports and runways contained in the installed GPWS terrain database.

The use of look-ahead terrain alerting and terrain display functions is prohibited during QFE operations.

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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

Scan Flow and Areas of Responsibility

The scan flow and areas of responsibility diagrams shown 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.

Normal Procedures Philosophy and Assumptions

Normal procedures verify for each phase of flight that:

- the airplane condition is satisfactory
- the flight deck configuration is correct

Normal procedures are done on each flight. Refer to the Supplementary Procedures (SP) chapter for procedures that are done as needed, for example the adverse weather procedures.

Normal procedures are written for a trained flight crew and assume:

- all systems operate normally
- the full use of all automated features (LNAV, VNAV, autoland, autopilot, and autothrottle) This does not preclude the possibility of manual flight for pilot proficiency where allowed

Normal procedures also assume coordination with the ground crew before:

- hydraulic system pressurization, or
- flight control surface movement, or
- airplane movement

Normal procedures do not include steps for flight deck lighting and crew comfort items.

Normal procedures are done by memory and scan flow. The panel illustration in this section shows the scan flow. The scan flow sequence may be changed as needed.

Configuration Check

It is the crew member's responsibility to verify correct system response. Before engine start, use 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 needed. Maintenance must first determine that it is safe to reset a tripped circuit breaker on the ground
- test the respective system light as needed

Before engine start, 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 illustrations in this section. Typical panel locations are shown.
- The preflight and postflight areas of responsibility are defined by the "Preflight Procedure - Captain" and "Preflight Procedure - First Officer".

The captain may direct actions outside of the crewmember's area of responsibility.

The general PF phase of flight responsibilities are:

- taxiing
- flight path and airspeed control
- airplane configuration
- navigation

The general PM phase of flight responsibilities are:

- checklist reading
- communications
- tasks asked for by the PF
- monitoring taxiing, flight path, airspeed, airplane configuration, and navigation

PF and PM duties may change during a flight. For example, the captain could be the PF during taxi but be the PM during takeoff through landing.

Normal procedures show who does a step by crew position (C, F/O, PF, or PM):

- in the procedure title, or
- in the far right column, or
- in the column heading of a table

The mode control panel is the PF's responsibility. When flying manually, the PF directs the PM to make the changes on the mode control panel.

The captain is the final authority for all tasks directed and done.

Control Display Unit (CDU) Procedures

Before taxi, the captain or first officer may make CDU entries. The other pilot must verify the entries.

Make CDU entries before taxi or when stopped, when possible. If CDU entries must be made during taxi, the PM makes the entries. The PF must verify the entries before they are executed.

In flight, the PM usually makes the CDU entries. The PF may also make simple, CDU entries when the workload allows. The pilot making the entries executes the change only after the other pilot verifies the entries.

During high workload times, for example departure or arrival, try to reduce the need for CDU entries. Do this by using the MCP heading, altitude, and speed control modes. The MCP can be easier to use than entering complex route modifications into the CDU.

Autopilot Flight Director System (AFDS) Procedures

The crew must always monitor:

- airplane course
- vertical path
- speed

When selecting a value on the MCP, verify that the respective value changes on the flight instruments, as applicable.

The crew must verify manually selected or automatic AFDS changes. Use the FMA to verify mode changes for the:

- autopilot
- flight director
- autothrottle

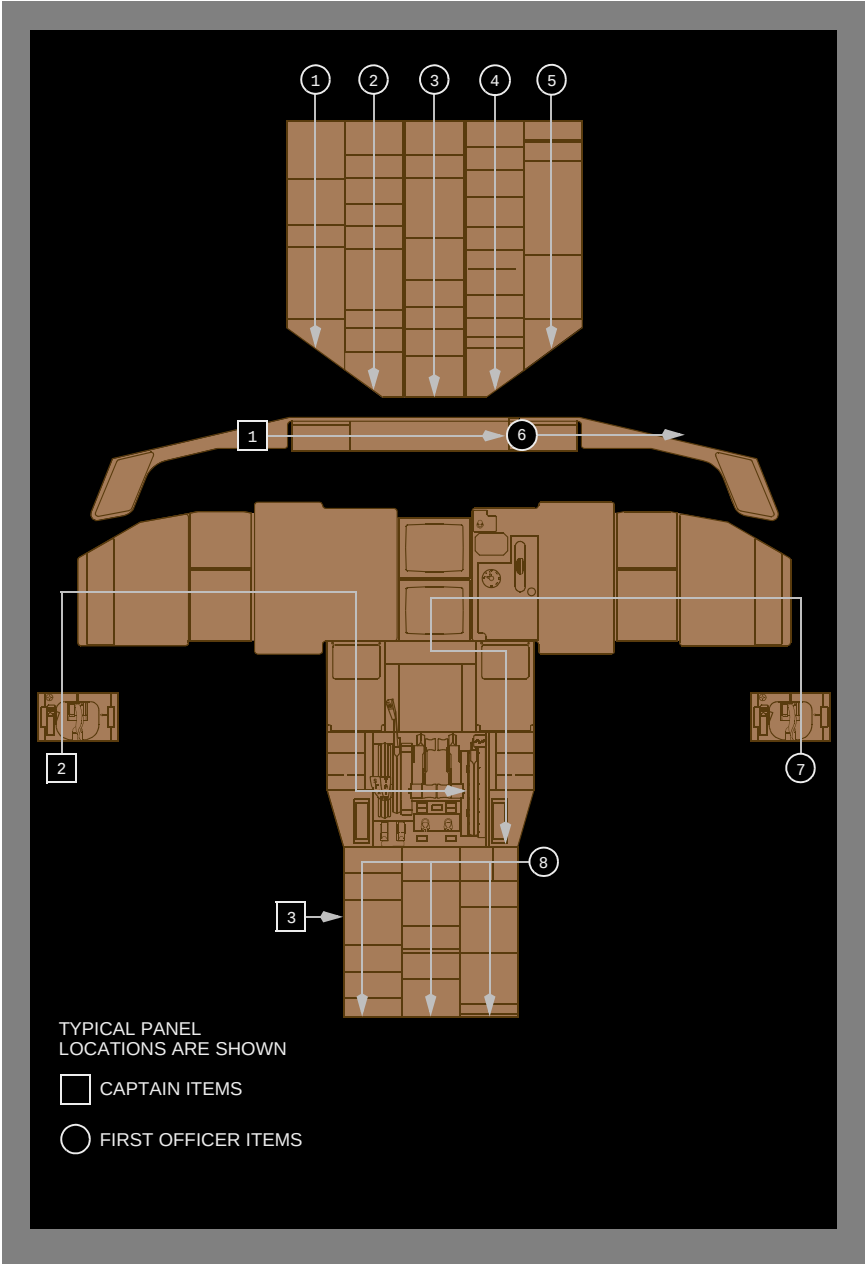
During LNAV and VNAV operations, verify all changes to the airplane's:

- course
- vertical path
- thrust
- speed

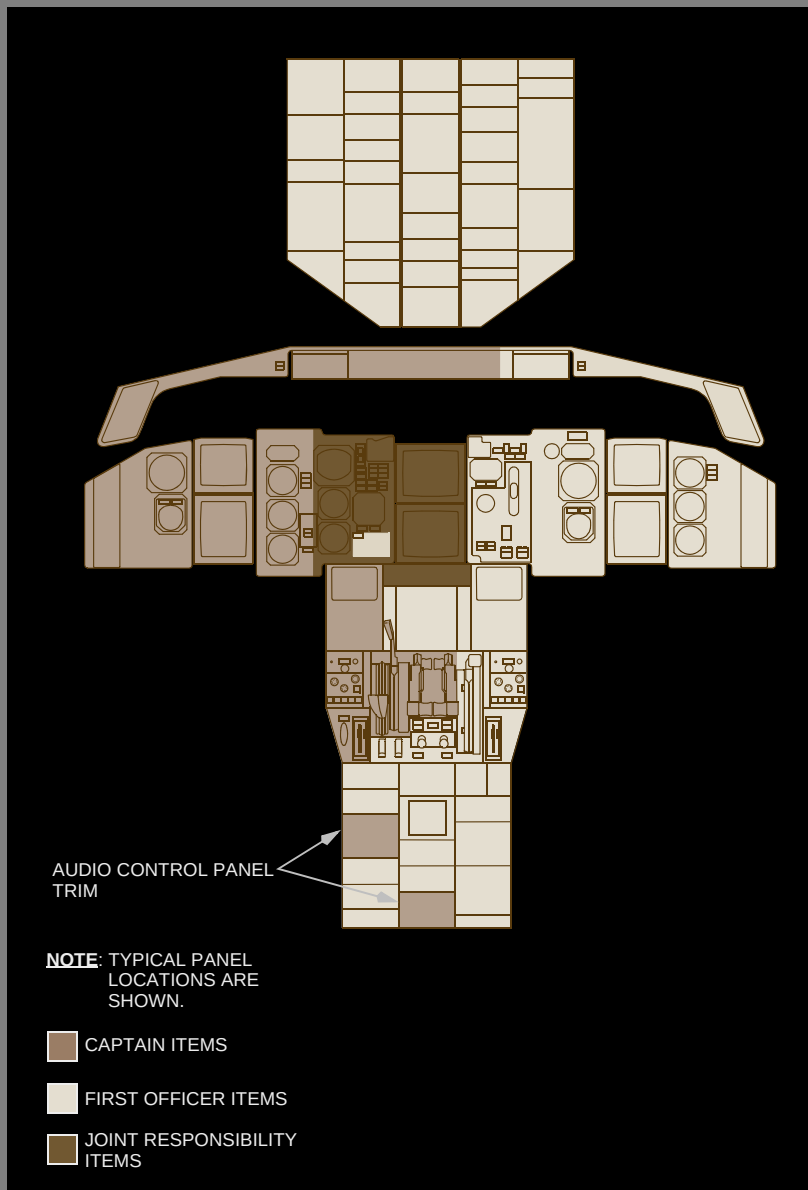
Announcing changes on the FMA and thrust mode display when they occur is a good CRM practice.



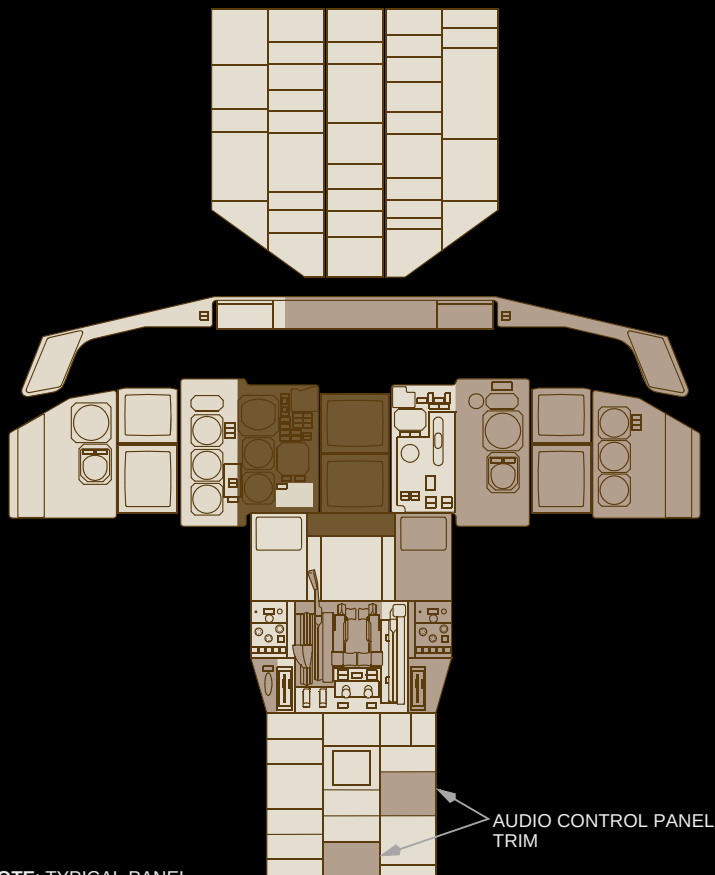
Preflight and Postflight Scan Flow



Areas of Responsibility - Captain as Pilot Flying or Taxiing



Areas of Responsibility - First Officer as Pilot Flying or Taxiing



NOTE: TYPICAL PANEL
LOCATIONS ARE
SHOWN.

-  CAPTAIN ITEMS
-  FIRST OFFICER ITEMS
-  JOINT RESPONSIBILITY
ITEMS



Preliminary Preflight Procedure – Captain or First Officer

The Preliminary Preflight Procedure assumes that the Electrical Power Up supplementary procedure is complete.

IRS mode selectors OFF, then NAV

Verify that the ON DC lights illuminate then extinguish.

Verify that the ALIGN lights are illuminated.

VP-BOY

VOICE RECORDER switch As needed

STATUS display Check

Verify that only expected messages are shown.

Verify that the following are sufficient for flight:

- oxygen pressure
- hydraulic quantity
- engine oil quantity

Do the remaining actions after a crew change or maintenance action.

Maintenance documents Check

VP-BMC, VP-BOQ, VP-BOZ through VQ-BMQ, VQ-BOG, VQ-BPT
(SB Adds VP-BDI, VP-BOY, VQ-BRA by adding the enhanced flight deck
security type door (service bulletin incorporated).)

FLIGHT DECK ACCESS SYSTEM switch Guard closed

VP-BRL, VQ-BPT

IVS ELECTRIC FILTER FAIL light Verify extinguished

BULK CARGO HEAT selector NORM or VENT

FLIGHT RECORDER switch NORM

SERVICE INTERPHONE switch OFF

RESERVE BRAKES and STEERING

RESET/DISABLE switch Guard closed

Verify that the ISLN light is extinguished.

Circuit breakers Check

VQ-BRA

(SB Deletes VP-BRL by deleting this step if the Rain Repellent system has been
removed.)

Rain Repellent Check

Verify that the sight level is above the refill mark.

Verify that the pressure indicator is in the green band.

Verify that the shutoff valve handle is in the vertical position.

Emergency equipment Check

Fire extinguisher – Checked and stowed

Crash axe – Stowed

Escape ropes – Stowed

Other needed equipment – Checked and stowed

Parking brake As needed

Set the parking brake if brake wear indicators will be checked
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 Data Set

IDENT page:

Verify that the MODEL is correct.

Verify that the navigation data base ACTIVE date range is current.

POS INIT page:

Verify that the time is correct.

Enter the present position on the SET IRS POS line. Use the most accurate latitude and longitude.

Navigation Data Set

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.

VP-BDI, VP-BMC, VP-BOY, VP-BRL through VQ-BPT
POS REF page:

Verify the correct RNP for the departure.

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

Performance Data Set

PERF INIT page:

**CAUTION: Do not enter the ZFW into the 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 the fuel quantity indicator agree.

Verify that the fuel is sufficient for flight.

Verify that the GR WT on the CDU and the dispatch papers agree.

TAKEOFF REF page:

Enter the CG.

Enter the takeoff V speeds.

Exterior Inspection

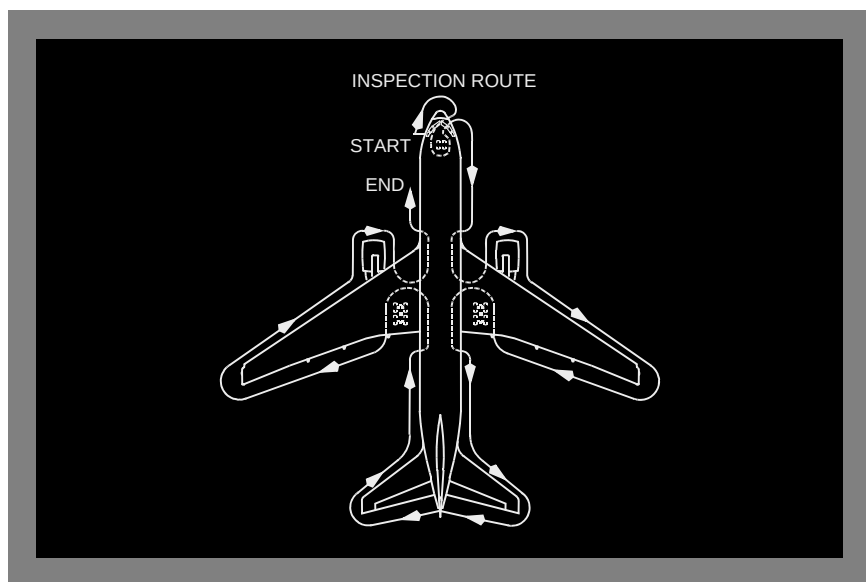
Before each flight the captain, first officer, or maintenance crew must verify that the airplane is satisfactory for flight.

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.



Left Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable) Check

Doors and access panels (not in use) Latched

Nose

Radome Check

Diverter strips - Secure

Forward access door Secure

E/E access door Secure

Nose Wheel Well

Tires and wheels Check

Gear strut and doors Check

Nose wheel steering assembly Check

Nose gear steering lockout pin As needed

Gear pin As needed

Exterior lights Check

Nose wheel spin brake (snubbers) In place

Wheel well light switches As needed

Right Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable) Check

Doors and access panels (not in use) Latched

Oxygen pressure relief green disc In place

Negative pressure relief doors Closed

Right 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
Leading edge slats	Check
Fuel sticks	Flush and secure

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 sticks	Flush and secure
Wing Surfaces	Check
Fuel tank vent	Check

Right Wing Tip and Trailing Edge

VP-BOQ

Winglet Surfaces	Check
Position and anti-collision lights	Check
Static discharge wicks	Check
Fuel jettison nozzle	Check
Ailerons 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

Negative pressure relief doors Closed

Tail

Vertical stabilizer and rudder Check

Tail skid Check

Verify that the tail skid is not damaged.

Horizontal stabilizer and elevator Check

Static discharge wicks Check

APU exhaust outlet Check

Left Aft Fuselage

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

VP-BOQ

Winglet Surfaces Check

Position and anti-collision lights Check

Static discharge wicks Check

Ailerons and trailing edge flaps Check

Fuel jettison nozzle Check

Left Wing and Leading Edge

Wing Surfaces Check

Fuel 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
Fan blades, probes, and spinner	Check
Probes, sensors, ports, vents, and drains (as applicable)	Check
Access panels	Latched

Left Wing Root, Pack, and Lower Fuselage

Fuel sticks	Flush and secure
Probes, sensors, ports, vents, and drains (as applicable)	Check
Exterior lights	Check
Pack inlet and pneumatic access doors	Secure
Negative and positive pressure relief doors	Closed
Leading edge slats	Check

Preflight Procedure – First Officer

The first officer normally does this procedure. The captain may do this procedure as needed.

VP-BDI, VQ-BOG

ELT switch Guard closed

Verify that the ON light is extinguished.

YAW DAMPER switches ON

The INOP lights stay illuminated until IRS alignment is complete.

VP-BOZ

ANTISKID switch ON

Verify that the OFF light is extinguished.

ELECTRONIC ENGINE CONTROL switches NORM

HYDRAULIC panel Set

Verify that the SYS PRESS lights are illuminated.

VP-BOY, VP-BOZ

Verify that the RSVR lights are extinguished.

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

Verify that the QTY lights are extinguished.

Left and Right ENGINE PRIMARY pump switches – ON

Verify that the PRESS lights are illuminated.

Center 1 and Center 2 ELECTRIC PRIMARY pump switches – Off

Verify that the PRESS lights are illuminated.

DEMAND pump selectors – OFF

Verify that the PRESS lights are illuminated.

VP-BWW through VQ-BMQ, VQ-BPT

WINDOW HEAT switches ON

Verify that the INOP lights are extinguished.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Left HF radio Set

VP-BWW through VQ-BMQ, VQ-BPT

Evacuation signal command switch Guard closed

BATTERY/STANDBY POWER CONTROL panel Set

BATTERY switch – ON

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG

Verify that the DISCH light is extinguished.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

Verify that the MAIN BAT DISCH and APU BAT DISCH lights are extinguished.

STANDBY POWER selector – AUTO

Verify that the standby power bus OFF light is extinguished.

Electrical panel Set

APU GENERATOR switch – ON

BUS TIE switches – AUTO

Verify that the AC BUS OFF lights are extinguished.

UTILITY BUS switches – ON

Verify that the OFF lights are extinguished.

GENERATOR CONTROL switches – ON

Verify that the OFF lights are illuminated.

Verify that the DRIVE lights are illuminated.

APU selector (as needed) START, then ON

Do not allow the APU selector to spring back to the ON position.

Verify that the RUN light is illuminated.

Lighting panel Set

VP-BDI, VP-BMC, VP-BOY, VP-BOZ, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG

TAXI light switch – OFF

RUNWAY TURNOFF light switches – OFF

EMERGENCY LIGHTS switch.....Guard closed

Verify that the UNARMED light is extinguished.

Note: Do not push PASSENGER OXYGEN switch. The switch causes deployment of the passenger oxygen masks.

PASSENGER OXYGEN ON light..... Verify extinguished

WARNING: Do not push the RAM AIR TURBINE switch. The switch causes deployment of the ram air turbine.

Ram air turbine UNLKD light..... Verify extinguished

Engine control panel Set

VP-BMC, VP-BOY, VP-BOZ

Engine ignition selector – 1 or 2

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Engine ignition selector – SINGLE

Engine start selectors – AUTO

FUEL JETTISON panel Set

Fuel jettison NOZZLE switches – Off

Fuel jettison selector – OFF

FUEL panel Set

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 both center pump PRESS lights are extinguished.

ANTI-ICE panel.....Set

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

WING anti-ice switch – Off

VP-BWW through VQ-BMQ, VQ-BPT

WING anti-ice selector – OFF

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

ENGINE anti-ice switches – Off

VP-BWW through VQ-BMQ, VQ-BPT

ENGINE anti-ice selectors – OFF

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

WIPER selector OFF

VP-BWW through VQ-BMQ, VQ-BPT

WIPER selectors OFF

Lighting panel Set

POSITION light switch – As needed

ANTI-COLLISION light switches – Off

WING light switch – As needed

LANDING light switches – OFF

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BRA

CARGO HEAT switches ON

VP-BWW through VQ-BMQ, VQ-BPT

FORWARD CARGO AIR CONDITIONING

temperature control AUTO

Verify that the INOP lights are extinguished.

VP-BWW through VQ-BMQ, VQ-BPT

CARGO HEAT switches ON

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

WINDOW HEAT switches ON

Verify that the INOP lights are extinguished.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Right HF radio Set

PASSENGER SIGNS panel Set

NO SMOKING selector – AUTO or ON

SEATBELTS selector – AUTO or ON

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CABIN ALTITUDE CONTROL panel Set

AUTO RATE control – Index

LANDING ALTITUDE selector – Destination airport elevation

MODE SELECTOR – AUTO 1 or AUTO 2

EQUIPMENT COOLING mode selector AUTO

VP-BMC, VP-BOY, VP-BOZ, VQ-BOG

CARGO HEAT switches ON

VQ-BMU

FORWARD CARGO AIR CONDITIONING selector AUTO

Verify that the INOP lights are extinguished.

Air conditioning panel Set

CABIN compartment temperature controls – AUTO

Set as needed.

The INOP lights stay illuminated until the trim air switch is ON.

TRIM AIR switch – ON

RECIRCULATION FAN switches – ON

Verify that the INOP lights are extinguished.

VP-BDI

GASPER FAN switch – ON

FLIGHT DECK compartment temperature control – AUTO

Set as needed.

Verify that the INOP light is extinguished.

PACK CONTROL selectors – AUTO

The PACK OFF lights stay illuminated until bleed air or external air is supplied.

BLEED AIR panel Set

LEFT, CENTER and RIGHT ISOLATION switches – On

Verify that the VALVE lights are extinguished.

ENGINE bleed air switches – ON

Verify that the OFF lights are illuminated.

APU bleed air switch – ON

Verify that the VALVE light is extinguished.

VP-BWW through VQ-BMQ, VQ-BPT

OBSERVER AUDIO SYSTEM switch NORM

FLIGHT DIRECTOR switch ON

VOR/DME switch AUTO

Oxygen Test and set

Select the status display.

Oxygen mask – Stowed and doors closed

RESET/TEST switch – Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

EMERGENCY/TEST selector – Push and hold

Continue to hold the RESET/TEST switch and push the EMERGENCY/TEST selector for 10 seconds. Verify that the yellow cross shows continuously in the flow indicator.

Verify that the crew oxygen pressure does not decrease more than 100 psig.

If the oxygen cylinder valve is not in the full open position, pressure can:

- decrease rapidly, or
- decrease more than 100 psig, or
- increase slowly back to normal

Release the RESET/TEST switch and the EMERGENCY/TEST selector. Verify that the yellow cross does not show in the flow indicator.

Normal/100% selector – 100%

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Crew oxygen pressure – Check EICAS

Verify that the pressure is sufficient for dispatch.

INSTRUMENT SOURCE SELECT panel Set

FLIGHT DIRECTOR source selector – R

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

NAVIGATION instrument source selector – FMC R

VP-BRL

FLIGHT MANAGEMENT COMPUTER switch – Off

ELECTRONIC FLIGHT INSTRUMENT switch – Off

INERTIAL REFERENCE SYSTEM switch – Off

AIR DATA source switch – Off

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

Set the altimeter.

Verify that the flight instrument indications are correct.

Verify that only these flags are shown:

- TCAS OFF

VP-BOY, VP-BOZ

- RA OFF

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

- V1 INOP until takeoff V-speeds are selected
- expected RDMI flags

Verify that the flight mode annunciations are correct:

- autothrottle mode is blank
- roll mode is TO
- pitch mode is TO
- AFDS status is FD

Select the map mode.

AUTOLAND STATUS annunciator Check

Verify that the indications are blank.

⋮ **VP-BOQ**
⋮ TERRAIN OVERRIDE Switch As needed

⋮ **VP-BOQ**
⋮ WEATHER RADAR Switch As needed

⋮ **VP-BOQ**
⋮ TERRAIN Switch As needed

Landing gear panel Set

Landing gear lever – DN

ALTERNATE GEAR EXTEND switch – Guard closed

VP-BOQ through VP-BRL, VQ-BRA
GROUND PROXIMITY FLAP OVERRIDE switch Off

VP-BDI, VP-BMC, VP-BWW through VQ-BPT
Ground proximity FLAP OVERRIDE switch Off

VP-BOQ through VP-BRL, VQ-BRA
GROUND PROXIMITY/CONFIGURATION
GEAR OVERRIDE switch Off

VP-BDI, VP-BMC, VP-BWW through VQ-BPT
Ground proximity GEAR OVERRIDE switch Off

VP-BDI, VP-BMC, VP-BWW through VQ-BPT
Ground proximity TERRAIN OVERRIDE switch Off

HEADING REFERENCE switch NORM

Alternate flaps panel Set

ALTERNATE FLAPS selector – NORM

Alternate flaps switches – Off

EICAS display Check

Upper EICAS display – Check

Verify that the primary engine indications show existing conditions.

Verify that no exceedance is shown.



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Lower EICAS display – Check

Secondary ENGINE indications – Check

Verify that the secondary engine indications show existing conditions.

Verify that no exceedance is shown.

Select the status display.

Status messages – Check

COMPUTER selector – AUTO

THRUST REFERENCE SET selector – BOTH and in

Verify that the TO mode is shown.

VP-BOY, VP-BOZ

TCAS DISPLAY indicator As needed

EFIS control panel Set

Decision height selector – As needed

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

TERRAIN switch – As needed

HSI RANGE selector – As needed

HSI TRAFFIC switch – As needed

HSI mode selector – MAP

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

HSI CENTER switch – As needed

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

WEATHER RADAR switch – Off

VP-BOY through VP-BRL, VQ-BRA

Verify that the ON light is extinguished.

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

Verify that weather radar indications are not shown on the HSI.

VP-BOQ

WEATHER RADAR/TERRAIN switch – As needed

MAP switches – As needed

-
- VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA**
Weather radar panel Set
- VP-BWW through VQ-BMQ, VQ-BPT**
ADF panel Set
- VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA**
Left VHF communications panel Set
- VP-BWW through VQ-BMQ, VQ-BPT**
Left radio tuning panel Set
- Verify that the OFF light is extinguished.
- VP-BWW through VQ-BMQ, VQ-BPT**
Weather radar panel Set
- VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA**
ADF panel Set
- VP-BOQ**
Transponder panel Set
- VP-BDI, VP-BMC, VP-BOY through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA**
Center VHF communications panel Set
- 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 lights are extinguished.
- VP-BWW through VQ-BMQ, VQ-BPT**
Center radio tuning panel Set
- Verify that the OFF light is extinguished.
- VP-BOQ**
Center VHF communications panel Set
- VP-BWW, VP-BWX, VQ-BPT**
ACARS Set
- VQ-BOG**
First officer's audio control panel As needed
- VP-BDI, VP-BMC, VP-BOY through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA**
Transponder panel Set
- ILS panel As needed

CARGO FIRE panel Set

CARGO FIRE ARM switches – Off

Verify that the FWD and AFT lights are extinguished.

Verify that the DISCH light is extinguished.

APU fire panel Set

Verify that the APU BTL DISCH light is extinguished.

APU fire switch – In

Verify that the APU light is extinguished.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Right VHF communications panel Set

VP-BWW through VQ-BMQ, VQ-BPT

Right radio tuning panel Set

Verify that the OFF light is extinguished.

VP-BDI through VQ-BMU, VQ-BPT, VQ-BRA

First officer's audio control panel As needed

VP-BWW through VQ-BMQ, VQ-BPT

Transponder panel Set

VP-BWW through VQ-BMQ, VQ-BPT

Observer audio control panel As needed

VP-BDI through VP-BOQ, VP-BWW through VQ-BPT

Flight deck printer Set

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.

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.

VOR/DME switch AUTO

Mode control panel Set

FLIGHT DIRECTOR switch – ON

AUTOTHROTTLE ARM switch – ARM

BANK LIMIT selector – As needed

Autopilot DISENGAGE bar – UP

Oxygen Test and set

Select the status display.

Oxygen mask – Stowed and doors closed

RESET/TEST switch – Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

EMERGENCY/TEST selector – Push and hold

Continue to hold the RESET/TEST switch and push the EMERGENCY/TEST selector for 10 seconds. Verify that the yellow cross shows continuously in the flow indicator.

Verify that the crew oxygen pressure does not decrease more than 100 psig.

If the oxygen cylinder valve is not in the full open position, pressure can:

- decrease rapidly, or
- decrease more than 100 psig, or
- increase slowly back to normal

Release the RESET/TEST switch and the EMERGENCY/TEST selector. Verify that the yellow cross does not show in the flow indicator.

Normal/100% selector – 100%

Crew oxygen pressure – Check EICAS

Verify that the pressure is sufficient for dispatch.

INSTRUMENT SOURCE SELECT panel Set

FLIGHT DIRECTOR source selector – L

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

NAVIGATION instrument source selector – FMC L

VP-BRL

FLIGHT MANAGEMENT COMPUTER switch – Off

ELECTRONIC FLIGHT INSTRUMENT switch – Off

INERTIAL REFERENCE SYSTEM switch – Off

AIR DATA source switch – Off

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

Set the altimeter.

Verify that the flight instrument indications are correct.

Verify that only these flags are shown:

- TCAS OFF

VP-BOY, VP-BOZ

- RA OFF

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

- V1 INOP until takeoff V-speeds are selected
- expected RDMI flags

Verify that the flight mode annunciations are correct:

- autothrottle mode is blank
- roll mode is TO
- pitch mode is TO
- AFDS status is FD

Select the map mode.

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AUTOLAND STATUS annunciator Check

Verify that the indications are blank.

VP-BOQ

WEATHER RADAR Switch As needed

VP-BOQ

TERRAIN Switch As needed

RESERVE BRAKES AND STEERING switch Off

Verify that the VALVE light is extinguished.

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

(SB Deletes VP-BOQ when conventional standby instruments replaced by ISFD.)

Standby instruments Check

Attitude indicator caging control – Pull, then release

ILS selector – OFF

Set the altimeter.

Verify that the flight instrument indications are correct.

Verify that no flags are shown.

(SB Adds VP-BOQ by adding procedures for the Integrated Standby Flight Display (ISFD).)

Integrated standby flight display Set

Verify that the approach mode display is blank.

Set the altimeter.

Verify that the flight instrument indications are correct.

Verify that no flags or messages are shown.

Standby engine indicator selector AUTO

AUTOBRAKES selector RTO

EFIS control panel Set

Decision height selector – As needed

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

TERRAIN switch – As needed

HSI RANGE selector – As needed

HSI TRAFFIC switch – As needed

HSI mode selector – MAP

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

HSI CENTER switch – As needed

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

WEATHER RADAR switch – Off

VP-BOY through VP-BRL, VQ-BRA

Verify that the ON light is extinguished.

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

Verify that weather radar indications are not shown on the HSI.

VP-BOQ

WEATHER RADAR/TERRAIN switch – As needed

MAP switches – As needed

ALTERNATE STABILIZER TRIM switches Neutral

SPEEDBRAKE lever DOWN

Reverse thrust levers Down

Forward thrust levers Closed

Flap lever Set

Set the flap lever to agree with the flap position.

Parking brake Set

Verify that the PARK BRAKE light is illuminated.

Note: Do not assume that the parking brake will prevent airplane movement. Accumulator pressure can be insufficient.

STABILIZER TRIM cutout switches Guards closed

FUEL CONTROL switches CUTOFF

FUEL CONTROL switch fire warning lights Verify extinguished

Captain's audio control panel As needed



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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.

Seat belt and shoulder harness Adjust

Call “PREFLIGHT CHECKLIST.”

Before Start Procedure

Start the Before Start Procedure after papers are on board.

Flight deck door Closed and locked F/O

(SB Deletes VP-BDI, VP-BOY, VQ-BRA Deleted procedures for aircraft with the enhanced flight deck security door.)

FLIGHT DECK DOOR switch – Locked

Verify that the UNLKD light is extinguished.

VP-BMC, VP-BOQ, VP-BOZ through VQ-BPT

(SB Adds VP-BDI, VP-BOY, VQ-BRA to provide procedures for aircraft with the enhanced flight deck security door.)

Verify that the LOCK FAIL light is extinguished.

Do the CDU Preflight Procedure – Performance Data steps before completing this procedure.

CDU display Set C, F/O

Normally the PF selects the TAKEOFF REF page.

Normally the PM selects the LEGS page.

Takeoff thrust reference Set C, F/O

Verify that the thrust reference mode is correct.

I VP-BDI through VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA
(SB Adds VP-BWW, VP-BWX when Mach Airspeed indicator installed.)

IAS bugs Set C, F/O

Set the bugs at V1, VR, VREF 30 + 40, and VREF 30 + 80.

MCP Set C

IAS/MACH selector – Set V2

Arm LNAV as needed.

Initial heading – Set

Initial altitude – Set

Taxi and Takeoff briefings Complete C, F/O

The pilot who will do the takeoff does the taxi and takeoff briefings.

Exterior doors Verify closed F/O

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Flight deck windows Closed and locked C, F/O

Verify that the lock lever is in the forward, locked position.

Verify that the WINDOW NOT CLOSED decal 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:

Verify that the nose gear steering is locked out. C, F/O

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 the PRESS light is extinguished.

Center 1 and Center 2 ELECTRIC PRIMARY pump switches – ON

Verify that the center 1 PRESS light is extinguished.

The center 2 PRESS light stays illuminated until after the engine start due to load shedding.

Left ELECTRIC DEMAND pump selector – AUTO

Verify that the PRESS light is extinguished.

Center AIR DEMAND pump selector – AUTO

Verify that the PRESS light is extinguished.

Fuel panel Set F/O

LEFT and RIGHT FUEL PUMP switches – ON

Verify that the PRESS lights are extinguished.



If there is fuel in the center tank:

CENTER FUEL PUMP switches – ON

Verify both PRESS lights are illuminated and CTR L FUEL PUMP and CTR R FUEL PUMP messages are shown.

RED ANTI-COLLISION light switch ON F/O

RECALL switch Push F/O

Verify that only the expected alert messages are shown.

Trim Set C

Stabilizer trim – ____ UNITS

Set the trim for takeoff.

Verify that the trim is in the greenband.

Aileron trim – 0 units

Rudder trim – 0 units

Call “BEFORE START CHECKLIST.” C

Do the BEFORE START checklist. F/O



Pushback or Towing Procedure

The Engine Start procedure may be done during pushback or towing.

Establish communications with ground handling personnel. C

CAUTION: Do not hold or turn the nose wheel 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

At airports where ground tracking is not available, select STANDBY.
At airports equipped to track airplanes on the ground, select an active transponder setting, but not a TCAS mode.

Set or release the parking brake as directed by ground handling personnel. C or F/O

When pushback or towing is complete:

Verify that the tow bar is disconnected. C

Verify that the nose gear steering is not locked out. C



Engine Start Procedure

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Do the ABORTED ENGINE START checklist for one or more of the following abort start conditions:

- the EGT does not increase by 25 seconds after the fuel control switch is moved to RUN
- there is no N1 rotation by 30 seconds after N2 is stabilized at idle
- the EGT quickly nears or exceeds the start limit
- the oil pressure indication is not normal by the time that the engine is stabilized at idle

Select the secondary engine indications. F/O

PACK CONTROL selectors.....OFF F/O

Verify that the PACK OFF lights are illuminated.

CANCEL switch Push F/O

Verify that the messages are cancelled.

Start sequence.....Announce C

Call “START ___ ENGINE” C

Engine start selector GND F/O

Verify that the oil pressure increases. C, F/O

When N2 is at 20%, or (if 20% N2 is not possible), at maximum motoring and a minimum of 15% N2:

Note: Maximum motoring occurs when N2 acceleration is less than 1% in approximately 5 seconds.

FUEL CONTROL switch RUN C

Verify that the EGT increases and stays below the EGT limit. C, F/O

After the engine is stabilized at idle, start the other engine.

Engine Start Procedure

VP-BMC, VP-BOY, VP-BOZ

Do the ABORTED ENGINE START checklist for one or more of the following abort start conditions:

- the EGT does not increase by 20 seconds after the fuel control switch is moved to RUN
- there is no N1 rotation when the EGT increases
- the EGT quickly nears or exceeds the start limit
- the N2 is not at idle by 2 minutes after the fuel control switch is moved to RUN
- the oil pressure indication is not normal by the time that the engine is stabilized at idle

Select the secondary engine indications. F/O

PACK CONTROL selectors OFF F/O

Verify that the PACK OFF lights are illuminated.

CANCEL switch Push F/O

Verify that the messages are cancelled.

Start sequence Announce C

Call "START ___ ENGINE" C

Engine start selector GND F/O

Verify that the oil pressure increases. C, F/O

Verify N2 rotation. C, F/O

At maximum motoring and a minimum of 15% N2:

Note: Maximum motoring occurs when N2 acceleration is less than 1% in approximately 5 seconds.

FUEL CONTROL switch RUN C

Verify that the EGT increases and stays below the EGT limit. C, F/O

Do not increase thrust above that needed to taxi until the oil temperature is a minimum of 50° C.

After the engine is stabilized at idle, start the other engine.

Before Taxi Procedure

APU selector OFF F/O

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

ENGINE ANTI-ICE switches As needed F/O

VP-BWW through VQ-BMQ, VQ-BPT

ENGINE ANTI-ICE selectors As needed F/O

PACK selectors AUTO F/O

LEFT and RIGHT ISOLATION switches Off F/O

Select the status display. 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.

Move the control wheel and the control column to full travel in both directions and verify:

- freedom of movement
- that the controls return to center
- correct flight control movement on the EICAS display

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
- correct flight control movement on the EICAS display.

Select the secondary engine indications. F/O

Transponder As needed F/O

At airports where ground tracking is not available, select STANDBY.
At airports equipped to track airplanes on the ground, select an active transponder setting, but not a TCAS mode.



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Recall	Check	C, F/O

Verify that only expected alert messages are shown.

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

VP-BMC, VP-BOY, VP-BOZ

Engine warm up **requirements:**

- engine oil temperature must be above the lower amber band before takeoff.

VP-BMC, VP-BOY, VP-BOZ

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.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Engine warm up **requirements:**

- engine oil temperature must be above the bottom of the temperature scale.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Engine warm up recommendations:

- run the engines for at least 3 minutes
- use a thrust setting normally used for taxi operations.

Pilot Flying	Pilot Monitoring
	Notify the cabin crew to prepare for takeoff. Verify that the cabin is secure.
The pilot who will do the takeoff updates changes to the takeoff briefing as needed.	
Set the weather radar display as needed.	
VP-BDI through VP-BOQ, VP-BWW through VQ-BPT Set the terrain display as needed.	
Call “BEFORE TAKEOFF CHECKLIST.”	Do the BEFORE TAKEOFF checklist.



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Takeoff Procedure

Pilot Flying	Pilot Monitoring
Before entering the departure runway, verify that the runway and runway entry point are correct.	
	When entering the departure runway, set the WHITE ANTI COLLISION light switch to ON. Use other lights as needed. Set the transponder mode selector to TA/RA.
Verify that the brakes are released. Align the airplane with the runway.	
Verify that the airplane heading agrees with the assigned runway heading.	
	When cleared for takeoff, set the left and right WING LANDING light switches to ON.
VP-BDI, VP-BOQ, VP-BRL through VQ-BRA Advance the thrust levers to approximately 70% N1. VP-BMC, VP-BOY, VP-BOZ Advance the thrust levers to approximately 1.10 EPR. Allow the engines to stabilize	
VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA Push the N1 switch. VP-BMC, VP-BOY, VP-BOZ Push the EPR switch. VP-BWW through VQ-BMQ, VQ-BPT Push the THR switch.	



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Pilot Flying	Pilot Monitoring
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 before 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.	Call "V1."
At VR, rotate toward 15° pitch attitude. After liftoff, follow F/D commands.	At VR, call "ROTATE." Monitor airspeed and vertical speed.
Establish a positive rate of climb.	
	Verify a positive rate of climb on the altimeter and call "POSITIVE RATE."
Verify a positive rate of climb on the altimeter and call "GEAR UP."	
	Set the landing gear lever to UP.
Above 400 feet radio altitude, call for a roll mode as needed.	Select or verify the roll mode.
At thrust reduction height, call "VNAV."	
	Push the VNAV switch.
Verify that climb thrust is set.	



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Pilot Flying	Pilot Monitoring
At the acceleration height, verify acceleration.	
Call “FLAPS___” according to the flap retraction schedule.	
	Set the flap lever as directed.
Engage the autopilot after a roll mode and VNAV are engaged.	
	After flap retraction is complete: VP-BWW through VQ-BMQ, VQ-BPT • Set the WING and ENGINE ANTI-ICE selectors to AUTO • Set the landing gear lever to OFF after landing gear retraction is complete
Call “AFTER TAKEOFF CHECKLIST.”	
	Do the AFTER TAKEOFF checklist.

Takeoff Flap Retraction Speed Schedule

Takeoff Flaps	At "Display" or Speed (knots)	Select Flaps
20 or 15	"F" VREF 30 + 20	5
	"F" VREF 30 + 40	1
	"F" VREF 30 + 60	UP
5	"F" VREF 30 + 40	1
	"F" VREF 30 + 60	UP

"F" = Minimum flap retraction speed for next
flap setting on speed tape display (as installed)



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Climb and Cruise Procedure

Complete the After Takeoff Checklist before starting the Climb and Cruise Procedure.

Pilot Flying	Pilot Monitoring

VP-BDI, VP-BMC, VP-BOY, VP-BRL through VQ-BPT

	During climb and cruise, verify the RNP as needed.
	At or above 10,000 feet MSL, set the LANDING light switches to OFF.
	Set the passenger signs as needed.
At transition altitude, set and crosscheck the altimeters to standard.	
	When either CTR L or CTR R FUEL PUMP message is shown, select the respective CENTER FUEL PUMP switch off. Select both CENTER FUEL PUMP switches off when either CTR L or CTR R FUEL PUMP message is shown and the center tank is empty. Note: During cruise flight, whenever center tank usable fuel is indicated with CENTER FUEL PUMP switches selected off, both CENTER FUEL PUMP switches may be re-selected on.
	Before the top of descent, modify the active route as needed for the arrival and approach.



Descent Procedure

Start the Descent Procedure before the airplane descends below the cruise altitude for arrival at destination.

Complete the Descent Procedure by 10,000 feet MSL.

Pilot Flying	Pilot Monitoring

VP-BDI, VP-BMC, VP-BOY, VP-BRL through VQ-BPT

	During the descent, verify the RNP as needed.
	Verify that pressurization is set to landing altitude.
Review all alert messages.	Recall and review all alert messages.
Verify VREF on the APPROACH REF page.	VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA Enter VREF on the APPROACH REF page.

VP-BDI through VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA
(SB Adds VP-BWW, VP-BWX for airplanes with conventional Mach/Airspeed indicator.)

Set the bugs at VREF, VREF 30 + 40, and VREF 30 + 80.

Set the RADIO/BARO minimums as needed for the approach.	
Set or verify the navigation radios and course for the approach.	
	Set the AUTOBRAKE selector to the needed brake setting.
	Check landing performance
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

VP-BDI, VP-BMC, VP-BOY, VP-BRL through VQ-BPT

	During arrival and approach, verify the RNP as needed.
	Set the passenger signs as needed.
	At or above 10,000 feet MSL, set the LEFT and RIGHT WING LANDING light switches to ON.
At transition level, set and crosscheck the altimeters.	
Update the arrival and approach, as needed.	
Update the approach briefing as needed.	
Call "APPROACH CHECKLIST."	Do the APPROACH checklist.

Flap Extension Schedule

Current Flap Position	At "Display" or Speed (knots)	Select Flaps	Command Speed for Selected Flaps
UP	"Ref Bug" VREF30 + 80	1	VREF30 + 60
1	VREF30 + 60	5	"Ref Bug" VREF30 + 40
5	"Ref Bug" VREF30 + 40	20	VREF30 + 20
20	VREF30 + 20	25 or 30	(VREF25 or VREF30) + wind additives

Landing Procedure - ILS

Pilot Flying	Pilot Monitoring
Initially - If on radar vectors - HDG SEL - Pitch mode (as needed) - If enroute to a fix - LNAV or other roll mode - VNAV or other pitch mode	
	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Call “FLAPS___” according to the flap extension schedule.	Set the flap lever as directed.
When on localizer intercept heading: - verify that the ILS is tuned and identified - verify that the LOC and G/S pointers are shown	
Arm the APP mode. VP-BMC Engage the other autopilots.	

VP-BOQ through VP-BRL, VQ-BMQ through VQ-BRA

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.

VP-BDI, VP-BMC, VP-BWW, VP-BWX

Note: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it.

Use LNAV, HDG SEL or HDG HOLD to intercept the final approach course, as needed.	
Verify that the localizer is captured.	Verify final approach course heading.
	Call “GLIDESLOPE ALIVE.”



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Pilot Flying	Pilot Monitoring
At glideslope alive, call: • “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.
At the final approach fix (LOM, MKR, DME), verify the crossing altitude.	
Monitor the approach. Verify the autoland status at 500 feet AGL.	

Landing Procedure - Instrument Approach Using VNAV

Use the autopilot during the approach to give:

- autopilot alerts and mode fail indications
- more accurate course and glide path tracking
- lower RNP limits.

This procedure is not authorized using QFE.

Pilot Flying	Pilot Monitoring
Initially • If on radar vectors • HDG SEL • Pitch mode (as needed) • If enroute to a fix • LNAV or other roll mode • VNAV or other pitch mode	
	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Call “FLAPS __” according to the flap extension schedule.	Set the flap lever as directed.
The recommended roll modes for the final approach are: • for a RNAV or GPS approach use LNAV • VP-BOQ, VP-BOY, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA • for a LOC-BC approach use LNAV or B/CRS • VP-BDI, VP-BMC, VP-BOZ, VP-BWW through VQ-BMQ, VQ-BPT • for a LOC-BC approach use LNAV • for a VOR or NDB approach use LNAV • for a LOC, SDF, or LDA approach use LNAV or LOC	
	Verify that the VNAV glide path angle is shown on the final approach segment of the LEGS page.
When on the final approach course intercept heading for LOC, LOC-BC, SDF, or LDA approaches: • verify that the localizer is tuned and identified • verify that the LOC pointer is shown	
Arm the LNAV or LOC mode.	



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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 or HDG HOLD to intercept the final approach course as needed.	
Verify that LNAV is engaged or that the localizer is captured.	
VQ-BPT Approximately 2 NM before the final approach fix and after ALT HOLD, VNAV PTH or VNAV ALT is annunciated: VP-BDI through VQ-BOG, VQ-BRA Approximately 2 NM before the final approach fix and after ALT HOLD or VNAV PTH is annunciated: • verify that the autopilot is engaged • 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.
When at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP.	
At the final approach fix, verify the crossing altitude and crosscheck the altimeters.	



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Pilot Flying	Pilot Monitoring
Monitor the approach.	
If suitable visual reference is established at MDA(H), DA(H), or the missed approach point, disengage the autopilot in accordance with regulatory requirements, and disconnect the autothrottle at the same time. Maintain the glide path to landing.	



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Go-Around and Missed Approach Procedure

Pilot Flying	Pilot Monitoring
At the same time: • push the GA switch • call “FLAPS 20”	Position the flap lever to 20.
Verify: • the rotation to go-around attitude • that the thrust increases	
	Verify that the thrust is sufficient for the go-around or adjust as needed.
Verify a positive rate of climb on the altimeter and call “GEAR UP.”	Verify a positive rate of climb on the altimeter and call “POSITIVE RATE.” Set the landing gear lever to UP.
Above 400 feet radio altitude, select 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 “CLIMB THRUST.”	Select CLB thrust.
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 the flap maneuvering speed, select FLCH or VNAV as needed.	
Verify that climb thrust is set.	
Verify that the missed approach altitude is captured.	
	Set the landing gear lever to OFF after landing gear retraction is complete.
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 moved, a full stop landing must be made. If an engine stays in reverse, safe flight is not possible.	
Without delay, move the reverse thrust levers to the interlocks and hold light pressure until the interlocks release. Apply reverse thrust as needed.	Verify that the forward thrust levers are closed. When both REV indications are green, call "REVERSERS NORMAL." If there is no REV indication(s) or the indication(s) stays amber, call "NO REVERSER LEFT ENGINE", or "NO REVERSER RIGHT ENGINE", or "NO REVERSERS".
By 60 knots, start movement of the reverse thrust levers to be at the reverse idle detent before taxi speed.	Call "60 KNOTS."
After the engines are at reverse idle, move the reverse thrust levers full down.	
Before taxi speed, disarm the autobrakes. Use manual braking as needed.	
Before turning off the runway, disconnect the autopilot.	

After Landing Procedure

Start the After Landing Procedure when clear of the active runway.

VP-BMC, VP-BOY, VP-BOZ

Engine cool down recommendations:

- Run the engines for at least 5 minutes
- Use a thrust setting no higher than that normally used for all engine taxi operations.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Engine cool down recommendations:

- Run the engines for at least 3 minutes
- Use a thrust setting normally used for taxi operations.

Pilot Flying	Pilot Monitoring
The captain moves or verifies that the SPEEDBRAKE lever is DOWN.	
	Set the APU selector to START, then ON, as needed. Do not allow the APU selector to spring back to the ON position.

VP-BWW through VQ-BMQ, VQ-BPT

	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 to OFF.
	Set the flap lever to UP.
	Set the transponder mode selector as needed. At airports where ground tracking is not available, select STANDBY. At airports equipped to track airplanes on the ground, select an active transponder setting, but not a TCAS mode.



Shutdown Procedure

Start the Shutdown Procedure after taxi is complete.

Parking brake Set C or F/O

Verify that the PARK BRAKE light is illuminated.

Electrical power Set F/O

If APU power is needed:

Verify that the APU RUN light is illuminated.

If external power is needed:

Verify that the EXTERNAL POWER AVAIL light is illuminated.

EXTERNAL POWER switch – Push

Verify that the ON light is illuminated.

- VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA
ENGINE ANTI-ICE switches Off F/O
- VP-BWW through VQ-BMQ, VQ-BPT
WING ANTI-ICE selector OFF F/O
- VP-BWW through VQ-BMQ, VQ-BPT
ENGINE ANTI-ICE selectors OFF F/O
- FUEL CONTROL switches CUTOFF C

If towing is needed:

Establish communications with ground handling personnel 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.

Verify that the nose gear steering is 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.

Set or release the parking brake as directed by ground handling personnel C or F/O

SEATBELTS selector OFF F/O

HYDRAULIC panel Set F/O

Note: Depressurize the right system last to prevent fluid transfer between systems.

Center AIR DEMAND pump selector – OFF

Left ELECTRIC DEMAND pump selector – OFF

Center 1 and Center 2 ELECTRIC PRIMARY pump switches – Off

Right ELECTRIC DEMAND pump selector – OFF

FUEL PUMP switches Off F/O

RED ANTI-COLLISION light switch Off F/O

LEFT and RIGHT ISOLATION switches On F/O

FLIGHT DIRECTOR switches OFF C, F/O

Status messages Check F/O

Record shown status messages in maintenance log.

TCAS mode selector STANDBY F/O



After wheel chocks are in place:

- Parking brake – Release C or F/O
- APU selector As needed F/O
- (SB Deletes VP-BDI, VP-BOY, VQ-BRA if Enhanced flight deck security door installed.)
- Flight deck door Unlock F/O
- Verify that the flight deck door UNLKD lights are illuminated.
- Call “SHUTDOWN CHECKLIST.” C
- Do the SHUTDOWN checklist. F/O



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Secure Procedure

IRS mode selectors	OFF	F/O
EMERGENCY LIGHTS switch	OFF	F/O
WINDOW HEAT switches	Off	F/O
CARGO HEAT switches	Off	F/O
PACK CONTROL selectors	OFF	F/O
Call “SECURE CHECKLIST.”		C
Do the SECURE checklist.		F/O

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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. System tests which the flight crew are likely to perform are also included.

Procedures accomplished in flight, or those that are an alternate means of accomplishing normal procedures (such as selecting reduced T.O. thrust), 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 Door Closing**

Door Lower

Raise door slightly, push and hold uplatch release button, then lower door approximately 2 inches (5 centimeters). Then, release button and continue to lower door until closed.

VP-BMC, VP-BRL, VQ-BOG

The left forward door may be lowered electrically using the main door switch.

VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

Doors with electrical operating systems may be lowered electrically using the control switch.

Door handle Down

Rotate to the down (flush) position.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Arming lever (interior only) SLIDE ARMED

While pushing arming lever release, position arming lever to SLIDE ARMED. Observe armed indicator in view and Direct Visual Indication of girt bar lockdown is completely yellow.

VP-BWW through VQ-BMQ, VQ-BPT

Arming lever (interior only) AUTOMATIC

While pushing arming lever release, position arming lever to AUTOMATIC. Observe armed indicator in view and Direct Visual Indication of girt bar lockdown is completely yellow.

Entry Door Opening

- I **VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA**
Arming Lever (interior only) SLIDE DISARMED

Position arming lever to SLIDE DISARMED. Observe armed indicator out of view, arming lever release button extended and girt bar lockdown indications show blank.

- VP-BWW through VQ-BMQ, VQ-BPT**
Arming Lever (interior only) MANUAL

Position arming lever to MANUAL. Observe armed indicator out of view, arming lever release button extended and girt bar lockdown indications show blank.

Note: Slide disarms automatically when the door is opened from outside.

- Door handle Up
Rotate aft to the up position.

- Door Raise
Raise the door until the uplatch is engaged.

- I **VP-BMC, VP-BRL, VQ-BOG**
The left forward door may be raised electrically using the main door switch.

- I **VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA**
Doors with electrical operating systems may be raised electrically using the control switch.

Flight Deck Door Access System Test

VP-BMC, VP-BOQ, VP-BOZ through VQ-BMQ, VQ-BOG, VQ-BPT
(SB Adds VP-BDI, VP-BOY, VQ-BRA Enhanced Security Flight Deck Door
procedure.)

- Flight Deck Access System switch Norm
- Flight Deck Door Open
- Flight Deck Door Lock selector AUTO
- Emergency access code Enter
- ENT key Push
 - Verify alert sounds.
 - Verify AUTO UNLK light illuminates.
- Flight Deck Door Lock selector DENY
 - Verify AUTO UNLK light extinguishes.
- Flight Deck Door Lock selector UNLKD
- Flight Deck Access System switch OFF
 - Verify LOCK FAIL light illuminates.
- Flight Deck Access System switch NORM (guard down)
 - Verify LOCK FAIL light extinguishes.

Windows

Flight Deck Window Closing

Window crank Rotate
Crank the window to the full closed position (the WINDOW NOT
CLOSED placard not visible).

Window lock lever Rotate
Rotate the window lock lever forward to the locked position.

Flight Deck Window Opening

Window lock lever Rotate
Rotate the window lock lever aft to the open position.

Window crank Rotate
Crank the window to the full open position (the WINDOW NOT
CLOSED placard is visible).

Lights

Indicator Lights Test

INDICATOR LIGHTS TEST switch Push and hold
Verify all indicator lights in the flight deck, except lights in the fuel
control and APU/engine fire switches illuminated.

INDICATOR LIGHTS TEST switch Release

Emergency Equipment

Oxygen Mask Microphone Test

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA	
BOOM/OXYGEN switch	OXY
RESET/TEST switch	Push and hold
EMERGENCY/TEST selector	Push and hold
VP-BWW through VQ-BMQ, VQ-BPT	
RADIO/INTERPHONE switch	INT
Verify oxygen flow sound is heard through the flight deck loudspeaker.	
VP-BDI	
MICROPHONE/INTERPHONE switch	INT
Verify oxygen flow sound is heard through the flight deck loudspeaker.	
VP-BMC through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA	
Push to talk switch	Push
Simultaneously push the push to talk switch, emergency/test selector, and reset/test switch.	
Verify oxygen flow sound is heard through the flight deck loudspeaker.	
VP-BMC through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA	
Push to talk switch	Release
VP-BWW through VQ-BMQ, VQ-BPT	
RADIO/INTERPHONE switch	Release
Verify oxygen flow sound is heard through the flight deck loudspeaker.	
VP-BDI	
MICROPHONE/INTERPHONE switch	Release
EMERGENCY/TEST selector	Release
RESET/TEST switch	Release

Intentionally
Blank



Supplementary Procedures

Air Systems

Chapter SP

Section 2

Air Conditioning Packs

Ground Conditioned Air Use

Before connecting ground conditioned air:

Pack Control selectors OFF

Prevents pack operation when conditioned air is supplied to the airplane. The packs or pack components can be damaged if operated with conditioned air.

After disconnecting conditioned air:

Pack Control selectors AUTO

Packs Off Takeoff

Before takeoff:

Pack Control selectors (both) OFF

VQ-BMU, VQ-BPT, VQ-BRA

Cabin Altitude Mode selector MAN

Position outflow valve approximately three-quarters open.

CABIN AUTO INOP message will be displayed.

After takeoff:

Note: If engine failure occurs, pack control selectors should remain OFF until reaching 1,500 feet or until obstacle clearance height has been attained, whichever is higher.

Pack Control selector (one only) AUTO

After engine thrust is reduced from takeoff, position one pack control selector to AUTO.

VQ-BMU, VQ-BPT, VQ-BRA

Cabin Altitude Mode selector AUTO 1 or AUTO 2

Pack Control selector (remaining pack) AUTO

When cabin pressurization stabilizes, position remaining pack control selector to AUTO.



Forward Cargo Air Conditioning

VP-BWW through VQ-BMU, VQ-BPT

Forward Cargo Air Conditioning System Set

If cargo carried in the forward cargo compartment is not temperature sensitive:

Forward Cargo Air Conditioning Switch OFF

If temperature sensitive cargo is carried in the forward cargo compartment:

Forward Cargo Air Conditioning switch ON

Forward Cargo Air Conditioning Temperature Control AUTO

Adjust temperature as appropriate for cargo.

Note: Select FWD Cargo Heat switch OFF if a temperature below 45 degrees F (7 degrees C) is being maintained by the forward cargo air conditioning system.



Supplementary Procedures

Anti-Ice, Rain

Chapter SP

Section 3

Ice Protection

Ice protection is provided by the airplane anti-ice systems.

Anti-Ice Use

Requirements for use of anti-ice and operational procedures for engine and wing anti-ice are moved from SP.3 to Supplementary Procedures, Adverse Weather Section SP.16.

Windshield Wiper Use

VP-BDI through VP-BOZ, VP-BWW through VQ-BPT

(SB Adds VP-BRL when the windshield wiper panel rain repellent switches are not installed, or have been deactivated.)

CAUTION: Do not use windshield wipers on a dry window.

Windshield Wiper selector (as required) LOW/HIGH

Windshield Wiper and Rain Repellent Use

VQ-BRA

(SB Deletes VP-BRL when the wiper control panel does not contain RAIN REPELLENT switches.)

CAUTION: Do not use windshield wipers or rain repellent on dry window. If rain repellent inadvertently applied, do not use windshield wipers until required for rain removal.

Windshield Wiper selector (as required) LOW/HIGH

Rain Repellent switch (as required) Push

Use on one window at a time.

Intentionally
Blank



Supplementary Procedures

Automatic Flight

Chapter SP

Section 4

AFDS

AFDS Operation

If Flight Director (F/D) operation is desired:

FLIGHT DIRECTOR switches ON

On ground, observe flight director command wings level and 8° pitch up and flight mode annunciations display TO, TO, FD.

VP-BMC, VP-BOY through VP-BRL, VQ-BMQ through VQ-BPT

In-flight, observe flight director command and flight mode annunciations display vertical speed (V/S) and heading hold (HDG HOLD) or attitude (ATT) if no autopilot in command (CMD), or display existing autopilot modes if any autopilot in command (CMD).

VP-BDI, VP-BOQ, VP-BWW, VP-BWX, VQ-BRA

In-flight, observe flight director command and flight mode annunciations display vertical speed (V/S) and heading hold (HDG HOLD) if no autopilot in command (CMD), or display existing autopilot modes if any autopilot in command (CMD).

VQ-BMU, VQ-BRA

Note: Command bars are not displayed if selected autopilot command mode and flight director source are the same.

AFDS Mode(s) Engage as desired

Observe flight director command and selected AFDS mode(s) is displayed.

If the autopilot is desired:

Command switch Engage

VP-BMC, VP-BOY through VP-BRL, VQ-BMU

Observe flight mode annunciations display V/S and HDG HOLD or ATT, or existing AFDS modes if flight director on and not in takeoff or go-around mode.

VQ-BMQ, VQ-BOG, VQ-BPT

Observe flight mode annunciations display V/S and HDG HOLD or ATT; or existing AFDS modes, including TO and GA, if at least one flight director is on.

VP-BDI, VP-BOQ, VP-BWW, VP-BWX, VQ-BRA

Observe flight mode annunciations display V/S and HDG HOLD, or existing AFDS modes if flight director on and not in takeoff or go-around mode.

VP-BRL

If the autopilot control wheel (CWS) steering is desired:

Control wheel steering switch Engage

Observe flight mode annunciation displays CWS.

Note: Do not use CWS for takeoff or landing flare maneuver.

Heading Hold

Rolls wings level and maintains the heading that exists at the time the wings become level.

Heading Hold switch Engage

Observe HDG HOLD displayed in the roll mode annunciator.

Heading Select

Heading selector Set as desired

Heading selector switch Push

Observe HDG SEL is displayed in the roll mode annunciator.

Bank Limit selector Set as desired

Altitude Hold

Altitude Hold switch Engage

Verify ALT HOLD is displayed in the pitch mode annunciator.

Flight Level Change, Climb or Descent

Altitude selector Set

Set level off altitude in the altitude window.

Flight Level Change switch Engage

Observe SPD in the pitch mode annunciator and FLCH displayed in the autothrottle mode annunciator.

IAS/MACH selector Set

Set the desired speed in the speed window.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Climb Thrust Reference Mode Select switch (if required)..... Select

If climb initiated, select climb reference N1.

VP-BMC, VP-BOY, VP-BOZ

Climb Thrust Reference Mode Select switch (if required)..... Select

If climb initiated, select climb reference EPR.

Vertical Speed, Climb or Descent

Altitude selector Set

Set level off altitude in the altitude window.

Vertical Speed switch.....Engage

Observe V/S displayed in the pitch mode annunciator.

Note: The vertical speed mode does not provide automatic low speed protection and permits flight away from selected altitude. For level-off protection, always select new level-off altitude prior to engaging vertical speed mode.

Vertical Speed selector.....Set

Set desired rate in vertical speed window.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Climb Thrust Reference Mode Select switch (if required)..... Select

If climb initiated, select climb reference N1.

VP-BMC, VP-BOY, VP-BOZ

Climb Thrust Reference Mode Select switch (if required)..... Select

If climb initiated, select climb reference EPR.

Intermediate Level Off

Altitude selector Rotate
Set desired altitude in altitude window.

At MCP altitude:

- I **VP-BDI through VQ-BOG, VQ-BRA**
Verify pitch mode annunciation is ALT HOLD.

VQ-BPT

Verify pitch mode annunciation is VNAV ALT (if VNAV engaged) or ALT HOLD (if FLCH or V/S was engaged).

To resume climb/descent:

Altitude selector Rotate
Set desired altitude in the altitude window.

If using VNAV:

- I **VP-BDI through VQ-BOG, VQ-BRA**
VNAV switch Engage
Verify pitch mode annunciation is VNAV SPD or VNAV PTH as appropriate.

VQ-BPT

Altitude selector Push
Verify pitch mode annunciation is VNAV SPD or VNAV PTH as appropriate.

If using Flight Level Change:

Flight Level Change switch Engage
Verify pitch mode annunciation is SPD and autothrottle annunciation is FLCH.

IAS/MACH selector Rotate
Set the desired speed in the IAS/MACH window.

Speed Intervention

IAS/MACH selector Push

Verify IAS/MACH window opens.

IAS/MACH selector Rotate

Set the desired speed in the IAS/MACH window.

To resume FMC speed schedule:

IAS/MACH selector Push

Verify IAS/MACH window blanks.

Autothrottle Operation

Autothrottle switch A/T ARM

VP-BMC, VP-BOY, VP-BOZ

If EPR mode desired:

Thrust Reference Mode Select switch (As desired) Select
Select desired reference EPR.

EPR switch Engage
Observe EPR displayed in the autothrottle mode annunciator.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

If N1 mode desired:

Thrust Reference Mode Select switch (As desired) Select
Select desired reference N1.

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

N1 switch Engage
Observe N1 displayed in the autothrottle mode annunciator.

VP-BWW through VQ-BMQ, VQ-BPT

THR switch Engage
Observe N1 displayed in the autothrottle mode annunciator.

If Speed mode desired:

Thrust Reference Mode Select switch (As desired) Select

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Select desired reference N1.

VP-BMC, VP-BOY, VP-BOZ

Select desired reference EPR.

Speed switch Engage
Observe SPD displayed in the autothrottle mode annunciator.

IAS/MACH selector Set
Set the desired speed in the IAS/MACH window.

Instrument Approach Using (V/S)

Pilot Flying	Pilot Monitoring
Initially - If on radar vectors - HDG SEL - Pitch mode (as needed) - If enroute to a fix - LNAV or other roll mode - VNAV or other pitch mode	
Call "FLAPS ____" according to the flap extension schedule.	Set the flap lever as directed.

Note: Autopilot use is recommended until suitable visual reference is established.

Note: If required to remain at or above the MDA(H) during the missed approach, missed approach must be initiated at least 50 feet above MDA(H).

Recommended roll modes for final approach:

- VP-BDI, VP-BMC, VP-BOZ, VP-BWW through VQ-BMQ, VQ-BPT**
- RNAV, GPS, LOC-BC, VOR or NDB approach: LNAV or HDG SEL
- VP-BOQ, VP-BOY, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA**
- LOC-BC, VOR or NDB approach: LNAV or HDG SEL (B/CRS for LOC-BC approaches)
- 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 or HDG 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.	
Approximately 2 NM before the final approach fix set the MDA(H) on the MCP.	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 speed brake lever to ARM.ED	

Before descent to MDA(H):

MCP altitude selector Set

Set the first intermediate altitude constraint or MDA(H). When the current constraint is assured, the next constraint may be set before ALT HOLD engaged to achieve continuous descent path.

If constraints or MDA(H) do not end in zero zero (00; for example, 1820), set MCP ALTITUDE window to the closest 100 foot increment below the constraint or MDA(H).

At descent point:

Pilot Flying	Pilot Monitoring
Call "FLAPS ____" as needed for landing.	Set the flap lever as directed.

V/S switch Push

Verify V/S mode annunciates.

Desired V/S Set

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Set desired V/S to descend to MDA(H). Use a V/S that results in no level flight segment at MDA(H).

Pilot Flying	Pilot Monitoring
Call "LANDING CHECKLIST."	Do the LANDING checklist.

Approximately 300 feet above MDA(H):

MCP altitude selector Set Missed Approach Altitude

At MDA(H)/Missed Approach Point:

If suitable visual reference is not established, execute missed approach.

After suitable visual reference is established:

A/P Disengage Switch Push
Disengage autopilot in accordance with regulatory requirements.

A/T Disconnect Switch Push
Disconnect the autothrottle with the autopilot.

Circling Approach

Note: Autopilot use is recommended until intercepting the landing profile.

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 Selector Set

If the MDA(H) does not end in zero zero (00; for example, 1820), set MCP ALTITUDE window to the closest 100 foot increment below the MDA(H)

Accomplish an instrument approach and establish suitable visual reference.

At MDA(H):

ALT HOLD switch (if required) Push
Enables level off at MDA(H). Verify ALT HOLD mode annunciates.

MCP altitude selector Set Missed Approach Altitude

HDG SEL Switch Push
Verify HDG SEL mode annunciates.

Before turning base or initiating the turn to base:

- Landing flaps (if not previously selected)
- Do the LANDING checklist.

Intercepting the landing profile:

Autopilot disengage switch Push

Autothrottle disconnect switch Push

Autoland Status Annunciator Test

AUTOLAND STATUS ANNUNCIATOR TEST switch 1 Push
Observe LAND 3 and NO LAND 3 in view.

AUTOLAND STATUS ANNUNCIATOR TEST switch 2 Push
Observe LAND 2 and NO AUTOLND in view.

Autoland Status Annunciator Reset

AUTOLAND STATUS ANNUNCIATOR
PUSH/RESET switch Push

Note: Flight in turbulence can cause a NO LAND 3 annunciation that does not reset. If this occurs during climb, cruise, or descent before selecting APP, disengage the autopilot and turn off both flight directors before resetting the ASA. The flight directors can then be turned back on and the autopilot re-engaged.

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**Supplementary Procedures**
Communications**Chapter SP**
Section 5**Cockpit Voice Recorder Test****VP-BDI through VP-BOY, VP-BWW, VP-BWX, VQ-BOG**

Voice Recorder Test switch Push

Observe STATUS light is illuminated (extinguishes after one second). A tone may be heard with a headset plugged into the headset jack on the voice recorder panel.

VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

Voice Recorder Test switch Push

Push and observe monitor indicator needle to be in the green band. A tone may be heard with headset plugged into headset jack. Test will last approximately 5 seconds.

Aircraft Communications Addressing and Reporting System (ACARS)

VP-BDI through VP-BOQ, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

The following procedures are applicable to the noted ACARS functions from the company pages.

Pre-Departure Clearance

The flight crew shall manually verify (compare) the filed flight plan versus the digital pre-departure clearance and shall initiate voice contact with Air Traffic Control if any question/confusion exists between the filed flight plan and the digital pre-departure clearance.

Digital-Automatic Information Service (D-ATIS)

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 and alpha values are different, the flight crew must not accept the D-ATIS altimeter setting.

Oceanic Clearances

The flight crew shall manually verify (compare) the filed flight plan versus the digital oceanic clearance and shall initiate voice contact with Air Traffic Control if any question/confusion exists between the filed flight plan and the digital oceanic clearance.

Weight and Balance

The flight crew shall verify the Weight and Balance numeric and alphabetical values are identical. If the Weight and Balance numeric and alphabetical values are different, the flight crew must not accept the Weight and Balance data.

Takeoff Data

The flight crew shall verify the Takeoff Data numeric and alphabetic values are identical. If the Takeoff Data numeric and alphabetic values are different, the flight crew must not accept the Takeoff Data message.



Supplementary Procedures

Electrical

Chapter SP

Section 6

Electrical Power Up

The following procedure is accomplished to permit safe application of electrical power.

Battery switch ON

Standby Power selector AUTO

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

Verify APU BAT DISCH and MAIN BAT DISCH lights illuminated and standby bus OFF light extinguishes.

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG

Verify battery DISCH light illuminated and standby bus OFF light extinguishes.

Hydraulic Electric Primary Pump switches Off

Hydraulic Demand Pump switches Off

Landing Gear Lever DN

Alternate Flaps selector NORM

Electrical Power Establish

Bus Tie switches AUTO

If external power is desired:

If External Power AVAIL light is illuminated:

External Power switch Push

If APU power is desired:

APU Generator switch ON

APU selector START, then ON

Position the APU selector back to the ON position. Do not allow the APU selector to spring back to the ON position.

Electrical Power Down

The following flight deck procedures are accomplished to permit removal of electrical power from the airplane.

APU selector/External Power switch Off

When APU RUN light extinguishes:

Standby Power selector OFF

Battery switch OFF

Operation With Less Than 90 KVA External Power Source

When external power source is less than required (90 KVA), airplane electrical loads must be minimized by supplementing normal procedures as follows:

Before Start Procedure

Accomplish normal exterior Inspection, Preflight Procedure – First Officer, Preflight Procedure – Captain and Before Start Procedure through “Start Clearance.....Obtain”.

Confirm cargo loading complete.

Utility Bus switches OFF

Hydraulic System Set

Demand Pump selector (right) AUTO

Observe PRESS light extinguished.

Fuel Pump switches (one left and one right main wing) ON

Observe PRESS lights extinguished.

Note: Delay activation of the remaining hydraulic and fuel pumps, setting trim and checking flight controls until after engines are started.

Complete the normal Before Start and Engine Start procedures.

Before Taxi Procedure

Hydraulic System	Set
Electric Primary Pump switches (both)	ON
Demand Pump selectors (remaining pumps)	AUTO
Utility Bus switches	ON
Fuel Pump switches (remaining pumps)	ON
Position switches ON for all tanks containing fuel.	
Trim	Set
Flight controls	Check

Displace control wheel and control column to full travel in both directions and verify:

- freedom of movement
- controls return to center
- proper flight control movement on EICAS status display.

Hold the nose wheel steering tiller during rudder check to prevent undesired nose wheel movement.

Displace rudder pedals to full travel in both directions and verify:

- freedom of movement
- rudder pedals return to center
- proper flight control movement on EICAS status display.

Complete normal Before Taxi procedure.

Shutdown Procedure

After park brake is set and prior to establishing external power:

Hydraulic System	Set
Electric Primary Pump switches (both)	OFF
Demand Pump selectors (All)	OFF
Fuel Pump switches	OFF

Accomplish normal Shutdown procedure.

Standby Power Test

Airplane must be on ground with all busses powered.

Standby Power Selector BAT

I

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG

Observe battery DISCH light illuminates and standby power
OFF light remains extinguished.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

Observe APU BAT DISCH and MAIN BAT DISCH lights
illuminate and standby power OFF light remains extinguished.

Standby Power Selector AUTO

I

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG

Observe battery DISCH light extinguishes and standby power
OFF light remains extinguished.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

Observe APU BAT DISCH and MAIN BAT DISCH lights
extinguish and standby power OFF light remains extinguished.

Transfer From External Power To APU Power

Prior to disconnecting external power:

External Power switch Push

Observe ON light extinguish.

Hydraulic Generator Test

Electrical and pneumatic power must be established on the airplane.

Center 1/2 Electric Primary Pump Switches OFF
Center Air Demand Pump Selector AUTO
EICAS Status Display ON
Hydraulic Generator Test Switch HYD GEN

While holding the test switch in the HYD GEN position, verify the HYD GEN ON and HYD GEN VAL Status messages appear on EICAS, and Captain ADI and HSI are powered with no flags displayed. The HYD GEN ON and HYD GEN VAL messages should no longer be displayed when the test switch is released.

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Supplementary Procedures

Engines, APU

Chapter SP

Section 7

Engines

Engine Crossbleed Start

The APU must be shut down or the APU bleed air switch must be OFF

Check that the area behind the airplane is clear

Engine Bleed Air switch (operating engine) ON

Advance thrust on operating engine to approximately 70% N2 and accomplish normal Engine Start procedure

Engine Ground Pneumatic Start

Check duct pressure 30 psi or greater

Start engine using normal Engine Start procedure

Reduced Thrust Selection Prior To Takeoff

VP-BMC through VQ-BMQ, VQ-BPT, VQ-BRA

If reduced takeoff thrust desired:

Assumed Temperature Set

Rotate assumed temperature selector clockwise and set desired temperature value or enter required temperature on Takeoff Reference page

Observe D-TO displayed in green on the EICAS

If reduced climb thrust desired:

Thrust Reference Mode Select switch 1 or 2

Select desired climb thrust reference; 1 or 2

Observe TO 1 or TO 2 (D-TO 1 or D-TO 2 for an assumed temperature derated takeoff) displayed on the EICAS in green for the TO or D-TO and in white for the numerals 1 or 2

Reduced Thrust Selection Prior To Takeoff

I VP-BDI, VQ-BMU, VQ-BOG

If both reduced takeoff thrust and reduced climb thrust desired:

Thrust Reference Mode Select switch 1 or 2

Select desired thrust reference; 1 or 2

CLB 1 or CLB 2 is preselected

Observe TO 1 or TO 2 displayed in green on the EICAS

If additional takeoff thrust reduction desired:

Assumed Temperature Set

Rotate assumed temperature selector clockwise and set desired temperature value or enter temperature on Takeoff Reference page

CLB 1 or CLB 2 is preselected

Observe D-TO 1 or D-TO 2 displayed in green on the EICAS

If only reduced takeoff thrust desired:

Assumed Temperature Set

Rotate assumed temperature selector clockwise and set desired temperature value or enter temperature on Takeoff Reference page

Observe D-TO displayed in green on the EICAS

Reduced Takeoff Thrust Change or Cancellation

VP-BMC through VQ-BMQ, VQ-BPT, VQ-BRA

If change desired:

Assumed Temperature Set

Enter new temperature value on Takeoff Reference page

If cancellation desired:

Thrust Reference Mode Select switch As desired

Select desired thrust reference mode; TO/GA, CLB, CON or
CRZ

Observe associated mode displayed

Note: If full takeoff thrust desired during takeoff following 80
knots (autothrottle in THR HOLD mode) thrust levers must
be adjusted manually.

Reduced Takeoff Thrust Change or Cancellation

VP-BDI, VQ-BMU, VQ-BOG

If change desired:

Accomplish “Reduced Thrust Selection Prior To Takeoff” procedural
steps

If cancellation desired:

Thrust Reference Mode Select switch As desired

Select desired thrust reference mode; TO/GA, CLB, CON or
CRZ

Observe associated mode displayed

Note: If full takeoff thrust desired during takeoff following 80
knots (autothrottle in THR HOLD mode) thrust levers must
be adjusted manually.

Reduced Climb Thrust Change or Cancellation

VP-BMC through VQ-BMQ, VQ-BPT, VQ-BRA

If change desired:

- Thrust Reference Mode Select switch 1 or 2
- Select desired climb thrust reference; 1 or 2
- Observe CLB 1 or CLB 2 (TO 1 or TO 2; ground only) displayed

If cancellation desired:

- Thrust Reference Mode Select switch 1 or 2
- Push switch associated with current thrust reduction
- Observe CLB or TO (ground only) displayed

Note: If preselected reduced climb thrust is changed or cancelled and reduced takeoff thrust is still desired, reduced takeoff thrust must be reselected.

Reduced Climb Thrust Change or Cancellation

I VP-BDI, VQ-BMU, VQ-BOG

If change desired:

- Thrust Reference Mode Select switch 1 or 2
- Select desired climb thrust reference; 1 or 2
- Observe CLB 1 or CLB 2 (TO 1 or TO 2; ground only) displayed

If cancellation desired:

- Thrust Reference Mode Select switch 1 or 2
- Push switch associated with current thrust reduction
- Observe CLB or TO (ground only) displayed

Reduced Climb Thrust Selection In-flight

- Thrust Reference Mode Select switch CLB
- Observe CLB displayed

- Thrust Reference Mode Select switch 1 or 2
- Select desired thrust reference; 1 or 2
- Observe CLB 1 or CLB 2 displayed



Supplementary Procedures

Fire Protection

Chapter SP

Section 8

Engine, APU and Cargo Fire/Overheat Test

Engine/APU/Cargo Fire/Overheat Test switch Push

Observe the fire bell ring intermittently

Observe the following lights illuminate:

Discrete FIRE warning

Fuel control switches

L and R ENG OVHT

LEFT, RIGHT and APU fire switches

FWD and AFT cargo fire

Master Warning

Observe the following EICAS messages:

APU FIRE warning

FWD and AFT CARGO FIRE warning

L and R ENGINE FIRE warning

L and R ENG OVHT caution

Wheel Well Fire Detection Test

Wheel Well Fire Test switch Push

Observe the fire bell ring intermittently

Observe the following lights illuminate:

Discrete FIRE warning

WHL WELL FIRE

Master Warning

Observe the following EICAS message:

WHEEL WELL FIRE warning

Intentionally
Blank



Supplementary Procedures

Flight Instruments, Displays

Chapter SP

Section 10

Flight Recorder Test

Flight Recorder switch Test
Observe OFF light extinguish.

Heading Reference Switch Operation

Use TRUE when operating in a region where true referencing is needed.
Use NORM in all other regions.

HDG REF switch NORM or TRUE

Note: If using HDG SEL mode and the HDG REF switch position is changed, the AFDS roll mode will change to HDG HOLD.
HDG SEL can be reselected.

Note: If the HDG REF switch position must be changed for an approach, it must be changed before the LOC or APP switch is pushed to arm LOC mode.

If the HDG REF switch position is changed after LOC mode is armed:

- The AFDS roll mode will not change from HDG SEL to HDG HOLD
- The AFDS will not follow the MCP-selected heading
- LOC capture and tracking performance may be degraded
- Exiting the LOC mode restores normal operation of the HDG REF switch and the AFDS. LOC 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.

Altimeters Set

Set primary and standby altimeters to QFE when below transition altitude/level.

Note: If the QFE altimeter setting is beyond the range of the altimeters, QNH procedures must be used with QNH set in the altimeters.

Landing Altitude Indicator Set at Zero

(SB Deletes VP-BDI with updated enhanced GPWS computers.)

GROUND PROXIMITY TERRAIN OVERRIDE switch OVRD

**Transponder Test (TCAS equipped airplanes)**

This procedure requires the IRSs to be aligned and in NAV mode.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

TCAS Test switch Push

VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT

Verify: "TCAS TEST" aural sounds, and "TCAS TEST PASS" aural sounds.

VP-BRL, VQ-BOG

Verify "TCAS SYSTEM TEST OK" aural sounds.

VP-BMC, VP-BOY, VP-BOZ, VQ-BRA

Transponder Mode selector TEST

VP-BOY, VP-BOZ

Verify "TCAS TEST" aural sounds, and "TCAS TEST PASS" aural sounds.

VP-BMC, VQ-BRA

Verify "TCAS SYSTEM TEST OK" aural sounds.

Weather Radar Test

I **VP-BDI, VP-BMC, VQ-BOG**
Weather Radar Mode Any mode other than TEST

I **VP-BOQ through VQ-BMU, VQ-BPT, VQ-BRA**
Weather Radar Mode TEST
HSI Mode selector MAP
Weather Radar switch ON

I **VP-BDI, VP-BMC, VQ-BOG**
Weather Radar Mode TEST
Observe radar test pattern on HSI.

VP-BWW, VP-BWX, VQ-BMU

Note: If the airplane is on the ground and the thrust levers are not advanced for takeoff, the WXR tests the predictive windshear system (PWS) indications. These include the WINDSHEAR SYS EICAS advisory, the PWS caution, and PWS warning. Deactivating WXR on the EFIS control panel will not discontinue the test and can result in automatic WXR activation on both pilot displays. The PWS test lasts approximately 15 seconds.

I **VP-BDI, VP-BMC, VQ-BOG**
Note: If the airplane is on the ground and the thrust levers are not advanced for takeoff, the WXR tests the predictive windshear system (PWS) indications. These include the WINDSHEAR SYS EICAS advisory, the PWS caution, and PWS warning. Deactivating WXR on the EFIS control panel will discontinue the test. The PWS test lasts approximately 15 seconds.

Weather Radar switch OFF
Select captain's and first officer's weather radar displays off.

Weather Radar Mode As desired

IRS

Align Lights Flashing

Do not move IRS Mode selector to OFF except where called for in procedure.

POS INIT page Select

Set IRS Position Enter Present Position

Enter present position using most accurate latitude and longitude available. If a position is already displayed on the SET IRS POS line, enter new position over displayed position.

If ALIGN light continues to flash:

Set IRS Position Enter Present Position

Re-enter same present position.

If ALIGN light continues to flash after re-entry:

IRS OFF

Rotate IRS Mode selector to OFF and verify ALIGN light extinguished.

Note: Light must be extinguished before continuing with procedure (approximately 30 seconds).

IRS NAV

Rotate IRS Mode selector to NAV and verify ALIGN light illuminated.

Set IRS Position Enter

Enter present position in boxes. If ALIGN light flashes, re-enter same present position over displayed position.

Note: Approximately ten minutes is required for realignment.

If ALIGN light continues to flash, maintenance action is required.



Fast Realignment

If the combined operating time from the last full IRS alignment to the expected next destination arrival time does not exceed 18 hours, a fast realignment may be accomplished.

IRS Mode selectors ALIGN

CDU Set

Enter present position on SET IRS POSITION line of Position Initialization page.

IRS Mode selectors NAV

High Latitude Alignment

This procedure applies to alignment at latitudes greater than 70°12.0' and less than 78°15.0'.

IRS Mode selectors OFF, then ALIGN

POS INIT page Set

Enter present position on SET IRS POS line using the most accurate latitude and longitude available.

IRS Mode selectors NAV

Select NAV after remaining in ALIGN for 17 minutes minimum.
Verify ALIGN lights extinguished.

Position Entry Using IRS Mode Selector Panel

Latitude Enter

Begin with N or S, followed by latitude including trailing zeros, i.e., N003°30.0' entered as N3300.

Longitude Enter

Begin with E or W, followed by longitude including trailing zeros, i.e., E001°11.0' entered as E1110.

Lateral Navigation

Alternate Route Entry/Activation

Desired RTE page 1 Select

If desired route (1 or 2) not displayed, select desired route.

Route (if required) Enter

Enter route using preflight procedure.

ACTIVATE Select

If in-flight, use DIRECT TO or INTC LEG TO boxes to enter desired course from present position to new route.

EXEC key Push

Direct To A Waypoint Using Direct Intercept

VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

DIR INTC key Push

Direct To Waypoint Enter

Enter waypoint in the DIR/INTC boxes.

Note: If waypoint not previously in route, a discontinuity occurs.

Waypoint Sequence Check

Enter waypoints in desired sequence.

VP-BOZ, VQ-BRA

Note: If Direct-To waypoint is an existing downstream waypoint with one or more preceding waypoints; and step climb altitudes are assigned to any of those preceding waypoints; and the ABEAM PTS function is selected: delete the step climb altitude(s) before executing the Direct-To route modification.

Step climb altitude(s) may be reentered, if appropriate, on the abeam waypoints after the Direct-To modification is complete.

EXEC key Push

Direct To A Waypoint Using Overwrite

RTE LEGS page Select

Desired Waypoint Enter

Enter the desired waypoint over the active waypoint.

Waypoint Sequence Check

Enter waypoints in desired sequence.

VP-BOZ, VQ-BRA

Note: If Direct-To waypoint is an existing downstream waypoint with one or more preceding waypoints; and step climb altitudes are assigned to any of those preceding waypoints; and the ABEAM PTS function is selected: delete the step climb altitude(s) before executing the Direct-To route modification.

Step climb altitude(s) may be reentered, if appropriate, on the abeam waypoints after the Direct-To modification is complete.

EXEC key Push

Estimate For Alternate

PROGRESS page 1 Select

Desired Destination Enter

Note: Estimates displayed are for present position direct.

Holding Pattern Entry

Holding fix must be a route waypoint or present position before accomplishing following steps.

HOLD key Push

NEXT HOLD (if displayed)..... Select

Holding Fix Enter

To hold at present position, select PPOS. To hold at waypoint, enter waypoint identifier in HOLD AT boxes.

HOLD page Check

EXEC key Push

Holding Pattern Exit

To exit holding accomplish the following procedure or refer to one of the "Direct to a Waypoint" procedures.

EXIT HOLD Select

EXEC key Push

Intercept A Leg Or Course To A Waypoint Using Direct Intercept

VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

DIR INTC key Push

Desired Waypoint Enter

Enter waypoint in the DIR/INTC boxes.

Note: If waypoint not previously in route, a discontinuity occurs.

If waypoint was previously in route, the inbound course is set to same inbound great circle course. For airways, displayed course may not be identical to charted value.

If inbound course not correct:

Intercept Course Enter

VP-BOZ, VQ-BRA

Enter course desired at waypoint into INTC CRS boxes (or over existing intercept course to value if waypoint was already in route).

VP-BOQ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT

Enter course desired at waypoint into INTC CRS TO boxes (or over existing intercept course to value if waypoint was already in route).

EXEC key Push

Waypoint Sequence Check

Enter waypoints in desired sequence.

EXEC key Push

If necessary, use Heading Select mode to change intercept heading. Then, arm LNAV mode.

Intercept A Leg Or Course To A Waypoint Using Overwrite

RTE LEGS page Select

Desired Waypoint Enter

Enter the desired waypoint over the active waypoint.

Note: If waypoint not previously in route, a discontinuity occurs.

If waypoint was previously in route, the inbound course is set to same inbound great circle course. For airways, displayed course may not be identical to charted value.

If inbound course not correct:

Intercept Course Enter

VP-BOZ, VQ-BRA

Enter course desired at waypoint in INTC CRS boxes (or over existing intercept course to value if waypoint was already in route).

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Enter course desired at waypoint in INTC CRS TO boxes (or over existing intercept course to value if waypoint was already in route).

EXEC key Push

Waypoint Sequence Check

Enter waypoints in desired sequence.

EXEC key Push

If necessary, use Heading Select mode to change intercept heading. Then, arm LNAV mode.

Lateral Offset

RTE page Select

Offset Enter

Enter desired offset direction and distance over OFFSET dashes.

EXEC key Push

To remove offset, accomplish Direct To procedure or enter "0" in OFFSET line.

Leg Modification

To modify active waypoint or leg, accomplish one of the Direct To or Intercept A Leg Or Course procedures except when entering along track waypoints.

RTE LEGS page Select

To change waypoint sequence:

Desired Waypoint Sequence Enter

Note: If waypoint not previously in route a discontinuity occurs except when entering along track waypoints.

EXEC key Push

To delete a waypoint at end of route:

DEL key Push

Waypoint Select

EXEC key Push

To enter along track waypoints:

Along Track Displacement Enter

Select reference waypoint to scratch pad and modify for desired displacement.

Reference Waypoint Select

The FMC will automatically position the created waypoint to the appropriate position.

EXEC key Push

Route Removal

RTE page 1 Select

Origin Enter

If EXEC key illuminates:

EXEC key Push



SID Change Or Runway Change

This entire procedure must be accomplished when a SID is used and the runway or SID is changed. This will prevent the possibility of incorrect routing or inadequate obstacle clearance.

DEPARTURES page Select
Runway Reselect
SID Reselect
Transition (if required) Reselect
RTE LEGS page Select
Waypoint Sequence and Altitudes Check
 Modify as necessary to agree with clearance.
EXEC key Push

STAR, Profile Descent Or Approach Change

Associated airport must be entered as route origin or destination.

ARRIVALS page Select
STAR or Profile Descent (if required) Select
Transition (if required) Select
Approach Select
Approach Transition (if required) Select
RTE LEGS page Select
Waypoint Sequence and Altitudes Check
 Modify as necessary to agree with clearance.
EXEC key Push

Vertical Navigation

Climb, Cruise Or Descent Speed Schedule Change

CLB or CRZ or DES page Select

To change schedule:

Desired Schedule Select

To enter fixed speed schedule:

Desired Speed Enter

Enter speed on ECON/SEL SPD line (line 2L).

EXEC key Push

Climb Or Descent Direct To MCP Altitude

This procedure deletes all waypoint altitude constraints between current airplane altitude and altitude set in MCP.

Altitude Window Set

CLB or DES page Select

CLB DIR or DES DIR Select

EXEC key Push

Cruise Altitude Change

VQ-BPT

Altitude Window Set

Altitude selector Push

Cruise Altitude Change

VP-BDI through VQ-BOG, VQ-BRA

Altitude Window Set

CRZ page Select

Cruise Altitude Enter

EXEC key Push



Speed/Altitude Constraint At Waypoint

RTE LEGS page Select

To enter or modify constraint:

Speed/Altitude Enter

Note: Speed entry requires "/" mark and altitude.

EXEC key Push

To delete constraint:

DEL key Push

Speed/Altitude Select

Select undesired constraint and observe estimated values appear.

EXEC key Push

Speed/Altitude Transition And Restriction

CLB or DES page Select

To enter speed/altitude restriction:

Speed/Altitude Enter

EXEC key Push

To delete speed/altitude restriction or transition:

DEL key Push

Speed/Altitude Select

EXEC key Push



Temporary Altitude Restriction

Altitude Window Set

To resume climb or descent:

Altitude Window Set

VQ-BPT

Altitude selector Push

VP-BDI through VQ-BOG, VQ-BRA

VNAV Engage

Temporary Speed Restriction

IAS/MACH selector Push

Speed Window Set

To resume FMC speed schedule:

IAS/MACH selector Push



Performance Data Entries

Descent Forecast

DES page	Select
DESCENT FORECAST page	Select
Transition Level	Check
Thermal Anti-ice On Altitude (if required)	Enter
Wind Altitude	Enter
Enter altitude over dashes on left.	
Wind Direction/Speed	Enter

Step Climb Evaluation

CRZ page	Select
Step to Altitude	Enter
Savings	Check

Waypoint Winds

RTE LEGS page	Select
RTE DATA page	Select
WINDS page	Select
Altitude and Wind	Enter
EXEC key	Push

Additional CDU Functions

Data Link Request

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

For Pegasus FMC

FMC COMM page Select

Desired page Select

Request send Select

Fix Page Entries

FIX page Select

Fix Identifier Enter

Bearing or Distance From Fix Enter

Enter desired bearing or distance or select ABEAM.

Note: Bearing/distance from fix may be used as route waypoint.

HSI Plan Mode Control

HSI Mode PLAN

RTE LEGS page Select

Map Center Step Select



Navaid Inhibit

To inhibit use of radio navigation aids for position updates:

- INIT REF page Select
- INDEX page Select
- NAV DATA page Select
- Navaid Identifier Enter

To inhibit use of the navaid:

- NAVAID INHIBIT line Enter

To inhibit use of the VOR only:

- VOR ONLY INHIBIT line Enter

To inhibit use of all VORs:

- VP-BOZ, VQ-BRA**
VOR/DME NAV INHIBIT prompt Select
ALL is displayed in the VOR ONLY INHIBIT line and the
prompt changes to ENABLE.
- VP-BDI through VP-BOY, VP-BRL through VQ-BPT**
VOR/DME NAV OFF/ON prompt Select
ALL is displayed in the VOR ONLY INHIBIT line and OFF
is displayed in large font.

Radio Update Purge

VP-BOZ, VQ-BRA

- INIT REF page Select
- INDEX page Select
- POS Page 2/3 Select
- RADIO UPDATE PURGE Select
- CONFIRM Select



Update Active Navigation Database

The navigation database can be changed only on the ground. Changing the database removes all previously entered route data.

INIT REF Select

IDENT page Enter

Inactive Date line Enter

Transfers inactive date range to scratchpad

Active Date line Enter

Transfers inactive database line to active database line. Transfers active database line to the inactive database line.

Intentionally
Blank

**Supplementary Procedures****Chapter SP****Fuel****Section 12**

Fuel Balancing

If an engine fuel leak is suspected:

Accomplish the FUEL LEAK ENGINE checklist

Note: Fuel pump pressure should be supplied to the engines at all times. At high altitude, without fuel pump pressure, thrust deterioration or engine flameout may occur.

When the fuel quantities in left main and right main tanks differ by an appreciable amount:

Crossfeed switches (both) ON

Fuel pump switches (low quantity tank) OFF

When fuel load balanced:

Fuel pump switches ON

Crossfeed switches (both) OFF

Fuel Quantity Test

Fuel Quantity Test switch FUEL QTY

Observe FUEL CONFIG light illuminate and LOW FUEL message display

Observe fuel quantity indicators display all eights (8) except initial digit in total fuel quantity indicator which displays one (1). Observe fuel temperature indicator display -188 degrees Centigrade.

Intentionally
Blank



Supplementary Procedures

Warning Systems

Chapter SP

Section 15

EICAS Test

This procedure requires the airplane to be on the ground and parking brake set.

EICAS Test switch Push

Wait 5 seconds and switch to L then R.

Observe TEST OK message displayed on CRTs in both positions.

Note: Standby engine indications will be displayed during test and siren aural will sound.

EICAS Test switch Push

Event Record

Event Record switch Push

Use as directed by Flight Operations for maintenance analysis or at the discretion of the captain to manually record parameters for a suspect condition.

Landing Configuration Warning Test

Configuration Test switch LDG

Observe CONFIG light illuminate and GEAR NOT DOWN message display.

Stall Warning Test

L Stall Warning Test switch STALL
Observe control columns vibrate.

R Stall Warning Test switch STALL
Observe control columns vibrate.

L and R Stall Warning Test switches STALL
Observe both stall warning systems vibrate control columns and
also move control columns forward.

Note: A minimum of one hydraulic system must be pressurized for
proper verification of the control column nudger.

Takeoff Configuration Warning Test

Establish one or more of the following conditions:

Flaps not in takeoff position

Speedbrakes not down

Stabilizer units set greater than green band

Park brake set

Configuration Test switch T/O
Observe CONFIG light illuminate, and appropriate configuration
warning message(s) display.

Establish appropriate configuration.



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:

VP-BDI, VQ-BMU, VQ-BOG

- 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.

VP-BDI, VQ-BMU, VQ-BOG

- 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.

VP-BMC through VQ-BMQ, VQ-BPT, VQ-BRA

- 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.

VP-BMC through VQ-BMQ, VQ-BPT, VQ-BRA

- 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).

Cold Weather Operations

Considerations associated with cold weather operation are primarily concerned with low temperatures and with ice, snow, slush and standing water on the airplane, ramps, taxiways, and runways.

Icing conditions exist when OAT (on the ground) or TAT (in-flight) is 10°C or below and any of the following exist:

- visible moisture (clouds, fog with visibility of one statute mile (1600 m) or less, due to meteorological conditions such as rain, snow, sleet, ice crystals), or
- ice, snow, slush or standing water is present on the ramps, taxiways, or runways.

CAUTION: Do not use engine anti-ice when OAT (on the ground) is above 10°C. Do not use engine or wing anti-ice when TAT (in-flight) is above 10°C.

Exterior Inspection

Although removal of surface snow, ice and frost is normally a maintenance function, during preflight procedures, the captain or first officer should carefully inspect areas where surface snow, ice or frost could change or affect normal system operations.

Do the normal Exterior Inspection with the following additional steps:

Surfaces Check

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/static probes and static ports Check

Verify that all pitot/static probes and static ports are free of snow and ice. Water rundown after snow removal can 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.

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-
- Air conditioning inlets and exits Check
 Verify that the air inlets and exits, including the outflow valve, 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:

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

- If the engine has been cold soaked for more than 4 hours at ambient temperatures below -30°C, do not start or motor the engine. Maintenance personnel should do appropriate procedures for adverse weather heating of the engine fuel system components.
- Oil pressure can be slow to rise
- Initial oil pressure rise can be higher than normal
- Additional warm-up time can be needed to allow oil temperature to reach the normal range



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 can 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:

I	VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA		
	ENGINE ANTI-ICE switches	ON	F/O
	VP-BWW through VQ-BMQ, VQ-BPT		
	ENGINE ANTI-ICE selectors	ON	F/O

When engine anti-ice is no longer needed:

I	VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA		
	ENGINE ANTI-ICE switches	OFF	F/O
	VP-BWW through VQ-BMQ, VQ-BPT		
	ENGINE ANTI-ICE selectors	OFF	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 lever Set 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 can 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.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Run-up to a minimum of 60% N1 for approximately 30 seconds duration at intervals no greater than 30 minutes.

VP-BMC, VP-BOY, VP-BOZ

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 15 minutes.

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.

If de-icing / anti-icing is needed:

Call “FLAPS UP”. C

Flaps UP F/O
Prevents ice and slush from accumulating in flap cavities during de-icing.

Thrust levers Idle C
Reduces the possibility of injury to personnel at inlet or exhaust areas.

Engine BLEED air switches OFF F/O
Reduces the possibility of fumes entering the air conditioning system.

APU BLEED air switch OFF F/O
Reduces the possibility of fumes entering the air conditioning system.

After de-icing / anti-icing is completed:

Wait approximately one minute after de-icing is completed to turn BLEED air switches on to ensure all de-icing fluid has been cleared:

Engine BLEED air switches ON F/O

APU BLEED air switch ON 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 of exterior de-icing / anti-icing.

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:

PF

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Run-up to a minimum of 60% N1 for approximately 30 seconds duration and confirm stable engine operation before the start of the takeoff roll.

VP-BMC, VP-BOY, VP-BOZ

Run-up to a minimum of 50% N1 and confirm stable engine operation before the start of the takeoff roll.

Engine Anti-ice Operation - In-flight

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Engine anti-ice must be ON during all flight operations when icing conditions exist or are anticipated, except when the temperature is below -40°C SAT.

VP-BWW through VQ-BMQ, VQ-BPT

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.

VP-BMC through VP-BRL, VQ-BMU, VQ-BRA

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.

VP-BDI, VQ-BOG

WARNING: Do not rely on airframe visual icing cues or illumination of the ICING light before activating engine anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

CAUTION: Do not use engine anti-ice when TAT is above 10°C.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

When engine anti-ice is needed:

ENGINE ANTI-ICE switches ON PM

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE switches OFF PM

Manual Use of Engine Anti-ice

VP-BWW through VQ-BMQ, VQ-BPT

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

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

CAUTION: Avoid prolonged operation in moderate to severe icing conditions.

If moderate to severe icing conditions are encountered:

During flight in moderate to severe icing conditions for prolonged periods with N1 settings at or below 70%, or if fan icing is suspected due to high engine vibration, increase thrust on one engine at a time to a minimum of 70% N1 for 10 to 30 seconds every 10 minutes.

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.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

The wing anti-ice system may be used as a de-icer or anti-icer in flight only. The primary method is to use it as a de-icer by allowing ice to accumulate before turning wing anti-ice on. This procedure provides the cleanest airfoil surface, the least possible runback ice formation, and the least thrust and fuel penalty. Normally it is not necessary to shed ice periodically unless extended flight through icing conditions is necessary (holding).

VP-BWW through VQ-BMQ, VQ-BPT

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.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

The secondary method is to select the WING ANTI-ICE switch ON when wing icing is possible and use the system as an anti-icer.

VP-BWW through VQ-BMQ, VQ-BPT

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.

CAUTION: Do not use wing anti-ice when TAT is above 10°C.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

When wing anti-ice is needed:

WING ANTI-ICE switch ON PM

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

When wing anti-ice is no longer needed:

WING ANTI-ICE switch OFF PM

Manual Use of Wing Anti-ice

VP-BWW through VQ-BMQ, VQ-BPT

When manual use of wing anti-ice is needed:

WING ANTI-ICE selector ON PM

When manual use of wing anti-ice is no longer needed:

WING ANTI-ICE selector AUTO or OFF PM

Airframe Buffet on Approach in Icing Conditions

Note: Operations in icing conditions have resulted in rare occurrences of higher than normal airframe buffet upon selection of landing flaps. No flight crew action is needed..

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:

- no corrections are needed for reported temperatures above 0°C or if the airport temperature is at or above the minimum published temperature for the procedure being flown
- do not correct altimeter barometric reference settings
- ATC assigned altitudes or flight levels should not be adjusted for temperature when under radar control
- corrections apply to QNH and QFE operations
- 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
- subtract the elevation of the altimeter barometric reference setting source (normally the departure or destination airport elevation) from the published minimum altitude to be flown to determine “height above altimeter reference source”

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- 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.

Altitude Correction Table - Heights and Altitudes in Feet

Airport Temp °C	Height Above Altimeter 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 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 to less than flaps 20 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:

I	VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA		
	ENGINE ANTI-ICE switches	ON	F/O
	VP-BWW through VQ-BMQ, VQ-BPT		
	ENGINE ANTI-ICE selectors	ON	F/O

When engine anti-ice is no longer needed:

I	VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA		
	ENGINE ANTI-ICE switches	OFF	F/O
	VP-BWW through VQ-BMQ, VQ-BPT		
	ENGINE ANTI-ICE selectors	OFF	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.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Run-up to a minimum of 60% N1 for approximately 30 seconds duration at intervals no greater than 30 minutes.

VP-BMC, VP-BOY, VP-BOZ

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 15 minutes.

Secure Procedure

Do the following steps after completing the normal Secure Procedure:

If the airplane will be attended, do the normal Secure Procedure with the following modification:

PACK CONTROL selectors 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:

Cabin altitude mode selector MAN F/O

Cabin altitude manual control DESCEND F/O

Position the outflow valve fully closed to inhibit the intake of snow or ice.

Wheel chocks Verify in place C or F/O

Parking brake Released C

Reduces the possibility of frozen brakes.

Cold weather maintenance procedures for securing the airplane may be required. These procedures are found in the approved Aircraft Maintenance Manual.

Hot Weather Operation

During ground operation the following considerations will help keep the airplane as cool as possible:

- If a ground source of conditioned air is available, the supply should be plugged in immediately after engine shutdown and should not be removed until either the APU or the engines are started.
- If a ground source of conditioned air is not available, use both air conditioning packs and recirculation fans.
- Keep all doors and windows, including cargo doors, closed as much as possible.
- Electronic components which contribute to a high temperature level in the flight deck should be turned off while not in use.
- Open all passenger cabin gasper outlets and close all window shades on the sun-exposed side of the passenger cabin.
- Open all flight deck air outlets.

Note: If only a ground source of conditioned air is supplied (no bleed air from the APU or ground external air), then TAT probes are not aspirated. Because of high TAT probe temperatures, the FMCs or TMSP 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

VP-BDI through VQ-BPT

(SB Adds VQ-BRA to limit engine deceleration to approach idle with continuous ignition selected, with Boeing Service Bulletin 767-73-0043 incorporated on GE FADEC CF6 80C2 engines, or Boeing Service Bulletin 767-73-0044 incorporated on PW 4000 engines.)

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 also be avoided.

When flight in or near heavy rain, hail or sleet is encountered or anticipated, accomplish the following:

Engine Start selectors CONT

[This selection maintains a minimum thrust setting of approach idle and provides continuous ignition.]

Moderate to Heavy Rain, Hail or Sleet

(SB Deletes VQ-BRA when equipped with electronic engine controls which limit engine deceleration to approach idle with continuous ignition selected.)

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 also be avoided.

Operation in a Sandy or Dusty Environment

The main hazards of a sandy or dusty environment are erosion (especially of engine fan blades), accumulation of sand or dust on critical surfaces and blockage. The effects of sand ingestion occur predominantly during takeoff, landing and taxi operations. The adverse effects, however, can occur if the airplane's flight path was through a cloud of visible sand or dust, or the airplane was parked during a sand or dust storm. Premature engine deterioration can result from sand or dust ingestion, causing increased fuel burn and reduced EGT margins.

CAUTION: After a sandstorm, if all taxiways and runways are not carefully inspected and swept for debris before flight ops are conducted, the risk of engine damage and wear is increased.

Exterior Inspection

Although removal of sand and dust contaminants is primarily a maintenance function, during the exterior inspection the captain or first officer should carefully inspect areas where accumulation of sand or dust could change or affect normal system operations.

Do the normal Exterior Inspection with the following additional steps:

Windshield Check

Verify that the windshield has been cleaned.

Note: Do not use windshield wipers for sand or dust removal.

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.

Air conditioning inlets and exits Check

Verify that the left and right ram air inlets are free of sand and dust.
Verify that the cabin pressure outflow valve and both positive pressure relief valves are free of sand and dust.

Leading edge flaps Check

Verify that all leading edges are undamaged.

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Engine inlets Check

Verify that the inlet cowling is free of sand and dust.

Verify that the fan is free to rotate and fan blades are undamaged.

Fuel tank vents Check

Verify that all vents are free of sand and dust.

Landing gear Check

Verify that gear struts and doors are free of sand and dust build-up.

Vertical and horizontal stabilizers Check

Verify that all leading edges are undamaged.

APU air inlets Check

Ensure that the APU inlet door and cooling air inlet are free of sand and dust before APU start.

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.

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 condition source, as much as possible. If the APU must be used for air conditioning, maintain a temperature as high as possible while still providing a tolerable flight deck and cabin environment.

APU BLEED air switch OFF F/O

If APU bleed air will be used and the APU is not operating:

APU 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.

Engine BLEED air switches.....OFF F/O

APU BLEED air switch ON F/O

Engine Start Procedure

Do the normal Engine Start Procedure with the following modifications:

Note: Use a filtered ground cart for pneumatic air for engine start, if available.

ENGINE START switch GRD F/O

Verify that the N2 RPM increases. C, F/O

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.

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 operating:

APU BLEED air switch OFF F/O

APU START F/O

Note: Run the APU for one full minute before using it as a bleed air source.

Engine BLEED air switches OFF F/O

APU BLEED air switch ON F/O

Flight controls Check C

Verify that there is no increase in control forces due to sand or dust contaminants.

Taxi-Out

Do the following, conditions 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 use minimum N1 whenever possible to avoid creating engine vortices during ground operations.
- Maintain a greater than normal separation from other aircraft while taxiing and avoid the ingestion of another engine's wake.
- Avoid engine overhang of unprepared surfaces.
- In the event of a crosswind during 180° turns, turn away from the wind if possible to minimize sand and dust ingestion.
- Whenever possible, avoid situations that would require the airplane to be brought to a complete stop.
- Avoid excessive braking. The presence of sand or dust will increase brake wear.

Takeoff

Do the following to minimize sand and dust ingestion by the engines during takeoff:

- Use the full fixed derate and/or assumed temperature thrust reduction that meets performance requirements.
- If cabin and flight deck temperatures can be maintained at a tolerable temperature, consider a Packs Off Takeoff.
- Before takeoff, allow sand and dust to settle.
- 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.

VP-BMC, VP-BOY, VP-BOZ

- 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.

The presence of sand or dust will increase brake wear. A light layer of sand or dust on the runway may reduce tire-to-runway friction.

After Landing Procedure

Do the normal After Landing Procedure with the following modifications:

If bleed air is needed to maintain tolerable flight deck and cabin temperatures, use APU bleed air rather than engine bleed air during the taxi in. Limit APU bleed air use as much as possible to reduce sand and dust ingestion.

If APU bleed air will be used and the APU is not operating:

APU BLEED air switch OFF F/O

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.

Engine BLEED air switches OFF F/O

APU BLEED air switch ON 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.
- 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:

- Cabin altitude mode selector MAN F/O
- Cabin altitude manual control DESCEND F/O
- Position the outflow valve fully closed to inhibit the intake of sand or dust.

Additional procedures for securing the airplane during sandy or dusty conditions may be needed. These procedures are normally done by maintenance personnel, and include, but are not limited to:

- 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 closed.

Turbulence

During flight in light to moderate turbulence, the autopilot may remain engaged unless airspeed, altitude or attitude deviations require use of manual control. The turbulent air penetration speed is 290 knots/.78 Mach. Below 10,000 feet a speed between 240 and 250 knots provides adequate buffet margin.

- Passenger Signs ON
- Advise passengers to fasten seat belts prior to entering areas of reported or anticipated turbulence. Instruct flight attendants to check that all passenger seat belts are fastened.

Severe Turbulence

Severe turbulence should be avoided if at all possible. If severe turbulence cannot be avoided, an increased buffet margin is recommended. This can be obtained by descending approximately 4,000 feet below optimum altitude. The autothrottle should be off in severe turbulence.

- Engine start selectors CONT

Windshear

Windshear is a change of wind speed and/or direction over a short distance along the flight path. Indications of windshear are listed in the Windshear non-normal maneuver in this manual.

Avoidance

The flight crew should search for any clues to the presence of windshear along the intended flight path. Presence of windshear may be indicated by:

- Thunderstorm activity
- Virga (rain that evaporates before reaching the ground)
- Pilot reports
- Low level windshear alerting system (LLWAS) warnings.

Stay clear of thunderstorm cells and heavy precipitation and areas of known windshear. If presence of windshear is confirmed, delay takeoff or do not continue an approach.

Precautions

If windshear is suspected, be especially alert to any of the danger signals and be prepared for the possibility of an inadvertent encounter. The following precautionary actions are recommended if windshear is suspected:

Takeoff

VP-BMC through VQ-BMQ, VQ-BPT, VQ-BRA

- Takeoff with full rated takeoff thrust is recommended.

VP-BDI, VQ-BMU, VQ-BOG

- Takeoff with full rated takeoff thrust is recommended, unless the use of a fixed derate is required to meet a dispatch performance requirement.
- For optimum takeoff performance, use Flaps 20 for takeoff unless limited by obstacle clearance and/or climb gradient. Flaps 15 may also 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 V_r speed to the performance limited gross weight rotations 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 V_r , do not attempt to accelerate to the increased V_r , 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.

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- 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 crosswind or tailwind limitations. Use ILS G/S, VNAV path or VASI/PAPI 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 20 knots.
- Avoid large thrust reductions or trim changes in response to sudden airspeed increases as these may be followed by airspeed decreases.
- Crosscheck flight director commands using vertical flight path instruments.
- Crew coordination and awareness are very important, particularly at night or in marginal weather conditions. Closely monitor the vertical flight path instruments such as vertical speed, altimeters and glideslope displacement. The pilot monitoring should call out any deviations from normal. Use of the autopilot and autothrottle for the approach may provide more monitoring and recognition time.

Recovery

Accomplish the WINDSHEAR maneuver found in the Non-Normal Maneuvers section of this manual.

Ice Crystal Icing

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.

These weather conditions are 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.

Flight in clouds containing ice crystals has been associated with engine vibration, engine power-loss, engine damage and airplane Total Air Temperature (TAT) probe icing.

Recognizing Ice Crystal Icing Weather

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 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)

VP-BMC through VP-BRL, VQ-BMU, VQ-BRA

Note: There is no significant airframe icing.

| VP-BDI, VP-BWW through VQ-BMQ, VQ-BOG, VQ-BPT

Note: There is no significant airframe icing. The icing conditions detection system does not detect ice crystal icing. It is designed to detect supercooled water only.

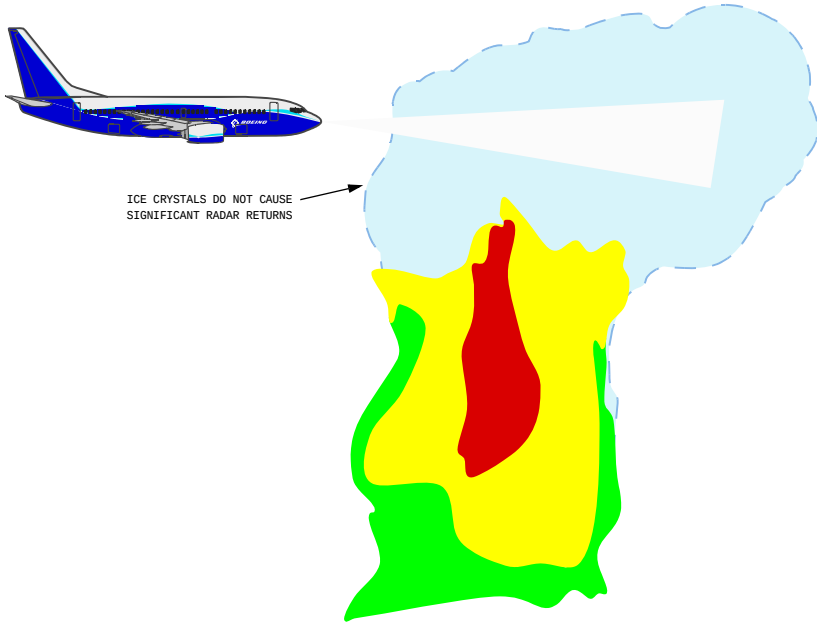
Avoiding Ice Crystal Icing Weather

During flight in IMC, avoid flying directly over significant amber or red radar returns, even if there are no returns at airplane altitude

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Use the weather radar controls to assess weather radar reflectivity below the airplane flight path. Refer to weather radar operating instructions for additional information.



Suspected Ice Crystal Icing

Exit the ice crystal icing conditions. Request a route change to minimize the time above red and amber radar returns.

Do the Ice Crystal Icing non-normal checklist in QRH NNC-03.



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Performance Inflight

Chapter PI

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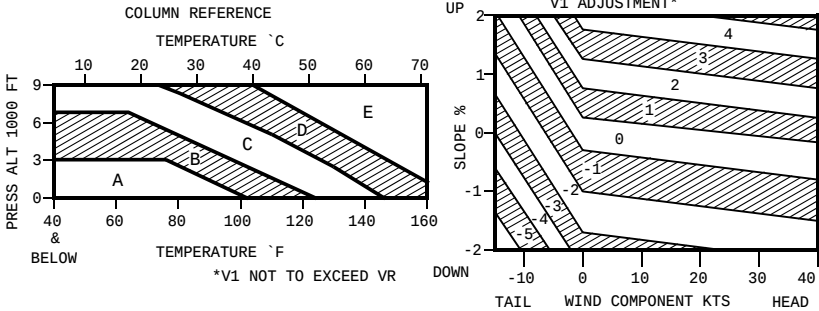
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General

Section 10

Takeoff Speeds
Max Takeoff Thrust



FLAPS	WT 1000 KG	A			B			C			D			E		
		V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂
5	190	166	170	175	167	171	176									
	180	160	165	171	162	166	171									
	170	154	160	166	156	161	166	159	162	166						
	160	148	154	161	150	156	161	153	157	161						
	150	141	148	156	144	150	156	147	151	156	150	153	156			
	140	135	142	151	137	144	150	140	145	150	144	147	150			
	130	128	136	145	130	137	145	134	139	145	137	141	145	141	142	145
	120	121	129	140	124	131	140	127	132	140	130	134	140	134	136	140
	110	114	122	134	116	124	134	119	126	134	123	127	134	126	129	134
	100	106	114	128	109	116	128	112	118	127	115	120	127	118	122	127
15	190	160	163	168												
	180	154	158	164	157	159	164									
	170	148	152	159	151	154	159									
	160	142	147	154	145	148	154									
	150	137	142	150	139	143	149	142	145	150						
	140	130	135	144	132	136	144	135	138	144						
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	120	117	122	134	120	124	134	122	126	134	125	128	133	123	124	128
	110	111	117	128	113	118	128	116	120	128	119	122	128	115	117	122
	100	104	109	122	106	111	122	108	113	122	112	115	122	113	118	122
20	190	158	159	165	155	155	159									
	180	152	153	159	148	149	154									
	170	146	148	154	142	143	149	144	145	150						
	160	140	142	149	136	138	144	139	140	145						
	150	133	136	145	130	132	139	132	134	139						
	140	127	131	139	124	127	134	126	128	134	130	130	134			
	130	121	125	134	117	120	129	120	122	129	124	124	129	119	120	124
	120	114	119	129	110	114	124	113	116	124	117	118	124	113	113	118
	110	107	112	124	103	108	118	105	109	118	109	111	118			
	100	99	105	118												

CHECK V1(MCG) IN BOXED AREA

V1(MCG)

Max Takeoff Thrust

ACTUAL OAT		PRESSURE ALTITUDE (FT)						
°C	°F	-1000	0	2000	4000	6000	8000	9000
50	122	103	101	97				
40	104	108	106	101	97	93	90	
30	86	111	109	105	101	97	94	92
20	68	111	110	107	104	100	96	95
10	50	111	110	107	104	101	98	96
-50	-58	113	111	108	105	102	98	97

Maximum Allowable Clearway

FIELD LENGTH (FT)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (FT)
4000	350
6000	500
8000	600
10000	700
12000	800
14000	900

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (FT)	NORMAL V1 (KIAS)		
	120	140	160
800	-5	-3	-2
600	-3	-2	-2
400	-2	-1	-1
200	-1	-1	-1
0	0	0	0
-200	1	1	1
-400	2	1	1
-600	3	2	2
-800	5	3	2



Stab Trim Setting

Max Takeoff Thrust

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	6 1/2	5 1/2	4 1/2	4	3	2
180	7	6	5 1/2	4 1/2	3 1/2	2 1/2	2
170	6 1/2	6	5	4	3 1/2	2 1/2	1 1/2
160	6 1/2	5 1/2	5	4	3	2 1/2	1 1/2
150	6	5	4 1/2	3 1/2	3	2	1
140	5 1/2	4 1/2	4	3	2 1/2	1 1/2	1/2
130	5	4	3	2 1/2	1 1/2	1	1/2
120	4	3 1/2	2 1/2	2	1 1/2	1/2	1/2
110	3 1/2	3	2 1/2	1 1/2	1	1/2	1/2
100	3 1/2	2 1/2	2	1	1/2	1/2	1/2

VREF (KIAS)

WEIGHT (1000 KG)	FLAPS		
	30	25	20
190	179	170	179
180	171	166	173
170	164	161	168
160	156	156	162
150	148	151	157
140	142	146	151
130	137	141	146
120	131	135	141
110	125	129	135
100	119	123	128

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF30 + 80
1	VREF30 + 60
5	VREF30 + 40
15	VREF30 + 20
20	VREF30 + 20
25	VREF25
30	VREF30

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-19.5	-23.6	-27.8	-22.8	-26.9	-31.1	-32.7	-36.8	-41.0
200	-19.4	-23.6	-27.7	-22.7	-26.9	-31.1	-31.5	-35.7	-39.8
190	-19.0	-23.2	-27.4	-22.3	-26.4	-30.6	-30.0	-34.2	-38.3
180	-18.4	-22.5	-26.7	-21.4	-25.5	-29.7	-28.1	-32.3	-36.5
170	-17.4	-21.5	-25.7	-20.0	-24.2	-28.4	-25.9	-30.1	-34.2
160	-16.0	-20.2	-24.4	-18.3	-22.5	-26.6	-23.4	-27.6	-31.7
150	-14.5	-18.7	-22.8	-16.3	-20.5	-24.7	-20.6	-24.8	-29.0
140	-12.7	-16.8	-21.0	-14.2	-18.4	-22.5	-17.6	-21.8	-26.0
130	-10.6	-14.8	-19.0	-11.9	-16.1	-20.3	-14.5	-18.7	-22.8
120	-8.4	-12.6	-16.8	-9.7	-13.8	-18.0	-11.2	-15.4	-19.6
110	-6.1	-10.3	-14.4	-7.5	-11.7	-15.8	-7.9	-12.1	-16.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
5000				93.5			107.6		
5400	105.9			113.8			128.0	102.6	
5800	127.1	100.8		135.4	108.7		149.7	122.8	97.6
6200	149.8	121.6	95.8	158.2	129.8	103.6	172.5	144.2	117.7
6600	173.7	144.0	116.3	182.2	152.4	124.4	196.0	166.7	138.8
7000	198.8	167.6	138.3	206.7	176.2	146.6	220.1	190.0	161.0
7400	224.9	192.4	161.6		200.6	170.1		214.1	184.1
7800		218.4	186.1		225.3	194.4			208.0
8200			211.9			219.1			

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -108 ft/+108 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 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
190	-21	-21	-21	-16	-16	-16	-7	-7	-7
180	-21	-21	-21	-16	-16	-16	-6	-6	-6
170	-22	-22	-22	-17	-17	-17	-6	-6	-6
160	-22	-22	-22	-17	-17	-17	-6	-6	-6
150	-23	-23	-23	-18	-18	-18	-7	-7	-7
140	-24	-24	-24	-19	-19	-19	-8	-8	-8
130	-24	-24	-24	-20	-20	-20	-9	-9	-9
120	-25	-25	-25	-21	-21	-21	-11	-11	-11
110	-26	-26	-26	-22	-22	-22	-13	-13	-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).

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-27.5	-32.0	-36.5	-32.2	-36.7	-41.3	-43.4	-48.0	-52.5
200	-26.2	-30.7	-35.3	-30.4	-34.9	-39.5	-40.2	-44.7	-49.3
190	-24.8	-29.4	-33.9	-28.5	-33.0	-37.6	-37.0	-41.5	-46.1
180	-23.3	-27.8	-32.4	-26.5	-31.0	-35.6	-33.8	-38.3	-42.9
170	-21.7	-26.2	-30.8	-24.4	-29.0	-33.5	-30.6	-35.2	-39.7
160	-19.9	-24.5	-29.0	-22.3	-26.8	-31.3	-27.5	-32.0	-36.5
150	-18.0	-22.6	-27.1	-20.0	-24.5	-29.1	-24.3	-28.8	-33.4
140	-16.0	-20.6	-25.1	-17.7	-22.2	-26.7	-21.2	-25.7	-30.3
130	-13.9	-18.4	-23.0	-15.2	-19.7	-24.3	-18.1	-22.6	-27.1
120	-11.6	-16.2	-20.7	-12.7	-17.2	-21.7	-15.0	-19.5	-24.0
110	-9.3	-13.8	-18.3	-10.0	-14.6	-19.1	-11.9	-16.4	-21.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
6200							98.8		
6600							122.3	90.9	
7000	90.6			113.9			146.9	114.0	
7400	118.7			141.3	104.7		173.0	138.2	105.8
7800	148.5	108.7		170.2	131.5	95.6	200.8	163.7	129.5
8200	180.4	137.8	98.9	201.1	159.9	122.0	229.9	190.9	154.6
8600	214.7	168.9	127.4		190.0	149.8		219.7	181.2
9000		202.4	157.8		222.0	179.3			209.5
9400			190.4			210.7			
9800			225.3						

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -155 ft/+155 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 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
210	-28	-28	-28	-21	-21	-21	-11	-11	-11
200	-29	-29	-29	-22	-22	-22	-11	-11	-11
190	-30	-30	-30	-23	-23	-23	-11	-11	-11
180	-30	-30	-30	-24	-24	-24	-11	-11	-11
170	-31	-31	-31	-25	-25	-25	-12	-12	-12
160	-32	-32	-32	-26	-26	-26	-13	-13	-13
150	-32	-32	-32	-27	-27	-27	-15	-15	-15
140	-32	-32	-32	-28	-28	-28	-17	-17	-17
130	-33	-33	-33	-29	-29	-29	-19	-19	-19
120	-33	-33	-33	-30	-30	-30	-21	-21	-21
110	-33	-33	-33	-31	-31	-31	-24	-24	-24

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).



ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
210	0.0	0.0	0.0	-9.0	-9.0	-9.0	-19.9	-19.9	-19.9
200	0.0	0.0	0.0	-10.1	-10.1	-10.1	-20.1	-20.1	-20.1
190	-1.1	-1.1	-1.1	-10.8	-10.8	-10.8	-20.0	-20.0	-20.0
180	-2.1	-2.1	-2.1	-11.2	-11.2	-11.2	-19.6	-19.6	-19.6
170	-2.7	-2.7	-2.7	-11.3	-11.3	-11.3	-18.9	-18.9	-18.9
160	-3.0	-3.0	-3.0	-11.1	-11.1	-11.1	-18.0	-18.0	-18.0
150	-3.0	-3.0	-3.0	-10.5	-10.5	-10.5	-16.9	-16.9	-16.9
140	-2.7	-2.7	-2.7	-9.5	-9.5	-9.5	-15.4	-15.4	-15.4
130	-2.2	-2.2	-2.2	-8.2	-8.2	-8.2	-13.7	-13.7	-13.7
120	-1.3	-1.3	-1.3	-6.6	-6.6	-6.6	-11.8	-11.8	-11.8
110	-0.3	-0.3	-0.3	-4.6	-4.6	-4.6	-9.6	-9.6	-9.6

V1(MCG) Limit Weight (1000 KG)

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
3800	99.1								
4200	138.1								
4600	176.7	114.8							
5000	214.9	153.6	91.3	93.8					
5400		192.0	130.4	120.4					
5800			169.0	148.3	104.3				
6200			207.3	177.8	131.4				
6600				209.3	159.9	115.0	98.4		
7000					190.2	142.6	114.6		
7400					222.4	171.8	131.5	100.0	
7800						202.8	149.3	116.2	
8200							168.1	133.2	101.6
8600							188.2	151.1	117.9
9000							209.8	170.1	135.0
9400								190.3	153.0
9800								212.0	172.0
10200									192.4
10600									214.3

1. Enter Weight Adjustment table with reported braking action and field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by - 81 ft/ + 81 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by - 81 ft/ + 81 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by - 126 ft/ + 126 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 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
190	-7	-7	-7	-17	-17	-17	-29	-29	-29
180	-8	-8	-8	-18	-18	-18	-30	-30	-30
170	-9	-9	-9	-19	-19	-19	-32	-32	-32
160	-10	-10	-10	-21	-21	-21	-33	-33	-33
150	-10	-10	-10	-22	-22	-22	-35	-35	-35
140	-11	-11	-11	-23	-23	-23	-36	-36	-36
130	-12	-12	-12	-24	-24	-24	-38	-38	-38
120	-12	-12	-12	-25	-25	-25	-40	-40	-40
110	-12	-12	-12	-26	-26	-26	-41	-41	-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).

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-2.1	-2.6	-3.0	-15.0	-15.4	-15.8	-25.8	-26.2	-26.7
200	-3.3	-3.8	-4.2	-15.6	-16.0	-16.5	-25.9	-26.3	-26.7
190	-4.3	-4.7	-5.1	-16.0	-16.4	-16.8	-25.6	-26.0	-26.4
180	-5.0	-5.4	-5.8	-16.1	-16.5	-16.9	-25.0	-25.4	-25.8
170	-5.4	-5.8	-6.3	-15.9	-16.3	-16.7	-24.0	-24.4	-24.9
160	-5.6	-6.0	-6.5	-15.4	-15.9	-16.3	-22.8	-23.2	-23.6
150	-5.6	-6.0	-6.4	-14.7	-15.1	-15.5	-21.2	-21.6	-22.0
140	-5.3	-5.7	-6.1	-13.6	-14.1	-14.5	-19.2	-19.7	-20.1
130	-4.7	-5.1	-5.6	-12.3	-12.7	-13.1	-17.0	-17.4	-17.8
120	-3.9	-4.4	-4.8	-10.7	-11.1	-11.5	-14.4	-14.8	-15.3
110	-2.9	-3.3	-3.7	-8.8	-9.2	-9.6	-11.5	-11.9	-12.4

V1(MCG) Limit Weight (1000 KG)

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	141.3								
5000	187.8	111.6							
5400	228.6	163.2							
5800		206.4	136.2						
6200			183.5						
6600			224.6	122.6					
7000				167.1	96.4				
7400				208.3	143.1				
7800					186.0	118.0			
8200					226.3	162.8			
8600						204.3			
9800							109.0		
10200							135.3		
10600							163.5	109.0	
11000							194.1	135.3	
11400							226.8	163.5	109.0
11800								194.1	135.3
12200								226.8	163.5
12600									194.1
13000									226.8

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 -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -175 ft/+175 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for available 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
210	-7	-7	-7	-21	-21	-21	-41	-41	-41
200	-8	-8	-8	-22	-22	-22	-41	-41	-41
190	-9	-9	-9	-23	-23	-23	-42	-42	-42
180	-10	-10	-10	-24	-24	-24	-43	-43	-43
170	-11	-11	-11	-25	-25	-25	-45	-45	-45
160	-12	-12	-12	-27	-27	-27	-47	-47	-47
150	-13	-13	-13	-29	-29	-29	-49	-49	-49
140	-14	-14	-14	-30	-30	-30	-51	-51	-51
130	-15	-15	-15	-32	-32	-32	-52	-52	-52
120	-16	-16	-16	-33	-33	-33	-53	-53	-53
110	-17	-17	-17	-34	-34	-34	-54	-54	-54

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).



767 Flight Crew Operations Manual

Takeoff %N1**Max Takeoff Thrust****Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off**

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F		-1000	0	2000	4000	6000	8000	9000
55	131	58	106.1	106.1	105.9	105.5	105.1	104.9	104.7
50	122	53	106.8	106.9	106.8	106.5	106.1	105.9	105.7
45	113	48	107.5	107.5	107.5	107.3	107.0	106.9	106.6
40	104	43	108.2	108.2	108.2	108.0	107.9	107.8	107.7
35	95	38	109.0	108.9	109.0	108.8	108.7	108.7	108.6
30	86	33	109.1	109.8	109.8	109.7	109.6	109.7	109.6
25	77	28	108.2	108.9	110.3	110.6	110.5	110.6	110.6
20	68	23	107.3	108.0	109.4	110.6	111.3	111.4	111.3
15	59	18	106.4	107.1	108.5	109.7	111.0	112.0	112.1
10	50	13	105.5	106.2	107.5	108.8	110.0	111.3	112.1
0	32	3	103.6	104.3	105.7	106.9	108.1	109.4	110.1
-10	14	-7	101.7	102.4	103.8	104.9	106.1	107.4	108.1
-20	-4	-17	99.8	100.4	101.8	103.0	104.2	105.4	106.1
-30	-22	-27	97.9	98.5	99.8	101.0	102.2	103.4	104.0
-40	-40	-37	95.9	96.4	97.8	99.0	100.1	101.3	102.0
-50	-58	-47	93.8	94.4	95.8	96.9	98.0	99.2	99.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	9000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5	0.5

Assumed Temperature Reduced Thrust

Minimum Assumed Temperature

MINIMUM ASSUMED TEMP	PRESSURE ALTITUDE (FT)									
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
°F	90	86	83	79	76	72	69	65	62	58
°C	32	30	28	26	24	22	20	18	16	14

Assumed Temperature Limit %N1

Based on engine bleed for packs on

ACTUAL OAT (°C)	ASSUMED TEMPERATURE (°C)											
	15	20	25	30	35	40	45	50	55	60	65	70
55												
50									105.3	104.3	102.5	100.9
45								106.0	104.5	102.7	101.0	99.4
40							106.6	105.2	103.7	101.9	100.2	98.6
35						107.3	105.8	104.3	102.8	101.1	99.4	97.8
30					108.0	106.5	104.9	103.5	102.0	100.3	98.6	97.0
25				108.9	107.1	105.6	104.1	102.7	101.2	99.5	97.8	96.2
20			109.7	108.0	106.2	104.7	103.2	101.8	100.3	98.7	97.0	95.5
15		110.6	108.8	107.1	105.4	103.9	102.4	101.0	99.5	97.9	96.2	94.7
10	111.2	109.6	107.9	106.1	104.4	103.0	101.5	100.1	98.6	97.0	95.4	93.8
5	110.2	108.6	106.9	105.2	103.5	102.1	100.6	99.2	97.8	96.2	94.5	93.0
0	109.2	107.7	106.0	104.3	102.6	101.2	99.7	98.3	96.9	95.3	93.7	
-10	107.2	105.7	104.0	102.4	100.7	99.3	97.9	96.5	95.2	93.6	92.0	
-20	105.2	103.7	102.1	100.4	98.8	97.4	96.0	94.7	93.4	91.8		
-30	103.2	101.7	100.1	98.5	96.9	95.5	94.2	92.9	91.5			
-40	101.0	99.6	98.0	96.5	94.9	93.6	92.2					
-50	98.9	97.5	95.9	94.4	92.9	91.6						
-60	96.7	95.3	93.8	92.3								

%N1 Adjustment for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)										
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
PACKS OFF	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.5	0.5

%N1 Altitude Adjustment

ASSUMED TEMP (°C)	PRESSURE ALTITUDE (FT)										
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
70	0.2	0.1	0.0	-0.2	-0.3	-0.5	-0.6	-0.8	-1.0	-1.2	-1.3
60	0.1	0.1	0.0	-0.2	-0.3	-0.5	-0.6	-0.8	-1.0	-1.2	-1.3
50	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.5	-0.7	-0.9	-1.0
40	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.4	-0.4
32 & BELOW	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2



Assumed Temperature Reduced Thrust

Assumed Temperature Minimum %N1

Based on 25% takeoff thrust reduction

ACTUAL OAT (°C)	PRESSURE ALTITUDE (FT)										
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
55	96.9	96.9	96.9	96.8	96.6	96.5	96.4	96.2	96.0	95.9	95.9
50	97.4	97.4	97.4	97.4	97.3	97.2	97.1	97.0	96.8	96.7	96.6
45	97.8	97.8	97.8	97.8	97.8	97.8	97.7	97.5	97.4	97.4	97.3
40	98.3	98.3	98.2	98.2	98.2	98.1	98.1	98.0	97.9	97.9	97.9
35	98.6	98.6	98.5	98.5	98.5	98.5	98.5	98.4	98.4	98.4	98.4
30	98.0	98.5	98.9	98.9	98.9	98.9	98.8	98.8	98.8	98.8	98.8
25	97.2	97.7	98.1	98.5	98.9	98.9	99.1	99.1	99.0	99.1	99.1
20	96.4	96.9	97.3	97.7	98.1	98.4	98.8	99.0	99.2	99.2	99.2
15	95.6	96.0	96.5	96.9	97.2	97.6	98.0	98.3	98.6	98.9	99.1
10	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.8	98.1	98.4
0 & BELOW	93.1	93.6	94.0	94.3	94.7	95.1	95.4	95.8	96.1	96.4	96.7

1. Enter Minimum Assumed Temperature table with airport pressure altitude to determine minimum assumed temperature.
2. Enter Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature to determine assumed temperature limit %N1. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table.
3. Enter %N1 Altitude Adjustment table with assumed temperature and airport pressure altitude to determine altitude adjustment to %N1 found in step 2.
4. Ensure Takeoff %N1 from step 3 is greater than or equal to minimum %N1 allowed for airport conditions from Assumed Temperature Minimum %N1 table.

Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (KIAS OR MACH)								
	0	5	10	15	20	25	30	35	40
	250	250	250	290	290	290	290	.78	.78
60	96.5	97.2	97.0	97.4	96.7	95.1	96.1	95.1	94.7
50	97.6	98.7	99.0	99.6	98.9	97.3	98.2	95.0	93.8
40	98.8	99.8	100.4	101.2	101.0	99.3	100.1	97.0	95.8
30	99.1	101.1	101.6	102.4	102.5	101.2	101.9	98.8	97.7
20	97.5	101.3	103.3	103.8	104.1	102.8	103.4	100.5	99.4
10	95.8	99.6	102.9	104.4	105.6	104.6	104.7	102.6	100.9
0	94.2	97.8	101.1	102.6	105.0	106.9	106.5	104.3	102.4
-10	92.5	96.1	99.4	100.8	103.2	105.3	107.1	106.3	104.3
-20	90.8	94.3	97.6	99.0	101.5	103.4	105.1	106.5	106.4
-30	89.1	92.4	95.7	97.1	99.7	101.5	103.2	104.4	104.4
-40	87.3	90.5	93.9	95.2	97.8	99.5	101.2	102.2	102.2
-50	85.5	88.6	91.9	93.3	95.8	97.5	99.1	100.1	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	0	5	10	15	20	25	30	35	40
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.8	-0.9	-1.1	-1.4	-1.9
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.1	-1.3	-1.4	-1.7	-2.2	-2.4

Go-around %N1**Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off**

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F		-1000	0	2000	4000	6000	8000	9000
55	131	58	106.1	106.1	105.9	105.5	105.1	104.9	104.7
50	122	53	106.8	106.9	106.8	106.5	106.1	105.9	105.7
45	113	48	107.5	107.5	107.5	107.3	107.0	106.9	106.6
40	104	43	108.2	108.2	108.2	108.0	107.9	107.8	107.7
35	95	38	109.0	108.9	109.0	108.8	108.7	108.7	108.6
30	86	33	109.1	109.8	109.8	109.7	109.6	109.7	109.6
25	77	28	108.2	108.9	110.3	110.6	110.5	110.6	110.6
20	68	23	107.3	108.0	109.4	110.6	111.3	111.4	111.3
15	59	18	106.4	107.1	108.5	109.7	111.0	112.0	112.1
10	50	13	105.5	106.2	107.5	108.8	110.0	111.3	112.1
0	32	3	103.6	104.3	105.7	106.9	108.1	109.4	110.1
-10	14	-7	101.7	102.4	103.8	104.9	106.1	107.4	108.1
-20	-4	-17	99.8	100.4	101.8	103.0	104.2	105.4	106.1
-30	-22	-27	97.9	98.5	99.8	101.0	102.2	103.4	104.0
-40	-40	-37	95.9	96.4	97.8	99.0	100.1	101.3	102.0
-50	-58	-47	93.8	94.4	95.8	96.9	98.0	99.2	99.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	9000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5	0.5

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (290/.78)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	4.0	4.0			
	V/S (FT/MIN)	1600	1000			
30000	PITCH ATT	4.5	4.0	4.0	4.0	4.0
	V/S (FT/MIN)	2700	2100	1700	1300	1000
20000	PITCH ATT	7.0	6.5	6.0	6.0	5.5
	V/S (FT/MIN)	4200	3400	2700	2300	1900
10000	PITCH ATT	10.5	9.0	8.5	8.0	7.5
	V/S (FT/MIN)	5600	4500	3700	3200	2700
SEA LEVEL	PITCH ATT	13.5	11.5	10.5	9.5	9.0
	V/S (FT/MIN)	6300	5100	4300	3600	3100

Cruise (.78/290)

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	2.0	2.5	3.5		
	%N1	88.1	92.1	97.5		
35000	PITCH ATT	1.5	2.0	2.5	3.0	3.5
	%N1	85.1	87.3	90.0	93.6	98.2
30000	PITCH ATT	1.0	1.5	2.0	2.0	2.5
	%N1	84.2	85.7	87.4	89.4	91.9
25000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	80.7	82.2	83.8	85.8	87.9
20000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	76.7	78.2	79.8	81.9	83.9
15000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	72.7	74.3	76.1	77.9	79.9

Descent (.78/290)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	-1.5	-0.5	0.0	0.5	1.0
	V/S (FT/MIN)	-2600	-2600	-2700	-2800	-3100
30000	PITCH ATT	-2.5	-1.5	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2700	-2400	-2200	-2100	-2000
20000	PITCH ATT	-2.5	-1.5	-1.0	0.0	0.5
	V/S (FT/MIN)	-2400	-2100	-2000	-1900	-1800
10000	PITCH ATT	-2.5	-1.5	-1.0	-0.5	0.5
	V/S (FT/MIN)	-2100	-1900	-1700	-1700	-1600
SEA LEVEL	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2000	-1700	-1600	-1500	-1500

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF30+80)**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	58.7	63.4	67.3	70.9	74.4
	KIAS	199	211	222	236	251
5000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	54.8	59.0	63.1	66.8	69.9
	KIAS	199	211	222	236	251

Terminal Area (5000 FT)**Set Thrust for Level Flight**

FLAP POSITION (GEAR POSITION) (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS UP (GEAR UP) (VREF30+80)	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	55.6	60.1	64.6	68.0	71.1
	KIAS	199	211	222	236	251
FLAPS 1 (GEAR UP) (VREF30+60)	PITCH ATT	6.0	6.5	6.5	6.5	6.5
	%N1	56.6	61.6	65.8	69.4	72.9
	KIAS	179	191	202	216	231
FLAPS 5 (GEAR UP) (VREF30+40)	PITCH ATT	4.5	4.5	5.0	4.5	4.5
	%N1	59.0	64.1	68.3	72.4	75.7
	KIAS	159	171	182	196	211
FLAPS 15 (GEAR UP) (VREF30+20)	PITCH ATT	5.5	5.5	6.0	6.0	5.5
	%N1	61.1	65.9	70.6	74.3	77.6
	KIAS	139	151	162	176	191
FLAPS 20 (GEAR DOWN) (VREF30+20)	PITCH ATT	4.0	4.5	4.5	4.0	3.5
	%N1	67.6	72.9	77.5	81.6	85.4
	KIAS	139	151	162	176	191

Final Approach (1500 FT)**Gear Down, Set Thrust for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS 20 (VREF20 +10)	PITCH ATT	1.5	1.5	1.5	1.5	1.5
	%N1	48.0	51.8	55.6	59.2	62.6
	KIAS	138	150	162	172	184

Go-Around (VREF 30 + 20)**Flaps 20, Gear Up, Set Go-Around Thrust**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	18.0	15.0	12.5	10.5	9.0
	V/S (FT/MIN)	4000	3300	2700	2300	2000
	KIAS	139	151	162	176	191
5000	PITCH ATT	21.5	17.5	15.0	12.5	10.5
	V/S (FT/MIN)	4500	3800	3200	2800	2400
	KIAS	139	151	162	176	191
SEA LEVEL	PITCH ATT	25.0	20.5	17.0	14.5	12.0
	V/S (FT/MIN)	5000	4200	3600	3200	2800
	KIAS	139	151	162	176	191

Intentionally
Blank



Performance Inflight

All Engine

Chapter PI

Section 11

Long Range Cruise Maximum Operating Altitude

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°)
190	28900	-1	34400	33500	32600	30900	29300
185	29400	-2	35000	34100	33200	31500	29900
180	30100	-4	35600	34700	33800	32100	30500
175	30700	-5	36100	35300	34400	32700	31100
170	31300	-7	36800	35900	35000	33300	31800
165	31900	-8	37400	36500	35600	34000	32400
160	32600	-9	38000	37100	36300	34600	33100
155	33300	-11	38700	37800	36900	35300	33800
150	34000	-13	39400	38500	37600	36000	34500
145	34700	-14	40100	39200	38300	36700	35200
140	35400	-16	40800	39900	39000	37400	35900
135	36200	-17	41500	40700	39800	38200	36700
130	37000	-17	42300	41400	40600	38900	37400
125	37800	-17	43000	42300	41400	39800	38300
120	38600	-17	43000	43000	42200	40600	39100
115	39500	-17	43000	43000	43000	41500	40000
110	40500	-17	43000	43000	43000	42400	40900
105	41400	-17	43000	43000	43000	43000	41900
100	42400	-17	43000	43000	43000	43000	42900

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°)
190	28900	5	33800*	33500	32600	30900	29300
185	29400	3	34400*	34100	33200	31500	29900
180	30100	2	35000*	34700	33800	32100	30500
175	30700	1	35600*	35300	34400	32700	31100
170	31300	-1	36200*	35900	35000	33300	31800
165	31900	-2	36800*	36500	35600	34000	32400
160	32600	-4	37400*	37100	36300	34600	33100
155	33300	-5	38000*	37800	36900	35300	33800
150	34000	-7	38600*	38500	37600	36000	34500
145	34700	-8	39300*	39200	38300	36700	35200
140	35400	-10	40000*	39900	39000	37400	35900
135	36200	-12	40700*	40700	39800	38200	36700
130	37000	-12	41500*	41400	40600	38900	37400
125	37800	-12	42200*	42200*	41400	39800	38300
120	38600	-12	43000	43000	42200	40600	39100
115	39500	-12	43000	43000	43000	41500	40000
110	40500	-12	43000	43000	43000	42400	40900
105	41400	-12	43000	43000	43000	43000	41900
100	42400	-12	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.

Long Range Cruise Maximum Operating Altitude
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°)
190	28900	10	32700*	32700*	32600	30900	29300
185	29400	9	33400*	33400*	33200	31500	29900
180	30100	8	34000*	34000*	33800	32100	30500
175	30700	6	34700*	34700*	34400	32700	31100
170	31300	5	35300*	35300*	35000	33300	31800
165	31900	3	35900*	35900*	35600	34000	32400
160	32600	2	36500*	36500*	36300	34600	33100
155	33300	0	37100*	37100*	36900	35300	33800
150	34000	-1	37700*	37700*	37600	36000	34500
145	34700	-3	38400*	38400*	38300	36700	35200
140	35400	-4	39100*	39100*	39000	37400	35900
135	36200	-6	39800*	39800*	39800	38200	36700
130	37000	-6	40600*	40600*	40600	38900	37400
125	37800	-6	41300*	41300*	41300*	39800	38300
120	38600	-6	42100*	42100*	42100*	40600	39100
115	39500	-6	43000	43000	43000	41500	40000
110	40500	-6	43000	43000	43000	42400	40900
105	41400	-6	43000	43000	43000	43000	41900
100	42400	-6	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.



Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		23	25	27	29	31	33	35	37	39	41	43
190	%N1	89.7	90.8	92.0	93.4	95.2	97.6					
	MACH	.772	.787	.799	.804	.802	.798					
	KIAS	338	331	324	312	298	284					
	FF/ENG	3272	3196	3145	3109	3115	3191					
180	%N1	88.7	89.7	90.9	92.1	93.7	95.6	98.8				
	MACH	.762	.777	.792	.802	.803	.800	.797				
	KIAS	334	327	320	312	299	285	271				
	FF/ENG	3131	3054	3000	2957	2931	2951	3086				
170	%N1	87.6	88.6	89.7	90.9	92.2	94.0	96.2				
	MACH	.751	.767	.782	.797	.804	.802	.799				
	KIAS	329	323	316	309	299	285	272				
	FF/ENG	2983	2915	2856	2814	2773	2765	2809				
160	%N1	86.3	87.5	88.5	89.7	90.9	92.3	94.2	97.4			
	MACH	.736	.756	.772	.788	.800	.804	.801	.798			
	KIAS	322	318	312	305	297	286	272	259			
	FF/ENG	2825	2772	2717	2671	2629	2598	2599	2693			
150	%N1	84.9	86.3	87.3	88.4	89.5	90.8	92.4	94.8	99.2		
	MACH	.715	.743	.761	.776	.792	.803	.803	.800	.797		
	KIAS	312	312	307	300	294	285	273	260	247		
	FF/ENG	2643	2623	2577	2530	2489	2449	2429	2463	2609		
140	%N1	83.2	84.7	86.1	87.1	88.2	89.4	90.7	92.8	95.9		
	MACH	.692	.721	.747	.764	.780	.795	.804	.802	.799		
	KIAS	301	302	301	295	289	283	273	261	248		
	FF/ENG	2460	2448	2431	2392	2347	2311	2277	2279	2345		
130	%N1	81.4	83.0	84.4	85.7	86.8	87.9	89.1	90.9	93.5	97.0	
	MACH	.668	.696	.726	.750	.767	.783	.798	.804	.802	.798	
	KIAS	290	291	292	289	284	278	271	261	248	236	
	FF/ENG	2281	2266	2263	2247	2210	2169	2136	2119	2144	2222	
120	%N1	79.4	81.1	82.6	84.1	85.3	86.4	87.5	89.1	91.5	94.1	97.9
	MACH	.645	.670	.698	.729	.752	.770	.786	.800	.804	.801	.798
	KIAS	279	279	280	281	278	273	267	260	249	237	225
	FF/ENG	2110	2093	2082	2085	2068	2032	1996	1976	1975	2005	2089
110	%N1	77.4	78.8	80.5	82.1	83.6	84.8	85.9	87.4	89.5	91.9	94.5
	MACH	.621	.645	.671	.699	.730	.753	.771	.787	.801	.804	.801
	KIAS	269	268	268	268	269	266	261	255	248	238	226
	FF/ENG	1947	1927	1912	1904	1911	1893	1859	1837	1829	1830	1861
100	%N1	75.3	76.6	78.1	79.8	81.4	82.9	84.1	85.6	87.6	89.7	92.0
	MACH	.596	.619	.642	.669	.698	.729	.753	.771	.788	.801	.804
	KIAS	257	257	256	256	256	257	254	249	244	237	227
	FF/ENG	1786	1769	1750	1736	1733	1741	1722	1699	1689	1681	1683

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	161
564	522	485	453	425	400	382	366	351	337	324
847	784	728	680	638	600	574	549	527	507	488
1131	1047	971	907	850	800	765	733	703	676	651
1416	1310	1215	1134	1063	1000	956	916	879	845	814
1702	1573	1459	1361	1276	1200	1148	1100	1055	1014	977
1990	1839	1704	1589	1490	1400	1339	1283	1231	1183	1140
2279	2105	1950	1818	1703	1600	1531	1466	1407	1352	1302
2570	2372	2197	2047	1917	1800	1722	1649	1582	1520	1464
2861	2640	2443	2276	2130	2000	1913	1832	1757	1689	1626

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.7	0:39	2.3	0:38	2.0	0:36	1.7	0:35	1.5	0:35
400	5.6	1:14	5.0	1:11	4.4	1:07	4.0	1:04	3.7	1:01
600	8.5	1:49	7.7	1:44	6.8	1:37	6.3	1:32	5.8	1:28
800	11.3	2:25	10.4	2:17	9.2	2:08	8.5	2:01	7.9	1:55
1000	14.1	3:01	13.0	2:51	11.6	2:39	10.7	2:30	9.9	2:23
1200	16.9	3:37	15.6	3:25	14.0	3:10	12.9	2:59	12.0	2:50
1400	19.7	4:13	18.2	4:00	16.3	3:41	15.1	3:29	14.0	3:17
1600	22.4	4:50	20.8	4:34	18.6	4:13	17.3	3:59	16.0	3:45
1800	25.1	5:28	23.3	5:09	20.9	4:45	19.4	4:29	18.0	4:13
2000	27.8	6:06	25.8	5:45	23.2	5:17	21.5	4:59	20.0	4:41

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.2	-0.1	0.0	0.1	0.2
4	-0.5	-0.2	0.0	0.3	0.5
6	-0.8	-0.4	0.0	0.4	0.9
8	-1.1	-0.5	0.0	0.6	1.2
10	-1.3	-0.7	0.0	0.8	1.5
12	-1.6	-0.8	0.0	0.9	1.9
14	-1.9	-0.9	0.0	1.1	2.2
16	-2.2	-1.1	0.0	1.3	2.5
18	-2.5	-1.2	0.0	1.4	2.9
20	-2.7	-1.4	0.0	1.6	3.2
22	-3.0	-1.5	0.0	1.8	3.5
24	-3.3	-1.7	0.0	1.9	3.9
26	-3.6	-1.8	0.0	2.1	4.2
28	-3.9	-1.9	0.0	2.3	4.5
30	-4.2	-2.1	0.0	2.5	4.8
32	-4.4	-2.2	0.0	2.6	5.2

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
1297	1225	1159	1101	1048	1000	957	918	881	848	817
1943	1836	1738	1651	1572	1500	1437	1378	1323	1273	1228
2591	2448	2318	2201	2096	2000	1916	1838	1766	1699	1638
3243	3063	2899	2753	2621	2500	2395	2298	2208	2125	2049
3899	3682	3483	3306	3147	3000	2875	2758	2650	2551	2460
4559	4303	4069	3860	3672	3500	3354	3218	3092	2977	2871
5223	4926	4656	4415	4199	4000	3833	3678	3535	3403	3282
5892	5553	5245	4971	4726	4500	4313	4138	3977	3828	3693
6565	6184	5837	5529	5253	5000	4792	4598	4419	4254	4103
7243	6818	6431	6089	5781	5500	5271	5059	4861	4680	4514
7925	7455	7027	6649	6310	6000	5750	5518	5302	5104	4923

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)
1000	9.8	2:22	9.4	2:20	9.2	2:19	8.9	2:18	8.9	2:19
1500	14.8	3:29	14.3	3:27	13.9	3:25	13.6	3:23	13.5	3:24
2000	19.7	4:38	19.1	4:34	18.5	4:31	18.1	4:29	17.9	4:29
2500	24.5	5:48	23.8	5:42	23.1	5:38	22.5	5:35	22.3	5:34
3000	29.2	6:59	28.4	6:51	27.5	6:46	26.8	6:42	26.5	6:40
3500	33.8	8:12	32.8	8:01	31.9	7:54	31.1	7:49	30.6	7:46
4000	38.3	9:27	37.2	9:13	36.1	9:03	35.2	8:57	34.6	8:52
4500	42.7	10:42	41.5	10:25	40.3	10:13	39.3	10:05	38.6	10:00
5000	47.0	12:00	45.6	11:40	44.4	11:24	43.2	11:15	42.4	11:07
5500	51.2	13:18	49.7	12:56	48.4	12:37	47.1	12:25	46.2	12:16
6000	55.3	14:39	53.7	14:13	52.3	13:51	50.9	13:36	49.9	13:25

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	1.2	2.3
10	-1.5	-0.8	0.0	2.4	4.9
15	-2.3	-1.2	0.0	3.5	7.4
20	-3.2	-1.6	0.0	4.6	9.6
25	-4.0	-2.0	0.0	5.5	11.6
30	-4.8	-2.5	0.0	6.3	13.4
35	-5.7	-2.9	0.0	7.0	15.0
40	-6.5	-3.3	0.0	7.6	16.3
45	-7.4	-3.7	0.0	8.0	17.4
50	-8.3	-4.1	0.0	8.4	18.3
55	-9.2	-4.5	0.0	8.7	18.9
60	-10.0	-4.9	0.0	8.8	19.4
65	-10.9	-5.3	0.0	8.9	19.6
70	-11.8	-5.7	0.0	8.8	19.6

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)														
	190	180	170	160	150	140	135	130	125	120	115	110	105	100	
43									46	30	18	9	3	1	
41							38	25	15	7	3	1	1	3	
39							11	5	2	0	1	3	6		
37				30	13	3	1	0	1	3	7	12	17	24	
35		38	19	7	1	1	2	5	8	13	18	24	31	38	
33	24	11	4	0	2	6	10	14	19	25	31	38	45	53	
31	5	1	1	3	9	17	22	27	33	39	46	53	60	68	
29	0	2	5	11	20	29	35	41	47	53	60	67	74	81	
27	4	8	15	23	33	43	49	55	61	67	74	80	87	94	
25	12	19	27	36	46	57	63	68	74	80	86	93	99	105	
23	23	31	40	50	60	70	76	81	87	93	98	104	110	115	

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 .78/290/250

PRESSURE ALT (1000 FT)	17	19	21	23	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	66	73	80	87	94	101	108	115	120	126	131	137	142	147
TIME (MINUTES)	16	17	18	19	20	21	22	23	24	25	26	26	27	28



Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
190	%N1	68.7	71.4	76.0	80.2	84.3	88.6	93.2		
	KIAS	259	259	259	259	259	259	261		
	FF/ENG	2940	2920	2890	2870	2870	2910	2960		
180	%N1	67.2	69.9	74.4	78.7	82.8	87.1	91.6		
	KIAS	251	251	251	251	251	251	254		
	FF/ENG	2790	2760	2730	2710	2700	2740	2780		
170	%N1	65.8	68.4	72.6	77.1	81.4	85.5	89.9	95.4	
	KIAS	244	244	244	244	244	244	246	254	
	FF/ENG	2640	2610	2580	2560	2550	2570	2610	2780	
160	%N1	63.9	66.8	70.9	75.4	79.8	84.0	88.3	93.3	
	KIAS	236	236	236	236	236	236	238	241	
	FF/ENG	2500	2460	2430	2410	2390	2400	2430	2520	
150	%N1	62.0	65.1	69.1	73.7	78.0	82.2	86.6	91.3	
	KIAS	228	228	228	228	228	228	230	233	
	FF/ENG	2350	2310	2280	2250	2240	2240	2260	2310	
140	%N1	60.1	63.1	67.3	71.6	76.1	80.4	84.7	89.3	
	KIAS	222	222	222	222	222	222	222	224	
	FF/ENG	2210	2170	2130	2110	2090	2080	2100	2140	
130	%N1	58.2	61.1	65.4	69.5	74.1	78.6	82.8	87.2	94.2
	KIAS	217	217	217	217	217	217	217	217	219
	FF/ENG	2080	2040	1990	1970	1940	1930	1940	1970	2120
120	%N1	56.2	59.0	63.4	67.4	72.1	76.4	80.7	85.1	91.6
	KIAS	211	211	211	211	211	211	211	211	211
	FF/ENG	1940	1910	1860	1830	1810	1790	1790	1800	1890
110	%N1	54.3	56.9	61.1	65.4	69.6	74.2	78.6	82.8	89.0
	KIAS	205	205	205	205	205	205	205	205	205
	FF/ENG	1810	1780	1730	1700	1670	1660	1640	1650	1710
100	%N1	52.3	54.8	58.7	63.3	67.2	72.0	76.3	80.6	86.5
	KIAS	199	199	199	199	199	199	199	199	199
	FF/ENG	1680	1650	1600	1570	1540	1520	1510	1510	1560

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Advisory Information

Chapter PI

Section 12

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF25	ONE REV	NO REV
MAX MANUAL	3200	110/-60	80	-130	440	50	-40	80	-70	250	80	170
MAX AUTO	5370	130/-130	150	-250	840	0	0	160	-160	600	0	0
AUTOBRAKE 4	5540	140/-140	160	-260	880	0	0	160	-160	630	0	0
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	-20	190	-190	710	0	0
AUTOBRAKE 2	7090	190/-190	220	-350	1190	50	-120	220	-210	630	110	110
AUTOBRAKE 1	7740	220/-220	250	-390	1360	170	-220	250	-230	580	480	620

Good Reported Braking Action

MAX MANUAL	4400	110/-100	120	-210	720	120	-110	120	-110	340	260	580
MAX AUTO	5380	130/-130	150	-250	860	20	0	160	-160	600	20	80
AUTOBRAKE 4	5540	140/-140	160	-260	880	10	0	160	-160	630	10	50
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	-20	190	-190	710	0	0

Medium Reported Braking Action

MAX MANUAL	6030	170/-160	190	-330	1190	300	-230	180	-170	440	690	1660
MAX AUTO	6060	170/-160	190	-330	1190	260	-160	190	-170	570	600	1580
AUTOBRAKE 4	6130	170/-160	190	-330	1200	240	-140	190	-180	610	530	1510
AUTOBRAKE 3	6670	180/-170	200	-350	1260	160	-100	200	-200	710	350	1100

Poor Reported Braking Action

MAX MANUAL	7790	240/-230	260	-480	1830	660	-440	250	-220	520	1450	3870
MAX AUTO	7790	240/-230	260	-480	1820	660	-440	250	-220	510	1460	3890
AUTOBRAKE 4	7790	240/-230	260	-480	1820	670	-430	250	-220	520	1460	3890
AUTOBRAKE 3	7870	240/-220	260	-480	1840	610	-360	250	-230	660	1330	3760

Reference distance assumes sea level, standard day, no wind or slope, VREF25 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 400 ft.

Reference distance for auto braking is applicable for auto or manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABV SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABV VREF 30	ONE REV	NO REV
MAX MANUAL	3150	140/-70	80	-130	440	50	-40	80	-70	250	80	160
MAX AUTO	5220	210/-140	150	-240	830	0	0	150	-150	600	0	0
AUTOBRAKE 4	5380	220/-140	150	-250	870	0	0	160	-160	620	0	0
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	-10	190	-190	720	0	0
AUTOBRAKE 2	6930	280/-200	210	-340	1180	40	-110	210	-210	640	80	80
AUTOBRAKE 1	7590	300/-220	240	-390	1350	160	-210	240	-230	580	410	540

Good Reported Braking Action

MAX MANUAL	4340	160/-110	120	-210	720	120	-110	120	-110	350	240	540
MAX AUTO	5230	210/-140	150	-250	850	20	0	150	-150	600	20	80
AUTOBRAKE 4	5390	220/-140	150	-250	870	10	0	160	-160	620	10	50
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	-10	190	-190	720	0	0

Medium Reported Braking Action

MAX MANUAL	5960	230/-170	190	-330	1190	300	-240	180	-170	450	650	1540
MAX AUTO	5960	250/-170	190	-330	1190	280	-170	180	-170	560	600	1500
AUTOBRAKE 4	6020	250/-170	190	-330	1200	260	-150	190	-180	600	540	1430
AUTOBRAKE 3	6510	280/-180	200	-350	1250	170	-100	200	-190	720	360	1060

Poor Reported Braking Action

MAX MANUAL	7720	310/-230	260	-480	1830	680	-440	250	-220	520	1370	3600
MAX AUTO	7720	310/-230	260	-480	1830	680	-440	250	-220	520	1380	3610
AUTOBRAKE 4	7720	310/-230	260	-480	1830	680	-440	250	-220	520	1380	3610
AUTOBRAKE 3	7750	330/-230	260	-480	1840	640	-360	250	-230	670	1290	3520

Reference distance assumes sea level, standard day, no wind or slope, VREF30 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 400 ft.

Reference distance for auto braking is applicable for both auto and manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Dry Runway

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	4210	90/-90	100	-170/570	90/-80	110/-110	420	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	4130	160/-100	100	-170/570	90/-80	110/-110	440	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	4530	260/-110	130	-170/570	80/-70	130/-120	320	200	440
ANTI-SKID OFF (FLAPS 25)	VREF25	5920	160/-150	160	-290/1010	190/-160	160/-150	440	410	960
ANTI-SKID OFF (FLAPS 30)	VREF30	5770	230/-160	160	-290/1010	190/-160	160/-150	450	380	880
ENGINE FAILURE (FLAPS 20)	VREF20	3460	150/-80	90	-140/470	60/-50	90/-90	280	0	110
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	4140	110/-100	100	-160/530	70/-60	100/-100	380	140	300
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	3350	90/-80	80	-130/460	50/-50	80/-80	290	100	200
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	3300	130/-80	80	-130/460	60/-50	80/-80	300	90	190
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	3680	90/-90	90	-150/530	70/-60	90/-90	310	140	300
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	3620	140/-90	90	-150/530	70/-70	90/-90	330	130	280
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	4890	190/-110	130	-180/600	100/-90	130/-130	510	230	510
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	4570	180/-110	130	-180/610	110/-90	130/-120	420	260	570
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	5800	240/-150	170	-230/780	160/-140	170/-160	580	430	990

***Reference distance assumes sea level, standard day with no wind or slope.**

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Dry Runway**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
LE SLAT ASYM (FLAPS = 20)	VREF30+30	4140	170/-90	110	-150/520	70/-60	110/-110	310	160	340
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	4440	170/-100	120	-160/540	80/-70	120/-120	320	180	390
LE SLAT DISAGREE (FLAPS > 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	3940	180/-90	100	-150/500	60/-60	100/-100	280	140	290
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	4260	180/-100	110	-160/540	80/-70	120/-110	330	0	180
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	6240	150/-150	180	-300/1010	270/-220	180/-180	620	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	6090	250/-150	180	-300/1010	280/-230	180/-180	640	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	6220	220/-160	190	-250/860	160/-150	190/-180	380	530	1220
ANTI-SKID OFF (FLAPS 25)	VREF25	6660	190/-180	190	-350/1240	290/-230	190/-180	490	630	1530
ANTI-SKID OFF (FLAPS 30)	VREF30	6500	260/-180	190	-350/1240	290/-230	190/-180	490	590	1410
ENGINE FAILURE (FLAPS 20)	VREF20	4980	150/-130	140	-230/800	160/-140	140/-140	410	0	410
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	5600	170/-150	160	-250/840	170/-150	160/-150	510	430	1010
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	5760	240/-160	180	-250/860	190/-170	180/-170	510	530	1250
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560

***Reference distance assumes sea level, standard day with no wind or slope.**

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Good Reported Braking Action**

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	5130	200/-130	150	-230/790	150/-130	150/-140	380	380	860
LE SLAT ASYM (FLAPS = 20)	VREF30+30	5770	220/-150	170	-250/840	170/-150	170/-170	420	470	1080
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	6180	230/-160	190	-260/870	180/-160	190/-180	430	520	1190
LE SLAT DISAGREE (FLAPS > 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	5500	200/-140	160	-240/810	150/-140	160/-160	380	420	950
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	6160	230/-160	180	-270/900	210/-180	190/-180	470	0	590
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Medium Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	9940	240/-230	310	-560/1950	1000/-670	320/-320	870	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	9650	370/-230	310	-550/1940	1000/-670	320/-320	870	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	8820	340/-250	300	-400/1400	410/-330	300/-270	520	1430	3670
ANTI-SKID OFF (FLAPS 25)	VREF25	8370	260/-250	260	-500/1870	640/-440	250/-230	560	1370	3680
ANTI-SKID OFF (FLAPS 30)	VREF30	8180	350/-250	260	-500/1870	650/-440	250/-230	560	1290	3390
ENGINE FAILURE (FLAPS 20)	VREF20	7250	240/-220	230	-390/1360	440/-340	230/-220	560	0	1250
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	7520	260/-230	240	-380/1340	400/-310	240/-220	630	1120	2890
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	7850	350/-240	270	-390/1370	430/-340	260/-240	620	1300	3370
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	7070	290/-210	230	-360/1280	350/-280	230/-210	490	980	2430
LE SLAT ASYM (FLAPS = 20)	VREF30+30	7900	320/-230	260	-380/1350	390/-320	260/-240	530	1170	2930
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	8430	340/-250	290	-400/1380	410/-330	280/-260	540	1340	3430
LE SLAT DISAGREE (FLAPS > 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	7550	300/-220	250	-370/1310	360/-290	250/-230	490	1050	2620
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	8860	360/-260	290	-430/1510	530/-420	290/-280	610	0	1680
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010	2540
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110	2810
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010	2540
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110	2810

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	16490	320/-200	570	-1120/4230	6080/-2020	600/-590	1090	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	15920	480/-200	550	-1100/4180	5960/-1970	580/-570	1080	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	11600	480/-370	430	-590/2140	900/-630	410/-370	640	3020	8970
ANTI-SKID OFF (FLAPS 25)	VREF25	10950	380/-360	370	-800/3310	3040/-940	350/-310	630	3540	14250
ANTI-SKID OFF (FLAPS 30)	VREF30	10760	480/-360	360	-800/3310	3040/-950	350/-310	630	3380	13380
ENGINE FAILURE (FLAPS 20)	VREF20	9970	360/-320	340	-600/2200	1100/-700	330/-310	690	0	3070
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	9560	360/-310	330	-550/2030	840/-570	320/-290	710	2280	6740
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	10000	460/-330	360	-560/2060	890/-610	350/-310	690	2540	7490
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)							
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	9120	400/-290	320	-530/1950	760/-520	310/-280	570	2010 5610
LE SLAT ASYM (FLAPS = 20)	VREF30+30	10100	430/-320	360	-560/2040	820/-570	350/-320	600	2310 6530
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	10880	460/-350	400	-570/2100	870/-610	380/-340	630	2700 7890
LE SLAT DISAGREE (FLAPS > 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	9680	410/-310	340	-540/1990	780/-540	330/-300	560	2120 5910
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	11960	500/-380	420	-660/2380	1260/-830	410/-390	730	0 3880
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160 6210
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290 6540
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160 6210
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290 6540

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (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
180	0	15.1	16.1	17.0	22.8	24.3	25.8	31.8	33.9	35.9	41.8	44.6	47.4	52.7	56.3	59.9			
	10	15.7	16.6	17.6	23.6	25.1	26.6	32.9	35.0	37.2	43.2	46.1	49.1	54.5	58.3	62.0			
	20	16.2	17.2	18.2	24.4	26.0	27.5	34.0	36.2	38.5	44.7	47.7	50.7	56.4	60.3	64.2			
	30	16.7	17.7	18.7	25.2	26.8	28.4	35.0	37.4	39.7	46.1	49.2	52.3	58.2	62.2	66.2			
	40	16.9	18.0	19.0	25.6	27.3	29.0	35.8	38.2	40.5	47.2	50.4	53.6	59.6	63.7	67.9			
160	0	13.7	14.5	15.3	20.6	21.9	23.2	28.5	30.4	32.3	37.5	40.0	42.5	47.2	50.4	53.6	57.6	61.6	65.6
	10	14.1	15.0	15.9	21.3	22.6	24.0	29.5	31.5	33.4	38.8	41.4	44.0	48.9	52.2	55.5	59.6	63.8	67.9
	20	14.6	15.5	16.4	22.0	23.4	24.8	30.5	32.5	34.5	40.1	42.8	45.4	50.5	54.0	57.4	61.7	65.9	70.2
	30	15.0	16.0	16.9	22.7	24.1	25.5	31.5	33.5	35.6	41.3	44.1	46.9	52.1	55.7	59.3	63.7	68.1	72.5
	40	15.3	16.2	17.2	23.1	24.5	26.0	32.1	34.2	36.3	42.3	45.1	48.0	53.4	57.0	60.7	65.2	69.8	74.3
140	0	12.2	13.0	13.7	18.3	19.4	20.6	25.3	26.9	28.6	33.1	35.3	37.4	41.5	44.3	47.1	50.6	54.0	57.5
	10	12.7	13.4	14.2	18.9	20.1	21.3	26.2	27.9	29.5	34.2	36.5	38.8	43.0	45.9	48.8	52.4	56.0	59.6
	20	13.1	13.9	14.6	19.6	20.8	22.0	27.0	28.8	30.5	35.4	37.7	40.1	44.4	47.4	50.5	54.1	57.8	61.6
	30	13.5	14.3	15.1	20.2	21.4	22.7	27.9	29.7	31.5	36.5	38.9	41.3	45.9	49.0	52.1	55.9	59.7	63.6
	40	13.7	14.5	15.3	20.5	21.8	23.1	28.4	30.3	32.1	37.3	39.8	42.2	46.9	50.1	53.3	57.2	61.2	65.1
120	0	10.8	11.5	12.1	16.0	17.0	18.0	22.0	23.4	24.8	28.6	30.5	32.3	35.7	38.1	40.5	43.3	46.2	49.1
	10	11.2	11.9	12.5	16.6	17.6	18.6	22.8	24.2	25.7	29.6	31.5	33.4	37.0	39.4	41.9	44.8	47.8	50.9
	20	11.6	12.2	12.9	17.1	18.2	19.3	23.5	25.0	26.5	30.6	32.6	34.6	38.2	40.7	43.3	46.3	49.4	52.6
	30	11.9	12.6	13.3	17.7	18.8	19.9	24.2	25.8	27.3	31.5	33.6	35.7	39.4	42.0	44.7	47.8	51.0	54.3
	40	12.1	12.8	13.5	18.0	19.1	20.2	24.7	26.3	27.9	32.2	34.3	36.4	40.3	43.0	45.7	48.9	52.2	55.6
100	0	9.4	10.0	10.5	13.8	14.6	15.5	18.7	19.8	21.0	24.0	25.5	27.1	29.7	31.6	33.6	35.7	38.0	40.4
	10	9.8	10.3	10.9	14.3	15.1	16.0	19.3	20.5	21.7	24.8	26.4	28.0	30.7	32.7	34.7	36.9	39.4	41.8
	20	10.1	10.7	11.2	14.7	15.6	16.5	20.0	21.2	22.5	25.7	27.3	29.0	31.7	33.8	35.9	38.2	40.7	43.2
	30	10.4	11.0	11.6	15.2	16.1	17.0	20.6	21.9	23.2	26.5	28.2	29.9	32.7	34.9	37.0	39.4	42.0	44.6
	40	10.5	11.1	11.7	15.4	16.4	17.3	20.9	22.3	23.6	27.0	28.7	30.5	33.4	35.6	37.8	40.2	42.9	45.6

*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, altitude, and OAT effects.

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	RTO MAX MAN	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0
	MAX MAN	1.0	6.1	11.2	16.1	21.0	25.8	30.5	35.2	39.8	44.5	49.1	53.8
	MAX AUTO	1.7	6.1	10.4	14.7	18.9	23.1	27.3	31.5	35.8	40.0	44.3	48.7
	AUTOBRAKE 4	1.9	6.0	10.1	14.1	18.1	22.0	26.0	29.9	33.8	37.8	41.8	45.8
	AUTOBRAKE 3	1.8	5.7	9.5	13.2	17.0	20.7	24.3	28.0	31.6	35.3	39.0	42.8
	AUTOBRAKE 2	1.7	5.4	9.0	12.5	15.9	19.3	22.7	26.1	29.4	32.8	36.2	39.7
	AUTOBRAKE 1	1.7	5.0	8.2	11.3	14.4	17.4	20.3	23.3	26.2	29.1	32.1	35.0

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Two Engines Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	MAX MAN	0.0	5.0	9.9	14.6	19.2	23.8	28.2	32.6	37.0	41.3	45.6	49.9
	MAX AUTO	0.2	3.7	7.3	10.8	14.3	17.9	21.5	25.1	28.7	32.4	36.2	40.0
	AUTOBRAKE 4	0.0	2.9	6.0	9.0	12.1	15.1	18.2	21.3	24.5	27.7	30.9	34.2
	AUTOBRAKE 3	0.0	1.8	4.3	6.9	9.5	12.1	14.8	17.4	20.1	23.9	25.7	28.6
	AUTOBRAKE 2	0.0	0.7	2.8	4.8	6.9	8.9	11.0	13.1	15.3	17.6	19.9	22.2
	AUTOBRAKE 1	0.0	0.4	1.8	3.2	4.6	6.0	7.5	9.0	10.5	12.1	13.8	15.5

Cooling Time (Minutes)

Category "C" and "D" Brakes

		ADJUSTED BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
		14 & BELOW	15	16	18	20	24	28	34	35 TO 42	43 & ABOVE
		BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON EICAS									
		UP TO 1	1	1	2	2	3	4	5	5 TO 6	7 & ABOVE
INFLIGHT	NO SPECIAL	PROCEDURE REQUIRED	1	1	2	2	3	4	6	CAUTION	FUSE PLUG MELT ZONE
GEAR DOWN			11	15	19	24	34	44	59		
GROUND											

Observe maximum quick turnaround limit.

Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.

Add 1.0 million foot pounds per brake for each taxi mile.

For one brake deactivated, increase brake energy by 15 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 6 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 10 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.



Performance Inflight

Engine Inoperative

Chapter PI

Section 13

ENGINE INOP

Initial Max Continuous %N1

Based on .80M, packs on or off and APU on

TAT (°C)	PRESSURE ALTITUDE (1000 FT)							
	29	31	33	35	37	39	41	43
20	103.8	103.4	102.5					
15	104.4	104.0	103.3	102.3	101.1	100.8	100.8	100.8
10	105.2	104.6	104.0	103.2	101.9	101.4	101.4	101.4
5	106.1	105.5	104.7	103.9	102.6	102.1	102.2	102.2
0	107.1	106.4	105.6	104.7	103.3	102.9	102.9	102.9
-5	106.9	107.5	106.6	105.7	104.3	103.9	103.9	103.9
-10	106.0	107.1	107.7	106.7	105.3	104.9	104.9	104.9
-15	105.1	106.2	107.1	107.8	106.5	106.2	106.2	106.2
-20	104.2	105.3	106.2	106.9	106.6	106.4	106.4	106.4
-25	103.2	104.3	105.3	105.8	105.8	105.6	105.6	105.6
-30	102.3	103.3	104.3	104.7	104.7	104.7	104.7	104.7
-35	101.3	102.4	103.3	103.6	103.6	103.6	103.6	103.6
-40	100.3	101.3	102.3	102.6	102.6	102.6	102.6	102.6

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

37000 FT to 27000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

37000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.63	102.6	103.6	104.7	105.8	106.9	105.8	104.8	104.1	103.3	101.8	98.8	95.7	
220	.69	102.6	103.6	104.7	105.8	106.9	105.9	104.8	104.0	103.3	102.4	100.4	97.5	
240	.74	102.6	103.6	104.7	105.8	106.9	106.1	105.0	104.0	103.3	102.5	101.7	99.4	
260	.80	102.6	103.6	104.7	105.8	106.6	106.5	105.3	104.3	103.3	102.6	101.9	101.1	
35000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.60	102.6	103.6	104.7	105.8	106.9	107.2	106.2	105.5	104.7	103.2	100.2	97.1	
220	.66	102.6	103.6	104.7	105.8	106.9	107.3	106.2	105.4	104.7	103.8	101.8	98.8	
240	.71	102.6	103.6	104.7	105.8	106.9	107.5	106.4	105.3	104.6	104.0	102.9	100.5	
260	.77	102.6	103.6	104.7	105.8	106.9	107.7	106.6	105.6	104.5	103.9	103.2	102.1	
33000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.58	102.6	103.6	104.7	105.8	106.9	107.9	107.2	106.5	105.8	104.9	102.6	99.6	
220	.63	102.6	103.6	104.7	105.8	106.9	107.9	107.3	106.3	105.7	105.0	104.1	101.2	
240	.68	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.4	105.5	104.9	104.1	102.7	
260	.74	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.5	105.5	104.7	104.1	103.3	
31000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.55	102.6	103.6	104.7	105.8	106.8	107.9	108.1	107.2	106.6	106.0	105.0	102.0	
220	.61	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.6	106.0	105.3	103.5	
240	.66	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.4	105.7	105.1	104.4	
260	.71	102.6	103.6	104.7	105.8	106.9	107.9	108.3	107.3	106.4	105.5	104.9	104.3	
29000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.5	106.8	106.1	105.5	103.6	100.7
220	.58	102.6	103.6	104.7	105.8	106.9	107.9	108.5	107.7	106.7	106.1	105.5	104.9	102.1
240	.63	102.6	103.6	104.7	105.8	106.9	107.9	108.7	107.7	106.8	106.0	105.4	104.8	103.5
260	.68	102.6	103.6	104.7	105.8	106.9	107.9	108.8	107.7	106.8	105.9	105.3	104.7	104.0
27000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.51	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.1	101.4
220	.56	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.4	105.6	104.9	104.2	102.7
240	.60	102.6	103.6	104.7	105.8	106.9	107.9	108.6	107.6	106.7	105.7	105.0	104.3	103.6
260	.65	102.2	103.2	104.2	105.1	106.1	107.0	107.9	107.8	106.8	105.9	105.0	104.3	103.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	27	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.8	-0.9	-1.0	-1.1	-1.2	-1.4
ENGINE & WING ANTI-ICE ON	-1.7	-1.9	-2.1	-2.3	-2.5	-2.9

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

25000 FT to 16000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

25000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.49	102.6	103.6	104.7	105.8	106.8	107.8	107.8	106.9	105.9	104.9	104.1	103.3	101.8	99.0	
220	.53	102.3	103.3	104.3	105.3	106.2	107.1	107.9	107.1	106.1	105.0	104.2	103.4	102.7	100.3	
240	.58	101.6	102.6	103.6	104.5	105.5	106.4	107.2	107.2	106.3	105.3	104.3	103.6	102.8	101.5	
260	.63	100.8	101.8	102.8	103.8	104.7	105.6	106.5	107.3	106.6	105.6	104.6	103.8	103.0	102.2	
24000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.6	106.6	105.6	104.9	104.1	103.2	100.5	
220	.52	102.3	103.3	104.3	105.3	106.2	107.2	108.0	107.7	106.8	105.8	104.9	104.1	103.4	101.6	
240	.57	101.6	102.6	103.6	104.5	105.5	106.4	107.3	107.8	107.0	106.0	105.0	104.2	103.5	102.7	
260	.61	100.8	101.8	102.8	103.7	104.7	105.6	106.5	107.4	107.1	106.2	105.2	104.4	103.6	102.8	
22000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	108.9	107.9	106.9	106.1	105.2	103.7	
220	.50	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	109.0	108.0	107.0	106.1	105.3	104.4	
240	.55	102.6	103.6	104.7	105.7	106.6	107.6	108.5	109.4	109.2	108.2	107.2	106.3	105.4	104.6	
260	.59	102.0	103.0	104.0	105.0	105.9	106.9	107.8	108.7	109.3	108.5	107.5	106.5	105.6	104.8	
20000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.44	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.8	108.8	107.9	106.9	106.1	104.0
220	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.9	108.9	108.0	107.0	106.1	104.8
240	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	110.1	109.1	108.1	107.2	106.2	105.4
260	.57	102.4	103.4	104.4	105.4	106.4	107.4	108.3	109.3	110.2	110.1	109.3	108.3	107.4	106.4	105.6
18000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.42	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.4	109.4	108.4	107.5	106.7	105.6
220	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.3	109.3	108.3	107.4	106.6	105.7
240	.51	102.3	103.3	104.3	105.3	106.3	107.2	108.2	109.1	110.1	110.2	109.4	108.4	107.4	106.6	105.7
260	.55	101.6	102.6	103.6	104.6	105.6	106.6	107.5	108.5	109.4	110.3	109.5	108.6	107.6	106.7	105.8
16000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.41	100.9	102.0	103.0	104.1	105.1	106.2	107.2	108.2	109.1	110.1	109.5	108.6	107.7	106.9	106.1
220	.45	100.6	101.7	102.7	103.7	104.8	105.8	106.8	107.8	108.8	109.8	109.4	108.5	107.6	106.8	105.9
240	.49	100.3	101.3	102.3	103.4	104.4	105.4	106.4	107.4	108.4	109.4	109.4	108.5	107.5	106.7	105.9
260	.53	99.9	101.0	102.0	103.0	104.0	105.0	106.1	107.1	108.0	109.0	109.5	108.6	107.7	106.8	106.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	16	18	20	22	24	25
ENGINE ANTI-ICE ON	-0.4	-0.4	-0.5	-0.6	-0.7	-0.7
ENGINE & WING ANTI-ICE ON	-1.1	-1.1	-1.2	-1.4	-1.5	-1.5

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

14000 FT to 5000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

14000 FT PRESS ALT		TAT (°C)															
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.39	101.1	102.1	103.1	104.2	105.2	106.3	107.3	108.3	109.3	110.2	109.4	108.5	107.6	106.8	106.1	
220	.43	100.8	101.8	102.8	103.9	104.8	105.8	106.8	107.7	108.6	109.6	109.4	108.4	107.6	106.7	106.0	
240	.47	100.2	101.2	102.2	103.2	104.1	105.1	106.0	107.0	107.9	108.9	109.4	108.4	107.5	106.6	105.9	
260	.51	99.5	100.5	101.5	102.5	103.4	104.4	105.3	106.2	107.2	108.1	109.1	108.4	107.5	106.7	105.9	
12000 FT PRESS ALT		TAT (°C)															
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.38	100.0	101.0	101.9	102.9	103.9	104.8	105.8	106.7	107.7	108.6	109.2	108.2	107.4	106.6	105.8	
220	.41	99.4	100.4	101.4	102.4	103.4	104.3	105.3	106.2	107.1	108.1	109.0	108.3	107.4	106.6	105.8	
240	.45	98.9	99.9	100.9	101.9	102.8	103.8	104.7	105.6	106.6	107.5	108.4	108.4	107.5	106.7	105.9	
260	.49	98.4	99.4	100.3	101.3	102.3	103.2	104.1	105.1	106.0	106.9	107.8	108.5	107.6	106.8	105.9	
10000 FT PRESS ALT		TAT (°C)															
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.36	98.2	99.2	100.2	101.2	102.1	103.1	104.0	104.9	105.8	106.8	107.7	107.8	107.0	106.2	105.4	
220	.40	97.7	98.7	99.7	100.7	101.6	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4	
240	.43	97.4	98.4	99.3	100.3	101.3	102.2	103.1	104.1	105.0	105.9	106.8	107.7	107.2	106.4	105.6	
260	.47	97.0	98.0	99.0	99.9	100.9	101.8	102.7	103.7	104.6	105.5	106.4	107.3	107.4	106.6	105.8	
5000 FT PRESS ALT		TAT (°C)															
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.33	95.5	96.5	97.5	98.4	99.4	100.3	101.2	102.1	103.1	104.0	104.8	105.7	106.6	106.4	105.7	
220	.36	95.1	96.1	97.1	98.0	99.0	99.9	100.8	101.7	102.7	103.6	104.4	105.3	106.2	106.4	105.7	
240	.40	94.7	95.7	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	104.0	104.9	105.8	106.4	105.7	
260	.43	94.4	95.4	96.4	97.3	98.3	99.2	100.1	101.0	101.9	102.8	103.7	104.6	105.5	106.3	105.9	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	5	10	12	14
ENGINE ANTI-ICE ON	-0.6	-0.5	-0.5	-0.6
ENGINE & WING ANTI-ICE ON	-1.2	-1.1	-1.2	-1.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	183	276	18400	17400	15600
180	174	269	20000	19100	17700
170	165	262	21200	20600	19700
160	155	254	22600	21900	21000
150	145	247	24000	23200	22300
140	135	238	25500	24700	23700
130	126	230	27200	26700	25500
120	116	221	29100	28900	28100
110	106	212	30900	30900	30500
100	97	202	32900	32800	32600

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
274	255	239	224	211	200	190	180	172	164	157
547	510	477	448	423	400	380	361	344	329	315
819	763	715	672	634	600	570	542	517	494	473
1090	1016	952	895	845	800	760	723	690	660	632
1361	1269	1189	1119	1056	1000	950	904	863	825	790
1632	1522	1426	1342	1267	1200	1140	1085	1036	990	949
1902	1775	1664	1565	1478	1400	1330	1266	1208	1156	1107
2174	2029	1901	1789	1689	1600	1520	1447	1381	1321	1266
2447	2283	2139	2013	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)										
	100	110	120	130	140	150	160	170	180	190	
200	1.5	1.7	1.8	1.9	2.1	2.1	2.3	2.4	2.5	2.6	0:33
400	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.4	5.8	6.0	1:05
600	5.2	5.7	6.1	6.6	7.0	7.5	7.9	8.3	8.8	9.3	1:36
800	6.9	7.5	8.1	8.8	9.4	10.0	10.6	11.2	11.8	12.4	2:08
1000	8.6	9.4	10.1	10.9	11.7	12.4	13.2	13.9	14.7	15.5	2:39
1200	10.2	11.2	12.1	13.1	14.0	14.9	15.8	16.7	17.6	18.5	3:10
1400	11.9	13.0	14.0	15.2	16.3	17.3	18.4	19.4	20.5	21.5	3:42
1600	13.5	14.8	16.0	17.2	18.5	19.6	20.9	22.0	23.3	24.5	4:14
1800	15.1	16.5	17.8	19.2	20.6	22.0	23.3	24.6	26.0	27.4	4:45

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb and APU on

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	15400	13000	10200
185	16300	14200	11400
180	17200	15300	12700
175	18200	16500	13900
170	19100	17600	15200
165	20000	18700	16400
160	20700	19700	17800
155	21400	20500	19100
150	22100	21200	20200
145	22800	21900	20900
140	23600	22600	21600
135	24300	23400	22300
130	25100	24100	23000
125	26100	24900	23700
120	27200	26200	24500
115	28300	27600	25700
110	29400	29000	27400
105	30500	30300	29100
100	31400	31300	30500

With engine anti-ice on, decrease altitude capability by 1800 ft.

With engine and wing anti-ice on, decrease altitude capability by 3800 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	14	18	21	23	25	27	29	31
190	%N1	98.8	102.4							
	MACH	.583	.616							
	KIAS	324	318							
	FF/ENG	6358	6418							
180	%N1	97.2	100.7	105.0						
	MACH	.572	.605	.641						
	KIAS	317	312	307						
	FF/ENG	6000	6034	6176						
170	%N1	95.6	99.0	102.9						
	MACH	.559	.593	.628						
	KIAS	310	306	300						
	FF/ENG	5646	5675	5766						
160	%N1	93.9	97.2	100.8	104.3					
	MACH	.545	.580	.614	.643					
	KIAS	303	299	294	290					
	FF/ENG	5286	5313	5367	5482					
150	%N1	92.1	95.3	98.8	101.9	104.6				
	MACH	.532	.567	.601	.628	.647				
	KIAS	295	292	287	283	281				
	FF/ENG	4945	4965	4991	5067	5157				
140	%N1	90.3	93.4	96.8	99.6	101.8				
	MACH	.518	.551	.587	.612	.632				
	KIAS	287	283	280	276	273				
	FF/ENG	4609	4607	4633	4669	4732				
130	%N1	88.4	91.4	94.7	97.3	99.3	101.6			
	MACH	.503	.535	.571	.597	.615	.635			
	KIAS	278	275	272	268	266	263			
	FF/ENG	4279	4262	4280	4301	4328	4393			
120	%N1	86.3	89.3	92.4	95.0	96.8	98.8	101.3		
	MACH	.487	.518	.553	.580	.598	.616	.636		
	KIAS	269	266	263	261	258	255	253		
	FF/ENG	3955	3927	3928	3944	3959	3986	4051		
110	%N1	84.0	87.1	90.1	92.6	94.3	96.2	98.2	100.7	
	MACH	.470	.501	.534	.562	.580	.598	.617	.637	
	KIAS	260	257	254	252	250	248	245	243	
	FF/ENG	3634	3599	3585	3597	3606	3617	3642	3703	
100	%N1	81.5	84.6	87.6	90.0	91.7	93.4	95.3	97.3	99.9
	MACH	.450	.482	.514	.540	.559	.578	.597	.615	.636
	KIAS	249	247	244	242	241	239	237	234	232
	FF/ENG	3300	3279	3253	3247	3260	3267	3277	3297	3350

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	190	181	173	166	159
575	529	489	455	426	400	381	363	347	332	319
864	796	735	684	640	600	571	544	520	498	478
1155	1063	982	913	853	800	761	726	693	664	637
1446	1331	1228	1142	1067	1000	952	907	866	829	796
1738	1598	1475	1370	1281	1200	1142	1088	1039	995	955
2032	1868	1723	1600	1495	1400	1332	1269	1212	1160	1113
2327	2138	1971	1830	1709	1600	1522	1451	1385	1325	1271
2623	2409	2219	2060	1923	1800	1712	1631	1557	1489	1429

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:41	2.3	0:40	2.0	0:38	1.9	0:37	1.7	0:36
400	5.4	1:17	4.9	1:15	4.6	1:12	4.3	1:09	4.2	1:07
600	8.1	1:54	7.6	1:50	7.1	1:45	6.8	1:41	6.6	1:37
800	10.8	2:32	10.2	2:25	9.6	2:19	9.2	2:14	8.9	2:08
1000	13.5	3:09	12.7	3:01	12.1	2:53	11.5	2:46	11.3	2:39
1200	16.2	3:47	15.3	3:37	14.5	3:27	13.9	3:19	13.6	3:11
1400	18.8	4:26	17.8	4:14	16.9	4:02	16.2	3:52	15.8	3:42
1600	21.4	5:04	20.2	4:50	19.3	4:36	18.5	4:25	18.1	4:14
1800	24.0	5:43	22.7	5:27	21.6	5:12	20.7	4:58	20.3	4:45

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.1	0.0	0.2	0.4
4	-0.6	-0.3	0.0	0.5	0.9
6	-1.0	-0.5	0.0	0.7	1.4
8	-1.3	-0.6	0.0	1.0	2.0
10	-1.6	-0.8	0.0	1.3	2.5
12	-2.0	-1.0	0.0	1.6	3.0
14	-2.3	-1.2	0.0	1.8	3.6
16	-2.7	-1.3	0.0	2.1	4.1
18	-3.0	-1.5	0.0	2.4	4.7
20	-3.4	-1.7	0.0	2.6	5.2
22	-3.7	-1.8	0.0	2.9	5.7
24	-4.1	-2.0	0.0	3.1	6.3
26	-4.4	-2.2	0.0	3.4	6.8
28	-4.8	-2.3	0.0	3.6	7.4
30	-5.1	-2.5	0.0	3.8	7.9

Includes APU fuel burn.



767 Flight Crew Operations Manual

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	87.3	90.3	94.9	100.2			
	KIAS	259	259	259	259			
	FF/ENG	5450	5490	5600	5810			
180	%N1	85.5	88.7	93.1	98.2	105.4		
	KIAS	251	251	251	251	251		
	FF/ENG	5140	5170	5250	5410	5770		
170	%N1	83.8	86.9	91.3	96.2	102.4		
	KIAS	244	244	244	244	244		
	FF/ENG	4840	4850	4910	5040	5310		
160	%N1	82.0	85.0	89.4	94.2	99.9		
	KIAS	236	236	236	236	236		
	FF/ENG	4530	4540	4580	4680	4890		
150	%N1	79.8	83.0	87.5	92.1	97.5		
	KIAS	228	228	228	228	228		
	FF/ENG	4230	4240	4260	4330	4490		
140	%N1	77.6	81.0	85.4	90.0	95.0	101.7	
	KIAS	222	222	222	222	222	222	
	FF/ENG	3940	3940	3950	4000	4120	4370	
130	%N1	75.5	78.6	83.2	87.7	92.5	98.4	
	KIAS	217	217	217	217	217	217	
	FF/ENG	3660	3650	3660	3690	3770	3950	
120	%N1	73.2	76.2	81.0	85.5	90.1	95.4	
	KIAS	211	211	211	211	211	211	
	FF/ENG	3380	3370	3370	3390	3440	3560	
110	%N1	70.6	73.9	78.4	83.0	87.6	92.6	99.0
	KIAS	205	205	205	205	205	205	205
	FF/ENG	3120	3100	3090	3100	3140	3220	3410
100	%N1	67.9	71.2	75.7	80.5	85.0	89.7	95.3
	KIAS	199	199	199	199	199	199	199
	FF/ENG	2850	2840	2830	2820	2840	2890	3020

This table includes 5% additional fuel for holding in a racetrack pattern.



Performance Inflight

Gear Down

Chapter PI

Section 14

GEAR DOWN

200 KIAS Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
55	96.7	97.4	97.0	97.0	96.6	96.7	97.0	97.1	96.1	95.2	96.3	98.2	99.9
50	97.2	98.3	98.1	98.1	97.8	97.9	98.3	98.3	97.3	96.2	96.2	97.5	99.2
45	97.9	98.8	99.1	99.1	98.9	99.0	99.5	99.5	98.5	97.4	97.4	98.1	98.8
40	98.5	99.3	99.9	100.1	99.9	100.2	100.6	100.7	99.6	98.6	98.5	99.3	99.9
35	99.1	100.0	100.4	100.7	100.9	101.2	101.7	101.8	100.7	99.7	99.6	100.4	101.0
30	99.6	100.6	101.1	101.2	101.4	102.1	102.8	102.9	101.8	100.8	100.7	101.4	102.1
25	98.7	101.4	101.7	101.9	102.0	102.6	103.5	103.9	102.9	101.8	101.7	102.5	103.1
20	97.9	101.9	102.5	102.6	102.7	103.3	104.1	104.6	103.7	102.8	102.7	103.4	104.1
15	97.1	101.0	103.5	103.4	103.4	104.0	104.9	105.3	104.5	103.6	103.6	104.4	105.0
10	96.3	100.2	103.6	104.4	104.2	104.8	105.7	106.2	105.3	104.5	104.4	105.2	105.9
5	95.5	99.3	102.7	103.9	104.9	105.6	106.5	107.0	106.2	105.4	105.3	105.9	106.6
0	94.7	98.4	101.8	103.0	104.0	105.6	107.3	107.8	107.2	106.3	106.2	106.7	107.2
-5	93.8	97.5	100.9	102.1	103.0	104.7	106.7	108.3	108.2	107.6	107.1	107.5	108.0
-10	93.0	96.6	100.0	101.2	102.2	103.7	105.8	107.3	108.2	108.5	108.5	108.5	108.5
-15	92.1	95.7	99.1	100.3	101.2	102.8	104.8	106.4	107.3	107.5	107.5	107.5	107.5
-20	91.3	94.8	98.2	99.3	100.3	102.0	103.9	105.5	106.3	106.5	106.5	106.5	106.5
-25	90.4	93.9	97.3	98.4	99.4	101.0	103.0	104.6	105.4	105.4	105.4	105.4	105.4
-30	89.5	93.0	96.4	97.5	98.5	100.0	102.0	103.7	104.4	104.4	104.4	104.4	104.4
-35	88.6	92.0	95.4	96.5	97.5	99.0	101.1	102.7	103.3	103.3	103.3	103.3	103.3
-40	87.7	91.1	94.5	95.6	96.5	98.1	100.1	101.8	102.2	102.2	102.2	102.2	102.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.7	-0.8	-0.8	-0.9	-1.0	-1.0	-1.1
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.2	-1.3	-1.3	-1.4	-1.5	-1.5	-1.7

GEAR DOWN

Long Range Cruise Altitude Capability

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	19800	18200	14800
185	20700	19300	17400
180	21700	20300	18600
175	22700	21200	19800
170	23700	22200	20800
165	24800	23200	21700
160	25800	24100	22700
155	26800	25200	23700
150	27600	26400	24800
145	28500	27700	26100
140	29300	29000	27500
135	30000	30000	29000
130	30700	30700	30100
125	31400	31400	30900
120	32200	32100	31700
115	32900	32900	32500
110	33700	33600	33300
105	34500	34400	34200
100	35300	35200	35000
95	36100	36100	35800
90	36900	36900	36600



GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		10	14	18	21	23	25	27	29	31	33	35
190	%N1	91.6	95.1	99.1								
	MACH	.472	.508	.546								
	KIAS	261	261	260								
	FF/ENG	4765	4811	4928								
180	%N1	90.0	93.4	97.3	100.6							
	MACH	.461	.495	.534	.563							
	KIAS	255	254	254	253							
	FF/ENG	4490	4522	4612	4715							
170	%N1	88.4	91.7	95.4	98.5	101.0						
	MACH	.449	.483	.520	.550	.571						
	KIAS	248	248	247	246	246						
	FF/ENG	4225	4241	4295	4386	4471						
160	%N1	86.8	89.9	93.5	96.5	98.6	101.4					
	MACH	.437	.469	.506	.536	.555	.577					
	KIAS	241	240	240	240	239	238					
	FF/ENG	3963	3961	4000	4072	4126	4222					
150	%N1	84.8	88.1	91.5	94.3	96.4	98.7	101.6				
	MACH	.424	.456	.491	.520	.540	.561	.583				
	KIAS	234	233	233	232	232	231	231				
	FF/ENG	3703	3693	3717	3758	3812	3868	3966				
140	%N1	82.8	86.2	89.5	92.2	94.2	96.3	98.7	101.9			
	MACH	.411	.442	.476	.504	.524	.544	.565	.587			
	KIAS	227	226	225	225	225	224	224	223			
	FF/ENG	3443	3434	3440	3465	3502	3549	3611	3704			
130	%N1	81.0	84.1	87.3	90.0	91.8	93.9	96.0	98.6	102.0		
	MACH	.398	.427	.460	.487	.506	.527	.548	.570	.591		
	KIAS	220	219	218	217	217	217	216	216	214		
	FF/ENG	3205	3176	3170	3187	3205	3244	3286	3353	3436		
120	%N1	78.7	81.8	85.2	87.7	89.5	91.3	93.4	95.6	98.3	101.8	
	MACH	.385	.411	.443	.469	.488	.508	.529	.550	.572	.593	
	KIAS	212	210	210	209	209	209	209	208	207	206	
	FF/ENG	2974	2918	2912	2913	2927	2944	2981	3022	3090	3165	
110	%N1	76.1	79.6	82.8	85.3	87.0	88.8	90.7	92.7	95.0	97.7	101.5
	MACH	.369	.396	.426	.451	.469	.488	.508	.529	.551	.574	.595
	KIAS	203	203	201	201	200	200	200	200	199	199	197
	FF/ENG	2726	2685	2658	2653	2654	2668	2682	2717	2759	2822	2895
100	%N1	73.5	76.9	80.1	82.7	84.4	86.0	87.9	89.8	91.9	94.1	96.9
	MACH	.353	.380	.408	.432	.449	.467	.487	.507	.528	.550	.574
	KIAS	195	194	192	192	192	191	191	191	191	190	190
	FF/ENG	2489	2454	2407	2400	2397	2397	2408	2421	2454	2495	2553

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	288	259	236	217	200	189	179	170	161	154
650	581	521	474	434	400	378	357	339	323	308
981	875	784	711	652	600	567	536	509	484	462
1317	1173	1049	951	870	800	755	714	677	644	615
1656	1472	1315	1190	1089	1000	944	893	846	805	768
2000	1775	1583	1431	1308	1200	1132	1070	1014	964	920
2349	2082	1854	1674	1527	1400	1320	1248	1182	1124	1072
2703	2391	2125	1916	1747	1600	1508	1425	1349	1282	1223
3062	2705	2400	2161	1968	1800	1696	1602	1517	1441	1374
3427	3021	2675	2406	2188	2000	1884	1779	1684	1599	1524

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		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	4.8	0:49	4.4	0:47	4.0	0:45	3.7	0:44	3.3	0:41
400	9.9	1:36	9.2	1:32	8.6	1:27	8.0	1:23	7.5	1:17
600	14.9	2:24	13.9	2:17	13.0	2:09	12.2	2:03	11.5	1:53
800	19.8	3:12	18.5	3:02	17.4	2:52	16.4	2:43	15.4	2:30
1000	24.6	4:02	23.0	3:49	21.6	3:36	20.4	3:24	19.2	3:07
1200	29.3	4:52	27.4	4:36	25.8	4:20	24.4	4:05	23.0	3:45
1400	33.9	5:43	31.8	5:24	29.9	5:06	28.3	4:48	26.6	4:23
1600	38.5	6:36	36.0	6:13	33.9	5:51	32.1	5:31	30.1	5:02
1800	42.9	7:29	40.2	7:03	37.8	6:38	35.8	6:14	33.6	5:41
2000	47.2	8:24	44.2	7:54	41.6	7:26	39.4	6:58	37.0	6:21

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	0.6	1.3
10	-1.5	-0.8	0.0	1.3	2.7
15	-2.4	-1.2	0.0	1.9	4.0
20	-3.2	-1.6	0.0	2.5	5.3
25	-4.0	-2.0	0.0	3.1	6.6
30	-4.8	-2.4	0.0	3.7	7.8
35	-5.6	-2.8	0.0	4.3	8.9
40	-6.4	-3.2	0.0	4.8	10.1
45	-7.2	-3.6	0.0	5.3	11.1
50	-8.0	-4.0	0.0	5.8	12.1
55	-8.9	-4.5	0.0	6.3	13.1
60	-9.7	-4.9	0.0	6.7	14.0

Descent at VREF30 + 70

PRESSURE ALTITUDE (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	16	26	36	40	44	48	52	56	60	64	68	71	74
TIME (MINUTES)	7	10	12	13	14	15	16	16	17	18	19	19	20

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	83.1	85.9	90.1	94.6	100.0		
	KIAS	249	249	249	249	249		
	FF/ENG	4710	4690	4710	4790	4980		
180	%N1	81.2	84.2	88.4	92.8	97.9		
	KIAS	241	241	241	241	241		
	FF/ENG	4440	4410	4420	4470	4610		
170	%N1	79.4	82.5	86.7	91.0	95.9	102.5	
	KIAS	234	234	234	234	234	234	
	FF/ENG	4180	4160	4150	4180	4280	4550	
160	%N1	77.4	80.5	84.7	89.0	93.7	99.6	
	KIAS	226	226	226	226	226	226	
	FF/ENG	3910	3890	3860	3880	3950	4140	
150	%N1	75.4	78.3	82.7	87.0	91.5	96.9	
	KIAS	218	218	218	218	218	218	
	FF/ENG	3650	3620	3590	3590	3640	3770	
140	%N1	73.6	76.4	80.9	85.2	89.5	94.6	102.0
	KIAS	212	212	212	212	212	212	212
	FF/ENG	3420	3390	3360	3350	3380	3470	3710
130	%N1	71.5	74.6	79.0	83.2	87.6	92.4	98.6
	KIAS	207	207	207	207	207	207	207
	FF/ENG	3210	3180	3150	3120	3140	3210	3380
120	%N1	69.4	72.6	76.8	81.2	85.6	90.2	95.7
	KIAS	201	201	201	201	201	201	201
	FF/ENG	3000	2970	2930	2900	2910	2950	3060
110	%N1	67.3	70.3	74.7	79.2	83.6	88.0	93.1
	KIAS	195	195	195	195	195	195	195
	FF/ENG	2800	2760	2730	2690	2680	2710	2790
100	%N1	65.1	68.0	72.5	76.8	81.2	85.7	90.5
	KIAS	189	189	189	189	189	189	189
	FF/ENG	2590	2560	2520	2490	2470	2480	2520

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 15

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Initial Max Continuous %N1

29000 FT to 10000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

29000 FT PRESS ALT												TAT (°C)	
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.7	106.8	106.1	105.5	104.9	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.8	106.1	105.5	102.8	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.5	106.8	106.2	103.6	100.5	
27000 FT PRESS ALT												TAT (°C)	
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.6	106.7	105.7	105.0	104.3	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.0	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.0	107.0	106.3	105.6	104.7	101.8	
25000 FT PRESS ALT												TAT (°C)	
MACH	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
0.6	102.3	103.2	104.2	105.2	106.1	106.9	107.3	106.4	105.4	104.4	103.6	102.9	
0.5	103.6	104.7	105.8	106.8	107.6	107.8	106.9	105.9	104.9	104.1	103.4	102.1	
0.4	103.6	104.7	105.8	106.8	107.9	107.7	106.7	105.7	104.9	104.1	102.8	100.0	
23000 FT PRESS ALT												TAT (°C)	
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.2	104.2	105.2	106.1	107.0	107.9	108.0	107.2	106.2	105.3	104.5	103.7	
0.5	104.7	105.8	106.8	107.8	108.7	108.6	107.7	106.7	105.8	105.0	104.2	102.7	
0.4	104.7	105.8	106.8	107.9	108.9	108.6	107.6	106.6	105.8	105.0	103.4	100.8	
21000 FT PRESS ALT												TAT (°C)	
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.9	104.8	105.8	106.8	107.7	108.6	109.5	109.4	108.5	107.5	106.6	105.7	
0.5	104.7	105.8	106.8	107.9	108.9	109.9	109.9	109.0	108.0	107.0	106.1	105.3	
0.4	104.7	105.8	106.8	107.9	108.9	109.9	109.8	108.8	107.8	106.9	106.1	104.2	
19000 FT PRESS ALT												TAT (°C)	
MACH	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
0.6	104.3	105.3	106.2	107.2	108.1	109.0	110.0	109.6	108.7	107.7	106.8	105.9	
0.5	105.8	106.8	107.9	108.9	109.8	110.7	110.1	109.2	108.2	107.3	106.4	105.5	
0.4	105.8	106.8	107.9	108.9	109.9	110.9	110.1	109.1	108.2	107.2	106.4	104.3	
15000 FT PRESS ALT												TAT (°C)	
MACH	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
0.6	102.8	103.8	104.7	105.6	106.6	107.5	108.4	109.2	108.2	107.3	106.4	105.7	
0.5	104.3	105.2	106.2	107.1	108.1	109.0	109.4	108.4	107.5	106.7	105.9	105.1	
0.4	105.2	106.2	107.2	108.2	109.2	110.2	109.5	108.6	107.7	106.9	106.1	105.1	
10000 FT PRESS ALT												TAT (°C)	
MACH	-15	-10	-5	0	5	10	15	20	25	30	35	40	
0.6	100.3	101.2	102.1	103.0	103.9	104.8	105.6	106.5	107.4	106.7	106.0	105.2	
0.5	101.4	102.4	103.3	104.2	105.1	106.0	106.9	107.5	106.8	106.0	105.2	104.5	
0.4	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4	104.7	104.1	

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
180	171	238	2900		
170	162	231	5500	3700	1600
160	153	223	8200	6600	4700
150	143	215	10600	9200	7600
140	134	210	12800	11800	10100
130	125	205	14900	14400	12900
120	115	199	16700	16500	15600
110	106	193	18900	18800	18100
100	96	188	21000	20800	20400

Includes APU fuel burn.

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
160	4300	1700	
155	5800	3400	
150	7400	5000	2500
145	8900	6700	4200
140	10300	8400	6000
135	11700	9900	7800
130	13100	11700	9500
125	14600	13600	11400
120	15700	15300	13400
115	16700	16600	15300
110	17900	17800	17000
105	19100	19000	18400
100	20300	20200	19700
95	21300	21200	20700
90	22300	22200	21600

With engine anti-ice on, decrease altitude capability by 1200 ft.**With engine and wing anti-ice on, decrease altitude capability by 2500 ft.**

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		6	8	10	12	14	16	18	20
160	%N1	103.3							
	MACH	.398							
	KIAS	237							
	FF/ENG	7736							
150	%N1	101.0	103.1						
	MACH	.389	.400						
	KIAS	231	229						
	FF/ENG	7195	7225						
140	%N1	98.6	100.6	102.7	105.3				
	MACH	.379	.390	.401	.412				
	KIAS	225	223	221	219				
	FF/ENG	6672	6685	6714	6765				
130	%N1	96.2	98.0	100.0	102.2	104.8			
	MACH	.367	.379	.391	.402	.412			
	KIAS	218	217	215	213	211			
	FF/ENG	6167	6164	6175	6200	6251			
120	%N1	93.8	95.5	97.3	99.2	101.5	104.2		
	MACH	.355	.367	.379	.390	.402	.412		
	KIAS	211	210	209	207	205	203		
	FF/ENG	5671	5660	5658	5666	5686	5740		
110	%N1	91.2	92.8	94.5	96.3	98.3	100.5	103.4	
	MACH	.342	.353	.365	.377	.389	.401	.413	
	KIAS	203	202	201	200	199	197	195	
	FF/ENG	5188	5169	5157	5156	5159	5177	5259	
100	%N1	88.4	90.1	91.6	93.3	95.2	97.1	99.5	102.8
	MACH	.328	.339	.351	.363	.375	.387	.400	.417
	KIAS	195	194	193	192	191	190	189	189
	FF/ENG	4697	4689	4671	4659	4657	4658	4700	4837

**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
164	146	131	118	109	100	94	89	84	79	75
334	296	264	239	218	200	187	175	165	156	148
505	447	398	359	327	300	281	263	247	234	222
677	598	531	479	437	400	374	350	329	311	295
850	751	666	600	546	500	467	438	411	388	368
1025	904	801	720	656	600	560	524	493	465	441
1200	1057	936	841	766	700	653	611	574	541	513
1377	1212	1072	963	876	800	746	698	655	618	586
1554	1367	1208	1085	986	900	839	785	737	694	658
1733	1523	1345	1207	1096	1000	932	872	818	771	731

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		10		14		18	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	2.5	0:27	2.2	0:27	2.0	0:26	1.8	0:26
200	5.2	0:52	4.8	0:50	4.6	0:49	4.4	0:47
300	7.8	1:17	7.4	1:14	7.1	1:12	7.0	1:09
400	10.5	1:42	9.9	1:38	9.5	1:35	9.5	1:31
500	13.1	2:08	12.4	2:02	12.0	1:58	11.9	1:54
600	15.7	2:33	14.9	2:27	14.4	2:22	14.3	2:16
700	18.2	2:59	17.3	2:51	16.7	2:45	16.7	2:39
800	20.7	3:25	19.7	3:16	19.0	3:09	19.0	3:01
900	23.2	3:51	22.1	3:41	21.3	3:32	21.2	3:24
1000	25.7	4:18	24.4	4:06	23.6	3:56	23.5	3:47

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.2	0.0	0.2	0.5
4	-0.7	-0.3	0.0	0.5	1.1
6	-1.0	-0.5	0.0	0.8	1.7
8	-1.4	-0.7	0.0	1.1	2.3
10	-1.8	-0.9	0.0	1.4	2.9
12	-2.1	-1.1	0.0	1.7	3.4
14	-2.5	-1.2	0.0	2.0	4.0
16	-2.9	-1.4	0.0	2.3	4.6
18	-3.2	-1.6	0.0	2.6	5.2
20	-3.6	-1.8	0.0	2.9	5.8
22	-4.0	-2.0	0.0	3.1	6.4
24	-4.4	-2.1	0.0	3.4	6.9
26	-4.7	-2.3	0.0	3.7	7.5
28	-5.1	-2.5	0.0	4.0	8.1
30	-5.5	-2.7	0.0	4.3	8.7

Includes APU fuel burn.

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GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
180	%N1	101.3				
	KIAS	241				
	FF/ENG	8700				
170	%N1	99.2	103.1			
	KIAS	234	234			
	FF/ENG	8130	8300			
160	%N1	96.9	100.4			
	KIAS	226	226			
	FF/ENG	7540	7640			
150	%N1	94.5	97.9	103.9		
	KIAS	218	218	218		
	FF/ENG	6970	7030	7280		
140	%N1	92.5	95.6	101.0		
	KIAS	212	212	212		
	FF/ENG	6480	6520	6690		
130	%N1	90.4	93.5	98.5	105.9	
	KIAS	207	207	207	207	
	FF/ENG	6040	6070	6170	6500	
120	%N1	88.2	91.2	95.9	102.0	
	KIAS	201	201	201	201	
	FF/ENG	5600	5610	5670	5870	
110	%N1	86.0	88.9	93.4	98.8	
	KIAS	195	195	195	195	
	FF/ENG	5170	5170	5210	5330	
100	%N1	83.5	86.5	90.8	95.8	102.8
	KIAS	189	189	189	189	189
	FF/ENG	4750	4750	4760	4830	5080

This table includes 5% additional fuel for holding in a racetrack pattern.



Performance Inflight

Text

Chapter PI

Section 16

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, brakes deactivated, improved climb, contaminated runway situations, brake energy limits, or obstacle clearance with unbalanced V1. These speeds may be used for weights less than or equal to the performance limited weight.

Normal takeoff speeds, V1, VR, and V2, with anti-skid on and all brakes operative, are read from the table by entering with takeoff flap setting, brake release weight and appropriate column. The appropriate column is obtained by entering the Column Reference chart with the airport pressure altitude and the actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the V1 Adjustment chart. Adjusted V1 must not exceed VR. These takeoff speeds are not valid when the brake release weight is based on clearway, stopway, improved climb or is limited by tire speed or brake energy.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). Therefore compare the adjusted V1 to the V1(MCG). To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length.

Clearway and Stopway V1 Adjustments

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR.

Maximum allowable clearway limits are provided for guidance when more precise data is not available.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 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 Takeoff

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 assumes 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 13 mm (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 field/obstacle limit weight for the takeoff flap setting.
2. Enter the Weight Adjustment table with the 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 adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

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 the Takeoff Speeds table in this section.
2. If V1(MCG) limited, set $V1=V1(MCG)$. If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set $V1=V1(MCG)$.

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. 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.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal runway/obstacle limited weight and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE ADJUSTMENT		
FIELD LENGTH (FT)	WEIGHT (1000 KG)	V1 ADJUSTMENT (KTS)
6000	-46.6	-44
7000	-46.6	-42
8000	-46.6	-39
9000	-37.9	-37
10000	-27.1	-34
12000	-22.7	-31
14000	-22.7	-29

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance adjusted for wind and slope exceeds approximately 8400 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Brakes Deactivated

When operating with brakes deactivated, the field 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 3200 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ONE BRAKE DEACTIVATED SPEED ADJUSTMENT	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KTS)
4000	-2
6000	-2
8000	-2
10000	-2
12000	-2
14000	-2

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance exceeds approximately 3800 ft for one brake deactivated.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. %N1 adjustments are shown for packs off operation.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of reduced thrust is not allowed on runways contaminated with water, ice, slush or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

Enter the Minimum Assumed Temperature table with airport pressure altitude and read minimum assumed temperature. If assumed temperature is below this value, use the Takeoff %N1 table to set takeoff thrust. To find assumed temperature reduced thrust, obtain the assumed temperature %N1 by entering the Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table. Apply the altitude adjustment shown in the %N1 Altitude Adjustment table. Check the resulting value by entering the Minimum Assumed Temperature Limit %N1 table with actual airport temperature and pressure altitude. Use the greater of assumed temperature limit %N1 or minimum %N1 as the assumed temperature reduced thrust %N1. Determine takeoff speeds using the actual takeoff weight and assumed temperature.

Max Climb %N1

This table shows Max Climb %N1 for a 250/290/.78 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 packs off and anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for packs off and anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. 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 maximum cruise thrust at 0 ft/min residual rate of climb or maximum climb thrust at 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 12° 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 .80M 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 .78/290/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

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 table makes no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Distance and time for descent are shown for a .78/290/250 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 at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

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. 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 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 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, temperature, and speed conditions as well as thrust reverser configuration. Each adjustment is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landing at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight, the brakes on speed adjusted for wind and 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 Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse Thrust) 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 or brake temperature monitor system (BTMS) indication on EICAS. Times are provided for ground cooling and inflight gear down cooling.

If brake temperature monitor indication on EICAS is available, 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 the recommended cooling schedule by entering at the bottom of the chart. The brake temperature light illuminates when the hottest brake is registering 5 on the EICAS indication and extinguishes as the hottest brake cools with an EICAS indication of 4.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .80M 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 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/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. The cruise segment is at a level off altitude which is based on 100 ft/min residual rate of climb.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude are used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (KG/HR)					
	GROSS WEIGHT (1000 KG)					
	190	170	150	130	110	90
43					60	55
39				65	60	60
35		75	70	70	65	65
31	75	75	75	75	70	65
27	85	85	80	75	75	70
25	85	85	85	80	75	70
20	95	90	90	85	80	75
15	105	105	95	95	90	85
10	115	115	105	105	100	95
5	125	125	120	115	110	105

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/290/250 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 Fuel Required Adjustment 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

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 the 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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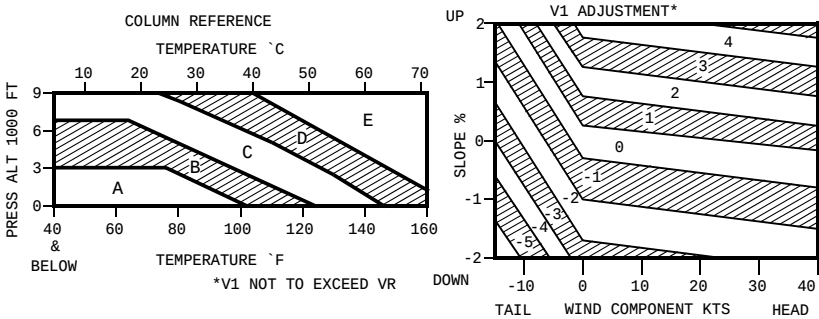
Performance Inflight

Chapter PI

General

Section 20

Takeoff Speeds
Max Takeoff Thrust



FLAPS	WT 1000 KG	A			B			C			D			E		
		V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂
5	190	166	170	175	167	171	176									
	180	160	165	171	162	166	171									
	170	154	160	166	156	161	166	159	162	166						
	160	148	154	161	150	156	161	153	157	161						
	150	141	148	156	144	150	156	147	151	156	150	153	156			
	140	135	142	151	137	144	150	140	145	150	144	147	150			
	130	128	136	145	130	137	145	134	139	145	137	141	145	141	142	145
	120	121	129	140	124	131	140	127	132	140	130	134	140	134	136	140
	110	114	122	134	116	124	134	119	126	134	123	127	134	126	129	134
	100	106	114	128	109	116	128	112	118	127	115	120	127	118	122	127
15	190	160	163	168	157	159	164									
	180	154	158	164	151	154	159									
	170	148	152	159	145	148	154									
	160	142	147	154	139	143	149	142	145	150						
	150	137	142	150	132	136	144	135	138	144						
	140	130	135	144	126	130	139	128	132	139	132	134	139			
	130	124	129	139	120	124	134	122	126	134	125	128	133	123	124	128
	120	117	122	134	113	118	128	116	120	128	119	122	128	115	117	122
	110	111	117	128	106	111	122	108	113	122	112	115	122	113	118	122
	100	104	109	122												
20	190	158	159	165	155	155	159									
	180	152	153	159	148	149	154									
	170	146	148	154	142	143	149	144	145	150						
	160	140	142	149	136	138	144	139	140	145						
	150	133	136	145	130	132	139	132	134	139						
	140	127	131	139	124	127	134	126	128	134	130	130	134			
	130	121	125	134	117	120	129	120	122	129	124	124	129	119	120	124
	120	114	119	129	110	114	124	113	116	124	117	118	124	113	113	118
	110	107	112	124	103	108	118	105	109	118	109	111	118			
	100	99	105	118												

CHECK V1(MCG) IN BOXED AREA

V1(MCG)

Max Takeoff Thrust

ACTUAL OAT		PRESSURE ALTITUDE (FT)						
°C	°F	-1000	0	2000	4000	6000	8000	9000
50	122	103	101	97				
40	104	108	106	101	97	93	90	
30	86	111	109	105	101	97	94	92
20	68	111	110	107	104	100	96	95
10	50	111	110	107	104	101	98	96
-50	-58	113	111	108	105	102	98	97



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Maximum Allowable Clearway

FIELD LENGTH (FT)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (FT)
4000	350
6000	500
8000	600
10000	700
12000	800
14000	900

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (FT)	NORMAL V1 (KIAS)		
	120	140	160
800	-5	-3	-2
600	-3	-2	-2
400	-2	-1	-1
200	-1	-1	-1
0	0	0	0
-200	1	1	1
-400	2	1	1
-600	3	2	2
-800	5	3	2

Stab Trim Setting Max Takeoff Thrust

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	6 1/2	5 1/2	4 1/2	4	3	2
180	7	6	5 1/2	4 1/2	3 1/2	2 1/2	2
170	6 1/2	6	5	4	3 1/2	2 1/2	1 1/2
160	6 1/2	5 1/2	5	4	3	2 1/2	1 1/2
150	6	5	4 1/2	3 1/2	3	2	1
140	5 1/2	4 1/2	4	3	2 1/2	1 1/2	1/2
130	5	4	3	2 1/2	1 1/2	1	1/2
120	4	3 1/2	2 1/2	2	1 1/2	1/2	1/2
110	3 1/2	3	2 1/2	1 1/2	1	1/2	1/2
100	3 1/2	2 1/2	2	1	1/2	1/2	1/2



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VREF (KIAS)

WEIGHT (1000 KG)	FLAPS		
	30	25	20
190	179	170	179
180	171	166	173
170	164	161	168
160	156	156	162
150	148	151	157
140	142	146	151
130	137	141	146
120	131	135	141
110	125	129	135
100	119	123	128



Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF30 + 80
1	VREF30 + 60
5	VREF30 + 40
15	VREF30 + 20
20	VREF30 + 20
25	VREF25
30	VREF30

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-19.5	-23.6	-27.8	-22.8	-26.9	-31.1	-32.7	-36.8	-41.0
200	-19.4	-23.6	-27.7	-22.7	-26.9	-31.1	-31.5	-35.7	-39.8
190	-19.0	-23.2	-27.4	-22.3	-26.4	-30.6	-30.0	-34.2	-38.3
180	-18.4	-22.5	-26.7	-21.4	-25.5	-29.7	-28.1	-32.3	-36.5
170	-17.4	-21.5	-25.7	-20.0	-24.2	-28.4	-25.9	-30.1	-34.2
160	-16.0	-20.2	-24.4	-18.3	-22.5	-26.6	-23.4	-27.6	-31.7
150	-14.5	-18.7	-22.8	-16.3	-20.5	-24.7	-20.6	-24.8	-29.0
140	-12.7	-16.8	-21.0	-14.2	-18.4	-22.5	-17.6	-21.8	-26.0
130	-10.6	-14.8	-19.0	-11.9	-16.1	-20.3	-14.5	-18.7	-22.8
120	-8.4	-12.6	-16.8	-9.7	-13.8	-18.0	-11.2	-15.4	-19.6
110	-6.1	-10.3	-14.4	-7.5	-11.7	-15.8	-7.9	-12.1	-16.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
5000				93.5			107.6		
5400	105.9			113.8			128.0	102.6	
5800	127.1	100.8		135.4	108.7		149.7	122.8	97.6
6200	149.8	121.6	95.8	158.2	129.8	103.6	172.5	144.2	117.7
6600	173.7	144.0	116.3	182.2	152.4	124.4	196.0	166.7	138.8
7000	198.8	167.6	138.3	206.7	176.2	146.6	220.1	190.0	161.0
7400	224.9	192.4	161.6		200.6	170.1		214.1	184.1
7800		218.4	186.1		225.3	194.4			208.0
8200			211.9			219.1			

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -108 ft/+108 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 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
190	-21	-21	-21	-16	-16	-16	-7	-7	-7
180	-21	-21	-21	-16	-16	-16	-6	-6	-6
170	-22	-22	-22	-17	-17	-17	-6	-6	-6
160	-22	-22	-22	-17	-17	-17	-6	-6	-6
150	-23	-23	-23	-18	-18	-18	-7	-7	-7
140	-24	-24	-24	-19	-19	-19	-8	-8	-8
130	-24	-24	-24	-20	-20	-20	-9	-9	-9
120	-25	-25	-25	-21	-21	-21	-11	-11	-11
110	-26	-26	-26	-22	-22	-22	-13	-13	-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).

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-27.5	-32.0	-36.5	-32.2	-36.7	-41.3	-43.4	-48.0	-52.5
200	-26.2	-30.7	-35.3	-30.4	-34.9	-39.5	-40.2	-44.7	-49.3
190	-24.8	-29.4	-33.9	-28.5	-33.0	-37.6	-37.0	-41.5	-46.1
180	-23.3	-27.8	-32.4	-26.5	-31.0	-35.6	-33.8	-38.3	-42.9
170	-21.7	-26.2	-30.8	-24.4	-29.0	-33.5	-30.6	-35.2	-39.7
160	-19.9	-24.5	-29.0	-22.3	-26.8	-31.3	-27.5	-32.0	-36.5
150	-18.0	-22.6	-27.1	-20.0	-24.5	-29.1	-24.3	-28.8	-33.4
140	-16.0	-20.6	-25.1	-17.7	-22.2	-26.7	-21.2	-25.7	-30.3
130	-13.9	-18.4	-23.0	-15.2	-19.7	-24.3	-18.1	-22.6	-27.1
120	-11.6	-16.2	-20.7	-12.7	-17.2	-21.7	-15.0	-19.5	-24.0
110	-9.3	-13.8	-18.3	-10.0	-14.6	-19.1	-11.9	-16.4	-21.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
6200							98.8		
6600							122.3	90.9	
7000	90.6			113.9			146.9	114.0	
7400	118.7			141.3	104.7		173.0	138.2	105.8
7800	148.5	108.7		170.2	131.5	95.6	200.8	163.7	129.5
8200	180.4	137.8	98.9	201.1	159.9	122.0	229.9	190.9	154.6
8600	214.7	168.9	127.4		190.0	149.8		219.7	181.2
9000		202.4	157.8		222.0	179.3			209.5
9400			190.4			210.7			
9800			225.3						

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -155 ft/+155 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 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
210	-28	-28	-28	-21	-21	-21	-11	-11	-11
200	-29	-29	-29	-22	-22	-22	-11	-11	-11
190	-30	-30	-30	-23	-23	-23	-11	-11	-11
180	-30	-30	-30	-24	-24	-24	-11	-11	-11
170	-31	-31	-31	-25	-25	-25	-12	-12	-12
160	-32	-32	-32	-26	-26	-26	-13	-13	-13
150	-32	-32	-32	-27	-27	-27	-15	-15	-15
140	-32	-32	-32	-28	-28	-28	-17	-17	-17
130	-33	-33	-33	-29	-29	-29	-19	-19	-19
120	-33	-33	-33	-30	-30	-30	-21	-21	-21
110	-33	-33	-33	-31	-31	-31	-24	-24	-24

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).

ADVISORY INFORMATION

Slippery Runway Takeoff Maximum Reverse Thrust Weight Adjustment (1000 KG)

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
210	0.0	0.0	0.0	-9.0	-9.0	-9.0	-19.9	-19.9	-19.9
200	0.0	0.0	0.0	-10.1	-10.1	-10.1	-20.1	-20.1	-20.1
190	-1.1	-1.1	-1.1	-10.8	-10.8	-10.8	-20.0	-20.0	-20.0
180	-2.1	-2.1	-2.1	-11.2	-11.2	-11.2	-19.6	-19.6	-19.6
170	-2.7	-2.7	-2.7	-11.3	-11.3	-11.3	-18.9	-18.9	-18.9
160	-3.0	-3.0	-3.0	-11.1	-11.1	-11.1	-18.0	-18.0	-18.0
150	-3.0	-3.0	-3.0	-10.5	-10.5	-10.5	-16.9	-16.9	-16.9
140	-2.7	-2.7	-2.7	-9.5	-9.5	-9.5	-15.4	-15.4	-15.4
130	-2.2	-2.2	-2.2	-8.2	-8.2	-8.2	-13.7	-13.7	-13.7
120	-1.3	-1.3	-1.3	-6.6	-6.6	-6.6	-11.8	-11.8	-11.8
110	-0.3	-0.3	-0.3	-4.6	-4.6	-4.6	-9.6	-9.6	-9.6

V1(MCG) Limit Weight (1000 KG)

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
3800	99.1								
4200	138.1								
4600	176.7	114.8							
5000	214.9	153.6	91.3	93.8					
5400		192.0	130.4	120.4					
5800			169.0	148.3	104.3				
6200			207.3	177.8	131.4				
6600				209.3	159.9	115.0	98.4		
7000					190.2	142.6	114.6		
7400					222.4	171.8	131.5	100.0	
7800						202.8	149.3	116.2	
8200							168.1	133.2	101.6
8600							188.2	151.1	117.9
9000							209.8	170.1	135.0
9400								190.3	153.0
9800								212.0	172.0
10200									192.4
10600									214.3

1. Enter Weight Adjustment table with reported braking action and field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by - 81 ft/ + 81 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by - 81 ft/ + 81 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by - 126 ft/ + 126 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 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
190	-7	-7	-7	-17	-17	-17	-29	-29	-29
180	-8	-8	-8	-18	-18	-18	-30	-30	-30
170	-9	-9	-9	-19	-19	-19	-32	-32	-32
160	-10	-10	-10	-21	-21	-21	-33	-33	-33
150	-10	-10	-10	-22	-22	-22	-35	-35	-35
140	-11	-11	-11	-23	-23	-23	-36	-36	-36
130	-12	-12	-12	-24	-24	-24	-38	-38	-38
120	-12	-12	-12	-25	-25	-25	-40	-40	-40
110	-12	-12	-12	-26	-26	-26	-41	-41	-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).

ADVISORY INFORMATION

Slippery Runway Takeoff No Reverse Thrust Weight Adjustment (1000 KG)

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
210	-2.1	-2.6	-3.0	-15.0	-15.4	-15.8	-25.8	-26.2	-26.7
200	-3.3	-3.8	-4.2	-15.6	-16.0	-16.5	-25.9	-26.3	-26.7
190	-4.3	-4.7	-5.1	-16.0	-16.4	-16.8	-25.6	-26.0	-26.4
180	-5.0	-5.4	-5.8	-16.1	-16.5	-16.9	-25.0	-25.4	-25.8
170	-5.4	-5.8	-6.3	-15.9	-16.3	-16.7	-24.0	-24.4	-24.9
160	-5.6	-6.0	-6.5	-15.4	-15.9	-16.3	-22.8	-23.2	-23.6
150	-5.6	-6.0	-6.4	-14.7	-15.1	-15.5	-21.2	-21.6	-22.0
140	-5.3	-5.7	-6.1	-13.6	-14.1	-14.5	-19.2	-19.7	-20.1
130	-4.7	-5.1	-5.6	-12.3	-12.7	-13.1	-17.0	-17.4	-17.8
120	-3.9	-4.4	-4.8	-10.7	-11.1	-11.5	-14.4	-14.8	-15.3
110	-2.9	-3.3	-3.7	-8.8	-9.2	-9.6	-11.5	-11.9	-12.4

V1(MCG) Limit Weight (1000 KG)

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	141.3								
5000	187.8	111.6							
5400	228.6	163.2							
5800		206.4	136.2						
6200			183.5						
6600			224.6	122.6					
7000				167.1	96.4				
7400				208.3	143.1				
7800					186.0	118.0			
8200					226.3	162.8			
8600						204.3			
9800							109.0		
10200							135.3		
10600							163.5	109.0	
11000							194.1	135.3	
11400							226.8	163.5	109.0
11800								194.1	135.3
12200								226.8	163.5
12600									194.1
13000									226.8

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 -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -175 ft/+175 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for available 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
210	-7	-7	-7	-21	-21	-21	-41	-41	-41
200	-8	-8	-8	-22	-22	-22	-41	-41	-41
190	-9	-9	-9	-23	-23	-23	-42	-42	-42
180	-10	-10	-10	-24	-24	-24	-43	-43	-43
170	-11	-11	-11	-25	-25	-25	-45	-45	-45
160	-12	-12	-12	-27	-27	-27	-47	-47	-47
150	-13	-13	-13	-29	-29	-29	-49	-49	-49
140	-14	-14	-14	-30	-30	-30	-51	-51	-51
130	-15	-15	-15	-32	-32	-32	-52	-52	-52
120	-16	-16	-16	-33	-33	-33	-53	-53	-53
110	-17	-17	-17	-34	-34	-34	-54	-54	-54

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).

Takeoff %N1

Max Takeoff Thrust

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F		-1000	0	2000	4000	6000	8000	9000
55	131	58	106.1	106.1	105.9	105.5	105.1	104.9	104.7
50	122	53	106.8	106.9	106.8	106.5	106.1	105.9	105.7
45	113	48	107.5	107.5	107.5	107.3	107.0	106.9	106.6
40	104	43	108.2	108.2	108.2	108.0	107.9	107.8	107.7
35	95	38	109.0	108.9	109.0	108.8	108.7	108.7	108.6
30	86	33	109.1	109.8	109.8	109.7	109.6	109.7	109.6
25	77	28	108.2	108.9	110.3	110.6	110.5	110.6	110.6
20	68	23	107.3	108.0	109.4	110.6	111.3	111.4	111.3
15	59	18	106.4	107.1	108.5	109.7	111.0	112.0	112.1
10	50	13	105.5	106.2	107.5	108.8	110.0	111.3	112.1
0	32	3	103.6	104.3	105.7	106.9	108.1	109.4	110.1
-10	14	-7	101.7	102.4	103.8	104.9	106.1	107.4	108.1
-20	-4	-17	99.8	100.4	101.8	103.0	104.2	105.4	106.1
-30	-22	-27	97.9	98.5	99.8	101.0	102.2	103.4	104.0
-40	-40	-37	95.9	96.4	97.8	99.0	100.1	101.3	102.0
-50	-58	-47	93.8	94.4	95.8	96.9	98.0	99.2	99.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	9000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5	0.5

Assumed Temperature Reduced Thrust

Minimum Assumed Temperature

MINIMUM ASSUMED TEMP	PRESSURE ALTITUDE (FT)									
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
°F	90	86	83	79	76	72	69	65	62	58
°C	32	30	28	26	24	22	20	18	16	14

Assumed Temperature Limit %N1

Based on engine bleed for packs on

ACTUAL OAT (°C)	ASSUMED TEMPERATURE (°C)											
	15	20	25	30	35	40	45	50	55	60	65	70
55												
50									105.3	104.3	102.5	100.9
45								106.0	104.5	102.7	101.0	99.4
40							106.6	105.2	103.7	101.9	100.2	98.6
35						107.3	105.8	104.3	102.8	101.1	99.4	97.8
30					108.0	106.5	104.9	103.5	102.0	100.3	98.6	97.0
25				108.9	107.1	105.6	104.1	102.7	101.2	99.5	97.8	96.2
20			109.7	108.0	106.2	104.7	103.2	101.8	100.3	98.7	97.0	95.5
15		110.6	108.8	107.1	105.4	103.9	102.4	101.0	99.5	97.9	96.2	94.7
10	111.2	109.6	107.9	106.1	104.4	103.0	101.5	100.1	98.6	97.0	95.4	93.8
5	110.2	108.6	106.9	105.2	103.5	102.1	100.6	99.2	97.8	96.2	94.5	93.0
0	109.2	107.7	106.0	104.3	102.6	101.2	99.7	98.3	96.9	95.3	93.7	
-10	107.2	105.7	104.0	102.4	100.7	99.3	97.9	96.5	95.2	93.6	92.0	
-20	105.2	103.7	102.1	100.4	98.8	97.4	96.0	94.7	93.4	91.8		
-30	103.2	101.7	100.1	98.5	96.9	95.5	94.2	92.9	91.5			
-40	101.0	99.6	98.0	96.5	94.9	93.6	92.2					
-50	98.9	97.5	95.9	94.4	92.9	91.6						
-60	96.7	95.3	93.8	92.3								

%N1 Adjustment for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)										
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
PACKS OFF	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.5	0.5

%N1 Altitude Adjustment

ASSUMED TEMP (°C)	PRESSURE ALTITUDE (FT)										
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
70	0.2	0.1	0.0	-0.2	-0.3	-0.5	-0.6	-0.8	-1.0	-1.2	-1.3
60	0.1	0.1	0.0	-0.2	-0.3	-0.5	-0.6	-0.8	-1.0	-1.2	-1.3
50	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.5	-0.7	-0.9	-1.0
40	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.4	-0.4
32 & BELOW	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2

Assumed Temperature Reduced Thrust

Assumed Temperature Minimum %N1

Based on 25% takeoff thrust reduction

ACTUAL OAT (°C)	PRESSURE ALTITUDE (FT)										
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
55	96.9	96.9	96.9	96.8	96.6	96.5	96.4	96.2	96.0	95.9	95.9
50	97.4	97.4	97.4	97.4	97.3	97.2	97.1	97.0	96.8	96.7	96.6
45	97.8	97.8	97.8	97.8	97.8	97.8	97.7	97.5	97.4	97.4	97.3
40	98.3	98.3	98.2	98.2	98.2	98.1	98.1	98.0	97.9	97.9	97.9
35	98.6	98.6	98.5	98.5	98.5	98.5	98.5	98.4	98.4	98.4	98.4
30	98.0	98.5	98.9	98.9	98.9	98.9	98.8	98.8	98.8	98.8	98.8
25	97.2	97.7	98.1	98.5	98.9	98.9	99.1	99.1	99.0	99.1	99.1
20	96.4	96.9	97.3	97.7	98.1	98.4	98.8	99.0	99.2	99.2	99.2
15	95.6	96.0	96.5	96.9	97.2	97.6	98.0	98.3	98.6	98.9	99.1
10	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.8	98.1	98.4
0 & BELOW	93.1	93.6	94.0	94.3	94.7	95.1	95.4	95.8	96.1	96.4	96.7

1. Enter Minimum Assumed Temperature table with airport pressure altitude to determine minimum assumed temperature.
2. Enter Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature to determine assumed temperature limit %N1. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table.
3. Enter %N1 Altitude Adjustment table with assumed temperature and airport pressure altitude to determine altitude adjustment to %N1 found in step 2.
4. Ensure Takeoff %N1 from step 3 is greater than or equal to minimum %N1 allowed for airport conditions from Assumed Temperature Minimum %N1 table.

Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (KIAS OR MACH)								
	0	5	10	15	20	25	30	35	40
	250	250	250	290	290	290	290	.78	.78
60	96.5	97.2	97.0	97.4	96.7	95.1	96.1	95.1	94.7
50	97.6	98.7	99.0	99.6	98.9	97.3	98.2	95.0	93.8
40	98.8	99.8	100.4	101.2	101.0	99.3	100.1	97.0	95.8
30	99.1	101.1	101.6	102.4	102.5	101.2	101.9	98.8	97.7
20	97.5	101.3	103.3	103.8	104.1	102.8	103.4	100.5	99.4
10	95.8	99.6	102.9	104.4	105.6	104.6	104.7	102.6	100.9
0	94.2	97.8	101.1	102.6	105.0	106.9	106.5	104.3	102.4
-10	92.5	96.1	99.4	100.8	103.2	105.3	107.1	106.3	104.3
-20	90.8	94.3	97.6	99.0	101.5	103.4	105.1	106.5	106.4
-30	89.1	92.4	95.7	97.1	99.7	101.5	103.2	104.4	104.4
-40	87.3	90.5	93.9	95.2	97.8	99.5	101.2	102.2	102.2
-50	85.5	88.6	91.9	93.3	95.8	97.5	99.1	100.1	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	0	5	10	15	20	25	30	35	40
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.8	-0.9	-1.1	-1.4	-1.9
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.1	-1.3	-1.4	-1.7	-2.2	-2.4

Go-around %N1

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F		-1000	0	2000	4000	6000	8000	9000
55	131	58	106.1	106.1	105.9	105.5	105.1	104.9	104.7
50	122	53	106.8	106.9	106.8	106.5	106.1	105.9	105.7
45	113	48	107.5	107.5	107.5	107.3	107.0	106.9	106.6
40	104	43	108.2	108.2	108.2	108.0	107.9	107.8	107.7
35	95	38	109.0	108.9	109.0	108.8	108.7	108.7	108.6
30	86	33	109.1	109.8	109.8	109.7	109.6	109.7	109.6
25	77	28	108.2	108.9	110.3	110.6	110.5	110.6	110.6
20	68	23	107.3	108.0	109.4	110.6	111.3	111.4	111.3
15	59	18	106.4	107.1	108.5	109.7	111.0	112.0	112.1
10	50	13	105.5	106.2	107.5	108.8	110.0	111.3	112.1
0	32	3	103.6	104.3	105.7	106.9	108.1	109.4	110.1
-10	14	-7	101.7	102.4	103.8	104.9	106.1	107.4	108.1
-20	-4	-17	99.8	100.4	101.8	103.0	104.2	105.4	106.1
-30	-22	-27	97.9	98.5	99.8	101.0	102.2	103.4	104.0
-40	-40	-37	95.9	96.4	97.8	99.0	100.1	101.3	102.0
-50	-58	-47	93.8	94.4	95.8	96.9	98.0	99.2	99.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	9000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5	0.5

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (.290/.78)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	4.0	4.0			
	V/S (FT/MIN)	1600	1000			
30000	PITCH ATT	4.5	4.0	4.0	4.0	4.0
	V/S (FT/MIN)	2700	2100	1700	1300	1000
20000	PITCH ATT	7.0	6.5	6.0	6.0	5.5
	V/S (FT/MIN)	4200	3400	2700	2300	1900
10000	PITCH ATT	10.5	9.0	8.5	8.0	7.5
	V/S (FT/MIN)	5600	4500	3700	3200	2700
SEA LEVEL	PITCH ATT	13.5	11.5	10.5	9.5	9.0
	V/S (FT/MIN)	6300	5100	4300	3600	3100

Cruise (.78/290)

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	2.0	2.5	3.5		
	%N1	88.1	92.1	97.5		
35000	PITCH ATT	1.5	2.0	2.5	3.0	3.5
	%N1	85.1	87.3	90.0	93.6	98.2
30000	PITCH ATT	1.0	1.5	2.0	2.0	2.5
	%N1	84.2	85.7	87.4	89.4	91.9
25000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	80.7	82.2	83.8	85.8	87.9
20000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	76.7	78.2	79.8	81.9	83.9
15000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	72.7	74.3	76.1	77.9	79.9

Descent (.78/290)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	-1.5	-0.5	0.0	0.5	1.0
	V/S (FT/MIN)	-2600	-2600	-2700	-2800	-3100
30000	PITCH ATT	-2.5	-1.5	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2700	-2400	-2200	-2100	-2000
20000	PITCH ATT	-2.5	-1.5	-1.0	0.0	0.5
	V/S (FT/MIN)	-2400	-2100	-2000	-1900	-1800
10000	PITCH ATT	-2.5	-1.5	-1.0	-0.5	0.5
	V/S (FT/MIN)	-2100	-1900	-1700	-1700	-1600
SEA LEVEL	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2000	-1700	-1600	-1500	-1500

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF30+80)**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	58.7	63.4	67.3	70.9	74.4
	KIAS	199	211	222	236	251
5000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	54.8	59.0	63.1	66.8	69.9
	KIAS	199	211	222	236	251

Terminal Area (5000 FT)**Set Thrust for Level Flight**

FLAP POSITION (GEAR POSITION) (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS UP (GEAR UP) (VREF30+80)	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	55.6	60.1	64.6	68.0	71.1
	KIAS	199	211	222	236	251
FLAPS 1 (GEAR UP) (VREF30+60)	PITCH ATT	6.0	6.5	6.5	6.5	6.5
	%N1	56.6	61.6	65.8	69.4	72.9
	KIAS	179	191	202	216	231
FLAPS 5 (GEAR UP) (VREF30+40)	PITCH ATT	4.5	4.5	5.0	4.5	4.5
	%N1	59.0	64.1	68.3	72.4	75.7
	KIAS	159	171	182	196	211
FLAPS 15 (GEAR UP) (VREF30+20)	PITCH ATT	5.5	5.5	6.0	6.0	5.5
	%N1	61.1	65.9	70.6	74.3	77.6
	KIAS	139	151	162	176	191
FLAPS 20 (GEAR DOWN) (VREF30+20)	PITCH ATT	4.0	4.5	4.5	4.0	3.5
	%N1	67.6	72.9	77.5	81.6	85.4
	KIAS	139	151	162	176	191

Final Approach (1500 FT)**Gear Down, Set Thrust for 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS 20 (VREF20 +10)	PITCH ATT	1.5	1.5	1.5	1.5	1.5
	%N1	48.0	51.8	55.6	59.2	62.6
	KIAS	138	150	162	172	184

Go-Around (VREF 30 + 20)**Flaps 20, Gear Up, Set Go-Around Thrust**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	18.0	15.0	12.5	10.5	9.0
	V/S (FT/MIN)	4000	3300	2700	2300	2000
	KIAS	139	151	162	176	191
5000	PITCH ATT	21.5	17.5	15.0	12.5	10.5
	V/S (FT/MIN)	4500	3800	3200	2800	2400
	KIAS	139	151	162	176	191
SEA LEVEL	PITCH ATT	25.0	20.5	17.0	14.5	12.0
	V/S (FT/MIN)	5000	4200	3600	3200	2800
	KIAS	139	151	162	176	191

Intentionally
Blank



Performance Inflight

All Engine

Chapter PI

Section 21

Long Range Cruise Maximum Operating Altitude

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°)
190	28900	-1	34400	33500	32600	30900	29300
185	29400	-2	35000	34100	33200	31500	29900
180	30100	-4	35600	34700	33800	32100	30500
175	30700	-5	36100	35300	34400	32700	31100
170	31300	-7	36800	35900	35000	33300	31800
165	31900	-8	37400	36500	35600	34000	32400
160	32600	-9	38000	37100	36300	34600	33100
155	33300	-11	38700	37800	36900	35300	33800
150	34000	-13	39400	38500	37600	36000	34500
145	34700	-14	40100	39200	38300	36700	35200
140	35400	-16	40800	39900	39000	37400	35900
135	36200	-17	41500	40700	39800	38200	36700
130	37000	-17	42300	41400	40600	38900	37400
125	37800	-17	43000	42300	41400	39800	38300
120	38600	-17	43000	43000	42200	40600	39100
115	39500	-17	43000	43000	43000	41500	40000
110	40500	-17	43000	43000	43000	42400	40900
105	41400	-17	43000	43000	43000	43000	41900
100	42400	-17	43000	43000	43000	43000	42900

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°)
190	28900	5	33800*	33500	32600	30900	29300
185	29400	3	34400*	34100	33200	31500	29900
180	30100	2	35000*	34700	33800	32100	30500
175	30700	1	35600*	35300	34400	32700	31100
170	31300	-1	36200*	35900	35000	33300	31800
165	31900	-2	36800*	36500	35600	34000	32400
160	32600	-4	37400*	37100	36300	34600	33100
155	33300	-5	38000*	37800	36900	35300	33800
150	34000	-7	38600*	38500	37600	36000	34500
145	34700	-8	39300*	39200	38300	36700	35200
140	35400	-10	40000*	39900	39000	37400	35900
135	36200	-12	40700*	40700	39800	38200	36700
130	37000	-12	41500*	41400	40600	38900	37400
125	37800	-12	42200*	42200*	41400	39800	38300
120	38600	-12	43000	43000	42200	40600	39100
115	39500	-12	43000	43000	43000	41500	40000
110	40500	-12	43000	43000	43000	42400	40900
105	41400	-12	43000	43000	43000	43000	41900
100	42400	-12	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.

Long Range Cruise Maximum Operating Altitude
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°)
190	28900	10	32700*	32700*	32600	30900	29300
185	29400	9	33400*	33400*	33200	31500	29900
180	30100	8	34000*	34000*	33800	32100	30500
175	30700	6	34700*	34700*	34400	32700	31100
170	31300	5	35300*	35300*	35000	33300	31800
165	31900	3	35900*	35900*	35600	34000	32400
160	32600	2	36500*	36500*	36300	34600	33100
155	33300	0	37100*	37100*	36900	35300	33800
150	34000	-1	37700*	37700*	37600	36000	34500
145	34700	-3	38400*	38400*	38300	36700	35200
140	35400	-4	39100*	39100*	39000	37400	35900
135	36200	-6	39800*	39800*	39800	38200	36700
130	37000	-6	40600*	40600*	40600	38900	37400
125	37800	-6	41300*	41300*	41300*	39800	38300
120	38600	-6	42100*	42100*	42100*	40600	39100
115	39500	-6	43000	43000	43000	41500	40000
110	40500	-6	43000	43000	43000	42400	40900
105	41400	-6	43000	43000	43000	43000	41900
100	42400	-6	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		23	25	27	29	31	33	35	37	39	41	43
190	%N1	89.7	90.8	92.0	93.4	95.2	97.6					
	MACH	.772	.787	.799	.804	.802	.798					
	KIAS	338	331	324	312	298	284					
	FF/ENG	3272	3196	3145	3109	3115	3191					
180	%N1	88.7	89.7	90.9	92.1	93.7	95.6	98.8				
	MACH	.762	.777	.792	.802	.803	.800	.797				
	KIAS	334	327	320	312	299	285	271				
	FF/ENG	3131	3054	3000	2957	2931	2951	3086				
170	%N1	87.6	88.6	89.7	90.9	92.2	94.0	96.2				
	MACH	.751	.767	.782	.797	.804	.802	.799				
	KIAS	329	323	316	309	299	285	272				
	FF/ENG	2983	2915	2856	2814	2773	2765	2809				
160	%N1	86.3	87.5	88.5	89.7	90.9	92.3	94.2	97.4			
	MACH	.736	.756	.772	.788	.800	.804	.801	.798			
	KIAS	322	318	312	305	297	286	272	259			
	FF/ENG	2825	2772	2717	2671	2629	2598	2599	2693			
150	%N1	84.9	86.3	87.3	88.4	89.5	90.8	92.4	94.8	99.2		
	MACH	.715	.743	.761	.776	.792	.803	.803	.800	.797		
	KIAS	312	312	307	300	294	285	273	260	247		
	FF/ENG	2643	2623	2577	2530	2489	2449	2429	2463	2609		
140	%N1	83.2	84.7	86.1	87.1	88.2	89.4	90.7	92.8	95.9		
	MACH	.692	.721	.747	.764	.780	.795	.804	.802	.799		
	KIAS	301	302	301	295	289	283	273	261	248		
	FF/ENG	2460	2448	2431	2392	2347	2311	2277	2279	2345		
130	%N1	81.4	83.0	84.4	85.7	86.8	87.9	89.1	90.9	93.5	97.0	
	MACH	.668	.696	.726	.750	.767	.783	.798	.804	.802	.798	
	KIAS	290	291	292	289	284	278	271	261	248	236	
	FF/ENG	2281	2266	2263	2247	2210	2169	2136	2119	2144	2222	
120	%N1	79.4	81.1	82.6	84.1	85.3	86.4	87.5	89.1	91.5	94.1	97.9
	MACH	.645	.670	.698	.729	.752	.770	.786	.800	.804	.801	.798
	KIAS	279	279	280	281	278	273	267	260	249	237	225
	FF/ENG	2110	2093	2082	2085	2068	2032	1996	1976	1975	2005	2089
110	%N1	77.4	78.8	80.5	82.1	83.6	84.8	85.9	87.4	89.5	91.9	94.5
	MACH	.621	.645	.671	.699	.730	.753	.771	.787	.801	.804	.801
	KIAS	269	268	268	268	269	266	261	255	248	238	226
	FF/ENG	1947	1927	1912	1904	1911	1893	1859	1837	1829	1830	1861
100	%N1	75.3	76.6	78.1	79.8	81.4	82.9	84.1	85.6	87.6	89.7	92.0
	MACH	.596	.619	.642	.669	.698	.729	.753	.771	.788	.801	.804
	KIAS	257	257	256	256	256	257	254	249	244	237	227
	FF/ENG	1786	1769	1750	1736	1733	1741	1722	1699	1689	1681	1683

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	161
564	522	485	453	425	400	382	366	351	337	324
847	784	728	680	638	600	574	549	527	507	488
1131	1047	971	907	850	800	765	733	703	676	651
1416	1310	1215	1134	1063	1000	956	916	879	845	814
1702	1573	1459	1361	1276	1200	1148	1100	1055	1014	977
1990	1839	1704	1589	1490	1400	1339	1283	1231	1183	1140
2279	2105	1950	1818	1703	1600	1531	1466	1407	1352	1302
2570	2372	2197	2047	1917	1800	1722	1649	1582	1520	1464
2861	2640	2443	2276	2130	2000	1913	1832	1757	1689	1626

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.7	0:39	2.3	0:38	2.0	0:36	1.7	0:35	1.5	0:35
400	5.6	1:14	5.0	1:11	4.4	1:07	4.0	1:04	3.7	1:01
600	8.5	1:49	7.7	1:44	6.8	1:37	6.3	1:32	5.8	1:28
800	11.3	2:25	10.4	2:17	9.2	2:08	8.5	2:01	7.9	1:55
1000	14.1	3:01	13.0	2:51	11.6	2:39	10.7	2:30	9.9	2:23
1200	16.9	3:37	15.6	3:25	14.0	3:10	12.9	2:59	12.0	2:50
1400	19.7	4:13	18.2	4:00	16.3	3:41	15.1	3:29	14.0	3:17
1600	22.4	4:50	20.8	4:34	18.6	4:13	17.3	3:59	16.0	3:45
1800	25.1	5:28	23.3	5:09	20.9	4:45	19.4	4:29	18.0	4:13
2000	27.8	6:06	25.8	5:45	23.2	5:17	21.5	4:59	20.0	4:41

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.2	-0.1	0.0	0.1	0.2
4	-0.5	-0.2	0.0	0.3	0.5
6	-0.8	-0.4	0.0	0.4	0.9
8	-1.1	-0.5	0.0	0.6	1.2
10	-1.3	-0.7	0.0	0.8	1.5
12	-1.6	-0.8	0.0	0.9	1.9
14	-1.9	-0.9	0.0	1.1	2.2
16	-2.2	-1.1	0.0	1.3	2.5
18	-2.5	-1.2	0.0	1.4	2.9
20	-2.7	-1.4	0.0	1.6	3.2
22	-3.0	-1.5	0.0	1.8	3.5
24	-3.3	-1.7	0.0	1.9	3.9
26	-3.6	-1.8	0.0	2.1	4.2
28	-3.9	-1.9	0.0	2.3	4.5
30	-4.2	-2.1	0.0	2.5	4.8
32	-4.4	-2.2	0.0	2.6	5.2



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
1297	1225	1159	1101	1048	1000	957	918	881	848	817
1943	1836	1738	1651	1572	1500	1437	1378	1323	1273	1228
2591	2448	2318	2201	2096	2000	1916	1838	1766	1699	1638
3243	3063	2899	2753	2621	2500	2395	2298	2208	2125	2049
3899	3682	3483	3306	3147	3000	2875	2758	2650	2551	2460
4559	4303	4069	3860	3672	3500	3354	3218	3092	2977	2871
5223	4926	4656	4415	4199	4000	3833	3678	3535	3403	3282
5892	5553	5245	4971	4726	4500	4313	4138	3977	3828	3693
6565	6184	5837	5529	5253	5000	4792	4598	4419	4254	4103
7243	6818	6431	6089	5781	5500	5271	5059	4861	4680	4514
7925	7455	7027	6649	6310	6000	5750	5518	5302	5104	4923

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)
1000	9.8	2:22	9.4	2:20	9.2	2:19	8.9	2:18	8.9	2:19
1500	14.8	3:29	14.3	3:27	13.9	3:25	13.6	3:23	13.5	3:24
2000	19.7	4:38	19.1	4:34	18.5	4:31	18.1	4:29	17.9	4:29
2500	24.5	5:48	23.8	5:42	23.1	5:38	22.5	5:35	22.3	5:34
3000	29.2	6:59	28.4	6:51	27.5	6:46	26.8	6:42	26.5	6:40
3500	33.8	8:12	32.8	8:01	31.9	7:54	31.1	7:49	30.6	7:46
4000	38.3	9:27	37.2	9:13	36.1	9:03	35.2	8:57	34.6	8:52
4500	42.7	10:42	41.5	10:25	40.3	10:13	39.3	10:05	38.6	10:00
5000	47.0	12:00	45.6	11:40	44.4	11:24	43.2	11:15	42.4	11:07
5500	51.2	13:18	49.7	12:56	48.4	12:37	47.1	12:25	46.2	12:16
6000	55.3	14:39	53.7	14:13	52.3	13:51	50.9	13:36	49.9	13:25

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	1.2	2.3
10	-1.5	-0.8	0.0	2.4	4.9
15	-2.3	-1.2	0.0	3.5	7.4
20	-3.2	-1.6	0.0	4.6	9.6
25	-4.0	-2.0	0.0	5.5	11.6
30	-4.8	-2.5	0.0	6.3	13.4
35	-5.7	-2.9	0.0	7.0	15.0
40	-6.5	-3.3	0.0	7.6	16.3
45	-7.4	-3.7	0.0	8.0	17.4
50	-8.3	-4.1	0.0	8.4	18.3
55	-9.2	-4.5	0.0	8.7	18.9
60	-10.0	-4.9	0.0	8.8	19.4
65	-10.9	-5.3	0.0	8.9	19.6
70	-11.8	-5.7	0.0	8.8	19.6

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)														
	190	180	170	160	150	140	135	130	125	120	115	110	105	100	
43									46	30	18	9	3	1	
41							38	25	15	7	3	1	1	3	
39					42	19	11	5	2	0	1	3	6	12	
37				30	13	3	1	0	1	3	7	12	17	24	
35		38	19	7	1	1	2	5	8	13	18	24	31	38	
33	24	11	4	0	2	6	10	14	19	25	31	38	45	53	
31	5	1	1	3	9	17	22	27	33	39	46	53	60	68	
29	0	2	5	11	20	29	35	41	47	53	60	67	74	81	
27	4	8	15	23	33	43	49	55	61	67	74	80	87	94	
25	12	19	27	36	46	57	63	68	74	80	86	93	99	105	
23	23	31	40	50	60	70	76	81	87	93	98	104	110	115	

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 .78/290/250

PRESSURE ALT (1000 FT)	17	19	21	23	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	66	73	80	87	94	101	108	115	120	126	131	137	142	147
TIME (MINUTES)	16	17	18	19	20	21	22	23	24	25	26	26	27	28

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
190	%N1	68.7	71.4	76.0	80.2	84.3	88.6	93.2		
	KIAS	259	259	259	259	259	259	261		
	FF/ENG	2940	2920	2890	2870	2870	2910	2960		
180	%N1	67.2	69.9	74.4	78.7	82.8	87.1	91.6		
	KIAS	251	251	251	251	251	251	254		
	FF/ENG	2790	2760	2730	2710	2700	2740	2780		
170	%N1	65.8	68.4	72.6	77.1	81.4	85.5	89.9	95.4	
	KIAS	244	244	244	244	244	244	246	254	
	FF/ENG	2640	2610	2580	2560	2550	2570	2610	2780	
160	%N1	63.9	66.8	70.9	75.4	79.8	84.0	88.3	93.3	
	KIAS	236	236	236	236	236	236	238	241	
	FF/ENG	2500	2460	2430	2410	2390	2400	2430	2520	
150	%N1	62.0	65.1	69.1	73.7	78.0	82.2	86.6	91.3	
	KIAS	228	228	228	228	228	228	230	233	
	FF/ENG	2350	2310	2280	2250	2240	2240	2260	2310	
140	%N1	60.1	63.1	67.3	71.6	76.1	80.4	84.7	89.3	
	KIAS	222	222	222	222	222	222	222	224	
	FF/ENG	2210	2170	2130	2110	2090	2080	2100	2140	
130	%N1	58.2	61.1	65.4	69.5	74.1	78.6	82.8	87.2	94.2
	KIAS	217	217	217	217	217	217	217	217	219
	FF/ENG	2080	2040	1990	1970	1940	1930	1940	1970	2120
120	%N1	56.2	59.0	63.4	67.4	72.1	76.4	80.7	85.1	91.6
	KIAS	211	211	211	211	211	211	211	211	211
	FF/ENG	1940	1910	1860	1830	1810	1790	1790	1800	1890
110	%N1	54.3	56.9	61.1	65.4	69.6	74.2	78.6	82.8	89.0
	KIAS	205	205	205	205	205	205	205	205	205
	FF/ENG	1810	1780	1730	1700	1670	1660	1640	1650	1710
100	%N1	52.3	54.8	58.7	63.3	67.2	72.0	76.3	80.6	86.5
	KIAS	199	199	199	199	199	199	199	199	199
	FF/ENG	1680	1650	1600	1570	1540	1520	1510	1510	1560

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Advisory Information

Chapter PI

Section 22

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF25	ONE REV	NO REV
MAX MANUAL	3200	110/-60	80	-130	440	50	-40	80	-70	250	80	170
MAX AUTO	5370	130/-130	150	-250	840	0	0	160	-160	600	0	0
AUTOBRAKE 4	5540	140/-140	160	-260	880	0	0	160	-160	630	0	0
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	-20	190	-190	710	0	0
AUTOBRAKE 2	7090	190/-190	220	-350	1190	50	-120	220	-210	630	110	110
AUTOBRAKE 1	7740	220/-220	250	-390	1360	170	-220	250	-230	580	480	620

Good Reported Braking Action

MAX MANUAL	5060	120/-120	140	-240	830	140	-120	140	-130	400	300	660
MAX AUTO	6180	150/-150	180	-290	980	20	0	180	-180	700	20	90
AUTOBRAKE 4	6370	160/-160	180	-300	1010	10	0	190	-190	720	10	60
AUTOBRAKE 3	7320	190/-190	220	-350	1190	0	-20	220	-220	820	0	0

Medium Reported Braking Action

MAX MANUAL	6940	190/-190	220	-370	1360	340	-270	210	-190	510	790	1910
MAX AUTO	6970	190/-180	220	-380	1370	300	-180	210	-200	660	700	1820
AUTOBRAKE 4	7050	190/-190	220	-380	1380	280	-160	220	-200	710	610	1730
AUTOBRAKE 3	7670	210/-200	230	-400	1450	180	-120	230	-230	820	410	1270

Poor Reported Braking Action

MAX MANUAL	8960	270/-260	300	-550	2100	760	-500	290	-260	590	1670	4460
MAX AUTO	8960	270/-260	300	-550	2100	760	-500	290	-260	590	1670	4470
AUTOBRAKE 4	8960	270/-260	300	-550	2100	770	-500	290	-260	600	1670	4470
AUTOBRAKE 3	9050	270/-260	300	-550	2110	700	-410	290	-270	760	1530	4320

Reference distance assumes sea level, standard day, no wind or slope, VREF25 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 460 ft.

Reference distance for auto braking is applicable for auto or manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABV SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABV VREF 30	ONE REV	NO REV
MAX MANUAL	3150	140/-70	80	-130	440	50	-40	80	-70	250	80	160
MAX AUTO	5220	210/-140	150	-240	830	0	0	150	-150	600	0	0
AUTOBRAKE 4	5380	220/-140	150	-250	870	0	0	160	-160	620	0	0
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	-10	190	-190	720	0	0
AUTOBRAKE 2	6930	280/-200	210	-340	1180	40	-110	210	-210	640	80	80
AUTOBRAKE 1	7590	300/-220	240	-390	1350	160	-210	240	-230	580	410	540

Good Reported Braking Action

MAX MANUAL	5000	180/-130	140	-240	830	140	-120	140	-130	400	280	620
MAX AUTO	6010	250/-160	170	-280	970	20	0	170	-170	690	20	90
AUTOBRAKE 4	6190	260/-170	180	-290	1000	10	0	180	-180	710	10	60
AUTOBRAKE 3	7110	300/-200	210	-340	1180	0	-10	210	-210	830	0	0

Medium Reported Braking Action

MAX MANUAL	6860	260/-190	210	-370	1370	350	-270	210	-190	510	740	1770
MAX AUTO	6860	280/-190	210	-380	1370	320	-190	210	-200	650	690	1720
AUTOBRAKE 4	6920	290/-200	220	-380	1380	300	-170	210	-200	690	620	1650
AUTOBRAKE 3	7480	320/-210	230	-400	1440	190	-110	230	-220	830	410	1220

Poor Reported Braking Action

MAX MANUAL	8870	360/-270	300	-550	2110	780	-510	290	-260	600	1580	4140
MAX AUTO	8870	360/-270	300	-550	2100	780	-510	290	-260	590	1580	4150
AUTOBRAKE 4	8870	360/-270	300	-550	2100	780	-510	290	-260	590	1580	4150
AUTOBRAKE 3	8920	380/-270	300	-550	2110	730	-420	290	-270	770	1480	4050

Reference distance assumes sea level, standard day, no wind or slope, VREF30 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 460 ft.

Reference distance for auto braking is applicable for both auto and manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance Dry Runway

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	4210	90/-90	100	-170/570	90/-80	110/-110	420	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	4130	160/-100	100	-170/570	90/-80	110/-110	440	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	4530	260/-110	130	-170/570	80/-70	130/-120	320	200	440
ANTI-SKID OFF (FLAPS 25)	VREF25	5920	160/-150	160	-290/1010	190/-160	160/-150	440	410	960
ANTI-SKID OFF (FLAPS 30)	VREF30	5770	230/-160	160	-290/1010	190/-160	160/-150	450	380	880
ENGINE FAILURE (FLAPS 20)	VREF20	3460	150/-80	90	-140/470	60/-50	90/-90	280	0	110
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	4140	110/-100	100	-160/530	70/-60	100/-100	380	140	300
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	3350	90/-80	80	-130/460	50/-50	80/-80	290	100	200
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	3300	130/-80	80	-130/460	60/-50	80/-80	300	90	190
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	3680	90/-90	90	-150/530	70/-60	90/-90	310	140	300
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	3620	140/-90	90	-150/530	70/-70	90/-90	330	130	280
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	4890	190/-110	130	-180/600	100/-90	130/-130	510	230	510
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	4570	180/-110	130	-180/610	110/-90	130/-120	420	260	570
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	5800	240/-150	170	-230/780	160/-140	170/-160	580	430	990

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Dry Runway**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
LE SLAT ASYM (FLAPS = 20)	VREF30+30	4140	170/-90	110	-150/520	70/-60	110/-110	310	160	340
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	4440	170/-100	120	-160/540	80/-70	120/-120	320	180	390
LE SLAT DISAGREE (FLAPS > 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	3940	180/-90	100	-150/500	60/-60	100/-100	280	140	290
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	4260	180/-100	110	-160/540	80/-70	120/-110	330	0	180
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	6240	150/-150	180	-300/1010	270/-220	180/-180	620	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	6090	250/-150	180	-300/1010	280/-230	180/-180	640	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	6220	220/-160	190	-250/860	160/-150	190/-180	380	530	1220
ANTI-SKID OFF (FLAPS 25)	VREF25	6660	190/-180	190	-350/1240	290/-230	190/-180	490	630	1530
ANTI-SKID OFF (FLAPS 30)	VREF30	6500	260/-180	190	-350/1240	290/-230	190/-180	490	590	1410
ENGINE FAILURE (FLAPS 20)	VREF20	4980	150/-130	140	-230/800	160/-140	140/-140	410	0	410
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	5600	170/-150	160	-250/840	170/-150	160/-150	510	430	1010
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	5760	240/-160	180	-250/860	190/-170	180/-170	510	530	1250
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560

***Reference distance assumes sea level, standard day with no wind or slope.**

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	5130	200/-130	150	-230/790	150/-130	150/-140	380	380	860
LE SLAT ASYM (FLAPS = 20)	VREF30+30	5770	220/-150	170	-250/840	170/-150	170/-170	420	470	1080
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	6180	230/-160	190	-260/870	180/-160	190/-180	430	520	1190
LE SLAT DISAGREE (FLAPS > 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	5500	200/-140	160	-240/810	150/-140	160/-160	380	420	950
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	6160	230/-160	180	-270/900	210/-180	190/-180	470	0	590
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	9940	240/-230	310	-560/1950	1000/-670	320/-320	870	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	9650	370/-230	310	-550/1940	1000/-670	320/-320	870	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	8820	340/-250	300	-400/1400	410/-330	300/-270	520	1430	3670
ANTI-SKID OFF (FLAPS 25)	VREF25	8370	260/-250	260	-500/1870	640/-440	250/-230	560	1370	3680
ANTI-SKID OFF (FLAPS 30)	VREF30	8180	350/-250	260	-500/1870	650/-440	250/-230	560	1290	3390
ENGINE FAILURE (FLAPS 20)	VREF20	7250	240/-220	230	-390/1360	440/-340	230/-220	560	0	1250
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	7520	260/-230	240	-380/1340	400/-310	240/-220	630	1120	2890
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	7850	350/-240	270	-390/1370	430/-340	260/-240	620	1300	3370
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	7070	290/-210	230	-360/1280	350/-280	230/-210	490	980	2430
LE SLAT ASYM (FLAPS = 20)	VREF30+30	7900	320/-230	260	-380/1350	390/-320	260/-240	530	1170	2930
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	8430	340/-250	290	-400/1380	410/-330	280/-260	540	1340	3430
LE SLAT DISAGREE (FLAPS > 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	7550	300/-220	250	-370/1310	360/-290	250/-230	490	1050	2620
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	8860	360/-260	290	-430/1510	530/-420	290/-280	610	0	1680
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010	2540
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110	2810
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010	2540
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110	2810

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	16490	320/-200	570	-1120/4230	6080/-2020	600/-590	1090	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	15920	480/-200	550	-1100/4180	5960/-1970	580/-570	1080	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	11600	480/-370	430	-590/2140	900/-630	410/-370	640	3020	8970
ANTI-SKID OFF (FLAPS 25)	VREF25	10950	380/-360	370	-800/3310	3040/-940	350/-310	630	3540	14250
ANTI-SKID OFF (FLAPS 30)	VREF30	10760	480/-360	360	-800/3310	3040/-950	350/-310	630	3380	13380
ENGINE FAILURE (FLAPS 20)	VREF20	9970	360/-320	340	-600/2200	1100/-700	330/-310	690	0	3070
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	9560	360/-310	330	-550/2030	840/-570	320/-290	710	2280	6740
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	10000	460/-330	360	-560/2060	890/-610	350/-310	690	2540	7490
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)							
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	9120	400/-290	320	-530/1950	760/-520	310/-280	570	2010 5610
LE SLAT ASYM (FLAPS = 20)	VREF30+30	10100	430/-320	360	-560/2040	820/-570	350/-320	600	2310 6530
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	10880	460/-350	400	-570/2100	870/-610	380/-340	630	2700 7890
LE SLAT DISAGREE (FLAPS > 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	9680	410/-310	340	-540/1990	780/-540	330/-300	560	2120 5910
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	11960	500/-380	420	-660/2380	1260/-830	410/-390	730	0 3880
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160 6210
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290 6540
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160 6210
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290 6540

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (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
180	0	15.1	16.1	17.0	22.8	24.3	25.8	31.8	33.9	35.9	41.8	44.6	47.4	52.7	56.3	59.9			
	10	15.7	16.6	17.6	23.6	25.1	26.6	32.9	35.0	37.2	43.2	46.1	49.1	54.5	58.3	62.0			
	20	16.2	17.2	18.2	24.4	26.0	27.5	34.0	36.2	38.5	44.7	47.7	50.7	56.4	60.3	64.2			
	30	16.7	17.7	18.7	25.2	26.8	28.4	35.0	37.4	39.7	46.1	49.2	52.3	58.2	62.2	66.2			
	40	16.9	18.0	19.0	25.6	27.3	29.0	35.8	38.2	40.5	47.2	50.4	53.6	59.6	63.7	67.9			
160	0	13.7	14.5	15.3	20.6	21.9	23.2	28.5	30.4	32.3	37.5	40.0	42.5	47.2	50.4	53.6	57.6	61.6	65.6
	10	14.1	15.0	15.9	21.3	22.6	24.0	29.5	31.5	33.4	38.8	41.4	44.0	48.9	52.2	55.5	59.6	63.8	67.9
	20	14.6	15.5	16.4	22.0	23.4	24.8	30.5	32.5	34.5	40.1	42.8	45.4	50.5	54.0	57.4	61.7	65.9	70.2
	30	15.0	16.0	16.9	22.7	24.1	25.5	31.5	33.5	35.6	41.3	44.1	46.9	52.1	55.7	59.3	63.7	68.1	72.5
	40	15.3	16.2	17.2	23.1	24.5	26.0	32.1	34.2	36.3	42.3	45.1	48.0	53.4	57.0	60.7	65.2	69.8	74.3
140	0	12.2	13.0	13.7	18.3	19.4	20.6	25.3	26.9	28.6	33.1	35.3	37.4	41.5	44.3	47.1	50.6	54.0	57.5
	10	12.7	13.4	14.2	18.9	20.1	21.3	26.2	27.9	29.5	34.2	36.5	38.8	43.0	45.9	48.8	52.4	56.0	59.6
	20	13.1	13.9	14.6	19.6	20.8	22.0	27.0	28.8	30.5	35.4	37.7	40.1	44.4	47.4	50.5	54.1	57.8	61.6
	30	13.5	14.3	15.1	20.2	21.4	22.7	27.9	29.7	31.5	36.5	38.9	41.3	45.9	49.0	52.1	55.9	59.7	63.6
	40	13.7	14.5	15.3	20.5	21.8	23.1	28.4	30.3	32.1	37.3	39.8	42.2	46.9	50.1	53.3	57.2	61.2	65.1
120	0	10.8	11.5	12.1	16.0	17.0	18.0	22.0	23.4	24.8	28.6	30.5	32.3	35.7	38.1	40.5	43.3	46.2	49.1
	10	11.2	11.9	12.5	16.6	17.6	18.6	22.8	24.2	25.7	29.6	31.5	33.4	37.0	39.4	41.9	44.8	47.8	50.9
	20	11.6	12.2	12.9	17.1	18.2	19.3	23.5	25.0	26.5	30.6	32.6	34.6	38.2	40.7	43.3	46.3	49.4	52.6
	30	11.9	12.6	13.3	17.7	18.8	19.9	24.2	25.8	27.3	31.5	33.6	35.7	39.4	42.0	44.7	47.8	51.0	54.3
	40	12.1	12.8	13.5	18.0	19.1	20.2	24.7	26.3	27.9	32.2	34.3	36.4	40.3	43.0	45.7	48.9	52.2	55.6
100	0	9.4	10.0	10.5	13.8	14.6	15.5	18.7	19.8	21.0	24.0	25.5	27.1	29.7	31.6	33.6	35.7	38.0	40.4
	10	9.8	10.3	10.9	14.3	15.1	16.0	19.3	20.5	21.7	24.8	26.4	28.0	30.7	32.7	34.7	36.9	39.4	41.8
	20	10.1	10.7	11.2	14.7	15.6	16.5	20.0	21.2	22.5	25.7	27.3	29.0	31.7	33.8	35.9	38.2	40.7	43.2
	30	10.4	11.0	11.6	15.2	16.1	17.0	20.6	21.9	23.2	26.5	28.2	29.9	32.7	34.9	37.0	39.4	42.0	44.6
	40	10.5	11.1	11.7	15.4	16.4	17.3	20.9	22.3	23.6	27.0	28.7	30.5	33.4	35.6	37.8	40.2	42.9	45.6

*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, altitude, and OAT effects.

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	RTO MAX MAN	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0
	MAX MAN	1.0	6.1	11.2	16.1	21.0	25.8	30.5	35.2	39.8	44.5	49.1	53.8
	MAX AUTO	1.7	6.1	10.4	14.7	18.9	23.1	27.3	31.5	35.8	40.0	44.3	48.7
	AUTOBRAKE 4	1.9	6.0	10.1	14.1	18.1	22.0	26.0	29.9	33.8	37.8	41.8	45.8
	AUTOBRAKE 3	1.8	5.7	9.5	13.2	17.0	20.7	24.3	28.0	31.6	35.3	39.0	42.8
	AUTOBRAKE 2	1.7	5.4	9.0	12.5	15.9	19.3	22.7	26.1	29.4	32.8	36.2	39.7
	AUTOBRAKE 1	1.7	5.0	8.2	11.3	14.4	17.4	20.3	23.3	26.2	29.1	32.1	35.0

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Two Engines Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	MAX MAN	0.0	5.0	9.9	14.6	19.2	23.8	28.2	32.6	37.0	41.3	45.6	49.9
	MAX AUTO	0.2	3.7	7.3	10.8	14.3	17.9	21.5	25.1	28.7	32.4	36.2	40.0
	AUTOBRAKE 4	0.0	2.9	6.0	9.0	12.1	15.1	18.2	21.3	24.5	27.7	30.9	34.2
	AUTOBRAKE 3	0.0	1.8	4.3	6.9	9.5	12.1	14.8	17.4	20.1	23.9	25.7	28.6
	AUTOBRAKE 2	0.0	0.7	2.8	4.8	6.9	8.9	11.0	13.1	15.3	17.6	19.9	22.2
	AUTOBRAKE 1	0.0	0.4	1.8	3.2	4.6	6.0	7.5	9.0	10.5	12.1	13.8	15.5

Cooling Time (Minutes)
Category "C" and "D" Brakes

		ADJUSTED BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
		14 & BELOW	15	16	18	20	24	28	34	35 TO 42	43 & ABOVE
		BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON EICAS									
		UP TO 1	1	1	2	2	3	4	5	5 TO 6	7 & ABOVE
INFLIGHT	NO SPECIAL	PROCEDURE REQUIRED	1	1	2	2	3	4	6	CAUTION	FUSE PLUG MELT ZONE
GEAR DOWN			11	15	19	24	34	44	59		
GROUND											

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.
For one brake deactivated, increase brake energy by 15 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 6 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 10 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.



Performance Inflight

Engine Inoperative

Chapter PI

Section 23

ENGINE INOP

Initial Max Continuous %N1

Based on .80M, packs on or off and APU on

TAT (°C)	PRESSURE ALTITUDE (1000 FT)							
	29	31	33	35	37	39	41	43
20	103.8	103.4	102.5					
15	104.4	104.0	103.3	102.3	101.1	100.8	100.8	100.8
10	105.2	104.6	104.0	103.2	101.9	101.4	101.4	101.4
5	106.1	105.5	104.7	103.9	102.6	102.1	102.2	102.2
0	107.1	106.4	105.6	104.7	103.3	102.9	102.9	102.9
-5	106.9	107.5	106.6	105.7	104.3	103.9	103.9	103.9
-10	106.0	107.1	107.7	106.7	105.3	104.9	104.9	104.9
-15	105.1	106.2	107.1	107.8	106.5	106.2	106.2	106.2
-20	104.2	105.3	106.2	106.9	106.6	106.4	106.4	106.4
-25	103.2	104.3	105.3	105.8	105.8	105.6	105.6	105.6
-30	102.3	103.3	104.3	104.7	104.7	104.7	104.7	104.7
-35	101.3	102.4	103.3	103.6	103.6	103.6	103.6	103.6
-40	100.3	101.3	102.3	102.6	102.6	102.6	102.6	102.6

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

37000 FT to 27000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

37000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.63	102.6	103.6	104.7	105.8	106.9	105.8	104.8	104.1	103.3	101.8	98.8	95.7	
220	.69	102.6	103.6	104.7	105.8	106.9	105.9	104.8	104.0	103.3	102.4	100.4	97.5	
240	.74	102.6	103.6	104.7	105.8	106.9	106.1	105.0	104.0	103.3	102.5	101.7	99.4	
260	.80	102.6	103.6	104.7	105.8	106.6	106.5	105.3	104.3	103.3	102.6	101.9	101.1	
35000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.60	102.6	103.6	104.7	105.8	106.9	107.2	106.2	105.5	104.7	103.2	100.2	97.1	
220	.66	102.6	103.6	104.7	105.8	106.9	107.3	106.2	105.4	104.7	103.8	101.8	98.8	
240	.71	102.6	103.6	104.7	105.8	106.9	107.5	106.4	105.3	104.6	104.0	102.9	100.5	
260	.77	102.6	103.6	104.7	105.8	106.9	107.7	106.6	105.6	104.5	103.9	103.2	102.1	
33000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.58	102.6	103.6	104.7	105.8	106.9	107.9	107.2	106.5	105.8	104.9	102.6	99.6	
220	.63	102.6	103.6	104.7	105.8	106.9	107.9	107.3	106.3	105.7	105.0	104.1	101.2	
240	.68	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.4	105.5	104.9	104.1	102.7	
260	.74	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.5	105.5	104.7	104.1	103.3	
31000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.55	102.6	103.6	104.7	105.8	106.8	107.9	108.1	107.2	106.6	106.0	105.0	102.0	
220	.61	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.6	106.0	105.3	103.5	
240	.66	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.4	105.7	105.1	104.4	
260	.71	102.6	103.6	104.7	105.8	106.9	107.9	108.3	107.3	106.4	105.5	104.9	104.3	
29000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.5	106.8	106.1	105.5	103.6	100.7
220	.58	102.6	103.6	104.7	105.8	106.9	107.9	108.5	107.7	106.7	106.1	105.5	104.9	102.1
240	.63	102.6	103.6	104.7	105.8	106.9	107.9	108.7	107.7	106.8	106.0	105.4	104.8	103.5
260	.68	102.6	103.6	104.7	105.8	106.9	107.9	108.8	107.7	106.8	105.9	105.3	104.7	104.0
27000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.51	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.1	101.4
220	.56	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.4	105.6	104.9	104.2	102.7
240	.60	102.6	103.6	104.7	105.8	106.9	107.9	108.6	107.6	106.7	105.7	105.0	104.3	103.6
260	.65	102.2	103.2	104.2	105.1	106.1	107.0	107.9	107.8	106.8	105.9	105.0	104.3	103.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	27	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.8	-0.9	-1.0	-1.1	-1.2	-1.4
ENGINE & WING ANTI-ICE ON	-1.7	-1.9	-2.1	-2.3	-2.5	-2.9

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

25000 FT to 16000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

25000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.49	102.6	103.6	104.7	105.8	106.8	107.8	107.8	106.9	105.9	104.9	104.1	103.3	101.8	99.0	
220	.53	102.3	103.3	104.3	105.3	106.2	107.1	107.9	107.1	106.1	105.0	104.2	103.4	102.7	100.3	
240	.58	101.6	102.6	103.6	104.5	105.5	106.4	107.2	107.2	106.3	105.3	104.3	103.6	102.8	101.5	
260	.63	100.8	101.8	102.8	103.8	104.7	105.6	106.5	107.3	106.6	105.6	104.6	103.8	103.0	102.2	
24000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.6	106.6	105.6	104.9	104.1	103.2	100.5	
220	.52	102.3	103.3	104.3	105.3	106.2	107.2	108.0	107.7	106.8	105.8	104.9	104.1	103.4	101.6	
240	.57	101.6	102.6	103.6	104.5	105.5	106.4	107.3	107.8	107.0	106.0	105.0	104.2	103.5	102.7	
260	.61	100.8	101.8	102.8	103.7	104.7	105.6	106.5	107.4	107.1	106.2	105.2	104.4	103.6	102.8	
22000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	108.9	107.9	106.9	106.1	105.2	103.7	
220	.50	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	109.0	108.0	107.0	106.1	105.3	104.4	
240	.55	102.6	103.6	104.7	105.7	106.6	107.6	108.5	109.4	109.2	108.2	107.2	106.3	105.4	104.6	
260	.59	102.0	103.0	104.0	105.0	105.9	106.9	107.8	108.7	109.3	108.5	107.5	106.5	105.6	104.8	
20000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.44	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.8	108.8	107.9	106.9	106.1	104.0
220	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.9	108.9	108.0	107.0	106.1	104.8
240	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	110.1	109.1	108.1	107.2	106.2	105.4
260	.57	102.4	103.4	104.4	105.4	106.4	107.4	108.3	109.3	110.2	110.1	109.3	108.3	107.4	106.4	105.6
18000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.42	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.4	109.4	108.4	107.5	106.7	105.6
220	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.3	109.3	108.3	107.4	106.6	105.7
240	.51	102.3	103.3	104.3	105.3	106.3	107.2	108.2	109.1	110.1	110.2	109.4	108.4	107.4	106.6	105.7
260	.55	101.6	102.6	103.6	104.6	105.6	106.6	107.5	108.5	109.4	110.3	109.5	108.6	107.6	106.7	105.8
16000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.41	100.9	102.0	103.0	104.1	105.1	106.2	107.2	108.2	109.1	110.1	109.5	108.6	107.7	106.9	106.1
220	.45	100.6	101.7	102.7	103.7	104.8	105.8	106.8	107.8	108.8	109.8	109.4	108.5	107.6	106.8	105.9
240	.49	100.3	101.3	102.3	103.4	104.4	105.4	106.4	107.4	108.4	109.4	109.4	108.5	107.5	106.7	105.9
260	.53	99.9	101.0	102.0	103.0	104.0	105.0	106.1	107.1	108.0	109.0	109.5	108.6	107.7	106.8	106.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	16	18	20	22	24	25
ENGINE ANTI-ICE ON	-0.4	-0.4	-0.5	-0.6	-0.7	-0.7
ENGINE & WING ANTI-ICE ON	-1.1	-1.1	-1.2	-1.4	-1.5	-1.5

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

14000 FT to 5000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

14000 FT PRESS ALT									TAT (°C)								
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.39	101.1	102.1	103.1	104.2	105.2	106.3	107.3	108.3	109.3	110.2	109.4	108.5	107.6	106.8	106.1	
220	.43	100.8	101.8	102.8	103.9	104.8	105.8	106.8	107.7	108.6	109.6	109.4	108.4	107.6	106.7	106.0	
240	.47	100.2	101.2	102.2	103.2	104.1	105.1	106.0	107.0	107.9	108.9	109.4	108.4	107.5	106.6	105.9	
260	.51	99.5	100.5	101.5	102.5	103.4	104.4	105.3	106.2	107.2	108.1	109.1	108.4	107.5	106.7	105.9	
12000 FT PRESS ALT									TAT (°C)								
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.38	100.0	101.0	101.9	102.9	103.9	104.8	105.8	106.7	107.7	108.6	109.2	108.2	107.4	106.6	105.8	
220	.41	99.4	100.4	101.4	102.4	103.4	104.3	105.3	106.2	107.1	108.1	109.0	108.3	107.4	106.6	105.8	
240	.45	98.9	99.9	100.9	101.9	102.8	103.8	104.7	105.6	106.6	107.5	108.4	108.4	107.5	106.7	105.9	
260	.49	98.4	99.4	100.3	101.3	102.3	103.2	104.1	105.1	106.0	106.9	107.8	108.5	107.6	106.8	105.9	
10000 FT PRESS ALT									TAT (°C)								
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.36	98.2	99.2	100.2	101.2	102.1	103.1	104.0	104.9	105.8	106.8	107.7	107.8	107.0	106.2	105.4	
220	.40	97.7	98.7	99.7	100.7	101.6	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4	
240	.43	97.4	98.4	99.3	100.3	101.3	102.2	103.1	104.1	105.0	105.9	106.8	107.7	107.2	106.4	105.6	
260	.47	97.0	98.0	99.0	99.9	100.9	101.8	102.7	103.7	104.6	105.5	106.4	107.3	107.4	106.6	105.8	
5000 FT PRESS ALT									TAT (°C)								
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.33	95.5	96.5	97.5	98.4	99.4	100.3	101.2	102.1	103.1	104.0	104.8	105.7	106.6	106.4	105.7	
220	.36	95.1	96.1	97.1	98.0	99.0	99.9	100.8	101.7	102.7	103.6	104.4	105.3	106.2	106.4	105.7	
240	.40	94.7	95.7	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	104.0	104.9	105.8	106.4	105.7	
260	.43	94.4	95.4	96.4	97.3	98.3	99.2	100.1	101.0	101.9	102.8	103.7	104.6	105.5	106.3	105.9	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	5	10	12	14
ENGINE ANTI-ICE ON	-0.6	-0.5	-0.5	-0.6
ENGINE & WING ANTI-ICE ON	-1.2	-1.1	-1.2	-1.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	183	276	18400	17400	15600
180	174	269	20000	19100	17700
170	165	262	21200	20600	19700
160	155	254	22600	21900	21000
150	145	247	24000	23200	22300
140	135	238	25500	24700	23700
130	126	230	27200	26700	25500
120	116	221	29100	28900	28100
110	106	212	30900	30900	30500
100	97	202	32900	32800	32600

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
274	255	239	224	211	200	190	180	172	164	157
547	510	477	448	423	400	380	361	344	329	315
819	763	715	672	634	600	570	542	517	494	473
1090	1016	952	895	845	800	760	723	690	660	632
1361	1269	1189	1119	1056	1000	950	904	863	825	790
1632	1522	1426	1342	1267	1200	1140	1085	1036	990	949
1902	1775	1664	1565	1478	1400	1330	1266	1208	1156	1107
2174	2029	1901	1789	1689	1600	1520	1447	1381	1321	1266
2447	2283	2139	2013	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)										
	100	110	120	130	140	150	160	170	180	190	
200	1.5	1.7	1.8	1.9	2.1	2.1	2.3	2.4	2.5	2.6	0:33
400	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.4	5.8	6.0	1:05
600	5.2	5.7	6.1	6.6	7.0	7.5	7.9	8.3	8.8	9.3	1:36
800	6.9	7.5	8.1	8.8	9.4	10.0	10.6	11.2	11.8	12.4	2:08
1000	8.6	9.4	10.1	10.9	11.7	12.4	13.2	13.9	14.7	15.5	2:39
1200	10.2	11.2	12.1	13.1	14.0	14.9	15.8	16.7	17.6	18.5	3:10
1400	11.9	13.0	14.0	15.2	16.3	17.3	18.4	19.4	20.5	21.5	3:42
1600	13.5	14.8	16.0	17.2	18.5	19.6	20.9	22.0	23.3	24.5	4:14
1800	15.1	16.5	17.8	19.2	20.6	22.0	23.3	24.6	26.0	27.4	4:45

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb and APU on

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	15400	13000	10200
185	16300	14200	11400
180	17200	15300	12700
175	18200	16500	13900
170	19100	17600	15200
165	20000	18700	16400
160	20700	19700	17800
155	21400	20500	19100
150	22100	21200	20200
145	22800	21900	20900
140	23600	22600	21600
135	24300	23400	22300
130	25100	24100	23000
125	26100	24900	23700
120	27200	26200	24500
115	28300	27600	25700
110	29400	29000	27400
105	30500	30300	29100
100	31400	31300	30500

With engine anti-ice on, decrease altitude capability by 1800 ft.

With engine and wing anti-ice on, decrease altitude capability by 3800 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	14	18	21	23	25	27	29	31
190	%N1	98.8	102.4							
	MACH	.583	.616							
	KIAS	324	318							
	FF/ENG	6358	6418							
180	%N1	97.2	100.7	105.0						
	MACH	.572	.605	.641						
	KIAS	317	312	307						
	FF/ENG	6000	6034	6176						
170	%N1	95.6	99.0	102.9						
	MACH	.559	.593	.628						
	KIAS	310	306	300						
	FF/ENG	5646	5675	5766						
160	%N1	93.9	97.2	100.8	104.3					
	MACH	.545	.580	.614	.643					
	KIAS	303	299	294	290					
	FF/ENG	5286	5313	5367	5482					
150	%N1	92.1	95.3	98.8	101.9	104.6				
	MACH	.532	.567	.601	.628	.647				
	KIAS	295	292	287	283	281				
	FF/ENG	4945	4965	4991	5067	5157				
140	%N1	90.3	93.4	96.8	99.6	101.8				
	MACH	.518	.551	.587	.612	.632				
	KIAS	287	283	280	276	273				
	FF/ENG	4609	4607	4633	4669	4732				
130	%N1	88.4	91.4	94.7	97.3	99.3	101.6			
	MACH	.503	.535	.571	.597	.615	.635			
	KIAS	278	275	272	268	266	263			
	FF/ENG	4279	4262	4280	4301	4328	4393			
120	%N1	86.3	89.3	92.4	95.0	96.8	98.8	101.3		
	MACH	.487	.518	.553	.580	.598	.616	.636		
	KIAS	269	266	263	261	258	255	253		
	FF/ENG	3955	3927	3928	3944	3959	3986	4051		
110	%N1	84.0	87.1	90.1	92.6	94.3	96.2	98.2	100.7	
	MACH	.470	.501	.534	.562	.580	.598	.617	.637	
	KIAS	260	257	254	252	250	248	245	243	
	FF/ENG	3634	3599	3585	3597	3606	3617	3642	3703	
100	%N1	81.5	84.6	87.6	90.0	91.7	93.4	95.3	97.3	99.9
	MACH	.450	.482	.514	.540	.559	.578	.597	.615	.636
	KIAS	249	247	244	242	241	239	237	234	232
	FF/ENG	3300	3279	3253	3247	3260	3267	3277	3297	3350

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	190	181	173	166	159
575	529	489	455	426	400	381	363	347	332	319
864	796	735	684	640	600	571	544	520	498	478
1155	1063	982	913	853	800	761	726	693	664	637
1446	1331	1228	1142	1067	1000	952	907	866	829	796
1738	1598	1475	1370	1281	1200	1142	1088	1039	995	955
2032	1868	1723	1600	1495	1400	1332	1269	1212	1160	1113
2327	2138	1971	1830	1709	1600	1522	1451	1385	1325	1271
2623	2409	2219	2060	1923	1800	1712	1631	1557	1489	1429

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:41	2.3	0:40	2.0	0:38	1.9	0:37	1.7	0:36
400	5.4	1:17	4.9	1:15	4.6	1:12	4.3	1:09	4.2	1:07
600	8.1	1:54	7.6	1:50	7.1	1:45	6.8	1:41	6.6	1:37
800	10.8	2:32	10.2	2:25	9.6	2:19	9.2	2:14	8.9	2:08
1000	13.5	3:09	12.7	3:01	12.1	2:53	11.5	2:46	11.3	2:39
1200	16.2	3:47	15.3	3:37	14.5	3:27	13.9	3:19	13.6	3:11
1400	18.8	4:26	17.8	4:14	16.9	4:02	16.2	3:52	15.8	3:42
1600	21.4	5:04	20.2	4:50	19.3	4:36	18.5	4:25	18.1	4:14
1800	24.0	5:43	22.7	5:27	21.6	5:12	20.7	4:58	20.3	4:45

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.1	0.0	0.2	0.4
4	-0.6	-0.3	0.0	0.5	0.9
6	-1.0	-0.5	0.0	0.7	1.4
8	-1.3	-0.6	0.0	1.0	2.0
10	-1.6	-0.8	0.0	1.3	2.5
12	-2.0	-1.0	0.0	1.6	3.0
14	-2.3	-1.2	0.0	1.8	3.6
16	-2.7	-1.3	0.0	2.1	4.1
18	-3.0	-1.5	0.0	2.4	4.7
20	-3.4	-1.7	0.0	2.6	5.2
22	-3.7	-1.8	0.0	2.9	5.7
24	-4.1	-2.0	0.0	3.1	6.3
26	-4.4	-2.2	0.0	3.4	6.8
28	-4.8	-2.3	0.0	3.6	7.4
30	-5.1	-2.5	0.0	3.8	7.9

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	87.3	90.3	94.9	100.2			
	KIAS	259	259	259	259			
	FF/ENG	5450	5490	5600	5810			
180	%N1	85.5	88.7	93.1	98.2	105.4		
	KIAS	251	251	251	251	251		
	FF/ENG	5140	5170	5250	5410	5770		
170	%N1	83.8	86.9	91.3	96.2	102.4		
	KIAS	244	244	244	244	244		
	FF/ENG	4840	4850	4910	5040	5310		
160	%N1	82.0	85.0	89.4	94.2	99.9		
	KIAS	236	236	236	236	236		
	FF/ENG	4530	4540	4580	4680	4890		
150	%N1	79.8	83.0	87.5	92.1	97.5		
	KIAS	228	228	228	228	228		
	FF/ENG	4230	4240	4260	4330	4490		
140	%N1	77.6	81.0	85.4	90.0	95.0	101.7	
	KIAS	222	222	222	222	222	222	
	FF/ENG	3940	3940	3950	4000	4120	4370	
130	%N1	75.5	78.6	83.2	87.7	92.5	98.4	
	KIAS	217	217	217	217	217	217	
	FF/ENG	3660	3650	3660	3690	3770	3950	
120	%N1	73.2	76.2	81.0	85.5	90.1	95.4	
	KIAS	211	211	211	211	211	211	
	FF/ENG	3380	3370	3370	3390	3440	3560	
110	%N1	70.6	73.9	78.4	83.0	87.6	92.6	99.0
	KIAS	205	205	205	205	205	205	205
	FF/ENG	3120	3100	3090	3100	3140	3220	3410
100	%N1	67.9	71.2	75.7	80.5	85.0	89.7	95.3
	KIAS	199	199	199	199	199	199	199
	FF/ENG	2850	2840	2830	2820	2840	2890	3020

This table includes 5% additional fuel for holding in a racetrack pattern.



Performance Inflight

Gear Down

Chapter PI

Section 24

GEAR DOWN

200 KIAS Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
55	96.7	97.4	97.0	97.0	96.6	96.7	97.0	97.1	96.1	95.2	96.3	98.2	99.9
50	97.2	98.3	98.1	98.1	97.8	97.9	98.3	98.3	97.3	96.2	96.2	97.5	99.2
45	97.9	98.8	99.1	99.1	98.9	99.0	99.5	99.5	98.5	97.4	97.4	98.1	98.8
40	98.5	99.3	99.9	100.1	99.9	100.2	100.6	100.7	99.6	98.6	98.5	99.3	99.9
35	99.1	100.0	100.4	100.7	100.9	101.2	101.7	101.8	100.7	99.7	99.6	100.4	101.0
30	99.6	100.6	101.1	101.2	101.4	102.1	102.8	102.9	101.8	100.8	100.7	101.4	102.1
25	98.7	101.4	101.7	101.9	102.0	102.6	103.5	103.9	102.9	101.8	101.7	102.5	103.1
20	97.9	101.9	102.5	102.6	102.7	103.3	104.1	104.6	103.7	102.8	102.7	103.4	104.1
15	97.1	101.0	103.5	103.4	103.4	104.0	104.9	105.3	104.5	103.6	103.6	104.4	105.0
10	96.3	100.2	103.6	104.4	104.2	104.8	105.7	106.2	105.3	104.5	104.4	105.2	105.9
5	95.5	99.3	102.7	103.9	104.9	105.6	106.5	107.0	106.2	105.4	105.3	105.9	106.6
0	94.7	98.4	101.8	103.0	104.0	105.6	107.3	107.8	107.2	106.3	106.2	106.7	107.2
-5	93.8	97.5	100.9	102.1	103.0	104.7	106.7	108.3	108.2	107.6	107.1	107.5	108.0
-10	93.0	96.6	100.0	101.2	102.2	103.7	105.8	107.3	108.2	108.5	108.5	108.5	108.5
-15	92.1	95.7	99.1	100.3	101.2	102.8	104.8	106.4	107.3	107.5	107.5	107.5	107.5
-20	91.3	94.8	98.2	99.3	100.3	102.0	103.9	105.5	106.3	106.5	106.5	106.5	106.5
-25	90.4	93.9	97.3	98.4	99.4	101.0	103.0	104.6	105.4	105.4	105.4	105.4	105.4
-30	89.5	93.0	96.4	97.5	98.5	100.0	102.0	103.7	104.4	104.4	104.4	104.4	104.4
-35	88.6	92.0	95.4	96.5	97.5	99.0	101.1	102.7	103.3	103.3	103.3	103.3	103.3
-40	87.7	91.1	94.5	95.6	96.5	98.1	100.1	101.8	102.2	102.2	102.2	102.2	102.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.7	-0.8	-0.8	-0.9	-1.0	-1.0	-1.1
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.2	-1.3	-1.3	-1.4	-1.5	-1.5	-1.7



GEAR DOWN

Long Range Cruise Altitude Capability

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	19800	18200	14800
185	20700	19300	17400
180	21700	20300	18600
175	22700	21200	19800
170	23700	22200	20800
165	24800	23200	21700
160	25800	24100	22700
155	26800	25200	23700
150	27600	26400	24800
145	28500	27700	26100
140	29300	29000	27500
135	30000	30000	29000
130	30700	30700	30100
125	31400	31400	30900
120	32200	32100	31700
115	32900	32900	32500
110	33700	33600	33300
105	34500	34400	34200
100	35300	35200	35000
95	36100	36100	35800
90	36900	36900	36600

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		10	14	18	21	23	25	27	29	31	33	35
190	%N1	91.6	95.1	99.1								
	MACH	.472	.508	.546								
	KIAS	261	261	260								
	FF/ENG	4765	4811	4928								
180	%N1	90.0	93.4	97.3	100.6							
	MACH	.461	.495	.534	.563							
	KIAS	255	254	254	253							
	FF/ENG	4490	4522	4612	4715							
170	%N1	88.4	91.7	95.4	98.5	101.0						
	MACH	.449	.483	.520	.550	.571						
	KIAS	248	248	247	246	246						
	FF/ENG	4225	4241	4295	4386	4471						
160	%N1	86.8	89.9	93.5	96.5	98.6	101.4					
	MACH	.437	.469	.506	.536	.555	.577					
	KIAS	241	240	240	240	239	238					
	FF/ENG	3963	3961	4000	4072	4126	4222					
150	%N1	84.8	88.1	91.5	94.3	96.4	98.7	101.6				
	MACH	.424	.456	.491	.520	.540	.561	.583				
	KIAS	234	233	233	232	232	231	231				
	FF/ENG	3703	3693	3717	3758	3812	3868	3966				
140	%N1	82.8	86.2	89.5	92.2	94.2	96.3	98.7	101.9			
	MACH	.411	.442	.476	.504	.524	.544	.565	.587			
	KIAS	227	226	225	225	225	224	224	223			
	FF/ENG	3443	3434	3440	3465	3502	3549	3611	3704			
130	%N1	81.0	84.1	87.3	90.0	91.8	93.9	96.0	98.6	102.0		
	MACH	.398	.427	.460	.487	.506	.527	.548	.570	.591		
	KIAS	220	219	218	217	217	217	216	216	214		
	FF/ENG	3205	3176	3170	3187	3205	3244	3286	3353	3436		
120	%N1	78.7	81.8	85.2	87.7	89.5	91.3	93.4	95.6	98.3	101.8	
	MACH	.385	.411	.443	.469	.488	.508	.529	.550	.572	.593	
	KIAS	212	210	210	209	209	209	209	208	207	206	
	FF/ENG	2974	2918	2912	2913	2927	2944	2981	3022	3090	3165	
110	%N1	76.1	79.6	82.8	85.3	87.0	88.8	90.7	92.7	95.0	97.7	101.5
	MACH	.369	.396	.426	.451	.469	.488	.508	.529	.551	.574	.595
	KIAS	203	203	201	201	200	200	200	200	199	199	197
	FF/ENG	2726	2685	2658	2653	2654	2668	2682	2717	2759	2822	2895
100	%N1	73.5	76.9	80.1	82.7	84.4	86.0	87.9	89.8	91.9	94.1	96.9
	MACH	.353	.380	.408	.432	.449	.467	.487	.507	.528	.550	.574
	KIAS	195	194	192	192	192	191	191	191	191	190	190
	FF/ENG	2489	2454	2407	2400	2397	2397	2408	2421	2454	2495	2553

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	288	259	236	217	200	189	179	170	161	154
650	581	521	474	434	400	378	357	339	323	308
981	875	784	711	652	600	567	536	509	484	462
1317	1173	1049	951	870	800	755	714	677	644	615
1656	1472	1315	1190	1089	1000	944	893	846	805	768
2000	1775	1583	1431	1308	1200	1132	1070	1014	964	920
2349	2082	1854	1674	1527	1400	1320	1248	1182	1124	1072
2703	2391	2125	1916	1747	1600	1508	1425	1349	1282	1223
3062	2705	2400	2161	1968	1800	1696	1602	1517	1441	1374
3427	3021	2675	2406	2188	2000	1884	1779	1684	1599	1524

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		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	4.8	0:49	4.4	0:47	4.0	0:45	3.7	0:44	3.3	0:41
400	9.9	1:36	9.2	1:32	8.6	1:27	8.0	1:23	7.5	1:17
600	14.9	2:24	13.9	2:17	13.0	2:09	12.2	2:03	11.5	1:53
800	19.8	3:12	18.5	3:02	17.4	2:52	16.4	2:43	15.4	2:30
1000	24.6	4:02	23.0	3:49	21.6	3:36	20.4	3:24	19.2	3:07
1200	29.3	4:52	27.4	4:36	25.8	4:20	24.4	4:05	23.0	3:45
1400	33.9	5:43	31.8	5:24	29.9	5:06	28.3	4:48	26.6	4:23
1600	38.5	6:36	36.0	6:13	33.9	5:51	32.1	5:31	30.1	5:02
1800	42.9	7:29	40.2	7:03	37.8	6:38	35.8	6:14	33.6	5:41
2000	47.2	8:24	44.2	7:54	41.6	7:26	39.4	6:58	37.0	6:21

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	0.6	1.3
10	-1.5	-0.8	0.0	1.3	2.7
15	-2.4	-1.2	0.0	1.9	4.0
20	-3.2	-1.6	0.0	2.5	5.3
25	-4.0	-2.0	0.0	3.1	6.6
30	-4.8	-2.4	0.0	3.7	7.8
35	-5.6	-2.8	0.0	4.3	8.9
40	-6.4	-3.2	0.0	4.8	10.1
45	-7.2	-3.6	0.0	5.3	11.1
50	-8.0	-4.0	0.0	5.8	12.1
55	-8.9	-4.5	0.0	6.3	13.1
60	-9.7	-4.9	0.0	6.7	14.0

Descent at VREF30 + 70

PRESSURE ALTITUDE (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	16	26	36	40	44	48	52	56	60	64	68	71	74
TIME (MINUTES)	7	10	12	13	14	15	16	16	17	18	19	19	20

GEAR DOWN

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	83.1	85.9	90.1	94.6	100.0		
	KIAS	249	249	249	249	249		
	FF/ENG	4710	4690	4710	4790	4980		
180	%N1	81.2	84.2	88.4	92.8	97.9		
	KIAS	241	241	241	241	241		
	FF/ENG	4440	4410	4420	4470	4610		
170	%N1	79.4	82.5	86.7	91.0	95.9	102.5	
	KIAS	234	234	234	234	234	234	
	FF/ENG	4180	4160	4150	4180	4280	4550	
160	%N1	77.4	80.5	84.7	89.0	93.7	99.6	
	KIAS	226	226	226	226	226	226	
	FF/ENG	3910	3890	3860	3880	3950	4140	
150	%N1	75.4	78.3	82.7	87.0	91.5	96.9	
	KIAS	218	218	218	218	218	218	
	FF/ENG	3650	3620	3590	3590	3640	3770	
140	%N1	73.6	76.4	80.9	85.2	89.5	94.6	102.0
	KIAS	212	212	212	212	212	212	212
	FF/ENG	3420	3390	3360	3350	3380	3470	3710
130	%N1	71.5	74.6	79.0	83.2	87.6	92.4	98.6
	KIAS	207	207	207	207	207	207	207
	FF/ENG	3210	3180	3150	3120	3140	3210	3380
120	%N1	69.4	72.6	76.8	81.2	85.6	90.2	95.7
	KIAS	201	201	201	201	201	201	201
	FF/ENG	3000	2970	2930	2900	2910	2950	3060
110	%N1	67.3	70.3	74.7	79.2	83.6	88.0	93.1
	KIAS	195	195	195	195	195	195	195
	FF/ENG	2800	2760	2730	2690	2680	2710	2790
100	%N1	65.1	68.0	72.5	76.8	81.2	85.7	90.5
	KIAS	189	189	189	189	189	189	189
	FF/ENG	2590	2560	2520	2490	2470	2480	2520

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight

Gear Down, Engine Inop

Chapter PI

Section 25

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Initial Max Continuous %N1

29000 FT to 10000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

29000 FT PRESS ALT								TAT (°C)					
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.7	106.8	106.1	105.5	104.9	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.8	106.1	105.5	102.8	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.5	106.8	106.2	103.6	100.5	
27000 FT PRESS ALT								TAT (°C)					
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.6	106.7	105.7	105.0	104.3	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.0	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.0	107.0	106.3	105.6	104.7	101.8	
25000 FT PRESS ALT								TAT (°C)					
MACH	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
0.6	102.3	103.2	104.2	105.2	106.1	106.9	107.3	106.4	105.4	104.4	103.6	102.9	
0.5	103.6	104.7	105.8	106.8	107.6	107.8	106.9	105.9	104.9	104.1	103.4	102.1	
0.4	103.6	104.7	105.8	106.8	107.9	107.7	106.7	105.7	104.9	104.1	102.8	100.0	
23000 FT PRESS ALT								TAT (°C)					
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.2	104.2	105.2	106.1	107.0	107.9	108.0	107.2	106.2	105.3	104.5	103.7	
0.5	104.7	105.8	106.8	107.8	108.7	108.6	107.7	106.7	105.8	105.0	104.2	102.7	
0.4	104.7	105.8	106.8	107.9	108.9	108.6	107.6	106.6	105.8	105.0	103.4	100.8	
21000 FT PRESS ALT								TAT (°C)					
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.9	104.8	105.8	106.8	107.7	108.6	109.5	109.4	108.5	107.5	106.6	105.7	
0.5	104.7	105.8	106.8	107.9	108.9	109.9	109.9	109.0	108.0	107.0	106.1	105.3	
0.4	104.7	105.8	106.8	107.9	108.9	109.9	109.8	108.8	107.8	106.9	106.1	104.2	
19000 FT PRESS ALT								TAT (°C)					
MACH	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
0.6	104.3	105.3	106.2	107.2	108.1	109.0	110.0	109.6	108.7	107.7	106.8	105.9	
0.5	105.8	106.8	107.9	108.9	109.8	110.7	110.1	109.2	108.2	107.3	106.4	105.5	
0.4	105.8	106.8	107.9	108.9	109.9	110.9	110.1	109.1	108.2	107.2	106.4	104.3	
15000 FT PRESS ALT								TAT (°C)					
MACH	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
0.6	102.8	103.8	104.7	105.6	106.6	107.5	108.4	109.2	108.2	107.3	106.4	105.7	
0.5	104.3	105.2	106.2	107.1	108.1	109.0	109.4	108.4	107.5	106.7	105.9	105.1	
0.4	105.2	106.2	107.2	108.2	109.2	110.2	109.5	108.6	107.7	106.9	106.1	105.1	
10000 FT PRESS ALT								TAT (°C)					
MACH	-15	-10	-5	0	5	10	15	20	25	30	35	40	
0.6	100.3	101.2	102.1	103.0	103.9	104.8	105.6	106.5	107.4	106.7	106.0	105.2	
0.5	101.4	102.4	103.3	104.2	105.1	106.0	106.9	107.5	106.8	106.0	105.2	104.5	
0.4	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4	104.7	104.1	

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
180	171	238	2900		
170	162	231	5500	3700	1600
160	153	223	8200	6600	4700
150	143	215	10600	9200	7600
140	134	210	12800	11800	10100
130	125	205	14900	14400	12900
120	115	199	16700	16500	15600
110	106	193	18900	18800	18100
100	96	188	21000	20800	20400

Includes APU fuel burn.

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
160	4300	1700	
155	5800	3400	
150	7400	5000	2500
145	8900	6700	4200
140	10300	8400	6000
135	11700	9900	7800
130	13100	11700	9500
125	14600	13600	11400
120	15700	15300	13400
115	16700	16600	15300
110	17900	17800	17000
105	19100	19000	18400
100	20300	20200	19700
95	21300	21200	20700
90	22300	22200	21600

With engine anti-ice on, decrease altitude capability by 1200 ft.

With engine and wing anti-ice on, decrease altitude capability by 2500 ft.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		6	8	10	12	14	16	18	20
160	%N1	103.3							
	MACH	.398							
	KIAS	237							
	FF/ENG	7736							
150	%N1	101.0	103.1						
	MACH	.389	.400						
	KIAS	231	229						
	FF/ENG	7195	7225						
140	%N1	98.6	100.6	102.7	105.3				
	MACH	.379	.390	.401	.412				
	KIAS	225	223	221	219				
	FF/ENG	6672	6685	6714	6765				
130	%N1	96.2	98.0	100.0	102.2	104.8			
	MACH	.367	.379	.391	.402	.412			
	KIAS	218	217	215	213	211			
	FF/ENG	6167	6164	6175	6200	6251			
120	%N1	93.8	95.5	97.3	99.2	101.5	104.2		
	MACH	.355	.367	.379	.390	.402	.412		
	KIAS	211	210	209	207	205	203		
	FF/ENG	5671	5660	5658	5666	5686	5740		
110	%N1	91.2	92.8	94.5	96.3	98.3	100.5	103.4	
	MACH	.342	.353	.365	.377	.389	.401	.413	
	KIAS	203	202	201	200	199	197	195	
	FF/ENG	5188	5169	5157	5156	5159	5177	5259	
100	%N1	88.4	90.1	91.6	93.3	95.2	97.1	99.5	102.8
	MACH	.328	.339	.351	.363	.375	.387	.400	.417
	KIAS	195	194	193	192	191	190	189	189
	FF/ENG	4697	4689	4671	4659	4657	4658	4700	4837

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
164	146	131	118	109	100	94	89	84	79	75
334	296	264	239	218	200	187	175	165	156	148
505	447	398	359	327	300	281	263	247	234	222
677	598	531	479	437	400	374	350	329	311	295
850	751	666	600	546	500	467	438	411	388	368
1025	904	801	720	656	600	560	524	493	465	441
1200	1057	936	841	766	700	653	611	574	541	513
1377	1212	1072	963	876	800	746	698	655	618	586
1554	1367	1208	1085	986	900	839	785	737	694	658
1733	1523	1345	1207	1096	1000	932	872	818	771	731

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		10		14		18	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	2.5	0:27	2.2	0:27	2.0	0:26	1.8	0:26
200	5.2	0:52	4.8	0:50	4.6	0:49	4.4	0:47
300	7.8	1:17	7.4	1:14	7.1	1:12	7.0	1:09
400	10.5	1:42	9.9	1:38	9.5	1:35	9.5	1:31
500	13.1	2:08	12.4	2:02	12.0	1:58	11.9	1:54
600	15.7	2:33	14.9	2:27	14.4	2:22	14.3	2:16
700	18.2	2:59	17.3	2:51	16.7	2:45	16.7	2:39
800	20.7	3:25	19.7	3:16	19.0	3:09	19.0	3:01
900	23.2	3:51	22.1	3:41	21.3	3:32	21.2	3:24
1000	25.7	4:18	24.4	4:06	23.6	3:56	23.5	3:47

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.2	0.0	0.2	0.5
4	-0.7	-0.3	0.0	0.5	1.1
6	-1.0	-0.5	0.0	0.8	1.7
8	-1.4	-0.7	0.0	1.1	2.3
10	-1.8	-0.9	0.0	1.4	2.9
12	-2.1	-1.1	0.0	1.7	3.4
14	-2.5	-1.2	0.0	2.0	4.0
16	-2.9	-1.4	0.0	2.3	4.6
18	-3.2	-1.6	0.0	2.6	5.2
20	-3.6	-1.8	0.0	2.9	5.8
22	-4.0	-2.0	0.0	3.1	6.4
24	-4.4	-2.1	0.0	3.4	6.9
26	-4.7	-2.3	0.0	3.7	7.5
28	-5.1	-2.5	0.0	4.0	8.1
30	-5.5	-2.7	0.0	4.3	8.7

Includes APU fuel burn.

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GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
180	%N1	101.3				
	KIAS	241				
	FF/ENG	8700				
170	%N1	99.2	103.1			
	KIAS	234	234			
	FF/ENG	8130	8300			
160	%N1	96.9	100.4			
	KIAS	226	226			
	FF/ENG	7540	7640			
150	%N1	94.5	97.9	103.9		
	KIAS	218	218	218		
	FF/ENG	6970	7030	7280		
140	%N1	92.5	95.6	101.0		
	KIAS	212	212	212		
	FF/ENG	6480	6520	6690		
130	%N1	90.4	93.5	98.5	105.9	
	KIAS	207	207	207	207	
	FF/ENG	6040	6070	6170	6500	
120	%N1	88.2	91.2	95.9	102.0	
	KIAS	201	201	201	201	
	FF/ENG	5600	5610	5670	5870	
110	%N1	86.0	88.9	93.4	98.8	
	KIAS	195	195	195	195	
	FF/ENG	5170	5170	5210	5330	
100	%N1	83.5	86.5	90.8	95.8	102.8
	KIAS	189	189	189	189	189
	FF/ENG	4750	4750	4760	4830	5080

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight

Text

Chapter PI

Section 26

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, brakes deactivated, improved climb, contaminated runway situations, brake energy limits, or obstacle clearance with unbalanced V1. These speeds may be used for weights less than or equal to the performance limited weight.

Normal takeoff speeds, V1, VR, and V2, with anti-skid on and all brakes operative, are read from the table by entering with takeoff flap setting, brake release weight and appropriate column. The appropriate column is obtained by entering the Column Reference chart with the airport pressure altitude and the actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the V1 Adjustment chart. Adjusted V1 must not exceed VR. These takeoff speeds are not valid when the brake release weight is based on clearway, stopway, improved climb or is limited by tire speed or brake energy.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). Therefore compare the adjusted V1 to the V1(MCG). To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length.

Clearway and Stopway V1 Adjustments

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR.

Maximum allowable clearway limits are provided for guidance when more precise data is not available.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 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 Takeoff

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 assumes 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 13 mm (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 field/obstacle limit weight for the takeoff flap setting.
2. Enter the Weight Adjustment table with the 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 adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

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 the Takeoff Speeds table in this section.
2. If V1(MCG) limited, set $V1=V1(MCG)$. If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set $V1=V1(MCG)$.

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. 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.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal runway/obstacle limited weight and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE ADJUSTMENT		
FIELD LENGTH (FT)	WEIGHT (1000 KG)	V1 ADJUSTMENT (KTS)
6000	-46.6	-44
7000	-46.6	-42
8000	-46.6	-39
9000	-37.9	-37
10000	-27.1	-34
12000	-22.7	-31
14000	-22.7	-29

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance adjusted for wind and slope exceeds approximately 8400 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Brakes Deactivated

When operating with brakes deactivated, the field 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 3200 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ONE BRAKE DEACTIVATED SPEED ADJUSTMENT	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KTS)
4000	-2
6000	-2
8000	-2
10000	-2
12000	-2
14000	-2

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance exceeds approximately 3800 ft for one brake deactivated.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. %N1 adjustments are shown for packs off operation.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of reduced thrust is not allowed on runways contaminated with water, ice, slush or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

Enter the Minimum Assumed Temperature table with airport pressure altitude and read minimum assumed temperature. If assumed temperature is below this value, use the Takeoff %N1 table to set takeoff thrust. To find assumed temperature reduced thrust, obtain the assumed temperature %N1 by entering the Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table. Apply the altitude adjustment shown in the %N1 Altitude Adjustment table. Check the resulting value by entering the Minimum Assumed Temperature Limit %N1 table with actual airport temperature and pressure altitude. Use the greater of assumed temperature limit %N1 or minimum %N1 as the assumed temperature reduced thrust %N1. Determine takeoff speeds using the actual takeoff weight and assumed temperature.

Max Climb %N1

This table shows Max Climb %N1 for a 250/290/.78 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 packs off and anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for packs off and anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. 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 maximum cruise thrust at 0 ft/min residual rate of climb or maximum climb thrust at 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 12° 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 .80M 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 .78/290/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

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 table makes no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Distance and time for descent are shown for a .78/290/250 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 at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

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. Landing distances for slippery runways are 115% of the actual landing distances.

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 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 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, temperature, and speed conditions as well as thrust reverser configuration. Each adjustment is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landing at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight, the brakes on speed adjusted for wind and 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 Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse Thrust) 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 or brake temperature monitor system (BTMS) indication on EICAS. Times are provided for ground cooling and inflight gear down cooling.

If brake temperature monitor indication on EICAS is available, 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 the recommended cooling schedule by entering at the bottom of the chart. The brake temperature light illuminates when the hottest brake is registering 5 on the EICAS indication and extinguishes as the hottest brake cools with an EICAS indication of 4.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .80M 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 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/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. The cruise segment is at a level off altitude which is based on 100 ft/min residual rate of climb.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude are used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (KG/HR)					
	GROSS WEIGHT (1000 KG)					
	190	170	150	130	110	90
43					60	55
39				65	60	60
35		75	70	70	65	65
31	75	75	75	75	70	65
27	85	85	80	75	75	70
25	85	85	85	80	75	70
20	95	90	90	85	80	75
15	105	105	95	95	90	85
10	115	115	105	105	100	95
5	125	125	120	115	110	105

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/290/250 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 Fuel Required Adjustment 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

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 the 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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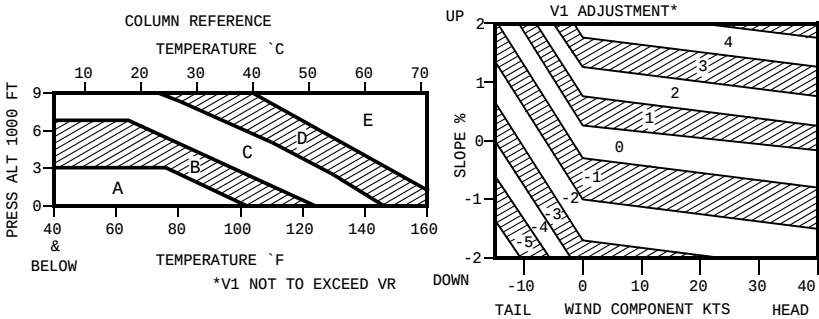
Performance Inflight

Chapter PI

General

Section 30

Takeoff Speeds
Max Takeoff Thrust



FLAPS	WT 1000 KG	A			B			C			D			E		
		V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂
5	190	166	170	175	167	171	176									
	180	160	165	171	162	166	171									
	170	154	160	166	156	161	166	159	162	166						
	160	148	154	161	150	156	161	153	157	161						
	150	141	148	156	144	150	156	147	151	156	150	153	156			
	140	135	142	151	137	144	150	140	145	150	144	147	150			
	130	128	136	145	130	137	145	134	139	145	137	141	145	141	142	145
	120	121	129	140	124	131	140	127	132	140	130	134	140	134	136	140
	110	114	122	134	116	124	134	119	126	134	123	127	134	126	129	134
	100	106	114	128	109	116	128	112	118	127	115	120	127	118	122	127
15	190	160	163	168	157	159	164									
	180	154	158	164	151	154	159									
	170	148	152	159	145	148	154									
	160	142	147	154	139	143	149	142	145	150						
	150	137	142	150	132	136	144	135	138	144						
	140	130	135	144	126	130	139	128	132	139	132	134	139			
	130	124	129	139	120	124	134	122	126	134	125	128	133	123	124	128
	120	117	122	134	113	118	128	116	120	128	119	122	128	115	117	122
	110	111	117	128	106	111	122	108	113	122	112	115	122			
	100	104	109	122												
20	190	158	159	165	155	155	159									
	180	152	153	159	148	149	154									
	170	146	148	154	142	143	149	144	145	150						
	160	140	142	149	136	138	144	139	140	145						
	150	133	136	145	130	132	139	132	134	139						
	140	127	131	139	124	127	134	126	128	134	130	130	134			
	130	121	125	134	117	120	129	120	122	129	124	124	129	119	120	124
	120	114	119	129	110	114	124	113	116	124	117	118	124	113	113	118
	110	107	112	124	103	108	118	105	109	118	109	111	118			
	100	99	105	118												

CHECK V1(MCG) IN BOXED AREA

V1(MCG)

Max Takeoff Thrust

ACTUAL OAT		PRESSURE ALTITUDE (FT)						
°C	°F	-1000	0	2000	4000	6000	8000	9000
50	122	103	101	97				
40	104	108	106	101	97	93	90	
30	86	111	109	105	101	97	94	92
20	68	111	110	107	104	100	96	95
10	50	111	110	107	104	101	98	96
-50	-58	113	111	108	105	102	98	97



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Maximum Allowable Clearway

FIELD LENGTH (FT)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (FT)
4000	350
6000	500
8000	600
10000	700
12000	800
14000	900

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (FT)	NORMAL V1 (KIAS)		
	120	140	160
800	-5	-3	-2
600	-3	-2	-2
400	-2	-1	-1
200	-1	-1	-1
0	0	0	0
-200	1	1	1
-400	2	1	1
-600	3	2	2
-800	5	3	2

Stab Trim Setting Max Takeoff Thrust

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	6 1/2	5 1/2	4 1/2	4	3	2
180	7	6	5 1/2	4 1/2	3 1/2	2 1/2	2
170	6 1/2	6	5	4	3 1/2	2 1/2	1 1/2
160	6 1/2	5 1/2	5	4	3	2 1/2	1 1/2
150	6	5	4 1/2	3 1/2	3	2	1
140	5 1/2	4 1/2	4	3	2 1/2	1 1/2	1/2
130	5	4	3	2 1/2	1 1/2	1	1/2
120	4	3 1/2	2 1/2	2	1 1/2	1/2	1/2
110	3 1/2	3	2 1/2	1 1/2	1	1/2	1/2
100	3 1/2	2 1/2	2	1	1/2	1/2	1/2

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VREF (KIAS)

WEIGHT (1000 KG)	FLAPS		
	30	25	20
190	179	170	179
180	171	166	173
170	164	161	168
160	156	156	162
150	148	151	157
140	142	146	151
130	137	141	146
120	131	135	141
110	125	129	135
100	119	123	128



Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF30 + 80
1	VREF30 + 60
5	VREF30 + 40
15	VREF30 + 20
20	VREF30 + 20
25	VREF25
30	VREF30

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-19.5	-23.6	-27.8	-22.8	-26.9	-31.1	-32.7	-36.8	-41.0
200	-19.4	-23.6	-27.7	-22.7	-26.9	-31.1	-31.5	-35.7	-39.8
190	-19.0	-23.2	-27.4	-22.3	-26.4	-30.6	-30.0	-34.2	-38.3
180	-18.4	-22.5	-26.7	-21.4	-25.5	-29.7	-28.1	-32.3	-36.5
170	-17.4	-21.5	-25.7	-20.0	-24.2	-28.4	-25.9	-30.1	-34.2
160	-16.0	-20.2	-24.4	-18.3	-22.5	-26.6	-23.4	-27.6	-31.7
150	-14.5	-18.7	-22.8	-16.3	-20.5	-24.7	-20.6	-24.8	-29.0
140	-12.7	-16.8	-21.0	-14.2	-18.4	-22.5	-17.6	-21.8	-26.0
130	-10.6	-14.8	-19.0	-11.9	-16.1	-20.3	-14.5	-18.7	-22.8
120	-8.4	-12.6	-16.8	-9.7	-13.8	-18.0	-11.2	-15.4	-19.6
110	-6.1	-10.3	-14.4	-7.5	-11.7	-15.8	-7.9	-12.1	-16.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
5000				93.5			107.6		
5400	105.9			113.8			128.0	102.6	
5800	127.1	100.8		135.4	108.7		149.7	122.8	97.6
6200	149.8	121.6	95.8	158.2	129.8	103.6	172.5	144.2	117.7
6600	173.7	144.0	116.3	182.2	152.4	124.4	196.0	166.7	138.8
7000	198.8	167.6	138.3	206.7	176.2	146.6	220.1	190.0	161.0
7400	224.9	192.4	161.6		200.6	170.1		214.1	184.1
7800		218.4	186.1		225.3	194.4			208.0
8200			211.9			219.1			

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -108 ft/+108 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 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
190	-21	-21	-21	-16	-16	-16	-7	-7	-7
180	-21	-21	-21	-16	-16	-16	-6	-6	-6
170	-22	-22	-22	-17	-17	-17	-6	-6	-6
160	-22	-22	-22	-17	-17	-17	-6	-6	-6
150	-23	-23	-23	-18	-18	-18	-7	-7	-7
140	-24	-24	-24	-19	-19	-19	-8	-8	-8
130	-24	-24	-24	-20	-20	-20	-9	-9	-9
120	-25	-25	-25	-21	-21	-21	-11	-11	-11
110	-26	-26	-26	-22	-22	-22	-13	-13	-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).

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-27.5	-32.0	-36.5	-32.2	-36.7	-41.3	-43.4	-48.0	-52.5
200	-26.2	-30.7	-35.3	-30.4	-34.9	-39.5	-40.2	-44.7	-49.3
190	-24.8	-29.4	-33.9	-28.5	-33.0	-37.6	-37.0	-41.5	-46.1
180	-23.3	-27.8	-32.4	-26.5	-31.0	-35.6	-33.8	-38.3	-42.9
170	-21.7	-26.2	-30.8	-24.4	-29.0	-33.5	-30.6	-35.2	-39.7
160	-19.9	-24.5	-29.0	-22.3	-26.8	-31.3	-27.5	-32.0	-36.5
150	-18.0	-22.6	-27.1	-20.0	-24.5	-29.1	-24.3	-28.8	-33.4
140	-16.0	-20.6	-25.1	-17.7	-22.2	-26.7	-21.2	-25.7	-30.3
130	-13.9	-18.4	-23.0	-15.2	-19.7	-24.3	-18.1	-22.6	-27.1
120	-11.6	-16.2	-20.7	-12.7	-17.2	-21.7	-15.0	-19.5	-24.0
110	-9.3	-13.8	-18.3	-10.0	-14.6	-19.1	-11.9	-16.4	-21.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
6200							98.8		
6600							122.3	90.9	
7000	90.6			113.9			146.9	114.0	
7400	118.7			141.3	104.7		173.0	138.2	105.8
7800	148.5	108.7		170.2	131.5	95.6	200.8	163.7	129.5
8200	180.4	137.8	98.9	201.1	159.9	122.0	229.9	190.9	154.6
8600	214.7	168.9	127.4		190.0	149.8		219.7	181.2
9000		202.4	157.8		222.0	179.3			209.5
9400			190.4			210.7			
9800			225.3						

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -155 ft/+155 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 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
210	-28	-28	-28	-21	-21	-21	-11	-11	-11
200	-29	-29	-29	-22	-22	-22	-11	-11	-11
190	-30	-30	-30	-23	-23	-23	-11	-11	-11
180	-30	-30	-30	-24	-24	-24	-11	-11	-11
170	-31	-31	-31	-25	-25	-25	-12	-12	-12
160	-32	-32	-32	-26	-26	-26	-13	-13	-13
150	-32	-32	-32	-27	-27	-27	-15	-15	-15
140	-32	-32	-32	-28	-28	-28	-17	-17	-17
130	-33	-33	-33	-29	-29	-29	-19	-19	-19
120	-33	-33	-33	-30	-30	-30	-21	-21	-21
110	-33	-33	-33	-31	-31	-31	-24	-24	-24

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).

ADVISORY INFORMATION

Slippery Runway Takeoff Maximum Reverse Thrust Weight Adjustment (1000 KG)

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
210	0.0	0.0	0.0	-9.0	-9.0	-9.0	-19.9	-19.9	-19.9
200	0.0	0.0	0.0	-10.1	-10.1	-10.1	-20.1	-20.1	-20.1
190	-1.1	-1.1	-1.1	-10.8	-10.8	-10.8	-20.0	-20.0	-20.0
180	-2.1	-2.1	-2.1	-11.2	-11.2	-11.2	-19.6	-19.6	-19.6
170	-2.7	-2.7	-2.7	-11.3	-11.3	-11.3	-18.9	-18.9	-18.9
160	-3.0	-3.0	-3.0	-11.1	-11.1	-11.1	-18.0	-18.0	-18.0
150	-3.0	-3.0	-3.0	-10.5	-10.5	-10.5	-16.9	-16.9	-16.9
140	-2.7	-2.7	-2.7	-9.5	-9.5	-9.5	-15.4	-15.4	-15.4
130	-2.2	-2.2	-2.2	-8.2	-8.2	-8.2	-13.7	-13.7	-13.7
120	-1.3	-1.3	-1.3	-6.6	-6.6	-6.6	-11.8	-11.8	-11.8
110	-0.3	-0.3	-0.3	-4.6	-4.6	-4.6	-9.6	-9.6	-9.6

V1(MCG) Limit Weight (1000 KG)

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
3800	99.1								
4200	138.1								
4600	176.7	114.8							
5000	214.9	153.6	91.3	93.8					
5400		192.0	130.4	120.4					
5800			169.0	148.3	104.3				
6200			207.3	177.8	131.4				
6600				209.3	159.9	115.0	98.4		
7000					190.2	142.6	114.6		
7400					222.4	171.8	131.5	100.0	
7800						202.8	149.3	116.2	
8200							168.1	133.2	101.6
8600							188.2	151.1	117.9
9000							209.8	170.1	135.0
9400								190.3	153.0
9800								212.0	172.0
10200									192.4
10600									214.3

1. Enter Weight Adjustment table with reported braking action and field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by - 81 ft/ + 81 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by - 81 ft/ + 81 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by - 126 ft/ + 126 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 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
190	-7	-7	-7	-17	-17	-17	-29	-29	-29
180	-8	-8	-8	-18	-18	-18	-30	-30	-30
170	-9	-9	-9	-19	-19	-19	-32	-32	-32
160	-10	-10	-10	-21	-21	-21	-33	-33	-33
150	-10	-10	-10	-22	-22	-22	-35	-35	-35
140	-11	-11	-11	-23	-23	-23	-36	-36	-36
130	-12	-12	-12	-24	-24	-24	-38	-38	-38
120	-12	-12	-12	-25	-25	-25	-40	-40	-40
110	-12	-12	-12	-26	-26	-26	-41	-41	-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).

ADVISORY INFORMATION

Slippery Runway Takeoff No Reverse Thrust Weight Adjustment (1000 KG)

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
210	-2.1	-2.6	-3.0	-15.0	-15.4	-15.8	-25.8	-26.2	-26.7
200	-3.3	-3.8	-4.2	-15.6	-16.0	-16.5	-25.9	-26.3	-26.7
190	-4.3	-4.7	-5.1	-16.0	-16.4	-16.8	-25.6	-26.0	-26.4
180	-5.0	-5.4	-5.8	-16.1	-16.5	-16.9	-25.0	-25.4	-25.8
170	-5.4	-5.8	-6.3	-15.9	-16.3	-16.7	-24.0	-24.4	-24.9
160	-5.6	-6.0	-6.5	-15.4	-15.9	-16.3	-22.8	-23.2	-23.6
150	-5.6	-6.0	-6.4	-14.7	-15.1	-15.5	-21.2	-21.6	-22.0
140	-5.3	-5.7	-6.1	-13.6	-14.1	-14.5	-19.2	-19.7	-20.1
130	-4.7	-5.1	-5.6	-12.3	-12.7	-13.1	-17.0	-17.4	-17.8
120	-3.9	-4.4	-4.8	-10.7	-11.1	-11.5	-14.4	-14.8	-15.3
110	-2.9	-3.3	-3.7	-8.8	-9.2	-9.6	-11.5	-11.9	-12.4

V1(MCG) Limit Weight (1000 KG)

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	141.3								
5000	187.8	111.6							
5400	228.6	163.2							
5800		206.4	136.2						
6200			183.5						
6600			224.6	122.6					
7000				167.1	96.4				
7400				208.3	143.1				
7800					186.0	118.0			
8200					226.3	162.8			
8600						204.3			
9800							109.0		
10200							135.3		
10600							163.5	109.0	
11000							194.1	135.3	
11400							226.8	163.5	109.0
11800								194.1	135.3
12200								226.8	163.5
12600									194.1
13000									226.8

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 -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -175 ft/+175 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for available 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
210	-7	-7	-7	-21	-21	-21	-41	-41	-41
200	-8	-8	-8	-22	-22	-22	-41	-41	-41
190	-9	-9	-9	-23	-23	-23	-42	-42	-42
180	-10	-10	-10	-24	-24	-24	-43	-43	-43
170	-11	-11	-11	-25	-25	-25	-45	-45	-45
160	-12	-12	-12	-27	-27	-27	-47	-47	-47
150	-13	-13	-13	-29	-29	-29	-49	-49	-49
140	-14	-14	-14	-30	-30	-30	-51	-51	-51
130	-15	-15	-15	-32	-32	-32	-52	-52	-52
120	-16	-16	-16	-33	-33	-33	-53	-53	-53
110	-17	-17	-17	-34	-34	-34	-54	-54	-54

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).

Takeoff %N1

Max Takeoff Thrust

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F		-1000	0	2000	4000	6000	8000	9000
55	131	58	106.1	106.1	105.9	105.5	105.1	104.9	104.7
50	122	53	106.8	106.9	106.8	106.5	106.1	105.9	105.7
45	113	48	107.5	107.5	107.5	107.3	107.0	106.9	106.6
40	104	43	108.2	108.2	108.2	108.0	107.9	107.8	107.7
35	95	38	109.0	108.9	109.0	108.8	108.7	108.7	108.6
30	86	33	109.1	109.8	109.8	109.7	109.6	109.7	109.6
25	77	28	108.2	108.9	110.3	110.6	110.5	110.6	110.6
20	68	23	107.3	108.0	109.4	110.6	111.3	111.4	111.3
15	59	18	106.4	107.1	108.5	109.7	111.0	112.0	112.1
10	50	13	105.5	106.2	107.5	108.8	110.0	111.3	112.1
0	32	3	103.6	104.3	105.7	106.9	108.1	109.4	110.1
-10	14	-7	101.7	102.4	103.8	104.9	106.1	107.4	108.1
-20	-4	-17	99.8	100.4	101.8	103.0	104.2	105.4	106.1
-30	-22	-27	97.9	98.5	99.8	101.0	102.2	103.4	104.0
-40	-40	-37	95.9	96.4	97.8	99.0	100.1	101.3	102.0
-50	-58	-47	93.8	94.4	95.8	96.9	98.0	99.2	99.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	9000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5	0.5

Assumed Temperature Reduced Thrust

Minimum Assumed Temperature

MINIMUM ASSUMED TEMP	PRESSURE ALTITUDE (FT)									
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
°F	90	86	83	79	76	72	69	65	62	58
°C	32	30	28	26	24	22	20	18	16	14

Assumed Temperature Limit %N1

Based on engine bleed for packs on

ACTUAL OAT (°C)	ASSUMED TEMPERATURE (°C)											
	15	20	25	30	35	40	45	50	55	60	65	70
55												
50									105.3	104.3	102.5	100.9
45								106.0	104.5	102.7	101.0	99.4
40							106.6	105.2	103.7	101.9	100.2	98.6
35						107.3	105.8	104.3	102.8	101.1	99.4	97.8
30					108.0	106.5	104.9	103.5	102.0	100.3	98.6	97.0
25				108.9	107.1	105.6	104.1	102.7	101.2	99.5	97.8	96.2
20			109.7	108.0	106.2	104.7	103.2	101.8	100.3	98.7	97.0	95.5
15		110.6	108.8	107.1	105.4	103.9	102.4	101.0	99.5	97.9	96.2	94.7
10	111.2	109.6	107.9	106.1	104.4	103.0	101.5	100.1	98.6	97.0	95.4	93.8
5	110.2	108.6	106.9	105.2	103.5	102.1	100.6	99.2	97.8	96.2	94.5	93.0
0	109.2	107.7	106.0	104.3	102.6	101.2	99.7	98.3	96.9	95.3	93.7	
-10	107.2	105.7	104.0	102.4	100.7	99.3	97.9	96.5	95.2	93.6	92.0	
-20	105.2	103.7	102.1	100.4	98.8	97.4	96.0	94.7	93.4	91.8		
-30	103.2	101.7	100.1	98.5	96.9	95.5	94.2	92.9	91.5			
-40	101.0	99.6	98.0	96.5	94.9	93.6	92.2					
-50	98.9	97.5	95.9	94.4	92.9	91.6						
-60	96.7	95.3	93.8	92.3								

%N1 Adjustment for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)										
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
PACKS OFF	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.5	0.5

%N1 Altitude Adjustment

ASSUMED TEMP (°C)	PRESSURE ALTITUDE (FT)										
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
70	0.2	0.1	0.0	-0.2	-0.3	-0.5	-0.6	-0.8	-1.0	-1.2	-1.3
60	0.1	0.1	0.0	-0.2	-0.3	-0.5	-0.6	-0.8	-1.0	-1.2	-1.3
50	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.5	-0.7	-0.9	-1.0
40	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.4	-0.4
32 & BELOW	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2

Assumed Temperature Reduced Thrust

Assumed Temperature Minimum %N1

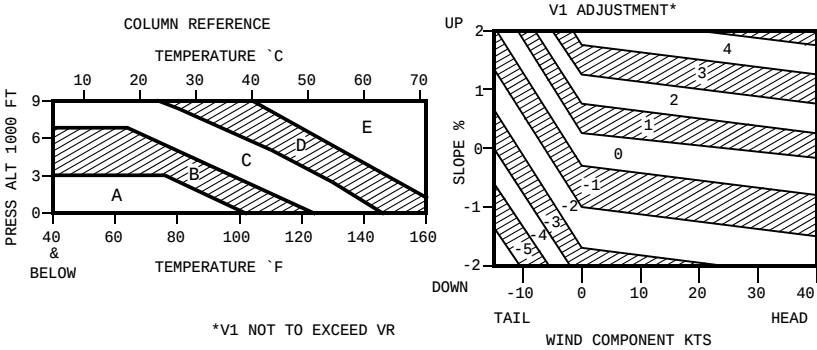
Based on 25% takeoff thrust reduction

ACTUAL OAT (°C)	PRESSURE ALTITUDE (FT)										
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000
55	96.9	96.9	96.9	96.8	96.6	96.5	96.4	96.2	96.0	95.9	95.9
50	97.4	97.4	97.4	97.4	97.3	97.2	97.1	97.0	96.8	96.7	96.6
45	97.8	97.8	97.8	97.8	97.8	97.8	97.7	97.5	97.4	97.4	97.3
40	98.3	98.3	98.2	98.2	98.2	98.1	98.1	98.0	97.9	97.9	97.9
35	98.6	98.6	98.5	98.5	98.5	98.5	98.5	98.4	98.4	98.4	98.4
30	98.0	98.5	98.9	98.9	98.9	98.9	98.8	98.8	98.8	98.8	98.8
25	97.2	97.7	98.1	98.5	98.9	98.9	99.1	99.1	99.0	99.1	99.1
20	96.4	96.9	97.3	97.7	98.1	98.4	98.8	99.0	99.2	99.2	99.2
15	95.6	96.0	96.5	96.9	97.2	97.6	98.0	98.3	98.6	98.9	99.1
10	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.8	98.1	98.4
0 & BELOW	93.1	93.6	94.0	94.3	94.7	95.1	95.4	95.8	96.1	96.4	96.7

1. Enter Minimum Assumed Temperature table with airport pressure altitude to determine minimum assumed temperature.
2. Enter Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature to determine assumed temperature limit %N1. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table.
3. Enter %N1 Altitude Adjustment table with assumed temperature and airport pressure altitude to determine altitude adjustment to %N1 found in step 2.
4. Ensure Takeoff %N1 from step 3 is greater than or equal to minimum %N1 allowed for airport conditions from Assumed Temperature Minimum %N1 table.

767 Flight Crew Operations Manual

TO1 Takeoff Speeds
10% Thrust Reduction



FLAPS	WT 1000 KG	A			B			C			D			E		
		V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂
5	190	168	171	175	170	173	176									
	180	163	167	171	165	168	171									
	170	156	161	166	159	162	166	162	164	166						
	160	150	156	161	153	157	161	156	159	161						
	150	144	150	156	147	151	156	150	153	156	153	155	156			
	140	137	144	151	140	145	150	143	147	150	146	148	150			
	130	130	137	145	133	138	145	136	140	145	139	142	145	143	143	145
	120	124	130	140	126	132	140	129	134	140	132	136	140	136	137	140
	110	116	123	134	118	125	134	121	127	134	125	128	134	128	130	134
	100	108	116	128	109	117	128	114	120	127	117	122	127	120	124	127
15	190	162	164	168												
	180	157	159	164	159	160	164									
	170	151	154	159	153	155	159									
	160	145	149	154	148	151	154									
	150	139	143	150	142	145	149	144	146	150						
	140	133	137	144	136	139	144	138	141	144						
	130	126	131	139	129	132	139	131	134	139	135	136	139			
	120	120	125	134	123	126	134	125	128	134	129	130	133			
	110	113	118	128	113	119	128	118	121	128	120	123	128	125	125	128
	100	106	111	122	108	113	122	110	115	122	114	117	122	117	119	122
20	190	160	160	165												
	180	155	155	159	157	157	159									
	170	148	149	154	150	150	154									
	160	143	144	149	145	145	149	147	147	150						
	150	136	139	145	139	139	144	141	141	145						
	140	130	133	139	133	134	139	135	136	139						
	130	123	126	134	126	128	134	128	129	134	131	131	134			
	120	116	120	129	119	122	129	122	124	129	126	126	129			
	110	109	114	124	112	115	124	115	117	124	119	119	124	121	121	124
	100	101	107	118	104	109	118	107	111	118	111	113	118	115	115	118

CHECK V1(MCG) IN BOXED AREA

TO1 V1(MCG)

10% Thrust Reduction

ACTUAL OAT		PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
50	122	99	97	93			
40	104	103	101	97	93	89	86
30	86	106	105	101	97	93	90
20	68	107	105	102	100	96	93
10	50	107	106	103	100	97	94
-50	-58	108	107	104	101	98	95

TO1 Takeoff %N1

10% Thrust Reduction

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
55	131	103.6	103.6	103.4	103.0	102.7	102.5
50	122	104.4	104.4	104.4	104.0	103.6	103.4
45	113	105.0	105.0	105.0	104.8	104.6	104.4
40	104	105.5	105.4	105.5	105.3	105.2	105.1
35	95	105.8	105.8	105.8	105.7	105.6	105.6
30	86	105.7	106.2	106.2	106.1	106.1	106.1
25	77	104.8	105.3	106.4	106.6	106.5	106.6
20	68	103.9	104.4	105.5	106.4	106.9	106.9
15	59	103.1	103.6	104.6	105.5	106.4	107.1
10	50	102.2	102.7	103.7	104.6	105.5	106.4
0	32	100.4	100.9	101.9	102.8	103.7	104.5
-10	14	98.6	99.0	100.1	100.9	101.8	102.6
-20	-4	96.7	97.2	98.2	99.1	99.9	100.7
-30	-22	94.8	95.3	96.3	97.1	98.0	98.8
-40	-40	92.9	93.3	94.3	95.2	96.0	96.8
-50	-58	90.9	91.3	92.3	93.2	94.0	94.7

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5

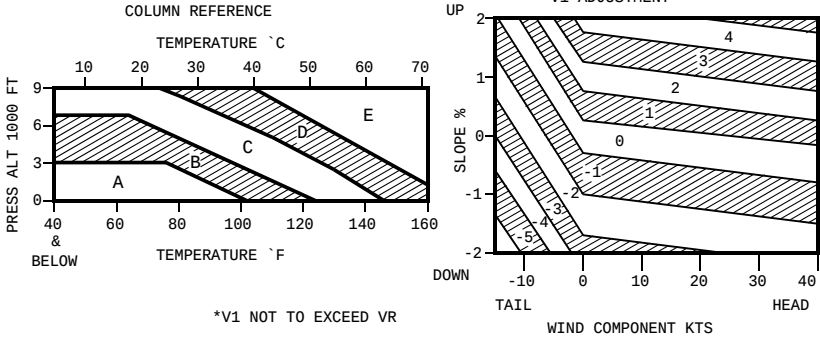


TO1 Stab Trim Setting

10% Thrust Reduction

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	7	6	5	4 1/2	3 1/2	2 1/2
180	7	6 1/2	6	5	4	3	2 1/2
170	7	6 1/2	5 1/2	4 1/2	4	3	2
160	7	6	5 1/2	4 1/2	3 1/2	3	2
150	6 1/2	5 1/2	5	4	3 1/2	2 1/2	1 1/2
140	6	5	4 1/2	3 1/2	3	2	1
130	5 1/2	4 1/2	3 1/2	3	2	1 1/2	1
120	4 1/2	4	3	2 1/2	2	1	1
110	4	3 1/2	3	2	1 1/2	1	1
100	4	3	2 1/2	1 1/2	1	1	1

TO2 Takeoff Speeds
20% Thrust Reduction



FLAPS	WT 1000 KG	A			B			C			D			E		
		V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂
5	190	171	172	175	173	174	176									
	180	165	168	171	167	169	171									
	170	159	162	166	162	163	166	164	165	166						
	160	153	157	161	156	158	161	158	160	161						
	150	146	151	156	149	152	156	152	154	156						
	140	139	145	151	142	146	150	145	148	150	148	149	150			
	130	133	138	145	136	139	145	139	141	145	142	143	145	144	144	145
	120	126	131	140	128	133	140	131	135	140	134	137	140	138	138	140
	110	118	124	134	120	126	134	123	128	134	127	129	134	130	131	134
	100	111	117	128	111	118	128	116	121	127	119	123	127	123	125	127
15	190	165	165	168												
	180	159	160	164	161	161	164									
	170	154	155	159	156	156	159									
	160	148	150	154	150	152	154									
	150	141	144	150	144	146	149	146	147	150						
	140	135	138	144	138	140	144	140	142	144						
	130	129	132	139	131	133	139	134	135	139	137	137	139			
	120	122	126	134	125	127	134	127	129	134	131	131	133			
	110	115	119	128	116	120	128	120	122	128	122	124	128	126	126	128
	100	108	112	122	110	114	122	112	116	122	116	118	122	119	120	122
20	190	161	161	165												
	180	156	156	159	158	158	159									
	170	150	150	154	151	151	154									
	160	145	145	149	146	146	149	148	148	150						
	150	138	140	145	140	140	144	142	142	145						
	140	132	134	139	135	135	139	137	137	139						
	130	125	127	134	128	129	134	130	130	134	132	132	134			
	120	118	121	129	121	123	129	124	125	129	127	127	129			
	110	111	115	124	114	116	124	117	118	124	120	120	124	122	122	124
	100	103	108	118	106	110	118	109	112	118	113	114	118	116	116	118

TO2 V1(MCG)
20% Thrust Reduction

ACTUAL OAT		PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
50	122	94	92	88			
40	104	98	96	92	88	85	82
30	86	101	100	96	92	88	85
20	68	101	100	97	94	91	88
10	50	101	100	97	95	92	89
-50	-58	103	101	98	96	93	90

TO2 Takeoff %N1

20% Thrust Reduction

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
55	131	99.8	99.7	99.5	99.1	98.8	98.6
50	122	100.5	100.5	100.4	100.1	99.7	99.6
45	113	101.1	101.1	101.1	100.9	100.7	100.5
40	104	101.7	101.7	101.7	101.5	101.4	101.3
35	95	101.8	101.8	101.8	101.7	101.7	101.7
30	86	101.6	102.0	102.0	101.9	101.8	101.9
25	77	100.7	101.1	102.0	102.2	102.2	102.2
20	68	99.9	100.3	101.2	101.9	102.3	102.3
15	59	99.0	99.4	100.3	101.1	101.7	102.2
10	50	98.2	98.6	99.5	100.2	100.9	101.5
0	32	96.5	96.9	97.7	98.4	99.1	99.7
-10	14	94.7	95.1	96.0	96.7	97.3	97.9
-20	-4	92.9	93.3	94.2	94.9	95.5	96.0
-30	-22	91.1	91.5	92.4	93.0	93.6	94.2
-40	-40	89.2	89.6	90.5	91.1	91.7	92.3
-50	-58	87.3	87.7	88.6	89.2	89.8	90.3

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5



TO2 Stab Trim Setting

20% Thrust Reduction

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	7	6 1/2	5 1/2	5	4	3
180	7	7	6 1/2	5 1/2	4 1/2	3 1/2	3
170	7	7	6	5	4 1/2	3 1/2	2 1/2
160	7	6 1/2	6	5	4	3 1/2	2 1/2
150	7	6	5 1/2	4 1/2	4	3	2
140	6 1/2	5 1/2	5	4	3 1/2	2 1/2	1 1/2
130	6	5	4	3 1/2	2 1/2	2	1 1/2
120	5	4 1/2	3 1/2	3	2 1/2	1 1/2	1 1/2
110	4 1/2	4	3 1/2	2 1/2	2	1 1/2	1 1/2
100	4 1/2	3 1/2	3	2	1 1/2	1 1/2	1 1/2

Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (KIAS OR MACH)								
	0	5	10	15	20	25	30	35	40
	250	250	250	290	290	290	290	.78	.78
60	96.5	97.2	97.0	97.4	96.7	95.1	96.1	95.1	94.7
50	97.6	98.7	99.0	99.6	98.9	97.3	98.2	95.0	93.8
40	98.8	99.8	100.4	101.2	101.0	99.3	100.1	97.0	95.8
30	99.1	101.1	101.6	102.4	102.5	101.2	101.9	98.8	97.7
20	97.5	101.3	103.3	103.8	104.1	102.8	103.4	100.5	99.4
10	95.8	99.6	102.9	104.4	105.6	104.6	104.7	102.6	100.9
0	94.2	97.8	101.1	102.6	105.0	106.9	106.5	104.3	102.4
-10	92.5	96.1	99.4	100.8	103.2	105.3	107.1	106.3	104.3
-20	90.8	94.3	97.6	99.0	101.5	103.4	105.1	106.5	106.4
-30	89.1	92.4	95.7	97.1	99.7	101.5	103.2	104.4	104.4
-40	87.3	90.5	93.9	95.2	97.8	99.5	101.2	102.2	102.2
-50	85.5	88.6	91.9	93.3	95.8	97.5	99.1	100.1	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	0	5	10	15	20	25	30	35	40
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.8	-0.9	-1.1	-1.4	-1.9
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.1	-1.3	-1.4	-1.7	-2.2	-2.4

Go-around %N1

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F		-1000	0	2000	4000	6000	8000	9000
55	131	58	106.1	106.1	105.9	105.5	105.1	104.9	104.7
50	122	53	106.8	106.9	106.8	106.5	106.1	105.9	105.7
45	113	48	107.5	107.5	107.5	107.3	107.0	106.9	106.6
40	104	43	108.2	108.2	108.2	108.0	107.9	107.8	107.7
35	95	38	109.0	108.9	109.0	108.8	108.7	108.7	108.6
30	86	33	109.1	109.8	109.8	109.7	109.6	109.7	109.6
25	77	28	108.2	108.9	110.3	110.6	110.5	110.6	110.6
20	68	23	107.3	108.0	109.4	110.6	111.3	111.4	111.3
15	59	18	106.4	107.1	108.5	109.7	111.0	112.0	112.1
10	50	13	105.5	106.2	107.5	108.8	110.0	111.3	112.1
0	32	3	103.6	104.3	105.7	106.9	108.1	109.4	110.1
-10	14	-7	101.7	102.4	103.8	104.9	106.1	107.4	108.1
-20	-4	-17	99.8	100.4	101.8	103.0	104.2	105.4	106.1
-30	-22	-27	97.9	98.5	99.8	101.0	102.2	103.4	104.0
-40	-40	-37	95.9	96.4	97.8	99.0	100.1	101.3	102.0
-50	-58	-47	93.8	94.4	95.8	96.9	98.0	99.2	99.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	9000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5	0.5

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (290/.78)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	4.0	4.0			
	V/S (FT/MIN)	1600	1000			
30000	PITCH ATT	4.5	4.0	4.0	4.0	4.0
	V/S (FT/MIN)	2700	2100	1700	1300	1000
20000	PITCH ATT	7.0	6.5	6.0	6.0	5.5
	V/S (FT/MIN)	4200	3400	2700	2300	1900
10000	PITCH ATT	10.5	9.0	8.5	8.0	7.5
	V/S (FT/MIN)	5600	4500	3700	3200	2700
SEA LEVEL	PITCH ATT	13.5	11.5	10.5	9.5	9.0
	V/S (FT/MIN)	6300	5100	4300	3600	3100

Cruise (.78/290)

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	2.0	2.5	3.5		
	%N1	88.1	92.1	97.5		
35000	PITCH ATT	1.5	2.0	2.5	3.0	3.5
	%N1	85.1	87.3	90.0	93.6	98.2
30000	PITCH ATT	1.0	1.5	2.0	2.0	2.5
	%N1	84.2	85.7	87.4	89.4	91.9
25000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	80.7	82.2	83.8	85.8	87.9
20000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	76.7	78.2	79.8	81.9	83.9
15000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	72.7	74.3	76.1	77.9	79.9

Descent (.78/290)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	-1.5	-0.5	0.0	0.5	1.0
	V/S (FT/MIN)	-2600	-2600	-2700	-2800	-3100
30000	PITCH ATT	-2.5	-1.5	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2700	-2400	-2200	-2100	-2000
20000	PITCH ATT	-2.5	-1.5	-1.0	0.0	0.5
	V/S (FT/MIN)	-2400	-2100	-2000	-1900	-1800
10000	PITCH ATT	-2.5	-1.5	-1.0	-0.5	0.5
	V/S (FT/MIN)	-2100	-1900	-1700	-1700	-1600
SEA LEVEL	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2000	-1700	-1600	-1500	-1500

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF30+80)

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	58.7	63.4	67.3	70.9	74.4
	KIAS	199	211	222	236	251
5000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	54.8	59.0	63.1	66.8	69.9
	KIAS	199	211	222	236	251

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (GEAR POSITION) (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS UP (GEAR UP) (VREF30+80)	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	55.6	60.1	64.6	68.0	71.1
	KIAS	199	211	222	236	251
FLAPS 1 (GEAR UP) (VREF30+60)	PITCH ATT	6.0	6.5	6.5	6.5	6.5
	%N1	56.6	61.6	65.8	69.4	72.9
	KIAS	179	191	202	216	231
FLAPS 5 (GEAR UP) (VREF30+40)	PITCH ATT	4.5	4.5	5.0	4.5	4.5
	%N1	59.0	64.1	68.3	72.4	75.7
	KIAS	159	171	182	196	211
FLAPS 15 (GEAR UP) (VREF30+20)	PITCH ATT	5.5	5.5	6.0	6.0	5.5
	%N1	61.1	65.9	70.6	74.3	77.6
	KIAS	139	151	162	176	191
FLAPS 20 (GEAR DOWN) (VREF30+20)	PITCH ATT	4.0	4.5	4.5	4.0	3.5
	%N1	67.6	72.9	77.5	81.6	85.4
	KIAS	139	151	162	176	191

Final Approach (1500 FT)

Gear Down, Set Thrust for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS 20 (VREF20 +10)	PITCH ATT	1.5	1.5	1.5	1.5	1.5
	%N1	48.0	51.8	55.6	59.2	62.6
	KIAS	138	150	162	172	184

Go-Around (VREF 30 + 20)

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	18.0	15.0	12.5	10.5	9.0
	V/S (FT/MIN)	4000	3300	2700	2300	2000
	KIAS	139	151	162	176	191
5000	PITCH ATT	21.5	17.5	15.0	12.5	10.5
	V/S (FT/MIN)	4500	3800	3200	2800	2400
	KIAS	139	151	162	176	191
SEA LEVEL	PITCH ATT	25.0	20.5	17.0	14.5	12.0
	V/S (FT/MIN)	5000	4200	3600	3200	2800
	KIAS	139	151	162	176	191

Intentionally
Blank



Performance Inflight

All Engine

Chapter PI

Section 31

Long Range Cruise Maximum Operating Altitude

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°)
190	28900	-1	34400	33500	32600	30900	29300
185	29400	-2	35000	34100	33200	31500	29900
180	30100	-4	35600	34700	33800	32100	30500
175	30700	-5	36100	35300	34400	32700	31100
170	31300	-7	36800	35900	35000	33300	31800
165	31900	-8	37400	36500	35600	34000	32400
160	32600	-9	38000	37100	36300	34600	33100
155	33300	-11	38700	37800	36900	35300	33800
150	34000	-13	39400	38500	37600	36000	34500
145	34700	-14	40100	39200	38300	36700	35200
140	35400	-16	40800	39900	39000	37400	35900
135	36200	-17	41500	40700	39800	38200	36700
130	37000	-17	42300	41400	40600	38900	37400
125	37800	-17	43000	42300	41400	39800	38300
120	38600	-17	43000	43000	42200	40600	39100
115	39500	-17	43000	43000	43000	41500	40000
110	40500	-17	43000	43000	43000	42400	40900
105	41400	-17	43000	43000	43000	43000	41900
100	42400	-17	43000	43000	43000	43000	42900

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°)
190	28900	5	33800*	33500	32600	30900	29300
185	29400	3	34400*	34100	33200	31500	29900
180	30100	2	35000*	34700	33800	32100	30500
175	30700	1	35600*	35300	34400	32700	31100
170	31300	-1	36200*	35900	35000	33300	31800
165	31900	-2	36800*	36500	35600	34000	32400
160	32600	-4	37400*	37100	36300	34600	33100
155	33300	-5	38000*	37800	36900	35300	33800
150	34000	-7	38600*	38500	37600	36000	34500
145	34700	-8	39300*	39200	38300	36700	35200
140	35400	-10	40000*	39900	39000	37400	35900
135	36200	-12	40700*	40700	39800	38200	36700
130	37000	-12	41500*	41400	40600	38900	37400
125	37800	-12	42200*	42200*	41400	39800	38300
120	38600	-12	43000	43000	42200	40600	39100
115	39500	-12	43000	43000	43000	41500	40000
110	40500	-12	43000	43000	43000	42400	40900
105	41400	-12	43000	43000	43000	43000	41900
100	42400	-12	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.

Long Range Cruise Maximum Operating Altitude
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°)
190	28900	10	32700*	32700*	32600	30900	29300
185	29400	9	33400*	33400*	33200	31500	29900
180	30100	8	34000*	34000*	33800	32100	30500
175	30700	6	34700*	34700*	34400	32700	31100
170	31300	5	35300*	35300*	35000	33300	31800
165	31900	3	35900*	35900*	35600	34000	32400
160	32600	2	36500*	36500*	36300	34600	33100
155	33300	0	37100*	37100*	36900	35300	33800
150	34000	-1	37700*	37700*	37600	36000	34500
145	34700	-3	38400*	38400*	38300	36700	35200
140	35400	-4	39100*	39100*	39000	37400	35900
135	36200	-6	39800*	39800*	39800	38200	36700
130	37000	-6	40600*	40600*	40600	38900	37400
125	37800	-6	41300*	41300*	41300*	39800	38300
120	38600	-6	42100*	42100*	42100*	40600	39100
115	39500	-6	43000	43000	43000	41500	40000
110	40500	-6	43000	43000	43000	42400	40900
105	41400	-6	43000	43000	43000	43000	41900
100	42400	-6	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		23	25	27	29	31	33	35	37	39	41	43
190	%N1	89.7	90.8	92.0	93.4	95.2	97.6					
	MACH	.772	.787	.799	.804	.802	.798					
	KIAS	338	331	324	312	298	284					
	FF/ENG	3272	3196	3145	3109	3115	3191					
180	%N1	88.7	89.7	90.9	92.1	93.7	95.6	98.8				
	MACH	.762	.777	.792	.802	.803	.800	.797				
	KIAS	334	327	320	312	299	285	271				
	FF/ENG	3131	3054	3000	2957	2931	2951	3086				
170	%N1	87.6	88.6	89.7	90.9	92.2	94.0	96.2				
	MACH	.751	.767	.782	.797	.804	.802	.799				
	KIAS	329	323	316	309	299	285	272				
	FF/ENG	2983	2915	2856	2814	2773	2765	2809				
160	%N1	86.3	87.5	88.5	89.7	90.9	92.3	94.2	97.4			
	MACH	.736	.756	.772	.788	.800	.804	.801	.798			
	KIAS	322	318	312	305	297	286	272	259			
	FF/ENG	2825	2772	2717	2671	2629	2598	2599	2693			
150	%N1	84.9	86.3	87.3	88.4	89.5	90.8	92.4	94.8	99.2		
	MACH	.715	.743	.761	.776	.792	.803	.803	.800	.797		
	KIAS	312	312	307	300	294	285	273	260	247		
	FF/ENG	2643	2623	2577	2530	2489	2449	2429	2463	2609		
140	%N1	83.2	84.7	86.1	87.1	88.2	89.4	90.7	92.8	95.9		
	MACH	.692	.721	.747	.764	.780	.795	.804	.802	.799		
	KIAS	301	302	301	295	289	283	273	261	248		
	FF/ENG	2460	2448	2431	2392	2347	2311	2277	2279	2345		
130	%N1	81.4	83.0	84.4	85.7	86.8	87.9	89.1	90.9	93.5	97.0	
	MACH	.668	.696	.726	.750	.767	.783	.798	.804	.802	.798	
	KIAS	290	291	292	289	284	278	271	261	248	236	
	FF/ENG	2281	2266	2263	2247	2210	2169	2136	2119	2144	2222	
120	%N1	79.4	81.1	82.6	84.1	85.3	86.4	87.5	89.1	91.5	94.1	97.9
	MACH	.645	.670	.698	.729	.752	.770	.786	.800	.804	.801	.798
	KIAS	279	279	280	281	278	273	267	260	249	237	225
	FF/ENG	2110	2093	2082	2085	2068	2032	1996	1976	1975	2005	2089
110	%N1	77.4	78.8	80.5	82.1	83.6	84.8	85.9	87.4	89.5	91.9	94.5
	MACH	.621	.645	.671	.699	.730	.753	.771	.787	.801	.804	.801
	KIAS	269	268	268	268	269	266	261	255	248	238	226
	FF/ENG	1947	1927	1912	1904	1911	1893	1859	1837	1829	1830	1861
100	%N1	75.3	76.6	78.1	79.8	81.4	82.9	84.1	85.6	87.6	89.7	92.0
	MACH	.596	.619	.642	.669	.698	.729	.753	.771	.788	.801	.804
	KIAS	257	257	256	256	256	257	254	249	244	237	227
	FF/ENG	1786	1769	1750	1736	1733	1741	1722	1699	1689	1681	1683

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	161
564	522	485	453	425	400	382	366	351	337	324
847	784	728	680	638	600	574	549	527	507	488
1131	1047	971	907	850	800	765	733	703	676	651
1416	1310	1215	1134	1063	1000	956	916	879	845	814
1702	1573	1459	1361	1276	1200	1148	1100	1055	1014	977
1990	1839	1704	1589	1490	1400	1339	1283	1231	1183	1140
2279	2105	1950	1818	1703	1600	1531	1466	1407	1352	1302
2570	2372	2197	2047	1917	1800	1722	1649	1582	1520	1464
2861	2640	2443	2276	2130	2000	1913	1832	1757	1689	1626

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.7	0:39	2.3	0:38	2.0	0:36	1.7	0:35	1.5	0:35
400	5.6	1:14	5.0	1:11	4.4	1:07	4.0	1:04	3.7	1:01
600	8.5	1:49	7.7	1:44	6.8	1:37	6.3	1:32	5.8	1:28
800	11.3	2:25	10.4	2:17	9.2	2:08	8.5	2:01	7.9	1:55
1000	14.1	3:01	13.0	2:51	11.6	2:39	10.7	2:30	9.9	2:23
1200	16.9	3:37	15.6	3:25	14.0	3:10	12.9	2:59	12.0	2:50
1400	19.7	4:13	18.2	4:00	16.3	3:41	15.1	3:29	14.0	3:17
1600	22.4	4:50	20.8	4:34	18.6	4:13	17.3	3:59	16.0	3:45
1800	25.1	5:28	23.3	5:09	20.9	4:45	19.4	4:29	18.0	4:13
2000	27.8	6:06	25.8	5:45	23.2	5:17	21.5	4:59	20.0	4:41

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.2	-0.1	0.0	0.1	0.2
4	-0.5	-0.2	0.0	0.3	0.5
6	-0.8	-0.4	0.0	0.4	0.9
8	-1.1	-0.5	0.0	0.6	1.2
10	-1.3	-0.7	0.0	0.8	1.5
12	-1.6	-0.8	0.0	0.9	1.9
14	-1.9	-0.9	0.0	1.1	2.2
16	-2.2	-1.1	0.0	1.3	2.5
18	-2.5	-1.2	0.0	1.4	2.9
20	-2.7	-1.4	0.0	1.6	3.2
22	-3.0	-1.5	0.0	1.8	3.5
24	-3.3	-1.7	0.0	1.9	3.9
26	-3.6	-1.8	0.0	2.1	4.2
28	-3.9	-1.9	0.0	2.3	4.5
30	-4.2	-2.1	0.0	2.5	4.8
32	-4.4	-2.2	0.0	2.6	5.2

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
1297	1225	1159	1101	1048	1000	957	918	881	848	817
1943	1836	1738	1651	1572	1500	1437	1378	1323	1273	1228
2591	2448	2318	2201	2096	2000	1916	1838	1766	1699	1638
3243	3063	2899	2753	2621	2500	2395	2298	2208	2125	2049
3899	3682	3483	3306	3147	3000	2875	2758	2650	2551	2460
4559	4303	4069	3860	3672	3500	3354	3218	3092	2977	2871
5223	4926	4656	4415	4199	4000	3833	3678	3535	3403	3282
5892	5553	5245	4971	4726	4500	4313	4138	3977	3828	3693
6565	6184	5837	5529	5253	5000	4792	4598	4419	4254	4103
7243	6818	6431	6089	5781	5500	5271	5059	4861	4680	4514
7925	7455	7027	6649	6310	6000	5750	5518	5302	5104	4923

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)
1000	9.8	2:22	9.4	2:20	9.2	2:19	8.9	2:18	8.9	2:19
1500	14.8	3:29	14.3	3:27	13.9	3:25	13.6	3:23	13.5	3:24
2000	19.7	4:38	19.1	4:34	18.5	4:31	18.1	4:29	17.9	4:29
2500	24.5	5:48	23.8	5:42	23.1	5:38	22.5	5:35	22.3	5:34
3000	29.2	6:59	28.4	6:51	27.5	6:46	26.8	6:42	26.5	6:40
3500	33.8	8:12	32.8	8:01	31.9	7:54	31.1	7:49	30.6	7:46
4000	38.3	9:27	37.2	9:13	36.1	9:03	35.2	8:57	34.6	8:52
4500	42.7	10:42	41.5	10:25	40.3	10:13	39.3	10:05	38.6	10:00
5000	47.0	12:00	45.6	11:40	44.4	11:24	43.2	11:15	42.4	11:07
5500	51.2	13:18	49.7	12:56	48.4	12:37	47.1	12:25	46.2	12:16
6000	55.3	14:39	53.7	14:13	52.3	13:51	50.9	13:36	49.9	13:25

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	1.2	2.3
10	-1.5	-0.8	0.0	2.4	4.9
15	-2.3	-1.2	0.0	3.5	7.4
20	-3.2	-1.6	0.0	4.6	9.6
25	-4.0	-2.0	0.0	5.5	11.6
30	-4.8	-2.5	0.0	6.3	13.4
35	-5.7	-2.9	0.0	7.0	15.0
40	-6.5	-3.3	0.0	7.6	16.3
45	-7.4	-3.7	0.0	8.0	17.4
50	-8.3	-4.1	0.0	8.4	18.3
55	-9.2	-4.5	0.0	8.7	18.9
60	-10.0	-4.9	0.0	8.8	19.4
65	-10.9	-5.3	0.0	8.9	19.6
70	-11.8	-5.7	0.0	8.8	19.6

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)														
	190	180	170	160	150	140	135	130	125	120	115	110	105	100	
43									46	30	18	9	3	1	
41							38	25	15	7	3	1	1	3	
39					42	19	11	5	2	0	1	3	6	12	
37				30	13	3	1	0	1	3	7	12	17	24	
35		38	19	7	1	1	2	5	8	13	18	24	31	38	
33	24	11	4	0	2	6	10	14	19	25	31	38	45	53	
31	5	1	1	3	9	17	22	27	33	39	46	53	60	68	
29	0	2	5	11	20	29	35	41	47	53	60	67	74	81	
27	4	8	15	23	33	43	49	55	61	67	74	80	87	94	
25	12	19	27	36	46	57	63	68	74	80	86	93	99	105	
23	23	31	40	50	60	70	76	81	87	93	98	104	110	115	

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 .78/290/250

PRESSURE ALT (1000 FT)	17	19	21	23	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	66	73	80	87	94	101	108	115	120	126	131	137	142	147
TIME (MINUTES)	16	17	18	19	20	21	22	23	24	25	26	26	27	28

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
190	%N1	68.7	71.4	76.0	80.2	84.3	88.6	93.2		
	KIAS	259	259	259	259	259	259	261		
	FF/ENG	2940	2920	2890	2870	2870	2910	2960		
180	%N1	67.2	69.9	74.4	78.7	82.8	87.1	91.6		
	KIAS	251	251	251	251	251	251	254		
	FF/ENG	2790	2760	2730	2710	2700	2740	2780		
170	%N1	65.8	68.4	72.6	77.1	81.4	85.5	89.9	95.4	
	KIAS	244	244	244	244	244	244	246	254	
	FF/ENG	2640	2610	2580	2560	2550	2570	2610	2780	
160	%N1	63.9	66.8	70.9	75.4	79.8	84.0	88.3	93.3	
	KIAS	236	236	236	236	236	236	238	241	
	FF/ENG	2500	2460	2430	2410	2390	2400	2430	2520	
150	%N1	62.0	65.1	69.1	73.7	78.0	82.2	86.6	91.3	
	KIAS	228	228	228	228	228	228	230	233	
	FF/ENG	2350	2310	2280	2250	2240	2240	2260	2310	
140	%N1	60.1	63.1	67.3	71.6	76.1	80.4	84.7	89.3	
	KIAS	222	222	222	222	222	222	222	224	
	FF/ENG	2210	2170	2130	2110	2090	2080	2100	2140	
130	%N1	58.2	61.1	65.4	69.5	74.1	78.6	82.8	87.2	94.2
	KIAS	217	217	217	217	217	217	217	217	219
	FF/ENG	2080	2040	1990	1970	1940	1930	1940	1970	2120
120	%N1	56.2	59.0	63.4	67.4	72.1	76.4	80.7	85.1	91.6
	KIAS	211	211	211	211	211	211	211	211	211
	FF/ENG	1940	1910	1860	1830	1810	1790	1790	1800	1890
110	%N1	54.3	56.9	61.1	65.4	69.6	74.2	78.6	82.8	89.0
	KIAS	205	205	205	205	205	205	205	205	205
	FF/ENG	1810	1780	1730	1700	1670	1660	1640	1650	1710
100	%N1	52.3	54.8	58.7	63.3	67.2	72.0	76.3	80.6	86.5
	KIAS	199	199	199	199	199	199	199	199	199
	FF/ENG	1680	1650	1600	1570	1540	1520	1510	1510	1560

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 25

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF25	ONE REV	NO REV
MAX MANUAL	3200	110/-60	80	-130	440	50	-40	80	-70	250	80	170
MAX AUTO	5370	130/-130	150	-250	840	0	0	160	-160	600	0	0
AUTOBRAKE 4	5540	140/-140	160	-260	880	0	0	160	-160	630	0	0
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	-20	190	-190	710	0	0
AUTOBRAKE 2	7090	190/-190	220	-350	1190	50	-120	220	-210	630	110	110
AUTOBRAKE 1	7740	220/-220	250	-390	1360	170	-220	250	-230	580	480	620

Good Reported Braking Action

MAX MANUAL	5060	120/-120	140	-240	830	140	-120	140	-130	400	300	660
MAX AUTO	6180	150/-150	180	-290	980	20	0	180	-180	700	20	90
AUTOBRAKE 4	6370	160/-160	180	-300	1010	10	0	190	-190	720	10	60
AUTOBRAKE 3	7320	190/-190	220	-350	1190	0	-20	220	-220	820	0	0

Medium Reported Braking Action

MAX MANUAL	6940	190/-190	220	-370	1360	340	-270	210	-190	510	790	1910
MAX AUTO	6970	190/-180	220	-380	1370	300	-180	210	-200	660	700	1820
AUTOBRAKE 4	7050	190/-190	220	-380	1380	280	-160	220	-200	710	610	1730
AUTOBRAKE 3	7670	210/-200	230	-400	1450	180	-120	230	-230	820	410	1270

Poor Reported Braking Action

MAX MANUAL	8960	270/-260	300	-550	2100	760	-500	290	-260	590	1670	4460
MAX AUTO	8960	270/-260	300	-550	2100	760	-500	290	-260	590	1670	4470
AUTOBRAKE 4	8960	270/-260	300	-550	2100	770	-500	290	-260	600	1670	4470
AUTOBRAKE 3	9050	270/-260	300	-550	2110	700	-410	290	-270	760	1530	4320

Reference distance assumes sea level, standard day, no wind or slope, VREF25 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 460 ft.

Reference distance for auto braking is applicable for auto or manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABV SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABV VREF 30	ONE REV	NO REV
MAX MANUAL	3150	140/-70	80	-130	440	50	-40	80	-70	250	80	160
MAX AUTO	5220	210/-140	150	-240	830	0	0	150	-150	600	0	0
AUTOBRAKE 4	5380	220/-140	150	-250	870	0	0	160	-160	620	0	0
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	-10	190	-190	720	0	0
AUTOBRAKE 2	6930	280/-200	210	-340	1180	40	-110	210	-210	640	80	80
AUTOBRAKE 1	7590	300/-220	240	-390	1350	160	-210	240	-230	580	410	540

Good Reported Braking Action

MAX MANUAL	5000	180/-130	140	-240	830	140	-120	140	-130	400	280	620
MAX AUTO	6010	250/-160	170	-280	970	20	0	170	-170	690	20	90
AUTOBRAKE 4	6190	260/-170	180	-290	1000	10	0	180	-180	710	10	60
AUTOBRAKE 3	7110	300/-200	210	-340	1180	0	-10	210	-210	830	0	0

Medium Reported Braking Action

MAX MANUAL	6860	260/-190	210	-370	1370	350	-270	210	-190	510	740	1770
MAX AUTO	6860	280/-190	210	-380	1370	320	-190	210	-200	650	690	1720
AUTOBRAKE 4	6920	290/-200	220	-380	1380	300	-170	210	-200	690	620	1650
AUTOBRAKE 3	7480	320/-210	230	-400	1440	190	-110	230	-220	830	410	1220

Poor Reported Braking Action

MAX MANUAL	8870	360/-270	300	-550	2110	780	-510	290	-260	600	1580	4140
MAX AUTO	8870	360/-270	300	-550	2100	780	-510	290	-260	590	1580	4150
AUTOBRAKE 4	8870	360/-270	300	-550	2100	780	-510	290	-260	590	1580	4150
AUTOBRAKE 3	8920	380/-270	300	-550	2110	730	-420	290	-270	770	1480	4050

Reference distance assumes sea level, standard day, no wind or slope, VREF30 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 460 ft.

Reference distance for auto braking is applicable for both auto and manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance Dry Runway

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	4210	90/-90	100	-170/570	90/-80	110/-110	420	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	4130	160/-100	100	-170/570	90/-80	110/-110	440	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	4530	260/-110	130	-170/570	80/-70	130/-120	320	200	440
ANTI-SKID OFF (FLAPS 25)	VREF25	5920	160/-150	160	-290/1010	190/-160	160/-150	440	410	960
ANTI-SKID OFF (FLAPS 30)	VREF30	5770	230/-160	160	-290/1010	190/-160	160/-150	450	380	880
ENGINE FAILURE (FLAPS 20)	VREF20	3460	150/-80	90	-140/470	60/-50	90/-90	280	0	110
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	4140	110/-100	100	-160/530	70/-60	100/-100	380	140	300
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	3350	90/-80	80	-130/460	50/-50	80/-80	290	100	200
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	3300	130/-80	80	-130/460	60/-50	80/-80	300	90	190
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	3680	90/-90	90	-150/530	70/-60	90/-90	310	140	300
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	3620	140/-90	90	-150/530	70/-70	90/-90	330	130	280
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	4890	190/-110	130	-180/600	100/-90	130/-130	510	230	510
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	4570	180/-110	130	-180/610	110/-90	130/-120	420	260	570
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	5800	240/-150	170	-230/780	160/-140	170/-160	580	430	990

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Dry Runway**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
LE SLAT ASYM (FLAPS = 20)	VREF30+30	4140	170/-90	110	-150/520	70/-60	110/-110	310	160	340
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	4440	170/-100	120	-160/540	80/-70	120/-120	320	180	390
LE SLAT DISAGREE (FLAPS > 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	3940	180/-90	100	-150/500	60/-60	100/-100	280	140	290
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	4260	180/-100	110	-160/540	80/-70	120/-110	330	0	180
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	6240	150/-150	180	-300/1010	270/-220	180/-180	620	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	6090	250/-150	180	-300/1010	280/-230	180/-180	640	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	6220	220/-160	190	-250/860	160/-150	190/-180	380	530	1220
ANTI-SKID OFF (FLAPS 25)	VREF25	6660	190/-180	190	-350/1240	290/-230	190/-180	490	630	1530
ANTI-SKID OFF (FLAPS 30)	VREF30	6500	260/-180	190	-350/1240	290/-230	190/-180	490	590	1410
ENGINE FAILURE (FLAPS 20)	VREF20	4980	150/-130	140	-230/800	160/-140	140/-140	410	0	410
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	5600	170/-150	160	-250/840	170/-150	160/-150	510	430	1010
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	5760	240/-160	180	-250/860	190/-170	180/-170	510	530	1250
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	5130	200/-130	150	-230/790	150/-130	150/-140	380	380	860
LE SLAT ASYM (FLAPS = 20)	VREF30+30	5770	220/-150	170	-250/840	170/-150	170/-170	420	470	1080
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	6180	230/-160	190	-260/870	180/-160	190/-180	430	520	1190
LE SLAT DISAGREE (FLAPS > 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	5500	200/-140	160	-240/810	150/-140	160/-160	380	420	950
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	6160	230/-160	180	-270/900	210/-180	190/-180	470	0	590
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	9940	240/-230	310	-560/1950	1000/-670	320/-320	870	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	9650	370/-230	310	-550/1940	1000/-670	320/-320	870	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	8820	340/-250	300	-400/1400	410/-330	300/-270	520	1430	3670
ANTI-SKID OFF (FLAPS 25)	VREF25	8370	260/-250	260	-500/1870	640/-440	250/-230	560	1370	3680
ANTI-SKID OFF (FLAPS 30)	VREF30	8180	350/-250	260	-500/1870	650/-440	250/-230	560	1290	3390
ENGINE FAILURE (FLAPS 20)	VREF20	7250	240/-220	230	-390/1360	440/-340	230/-220	560	0	1250
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	7520	260/-230	240	-380/1340	400/-310	240/-220	630	1120	2890
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	7850	350/-240	270	-390/1370	430/-340	260/-240	620	1300	3370
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	7070	290/-210	230	-360/1280	350/-280	230/-210	490	980	2430
LE SLAT ASYM (FLAPS = 20)	VREF30+30	7900	320/-230	260	-380/1350	390/-320	260/-240	530	1170	2930
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	8430	340/-250	290	-400/1380	410/-330	280/-260	540	1340	3430
LE SLAT DISAGREE (FLAPS > 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	7550	300/-220	250	-370/1310	360/-290	250/-230	490	1050	2620
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	8860	360/-260	290	-430/1510	530/-420	290/-280	610	0	1680
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010	2540
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110	2810
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010	2540
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110	2810

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	16490	320/-200	570	-1120/4230	6080/-2020	600/-590	1090	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	15920	480/-200	550	-1100/4180	5960/-1970	580/-570	1080	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	11600	480/-370	430	-590/2140	900/-630	410/-370	640	3020	8970
ANTI-SKID OFF (FLAPS 25)	VREF25	10950	380/-360	370	-800/3310	3040/-940	350/-310	630	3540	14250
ANTI-SKID OFF (FLAPS 30)	VREF30	10760	480/-360	360	-800/3310	3040/-950	350/-310	630	3380	13380
ENGINE FAILURE (FLAPS 20)	VREF20	9970	360/-320	340	-600/2200	1100/-700	330/-310	690	0	3070
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	9560	360/-310	330	-550/2030	840/-570	320/-290	710	2280	6740
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	10000	460/-330	360	-560/2060	890/-610	350/-310	690	2540	7490
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	9120	400/-290	320	-530/1950	760/-520	310/-280	570	2010	5610
LE SLAT ASYM (FLAPS = 20)	VREF30+30	10100	430/-320	360	-560/2040	820/-570	350/-320	600	2310	6530
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	10880	460/-350	400	-570/2100	870/-610	380/-340	630	2700	7890
LE SLAT DISAGREE (FLAPS > 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860	5230
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860	5230
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	9680	410/-310	340	-540/1990	780/-540	330/-300	560	2120	5910
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	11960	500/-380	420	-660/2380	1260/-830	410/-390	730	0	3880
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860	5230
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160	6210
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290	6540
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860	5230
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160	6210
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290	6540

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (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
180	0	15.1	16.1	17.0	22.8	24.3	25.8	31.8	33.9	35.9	41.8	44.6	47.4	52.7	56.3	59.9			
	10	15.7	16.6	17.6	23.6	25.1	26.6	32.9	35.0	37.2	43.2	46.1	49.1	54.5	58.3	62.0			
	20	16.2	17.2	18.2	24.4	26.0	27.5	34.0	36.2	38.5	44.7	47.7	50.7	56.4	60.3	64.2			
	30	16.7	17.7	18.7	25.2	26.8	28.4	35.0	37.4	39.7	46.1	49.2	52.3	58.2	62.2	66.2			
	40	16.9	18.0	19.0	25.6	27.3	29.0	35.8	38.2	40.5	47.2	50.4	53.6	59.6	63.7	67.9			
160	0	13.7	14.5	15.3	20.6	21.9	23.2	28.5	30.4	32.3	37.5	40.0	42.5	47.2	50.4	53.6	57.6	61.6	65.6
	10	14.1	15.0	15.9	21.3	22.6	24.0	29.5	31.5	33.4	38.8	41.4	44.0	48.9	52.2	55.5	59.6	63.8	67.9
	20	14.6	15.5	16.4	22.0	23.4	24.8	30.5	32.5	34.5	40.1	42.8	45.4	50.5	54.0	57.4	61.7	65.9	70.2
	30	15.0	16.0	16.9	22.7	24.1	25.5	31.5	33.5	35.6	41.3	44.1	46.9	52.1	55.7	59.3	63.7	68.1	72.5
	40	15.3	16.2	17.2	23.1	24.5	26.0	32.1	34.2	36.3	42.3	45.1	48.0	53.4	57.0	60.7	65.2	69.8	74.3
140	0	12.2	13.0	13.7	18.3	19.4	20.6	25.3	26.9	28.6	33.1	35.3	37.4	41.5	44.3	47.1	50.6	54.0	57.5
	10	12.7	13.4	14.2	18.9	20.1	21.3	26.2	27.9	29.5	34.2	36.5	38.8	43.0	45.9	48.8	52.4	56.0	59.6
	20	13.1	13.9	14.6	19.6	20.8	22.0	27.0	28.8	30.5	35.4	37.7	40.1	44.4	47.4	50.5	54.1	57.8	61.6
	30	13.5	14.3	15.1	20.2	21.4	22.7	27.9	29.7	31.5	36.5	38.9	41.3	45.9	49.0	52.1	55.9	59.7	63.6
	40	13.7	14.5	15.3	20.5	21.8	23.1	28.4	30.3	32.1	37.3	39.8	42.2	46.9	50.1	53.3	57.2	61.2	65.1
120	0	10.8	11.5	12.1	16.0	17.0	18.0	22.0	23.4	24.8	28.6	30.5	32.3	35.7	38.1	40.5	43.3	46.2	49.1
	10	11.2	11.9	12.5	16.6	17.6	18.6	22.8	24.2	25.7	29.6	31.5	33.4	37.0	39.4	41.9	44.8	47.8	50.9
	20	11.6	12.2	12.9	17.1	18.2	19.3	23.5	25.0	26.5	30.6	32.6	34.6	38.2	40.7	43.3	46.3	49.4	52.6
	30	11.9	12.6	13.3	17.7	18.8	19.9	24.2	25.8	27.3	31.5	33.6	35.7	39.4	42.0	44.7	47.8	51.0	54.3
	40	12.1	12.8	13.5	18.0	19.1	20.2	24.7	26.3	27.9	32.2	34.3	36.4	40.3	43.0	45.7	48.9	52.2	55.6
100	0	9.4	10.0	10.5	13.8	14.6	15.5	18.7	19.8	21.0	24.0	25.5	27.1	29.7	31.6	33.6	35.7	38.0	40.4
	10	9.8	10.3	10.9	14.3	15.1	16.0	19.3	20.5	21.7	24.8	26.4	28.0	30.7	32.7	34.7	36.9	39.4	41.8
	20	10.1	10.7	11.2	14.7	15.6	16.5	20.0	21.2	22.5	25.7	27.3	29.0	31.7	33.8	35.9	38.2	40.7	43.2
	30	10.4	11.0	11.6	15.2	16.1	17.0	20.6	21.9	23.2	26.5	28.2	29.9	32.7	34.9	37.0	39.4	42.0	44.6
	40	10.5	11.1	11.7	15.4	16.4	17.3	20.9	22.3	23.6	27.0	28.7	30.5	33.4	35.6	37.8	40.2	42.9	45.6

*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, altitude, and OAT effects.

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	RTO MAX MAN	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0
	MAX MAN	1.0	6.1	11.2	16.1	21.0	25.8	30.5	35.2	39.8	44.5	49.1	53.8
	MAX AUTO	1.7	6.1	10.4	14.7	18.9	23.1	27.3	31.5	35.8	40.0	44.3	48.7
	AUTOBRAKE 4	1.9	6.0	10.1	14.1	18.1	22.0	26.0	29.9	33.8	37.8	41.8	45.8
	AUTOBRAKE 3	1.8	5.7	9.5	13.2	17.0	20.7	24.3	28.0	31.6	35.3	39.0	42.8
	AUTOBRAKE 2	1.7	5.4	9.0	12.5	15.9	19.3	22.7	26.1	29.4	32.8	36.2	39.7
	AUTOBRAKE 1	1.7	5.0	8.2	11.3	14.4	17.4	20.3	23.3	26.2	29.1	32.1	35.0

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Two Engines Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	MAX MAN	0.0	5.0	9.9	14.6	19.2	23.8	28.2	32.6	37.0	41.3	45.6	49.9
	MAX AUTO	0.2	3.7	7.3	10.8	14.3	17.9	21.5	25.1	28.7	32.4	36.2	40.0
	AUTOBRAKE 4	0.0	2.9	6.0	9.0	12.1	15.1	18.2	21.3	24.5	27.7	30.9	34.2
	AUTOBRAKE 3	0.0	1.8	4.3	6.9	9.5	12.1	14.8	17.4	20.1	23.9	25.7	28.6
	AUTOBRAKE 2	0.0	0.7	2.8	4.8	6.9	8.9	11.0	13.1	15.3	17.6	19.9	22.2
	AUTOBRAKE 1	0.0	0.4	1.8	3.2	4.6	6.0	7.5	9.0	10.5	12.1	13.8	15.5

Cooling Time (Minutes)

Category "C" and "D" Brakes

		ADJUSTED BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
		14 & BELOW	15	16	18	20	24	28	34	35 TO 42	43 & ABOVE		
		BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON EICAS											
		UP TO 1	1	1	2	2	3	4	5	5 TO 6	7 & ABOVE		
INFLIGHT	NO SPECIAL	PROCEDURE REQUIRED	1	1	2	2	3	4	6	CAUTION	FUSE PLUG MELT ZONE		
GEAR DOWN			11	15	19	24	34	44	59				
GROUND													

Observe maximum quick turnaround limit.

Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.

Add 1.0 million foot pounds per brake for each taxi mile.

For one brake deactivated, increase brake energy by 15 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 6 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 10 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.



Performance Inflight

Engine Inoperative

Chapter PI

Section 33

ENGINE INOP

Initial Max Continuous %N1

Based on .80M, packs on or off and APU on

TAT (°C)	PRESSURE ALTITUDE (1000 FT)							
	29	31	33	35	37	39	41	43
20	103.8	103.4	102.5					
15	104.4	104.0	103.3	102.3	101.1	100.8	100.8	100.8
10	105.2	104.6	104.0	103.2	101.9	101.4	101.4	101.4
5	106.1	105.5	104.7	103.9	102.6	102.1	102.2	102.2
0	107.1	106.4	105.6	104.7	103.3	102.9	102.9	102.9
-5	106.9	107.5	106.6	105.7	104.3	103.9	103.9	103.9
-10	106.0	107.1	107.7	106.7	105.3	104.9	104.9	104.9
-15	105.1	106.2	107.1	107.8	106.5	106.2	106.2	106.2
-20	104.2	105.3	106.2	106.9	106.6	106.4	106.4	106.4
-25	103.2	104.3	105.3	105.8	105.8	105.6	105.6	105.6
-30	102.3	103.3	104.3	104.7	104.7	104.7	104.7	104.7
-35	101.3	102.4	103.3	103.6	103.6	103.6	103.6	103.6
-40	100.3	101.3	102.3	102.6	102.6	102.6	102.6	102.6

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

37000 FT to 27000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

37000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.63	102.6	103.6	104.7	105.8	106.9	105.8	104.8	104.1	103.3	101.8	98.8	95.7	
220	.69	102.6	103.6	104.7	105.8	106.9	105.9	104.8	104.0	103.3	102.4	100.4	97.5	
240	.74	102.6	103.6	104.7	105.8	106.9	106.1	105.0	104.0	103.3	102.5	101.7	99.4	
260	.80	102.6	103.6	104.7	105.8	106.6	106.5	105.3	104.3	103.3	102.6	101.9	101.1	
35000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.60	102.6	103.6	104.7	105.8	106.9	107.2	106.2	105.5	104.7	103.2	100.2	97.1	
220	.66	102.6	103.6	104.7	105.8	106.9	107.3	106.2	105.4	104.7	103.8	101.8	98.8	
240	.71	102.6	103.6	104.7	105.8	106.9	107.5	106.4	105.3	104.6	104.0	102.9	100.5	
260	.77	102.6	103.6	104.7	105.8	106.9	107.7	106.6	105.6	104.5	103.9	103.2	102.1	
33000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.58	102.6	103.6	104.7	105.8	106.9	107.9	107.2	106.5	105.8	104.9	102.6	99.6	
220	.63	102.6	103.6	104.7	105.8	106.9	107.9	107.3	106.3	105.7	105.0	104.1	101.2	
240	.68	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.4	105.5	104.9	104.1	102.7	
260	.74	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.5	105.5	104.7	104.1	103.3	
31000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.55	102.6	103.6	104.7	105.8	106.8	107.9	108.1	107.2	106.6	106.0	105.0	102.0	
220	.61	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.6	106.0	105.3	103.5	
240	.66	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.4	105.7	105.1	104.4	
260	.71	102.6	103.6	104.7	105.8	106.9	107.9	108.3	107.3	106.4	105.5	104.9	104.3	
29000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.5	106.8	106.1	105.5	103.6	100.7
220	.58	102.6	103.6	104.7	105.8	106.9	107.9	108.5	107.7	106.7	106.1	105.5	104.9	102.1
240	.63	102.6	103.6	104.7	105.8	106.9	107.9	108.7	107.7	106.8	106.0	105.4	104.8	103.5
260	.68	102.6	103.6	104.7	105.8	106.9	107.9	108.8	107.7	106.8	105.9	105.3	104.7	104.0
27000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.51	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.1	101.4
220	.56	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.4	105.6	104.9	104.2	102.7
240	.60	102.6	103.6	104.7	105.8	106.9	107.9	108.6	107.6	106.7	105.7	105.0	104.3	103.6
260	.65	102.2	103.2	104.2	105.1	106.1	107.0	107.9	107.8	106.8	105.9	105.0	104.3	103.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	27	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.8	-0.9	-1.0	-1.1	-1.2	-1.4
ENGINE & WING ANTI-ICE ON	-1.7	-1.9	-2.1	-2.3	-2.5	-2.9

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

25000 FT to 16000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

25000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.49	102.6	103.6	104.7	105.8	106.8	107.8	107.8	106.9	105.9	104.9	104.1	103.3	101.8	99.0	
220	.53	102.3	103.3	104.3	105.3	106.2	107.1	107.9	107.1	106.1	105.0	104.2	103.4	102.7	100.3	
240	.58	101.6	102.6	103.6	104.5	105.5	106.4	107.2	107.2	106.3	105.3	104.3	103.6	102.8	101.5	
260	.63	100.8	101.8	102.8	103.8	104.7	105.6	106.5	107.3	106.6	105.6	104.6	103.8	103.0	102.2	
24000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.6	106.6	105.6	104.9	104.1	103.2	100.5	
220	.52	102.3	103.3	104.3	105.3	106.2	107.2	108.0	107.7	106.8	105.8	104.9	104.1	103.4	101.6	
240	.57	101.6	102.6	103.6	104.5	105.5	106.4	107.3	107.8	107.0	106.0	105.0	104.2	103.5	102.7	
260	.61	100.8	101.8	102.8	103.7	104.7	105.6	106.5	107.4	107.1	106.2	105.2	104.4	103.6	102.8	
22000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	108.9	107.9	106.9	106.1	105.2	103.7	
220	.50	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	109.0	108.0	107.0	106.1	105.3	104.4	
240	.55	102.6	103.6	104.7	105.7	106.6	107.6	108.5	109.4	109.2	108.2	107.2	106.3	105.4	104.6	
260	.59	102.0	103.0	104.0	105.0	105.9	106.9	107.8	108.7	109.3	108.5	107.5	106.5	105.6	104.8	
20000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.44	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.8	108.8	107.9	106.9	106.1	104.0
220	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.9	108.9	108.0	107.0	106.1	104.8
240	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	110.1	109.1	108.1	107.2	106.2	105.4
260	.57	102.4	103.4	104.4	105.4	106.4	107.4	108.3	109.3	110.2	110.1	109.3	108.3	107.4	106.4	105.6
18000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.42	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.4	109.4	108.4	107.5	106.7	105.6
220	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.3	109.3	108.3	107.4	106.6	105.7
240	.51	102.3	103.3	104.3	105.3	106.3	107.2	108.2	109.1	110.1	110.2	109.4	108.4	107.4	106.6	105.7
260	.55	101.6	102.6	103.6	104.6	105.6	106.6	107.5	108.5	109.4	110.3	109.5	108.6	107.6	106.7	105.8
16000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.41	100.9	102.0	103.0	104.1	105.1	106.2	107.2	108.2	109.1	110.1	109.5	108.6	107.7	106.9	106.1
220	.45	100.6	101.7	102.7	103.7	104.8	105.8	106.8	107.8	108.8	109.8	109.4	108.5	107.6	106.8	105.9
240	.49	100.3	101.3	102.3	103.4	104.4	105.4	106.4	107.4	108.4	109.4	109.4	108.5	107.5	106.7	105.9
260	.53	99.9	101.0	102.0	103.0	104.0	105.0	106.1	107.1	108.0	109.0	109.5	108.6	107.7	106.8	106.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	16	18	20	22	24	25
ENGINE ANTI-ICE ON	-0.4	-0.4	-0.5	-0.6	-0.7	-0.7
ENGINE & WING ANTI-ICE ON	-1.1	-1.1	-1.2	-1.4	-1.5	-1.5

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

14000 FT to 5000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

14000 FT PRESS ALT									TAT (°C)								
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.39	101.1	102.1	103.1	104.2	105.2	106.3	107.3	108.3	109.3	110.2	109.4	108.5	107.6	106.8	106.1	
220	.43	100.8	101.8	102.8	103.9	104.8	105.8	106.8	107.7	108.6	109.6	109.4	108.4	107.6	106.7	106.0	
240	.47	100.2	101.2	102.2	103.2	104.1	105.1	106.0	107.0	107.9	108.9	109.4	108.4	107.5	106.6	105.9	
260	.51	99.5	100.5	101.5	102.5	103.4	104.4	105.3	106.2	107.2	108.1	109.1	108.4	107.5	106.7	105.9	
12000 FT PRESS ALT									TAT (°C)								
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.38	100.0	101.0	101.9	102.9	103.9	104.8	105.8	106.7	107.7	108.6	109.2	108.2	107.4	106.6	105.8	
220	.41	99.4	100.4	101.4	102.4	103.4	104.3	105.3	106.2	107.1	108.1	109.0	108.3	107.4	106.6	105.8	
240	.45	98.9	99.9	100.9	101.9	102.8	103.8	104.7	105.6	106.6	107.5	108.4	108.4	107.5	106.7	105.9	
260	.49	98.4	99.4	100.3	101.3	102.3	103.2	104.1	105.1	106.0	106.9	107.8	108.5	107.6	106.8	105.9	
10000 FT PRESS ALT									TAT (°C)								
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.36	98.2	99.2	100.2	101.2	102.1	103.1	104.0	104.9	105.8	106.8	107.7	107.8	107.0	106.2	105.4	
220	.40	97.7	98.7	99.7	100.7	101.6	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4	
240	.43	97.4	98.4	99.3	100.3	101.3	102.2	103.1	104.1	105.0	105.9	106.8	107.7	107.2	106.4	105.6	
260	.47	97.0	98.0	99.0	99.9	100.9	101.8	102.7	103.7	104.6	105.5	106.4	107.3	107.4	106.6	105.8	
5000 FT PRESS ALT									TAT (°C)								
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.33	95.5	96.5	97.5	98.4	99.4	100.3	101.2	102.1	103.1	104.0	104.8	105.7	106.6	106.4	105.7	
220	.36	95.1	96.1	97.1	98.0	99.0	99.9	100.8	101.7	102.7	103.6	104.4	105.3	106.2	106.4	105.7	
240	.40	94.7	95.7	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	104.0	104.9	105.8	106.4	105.7	
260	.43	94.4	95.4	96.4	97.3	98.3	99.2	100.1	101.0	101.9	102.8	103.7	104.6	105.5	106.3	105.9	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	5	10	12	14
ENGINE ANTI-ICE ON	-0.6	-0.5	-0.5	-0.6
ENGINE & WING ANTI-ICE ON	-1.2	-1.1	-1.2	-1.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	183	276	18400	17400	15600
180	174	269	20000	19100	17700
170	165	262	21200	20600	19700
160	155	254	22600	21900	21000
150	145	247	24000	23200	22300
140	135	238	25500	24700	23700
130	126	230	27200	26700	25500
120	116	221	29100	28900	28100
110	106	212	30900	30900	30500
100	97	202	32900	32800	32600

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
274	255	239	224	211	200	190	180	172	164	157
547	510	477	448	423	400	380	361	344	329	315
819	763	715	672	634	600	570	542	517	494	473
1090	1016	952	895	845	800	760	723	690	660	632
1361	1269	1189	1119	1056	1000	950	904	863	825	790
1632	1522	1426	1342	1267	1200	1140	1085	1036	990	949
1902	1775	1664	1565	1478	1400	1330	1266	1208	1156	1107
2174	2029	1901	1789	1689	1600	1520	1447	1381	1321	1266
2447	2283	2139	2013	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)										
	100	110	120	130	140	150	160	170	180	190	
200	1.5	1.7	1.8	1.9	2.1	2.1	2.3	2.4	2.5	2.6	0:33
400	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.4	5.8	6.0	1:05
600	5.2	5.7	6.1	6.6	7.0	7.5	7.9	8.3	8.8	9.3	1:36
800	6.9	7.5	8.1	8.8	9.4	10.0	10.6	11.2	11.8	12.4	2:08
1000	8.6	9.4	10.1	10.9	11.7	12.4	13.2	13.9	14.7	15.5	2:39
1200	10.2	11.2	12.1	13.1	14.0	14.9	15.8	16.7	17.6	18.5	3:10
1400	11.9	13.0	14.0	15.2	16.3	17.3	18.4	19.4	20.5	21.5	3:42
1600	13.5	14.8	16.0	17.2	18.5	19.6	20.9	22.0	23.3	24.5	4:14
1800	15.1	16.5	17.8	19.2	20.6	22.0	23.3	24.6	26.0	27.4	4:45

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb and APU on

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	15400	13000	10200
185	16300	14200	11400
180	17200	15300	12700
175	18200	16500	13900
170	19100	17600	15200
165	20000	18700	16400
160	20700	19700	17800
155	21400	20500	19100
150	22100	21200	20200
145	22800	21900	20900
140	23600	22600	21600
135	24300	23400	22300
130	25100	24100	23000
125	26100	24900	23700
120	27200	26200	24500
115	28300	27600	25700
110	29400	29000	27400
105	30500	30300	29100
100	31400	31300	30500

With engine anti-ice on, decrease altitude capability by 1800 ft.

With engine and wing anti-ice on, decrease altitude capability by 3800 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	14	18	21	23	25	27	29	31
190	%N1	98.8	102.4							
	MACH	.583	.616							
	KIAS	324	318							
	FF/ENG	6358	6418							
180	%N1	97.2	100.7	105.0						
	MACH	.572	.605	.641						
	KIAS	317	312	307						
	FF/ENG	6000	6034	6176						
170	%N1	95.6	99.0	102.9						
	MACH	.559	.593	.628						
	KIAS	310	306	300						
	FF/ENG	5646	5675	5766						
160	%N1	93.9	97.2	100.8	104.3					
	MACH	.545	.580	.614	.643					
	KIAS	303	299	294	290					
	FF/ENG	5286	5313	5367	5482					
150	%N1	92.1	95.3	98.8	101.9	104.6				
	MACH	.532	.567	.601	.628	.647				
	KIAS	295	292	287	283	281				
	FF/ENG	4945	4965	4991	5067	5157				
140	%N1	90.3	93.4	96.8	99.6	101.8				
	MACH	.518	.551	.587	.612	.632				
	KIAS	287	283	280	276	273				
	FF/ENG	4609	4607	4633	4669	4732				
130	%N1	88.4	91.4	94.7	97.3	99.3	101.6			
	MACH	.503	.535	.571	.597	.615	.635			
	KIAS	278	275	272	268	266	263			
	FF/ENG	4279	4262	4280	4301	4328	4393			
120	%N1	86.3	89.3	92.4	95.0	96.8	98.8	101.3		
	MACH	.487	.518	.553	.580	.598	.616	.636		
	KIAS	269	266	263	261	258	255	253		
	FF/ENG	3955	3927	3928	3944	3959	3986	4051		
110	%N1	84.0	87.1	90.1	92.6	94.3	96.2	98.2	100.7	
	MACH	.470	.501	.534	.562	.580	.598	.617	.637	
	KIAS	260	257	254	252	250	248	245	243	
	FF/ENG	3634	3599	3585	3597	3606	3617	3642	3703	
100	%N1	81.5	84.6	87.6	90.0	91.7	93.4	95.3	97.3	99.9
	MACH	.450	.482	.514	.540	.559	.578	.597	.615	.636
	KIAS	249	247	244	242	241	239	237	234	232
	FF/ENG	3300	3279	3253	3247	3260	3267	3277	3297	3350

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	190	181	173	166	159
575	529	489	455	426	400	381	363	347	332	319
864	796	735	684	640	600	571	544	520	498	478
1155	1063	982	913	853	800	761	726	693	664	637
1446	1331	1228	1142	1067	1000	952	907	866	829	796
1738	1598	1475	1370	1281	1200	1142	1088	1039	995	955
2032	1868	1723	1600	1495	1400	1332	1269	1212	1160	1113
2327	2138	1971	1830	1709	1600	1522	1451	1385	1325	1271
2623	2409	2219	2060	1923	1800	1712	1631	1557	1489	1429

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:41	2.3	0:40	2.0	0:38	1.9	0:37	1.7	0:36
400	5.4	1:17	4.9	1:15	4.6	1:12	4.3	1:09	4.2	1:07
600	8.1	1:54	7.6	1:50	7.1	1:45	6.8	1:41	6.6	1:37
800	10.8	2:32	10.2	2:25	9.6	2:19	9.2	2:14	8.9	2:08
1000	13.5	3:09	12.7	3:01	12.1	2:53	11.5	2:46	11.3	2:39
1200	16.2	3:47	15.3	3:37	14.5	3:27	13.9	3:19	13.6	3:11
1400	18.8	4:26	17.8	4:14	16.9	4:02	16.2	3:52	15.8	3:42
1600	21.4	5:04	20.2	4:50	19.3	4:36	18.5	4:25	18.1	4:14
1800	24.0	5:43	22.7	5:27	21.6	5:12	20.7	4:58	20.3	4:45

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.1	0.0	0.2	0.4
4	-0.6	-0.3	0.0	0.5	0.9
6	-1.0	-0.5	0.0	0.7	1.4
8	-1.3	-0.6	0.0	1.0	2.0
10	-1.6	-0.8	0.0	1.3	2.5
12	-2.0	-1.0	0.0	1.6	3.0
14	-2.3	-1.2	0.0	1.8	3.6
16	-2.7	-1.3	0.0	2.1	4.1
18	-3.0	-1.5	0.0	2.4	4.7
20	-3.4	-1.7	0.0	2.6	5.2
22	-3.7	-1.8	0.0	2.9	5.7
24	-4.1	-2.0	0.0	3.1	6.3
26	-4.4	-2.2	0.0	3.4	6.8
28	-4.8	-2.3	0.0	3.6	7.4
30	-5.1	-2.5	0.0	3.8	7.9

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	87.3	90.3	94.9	100.2			
	KIAS	259	259	259	259			
	FF/ENG	5450	5490	5600	5810			
180	%N1	85.5	88.7	93.1	98.2	105.4		
	KIAS	251	251	251	251	251		
	FF/ENG	5140	5170	5250	5410	5770		
170	%N1	83.8	86.9	91.3	96.2	102.4		
	KIAS	244	244	244	244	244		
	FF/ENG	4840	4850	4910	5040	5310		
160	%N1	82.0	85.0	89.4	94.2	99.9		
	KIAS	236	236	236	236	236		
	FF/ENG	4530	4540	4580	4680	4890		
150	%N1	79.8	83.0	87.5	92.1	97.5		
	KIAS	228	228	228	228	228		
	FF/ENG	4230	4240	4260	4330	4490		
140	%N1	77.6	81.0	85.4	90.0	95.0	101.7	
	KIAS	222	222	222	222	222	222	
	FF/ENG	3940	3940	3950	4000	4120	4370	
130	%N1	75.5	78.6	83.2	87.7	92.5	98.4	
	KIAS	217	217	217	217	217	217	
	FF/ENG	3660	3650	3660	3690	3770	3950	
120	%N1	73.2	76.2	81.0	85.5	90.1	95.4	
	KIAS	211	211	211	211	211	211	
	FF/ENG	3380	3370	3370	3390	3440	3560	
110	%N1	70.6	73.9	78.4	83.0	87.6	92.6	99.0
	KIAS	205	205	205	205	205	205	205
	FF/ENG	3120	3100	3090	3100	3140	3220	3410
100	%N1	67.9	71.2	75.7	80.5	85.0	89.7	95.3
	KIAS	199	199	199	199	199	199	199
	FF/ENG	2850	2840	2830	2820	2840	2890	3020

This table includes 5% additional fuel for holding in a racetrack pattern.



Performance Inflight

Gear Down

Chapter PI

Section 34

GEAR DOWN

200 KIAS Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
55	96.7	97.4	97.0	97.0	96.6	96.7	97.0	97.1	96.1	95.2	96.3	98.2	99.9
50	97.2	98.3	98.1	98.1	97.8	97.9	98.3	98.3	97.3	96.2	96.2	97.5	99.2
45	97.9	98.8	99.1	99.1	98.9	99.0	99.5	99.5	98.5	97.4	97.4	98.1	98.8
40	98.5	99.3	99.9	100.1	99.9	100.2	100.6	100.7	99.6	98.6	98.5	99.3	99.9
35	99.1	100.0	100.4	100.7	100.9	101.2	101.7	101.8	100.7	99.7	99.6	100.4	101.0
30	99.6	100.6	101.1	101.2	101.4	102.1	102.8	102.9	101.8	100.8	100.7	101.4	102.1
25	98.7	101.4	101.7	101.9	102.0	102.6	103.5	103.9	102.9	101.8	101.7	102.5	103.1
20	97.9	101.9	102.5	102.6	102.7	103.3	104.1	104.6	103.7	102.8	102.7	103.4	104.1
15	97.1	101.0	103.5	103.4	103.4	104.0	104.9	105.3	104.5	103.6	103.6	104.4	105.0
10	96.3	100.2	103.6	104.4	104.2	104.8	105.7	106.2	105.3	104.5	104.4	105.2	105.9
5	95.5	99.3	102.7	103.9	104.9	105.6	106.5	107.0	106.2	105.4	105.3	105.9	106.6
0	94.7	98.4	101.8	103.0	104.0	105.6	107.3	107.8	107.2	106.3	106.2	106.7	107.2
-5	93.8	97.5	100.9	102.1	103.0	104.7	106.7	108.3	108.2	107.6	107.1	107.5	108.0
-10	93.0	96.6	100.0	101.2	102.2	103.7	105.8	107.3	108.2	108.5	108.5	108.5	108.5
-15	92.1	95.7	99.1	100.3	101.2	102.8	104.8	106.4	107.3	107.5	107.5	107.5	107.5
-20	91.3	94.8	98.2	99.3	100.3	102.0	103.9	105.5	106.3	106.5	106.5	106.5	106.5
-25	90.4	93.9	97.3	98.4	99.4	101.0	103.0	104.6	105.4	105.4	105.4	105.4	105.4
-30	89.5	93.0	96.4	97.5	98.5	100.0	102.0	103.7	104.4	104.4	104.4	104.4	104.4
-35	88.6	92.0	95.4	96.5	97.5	99.0	101.1	102.7	103.3	103.3	103.3	103.3	103.3
-40	87.7	91.1	94.5	95.6	96.5	98.1	100.1	101.8	102.2	102.2	102.2	102.2	102.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.7	-0.8	-0.8	-0.9	-1.0	-1.0	-1.1
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.2	-1.3	-1.3	-1.4	-1.5	-1.5	-1.7

GEAR DOWN

Long Range Cruise Altitude Capability

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	19800	18200	14800
185	20700	19300	17400
180	21700	20300	18600
175	22700	21200	19800
170	23700	22200	20800
165	24800	23200	21700
160	25800	24100	22700
155	26800	25200	23700
150	27600	26400	24800
145	28500	27700	26100
140	29300	29000	27500
135	30000	30000	29000
130	30700	30700	30100
125	31400	31400	30900
120	32200	32100	31700
115	32900	32900	32500
110	33700	33600	33300
105	34500	34400	34200
100	35300	35200	35000
95	36100	36100	35800
90	36900	36900	36600

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		10	14	18	21	23	25	27	29	31	33	35
190	%N1	91.6	95.1	99.1								
	MACH	.472	.508	.546								
	KIAS	261	261	260								
	FF/ENG	4765	4811	4928								
180	%N1	90.0	93.4	97.3	100.6							
	MACH	.461	.495	.534	.563							
	KIAS	255	254	254	253							
	FF/ENG	4490	4522	4612	4715							
170	%N1	88.4	91.7	95.4	98.5	101.0						
	MACH	.449	.483	.520	.550	.571						
	KIAS	248	248	247	246	246						
	FF/ENG	4225	4241	4295	4386	4471						
160	%N1	86.8	89.9	93.5	96.5	98.6	101.4					
	MACH	.437	.469	.506	.536	.555	.577					
	KIAS	241	240	240	240	239	238					
	FF/ENG	3963	3961	4000	4072	4126	4222					
150	%N1	84.8	88.1	91.5	94.3	96.4	98.7	101.6				
	MACH	.424	.456	.491	.520	.540	.561	.583				
	KIAS	234	233	233	232	232	231	231				
	FF/ENG	3703	3693	3717	3758	3812	3868	3966				
140	%N1	82.8	86.2	89.5	92.2	94.2	96.3	98.7	101.9			
	MACH	.411	.442	.476	.504	.524	.544	.565	.587			
	KIAS	227	226	225	225	225	224	224	223			
	FF/ENG	3443	3434	3440	3465	3502	3549	3611	3704			
130	%N1	81.0	84.1	87.3	90.0	91.8	93.9	96.0	98.6	102.0		
	MACH	.398	.427	.460	.487	.506	.527	.548	.570	.591		
	KIAS	220	219	218	217	217	217	216	216	214		
	FF/ENG	3205	3176	3170	3187	3205	3244	3286	3353	3436		
120	%N1	78.7	81.8	85.2	87.7	89.5	91.3	93.4	95.6	98.3	101.8	
	MACH	.385	.411	.443	.469	.488	.508	.529	.550	.572	.593	
	KIAS	212	210	210	209	209	209	209	208	207	206	
	FF/ENG	2974	2918	2912	2913	2927	2944	2981	3022	3090	3165	
110	%N1	76.1	79.6	82.8	85.3	87.0	88.8	90.7	92.7	95.0	97.7	101.5
	MACH	.369	.396	.426	.451	.469	.488	.508	.529	.551	.574	.595
	KIAS	203	203	201	201	200	200	200	200	199	199	197
	FF/ENG	2726	2685	2658	2653	2654	2668	2682	2717	2759	2822	2895
100	%N1	73.5	76.9	80.1	82.7	84.4	86.0	87.9	89.8	91.9	94.1	96.9
	MACH	.353	.380	.408	.432	.449	.467	.487	.507	.528	.550	.574
	KIAS	195	194	192	192	192	191	191	191	191	190	190
	FF/ENG	2489	2454	2407	2400	2397	2397	2408	2421	2454	2495	2553

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	288	259	236	217	200	189	179	170	161	154
650	581	521	474	434	400	378	357	339	323	308
981	875	784	711	652	600	567	536	509	484	462
1317	1173	1049	951	870	800	755	714	677	644	615
1656	1472	1315	1190	1089	1000	944	893	846	805	768
2000	1775	1583	1431	1308	1200	1132	1070	1014	964	920
2349	2082	1854	1674	1527	1400	1320	1248	1182	1124	1072
2703	2391	2125	1916	1747	1600	1508	1425	1349	1282	1223
3062	2705	2400	2161	1968	1800	1696	1602	1517	1441	1374
3427	3021	2675	2406	2188	2000	1884	1779	1684	1599	1524

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		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	4.8	0:49	4.4	0:47	4.0	0:45	3.7	0:44	3.3	0:41
400	9.9	1:36	9.2	1:32	8.6	1:27	8.0	1:23	7.5	1:17
600	14.9	2:24	13.9	2:17	13.0	2:09	12.2	2:03	11.5	1:53
800	19.8	3:12	18.5	3:02	17.4	2:52	16.4	2:43	15.4	2:30
1000	24.6	4:02	23.0	3:49	21.6	3:36	20.4	3:24	19.2	3:07
1200	29.3	4:52	27.4	4:36	25.8	4:20	24.4	4:05	23.0	3:45
1400	33.9	5:43	31.8	5:24	29.9	5:06	28.3	4:48	26.6	4:23
1600	38.5	6:36	36.0	6:13	33.9	5:51	32.1	5:31	30.1	5:02
1800	42.9	7:29	40.2	7:03	37.8	6:38	35.8	6:14	33.6	5:41
2000	47.2	8:24	44.2	7:54	41.6	7:26	39.4	6:58	37.0	6:21

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	0.6	1.3
10	-1.5	-0.8	0.0	1.3	2.7
15	-2.4	-1.2	0.0	1.9	4.0
20	-3.2	-1.6	0.0	2.5	5.3
25	-4.0	-2.0	0.0	3.1	6.6
30	-4.8	-2.4	0.0	3.7	7.8
35	-5.6	-2.8	0.0	4.3	8.9
40	-6.4	-3.2	0.0	4.8	10.1
45	-7.2	-3.6	0.0	5.3	11.1
50	-8.0	-4.0	0.0	5.8	12.1
55	-8.9	-4.5	0.0	6.3	13.1
60	-9.7	-4.9	0.0	6.7	14.0

Descent at VREF30 + 70

PRESSURE ALTITUDE (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	16	26	36	40	44	48	52	56	60	64	68	71	74
TIME (MINUTES)	7	10	12	13	14	15	16	16	17	18	19	19	20

GEAR DOWN

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	83.1	85.9	90.1	94.6	100.0		
	KIAS	249	249	249	249	249		
	FF/ENG	4710	4690	4710	4790	4980		
180	%N1	81.2	84.2	88.4	92.8	97.9		
	KIAS	241	241	241	241	241		
	FF/ENG	4440	4410	4420	4470	4610		
170	%N1	79.4	82.5	86.7	91.0	95.9	102.5	
	KIAS	234	234	234	234	234	234	
	FF/ENG	4180	4160	4150	4180	4280	4550	
160	%N1	77.4	80.5	84.7	89.0	93.7	99.6	
	KIAS	226	226	226	226	226	226	
	FF/ENG	3910	3890	3860	3880	3950	4140	
150	%N1	75.4	78.3	82.7	87.0	91.5	96.9	
	KIAS	218	218	218	218	218	218	
	FF/ENG	3650	3620	3590	3590	3640	3770	
140	%N1	73.6	76.4	80.9	85.2	89.5	94.6	102.0
	KIAS	212	212	212	212	212	212	212
	FF/ENG	3420	3390	3360	3350	3380	3470	3710
130	%N1	71.5	74.6	79.0	83.2	87.6	92.4	98.6
	KIAS	207	207	207	207	207	207	207
	FF/ENG	3210	3180	3150	3120	3140	3210	3380
120	%N1	69.4	72.6	76.8	81.2	85.6	90.2	95.7
	KIAS	201	201	201	201	201	201	201
	FF/ENG	3000	2970	2930	2900	2910	2950	3060
110	%N1	67.3	70.3	74.7	79.2	83.6	88.0	93.1
	KIAS	195	195	195	195	195	195	195
	FF/ENG	2800	2760	2730	2690	2680	2710	2790
100	%N1	65.1	68.0	72.5	76.8	81.2	85.7	90.5
	KIAS	189	189	189	189	189	189	189
	FF/ENG	2590	2560	2520	2490	2470	2480	2520

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Gear Down, Engine Inop

Chapter PI

Section 35

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Initial Max Continuous %N1

29000 FT to 10000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

29000 FT PRESS ALT								TAT (°C)					
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.7	106.8	106.1	105.5	104.9	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.8	106.1	105.5	102.8	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.5	106.8	106.2	103.6	100.5	
27000 FT PRESS ALT								TAT (°C)					
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.6	106.7	105.7	105.0	104.3	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.0	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.0	107.0	106.3	105.6	104.7	101.8	
25000 FT PRESS ALT								TAT (°C)					
MACH	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
0.6	102.3	103.2	104.2	105.2	106.1	106.9	107.3	106.4	105.4	104.4	103.6	102.9	
0.5	103.6	104.7	105.8	106.8	107.6	107.8	106.9	105.9	104.9	104.1	103.4	102.1	
0.4	103.6	104.7	105.8	106.8	107.9	107.7	106.7	105.7	104.9	104.1	102.8	100.0	
23000 FT PRESS ALT								TAT (°C)					
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.2	104.2	105.2	106.1	107.0	107.9	108.0	107.2	106.2	105.3	104.5	103.7	
0.5	104.7	105.8	106.8	107.8	108.7	108.6	107.7	106.7	105.8	105.0	104.2	102.7	
0.4	104.7	105.8	106.8	107.9	108.9	108.6	107.6	106.6	105.8	105.0	103.4	100.8	
21000 FT PRESS ALT								TAT (°C)					
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.9	104.8	105.8	106.8	107.7	108.6	109.5	109.4	108.5	107.5	106.6	105.7	
0.5	104.7	105.8	106.8	107.9	108.9	109.9	109.9	109.0	108.0	107.0	106.1	105.3	
0.4	104.7	105.8	106.8	107.9	108.9	109.9	109.8	108.8	107.8	106.9	106.1	104.2	
19000 FT PRESS ALT								TAT (°C)					
MACH	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
0.6	104.3	105.3	106.2	107.2	108.1	109.0	110.0	109.6	108.7	107.7	106.8	105.9	
0.5	105.8	106.8	107.9	108.9	109.8	110.7	110.1	109.2	108.2	107.3	106.4	105.5	
0.4	105.8	106.8	107.9	108.9	109.9	110.9	110.1	109.1	108.2	107.2	106.4	104.3	
15000 FT PRESS ALT								TAT (°C)					
MACH	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
0.6	102.8	103.8	104.7	105.6	106.6	107.5	108.4	109.2	108.2	107.3	106.4	105.7	
0.5	104.3	105.2	106.2	107.1	108.1	109.0	109.4	108.4	107.5	106.7	105.9	105.1	
0.4	105.2	106.2	107.2	108.2	109.2	110.2	109.5	108.6	107.7	106.9	106.1	105.1	
10000 FT PRESS ALT								TAT (°C)					
MACH	-15	-10	-5	0	5	10	15	20	25	30	35	40	
0.6	100.3	101.2	102.1	103.0	103.9	104.8	105.6	106.5	107.4	106.7	106.0	105.2	
0.5	101.4	102.4	103.3	104.2	105.1	106.0	106.9	107.5	106.8	106.0	105.2	104.5	
0.4	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4	104.7	104.1	

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
180	171	238	2900		
170	162	231	5500	3700	1600
160	153	223	8200	6600	4700
150	143	215	10600	9200	7600
140	134	210	12800	11800	10100
130	125	205	14900	14400	12900
120	115	199	16700	16500	15600
110	106	193	18900	18800	18100
100	96	188	21000	20800	20400

Includes APU fuel burn.

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
160	4300	1700	
155	5800	3400	
150	7400	5000	2500
145	8900	6700	4200
140	10300	8400	6000
135	11700	9900	7800
130	13100	11700	9500
125	14600	13600	11400
120	15700	15300	13400
115	16700	16600	15300
110	17900	17800	17000
105	19100	19000	18400
100	20300	20200	19700
95	21300	21200	20700
90	22300	22200	21600

With engine anti-ice on, decrease altitude capability by 1200 ft.

With engine and wing anti-ice on, decrease altitude capability by 2500 ft.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		6	8	10	12	14	16	18	20
160	%N1	103.3							
	MACH	.398							
	KIAS	237							
	FF/ENG	7736							
150	%N1	101.0	103.1						
	MACH	.389	.400						
	KIAS	231	229						
	FF/ENG	7195	7225						
140	%N1	98.6	100.6	102.7	105.3				
	MACH	.379	.390	.401	.412				
	KIAS	225	223	221	219				
	FF/ENG	6672	6685	6714	6765				
130	%N1	96.2	98.0	100.0	102.2	104.8			
	MACH	.367	.379	.391	.402	.412			
	KIAS	218	217	215	213	211			
	FF/ENG	6167	6164	6175	6200	6251			
120	%N1	93.8	95.5	97.3	99.2	101.5	104.2		
	MACH	.355	.367	.379	.390	.402	.412		
	KIAS	211	210	209	207	205	203		
	FF/ENG	5671	5660	5658	5666	5686	5740		
110	%N1	91.2	92.8	94.5	96.3	98.3	100.5	103.4	
	MACH	.342	.353	.365	.377	.389	.401	.413	
	KIAS	203	202	201	200	199	197	195	
	FF/ENG	5188	5169	5157	5156	5159	5177	5259	
100	%N1	88.4	90.1	91.6	93.3	95.2	97.1	99.5	102.8
	MACH	.328	.339	.351	.363	.375	.387	.400	.417
	KIAS	195	194	193	192	191	190	189	189
	FF/ENG	4697	4689	4671	4659	4657	4658	4700	4837

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
164	146	131	118	109	100	94	89	84	79	75
334	296	264	239	218	200	187	175	165	156	148
505	447	398	359	327	300	281	263	247	234	222
677	598	531	479	437	400	374	350	329	311	295
850	751	666	600	546	500	467	438	411	388	368
1025	904	801	720	656	600	560	524	493	465	441
1200	1057	936	841	766	700	653	611	574	541	513
1377	1212	1072	963	876	800	746	698	655	618	586
1554	1367	1208	1085	986	900	839	785	737	694	658
1733	1523	1345	1207	1096	1000	932	872	818	771	731

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		10		14		18	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	2.5	0:27	2.2	0:27	2.0	0:26	1.8	0:26
200	5.2	0:52	4.8	0:50	4.6	0:49	4.4	0:47
300	7.8	1:17	7.4	1:14	7.1	1:12	7.0	1:09
400	10.5	1:42	9.9	1:38	9.5	1:35	9.5	1:31
500	13.1	2:08	12.4	2:02	12.0	1:58	11.9	1:54
600	15.7	2:33	14.9	2:27	14.4	2:22	14.3	2:16
700	18.2	2:59	17.3	2:51	16.7	2:45	16.7	2:39
800	20.7	3:25	19.7	3:16	19.0	3:09	19.0	3:01
900	23.2	3:51	22.1	3:41	21.3	3:32	21.2	3:24
1000	25.7	4:18	24.4	4:06	23.6	3:56	23.5	3:47

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.2	0.0	0.2	0.5
4	-0.7	-0.3	0.0	0.5	1.1
6	-1.0	-0.5	0.0	0.8	1.7
8	-1.4	-0.7	0.0	1.1	2.3
10	-1.8	-0.9	0.0	1.4	2.9
12	-2.1	-1.1	0.0	1.7	3.4
14	-2.5	-1.2	0.0	2.0	4.0
16	-2.9	-1.4	0.0	2.3	4.6
18	-3.2	-1.6	0.0	2.6	5.2
20	-3.6	-1.8	0.0	2.9	5.8
22	-4.0	-2.0	0.0	3.1	6.4
24	-4.4	-2.1	0.0	3.4	6.9
26	-4.7	-2.3	0.0	3.7	7.5
28	-5.1	-2.5	0.0	4.0	8.1
30	-5.5	-2.7	0.0	4.3	8.7

Includes APU fuel burn.

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GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
180	%N1	101.3				
	KIAS	241				
	FF/ENG	8700				
170	%N1	99.2	103.1			
	KIAS	234	234			
	FF/ENG	8130	8300			
160	%N1	96.9	100.4			
	KIAS	226	226			
	FF/ENG	7540	7640			
150	%N1	94.5	97.9	103.9		
	KIAS	218	218	218		
	FF/ENG	6970	7030	7280		
140	%N1	92.5	95.6	101.0		
	KIAS	212	212	212		
	FF/ENG	6480	6520	6690		
130	%N1	90.4	93.5	98.5	105.9	
	KIAS	207	207	207	207	
	FF/ENG	6040	6070	6170	6500	
120	%N1	88.2	91.2	95.9	102.0	
	KIAS	201	201	201	201	
	FF/ENG	5600	5610	5670	5870	
110	%N1	86.0	88.9	93.4	98.8	
	KIAS	195	195	195	195	
	FF/ENG	5170	5170	5210	5330	
100	%N1	83.5	86.5	90.8	95.8	102.8
	KIAS	189	189	189	189	189
	FF/ENG	4750	4750	4760	4830	5080

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight

Text

Chapter PI

Section 36

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, brakes deactivated, improved climb, contaminated runway situations, brake energy limits, or obstacle clearance with unbalanced V1. These speeds may be used for weights less than or equal to the performance limited weight.

Normal takeoff speeds, V1, VR, and V2, with anti-skid on and all brakes operative, are read from the table by entering with takeoff flap setting, brake release weight and appropriate column. The appropriate column is obtained by entering the Column Reference chart with the airport pressure altitude and the actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the V1 Adjustment chart. Adjusted V1 must not exceed VR. These takeoff speeds are not valid when the brake release weight is based on clearway, stopway, improved climb or is limited by tire speed or brake energy.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). Therefore compare the adjusted V1 to the V1(MCG). To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length.

Clearway and Stopway V1 Adjustments

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR.

Maximum allowable clearway limits are provided for guidance when more precise data is not available.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 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 Takeoff

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 assumes 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 13 mm (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 field/obstacle limit weight for the takeoff flap setting.
2. Enter the Weight Adjustment table with the 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 adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

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 the Takeoff Speeds table in this section.
2. If V1(MCG) limited, set $V1=V1(MCG)$. If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set $V1=V1(MCG)$.

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. 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.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal runway/obstacle limited weight and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE ADJUSTMENT		
FIELD LENGTH (FT)	WEIGHT (1000 KG)	V1 ADJUSTMENT (KTS)
6000	-46.6	-44
7000	-46.6	-42
8000	-46.6	-39
9000	-37.9	-37
10000	-27.1	-34
12000	-22.7	-31
14000	-22.7	-29

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance adjusted for wind and slope exceeds approximately 8400 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Brakes Deactivated

When operating with brakes deactivated, the field 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 3200 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ONE BRAKE DEACTIVATED SPEED ADJUSTMENT	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KTS)
4000	-2
6000	-2
8000	-2
10000	-2
12000	-2
14000	-2

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance exceeds approximately 3800 ft for one brake deactivated.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. %N1 adjustments are shown for packs off operation.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of reduced thrust is not allowed on runways contaminated with water, ice, slush or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

Enter the Minimum Assumed Temperature table with airport pressure altitude and read minimum assumed temperature. If assumed temperature is below this value, use the Takeoff %N1 table to set takeoff thrust. To find assumed temperature reduced thrust, obtain the assumed temperature %N1 by entering the Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table. Apply the altitude adjustment shown in the %N1 Altitude Adjustment table. Check the resulting value by entering the Minimum Assumed Temperature Limit %N1 table with actual airport temperature and pressure altitude. Use the greater of assumed temperature limit %N1 or minimum %N1 as the assumed temperature reduced thrust %N1. Determine takeoff speeds using the actual takeoff weight and assumed temperature.

Max Climb %N1

This table shows Max Climb %N1 for a 250/290/.78 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 packs off and anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for packs off and anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. 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 maximum cruise thrust at 0 ft/min residual rate of climb or maximum climb thrust at 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 12° 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 .80M 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 .78/290/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

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 table makes no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Distance and time for descent are shown for a .78/290/250 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 at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

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. Landing distances for slippery runways are 115% of the actual landing distances.

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 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 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, temperature, and speed conditions as well as thrust reverser configuration. Each adjustment is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landing at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight, the brakes on speed adjusted for wind and 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 Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse Thrust) 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 or brake temperature monitor system (BTMS) indication on EICAS. Times are provided for ground cooling and inflight gear down cooling.

If brake temperature monitor indication on EICAS is available, 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 the recommended cooling schedule by entering at the bottom of the chart. The brake temperature light illuminates when the hottest brake is registering 5 on the EICAS indication and extinguishes as the hottest brake cools with an EICAS indication of 4.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .80M 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 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/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. The cruise segment is at a level off altitude which is based on 100 ft/min residual rate of climb.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude are used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (KG/HR)					
	GROSS WEIGHT (1000 KG)					
	190	170	150	130	110	90
43					60	55
39				65	60	60
35		75	70	70	65	65
31	75	75	75	75	70	65
27	85	85	80	75	75	70
25	85	85	85	80	75	70
20	95	90	90	85	80	75
15	105	105	95	95	90	85
10	115	115	105	105	100	95
5	125	125	120	115	110	105

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/290/250 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 Fuel Required Adjustment 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

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 the 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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Intentionally
Blank



Performance Inflight

General

Chapter PI

Section 40

Takeoff Speeds

Max Takeoff Thrust

FLAPS	WEIGHT 1000 KG	V1	VR	V2
5	190	164	169	176
	180	158	164	171
	170	152	158	166
	160	146	153	161
	150	140	147	156
	140	134	141	151
	130	127	134	145
	120	120	128	139
	110	113	121	134
	100	105	114	127
	190	159	162	168
	180	153	157	164
15	170	147	151	159
	160	142	146	154
	150	135	141	149
	140	129	135	144
	130	123	129	139
	120	116	122	134
	110	109	116	128
	100	102	109	122
	190	157	158	164
	180	150	152	159
	170	144	147	154
	160	138	141	149
20	150	132	135	144
	140	126	130	140
	130	120	124	134
	120	113	118	129
	110	106	111	124
	100	98	105	118

CHECK V1(MCG) IN BOXED AREA

V1 ADJUSTMENT

OAT °C	PRESS	ALT	1000 FT			
	-1	0	2	4	6	8
70	9	10	12	14	16	16
60	7	8	10	11	13	14
50	4	5	7	9	11	12
40	2	3	5	7	9	11
30	0	0	2	5	7	9
20	0	0	1	3	5	7
10	0	0	1	3	4	6
-54	0	1	2	4	5	7

VR ADJUSTMENT

OAT °C	PRESS	ALT	1000 FT			
	-1	0	2	4	6	8
70	5	6	7	8	9	10
60	4	4	6	7	8	9
50	2	3	4	5	6	8
40	1	1	3	4	5	6
30	0	0	1	3	4	5
20	0	0	1	2	3	4
10	0	0	1	2	3	4
-54	0	0	1	2	3	4

SLOPE/WIND V1 ADJUSTMENTS*

WEIGHT 1000 KG	DN SLOPE % UP					TAIL			WIND		KTS		HEAD		
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40		
190	-4	-2	0	1	3	-1	-1	-1	0	0	0	1	1		
170	-4	-2	0	1	3	-2	-1	-1	0	0	0	1	1		
150	-3	-2	0	1	3	-2	-2	-1	0	0	1	1	1		
130	-2	-1	0	2	4	-3	-2	-1	0	1	1	1	2		
110	-2	-1	0	2	4	-4	-3	-1	0	1	1	2	2		

* V1 NOT TO EXCEED VR

V1(MCG)

Max Takeoff Thrust

ACTUAL OAT (°C)	PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
50	106	103	99			
40	110	108	104	100	96	91
30	114	112	108	103	100	95
20	114	113	109	106	102	98
10	114	113	110	106	103	99
-54	116	115	111	108	104	100



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Maximum Allowable Clearway

FIELD LENGTH (FT)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (FT)
4000	300
6000	450
8000	550
10000	600
12000	700
14000	750

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (FT)	NORMAL V1 (KIAS)		
	120	140	160
800	-3	-3	-2
600	-3	-3	-2
400	-3	-2	-1
200	-2	-1	-1
0	0	0	0
-200	2	1	0
-400	3	2	1
-600	3	2	1
-800	3	2	1

Stab Trim Setting

Max Takeoff Thrust

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	6 1/2	5 1/2	4 1/2	4	3	2
180	7	6	5 1/2	4 1/2	3 1/2	2 1/2	2
170	6 1/2	6	5	4	3 1/2	2 1/2	1 1/2
160	6 1/2	5 1/2	5	4	3	2 1/2	1 1/2
150	6	5	4 1/2	3 1/2	3	2	1
140	5 1/2	4 1/2	4	3	2 1/2	1 1/2	1/2
130	5	4	3	2 1/2	1 1/2	1	1/2
120	4	3 1/2	2 1/2	2	1 1/2	1/2	1/2
110	3 1/2	3	2 1/2	1 1/2	1	1/2	1/2
100	3 1/2	2 1/2	2	1	1/2	1/2	1/2



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VREF (KIAS)

WEIGHT (1000 KG)	FLAPS		
	30	25	20
190	179	170	179
180	171	166	173
170	164	161	168
160	156	156	162
150	148	151	157
140	142	146	151
130	137	141	146
120	131	135	141
110	125	129	135
100	119	123	128



Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF30 + 80
1	VREF30 + 60
5	VREF30 + 40
15	VREF30 + 20
20	VREF30 + 20
25	VREF25
30	VREF30

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-20.9	-25.6	-30.3	-25.1	-29.9	-34.6	-35.1	-39.8	-44.5
200	-20.3	-25.0	-29.7	-24.2	-28.9	-33.7	-33.3	-38.1	-42.8
190	-19.5	-24.2	-29.0	-23.1	-27.8	-32.5	-31.4	-36.1	-40.8
180	-18.5	-23.3	-28.0	-21.8	-26.5	-31.2	-29.2	-33.9	-38.6
170	-17.4	-22.1	-26.8	-20.3	-25.0	-29.7	-26.9	-31.6	-36.3
160	-16.0	-20.7	-25.4	-18.5	-23.3	-28.0	-24.3	-29.0	-33.7
150	-14.4	-19.1	-23.8	-16.6	-21.3	-26.1	-21.6	-26.3	-31.0
140	-12.6	-17.4	-22.1	-14.5	-19.2	-23.9	-18.6	-23.4	-28.1
130	-10.7	-15.4	-20.1	-12.2	-16.9	-21.6	-15.5	-20.2	-24.9
120	-8.5	-13.2	-17.9	-9.7	-14.4	-19.1	-12.2	-16.9	-21.6
110	-6.1	-10.9	-15.6	-6.9	-11.7	-16.4	-8.7	-13.4	-18.1
100	-3.6	-8.3	-13.0	-4.0	-8.7	-13.5	-5.0	-9.7	-14.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
4600				83.5			81.7		
5000				102.1			99.7		
5400	92.0			102.1	81.6		118.2	97.9	
5800	111.3	90.1		121.3	100.2		137.4	116.3	96.1
6200	131.3	109.3	88.2	141.3	119.3	98.3	157.3	135.5	114.5
6600	152.3	129.3	107.4	162.2	139.2	117.4	178.1	155.3	133.5
7000	174.3	150.1	127.3	184.1	160.0	137.2	199.9	176.0	153.3
7400	197.5	172.0	148.0	207.2	181.9	157.9	222.7	197.7	173.9
7800	222.0	195.1	169.8		204.9	179.6		220.4	195.4
8200		219.5	192.7		229.0	202.5			218.1
8600			217.0			226.6			

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -117 ft/+117 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 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
190	-21	-21	-21	-16	-16	-16	-7	-7	-7
180	-22	-22	-22	-17	-17	-17	-7	-7	-7
170	-22	-22	-22	-17	-17	-17	-7	-7	-7
160	-23	-23	-23	-18	-18	-18	-7	-7	-7
150	-23	-23	-23	-18	-18	-18	-8	-8	-8
140	-24	-24	-24	-19	-19	-19	-9	-9	-9
130	-25	-25	-25	-20	-20	-20	-10	-10	-10
120	-26	-26	-26	-22	-22	-22	-12	-12	-12
110	-27	-27	-27	-23	-23	-23	-15	-15	-15
100	-29	-29	-29	-24	-24	-24	-17	-17	-17

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).

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-27.2	-32.4	-37.6	-32.3	-37.5	-42.7	-44.3	-49.5	-54.7
200	-26.2	-31.3	-36.5	-30.7	-35.9	-41.0	-41.3	-46.5	-51.6
190	-24.9	-30.1	-35.3	-28.9	-34.1	-39.3	-38.2	-43.4	-48.6
180	-23.5	-28.7	-33.9	-27.0	-32.2	-37.4	-35.1	-40.3	-45.5
170	-21.9	-27.1	-32.3	-25.0	-30.2	-35.3	-32.0	-37.1	-42.3
160	-20.2	-25.4	-30.6	-22.8	-28.0	-33.2	-28.8	-33.9	-39.1
150	-18.3	-23.5	-28.6	-20.6	-25.7	-30.9	-25.5	-30.7	-35.8
140	-16.2	-21.4	-26.6	-18.1	-23.3	-28.5	-22.2	-27.4	-32.6
130	-14.0	-19.2	-24.3	-15.6	-20.8	-25.9	-18.9	-24.1	-29.2
120	-11.6	-16.8	-21.9	-12.9	-18.1	-23.2	-15.5	-20.7	-25.8
110	-9.0	-14.2	-19.4	-10.1	-15.3	-20.4	-12.1	-17.3	-22.4
100	-6.3	-11.5	-16.6	-7.1	-12.3	-17.5	-8.6	-13.8	-19.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
6200							86.7		
6600							106.5	84.8	
7000				90.7			127.2	104.5	82.8
7400	83.6			112.8	88.5		148.8	125.1	102.5
7800	108.9	81.0		136.2	110.5	86.3	171.7	146.6	123.0
8200	135.3	106.4		161.2	133.8	108.3	195.9	169.3	144.4
8600	163.4	132.6	103.8	188.1	158.6	131.4	221.4	193.4	167.0
9000	193.3	160.5	129.9	217.2	185.3	156.0		218.9	190.9
9400	224.8	190.2	157.6		214.3	182.5			216.3
9800		221.6	187.1			211.3			
10200			218.4						

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -165 ft/+165 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 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
210	-31	-31	-31	-26	-26	-26	-17	-17	-17
200	-31	-31	-31	-24	-24	-24	-13	-13	-13
190	-31	-31	-31	-24	-24	-24	-11	-11	-11
180	-31	-31	-31	-24	-24	-24	-10	-10	-10
170	-31	-31	-31	-25	-25	-25	-10	-10	-10
160	-32	-32	-32	-26	-26	-26	-11	-11	-11
150	-33	-33	-33	-27	-27	-27	-13	-13	-13
140	-33	-33	-33	-29	-29	-29	-15	-15	-15
130	-34	-34	-34	-30	-30	-30	-18	-18	-18
120	-34	-34	-34	-31	-31	-31	-21	-21	-21
110	-34	-34	-34	-32	-32	-32	-24	-24	-24
100	-34	-34	-34	-32	-32	-32	-27	-27	-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).

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
210	0.0	-0.2	-0.9	-10.1	-10.8	-11.5	-19.6	-20.3	-21.0
200	-0.7	-1.4	-2.1	-11.0	-11.7	-12.4	-19.8	-20.5	-21.2
190	-1.6	-2.4	-3.1	-11.6	-12.3	-13.0	-19.7	-20.4	-21.2
180	-2.4	-3.1	-3.8	-11.9	-12.6	-13.3	-19.4	-20.1	-20.8
170	-2.8	-3.6	-4.3	-11.9	-12.6	-13.3	-18.8	-19.5	-20.2
160	-3.1	-3.8	-4.5	-11.5	-12.3	-13.0	-17.9	-18.6	-19.3
150	-3.1	-3.8	-4.5	-10.9	-11.7	-12.4	-16.7	-17.4	-18.1
140	-2.8	-3.5	-4.3	-10.0	-10.7	-11.5	-15.3	-16.0	-16.7
130	-2.3	-3.0	-3.7	-8.8	-9.5	-10.3	-13.5	-14.3	-15.0
120	-1.5	-2.3	-3.0	-7.3	-8.0	-8.7	-11.6	-12.3	-13.0
110	-0.6	-1.3	-2.0	-5.5	-6.2	-6.9	-9.3	-10.0	-10.7
100	0.0	0.0	-0.8	-3.4	-4.1	-4.8	-6.8	-7.5	-8.2

V1(MCG) Limit Weight (1000 KG)

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
3800	81.7								
4200	119.8	92.5							
4600	157.4	130.4	103.1						
5000	194.4	167.8	140.9						
5400		204.7	178.2	104.5	86.6				
5800			215.0	130.5	111.7	93.5			
6200				157.7	137.9	118.9			
6600				186.5	165.6	145.5	88.1		
7000				217.2	194.9	173.6	103.1		
7400					226.1	203.5	118.7	89.6	
7800							135.0	104.6	
8200							152.2	120.3	91.1
8600							170.3	136.7	106.2
9000							189.6	154.0	121.9
9400							210.4	172.2	138.4
9800								191.7	155.7
10200								212.5	174.1
10600									193.7
11000									214.7

1. Enter Weight Adjustment table with reported braking action and field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -81 ft/+81 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -81 ft/+81 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -171 ft/+171 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 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
190	-7	-7	-7	-18	-18	-18	-30	-30	-30
180	-8	-8	-8	-19	-19	-19	-31	-31	-31
170	-9	-9	-9	-20	-20	-20	-33	-33	-33
160	-10	-10	-10	-21	-21	-21	-34	-34	-34
150	-11	-11	-11	-22	-22	-22	-35	-35	-35
140	-11	-11	-11	-23	-23	-23	-37	-37	-37
130	-12	-12	-12	-24	-24	-24	-38	-38	-38
120	-12	-12	-12	-25	-25	-25	-40	-40	-40
110	-13	-13	-13	-26	-26	-26	-41	-41	-41
100	-13	-13	-13	-27	-27	-27	-43	-43	-43

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).

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-2.4	-3.1	-3.7	-15.3	-15.9	-16.5	-26.4	-27.0	-27.7
200	-3.6	-4.2	-4.8	-15.9	-16.5	-17.2	-26.2	-26.8	-27.5
190	-4.5	-5.1	-5.8	-16.3	-16.9	-17.5	-25.7	-26.4	-27.0
180	-5.2	-5.8	-6.4	-16.4	-17.0	-17.6	-25.0	-25.6	-26.2
170	-5.6	-6.2	-6.8	-16.1	-16.8	-17.4	-23.9	-24.6	-25.2
160	-5.8	-6.4	-7.0	-15.6	-16.2	-16.9	-22.6	-23.2	-23.9
150	-5.7	-6.3	-6.9	-14.8	-15.4	-16.0	-21.0	-21.7	-22.3
140	-5.4	-6.0	-6.6	-13.7	-14.3	-14.9	-19.2	-19.8	-20.4
130	-4.8	-5.4	-6.0	-12.2	-12.9	-13.5	-17.0	-17.6	-18.3
120	-4.0	-4.6	-5.2	-10.5	-11.1	-11.8	-14.6	-15.2	-15.8
110	-2.9	-3.5	-4.1	-8.5	-9.1	-9.7	-11.9	-12.5	-13.1
100	-1.6	-2.2	-2.8	-6.2	-6.8	-7.4	-8.9	-9.5	-10.2

V1(MCG) Limit Weight (1000 KG)

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	103.9								
5000	158.3	124.7	84.4						
5400	202.0	174.4	143.4						
5800		215.9	189.7						
6200			229.8						
7000				120.0	88.2				
7400				165.1	136.2	105.6			
7800				206.7	180.1	152.0			
8200					220.8	194.6			
10200							97.7		
10600							122.3		
11000							148.4	98.9	
11400							176.5	123.5	
11800							206.9	149.7	100.1
12200								177.9	124.8
12600								208.5	151.1
13000									179.4
13400									210.1

1. Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -175 ft/+175 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for available 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
210	-7	-7	-7	-21	-21	-21	-42	-42	-42
200	-8	-8	-8	-22	-22	-22	-43	-43	-43
190	-9	-9	-9	-24	-24	-24	-44	-44	-44
180	-11	-11	-11	-25	-25	-25	-45	-45	-45
170	-12	-12	-12	-27	-27	-27	-47	-47	-47
160	-13	-13	-13	-28	-28	-28	-49	-49	-49
150	-14	-14	-14	-30	-30	-30	-51	-51	-51
140	-15	-15	-15	-32	-32	-32	-53	-53	-53
130	-16	-16	-16	-33	-33	-33	-55	-55	-55
120	-17	-17	-17	-35	-35	-35	-56	-56	-56
110	-18	-18	-18	-36	-36	-36	-56	-56	-56
100	-18	-18	-18	-37	-37	-37	-56	-56	-56

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).

Takeoff %N1

Max Takeoff Thrust

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		TAT	AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	(°C)	-1000	0	2000	4000	6000	8000	10000
55	140	61	106.3	106.2	106.2	105.9	105.5	105.1	104.7
50	122	51	107.5	107.3	107.2	107.0	106.5	106.2	105.7
45	113	46	108.5	108.3	108.3	108.0	107.6	107.2	106.7
40	104	41	109.4	109.3	109.4	109.0	108.6	108.2	107.7
35	95	36	110.4	110.3	110.5	110.1	109.8	109.2	108.6
30	86	31	110.7	111.3	111.5	111.0	111.0	110.3	109.6
25	77	26	109.9	110.5	112.1	111.9	112.1	111.3	110.6
20	68	21	109.0	109.6	111.2	112.1	112.8	112.1	111.4
15	59	16	108.2	108.8	110.3	111.2	112.5	112.6	112.2
10	50	11	107.3	107.9	109.5	110.3	111.7	111.9	112.9
5	41	6	106.5	107.1	108.6	109.4	110.7	111.0	111.9
0	32	1	105.6	106.2	107.7	108.5	109.8	110.1	110.9
-10	14	-9	103.8	104.4	105.9	106.7	108.0	108.3	108.9
-20	-4	-19	102.0	102.6	104.0	104.8	106.1	106.4	106.8
-30	-22	-30	100.1	100.7	102.1	102.9	104.2	104.5	104.7
-40	-40	-40	98.2	98.8	100.2	101.0	102.2	102.6	102.6
-50	-58	-50	96.3	96.8	98.2	98.9	100.1	100.4	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	10000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5	0.5

Assumed Temperature Reduced Thrust

Minimum Assumed Temperature

MINIMUM ASSUMED TEMP	PRESSURE ALTITUDE (FT)										
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
°F	93	86	83	79	76	72	69	65	62	58	54
°C	34	30	28	26	24	22	20	18	16	14	12

Assumed Temperature Limit %N1

Based on engine bleed for packs on

ACTUAL OAT (°C)	ASSUMED TEMPERATURE (°C)										
	20	25	30	35	40	45	50	55	60	65	70
55									104.4	102.7	100.9
50								105.4	103.7	101.9	100.2
45							106.5	104.6	102.9	101.1	99.4
40						107.5	105.7	103.8	102.1	100.3	99.0
35					108.4	106.6	104.9	103.0	101.3	99.5	99.2
30				109.4	107.6	105.8	104.0	102.1	100.4	99.4	99.4
25			110.5	108.6	106.8	105.0	103.2	101.4	99.7	98.7	98.7
20		111.5	109.6	107.8	105.9	104.2	102.4	100.6	98.9	97.6	97.6
15	112.5	110.6	108.8	106.9	105.1	103.4	101.7	99.8	98.2	96.8	96.8
10	111.6	109.8	107.9	106.1	104.3	102.6	100.9	99.0	97.4	96.1	96.1
5	110.7	108.9	107.1	105.2	103.4	101.7	100.0	98.2	96.6	95.3	95.3
0	109.8	108.0	106.2	104.4	102.6	100.9	99.2	97.4	95.8	94.6	94.6
-10	107.9	106.2	104.4	102.6	100.9	99.2	97.6	95.8	94.2	93.0	93.0
-20	106.0	104.3	102.6	100.8	99.1	97.5	95.9	94.2	92.6	91.4	91.4
-30	104.1	102.4	100.7	99.0	97.3	95.7	94.1	92.4	90.9	89.4	89.4
-40	102.1	100.4	98.8	97.1	95.5	93.9	92.3	90.7	89.2	87.7	87.7
-50	100.1	98.4	96.8	95.1	93.6	92.0	90.5	88.9	87.4	86.0	86.0

%N1 Adjustment for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)										
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
PACKS OFF	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.5	0.5	0.5

%N1 Altitude Adjustment

ASSUMED TEMP (°C)	PRESSURE ALTITUDE (FT)										
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
70	0.2	0.0	0.0	-0.2	-0.3	-0.5	-0.7	-1.0	-1.2	-1.4	-1.5
60	0.1	0.0	0.0	-0.2	-0.3	-0.4	-0.6	-0.8	-1.0	-1.2	-1.4
50	0.3	0.0	0.0	-0.2	-0.3	-0.4	-0.6	-0.8	-0.9	-1.1	-1.4
40	0.1	0.0	0.1	0.0	-0.1	-0.3	-0.5	-0.7	-0.9	-1.0	-1.4
32 & BELOW	0.0	0.0	0.1	0.1	-0.1	-0.3	-0.3	-0.4	-0.7	-1.0	-1.3

Assumed Temperature Reduced Thrust

Assumed Temperature Minimum %N1

Based on 25% takeoff thrust reduction

ACTUAL OAT (°C)	PRESSURE ALTITUDE (FT)											
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
54	97.5	97.4	97.2	97.2	97.0	97.2	96.9	97.1	97.6	98.1	98.7	99.2
50	97.9	97.8	97.7	97.6	97.5	97.7	97.5	97.2	97.3	97.5	98.1	98.6
45	98.5	98.5	98.3	98.3	98.2	98.0	98.2	97.9	97.6	97.5	97.3	97.9
40	98.8	99.1	99.0	98.9	98.8	98.7	98.5	98.6	98.3	98.2	98.0	97.8
35	99.3	99.3	99.2	99.2	99.1	98.9	99.1	98.9	98.6	98.5	98.3	98.5
30	98.6	98.9	99.4	99.4	99.3	99.2	99.0	99.2	99.3	99.1	98.6	98.4
25	97.9	98.1	98.7	99.0	99.2	99.4	99.3	99.4	99.5	99.0	98.8	98.6
20	97.1	97.4	97.6	98.2	98.5	98.7	98.8	99.3	99.1	98.9	99.1	98.9
15	96.4	96.6	96.8	97.5	97.7	97.9	98.1	98.2	98.6	98.8	98.6	98.7
10	95.6	95.9	96.1	96.7	96.9	97.1	97.3	97.4	97.9	97.7	97.8	97.9
5	94.9	95.1	95.3	96.0	96.2	96.4	96.5	96.6	97.1	96.9	97.0	97.1
0	93.8	94.3	94.6	94.9	95.4	95.6	95.7	95.9	95.9	96.1	96.2	96.4
-10	92.2	92.4	93.0	93.3	93.5	93.7	93.8	94.3	94.4	94.5	94.3	94.8
-20	90.6	90.8	91.4	91.7	91.9	92.1	92.2	92.3	92.7	92.6	92.8	92.9
-30	89.0	89.2	89.4	89.7	90.2	90.4	90.2	90.7	90.7	90.9	91.1	90.9
-40	87.0	87.5	87.7	88.0	88.2	88.4	88.5	88.9	89.0	89.2	89.1	89.3
-50	85.3	85.5	86.0	86.3	86.5	86.7	86.8	86.9	87.3	87.2	87.4	87.2
-54	84.6	84.8	85.3	85.6	85.8	85.9	86.1	86.2	86.5	86.5	86.4	86.5

1. Enter Minimum Assumed Temperature table with airport pressure altitude to determine minimum assumed temperature.
2. Enter Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature to determine assumed temperature limit %N1. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table.
3. Enter %N1 Altitude Adjustment table with assumed temperature and airport pressure altitude to determine altitude adjustment to %N1 found in step 2.
4. Ensure Takeoff %N1 from step 3 is greater than or equal to minimum %N1 allowed for airport conditions from Assumed Temperature Minimum %N1 table.

TO1 Takeoff Speeds

10% Thrust Reduction

FLAPS	WEIGHT 1000 KG	V1	VR	V2
5	190	167	171	176
	180	161	165	171
	170	155	160	166
	160	149	154	161
	150	143	148	156
	140	136	142	151
	130	130	136	145
	120	123	129	140
	110	115	123	134
	100	108	116	127
	90	99	107	121
15	190	161	163	169
	180	156	158	164
	170	150	153	159
	160	144	148	155
	150	138	142	150
	140	132	136	144
	130	125	130	139
	120	119	124	134
	110	112	117	128
	100	105	110	122
	90	96	104	117
20	190	159	160	164
	180	153	154	159
	170	147	148	154
	160	140	142	149
	150	134	137	145
	140	128	131	140
	130	122	126	135
	120	115	119	129
	110	108	113	124
	100	101	106	118
	90	92	100	113

CHECK V1(MCG) IN BOXED AREA

V1 ADJUSTMENT

OAT °C	PRESS ALT 1000 FT					
	-1	0	2	4	6	8
70	9	10	12	14	16	16
60	7	8	10	11	13	14
50	4	5	7	9	11	12
40	2	3	5	7	9	11
30	0	0	2	5	7	9
20	0	0	1	3	5	6
10	0	0	1	3	4	6
-50	0	1	2	4	5	7

VR ADJUSTMENT

OAT °C	PRESS ALT 1000 FT					
	-1	0	2	4	6	8
70	5	6	7	8	9	10
60	4	4	6	7	8	9
50	2	3	4	5	6	8
40	1	1	3	4	5	6
30	0	0	1	3	4	5
20	0	0	1	2	3	4
10	0	0	1	2	3	4
-50	0	0	1	2	3	4

DRY RUNWAY SLOPE/WIND V1 ADJUSTMENTS*

WEIGHT 1000 KG	DN SLOPE % UP			TAIL		WIND		KTS		HEAD			
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	1	3	-1	-1	-1	0	0	0	1	1
170	-4	-2	0	1	3	-2	-1	-1	0	0	0	1	1
150	-3	-2	0	1	3	-2	-2	-1	0	0	1	1	1
130	-2	-1	0	2	4	-3	-2	-1	0	1	1	1	2
110	-2	-1	0	2	4	-4	-3	-1	0	1	1	2	2
90	-1	-1	0	2	4	-5	-3	-1	0	1	1	2	2

* V1 NOT TO EXCEED VR

767 Flight Crew Operations Manual

T01 V1(MCG)

10% Thrust Reduction

ACTUAL OAT		PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
50	122	103	101	97	93	89	85
40	104	107	105	101	97	93	89
30	86	110	108	105	100	97	92
20	68	110	109	106	102	99	95
10	50	111	109	106	103	100	96
-50	-58	113	111	108	104	101	97

TO1 Takeoff %N1

10% Thrust Reduction

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
55	131	103.9	103.7	103.7	103.4	103.0	102.7
50	122	105.1	104.9	104.8	104.5	104.1	103.7
45	113	105.8	105.7	105.6	105.4	105.0	104.7
40	104	106.4	106.3	106.3	106.1	105.8	105.4
35	95	106.8	106.8	106.9	106.6	106.4	106.0
30	86	106.9	107.4	107.5	107.1	107.1	106.5
25	77	106.1	106.5	107.7	107.6	107.7	107.1
20	68	105.2	105.7	106.8	107.4	108.0	107.5
15	59	104.4	104.9	106.0	106.6	107.5	107.5
10	50	103.6	104.0	105.1	105.7	106.6	106.7
0	32	101.9	102.3	103.4	104.0	104.8	105.0
-10	14	100.1	100.5	101.6	102.2	103.0	103.2
-20	-4	98.3	98.8	99.9	100.4	101.1	101.3
-30	-22	96.5	96.9	98.0	98.5	99.2	99.4
-40	-40	94.6	95.0	96.1	96.6	97.3	97.5
-50	-58	92.7	93.1	94.1	94.6	95.3	95.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5

767 Flight Crew Operations Manual

TO1 Stab Trim Setting

10% Thrust Reduction

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	7	6	5	4 1/2	3 1/2	2 1/2
180	7	6 1/2	6	5	4	3	2 1/2
170	7	6 1/2	5 1/2	4 1/2	4	3	2
160	7	6	5 1/2	4 1/2	3 1/2	3	2
150	6 1/2	5 1/2	5	4	3 1/2	2 1/2	1 1/2
140	6	5	4 1/2	3 1/2	3	2	1
130	5 1/2	4 1/2	3 1/2	3	2	1 1/2	1/2
120	4 1/2	4	3	2 1/2	2	1	1/2
110	4	3 1/2	3	2	1 1/2	1/2	1/2
100	4	3	2 1/2	1 1/2	1	1/2	1/2

TO2 Takeoff Speeds

20% Thrust Reduction

FLAPS	WEIGHT 1000 KG	V1	VR	V2
5	190	170	172	176
	180	164	167	171
	170	158	161	166
	160	152	156	161
	150	145	150	156
	140	139	144	151
	130	132	138	145
	120	125	131	140
	110	118	124	134
	100	110	117	127
	90	102	111	121
15	190	164	165	169
	180	158	160	164
	170	153	155	159
	160	147	149	155
	150	141	144	150
	140	134	138	144
	130	128	132	139
	120	121	125	134
	110	114	119	128
	100	107	112	122
	90	99	106	117
20	190	161	161	164
	180	155	155	159
	170	149	150	154
	160	143	144	149
	150	137	139	145
	140	131	133	140
	130	125	127	135
	120	118	121	129
	110	111	114	124
	100	103	108	118
	90	95	102	113

CHECK V1(MCG) IN BOXED AREA

V1 ADJUSTMENT

OAT °C	PRESS ALT 1000 FT					
	-1	0	2	4	6	8
70	9	10	12	14	16	16
60	7	8	10	11	13	14
50	4	5	7	9	11	12
40	2	3	5	7	9	11
30	0	0	2	5	7	9
20	0	0	1	3	5	6
10	0	0	1	3	4	6
-50	0	1	2	4	5	7

VR ADJUSTMENT

OAT °C	PRESS ALT 1000 FT					
	-1	0	2	4	6	8
70	5	6	7	8	9	10
60	4	4	6	7	8	9
50	2	3	4	5	6	8
40	1	1	3	4	5	6
30	0	0	1	3	4	5
20	0	0	1	2	3	4
10	0	0	1	2	3	4
-50	0	0	1	2	3	4

DRY RUNWAY SLOPE/WIND V1 ADJUSTMENTS*

WEIGHT 1000 KG	DN SLOPE % UP			TAIL		WIND		KTS		HEAD			
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	1	3	-1	-1	-1	0	0	0	1	1
170	-4	-2	0	1	3	-2	-1	-1	0	0	0	1	1
150	-3	-2	0	1	3	-2	-2	-1	0	0	1	1	1
130	-2	-1	0	2	4	-3	-2	-1	0	1	1	1	2
110	-2	-1	0	2	4	-4	-3	-1	0	1	1	2	2
90	-1	-1	0	2	4	-5	-3	-1	0	1	1	2	2

* V1 NOT TO EXCEED VR

T02 V1(MCG)

20% Thrust Reduction

ACTUAL OAT		PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
50	122	97	95	92	88	85	81
40	104	102	100	96	92	88	85
30	86	105	103	99	95	92	88
20	68	105	104	101	97	94	90
10	50	105	104	101	98	95	91
-50	-58	107	106	103	99	96	92

TO2 Takeoff %N1

20% Thrust Reduction

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
55	131	99.9	99.8	99.8	99.6	99.1	98.8
50	122	101.1	101.0	100.8	100.6	100.2	99.8
45	113	102.0	101.8	101.8	101.5	101.2	100.8
40	104	102.4	102.4	102.4	102.2	102.0	101.7
35	95	102.6	102.5	102.7	102.4	102.3	101.9
30	86	102.6	102.9	103.1	102.7	102.8	102.3
25	77	101.8	102.1	103.0	102.9	103.0	102.6
20	68	101.0	101.3	102.2	102.7	103.0	102.7
15	59	100.2	100.5	101.4	101.8	102.4	102.4
10	50	99.3	99.7	100.6	101.0	101.6	101.7
0	32	97.7	98.1	98.9	99.3	99.9	100.0
-10	14	96.0	96.4	97.2	97.6	98.1	98.2
-20	-4	94.3	94.6	95.4	95.8	96.3	96.4
-30	-22	92.5	92.9	93.6	94.0	94.5	94.6
-40	-40	90.7	91.0	91.8	92.1	92.6	92.7
-50	-58	88.9	89.2	89.9	90.2	90.7	90.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5



767 Flight Crew Operations Manual

TO2 Stab Trim Setting

20% Thrust Reduction

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	7	6 1/2	5 1/2	5	4	3
180	7	7	6 1/2	5 1/2	4 1/2	3 1/2	3
170	7	7	6	5	4 1/2	3 1/2	2 1/2
160	7	6 1/2	6	5	4	3 1/2	2 1/2
150	7	6	5 1/2	4 1/2	4	3	2
140	6 1/2	5 1/2	5	4	3 1/2	2 1/2	1 1/2
130	6	5	4	3 1/2	2 1/2	2	1
120	5	4 1/2	3 1/2	3	2 1/2	1 1/2	1/2
110	4 1/2	4	3 1/2	2 1/2	2	1	1/2
100	4 1/2	3 1/2	3	2	1 1/2	1	1/2

Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (KIAS OR MACH)								
	0	5	10	15	20	25	30	35	40
	250	250	250	290	290	290	290	.78	.78
60	96.5	97.2	97.0	97.4	96.7	95.1	96.1	95.1	94.7
50	97.6	98.7	99.0	99.6	98.9	97.3	98.2	95.0	93.8
40	98.8	99.8	100.4	101.2	101.0	99.3	100.1	97.0	95.8
30	99.1	101.1	101.6	102.4	102.5	101.2	101.9	98.8	97.7
20	97.5	101.3	103.3	103.8	104.1	102.8	103.4	100.5	99.4
10	95.8	99.6	102.9	104.4	105.6	104.6	104.7	102.6	100.9
0	94.2	97.8	101.1	102.6	105.0	106.9	106.5	104.3	102.4
-10	92.5	96.1	99.4	100.8	103.2	105.3	107.1	106.3	104.3
-20	90.8	94.3	97.6	99.0	101.5	103.4	105.1	106.5	106.4
-30	89.1	92.4	95.7	97.1	99.7	101.5	103.2	104.4	104.4
-40	87.3	90.5	93.9	95.2	97.8	99.5	101.2	102.2	102.2
-50	85.5	88.6	91.9	93.3	95.8	97.5	99.1	100.1	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	0	5	10	15	20	25	30	35	40
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.8	-0.9	-1.1	-1.4	-1.9
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.1	-1.3	-1.4	-1.7	-2.2	-2.4

Go-around %N1

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F		-1000	0	2000	4000	6000	8000
55	131	58	106.3	106.2	106.2	105.9	105.5	105.1
50	122	53	107.5	107.3	107.2	107.0	106.5	106.2
45	113	48	108.5	108.3	108.3	108.0	107.5	107.2
40	104	43	109.4	109.3	109.4	109.0	108.6	108.2
35	95	38	110.4	110.3	110.5	110.1	109.8	109.2
30	86	33	110.7	111.3	111.5	111.0	111.0	110.2
25	77	28	109.9	110.5	112.1	111.9	112.1	111.2
20	68	23	109.0	109.6	111.2	112.1	112.8	112.1
15	59	18	108.2	108.8	110.3	111.2	112.5	112.6
10	50	13	107.3	107.9	109.5	110.3	111.6	111.9
0	32	3	105.6	106.2	107.7	108.5	109.8	110.1
-10	14	-7	103.8	104.4	105.9	106.7	108.0	108.3
-20	-4	-17	102.0	102.6	104.0	104.8	106.1	106.4
-30	-22	-27	100.1	100.7	102.1	102.9	104.1	104.5
-40	-40	-37	98.2	98.8	100.2	100.9	102.1	102.5
-50	-58	-47	96.3	96.8	98.2	98.9	100.1	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (.290/.78)**Flaps Up, Set Max Climb Thrust**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	4.0	4.0			
	V/S (FT/MIN)	1600	1000			
30000	PITCH ATT	4.5	4.0	4.0	4.0	4.0
	V/S (FT/MIN)	2700	2100	1700	1300	1000
20000	PITCH ATT	7.0	6.5	6.0	6.0	5.5
	V/S (FT/MIN)	4200	3400	2700	2300	1900
10000	PITCH ATT	10.5	9.0	8.5	8.0	7.5
	V/S (FT/MIN)	5600	4500	3700	3200	2700
SEA LEVEL	PITCH ATT	13.5	11.5	10.5	9.5	9.0
	V/S (FT/MIN)	6300	5100	4300	3600	3100

Cruise (.78/290)**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	2.0	2.5	3.5		
	%N1	88.1	92.1	97.5		
35000	PITCH ATT	1.5	2.0	2.5	3.0	3.5
	%N1	85.1	87.3	90.0	93.6	98.2
30000	PITCH ATT	1.0	1.5	2.0	2.0	2.5
	%N1	84.2	85.7	87.4	89.4	91.9
25000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	80.7	82.2	83.8	85.8	87.9
20000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	76.7	78.2	79.8	81.9	83.9
15000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	72.7	74.3	76.1	77.9	79.9

Descent (.78/290)**Flaps Up, Set Idle Thrust**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	-1.5	-0.5	0.0	0.5	1.0
	V/S (FT/MIN)	-2600	-2600	-2700	-2800	-3100
30000	PITCH ATT	-2.5	-1.5	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2700	-2400	-2200	-2100	-2000
20000	PITCH ATT	-2.5	-1.5	-1.0	0.0	0.5
	V/S (FT/MIN)	-2400	-2100	-2000	-1900	-1800
10000	PITCH ATT	-2.5	-1.5	-1.0	-0.5	0.5
	V/S (FT/MIN)	-2100	-1900	-1700	-1700	-1600
SEA LEVEL	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2000	-1700	-1600	-1500	-1500

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF30+80)

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	58.7	63.4	67.3	70.9	74.4
	KIAS	199	211	222	236	251
5000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	54.8	59.0	63.1	66.8	69.9
	KIAS	199	211	222	236	251

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (GEAR POSITION) (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS UP (GEAR UP) (VREF30+80)	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	55.6	60.1	64.6	68.0	71.1
	KIAS	199	211	222	236	251
FLAPS 1 (GEAR UP) (VREF30+60)	PITCH ATT	6.0	6.5	6.5	6.5	6.5
	%N1	56.6	61.6	65.8	69.4	72.9
	KIAS	179	191	202	216	231
FLAPS 5 (GEAR UP) (VREF30+40)	PITCH ATT	4.5	4.5	5.0	4.5	4.5
	%N1	59.0	64.1	68.3	72.4	75.7
	KIAS	159	171	182	196	211
FLAPS 15 (GEAR UP) (VREF30+20)	PITCH ATT	5.5	5.5	6.0	6.0	5.5
	%N1	61.1	65.9	70.6	74.3	77.6
	KIAS	139	151	162	176	191
FLAPS 20 (GEAR DOWN) (VREF30+20)	PITCH ATT	4.0	4.5	4.5	4.0	3.5
	%N1	67.6	72.9	77.5	81.6	85.4
	KIAS	139	151	162	176	191

Final Approach (1500 FT)

Gear Down, Set Thrust for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS 20 (VREF20 +10)	PITCH ATT	1.5	1.5	1.5	1.5	1.5
	%N1	48.0	51.8	55.6	59.2	62.6
	KIAS	138	150	162	172	184

Go-Around (VREF 30 + 20)

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	18.5	15.0	12.5	10.5	9.0
	V/S (FT/MIN)	4000	3300	2700	2300	2000
	KIAS	139	151	162	176	191
5000	PITCH ATT	22.0	18.0	15.5	13.0	10.5
	V/S (FT/MIN)	4700	3900	3300	2900	2600
	KIAS	139	151	162	176	191
SEA LEVEL	PITCH ATT	26.0	21.0	18.0	15.0	12.5
	V/S (FT/MIN)	5200	4400	3800	3300	3000
	KIAS	139	151	162	176	191



Performance Inflight

All Engine

Chapter PI

Section 41

Long Range Cruise Maximum Operating Altitude

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°)
190	28900	-1	34400	33500	32600	30900	29300
185	29400	-2	35000	34100	33200	31500	29900
180	30100	-4	35600	34700	33800	32100	30500
175	30700	-5	36100	35300	34400	32700	31100
170	31300	-7	36800	35900	35000	33300	31800
165	31900	-8	37400	36500	35600	34000	32400
160	32600	-9	38000	37100	36300	34600	33100
155	33300	-11	38700	37800	36900	35300	33800
150	34000	-13	39400	38500	37600	36000	34500
145	34700	-14	40100	39200	38300	36700	35200
140	35400	-16	40800	39900	39000	37400	35900
135	36200	-17	41500	40700	39800	38200	36700
130	37000	-17	42300	41400	40600	38900	37400
125	37800	-17	43000	42300	41400	39800	38300
120	38600	-17	43000	43000	42200	40600	39100
115	39500	-17	43000	43000	43000	41500	40000
110	40500	-17	43000	43000	43000	42400	40900
105	41400	-17	43000	43000	43000	43000	41900
100	42400	-17	43000	43000	43000	43000	42900

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°)
190	28900	5	33800*	33500	32600	30900	29300
185	29400	3	34400*	34100	33200	31500	29900
180	30100	2	35000*	34700	33800	32100	30500
175	30700	1	35600*	35300	34400	32700	31100
170	31300	-1	36200*	35900	35000	33300	31800
165	31900	-2	36800*	36500	35600	34000	32400
160	32600	-4	37400*	37100	36300	34600	33100
155	33300	-5	38000*	37800	36900	35300	33800
150	34000	-7	38600*	38500	37600	36000	34500
145	34700	-8	39300*	39200	38300	36700	35200
140	35400	-10	40000*	39900	39000	37400	35900
135	36200	-12	40700*	40700	39800	38200	36700
130	37000	-12	41500*	41400	40600	38900	37400
125	37800	-12	42200*	42200*	41400	39800	38300
120	38600	-12	43000	43000	42200	40600	39100
115	39500	-12	43000	43000	43000	41500	40000
110	40500	-12	43000	43000	43000	42400	40900
105	41400	-12	43000	43000	43000	43000	41900
100	42400	-12	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.

Long Range Cruise Maximum Operating Altitude 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°)
190	28900	10	32700*	32700*	32600	30900	29300
185	29400	9	33400*	33400*	33200	31500	29900
180	30100	8	34000*	34000*	33800	32100	30500
175	30700	6	34700*	34700*	34400	32700	31100
170	31300	5	35300*	35300*	35000	33300	31800
165	31900	3	35900*	35900*	35600	34000	32400
160	32600	2	36500*	36500*	36300	34600	33100
155	33300	0	37100*	37100*	36900	35300	33800
150	34000	-1	37700*	37700*	37600	36000	34500
145	34700	-3	38400*	38400*	38300	36700	35200
140	35400	-4	39100*	39100*	39000	37400	35900
135	36200	-6	39800*	39800*	39800	38200	36700
130	37000	-6	40600*	40600*	40600	38900	37400
125	37800	-6	41300*	41300*	41300*	39800	38300
120	38600	-6	42100*	42100*	42100*	40600	39100
115	39500	-6	43000	43000	43000	41500	40000
110	40500	-6	43000	43000	43000	42400	40900
105	41400	-6	43000	43000	43000	43000	41900
100	42400	-6	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		23	25	27	29	31	33	35	37	39	41	43
190	%N1	89.7	90.8	92.0	93.4	95.2	97.6					
	MACH	.772	.787	.799	.804	.802	.798					
	KIAS	338	331	324	312	298	284					
	FF/ENG	3272	3196	3145	3109	3115	3191					
180	%N1	88.7	89.7	90.9	92.1	93.7	95.6	98.8				
	MACH	.762	.777	.792	.802	.803	.800	.797				
	KIAS	334	327	320	312	299	285	271				
	FF/ENG	3131	3054	3000	2957	2931	2951	3086				
170	%N1	87.6	88.6	89.7	90.9	92.2	94.0	96.2				
	MACH	.751	.767	.782	.797	.804	.802	.799				
	KIAS	329	323	316	309	299	285	272				
	FF/ENG	2983	2915	2856	2814	2773	2765	2809				
160	%N1	86.3	87.5	88.5	89.7	90.9	92.3	94.2	97.4			
	MACH	.736	.756	.772	.788	.800	.804	.801	.798			
	KIAS	322	318	312	305	297	286	272	259			
	FF/ENG	2825	2772	2717	2671	2629	2598	2599	2693			
150	%N1	84.9	86.3	87.3	88.4	89.5	90.8	92.4	94.8	99.2		
	MACH	.715	.743	.761	.776	.792	.803	.803	.800	.797		
	KIAS	312	312	307	300	294	285	273	260	247		
	FF/ENG	2643	2623	2577	2530	2489	2449	2429	2463	2609		
140	%N1	83.2	84.7	86.1	87.1	88.2	89.4	90.7	92.8	95.9		
	MACH	.692	.721	.747	.764	.780	.795	.804	.802	.799		
	KIAS	301	302	301	295	289	283	273	261	248		
	FF/ENG	2460	2448	2431	2392	2347	2311	2277	2279	2345		
130	%N1	81.4	83.0	84.4	85.7	86.8	87.9	89.1	90.9	93.5	97.0	
	MACH	.668	.696	.726	.750	.767	.783	.798	.804	.802	.798	
	KIAS	290	291	292	289	284	278	271	261	248	236	
	FF/ENG	2281	2266	2263	2247	2210	2169	2136	2119	2144	2222	
120	%N1	79.4	81.1	82.6	84.1	85.3	86.4	87.5	89.1	91.5	94.1	97.9
	MACH	.645	.670	.698	.729	.752	.770	.786	.800	.804	.801	.798
	KIAS	279	279	280	281	278	273	267	260	249	237	225
	FF/ENG	2110	2093	2082	2085	2068	2032	1996	1976	1975	2005	2089
110	%N1	77.4	78.8	80.5	82.1	83.6	84.8	85.9	87.4	89.5	91.9	94.5
	MACH	.621	.645	.671	.699	.730	.753	.771	.787	.801	.804	.801
	KIAS	269	268	268	268	269	266	261	255	248	238	226
	FF/ENG	1947	1927	1912	1904	1911	1893	1859	1837	1829	1830	1861
100	%N1	75.3	76.6	78.1	79.8	81.4	82.9	84.1	85.6	87.6	89.7	92.0
	MACH	.596	.619	.642	.669	.698	.729	.753	.771	.788	.801	.804
	KIAS	257	257	256	256	256	257	254	249	244	237	227
	FF/ENG	1786	1769	1750	1736	1733	1741	1722	1699	1689	1681	1683

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	161
564	522	485	453	425	400	382	366	351	337	324
847	784	728	680	638	600	574	549	527	507	488
1131	1047	971	907	850	800	765	733	703	676	651
1416	1310	1215	1134	1063	1000	956	916	879	845	814
1702	1573	1459	1361	1276	1200	1148	1100	1055	1014	977
1990	1839	1704	1589	1490	1400	1339	1283	1231	1183	1140
2279	2105	1950	1818	1703	1600	1531	1466	1407	1352	1302
2570	2372	2197	2047	1917	1800	1722	1649	1582	1520	1464
2861	2640	2443	2276	2130	2000	1913	1832	1757	1689	1626

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.7	0:39	2.3	0:38	2.0	0:36	1.7	0:35	1.5	0:35
400	5.6	1:14	5.0	1:11	4.4	1:07	4.0	1:04	3.7	1:01
600	8.5	1:49	7.7	1:44	6.8	1:37	6.3	1:32	5.8	1:28
800	11.3	2:25	10.4	2:17	9.2	2:08	8.5	2:01	7.9	1:55
1000	14.1	3:01	13.0	2:51	11.6	2:39	10.7	2:30	9.9	2:23
1200	16.9	3:37	15.6	3:25	14.0	3:10	12.9	2:59	12.0	2:50
1400	19.7	4:13	18.2	4:00	16.3	3:41	15.1	3:29	14.0	3:17
1600	22.4	4:50	20.8	4:34	18.6	4:13	17.3	3:59	16.0	3:45
1800	25.1	5:28	23.3	5:09	20.9	4:45	19.4	4:29	18.0	4:13
2000	27.8	6:06	25.8	5:45	23.2	5:17	21.5	4:59	20.0	4:41

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.2	-0.1	0.0	0.1	0.2
4	-0.5	-0.2	0.0	0.3	0.5
6	-0.8	-0.4	0.0	0.4	0.9
8	-1.1	-0.5	0.0	0.6	1.2
10	-1.3	-0.7	0.0	0.8	1.5
12	-1.6	-0.8	0.0	0.9	1.9
14	-1.9	-0.9	0.0	1.1	2.2
16	-2.2	-1.1	0.0	1.3	2.5
18	-2.5	-1.2	0.0	1.4	2.9
20	-2.7	-1.4	0.0	1.6	3.2
22	-3.0	-1.5	0.0	1.8	3.5
24	-3.3	-1.7	0.0	1.9	3.9
26	-3.6	-1.8	0.0	2.1	4.2
28	-3.9	-1.9	0.0	2.3	4.5
30	-4.2	-2.1	0.0	2.5	4.8
32	-4.4	-2.2	0.0	2.6	5.2

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
1297	1225	1159	1101	1048	1000	957	918	881	848	817
1943	1836	1738	1651	1572	1500	1437	1378	1323	1273	1228
2591	2448	2318	2201	2096	2000	1916	1838	1766	1699	1638
3243	3063	2899	2753	2621	2500	2395	2298	2208	2125	2049
3899	3682	3483	3306	3147	3000	2875	2758	2650	2551	2460
4559	4303	4069	3860	3672	3500	3354	3218	3092	2977	2871
5223	4926	4656	4415	4199	4000	3833	3678	3535	3403	3282
5892	5553	5245	4971	4726	4500	4313	4138	3977	3828	3693
6565	6184	5837	5529	5253	5000	4792	4598	4419	4254	4103
7243	6818	6431	6089	5781	5500	5271	5059	4861	4680	4514
7925	7455	7027	6649	6310	6000	5750	5518	5302	5104	4923

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)
1000	9.8	2:22	9.4	2:20	9.2	2:19	8.9	2:18	8.9	2:19
1500	14.8	3:29	14.3	3:27	13.9	3:25	13.6	3:23	13.5	3:24
2000	19.7	4:38	19.1	4:34	18.5	4:31	18.1	4:29	17.9	4:29
2500	24.5	5:48	23.8	5:42	23.1	5:38	22.5	5:35	22.3	5:34
3000	29.2	6:59	28.4	6:51	27.5	6:46	26.8	6:42	26.5	6:40
3500	33.8	8:12	32.8	8:01	31.9	7:54	31.1	7:49	30.6	7:46
4000	38.3	9:27	37.2	9:13	36.1	9:03	35.2	8:57	34.6	8:52
4500	42.7	10:42	41.5	10:25	40.3	10:13	39.3	10:05	38.6	10:00
5000	47.0	12:00	45.6	11:40	44.4	11:24	43.2	11:15	42.4	11:07
5500	51.2	13:18	49.7	12:56	48.4	12:37	47.1	12:25	46.2	12:16
6000	55.3	14:39	53.7	14:13	52.3	13:51	50.9	13:36	49.9	13:25

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	1.2	2.3
10	-1.5	-0.8	0.0	2.4	4.9
15	-2.3	-1.2	0.0	3.5	7.4
20	-3.2	-1.6	0.0	4.6	9.6
25	-4.0	-2.0	0.0	5.5	11.6
30	-4.8	-2.5	0.0	6.3	13.4
35	-5.7	-2.9	0.0	7.0	15.0
40	-6.5	-3.3	0.0	7.6	16.3
45	-7.4	-3.7	0.0	8.0	17.4
50	-8.3	-4.1	0.0	8.4	18.3
55	-9.2	-4.5	0.0	8.7	18.9
60	-10.0	-4.9	0.0	8.8	19.4
65	-10.9	-5.3	0.0	8.9	19.6
70	-11.8	-5.7	0.0	8.8	19.6

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)														
	190	180	170	160	150	140	135	130	125	120	115	110	105	100	
43									46	30	18	9	3	1	
41							38	25	15	7	3	1	1	3	
39					42	19	11	5	2	0	1	3	6	12	
37				30	13	3	1	0	1	3	7	12	17	24	
35		38	19	7	1	1	2	5	8	13	18	24	31	38	
33	24	11	4	0	2	6	10	14	19	25	31	38	45	53	
31	5	1	1	3	9	17	22	27	33	39	46	53	60	68	
29	0	2	5	11	20	29	35	41	47	53	60	67	74	81	
27	4	8	15	23	33	43	49	55	61	67	74	80	87	94	
25	12	19	27	36	46	57	63	68	74	80	86	93	99	105	
23	23	31	40	50	60	70	76	81	87	93	98	104	110	115	

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 .78/290/250

PRESSURE ALT (1000 FT)	17	19	21	23	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	66	73	80	87	94	101	108	115	120	126	131	137	142	147
TIME (MINUTES)	16	17	18	19	20	21	22	23	24	25	26	26	27	28

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
190	%N1	68.7	71.4	76.0	80.2	84.3	88.6	93.2		
	KIAS	259	259	259	259	259	259	261		
	FF/ENG	2940	2920	2890	2870	2870	2910	2960		
180	%N1	67.2	69.9	74.4	78.7	82.8	87.1	91.6		
	KIAS	251	251	251	251	251	251	254		
	FF/ENG	2790	2760	2730	2710	2700	2740	2780		
170	%N1	65.8	68.4	72.6	77.1	81.4	85.5	89.9	95.4	
	KIAS	244	244	244	244	244	244	246	254	
	FF/ENG	2640	2610	2580	2560	2550	2570	2610	2780	
160	%N1	63.9	66.8	70.9	75.4	79.8	84.0	88.3	93.3	
	KIAS	236	236	236	236	236	236	238	241	
	FF/ENG	2500	2460	2430	2410	2390	2400	2430	2520	
150	%N1	62.0	65.1	69.1	73.7	78.0	82.2	86.6	91.3	
	KIAS	228	228	228	228	228	228	230	233	
	FF/ENG	2350	2310	2280	2250	2240	2240	2260	2310	
140	%N1	60.1	63.1	67.3	71.6	76.1	80.4	84.7	89.3	
	KIAS	222	222	222	222	222	222	222	224	
	FF/ENG	2210	2170	2130	2110	2090	2080	2100	2140	
130	%N1	58.2	61.1	65.4	69.5	74.1	78.6	82.8	87.2	94.2
	KIAS	217	217	217	217	217	217	217	217	219
	FF/ENG	2080	2040	1990	1970	1940	1930	1940	1970	2120
120	%N1	56.2	59.0	63.4	67.4	72.1	76.4	80.7	85.1	91.6
	KIAS	211	211	211	211	211	211	211	211	211
	FF/ENG	1940	1910	1860	1830	1810	1790	1790	1800	1890
110	%N1	54.3	56.9	61.1	65.4	69.6	74.2	78.6	82.8	89.0
	KIAS	205	205	205	205	205	205	205	205	205
	FF/ENG	1810	1780	1730	1700	1670	1660	1640	1650	1710
100	%N1	52.3	54.8	58.7	63.3	67.2	72.0	76.3	80.6	86.5
	KIAS	199	199	199	199	199	199	199	199	199
	FF/ENG	1680	1650	1600	1570	1540	1520	1510	1510	1560

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Advisory Information

Chapter PI

Section 42

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF25	ONE REV	NO REV
MAX MANUAL	3200	110/-60	80	-130	440	50	-40	80	-70	250	80	170
MAX AUTO	5370	130/-130	150	-250	840	0	0	160	-160	600	0	0
AUTOBRAKE 4	5540	140/-140	160	-260	880	0	0	160	-160	630	0	0
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	-20	190	-190	710	0	0
AUTOBRAKE 2	7090	190/-190	220	-350	1190	50	-120	220	-210	630	110	110
AUTOBRAKE 1	7740	220/-220	250	-390	1360	170	-220	250	-230	580	480	620

Good Reported Braking Action

MAX MANUAL	5060	120/-120	140	-240	830	140	-120	140	-130	400	300	660
MAX AUTO	6180	150/-150	180	-290	980	20	0	180	-180	700	20	90
AUTOBRAKE 4	6370	160/-160	180	-300	1010	10	0	190	-190	720	10	60
AUTOBRAKE 3	7320	190/-190	220	-350	1190	0	-20	220	-220	820	0	0

Medium Reported Braking Action

MAX MANUAL	6940	190/-190	220	-370	1360	340	-270	210	-190	510	790	1910
MAX AUTO	6970	190/-180	220	-380	1370	300	-180	210	-200	660	700	1820
AUTOBRAKE 4	7050	190/-190	220	-380	1380	280	-160	220	-200	710	610	1730
AUTOBRAKE 3	7670	210/-200	230	-400	1450	180	-120	230	-230	820	410	1270

Poor Reported Braking Action

MAX MANUAL	8960	270/-260	300	-550	2100	760	-500	290	-260	590	1670	4460
MAX AUTO	8960	270/-260	300	-550	2100	760	-500	290	-260	590	1670	4470
AUTOBRAKE 4	8960	270/-260	300	-550	2100	770	-500	290	-260	600	1670	4470
AUTOBRAKE 3	9050	270/-260	300	-550	2110	700	-410	290	-270	760	1530	4320

Reference distance assumes sea level, standard day, no wind or slope, VREF25 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 460 ft.

Reference distance for auto braking is applicable for auto or manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABV SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABV VREF 30	ONE REV	NO REV
MAX MANUAL	3150	140/-70	80	-130	440	50	-40	80	-70	250	80	160
MAX AUTO	5220	210/-140	150	-240	830	0	0	150	-150	600	0	0
AUTOBRAKE 4	5380	220/-140	150	-250	870	0	0	160	-160	620	0	0
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	-10	190	-190	720	0	0
AUTOBRAKE 2	6930	280/-200	210	-340	1180	40	-110	210	-210	640	80	80
AUTOBRAKE 1	7590	300/-220	240	-390	1350	160	-210	240	-230	580	410	540

Good Reported Braking Action

MAX MANUAL	5000	180/-130	140	-240	830	140	-120	140	-130	400	280	620
MAX AUTO	6010	250/-160	170	-280	970	20	0	170	-170	690	20	90
AUTOBRAKE 4	6190	260/-170	180	-290	1000	10	0	180	-180	710	10	60
AUTOBRAKE 3	7110	300/-200	210	-340	1180	0	-10	210	-210	830	0	0

Medium Reported Braking Action

MAX MANUAL	6860	260/-190	210	-370	1370	350	-270	210	-190	510	740	1770
MAX AUTO	6860	280/-190	210	-380	1370	320	-190	210	-200	650	690	1720
AUTOBRAKE 4	6920	290/-200	220	-380	1380	300	-170	210	-200	690	620	1650
AUTOBRAKE 3	7480	320/-210	230	-400	1440	190	-110	230	-220	830	410	1220

Poor Reported Braking Action

MAX MANUAL	8870	360/-270	300	-550	2110	780	-510	290	-260	600	1580	4140
MAX AUTO	8870	360/-270	300	-550	2100	780	-510	290	-260	590	1580	4150
AUTOBRAKE 4	8870	360/-270	300	-550	2100	780	-510	290	-260	590	1580	4150
AUTOBRAKE 3	8920	380/-270	300	-550	2110	730	-420	290	-270	770	1480	4050

Reference distance assumes sea level, standard day, no wind or slope, VREF30 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 460 ft.

Reference distance for auto braking is applicable for both auto and manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance Dry Runway

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	4210	90/-90	100	-170/570	90/-80	110/-110	420	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	4130	160/-100	100	-170/570	90/-80	110/-110	440	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	4530	260/-110	130	-170/570	80/-70	130/-120	320	200	440
ANTI-SKID OFF (FLAPS 25)	VREF25	5920	160/-150	160	-290/1010	190/-160	160/-150	440	410	960
ANTI-SKID OFF (FLAPS 30)	VREF30	5770	230/-160	160	-290/1010	190/-160	160/-150	450	380	880
ENGINE FAILURE (FLAPS 20)	VREF20	3460	150/-80	90	-140/470	60/-50	90/-90	280	0	110
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	4140	110/-100	100	-160/530	70/-60	100/-100	380	140	300
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	3350	90/-80	80	-130/460	50/-50	80/-80	290	100	200
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	3300	130/-80	80	-130/460	60/-50	80/-80	300	90	190
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	3680	90/-90	90	-150/530	70/-60	90/-90	310	140	300
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	3620	140/-90	90	-150/530	70/-70	90/-90	330	130	280
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	4890	190/-110	130	-180/600	100/-90	130/-130	510	230	510
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	4570	180/-110	130	-180/610	110/-90	130/-120	420	260	570
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	5800	240/-150	170	-230/780	160/-140	170/-160	580	430	990

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Dry Runway

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
LE SLAT ASYM (FLAPS = 20)	VREF30+30	4140	170/-90	110	-150/520	70/-60	110/-110	310	160	340
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	4440	170/-100	120	-160/540	80/-70	120/-120	320	180	390
LE SLAT DISAGREE (FLAPS > 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	3940	180/-90	100	-150/500	60/-60	100/-100	280	140	290
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	4260	180/-100	110	-160/540	80/-70	120/-110	330	0	180
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	6240	150/-150	180	-300/1010	270/-220	180/-180	620	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	6090	250/-150	180	-300/1010	280/-230	180/-180	640	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	6220	220/-160	190	-250/860	160/-150	190/-180	380	530	1220
ANTI-SKID OFF (FLAPS 25)	VREF25	6660	190/-180	190	-350/1240	290/-230	190/-180	490	630	1530
ANTI-SKID OFF (FLAPS 30)	VREF30	6500	260/-180	190	-350/1240	290/-230	190/-180	490	590	1410
ENGINE FAILURE (FLAPS 20)	VREF20	4980	150/-130	140	-230/800	160/-140	140/-140	410	0	410
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	5600	170/-150	160	-250/840	170/-150	160/-150	510	430	1010
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	5760	240/-160	180	-250/860	190/-170	180/-170	510	530	1250
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	5130	200/-130	150	-230/790	150/-130	150/-140	380	380	860
LE SLAT ASYM (FLAPS = 20)	VREF30+30	5770	220/-150	170	-250/840	170/-150	170/-170	420	470	1080
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	6180	230/-160	190	-260/870	180/-160	190/-180	430	520	1190
LE SLAT DISAGREE (FLAPS > 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	5500	200/-140	160	-240/810	150/-140	160/-160	380	420	950
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	6160	230/-160	180	-270/900	210/-180	190/-180	470	0	590
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	9940	240/-230	310	-560/1950	1000/-670	320/-320	870	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	9650	370/-230	310	-550/1940	1000/-670	320/-320	870	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	8820	340/-250	300	-400/1400	410/-330	300/-270	520	1430	3670
ANTI-SKID OFF (FLAPS 25)	VREF25	8370	260/-250	260	-500/1870	640/-440	250/-230	560	1370	3680
ANTI-SKID OFF (FLAPS 30)	VREF30	8180	350/-250	260	-500/1870	650/-440	250/-230	560	1290	3390
ENGINE FAILURE (FLAPS 20)	VREF20	7250	240/-220	230	-390/1360	440/-340	230/-220	560	0	1250
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	7520	260/-230	240	-380/1340	400/-310	240/-220	630	1120	2890
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	7850	350/-240	270	-390/1370	430/-340	260/-240	620	1300	3370
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090

***Reference distance assumes sea level, standard day with no wind or slope.**

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	7070	290/-210	230	-360/1280	350/-280	230/-210	490	980	2430
LE SLAT ASYM (FLAPS = 20)	VREF30+30	7900	320/-230	260	-380/1350	390/-320	260/-240	530	1170	2930
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	8430	340/-250	290	-400/1380	410/-330	280/-260	540	1340	3430
LE SLAT DISAGREE (FLAPS > 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	7550	300/-220	250	-370/1310	360/-290	250/-230	490	1050	2620
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	8860	360/-260	290	-430/1510	530/-420	290/-280	610	0	1680
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010	2540
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110	2810
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880	2200
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010	2540
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110	2810

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	16490	320/-200	570	-1120/4230	6080/-2020	600/-590	1090	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	15920	480/-200	550	-1100/4180	5960/-1970	580/-570	1080	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	11600	480/-370	430	-590/2140	900/-630	410/-370	640	3020	8970
ANTI-SKID OFF (FLAPS 25)	VREF25	10950	380/-360	370	-800/3310	3040/-940	350/-310	630	3540	14250
ANTI-SKID OFF (FLAPS 30)	VREF30	10760	480/-360	360	-800/3310	3040/-950	350/-310	630	3380	13380
ENGINE FAILURE (FLAPS 20)	VREF20	9970	360/-320	340	-600/2200	1100/-700	330/-310	690	0	3070
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	9560	360/-310	330	-550/2030	840/-570	320/-290	710	2280	6740
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	10000	460/-330	360	-560/2060	890/-610	350/-310	690	2540	7490
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)							
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	9120	400/-290	320	-530/1950	760/-520	310/-280	570	2010 5610
LE SLAT ASYM (FLAPS = 20)	VREF30+30	10100	430/-320	360	-560/2040	820/-570	350/-320	600	2310 6530
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	10880	460/-350	400	-570/2100	870/-610	380/-340	630	2700 7890
LE SLAT DISAGREE (FLAPS > 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	9680	410/-310	340	-540/1990	780/-540	330/-300	560	2120 5910
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	11960	500/-380	420	-660/2380	1260/-830	410/-390	730	0 3880
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160 6210
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290 6540
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160 6210
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290 6540

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (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
180	0	15.1	16.1	17.0	22.8	24.3	25.8	31.8	33.9	35.9	41.8	44.6	47.4	52.7	56.3	59.9			
	10	15.7	16.6	17.6	23.6	25.1	26.6	32.9	35.0	37.2	43.2	46.1	49.1	54.5	58.3	62.0			
	20	16.2	17.2	18.2	24.4	26.0	27.5	34.0	36.2	38.5	44.7	47.7	50.7	56.4	60.3	64.2			
	30	16.7	17.7	18.7	25.2	26.8	28.4	35.0	37.4	39.7	46.1	49.2	52.3	58.2	62.2	66.2			
	40	16.9	18.0	19.0	25.6	27.3	29.0	35.8	38.2	40.5	47.2	50.4	53.6	59.6	63.7	67.9			
160	0	13.7	14.5	15.3	20.6	21.9	23.2	28.5	30.4	32.3	37.5	40.0	42.5	47.2	50.4	53.6	57.6	61.6	65.6
	10	14.1	15.0	15.9	21.3	22.6	24.0	29.5	31.5	33.4	38.8	41.4	44.0	48.9	52.2	55.5	59.6	63.8	67.9
	20	14.6	15.5	16.4	22.0	23.4	24.8	30.5	32.5	34.5	40.1	42.8	45.4	50.5	54.0	57.4	61.7	65.9	70.2
	30	15.0	16.0	16.9	22.7	24.1	25.5	31.5	33.5	35.6	41.3	44.1	46.9	52.1	55.7	59.3	63.7	68.1	72.5
	40	15.3	16.2	17.2	23.1	24.5	26.0	32.1	34.2	36.3	42.3	45.1	48.0	53.4	57.0	60.7	65.2	69.8	74.3
140	0	12.2	13.0	13.7	18.3	19.4	20.6	25.3	26.9	28.6	33.1	35.3	37.4	41.5	44.3	47.1	50.6	54.0	57.5
	10	12.7	13.4	14.2	18.9	20.1	21.3	26.2	27.9	29.5	34.2	36.5	38.8	43.0	45.9	48.8	52.4	56.0	59.6
	20	13.1	13.9	14.6	19.6	20.8	22.0	27.0	28.8	30.5	35.4	37.7	40.1	44.4	47.4	50.5	54.1	57.8	61.6
	30	13.5	14.3	15.1	20.2	21.4	22.7	27.9	29.7	31.5	36.5	38.9	41.3	45.9	49.0	52.1	55.9	59.7	63.6
	40	13.7	14.5	15.3	20.5	21.8	23.1	28.4	30.3	32.1	37.3	39.8	42.2	46.9	50.1	53.3	57.2	61.2	65.1
120	0	10.8	11.5	12.1	16.0	17.0	18.0	22.0	23.4	24.8	28.6	30.5	32.3	35.7	38.1	40.5	43.3	46.2	49.1
	10	11.2	11.9	12.5	16.6	17.6	18.6	22.8	24.2	25.7	29.6	31.5	33.4	37.0	39.4	41.9	44.8	47.8	50.9
	20	11.6	12.2	12.9	17.1	18.2	19.3	23.5	25.0	26.5	30.6	32.6	34.6	38.2	40.7	43.3	46.3	49.4	52.6
	30	11.9	12.6	13.3	17.7	18.8	19.9	24.2	25.8	27.3	31.5	33.6	35.7	39.4	42.0	44.7	47.8	51.0	54.3
	40	12.1	12.8	13.5	18.0	19.1	20.2	24.7	26.3	27.9	32.2	34.3	36.4	40.3	43.0	45.7	48.9	52.2	55.6
100	0	9.4	10.0	10.5	13.8	14.6	15.5	18.7	19.8	21.0	24.0	25.5	27.1	29.7	31.6	33.6	35.7	38.0	40.4
	10	9.8	10.3	10.9	14.3	15.1	16.0	19.3	20.5	21.7	24.8	26.4	28.0	30.7	32.7	34.7	36.9	39.4	41.8
	20	10.1	10.7	11.2	14.7	15.6	16.5	20.0	21.2	22.5	25.7	27.3	29.0	31.7	33.8	35.9	38.2	40.7	43.2
	30	10.4	11.0	11.6	15.2	16.1	17.0	20.6	21.9	23.2	26.5	28.2	29.9	32.7	34.9	37.0	39.4	42.0	44.6
	40	10.5	11.1	11.7	15.4	16.4	17.3	20.9	22.3	23.6	27.0	28.7	30.5	33.4	35.6	37.8	40.2	42.9	45.6

*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, altitude, and OAT effects.

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	RTO MAX MAN	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0
	MAX MAN	1.0	6.1	11.2	16.1	21.0	25.8	30.5	35.2	39.8	44.5	49.1	53.8
	MAX AUTO	1.7	6.1	10.4	14.7	18.9	23.1	27.3	31.5	35.8	40.0	44.3	48.7
	AUTOBRAKE 4	1.9	6.0	10.1	14.1	18.1	22.0	26.0	29.9	33.8	37.8	41.8	45.8
	AUTOBRAKE 3	1.8	5.7	9.5	13.2	17.0	20.7	24.3	28.0	31.6	35.3	39.0	42.8
	AUTOBRAKE 2	1.7	5.4	9.0	12.5	15.9	19.3	22.7	26.1	29.4	32.8	36.2	39.7
	AUTOBRAKE 1	1.7	5.0	8.2	11.3	14.4	17.4	20.3	23.3	26.2	29.1	32.1	35.0

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Two Engines Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	MAX MAN	0.0	5.0	9.9	14.6	19.2	23.8	28.2	32.6	37.0	41.3	45.6	49.9
	MAX AUTO	0.2	3.7	7.3	10.8	14.3	17.9	21.5	25.1	28.7	32.4	36.2	40.0
	AUTOBRAKE 4	0.0	2.9	6.0	9.0	12.1	15.1	18.2	21.3	24.5	27.7	30.9	34.2
	AUTOBRAKE 3	0.0	1.8	4.3	6.9	9.5	12.1	14.8	17.4	20.1	23.9	25.7	28.6
	AUTOBRAKE 2	0.0	0.7	2.8	4.8	6.9	8.9	11.0	13.1	15.3	17.6	19.9	22.2
	AUTOBRAKE 1	0.0	0.4	1.8	3.2	4.6	6.0	7.5	9.0	10.5	12.1	13.8	15.5

Cooling Time (Minutes)
Category "C" and "D" Brakes

		ADJUSTED BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
		14 & BELOW	15	16	18	20	24	28	34	35 TO 42	43 & ABOVE
		BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON EICAS									
		UP TO 1	1	1	2	2	3	4	5	5 TO 6	7 & ABOVE
INFLIGHT	NO SPECIAL	PROCEDURE REQUIRED	1	1	2	2	3	4	6	CAUTION	FUSE PLUG MELT ZONE
GEAR DOWN			11	15	19	24	34	44	59		
GROUND											

Observe maximum quick turnaround limit.

Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.

Add 1.0 million foot pounds per brake for each taxi mile.

For one brake deactivated, increase brake energy by 15 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 6 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 10 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.



Performance Inflight

Engine Inoperative

Chapter PI

Section 43

ENGINE INOP

Initial Max Continuous %N1

Based on .80M, packs on or off and APU on

TAT (°C)	PRESSURE ALTITUDE (1000 FT)							
	29	31	33	35	37	39	41	43
20	103.8	103.4	102.5					
15	104.4	104.0	103.3	102.3	101.1	100.8	100.8	100.8
10	105.2	104.6	104.0	103.2	101.9	101.4	101.4	101.4
5	106.1	105.5	104.7	103.9	102.6	102.1	102.2	102.2
0	107.1	106.4	105.6	104.7	103.3	102.9	102.9	102.9
-5	106.9	107.5	106.6	105.7	104.3	103.9	103.9	103.9
-10	106.0	107.1	107.7	106.7	105.3	104.9	104.9	104.9
-15	105.1	106.2	107.1	107.8	106.5	106.2	106.2	106.2
-20	104.2	105.3	106.2	106.9	106.6	106.4	106.4	106.4
-25	103.2	104.3	105.3	105.8	105.8	105.6	105.6	105.6
-30	102.3	103.3	104.3	104.7	104.7	104.7	104.7	104.7
-35	101.3	102.4	103.3	103.6	103.6	103.6	103.6	103.6
-40	100.3	101.3	102.3	102.6	102.6	102.6	102.6	102.6

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

37000 FT to 27000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

37000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.63	102.6	103.6	104.7	105.8	106.9	105.8	104.8	104.1	103.3	101.8	98.8	95.7	
220	.69	102.6	103.6	104.7	105.8	106.9	105.9	104.8	104.0	103.3	102.4	100.4	97.5	
240	.74	102.6	103.6	104.7	105.8	106.9	106.1	105.0	104.0	103.3	102.5	101.7	99.4	
260	.80	102.6	103.6	104.7	105.8	106.6	106.5	105.3	104.3	103.3	102.6	101.9	101.1	
35000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.60	102.6	103.6	104.7	105.8	106.9	107.2	106.2	105.5	104.7	103.2	100.2	97.1	
220	.66	102.6	103.6	104.7	105.8	106.9	107.3	106.2	105.4	104.7	103.8	101.8	98.8	
240	.71	102.6	103.6	104.7	105.8	106.9	107.5	106.4	105.3	104.6	104.0	102.9	100.5	
260	.77	102.6	103.6	104.7	105.8	106.9	107.7	106.6	105.6	104.5	103.9	103.2	102.1	
33000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.58	102.6	103.6	104.7	105.8	106.9	107.9	107.2	106.5	105.8	104.9	102.6	99.6	
220	.63	102.6	103.6	104.7	105.8	106.9	107.9	107.3	106.3	105.7	105.0	104.1	101.2	
240	.68	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.4	105.5	104.9	104.1	102.7	
260	.74	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.5	105.5	104.7	104.1	103.3	
31000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.55	102.6	103.6	104.7	105.8	106.8	107.9	108.1	107.2	106.6	106.0	105.0	102.0	
220	.61	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.6	106.0	105.3	103.5	
240	.66	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.4	105.7	105.1	104.4	
260	.71	102.6	103.6	104.7	105.8	106.9	107.9	108.3	107.3	106.4	105.5	104.9	104.3	
29000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.5	106.8	106.1	105.5	103.6	100.7
220	.58	102.6	103.6	104.7	105.8	106.9	107.9	108.5	107.7	106.7	106.1	105.5	104.9	102.1
240	.63	102.6	103.6	104.7	105.8	106.9	107.9	108.7	107.7	106.8	106.0	105.4	104.8	103.5
260	.68	102.6	103.6	104.7	105.8	106.9	107.9	108.8	107.7	106.8	105.9	105.3	104.7	104.0
27000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.51	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.1	101.4
220	.56	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.4	105.6	104.9	104.2	102.7
240	.60	102.6	103.6	104.7	105.8	106.9	107.9	108.6	107.6	106.7	105.7	105.0	104.3	103.6
260	.65	102.2	103.2	104.2	105.1	106.1	107.0	107.9	107.8	106.8	105.9	105.0	104.3	103.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	27	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.8	-0.9	-1.0	-1.1	-1.2	-1.4
ENGINE & WING ANTI-ICE ON	-1.7	-1.9	-2.1	-2.3	-2.5	-2.9

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

25000 FT to 16000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

25000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.49	102.6	103.6	104.7	105.8	106.8	107.8	107.8	106.9	105.9	104.9	104.1	103.3	101.8	99.0	
220	.53	102.3	103.3	104.3	105.3	106.2	107.1	107.9	107.1	106.1	105.0	104.2	103.4	102.7	100.3	
240	.58	101.6	102.6	103.6	104.5	105.5	106.4	107.2	107.2	106.3	105.3	104.3	103.6	102.8	101.5	
260	.63	100.8	101.8	102.8	103.8	104.7	105.6	106.5	107.3	106.6	105.6	104.6	103.8	103.0	102.2	
24000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.6	106.6	105.6	104.9	104.1	103.2	100.5	
220	.52	102.3	103.3	104.3	105.3	106.2	107.2	108.0	107.7	106.8	105.8	104.9	104.1	103.4	101.6	
240	.57	101.6	102.6	103.6	104.5	105.5	106.4	107.3	107.8	107.0	106.0	105.0	104.2	103.5	102.7	
260	.61	100.8	101.8	102.8	103.7	104.7	105.6	106.5	107.4	107.1	106.2	105.2	104.4	103.6	102.8	
22000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	108.9	107.9	106.9	106.1	105.2	103.7	
220	.50	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	109.0	108.0	107.0	106.1	105.3	104.4	
240	.55	102.6	103.6	104.7	105.7	106.6	107.6	108.5	109.4	109.2	108.2	107.2	106.3	105.4	104.6	
260	.59	102.0	103.0	104.0	105.0	105.9	106.9	107.8	108.7	109.3	108.5	107.5	106.5	105.6	104.8	
20000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.44	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.8	108.8	107.9	106.9	106.1	104.0
220	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.9	108.9	108.0	107.0	106.1	104.8
240	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	110.1	109.1	108.1	107.2	106.2	105.4
260	.57	102.4	103.4	104.4	105.4	106.4	107.4	108.3	109.3	110.2	110.1	109.3	108.3	107.4	106.4	105.6
18000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.42	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.4	109.4	108.4	107.5	106.7	105.6
220	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.3	109.3	108.3	107.4	106.6	105.7
240	.51	102.3	103.3	104.3	105.3	106.3	107.2	108.2	109.1	110.1	110.2	109.4	108.4	107.4	106.6	105.7
260	.55	101.6	102.6	103.6	104.6	105.6	106.6	107.5	108.5	109.4	110.3	109.5	108.6	107.6	106.7	105.8
16000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.41	100.9	102.0	103.0	104.1	105.1	106.2	107.2	108.2	109.1	110.1	109.5	108.6	107.7	106.9	106.1
220	.45	100.6	101.7	102.7	103.7	104.8	105.8	106.8	107.8	108.8	109.8	109.4	108.5	107.6	106.8	105.9
240	.49	100.3	101.3	102.3	103.4	104.4	105.4	106.4	107.4	108.4	109.4	109.4	108.5	107.5	106.7	105.9
260	.53	99.9	101.0	102.0	103.0	104.0	105.0	106.1	107.1	108.0	109.0	109.5	108.6	107.7	106.8	106.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	16	18	20	22	24	25
ENGINE ANTI-ICE ON	-0.4	-0.4	-0.5	-0.6	-0.7	-0.7
ENGINE & WING ANTI-ICE ON	-1.1	-1.1	-1.2	-1.4	-1.5	-1.5

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

14000 FT to 5000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

14000 FT PRESS ALT									TAT (°C)								
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.39	101.1	102.1	103.1	104.2	105.2	106.3	107.3	108.3	109.3	110.2	109.4	108.5	107.6	106.8	106.1	
220	.43	100.8	101.8	102.8	103.9	104.8	105.8	106.8	107.7	108.6	109.6	109.4	108.4	107.6	106.7	106.0	
240	.47	100.2	101.2	102.2	103.2	104.1	105.1	106.0	107.0	107.9	108.9	109.4	108.4	107.5	106.6	105.9	
260	.51	99.5	100.5	101.5	102.5	103.4	104.4	105.3	106.2	107.2	108.1	109.1	108.4	107.5	106.7	105.9	
12000 FT PRESS ALT									TAT (°C)								
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.38	100.0	101.0	101.9	102.9	103.9	104.8	105.8	106.7	107.7	108.6	109.2	108.2	107.4	106.6	105.8	
220	.41	99.4	100.4	101.4	102.4	103.4	104.3	105.3	106.2	107.1	108.1	109.0	108.3	107.4	106.6	105.8	
240	.45	98.9	99.9	100.9	101.9	102.8	103.8	104.7	105.6	106.6	107.5	108.4	108.4	107.5	106.7	105.9	
260	.49	98.4	99.4	100.3	101.3	102.3	103.2	104.1	105.1	106.0	106.9	107.8	108.5	107.6	106.8	105.9	
10000 FT PRESS ALT									TAT (°C)								
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.36	98.2	99.2	100.2	101.2	102.1	103.1	104.0	104.9	105.8	106.8	107.7	107.8	107.0	106.2	105.4	
220	.40	97.7	98.7	99.7	100.7	101.6	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4	
240	.43	97.4	98.4	99.3	100.3	101.3	102.2	103.1	104.1	105.0	105.9	106.8	107.7	107.2	106.4	105.6	
260	.47	97.0	98.0	99.0	99.9	100.9	101.8	102.7	103.7	104.6	105.5	106.4	107.3	107.4	106.6	105.8	
5000 FT PRESS ALT									TAT (°C)								
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
200	.33	95.5	96.5	97.5	98.4	99.4	100.3	101.2	102.1	103.1	104.0	104.8	105.7	106.6	106.4	105.7	
220	.36	95.1	96.1	97.1	98.0	99.0	99.9	100.8	101.7	102.7	103.6	104.4	105.3	106.2	106.4	105.7	
240	.40	94.7	95.7	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	104.0	104.9	105.8	106.4	105.7	
260	.43	94.4	95.4	96.4	97.3	98.3	99.2	100.1	101.0	101.9	102.8	103.7	104.6	105.5	106.3	105.9	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	5	10	12	14
ENGINE ANTI-ICE ON	-0.6	-0.5	-0.5	-0.6
ENGINE & WING ANTI-ICE ON	-1.2	-1.1	-1.2	-1.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	183	276	18400	17400	15600
180	174	269	20000	19100	17700
170	165	262	21200	20600	19700
160	155	254	22600	21900	21000
150	145	247	24000	23200	22300
140	135	238	25500	24700	23700
130	126	230	27200	26700	25500
120	116	221	29100	28900	28100
110	106	212	30900	30900	30500
100	97	202	32900	32800	32600

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
274	255	239	224	211	200	190	180	172	164	157
547	510	477	448	423	400	380	361	344	329	315
819	763	715	672	634	600	570	542	517	494	473
1090	1016	952	895	845	800	760	723	690	660	632
1361	1269	1189	1119	1056	1000	950	904	863	825	790
1632	1522	1426	1342	1267	1200	1140	1085	1036	990	949
1902	1775	1664	1565	1478	1400	1330	1266	1208	1156	1107
2174	2029	1901	1789	1689	1600	1520	1447	1381	1321	1266
2447	2283	2139	2013	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)										
	100	110	120	130	140	150	160	170	180	190	
200	1.5	1.7	1.8	1.9	2.1	2.1	2.3	2.4	2.5	2.6	0:33
400	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.4	5.8	6.0	1:05
600	5.2	5.7	6.1	6.6	7.0	7.5	7.9	8.3	8.8	9.3	1:36
800	6.9	7.5	8.1	8.8	9.4	10.0	10.6	11.2	11.8	12.4	2:08
1000	8.6	9.4	10.1	10.9	11.7	12.4	13.2	13.9	14.7	15.5	2:39
1200	10.2	11.2	12.1	13.1	14.0	14.9	15.8	16.7	17.6	18.5	3:10
1400	11.9	13.0	14.0	15.2	16.3	17.3	18.4	19.4	20.5	21.5	3:42
1600	13.5	14.8	16.0	17.2	18.5	19.6	20.9	22.0	23.3	24.5	4:14
1800	15.1	16.5	17.8	19.2	20.6	22.0	23.3	24.6	26.0	27.4	4:45

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb and APU on

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	15400	13000	10200
185	16300	14200	11400
180	17200	15300	12700
175	18200	16500	13900
170	19100	17600	15200
165	20000	18700	16400
160	20700	19700	17800
155	21400	20500	19100
150	22100	21200	20200
145	22800	21900	20900
140	23600	22600	21600
135	24300	23400	22300
130	25100	24100	23000
125	26100	24900	23700
120	27200	26200	24500
115	28300	27600	25700
110	29400	29000	27400
105	30500	30300	29100
100	31400	31300	30500

With engine anti-ice on, decrease altitude capability by 1800 ft.

With engine and wing anti-ice on, decrease altitude capability by 3800 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	14	18	21	23	25	27	29	31
190	%N1	98.8	102.4							
	MACH	.583	.616							
	KIAS	324	318							
	FF/ENG	6358	6418							
180	%N1	97.2	100.7	105.0						
	MACH	.572	.605	.641						
	KIAS	317	312	307						
	FF/ENG	6000	6034	6176						
170	%N1	95.6	99.0	102.9						
	MACH	.559	.593	.628						
	KIAS	310	306	300						
	FF/ENG	5646	5675	5766						
160	%N1	93.9	97.2	100.8	104.3					
	MACH	.545	.580	.614	.643					
	KIAS	303	299	294	290					
	FF/ENG	5286	5313	5367	5482					
150	%N1	92.1	95.3	98.8	101.9	104.6				
	MACH	.532	.567	.601	.628	.647				
	KIAS	295	292	287	283	281				
	FF/ENG	4945	4965	4991	5067	5157				
140	%N1	90.3	93.4	96.8	99.6	101.8				
	MACH	.518	.551	.587	.612	.632				
	KIAS	287	283	280	276	273				
	FF/ENG	4609	4607	4633	4669	4732				
130	%N1	88.4	91.4	94.7	97.3	99.3	101.6			
	MACH	.503	.535	.571	.597	.615	.635			
	KIAS	278	275	272	268	266	263			
	FF/ENG	4279	4262	4280	4301	4328	4393			
120	%N1	86.3	89.3	92.4	95.0	96.8	98.8	101.3		
	MACH	.487	.518	.553	.580	.598	.616	.636		
	KIAS	269	266	263	261	258	255	253		
	FF/ENG	3955	3927	3928	3944	3959	3986	4051		
110	%N1	84.0	87.1	90.1	92.6	94.3	96.2	98.2	100.7	
	MACH	.470	.501	.534	.562	.580	.598	.617	.637	
	KIAS	260	257	254	252	250	248	245	243	
	FF/ENG	3634	3599	3585	3597	3606	3617	3642	3703	
100	%N1	81.5	84.6	87.6	90.0	91.7	93.4	95.3	97.3	99.9
	MACH	.450	.482	.514	.540	.559	.578	.597	.615	.636
	KIAS	249	247	244	242	241	239	237	234	232
	FF/ENG	3300	3279	3253	3247	3260	3267	3277	3297	3350

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	190	181	173	166	159
575	529	489	455	426	400	381	363	347	332	319
864	796	735	684	640	600	571	544	520	498	478
1155	1063	982	913	853	800	761	726	693	664	637
1446	1331	1228	1142	1067	1000	952	907	866	829	796
1738	1598	1475	1370	1281	1200	1142	1088	1039	995	955
2032	1868	1723	1600	1495	1400	1332	1269	1212	1160	1113
2327	2138	1971	1830	1709	1600	1522	1451	1385	1325	1271
2623	2409	2219	2060	1923	1800	1712	1631	1557	1489	1429

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:41	2.3	0:40	2.0	0:38	1.9	0:37	1.7	0:36
400	5.4	1:17	4.9	1:15	4.6	1:12	4.3	1:09	4.2	1:07
600	8.1	1:54	7.6	1:50	7.1	1:45	6.8	1:41	6.6	1:37
800	10.8	2:32	10.2	2:25	9.6	2:19	9.2	2:14	8.9	2:08
1000	13.5	3:09	12.7	3:01	12.1	2:53	11.5	2:46	11.3	2:39
1200	16.2	3:47	15.3	3:37	14.5	3:27	13.9	3:19	13.6	3:11
1400	18.8	4:26	17.8	4:14	16.9	4:02	16.2	3:52	15.8	3:42
1600	21.4	5:04	20.2	4:50	19.3	4:36	18.5	4:25	18.1	4:14
1800	24.0	5:43	22.7	5:27	21.6	5:12	20.7	4:58	20.3	4:45

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.1	0.0	0.2	0.4
4	-0.6	-0.3	0.0	0.5	0.9
6	-1.0	-0.5	0.0	0.7	1.4
8	-1.3	-0.6	0.0	1.0	2.0
10	-1.6	-0.8	0.0	1.3	2.5
12	-2.0	-1.0	0.0	1.6	3.0
14	-2.3	-1.2	0.0	1.8	3.6
16	-2.7	-1.3	0.0	2.1	4.1
18	-3.0	-1.5	0.0	2.4	4.7
20	-3.4	-1.7	0.0	2.6	5.2
22	-3.7	-1.8	0.0	2.9	5.7
24	-4.1	-2.0	0.0	3.1	6.3
26	-4.4	-2.2	0.0	3.4	6.8
28	-4.8	-2.3	0.0	3.6	7.4
30	-5.1	-2.5	0.0	3.8	7.9

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	87.3	90.3	94.9	100.2			
	KIAS	259	259	259	259			
	FF/ENG	5450	5490	5600	5810			
180	%N1	85.5	88.7	93.1	98.2	105.4		
	KIAS	251	251	251	251	251		
	FF/ENG	5140	5170	5250	5410	5770		
170	%N1	83.8	86.9	91.3	96.2	102.4		
	KIAS	244	244	244	244	244		
	FF/ENG	4840	4850	4910	5040	5310		
160	%N1	82.0	85.0	89.4	94.2	99.9		
	KIAS	236	236	236	236	236		
	FF/ENG	4530	4540	4580	4680	4890		
150	%N1	79.8	83.0	87.5	92.1	97.5		
	KIAS	228	228	228	228	228		
	FF/ENG	4230	4240	4260	4330	4490		
140	%N1	77.6	81.0	85.4	90.0	95.0	101.7	
	KIAS	222	222	222	222	222	222	
	FF/ENG	3940	3940	3950	4000	4120	4370	
130	%N1	75.5	78.6	83.2	87.7	92.5	98.4	
	KIAS	217	217	217	217	217	217	
	FF/ENG	3660	3650	3660	3690	3770	3950	
120	%N1	73.2	76.2	81.0	85.5	90.1	95.4	
	KIAS	211	211	211	211	211	211	
	FF/ENG	3380	3370	3370	3390	3440	3560	
110	%N1	70.6	73.9	78.4	83.0	87.6	92.6	99.0
	KIAS	205	205	205	205	205	205	205
	FF/ENG	3120	3100	3090	3100	3140	3220	3410
100	%N1	67.9	71.2	75.7	80.5	85.0	89.7	95.3
	KIAS	199	199	199	199	199	199	199
	FF/ENG	2850	2840	2830	2820	2840	2890	3020

This table includes 5% additional fuel for holding in a racetrack pattern.



Performance Inflight

Gear Down

Chapter PI

Section 44

GEAR DOWN

200 KIAS Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
55	96.7	97.4	97.0	97.0	96.6	96.7	97.0	97.1	96.1	95.2	96.3	98.2	99.9
50	97.2	98.3	98.1	98.1	97.8	97.9	98.3	98.3	97.3	96.2	96.2	97.5	99.2
45	97.9	98.8	99.1	99.1	98.9	99.0	99.5	99.5	98.5	97.4	97.4	98.1	98.8
40	98.5	99.3	99.9	100.1	99.9	100.2	100.6	100.7	99.6	98.6	98.5	99.3	99.9
35	99.1	100.0	100.4	100.7	100.9	101.2	101.7	101.8	100.7	99.7	99.6	100.4	101.0
30	99.6	100.6	101.1	101.2	101.4	102.1	102.8	102.9	101.8	100.8	100.7	101.4	102.1
25	98.7	101.4	101.7	101.9	102.0	102.6	103.5	103.9	102.9	101.8	101.7	102.5	103.1
20	97.9	101.9	102.5	102.6	102.7	103.3	104.1	104.6	103.7	102.8	102.7	103.4	104.1
15	97.1	101.0	103.5	103.4	103.4	104.0	104.9	105.3	104.5	103.6	103.6	104.4	105.0
10	96.3	100.2	103.6	104.4	104.2	104.8	105.7	106.2	105.3	104.5	104.4	105.2	105.9
5	95.5	99.3	102.7	103.9	104.9	105.6	106.5	107.0	106.2	105.4	105.3	105.9	106.6
0	94.7	98.4	101.8	103.0	104.0	105.6	107.3	107.8	107.2	106.3	106.2	106.7	107.2
-5	93.8	97.5	100.9	102.1	103.0	104.7	106.7	108.3	108.2	107.6	107.1	107.5	108.0
-10	93.0	96.6	100.0	101.2	102.2	103.7	105.8	107.3	108.2	108.5	108.5	108.5	108.5
-15	92.1	95.7	99.1	100.3	101.2	102.8	104.8	106.4	107.3	107.5	107.5	107.5	107.5
-20	91.3	94.8	98.2	99.3	100.3	102.0	103.9	105.5	106.3	106.5	106.5	106.5	106.5
-25	90.4	93.9	97.3	98.4	99.4	101.0	103.0	104.6	105.4	105.4	105.4	105.4	105.4
-30	89.5	93.0	96.4	97.5	98.5	100.0	102.0	103.7	104.4	104.4	104.4	104.4	104.4
-35	88.6	92.0	95.4	96.5	97.5	99.0	101.1	102.7	103.3	103.3	103.3	103.3	103.3
-40	87.7	91.1	94.5	95.6	96.5	98.1	100.1	101.8	102.2	102.2	102.2	102.2	102.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.7	-0.8	-0.8	-0.9	-1.0	-1.0	-1.1
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.2	-1.3	-1.3	-1.4	-1.5	-1.5	-1.7



GEAR DOWN

Long Range Cruise Altitude Capability

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	19800	18200	14800
185	20700	19300	17400
180	21700	20300	18600
175	22700	21200	19800
170	23700	22200	20800
165	24800	23200	21700
160	25800	24100	22700
155	26800	25200	23700
150	27600	26400	24800
145	28500	27700	26100
140	29300	29000	27500
135	30000	30000	29000
130	30700	30700	30100
125	31400	31400	30900
120	32200	32100	31700
115	32900	32900	32500
110	33700	33600	33300
105	34500	34400	34200
100	35300	35200	35000
95	36100	36100	35800
90	36900	36900	36600

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		10	14	18	21	23	25	27	29	31	33	35
190	%N1	91.6	95.1	99.1								
	MACH	.472	.508	.546								
	KIAS	261	261	260								
	FF/ENG	4765	4811	4928								
180	%N1	90.0	93.4	97.3	100.6							
	MACH	.461	.495	.534	.563							
	KIAS	255	254	254	253							
	FF/ENG	4490	4522	4612	4715							
170	%N1	88.4	91.7	95.4	98.5	101.0						
	MACH	.449	.483	.520	.550	.571						
	KIAS	248	248	247	246	246						
	FF/ENG	4225	4241	4295	4386	4471						
160	%N1	86.8	89.9	93.5	96.5	98.6	101.4					
	MACH	.437	.469	.506	.536	.555	.577					
	KIAS	241	240	240	240	239	238					
	FF/ENG	3963	3961	4000	4072	4126	4222					
150	%N1	84.8	88.1	91.5	94.3	96.4	98.7	101.6				
	MACH	.424	.456	.491	.520	.540	.561	.583				
	KIAS	234	233	233	232	232	231	231				
	FF/ENG	3703	3693	3717	3758	3812	3868	3966				
140	%N1	82.8	86.2	89.5	92.2	94.2	96.3	98.7	101.9			
	MACH	.411	.442	.476	.504	.524	.544	.565	.587			
	KIAS	227	226	225	225	225	224	224	223			
	FF/ENG	3443	3434	3440	3465	3502	3549	3611	3704			
130	%N1	81.0	84.1	87.3	90.0	91.8	93.9	96.0	98.6	102.0		
	MACH	.398	.427	.460	.487	.506	.527	.548	.570	.591		
	KIAS	220	219	218	217	217	217	216	216	214		
	FF/ENG	3205	3176	3170	3187	3205	3244	3286	3353	3436		
120	%N1	78.7	81.8	85.2	87.7	89.5	91.3	93.4	95.6	98.3	101.8	
	MACH	.385	.411	.443	.469	.488	.508	.529	.550	.572	.593	
	KIAS	212	210	210	209	209	209	209	208	207	206	
	FF/ENG	2974	2918	2912	2913	2927	2944	2981	3022	3090	3165	
110	%N1	76.1	79.6	82.8	85.3	87.0	88.8	90.7	92.7	95.0	97.7	101.5
	MACH	.369	.396	.426	.451	.469	.488	.508	.529	.551	.574	.595
	KIAS	203	203	201	201	200	200	200	200	199	199	197
	FF/ENG	2726	2685	2658	2653	2654	2668	2682	2717	2759	2822	2895
100	%N1	73.5	76.9	80.1	82.7	84.4	86.0	87.9	89.8	91.9	94.1	96.9
	MACH	.353	.380	.408	.432	.449	.467	.487	.507	.528	.550	.574
	KIAS	195	194	192	192	192	191	191	191	191	190	190
	FF/ENG	2489	2454	2407	2400	2397	2397	2408	2421	2454	2495	2553

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	288	259	236	217	200	189	179	170	161	154
650	581	521	474	434	400	378	357	339	323	308
981	875	784	711	652	600	567	536	509	484	462
1317	1173	1049	951	870	800	755	714	677	644	615
1656	1472	1315	1190	1089	1000	944	893	846	805	768
2000	1775	1583	1431	1308	1200	1132	1070	1014	964	920
2349	2082	1854	1674	1527	1400	1320	1248	1182	1124	1072
2703	2391	2125	1916	1747	1600	1508	1425	1349	1282	1223
3062	2705	2400	2161	1968	1800	1696	1602	1517	1441	1374
3427	3021	2675	2406	2188	2000	1884	1779	1684	1599	1524

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		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	4.8	0:49	4.4	0:47	4.0	0:45	3.7	0:44	3.3	0:41
400	9.9	1:36	9.2	1:32	8.6	1:27	8.0	1:23	7.5	1:17
600	14.9	2:24	13.9	2:17	13.0	2:09	12.2	2:03	11.5	1:53
800	19.8	3:12	18.5	3:02	17.4	2:52	16.4	2:43	15.4	2:30
1000	24.6	4:02	23.0	3:49	21.6	3:36	20.4	3:24	19.2	3:07
1200	29.3	4:52	27.4	4:36	25.8	4:20	24.4	4:05	23.0	3:45
1400	33.9	5:43	31.8	5:24	29.9	5:06	28.3	4:48	26.6	4:23
1600	38.5	6:36	36.0	6:13	33.9	5:51	32.1	5:31	30.1	5:02
1800	42.9	7:29	40.2	7:03	37.8	6:38	35.8	6:14	33.6	5:41
2000	47.2	8:24	44.2	7:54	41.6	7:26	39.4	6:58	37.0	6:21

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	0.6	1.3
10	-1.5	-0.8	0.0	1.3	2.7
15	-2.4	-1.2	0.0	1.9	4.0
20	-3.2	-1.6	0.0	2.5	5.3
25	-4.0	-2.0	0.0	3.1	6.6
30	-4.8	-2.4	0.0	3.7	7.8
35	-5.6	-2.8	0.0	4.3	8.9
40	-6.4	-3.2	0.0	4.8	10.1
45	-7.2	-3.6	0.0	5.3	11.1
50	-8.0	-4.0	0.0	5.8	12.1
55	-8.9	-4.5	0.0	6.3	13.1
60	-9.7	-4.9	0.0	6.7	14.0

Descent at VREF30 + 70

PRESSURE ALTITUDE (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	16	26	36	40	44	48	52	56	60	64	68	71	74
TIME (MINUTES)	7	10	12	13	14	15	16	16	17	18	19	19	20

GEAR DOWN

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	83.1	85.9	90.1	94.6	100.0		
	KIAS	249	249	249	249	249		
	FF/ENG	4710	4690	4710	4790	4980		
180	%N1	81.2	84.2	88.4	92.8	97.9		
	KIAS	241	241	241	241	241		
	FF/ENG	4440	4410	4420	4470	4610		
170	%N1	79.4	82.5	86.7	91.0	95.9	102.5	
	KIAS	234	234	234	234	234	234	
	FF/ENG	4180	4160	4150	4180	4280	4550	
160	%N1	77.4	80.5	84.7	89.0	93.7	99.6	
	KIAS	226	226	226	226	226	226	
	FF/ENG	3910	3890	3860	3880	3950	4140	
150	%N1	75.4	78.3	82.7	87.0	91.5	96.9	
	KIAS	218	218	218	218	218	218	
	FF/ENG	3650	3620	3590	3590	3640	3770	
140	%N1	73.6	76.4	80.9	85.2	89.5	94.6	102.0
	KIAS	212	212	212	212	212	212	212
	FF/ENG	3420	3390	3360	3350	3380	3470	3710
130	%N1	71.5	74.6	79.0	83.2	87.6	92.4	98.6
	KIAS	207	207	207	207	207	207	207
	FF/ENG	3210	3180	3150	3120	3140	3210	3380
120	%N1	69.4	72.6	76.8	81.2	85.6	90.2	95.7
	KIAS	201	201	201	201	201	201	201
	FF/ENG	3000	2970	2930	2900	2910	2950	3060
110	%N1	67.3	70.3	74.7	79.2	83.6	88.0	93.1
	KIAS	195	195	195	195	195	195	195
	FF/ENG	2800	2760	2730	2690	2680	2710	2790
100	%N1	65.1	68.0	72.5	76.8	81.2	85.7	90.5
	KIAS	189	189	189	189	189	189	189
	FF/ENG	2590	2560	2520	2490	2470	2480	2520

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 45

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Initial Max Continuous %N1

29000 FT to 10000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

29000 FT PRESS ALT												TAT (°C)	
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.7	106.8	106.1	105.5	104.9	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.8	106.1	105.5	102.8	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.5	106.8	106.2	103.6	100.5	
27000 FT PRESS ALT												TAT (°C)	
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.6	106.7	105.7	105.0	104.3	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.0	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.0	107.0	106.3	105.6	104.7	101.8	
25000 FT PRESS ALT												TAT (°C)	
MACH	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
0.6	102.3	103.2	104.2	105.2	106.1	106.9	107.3	106.4	105.4	104.4	103.6	102.9	
0.5	103.6	104.7	105.8	106.8	107.6	107.8	106.9	105.9	104.9	104.1	103.4	102.1	
0.4	103.6	104.7	105.8	106.8	107.9	107.7	106.7	105.7	104.9	104.1	102.8	100.0	
23000 FT PRESS ALT												TAT (°C)	
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.2	104.2	105.2	106.1	107.0	107.9	108.0	107.2	106.2	105.3	104.5	103.7	
0.5	104.7	105.8	106.8	107.8	108.7	108.6	107.7	106.7	105.8	105.0	104.2	102.7	
0.4	104.7	105.8	106.8	107.9	108.9	108.6	107.6	106.6	105.8	105.0	103.4	100.8	
21000 FT PRESS ALT												TAT (°C)	
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.9	104.8	105.8	106.8	107.7	108.6	109.5	109.4	108.5	107.5	106.6	105.7	
0.5	104.7	105.8	106.8	107.9	108.9	109.9	109.9	109.0	108.0	107.0	106.1	105.3	
0.4	104.7	105.8	106.8	107.9	108.9	109.9	109.8	108.8	107.8	106.9	106.1	104.2	
19000 FT PRESS ALT												TAT (°C)	
MACH	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
0.6	104.3	105.3	106.2	107.2	108.1	109.0	110.0	109.6	108.7	107.7	106.8	105.9	
0.5	105.8	106.8	107.9	108.9	109.8	110.7	110.1	109.2	108.2	107.3	106.4	105.5	
0.4	105.8	106.8	107.9	108.9	109.9	110.9	110.1	109.1	108.2	107.2	106.4	104.3	
15000 FT PRESS ALT												TAT (°C)	
MACH	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
0.6	102.8	103.8	104.7	105.6	106.6	107.5	108.4	109.2	108.2	107.3	106.4	105.7	
0.5	104.3	105.2	106.2	107.1	108.1	109.0	109.4	108.4	107.5	106.7	105.9	105.1	
0.4	105.2	106.2	107.2	108.2	109.2	110.2	109.5	108.6	107.7	106.9	106.1	105.1	
10000 FT PRESS ALT												TAT (°C)	
MACH	-15	-10	-5	0	5	10	15	20	25	30	35	40	
0.6	100.3	101.2	102.1	103.0	103.9	104.8	105.6	106.5	107.4	106.7	106.0	105.2	
0.5	101.4	102.4	103.3	104.2	105.1	106.0	106.9	107.5	106.8	106.0	105.2	104.5	
0.4	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4	104.7	104.1	

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
180	171	238	2900		
170	162	231	5500	3700	1600
160	153	223	8200	6600	4700
150	143	215	10600	9200	7600
140	134	210	12800	11800	10100
130	125	205	14900	14400	12900
120	115	199	16700	16500	15600
110	106	193	18900	18800	18100
100	96	188	21000	20800	20400

Includes APU fuel burn.

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
160	4300	1700	
155	5800	3400	
150	7400	5000	2500
145	8900	6700	4200
140	10300	8400	6000
135	11700	9900	7800
130	13100	11700	9500
125	14600	13600	11400
120	15700	15300	13400
115	16700	16600	15300
110	17900	17800	17000
105	19100	19000	18400
100	20300	20200	19700
95	21300	21200	20700
90	22300	22200	21600

With engine anti-ice on, decrease altitude capability by 1200 ft.

With engine and wing anti-ice on, decrease altitude capability by 2500 ft.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		6	8	10	12	14	16	18	20
160	%N1	103.3							
	MACH	.398							
	KIAS	237							
	FF/ENG	7736							
150	%N1	101.0	103.1						
	MACH	.389	.400						
	KIAS	231	229						
	FF/ENG	7195	7225						
140	%N1	98.6	100.6	102.7	105.3				
	MACH	.379	.390	.401	.412				
	KIAS	225	223	221	219				
	FF/ENG	6672	6685	6714	6765				
130	%N1	96.2	98.0	100.0	102.2	104.8			
	MACH	.367	.379	.391	.402	.412			
	KIAS	218	217	215	213	211			
	FF/ENG	6167	6164	6175	6200	6251			
120	%N1	93.8	95.5	97.3	99.2	101.5	104.2		
	MACH	.355	.367	.379	.390	.402	.412		
	KIAS	211	210	209	207	205	203		
	FF/ENG	5671	5660	5658	5666	5686	5740		
110	%N1	91.2	92.8	94.5	96.3	98.3	100.5	103.4	
	MACH	.342	.353	.365	.377	.389	.401	.413	
	KIAS	203	202	201	200	199	197	195	
	FF/ENG	5188	5169	5157	5156	5159	5177	5259	
100	%N1	88.4	90.1	91.6	93.3	95.2	97.1	99.5	102.8
	MACH	.328	.339	.351	.363	.375	.387	.400	.417
	KIAS	195	194	193	192	191	190	189	189
	FF/ENG	4697	4689	4671	4659	4657	4658	4700	4837

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
164	146	131	118	109	100	94	89	84	79	75
334	296	264	239	218	200	187	175	165	156	148
505	447	398	359	327	300	281	263	247	234	222
677	598	531	479	437	400	374	350	329	311	295
850	751	666	600	546	500	467	438	411	388	368
1025	904	801	720	656	600	560	524	493	465	441
1200	1057	936	841	766	700	653	611	574	541	513
1377	1212	1072	963	876	800	746	698	655	618	586
1554	1367	1208	1085	986	900	839	785	737	694	658
1733	1523	1345	1207	1096	1000	932	872	818	771	731

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		10		14		18	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	2.5	0:27	2.2	0:27	2.0	0:26	1.8	0:26
200	5.2	0:52	4.8	0:50	4.6	0:49	4.4	0:47
300	7.8	1:17	7.4	1:14	7.1	1:12	7.0	1:09
400	10.5	1:42	9.9	1:38	9.5	1:35	9.5	1:31
500	13.1	2:08	12.4	2:02	12.0	1:58	11.9	1:54
600	15.7	2:33	14.9	2:27	14.4	2:22	14.3	2:16
700	18.2	2:59	17.3	2:51	16.7	2:45	16.7	2:39
800	20.7	3:25	19.7	3:16	19.0	3:09	19.0	3:01
900	23.2	3:51	22.1	3:41	21.3	3:32	21.2	3:24
1000	25.7	4:18	24.4	4:06	23.6	3:56	23.5	3:47

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.2	0.0	0.2	0.5
4	-0.7	-0.3	0.0	0.5	1.1
6	-1.0	-0.5	0.0	0.8	1.7
8	-1.4	-0.7	0.0	1.1	2.3
10	-1.8	-0.9	0.0	1.4	2.9
12	-2.1	-1.1	0.0	1.7	3.4
14	-2.5	-1.2	0.0	2.0	4.0
16	-2.9	-1.4	0.0	2.3	4.6
18	-3.2	-1.6	0.0	2.6	5.2
20	-3.6	-1.8	0.0	2.9	5.8
22	-4.0	-2.0	0.0	3.1	6.4
24	-4.4	-2.1	0.0	3.4	6.9
26	-4.7	-2.3	0.0	3.7	7.5
28	-5.1	-2.5	0.0	4.0	8.1
30	-5.5	-2.7	0.0	4.3	8.7

Includes APU fuel burn.

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GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
180	%N1	101.3				
	KIAS	241				
	FF/ENG	8700				
170	%N1	99.2	103.1			
	KIAS	234	234			
	FF/ENG	8130	8300			
160	%N1	96.9	100.4			
	KIAS	226	226			
	FF/ENG	7540	7640			
150	%N1	94.5	97.9	103.9		
	KIAS	218	218	218		
	FF/ENG	6970	7030	7280		
140	%N1	92.5	95.6	101.0		
	KIAS	212	212	212		
	FF/ENG	6480	6520	6690		
130	%N1	90.4	93.5	98.5	105.9	
	KIAS	207	207	207	207	
	FF/ENG	6040	6070	6170	6500	
120	%N1	88.2	91.2	95.9	102.0	
	KIAS	201	201	201	201	
	FF/ENG	5600	5610	5670	5870	
110	%N1	86.0	88.9	93.4	98.8	
	KIAS	195	195	195	195	
	FF/ENG	5170	5170	5210	5330	
100	%N1	83.5	86.5	90.8	95.8	102.8
	KIAS	189	189	189	189	189
	FF/ENG	4750	4750	4760	4830	5080

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight

Text

Chapter PI

Section 46

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, brakes deactivated, improved climb, contaminated runway situations, brake energy limits, or obstacle clearance with unbalanced V1. These speeds may be used for weights less than or equal to the performance limited weight.

Normal takeoff speeds, V1, VR, and V2, with anti-skid on and all brakes operative, are read from the table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the V1 Adjustment chart. Adjusted V1 must not exceed VR. These takeoff speeds are not valid when the brake release weight is based on clearway, stopway, improved climb or is limited by tire speed or brake energy.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). Therefore compare the adjusted V1 to the V1(MCG). To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length.

Clearway and Stopway V1 Adjustments

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR.

Maximum allowable clearway limits are provided for guidance when more precise data is not available.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 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 Takeoff

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 assumes 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 13 mm (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 field/obstacle limit weight for the takeoff flap setting.

2. Enter the Weight Adjustment table with the 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 adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

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 the Takeoff Speeds table in this section.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. 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.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal runway/obstacle limited weight and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE ADJUSTMENT		
FIELD LENGTH (FT)	WEIGHT (1000 KG)	V1 ADJUSTMENT (KTS)
8000	-50.5	-33
8500	-46.8	-33
9100	-39.6	-32
9400	-35.9	-32
9700	-32.3	-31
10000	-28.7	-31
10200	-26.5	-31
12000	-26.5	-28
14000	-26.5	-26

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance adjusted for wind and slope exceeds approximately 8700 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Brakes Deactivated

When operating with brakes deactivated, the field 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 3000 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ONE BRAKE DEACTIVATED SPEED ADJUSTMENT	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KTS)
4000	-2
6000	-2
8000	-2
10000	-2
12000	-2
14000	-2

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance exceeds approximately 4000 ft for one brake deactivated.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. %N1 adjustments are shown for packs off operation.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of reduced thrust is not allowed on runways contaminated with water, ice, slush or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

Enter the Minimum Assumed Temperature table with airport pressure altitude and read minimum assumed temperature. If assumed temperature is below this value, use the Takeoff %N1 table to set takeoff thrust. To find assumed temperature reduced thrust, obtain the assumed temperature %N1 by entering the Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table. Apply the altitude adjustment shown in the %N1 Altitude Adjustment table. Check the resulting value by entering the Minimum Assumed Temperature Limit %N1 table with actual airport temperature and pressure altitude. Use the greater of assumed temperature limit %N1 or minimum %N1 as the assumed temperature reduced thrust %N1. Determine takeoff speeds using the actual takeoff weight and assumed temperature.

Max Climb %N1

This table shows Max Climb %N1 for a 250/290/.78 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 packs off and anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for packs off and anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. 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 maximum cruise thrust at 0 ft/min residual rate of climb or maximum climb thrust at 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 12° 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 .80M 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 .78/290/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

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 table makes no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Distance and time for descent are shown for a .78/290/250 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 at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

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. Landing distances for slippery runways are 115% of the actual landing distances.

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 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 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, temperature, and speed conditions as well as thrust reverser configuration. Each adjustment is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landing at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight, the brakes on speed adjusted for wind and 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 Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse Thrust) 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 or brake temperature monitor system (BTMS) indication on EICAS. Times are provided for ground cooling and inflight gear down cooling.

If brake temperature monitor indication on EICAS is available, 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 the recommended cooling schedule by entering at the bottom of the chart. The brake temperature light illuminates when the hottest brake is registering 5 on the EICAS indication and extinguishes as the hottest brake cools with an EICAS indication of 4.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .80M 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 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/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. The cruise segment is at a level off altitude which is based on 100 ft/min residual rate of climb.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude are used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (KG/HR)					
	GROSS WEIGHT (1000 KG)					
	190	170	150	130	110	90
43					60	55
39				65	60	60
35		75	70	70	65	65
31	75	75	75	75	70	65
27	85	85	80	75	75	70
25	85	85	85	80	75	70
20	95	90	90	85	80	75
15	105	105	95	95	90	85
10	115	115	105	105	100	95
5	125	125	120	115	110	105

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/290/250 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 Fuel Required Adjustment 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

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 the 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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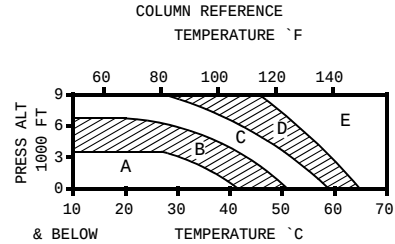
Performance Inflight

General

Chapter PI

Section 50

Takeoff Speeds
Max Takeoff Thrust



SLOPE/WIND V1 ADJUSTMENT*

WEIGHT 1000 KG	SLOPE %				WIND KTS							
	DN	UP	UP	UP	TAIL					HEAD		
190	-2	-1	0	1	2	-15	-10	-5	0	10	20	30
170	-3	-2	0	2	2	-2	-1	0	0	0	0	1
150	-2	-1	0	2	3	-3	-2	-1	0	0	1	1
130	-2	-1	0	2	3	-3	-2	-1	0	0	1	1
110	-1	0	1	3	-4	-3	-1	0	0	1	1	2
90	0	0	1	2	-4	-3	-1	0	0	1	2	3

*V1 NOT TO EXCEED VR

FLAPS	WT 1000 KG	A			B			C			D			E		
		V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂	V ₁	V _R	V ₂
5	190	166	170	175	169	172	176									
	180	161	165	171	163	166	171									
	170	155	160	166	158	161	166	160	163	166						
	160	149	154	161	152	156	161	154	157	161						
	150	143	148	156	145	150	156	148	151	156	151	153	156			
	140	136	142	151	139	144	151	141	145	151	145	147	151	147	148	151
	130	129	136	145	132	137	145	135	139	145	138	141	145	141	142	145
	120	122	129	140	125	131	140	128	133	139	131	134	139	134	136	139
	110	115	122	134	118	124	134	121	126	134	124	128	133	127	129	133
	100	108	115	127	110	117	127	113	119	127	116	120	127	119	122	127
15	90	101	108	121	104	109	121	106	111	121	108	113	121	112	115	121
	190	161	163	168												
	180	156	158	164	158	159	164									
	170	150	153	159	153	154	159	154	156	160						
	160	144	147	154	147	149	154	149	150	155						
	150	138	142	149	141	143	149	143	145	149	146	146	150			
	140	132	136	144	134	138	144	137	139	144	140	141	145			
	130	125	130	139	128	132	139	130	133	139	134	135	139	136	136	140
	120	119	124	134	121	125	134	124	127	134	127	129	134	130	130	134
	110	112	117	128	114	119	128	117	120	128	120	122	128	123	124	128
20	100	106	110	122	107	112	122	110	113	122	113	115	122	116	117	122
	90	99	102	116	100	104	116	103	106	116	105	108	116	108	110	116
	190	159	159	165												
	180	153	154	160	154	155	160									
	170	147	148	154	149	149	155									
	160	141	142	149	143	144	149	145	145	150						
	150	135	137	144	137	138	144	140	140	145						
	140	129	131	140	131	133	140	134	134	140	135	136	140			
	130	122	125	135	125	127	135	127	128	134	130	130	135	132	132	135
	120	116	119	129	118	121	129	121	122	129	124	124	129	126	126	130
	110	109	113	124	111	114	124	114	116	124	117	118	124	119	120	124
	100	102	106	118	104	108	118	107	109	118	110	111	118	113	113	118
	90	93	98	112	96	100	112	99	102	112	102	104	112	106	106	112

CHECK V1(MCG) IN BOXED AREA

V1(MCG)

Max Takeoff Thrust

ACTUAL OAT		PRESSURE ALTITUDE (FT)						
°C	°F	-1000	0	2000	4000	6000	8000	9000
55	131	99	97	93				
50	122	103	100	96	93			
45	113	106	103	99	95	92		
40	104	109	106	102	98	94	90	89
35	95	110	109	104	100	96	92	90
30	86	111	110	106	102	98	94	92
25	77	111	110	106	103	99	95	93
20	68	111	110	106	103	100	96	94
15	59	111	110	106	103	100	96	95
-50	-58	111	111	107	104	100	97	95

Maximum Allowable Clearway

FIELD LENGTH (FT)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (FT)
4000	350
6000	450
8000	550
10000	650
12000	750
14000	800

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (FT)	NORMAL V1 (KIAS)		
	120	140	160
800	-5	-3	-2
600	-3	-2	-2
400	-2	-1	-1
200	-1	-1	-1
0	0	0	0
-200	1	1	1
-400	2	1	1
-600	3	2	2
-800	5	3	2

Stab Trim Setting**Max Takeoff Thrust**

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	6 1/2	5 1/2	4 1/2	4	3	2
180	7	6	5 1/2	4 1/2	3 1/2	3	2
160	6 1/2	5 1/2	5	4	3	2 1/2	1 1/2
140	5 1/2	4 1/2	4	3	2	1 1/2	1/2
120	4	3 1/2	2 1/2	2	1	1/2	1/2
100	3 1/2	2 1/2	2	1	1/2	1/2	1/2



VREF (KIAS)

WEIGHT (1000 KG)	FLAPS		
	30	25	20
190	179	170	179
180	171	166	174
170	164	161	168
160	156	156	162
150	148	151	157
140	142	146	152
130	137	140	146
120	131	135	140
110	125	129	134
100	119	123	128



Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF30 + 80
1	VREF30 + 60
5	VREF30 + 40
15	VREF30 + 20
20	VREF30 + 20
25	VREF25
30	VREF30

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	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
200	-21.7	-26.1	-30.4	-25.3	-29.7	-34.0	-34.0	-38.3	-42.7
190	-20.7	-25.0	-29.4	-24.0	-28.3	-32.7	-31.7	-36.0	-40.4
180	-19.8	-24.1	-28.5	-22.7	-27.1	-31.5	-29.5	-33.9	-38.2
170	-18.6	-23.0	-27.3	-21.2	-25.6	-29.9	-27.1	-31.5	-35.8
160	-17.2	-21.6	-25.9	-19.5	-23.8	-28.2	-24.5	-28.9	-33.2
150	-15.6	-19.9	-24.3	-17.5	-21.9	-26.2	-21.7	-26.1	-30.5
140	-13.8	-18.1	-22.5	-15.4	-19.7	-24.1	-18.8	-23.2	-27.5
130	-11.7	-16.1	-20.5	-13.0	-17.4	-21.7	-15.7	-20.1	-24.4
120	-9.6	-13.9	-18.3	-10.5	-14.9	-19.2	-12.5	-16.9	-21.2
110	-7.2	-11.6	-15.9	-7.9	-12.2	-16.6	-9.1	-13.5	-17.8
100	-4.7	-9.1	-13.4	-5.1	-9.5	-13.8	-5.6	-10.0	-14.3
90	-2.1	-6.5	-10.9	-2.3	-6.6	-11.0	-1.9	-6.3	-10.6

V1(MCG) Limit Weight (1000 KG)

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
4600							79.3		
5000	74.3			83.4			99.7		
5400	95.7			104.6	72.8		120.7	89.5	
5800	117.6	85.0		126.7	94.0		142.8	110.1	79.3
6200	140.7	106.5	74.3	150.0	115.5	83.4	166.0	131.6	99.7
6600	165.5	129.0	95.7	174.8	138.1	104.6	190.5	154.2	120.7
7000	191.8	152.9	117.6	200.7	162.2	126.7	215.2	178.2	142.8
7400	218.5	178.5	140.7		187.7	150.0		202.9	166.0
7800		205.2	165.5		213.7	174.8			190.5
8200			191.8			200.7			215.2
8600			218.5						

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -135 ft/ + 135 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 KG)	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
190	-20	-20	-20	-15	-15	-15	-6	-6	-6
180	-21	-21	-21	-16	-16	-16	-6	-6	-6
170	-22	-22	-22	-16	-16	-16	-6	-6	-6
160	-22	-22	-22	-17	-17	-17	-6	-6	-6
150	-23	-23	-23	-18	-18	-18	-7	-7	-7
140	-24	-24	-24	-19	-19	-19	-8	-8	-8
130	-24	-24	-24	-20	-20	-20	-9	-9	-9
120	-25	-25	-25	-21	-21	-21	-11	-11	-11
110	-26	-26	-26	-22	-22	-22	-13	-13	-13
100	-26	-26	-26	-23	-23	-23	-15	-15	-15
90	-27	-27	-27	-24	-24	-24	-18	-18	-18

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).

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	.12 INCHES (3 mm)			.25 INCHES (6 mm)			.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
200	-27.1	-30.5	-34.0	-30.9	-34.3	-37.8	-39.8	-43.3	-46.7
190	-25.5	-28.9	-32.4	-29.0	-32.4	-35.9	-36.9	-40.4	-43.8
180	-23.8	-27.3	-30.7	-26.9	-30.4	-33.8	-34.0	-37.5	-40.9
170	-22.1	-25.5	-29.0	-24.8	-28.3	-31.7	-31.0	-34.5	-37.9
160	-20.3	-23.7	-27.2	-22.7	-26.1	-29.5	-28.0	-31.4	-34.9
150	-18.3	-21.8	-25.2	-20.4	-23.8	-27.3	-24.9	-28.3	-31.8
140	-16.3	-19.8	-23.2	-18.0	-21.5	-24.9	-21.7	-25.1	-28.6
130	-14.2	-17.7	-21.1	-15.6	-19.0	-22.5	-18.5	-21.9	-25.4
120	-12.0	-15.5	-18.9	-13.1	-16.5	-20.0	-15.2	-18.6	-22.1
110	-9.8	-13.2	-16.7	-10.5	-13.9	-17.4	-11.8	-15.3	-18.7
100	-7.4	-10.9	-14.3	-7.8	-11.2	-14.7	-8.4	-11.9	-15.3
90	-5.0	-8.5	-11.9	-5.1	-8.5	-12.0	-5.0	-8.5	-11.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	.12 INCHES (3 mm)			.25 INCHES (6 mm)			.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							85.8		
6200				74.9			109.6		
6600	77.6			101.9			134.2	90.5	
7000	107.2			129.4	80.3		160.2	114.4	71.6
7400	137.6	83.5		158.0	107.3		187.7	139.3	95.3
7800	169.4	113.2		187.9	135.0	85.7	216.9	165.6	119.3
8200	202.8	143.8	89.4	219.1	163.9	112.7		193.5	144.4
8600		175.9	119.2		194.1	140.7			171.0
9000		209.7	150.1			169.8			199.3
9400			182.6			200.3			
9800			216.5						

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -150 ft/+150 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for adjusted field length and pressure altitude.
4. Max allowable 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								
	.12 INCHES (3 mm)			.25 INCHES (6 mm)			.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
200	-26	-26	-26	-21	-21	-21	-12	-12	-12
190	-27	-27	-27	-21	-21	-21	-10	-10	-10
180	-28	-28	-28	-22	-22	-22	-10	-10	-10
170	-29	-29	-29	-23	-23	-23	-10	-10	-10
160	-30	-30	-30	-24	-24	-24	-11	-11	-11
150	-31	-31	-31	-26	-26	-26	-13	-13	-13
140	-31	-31	-31	-27	-27	-27	-16	-16	-16
130	-32	-32	-32	-28	-28	-28	-18	-18	-18
120	-32	-32	-32	-29	-29	-29	-21	-21	-21
110	-32	-32	-32	-30	-30	-30	-23	-23	-23
100	-32	-32	-32	-30	-30	-30	-25	-25	-25
90	-31	-31	-31	-30	-30	-30	-27	-27	-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).

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
190	-2.9	-2.9	-2.9	-13.4	-13.4	-13.4	-21.9	-21.9	-21.9
180	-3.5	-3.5	-3.5	-13.3	-13.3	-13.3	-21.2	-21.2	-21.2
170	-3.8	-3.8	-3.8	-13.1	-13.1	-13.1	-20.3	-20.3	-20.3
160	-3.9	-3.9	-3.9	-12.6	-12.6	-12.6	-19.2	-19.2	-19.2
150	-3.9	-3.9	-3.9	-11.9	-11.9	-11.9	-17.9	-17.9	-17.9
140	-3.6	-3.6	-3.6	-11.0	-11.0	-11.0	-16.4	-16.4	-16.4
130	-3.1	-3.1	-3.1	-9.9	-9.9	-9.9	-14.7	-14.7	-14.7
120	-2.6	-2.6	-2.6	-8.6	-8.6	-8.6	-12.8	-12.8	-12.8
110	-1.6	-1.6	-1.6	-7.1	-7.1	-7.1	-10.7	-10.7	-10.7
100	-0.5	-0.5	-0.5	-5.3	-5.3	-5.3	-8.4	-8.4	-8.4
90	0.0	0.0	0.0	-3.6	-3.6	-3.6	-6.1	-6.1	-6.1

V1(MCG) Limit Weight (1000 KG)

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
4000	118								
4400	159	106							
4800	198	147	93						
5200		187	135	103					
5600			175	132	95				
6000			214	162	123				
6400				194	153	115			
6800					184	144	101		
7200					217	175	118		
7600						207	136	103	
8000							155	120	
8400							175	138	105
8800							196	157	122
9200								177	140
9600								199	159
10000									179
10400									201

1. Enter Weight Adjustment table with reported braking action and field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -80 ft/+ 80 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -80 ft/+ 80 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -135 ft/+135 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 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
190	-7	-7	-7	-17	-17	-17	-29	-29	-29
180	-8	-8	-8	-18	-18	-18	-31	-31	-31
170	-9	-9	-9	-19	-19	-19	-32	-32	-32
160	-10	-10	-10	-21	-21	-21	-34	-34	-34
150	-11	-11	-11	-22	-22	-22	-35	-35	-35
140	-11	-11	-11	-23	-23	-23	-37	-37	-37
130	-12	-12	-12	-24	-24	-24	-38	-38	-38
120	-12	-12	-12	-25	-25	-25	-40	-40	-40
110	-13	-13	-13	-26	-26	-26	-41	-41	-41
100	-13	-13	-13	-27	-27	-27	-42	-42	-42
90	-13	-13	-13	-28	-28	-28	-43	-43	-43

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).

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
200	-4.6	-5.3	-6.0	-17.2	-18.0	-18.7	-27.7	-28.4	-29.1
190	-5.2	-5.9	-6.6	-17.1	-17.9	-18.6	-26.8	-27.5	-28.2
180	-5.6	-6.3	-7.0	-16.9	-17.6	-18.3	-25.7	-26.4	-27.1
170	-5.8	-6.5	-7.2	-16.4	-17.1	-17.8	-24.4	-25.2	-25.9
160	-5.8	-6.5	-7.3	-15.7	-16.4	-17.1	-23.0	-23.8	-24.5
150	-5.7	-6.4	-7.1	-14.8	-15.6	-16.3	-21.4	-22.2	-22.9
140	-5.3	-6.1	-6.8	-13.8	-14.5	-15.2	-19.7	-20.4	-21.1
130	-4.8	-5.5	-6.3	-12.5	-13.2	-14.0	-17.7	-18.5	-19.2
120	-4.1	-4.8	-5.6	-11.1	-11.8	-12.5	-15.6	-16.4	-17.1
110	-3.2	-4.0	-4.7	-9.4	-10.2	-10.9	-13.4	-14.1	-14.8
100	-2.2	-2.9	-3.6	-7.6	-8.3	-9.0	-10.9	-11.7	-12.4
90	-1.0	-1.8	-2.5	-5.7	-6.4	-7.2	-8.5	-9.2	-9.9

V1(MCG) Limit Weight (1000 KG)

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	100.7								
4600	153.9	94.7							
5000	198.3	149.1	88.8						
5400		194.2	144.1						
5800			189.9						
6200				95.7					
6600				141.7	91.0				
7000				184.6	137.2	86.2			
7400					180.5	132.7			
7800						176.3			
8200						217.3			
9000							72.2		
9400							99.5		
9800							126.9	80.4	
10200							154.7	107.6	
10600							183.0	135.2	88.5
11000							211.6	163.1	115.9
11400								191.5	143.5
11800									171.6
12200									200.1

1. Enter Weight Adjustment table with reported braking action and field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -100 ft/+ 100 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -100 ft/+ 100 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -160 ft/+160 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for adjusted field length and pressure altitude.
4. Max allowable slippery runway limited weight is lesser of weights from 1 and 3.



ADVISORY INFORMATION

Slippery Runway Takeoff**No Reverse Thrust****V1 Adjustment (KIAS)**

WEIGHT (1000 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
200	-7	-7	-7	-19	-19	-19	-36	-36	-36
190	-8	-8	-8	-21	-21	-21	-39	-39	-39
180	-9	-9	-9	-23	-23	-23	-41	-41	-41
170	-11	-11	-11	-24	-24	-24	-43	-43	-43
160	-12	-12	-12	-26	-26	-26	-45	-45	-45
150	-13	-13	-13	-28	-28	-28	-47	-47	-47
140	-14	-14	-14	-29	-29	-29	-49	-49	-49
130	-15	-15	-15	-30	-30	-30	-50	-50	-50
120	-15	-15	-15	-32	-32	-32	-52	-52	-52
110	-16	-16	-16	-33	-33	-33	-53	-53	-53
100	-17	-17	-17	-34	-34	-34	-54	-54	-54
90	-18	-18	-18	-35	-35	-35	-55	-55	-55

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).

Takeoff EPR

Max Takeoff Thrust

Based on engine bleed for packs on and anti-ice on or off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
70	158	1.24	1.23	1.25	1.25	1.25	1.25
65	149	1.29	1.28	1.27	1.27	1.27	1.27
60	140	1.34	1.33	1.33	1.32	1.32	1.32
55	131	1.39	1.38	1.38	1.37	1.37	1.37
50	122	1.43	1.42	1.42	1.42	1.42	1.42
45	113	1.46	1.46	1.46	1.46	1.46	1.46
40	104	1.51	1.51	1.51	1.51	1.50	1.51
35	95	1.53	1.55	1.55	1.54	1.54	1.54
30	86	1.53	1.56	1.58	1.58	1.58	1.58
25	77	1.53	1.56	1.58	1.60	1.60	1.60
20	68	1.53	1.56	1.58	1.60	1.61	1.62
15	59	1.53	1.56	1.58	1.60	1.61	1.64
10 & BELOW	50 & BELOW	1.53	1.56	1.58	1.60	1.61	1.64

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	4500	4501	6000 8000
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.02	0.02 0.02

Assumed Temperature Reduced Thrust**Based on 25% thrust reduction**

MINIMUM ALLOWABLE EPR FOR REDUCED THRUST	
MAX TAKEOFF EPR FOR ACTUAL OAT	MIN TAKEOFF EPR ALLOWED
1.75	1.44
1.70	1.42
1.65	1.40
1.60	1.38
1.55	1.35
1.50	1.33
1.45	1.30
1.40	1.27
1.35	1.24
1.31	1.21
1.25	1.21

Max Climb EPR

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (KIAS OR MACH)								
	0	5	10	15	20	25	30	35	40
	250	250	250	290	290	290	290	.78	.78
60	1.24	1.25	1.25	1.21	1.20	1.18	1.14	1.08	1.05
50	1.28	1.29	1.29	1.26	1.24	1.23	1.21	1.15	1.11
40	1.32	1.34	1.34	1.31	1.30	1.29	1.27	1.21	1.18
30	1.33	1.40	1.40	1.38	1.37	1.36	1.35	1.29	1.25
20	1.33	1.40	1.46	1.46	1.45	1.44	1.43	1.37	1.34
10	1.33	1.40	1.46	1.47	1.53	1.53	1.53	1.47	1.44
0	1.33	1.40	1.46	1.47	1.53	1.57	1.63	1.57	1.54
-10	1.33	1.40	1.46	1.47	1.53	1.57	1.64	1.67	1.63
-20 & BELOW	1.33	1.40	1.46	1.47	1.53	1.57	1.64	1.68	1.66

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	0	5	10	15	20	25	30	35	40
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03	-0.04	-0.04
ENGINE & WING ANTI-ICE ON	-0.02	-0.03	-0.04	-0.05	-0.05	-0.05	-0.07	-0.07	-0.08

Go-around EPR**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 (FT)					
°C	°F		-1000	0	2000	4000	6000	8000
55	131	58	1.38	1.38	1.37	1.37	1.36	1.37
50	122	53	1.42	1.42	1.42	1.42	1.41	1.42
45	113	48	1.46	1.46	1.47	1.46	1.46	1.46
40	104	43	1.51	1.51	1.51	1.51	1.51	1.51
35	95	38	1.54	1.56	1.55	1.55	1.55	1.55
30	86	33	1.54	1.57	1.59	1.59	1.59	1.59
25	77	28	1.54	1.57	1.60	1.62	1.61	1.62
20	68	23	1.54	1.57	1.60	1.62	1.63	1.64
15	59	18	1.54	1.57	1.60	1.62	1.63	1.66
10 & BELOW	50 & BELOW	13 & BELOW	1.54	1.57	1.60	1.62	1.63	1.66

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)							
	-1000	0	2000	4000	4500	4501	6000	8000
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
WING ANTI-ICE ON	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (290/.78)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	4.0	4.0			
	V/S (FT/MIN)	1500	900			
30000	PITCH ATT	4.0	4.0	3.5	3.5	4.0
	V/S (FT/MIN)	2600	2000	1600	1200	900
20000	PITCH ATT	6.5	6.0	6.0	5.5	5.5
	V/S (FT/MIN)	4000	3200	2600	2100	1700
10000	PITCH ATT	10.0	8.5	8.0	7.5	7.5
	V/S (FT/MIN)	5300	4300	3500	3000	2500
SEA LEVEL	PITCH ATT	12.5	11.0	10.0	9.5	9.0
	V/S (FT/MIN)	6000	4900	4100	3500	3000

Cruise (.78/290)

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	2.0	2.5	3.5		
	EPR	1.20	1.31	1.52		
	(Alt Mode %N1)	(82.7)	(86.3)	(93.0)		
35000	PITCH ATT	1.5	2.0	2.5	3.0	3.5
	EPR	1.11	1.16	1.23	1.34	1.53
	(Alt Mode %N1)	(79.8)	(81.8)	(84.3)	(87.8)	(93.7)
30000	PITCH ATT	1.0	1.5	2.0	2.0	2.5
	EPR	1.06	1.09	1.13	1.18	1.24
	(Alt Mode %N1)	(78.8)	(80.2)	(81.9)	(83.8)	(86.0)
25000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	EPR	1.02	1.04	1.07	1.10	1.14
	(Alt Mode %N1)	(75.1)	(76.5)	(78.2)	(80.1)	(82.2)
20000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	EPR	1.00	1.01	1.03	1.06	1.08
	(Alt Mode %N1)	(72.5)	(73.4)	(74.7)	(76.4)	(78.4)
15000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	EPR	0.99	1.00	1.01	1.03	1.05
	(Alt Mode %N1)	(70.1)	(70.5)	(71.4)	(73.0)	(74.8)

Descent (.78/290)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	-1.0	-0.5	0.0	0.5	0.5
	V/S (FT/MIN)	-2400	-2400	-2500	-3000	-3500
30000	PITCH ATT	-2.5	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2800	-2500	-2300	-2200	-2100
20000	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2600	-2300	-2100	-2000	-1900
10000	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2300	-2000	-1900	-1800	-1700
SEA LEVEL	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2000	-1700	-1600	-1500	-1500

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF30 + 80)**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	4.0	4.5	4.5	5.0	5.0
	EPR	1.01	1.02	1.04	1.05	1.05
	(Alt Mode %N1)	(54.8)	(59.3)	(63.5)	(67.1)	(70.1)
	KIAS	199	211	222	236	251
5000	PITCH ATT	4.0	4.5	5.0	5.0	4.5
	EPR	1.00	1.01	1.02	1.03	1.04
	(Alt Mode %N1)	(51.3)	(55.1)	(59.2)	(62.7)	(66.2)
	KIAS	199	211	222	236	251

Terminal Area (5000 FT)**Set Thrust for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS UP (VREF30+80) (GEAR UP)	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	EPR	1.02	1.03	1.04	1.05	1.06
	(Alt Mode %N1)	(51.9)	(56.0)	(60.2)	(63.8)	(67.2)
	KIAS	199	211	222	236	251
FLAPS 1 (VREF30+60) (GEAR UP)	PITCH ATT	6.0	6.5	6.5	6.5	6.5
	EPR	1.04	1.05	1.06	1.07	1.08
	(Alt Mode %N1)	(52.3)	(57.6)	(61.7)	(65.2)	(68.5)
	KIAS	179	191	202	216	231
FLAPS 5 (VREF30+40) (GEAR UP)	PITCH ATT	4.5	4.5	5.0	4.5	4.5
	EPR	1.05	1.07	1.08	1.10	1.11
	(Alt Mode %N1)	(55.2)	(60.2)	(64.2)	(67.9)	(71.3)
	KIAS	159	171	182	196	211
FLAPS 15 (VREF30+20) (GEAR UP)	PITCH ATT	5.5	5.5	6.0	6.0	5.5
	EPR	1.07	1.09	1.11	1.12	1.14
	(Alt Mode %N1)	(56.8)	(61.7)	(66.0)	(69.6)	(73.0)
	KIAS	139	151	162	176	191
FLAPS 20 (VREF30+20) (GEAR DOWN)	PITCH ATT	4.0	4.5	4.5	4.0	3.5
	EPR	1.10	1.12	1.15	1.18	1.21
	(Alt Mode %N1)	(63.3)	(68.0)	(72.3)	(76.5)	(80.3)
	KIAS	139	151	162	176	191

Final Approach (1500 FT)**Gear Down, Set Thrust for a 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS 20 (VREF20 + 10)	PITCH ATT	1.5	1.5	1.5	1.5	1.5
	EPR	1.03	1.04	1.04	1.05	1.05
	(Alt Mode %N1)	(43.3)	(47.9)	(52.1)	(55.7)	(59.2)
	KIAS	138	150	162	172	184

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around (VREF 30 + 20)

Flaps 20, Gear Up, Set Go-Around Thrust

Normal Mode EEC

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	18.0	15.0	12.5	10.5	8.5
	V/S (FT/MIN)	3900	3200	2700	2300	1900
	KIAS	139	151	162	176	191
5000	PITCH ATT	21.5	17.5	15.0	12.5	10.5
	V/S (FT/MIN)	4500	3800	3200	2800	2400
	KIAS	139	151	162	176	191
SEA LEVEL	PITCH ATT	25.0	20.5	17.5	14.5	12.5
	V/S (FT/MIN)	5100	4300	3700	3200	2900
	KIAS	139	151	162	176	191

Alternate Mode EEC

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	17.0	14.0	11.5	10.0	8.0
	V/S (FT/MIN)	3600	2900	2400	2000	1700
	KIAS	139	151	162	176	191
5000	PITCH ATT	20.0	16.5	14.0	11.5	9.5
	V/S (FT/MIN)	4100	3400	2900	2500	2100
	KIAS	139	151	162	176	191
SEA LEVEL	PITCH ATT	23.0	19.0	16.0	13.5	11.0
	V/S (FT/MIN)	4600	3900	3300	2900	2500
	KIAS	139	151	162	176	191



Performance Inflight

All Engine

Chapter PI

Section 51

Long Range Cruise Maximum Operating Altitude

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°)
190	29000	-2	34000*	33600	32700	30900	29400
185	29600	-3	34600*	34200	33300	31500	30000
180	30200	-4	35100*	34800	33800	32100	30600
175	30800	-6	35700*	35400	34400	32700	31200
170	31500	-7	36200*	36000	35000	33300	31800
165	32100	-8	36800*	36600	35700	34000	32500
160	32800	-10	37400*	37200	36300	34600	33100
155	33400	-11	38100*	37900	37000	35300	33800
150	34100	-13	38700*	38600	37700	36000	34500
145	34900	-15	39400*	39300	38400	36700	35200
140	35600	-16	40100*	40000	39100	37400	36000
135	36400	-17	40800*	40800	39900	38200	36700
130	37100	-17	41600*	41600	40600	38900	37500
125	38000	-17	42400*	42400	41500	39800	38300
120	38800	-17	43100	43100	42300	40600	39200
115	39700	-17	43100	43100	43100	41500	40100
110	40600	-17	43100	43100	43100	42400	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	29000	4	34000*	33600	32700	30900	29400
185	29600	3	34500*	34200	33300	31500	30000
180	30200	1	35100*	34800	33800	32100	30600
175	30800	0	35600*	35400	34400	32700	31200
170	31500	-1	36200*	36000	35000	33300	31800
165	32100	-3	36800*	36600	35700	34000	32500
160	32800	-4	37400*	37200	36300	34600	33100
155	33400	-6	38100*	37900	37000	35300	33800
150	34100	-7	38700*	38600	37700	36000	34500
145	34900	-9	39400*	39300	38400	36700	35200
140	35600	-11	40100*	40000	39100	37400	36000
135	36400	-12	40800*	40800	39900	38200	36700
130	37100	-12	41600*	41600	40600	38900	37500
125	38000	-12	42300*	42300*	41500	39800	38300
120	38800	-12	43100	43100	42300	40600	39200
115	39700	-12	43100	43100	43100	41500	40100
110	40600	-12	43100	43100	43100	42400	41000

*Denotes altitude thrust limited in level flight.

Long Range Cruise Maximum Operating Altitude
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°)
190	29000	10	33400*	33400*	32700	30900	29400
185	29600	8	34000*	34000*	33300	31500	30000
180	30200	7	34500*	34500*	33800	32100	30600
175	30800	6	35100*	35100*	34400	32700	31200
170	31500	4	35700*	35700*	35000	33300	31800
165	32100	3	36300*	36300*	35700	34000	32500
160	32800	1	36900*	36900*	36300	34600	33100
155	33400	0	37500*	37500*	37000	35300	33800
150	34100	-2	38200*	38200*	37700	36000	34500
145	34900	-3	38800*	38800*	38400	36700	35200
140	35600	-5	39500*	39500*	39100	37400	36000
135	36400	-6	40200*	40200*	39900	38200	36700
130	37100	-6	41000*	41000*	40600	38900	37500
125	38000	-6	41800*	41800*	41500	39800	38300
120	38800	-6	42600*	42600*	42300	40600	39200
115	39700	-6	43100	43100	43100	41500	40100
110	40600	-6	43100	43100	43100	42400	41000

*Denotes altitude thrust limited in level flight.



Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		23	25	27	29	31	33	35	37	39	41	43
190	EPR	1.12	1.15	1.19	1.25	1.33	1.46					
	MACH	.776	.790	.797	.802	.802	.796					
	KIAS	340	333	323	311	298	283					
	FF/ENG	3306	3258	3201	3162	3175	3275					
180	EPR	1.10	1.13	1.17	1.21	1.28	1.38	1.54				
	MACH	.764	.782	.794	.799	.802	.800	.792				
	KIAS	335	329	321	310	298	284	269				
	FF/ENG	3146	3115	3061	3006	2984	3029	3208				
170	EPR	1.09	1.11	1.15	1.19	1.23	1.31	1.44				
	MACH	.752	.771	.787	.796	.801	.802	.797				
	KIAS	329	324	318	309	298	285	271				
	FF/ENG	2991	2962	2918	2867	2823	2823	2897				
160	EPR	1.08	1.10	1.13	1.16	1.20	1.26	1.36	1.50			
	MACH	.737	.758	.777	.791	.798	.802	.801	.794			
	KIAS	322	318	314	307	296	285	272	258			
	FF/ENG	2831	2807	2773	2729	2674	2647	2665	2798			
150	EPR	1.06	1.08	1.11	1.14	1.17	1.22	1.29	1.40			
	MACH	.720	.743	.763	.781	.794	.799	.802	.799			
	KIAS	314	312	308	303	295	284	273	259			
	FF/ENG	2660	2650	2619	2585	2541	2490	2477	2532			
140	EPR	1.05	1.07	1.09	1.12	1.15	1.19	1.24	1.32	1.44		
	MACH	.701	.725	.747	.767	.785	.796	.801	.802	.798		
	KIAS	305	303	301	297	291	283	272	260	247		
	FF/ENG	2483	2482	2465	2432	2401	2354	2317	2326	2416		
130	EPR	1.04	1.05	1.07	1.10	1.12	1.16	1.20	1.26	1.35	1.48	
	MACH	.681	.704	.728	.751	.771	.788	.797	.801	.802	.796	
	KIAS	296	294	293	290	286	280	271	260	249	235	
	FF/ENG	2315	2308	2301	2282	2251	2219	2173	2159	2193	2293	
120	EPR	1.03	1.04	1.06	1.08	1.10	1.13	1.17	1.21	1.28	1.37	1.52
	MACH	.659	.683	.707	.731	.753	.774	.790	.798	.802	.801	.794
	KIAS	286	285	283	281	278	274	268	259	249	237	224
	FF/ENG	2157	2142	2127	2122	2101	2074	2041	2012	2016	2050	2163
110	EPR	1.02	1.03	1.04	1.06	1.08	1.11	1.14	1.17	1.22	1.29	1.39
	MACH	.635	.659	.683	.707	.732	.755	.775	.791	.798	.802	.801
	KIAS	275	274	273	272	270	267	263	256	247	237	226
	FF/ENG	2014	1986	1968	1949	1945	1925	1899	1881	1868	1865	1899
100	EPR	1.01	1.02	1.03	1.04	1.06	1.08	1.11	1.14	1.18	1.22	1.29
	MACH	.609	.633	.657	.682	.706	.731	.754	.775	.791	.798	.802
	KIAS	263	263	262	261	260	258	255	251	245	236	226
	FF/ENG	1871	1844	1818	1798	1781	1767	1751	1738	1735	1716	1709

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
281	260	241	226	212	200	191	182	174	167	161
561	520	484	452	425	400	382	366	351	337	325
843	781	726	679	637	600	574	549	527	507	488
1126	1043	969	905	850	800	765	733	703	676	651
1411	1306	1213	1133	1063	1000	956	916	879	845	814
1697	1570	1457	1361	1276	1200	1148	1100	1055	1014	977
1985	1836	1703	1589	1489	1400	1339	1283	1231	1183	1140
2275	2102	1948	1817	1703	1600	1531	1466	1407	1352	1302
2566	2369	2194	2045	1916	1800	1722	1649	1582	1521	1465
2858	2638	2442	2275	2130	2000	1913	1832	1757	1689	1627

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.8	0:39	2.4	0:38	1.9	0:36	1.7	0:35	1.5	0:35
400	5.8	1:13	5.2	1:10	4.4	1:06	4.0	1:03	3.7	1:01
600	8.8	1:48	8.1	1:42	6.8	1:35	6.3	1:31	5.8	1:28
800	11.7	2:23	10.8	2:15	9.2	2:05	8.5	2:00	8.0	1:55
1000	14.7	2:59	13.6	2:48	11.6	2:36	10.7	2:28	10.1	2:22
1200	17.6	3:35	16.3	3:22	13.9	3:06	12.9	2:57	12.2	2:50
1400	20.4	4:12	19.0	3:56	16.3	3:37	15.1	3:26	14.2	3:17
1600	23.2	4:49	21.7	4:30	18.6	4:08	17.3	3:55	16.3	3:45
1800	26.0	5:27	24.3	5:05	20.9	4:39	19.4	4:25	18.3	4:13
2000	28.8	6:05	26.9	5:40	23.2	5:10	21.5	4:54	20.3	4:41

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.2	-0.1	0.0	0.1	0.2
4	-0.5	-0.3	0.0	0.3	0.6
6	-0.8	-0.4	0.0	0.4	0.9
8	-1.1	-0.6	0.0	0.6	1.2
10	-1.4	-0.8	0.0	0.8	1.6
12	-1.8	-0.9	0.0	0.9	1.9
14	-2.1	-1.1	0.0	1.1	2.3
16	-2.4	-1.2	0.0	1.3	2.6
18	-2.7	-1.4	0.0	1.4	2.9
20	-3.0	-1.5	0.0	1.6	3.3
22	-3.3	-1.7	0.0	1.8	3.6
24	-3.5	-1.8	0.0	1.9	3.9
26	-3.8	-2.0	0.0	2.1	4.3
28	-4.1	-2.2	0.0	2.3	4.6
30	-4.4	-2.3	0.0	2.4	4.9



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
652	615	582	552	525	500	478	458	439	422	407
1296	1224	1158	1100	1048	1000	957	918	881	848	817
1942	1835	1737	1650	1572	1500	1437	1378	1323	1273	1227
2590	2448	2318	2201	2096	2000	1916	1838	1766	1699	1638
3242	3063	2899	2753	2621	2500	2396	2298	2208	2124	2048
3896	3679	3481	3305	3146	3000	2875	2758	2650	2550	2459
4554	4299	4066	3859	3672	3500	3354	3218	3092	2976	2870
5215	4920	4652	4413	4198	4000	3833	3678	3535	3402	3281
5880	5545	5240	4968	4724	4500	4312	4138	3976	3827	3691
6549	6172	5829	5525	5251	5000	4792	4598	4418	4253	4102
7222	6803	6421	6082	5779	5500	5271	5058	4860	4678	4512
7901	7437	7015	6642	6307	6000	5750	5517	5301	5103	4922

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	4.7	1:14	4.5	1:14	4.4	1:13	4.3	1:13	4.2	1:13
1000	9.9	2:21	9.6	2:19	9.3	2:18	9.1	2:18	9.1	2:19
1500	15.0	3:29	14.5	3:26	14.1	3:24	13.8	3:24	13.7	3:24
2000	20.0	4:38	19.4	4:33	18.8	4:30	18.4	4:29	18.3	4:29
2500	24.9	5:48	24.1	5:41	23.4	5:37	22.9	5:35	22.7	5:35
3000	29.6	6:58	28.7	6:50	27.9	6:44	27.3	6:41	27.0	6:40
3500	34.2	8:10	33.3	8:00	32.4	7:52	31.6	7:48	31.2	7:46
4000	38.8	9:24	37.7	9:11	36.7	9:01	35.8	8:56	35.3	8:53
4500	43.2	10:38	42.0	10:23	40.9	10:12	39.9	10:04	39.3	10:00
5000	47.6	11:54	46.3	11:37	45.0	11:23	43.9	11:14	43.2	11:07
5500	51.9	13:11	50.4	12:51	49.0	12:35	47.8	12:24	47.0	12:15
6000	56.1	14:30	54.5	14:07	53.0	13:49	51.6	13:35	50.7	13:24

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	2.8	6.4
10	-1.5	-0.8	0.0	4.2	10.2
15	-2.2	-1.2	0.0	5.6	13.5
20	-3.0	-1.6	0.0	6.7	16.3
25	-3.7	-2.0	0.0	7.7	18.6
30	-4.5	-2.4	0.0	8.5	20.5
35	-5.3	-2.8	0.0	9.1	21.8
40	-6.0	-3.2	0.0	9.6	22.7
45	-6.8	-3.5	0.0	9.9	23.1
50	-7.6	-3.8	0.0	10.0	23.0
55	-8.4	-4.2	0.0	10.0	22.4
60	-9.2	-4.5	0.0	9.7	21.3

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)										
	190	180	170	160	150	140	130	120	110	100	90
43								37	12	1	2
41							31	10	1	2	11
39					50	24	7	0	2	10	24
37				36	16	4	0	2	10	22	39
35		46	24	10	2	0	3	11	22	37	55
33	30	15	5	0	1	5	13	23	37	53	70
31	7	2	0	2	7	15	25	38	52	68	85
29	0	1	4	10	18	28	40	53	67	83	99
27	2	7	13	21	31	42	55	68	82	96	111
25	10	17	25	35	45	57	69	82	95	109	122

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 .78/290/250

PRESSURE ALT (1000 FT)	17	19	21	23	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	62	68	74	81	87	93	100	106	111	116	122	128	134	139
TIME (MINUTES)	16	17	17	18	19	20	21	22	23	23	24	25	26	26

Holding**Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
190	EPR	1.03	1.04	1.06	1.09	1.13	1.20	1.30		
	KIAS	259	259	259	259	261	264	267		
	FF/ENG	3060	3050	3030	2980	2900	2940	3030		
180	EPR	1.03	1.04	1.05	1.08	1.12	1.18	1.27		
	KIAS	251	251	251	252	254	256	259		
	FF/ENG	2900	2880	2860	2820	2740	2760	2830		
170	EPR	1.03	1.04	1.05	1.07	1.11	1.16	1.24	1.43	
	KIAS	244	244	244	245	246	248	251	254	
	FF/ENG	2750	2720	2700	2670	2590	2590	2650	2870	
160	EPR	1.02	1.03	1.05	1.06	1.10	1.15	1.22	1.36	
	KIAS	236	236	236	238	239	241	243	246	
	FF/ENG	2600	2560	2540	2510	2440	2430	2470	2580	
150	EPR	1.02	1.03	1.04	1.06	1.09	1.13	1.20	1.31	
	KIAS	228	228	229	230	231	233	235	238	
	FF/ENG	2450	2410	2380	2360	2290	2270	2300	2370	
140	EPR	1.02	1.02	1.04	1.05	1.08	1.11	1.18	1.27	
	KIAS	222	222	222	222	223	225	226	229	
	FF/ENG	2300	2260	2230	2200	2140	2120	2130	2180	
130	EPR	1.01	1.02	1.03	1.04	1.06	1.10	1.15	1.23	1.40
	KIAS	217	217	217	217	217	217	218	220	222
	FF/ENG	2160	2110	2090	2060	1990	1980	1970	2010	2180
120	EPR	1.01	1.01	1.02	1.04	1.05	1.08	1.13	1.20	1.33
	KIAS	211	211	211	211	211	211	211	211	214
	FF/ENG	2020	1970	1950	1910	1840	1850	1830	1830	1940
110	EPR	1.01	1.01	1.02	1.03	1.04	1.07	1.11	1.17	1.27
	KIAS	205	205	205	205	205	205	205	205	205
	FF/ENG	1880	1830	1810	1770	1700	1710	1700	1680	1750
100	EPR	1.00	1.01	1.01	1.02	1.03	1.05	1.08	1.14	1.22
	KIAS	199	199	199	199	199	199	199	199	199
	FF/ENG	1740	1700	1680	1640	1570	1570	1560	1540	1600

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Advisory Information

Chapter PI

Section 52

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF25	ONE REV	NO REV
MAX MANUAL	3220	110/-70	80	-130	440	50	-40	80	-80	250	70	140
MAX AUTO	5370	130/-130	150	-250	840	0	0	160	-160	600	0	0
AUTOBRAKE 4	5540	140/-140	160	-260	880	0	0	160	-160	630	0	0
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	0	190	-190	740	0	0
AUTOBRAKE 2	7150	190/-190	220	-350	1190	30	-110	230	-210	660	60	60
AUTOBRAKE 1	7840	220/-220	260	-400	1370	170	-220	270	-230	580	430	520

Good Reported Braking Action

MAX MANUAL	4460	110/-100	130	-210	740	130	-110	130	-120	350	230	520
MAX AUTO	5380	130/-130	150	-250	860	20	-10	160	-160	600	20	80
AUTOBRAKE 4	5540	140/-140	160	-260	880	10	0	160	-160	630	10	50
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	0	190	-190	740	0	0

Medium Reported Braking Action

MAX MANUAL	6140	170/-160	200	-330	1220	310	-240	210	-180	450	640	1540
MAX AUTO	6140	170/-160	200	-330	1220	300	-170	210	-180	570	610	1510
AUTOBRAKE 4	6190	170/-160	200	-340	1220	270	-150	210	-190	620	550	1450
AUTOBRAKE 3	6710	180/-180	210	-360	1280	170	-90	220	-210	740	350	1080

Poor Reported Braking Action

MAX MANUAL	8000	240/-230	280	-500	1910	720	-460	310	-250	520	1400	3700
MAX AUTO	8000	240/-230	280	-500	1910	720	-460	310	-250	510	1400	3710
AUTOBRAKE 4	8000	240/-230	280	-500	1910	720	-460	310	-250	510	1400	3710
AUTOBRAKE 3	8010	240/-230	280	-500	1920	690	-370	300	-260	680	1340	3640

Reference distance assumes sea level, standard day, no wind or slope, VREF25 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 400 ft.

Reference distance for auto braking is applicable for auto or manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF30	ONE REV	NO REV
MAX MANUAL	3170	140/-70	80	-130	440	50	-50	80	-80	260	60	130
MAX AUTO	5220	210/-140	150	-240	830	0	0	150	-150	600	0	0
AUTOBRAKE 4	5380	220/-140	150	-250	870	0	0	160	-160	620	0	0
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	0	190	-190	730	0	0
AUTOBRAKE 2	6970	280/-200	210	-350	1180	10	-100	220	-210	670	30	30
AUTOBRAKE 1	7690	300/-220	250	-400	1360	160	-210	260	-230	580	350	440

Good Reported Braking Action

MAX MANUAL	4400	160/-110	120	-210	740	130	-110	130	-120	350	220	480
MAX AUTO	5230	210/-140	150	-250	850	20	-10	150	-150	600	20	80
AUTOBRAKE 4	5390	220/-140	160	-250	870	10	0	160	-160	620	10	50
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	0	190	-190	730	0	0

Medium Reported Braking Action

MAX MANUAL	6070	230/-170	200	-330	1220	320	-250	210	-180	450	600	1430
MAX AUTO	6070	250/-170	190	-330	1220	310	-190	210	-180	550	600	1420
AUTOBRAKE 4	6080	250/-170	200	-330	1220	290	-160	200	-190	600	550	1380
AUTOBRAKE 3	6550	280/-190	210	-350	1280	180	-100	210	-200	730	360	1030

Poor Reported Braking Action

MAX MANUAL	7920	310/-240	280	-500	1920	730	-470	300	-250	520	1320	3420
MAX AUTO	7920	310/-240	280	-500	1910	730	-470	300	-250	520	1320	3430
AUTOBRAKE 4	7920	310/-240	280	-500	1910	730	-470	300	-250	520	1320	3430
AUTOBRAKE 3	7920	330/-240	280	-500	1920	720	-380	300	-260	670	1290	3390

Reference distance assumes sea level, standard day, no wind or slope, VREF30 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 400 ft.

Reference distance for auto braking is applicable for both auto and manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Dry Runway

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	4180	90/-90	110	-170/560	80/-70	100/-100	420	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	4100	160/-100	110	-170/570	90/-80	100/-100	440	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	4580	260/-110	130	-170/570	80/-70	130/-130	330	180	390
ANTI-SKID OFF (FLAPS 25)	VREF25	6020	160/-150	170	-300/1040	200/-170	170/-160	450	380	870
ANTI-SKID OFF (FLAPS 30)	VREF30	5870	230/-160	160	-290/1030	200/-170	170/-160	450	350	800
ENGINE FAILURE (FLAPS 20)	VREF20	3480	150/-80	90	-140/470	60/-50	90/-90	280	0	90
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	4180	110/-100	100	-160/540	70/-60	110/-100	390	120	260
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	3460	90/-80	90	-140/480	60/-60	90/-80	300	0	90
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	3400	130/-80	90	-140/480	60/-60	90/-80	310	0	80
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	3830	90/-90	100	-160/560	80/-70	100/-100	340	0	130
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	3760	150/-90	100	-160/560	80/-80	100/-100	350	0	130
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	5140	200/-120	140	-190/640	120/-110	140/-140	570	0	250
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	5110	200/-120	140	-210/700	150/-130	150/-140	520	0	0
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	6260	260/-150	180	-250/850	210/-180	190/-180	670	0	510

***Reference distance assumes sea level, standard day with no wind or slope.**

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Dry Runway**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	3710	180/-80	100	-140/490	60/-50	100/-90	280	100	220
LE SLAT ASYM (FLAPS = 20)	VREF30+30	4180	170/-90	110	-160/520	70/-60	120/-110	310	140	290
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	4490	170/-100	120	-160/540	80/-70	130/-120	320	160	340
LE SLAT DISAGREE (FLAPS > 20)	VREF20	3420	140/-80	80	-130/460	50/-50	90/-80	270	80	180
LE SLAT DISAGREE - ALTN FLAP EXT ACOMPLISHED (FLAPS = 20)	VREF20	3420	140/-80	80	-130/460	50/-50	90/-80	270	80	180
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	3980	180/-90	100	-150/500	60/-60	110/-100	280	120	250
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	4280	180/-100	110	-160/540	80/-70	120/-110	330	0	150
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	3420	140/-80	80	-130/460	50/-50	90/-80	270	80	180
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	3710	180/-80	100	-140/490	60/-50	100/-90	280	100	220
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	3930	220/-90	100	-150/500	60/-60	110/-100	270	110	250
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	3420	140/-80	80	-130/460	50/-50	90/-80	270	80	180
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	3710	180/-80	100	-140/490	60/-50	100/-90	280	100	220
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	3930	220/-90	100	-150/500	60/-60	110/-100	270	110	250

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	6140	150/-150	180	-290/990	260/-220	170/-170	620	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	5990	250/-150	180	-290/990	270/-220	170/-170	630	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	6310	220/-160	200	-260/870	170/-150	210/-180	380	490	1120
ANTI-SKID OFF (FLAPS 25)	VREF25	6800	190/-180	200	-360/1280	300/-240	210/-190	490	590	1410
ANTI-SKID OFF (FLAPS 30)	VREF30	6630	260/-180	200	-360/1280	310/-240	200/-180	490	550	1290
ENGINE FAILURE (FLAPS 20)	VREF20	5030	150/-130	140	-230/810	160/-140	150/-140	410	0	360
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	5690	170/-150	170	-250/860	180/-150	170/-150	510	400	920
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	4950	130/-130	140	-240/820	170/-140	140/-140	430	0	330
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	4860	200/-130	140	-240/820	170/-150	140/-140	440	0	310
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	4950	130/-130	140	-240/820	170/-140	140/-140	430	0	330
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	4860	200/-130	140	-240/820	170/-150	140/-140	440	0	310
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	7270	300/-190	220	-310/1050	310/-260	230/-210	750	0	850
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	6970	280/-170	210	-310/1050	330/-270	210/-210	690	0	0
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	7270	300/-190	220	-310/1050	310/-260	230/-210	750	0	850

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Good Reported Braking Action**

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	5210	200/-130	160	-230/800	150/-130	160/-150	380	340	770
LE SLAT ASYM (FLAPS = 20)	VREF30+30	5860	220/-150	180	-250/860	180/-150	190/-170	430	430	990
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	6280	230/-160	200	-260/890	190/-160	210/-180	430	480	1100
LE SLAT DISAGREE (FLAPS > 20)	VREF20	4800	140/-130	140	-220/770	140/-120	140/-130	380	290	670
LE SLAT DISAGREE - ALTN FLAP EXT ACOMPLISHED (FLAPS = 20)	VREF20	4800	140/-130	140	-220/770	140/-120	140/-130	380	290	670
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	5580	200/-140	170	-240/830	160/-140	180/-160	390	380	860
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	6210	230/-160	190	-270/910	210/-180	200/-180	470	0	540
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	4800	140/-130	140	-220/770	140/-120	140/-130	380	290	670
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	5220	200/-140	160	-230/800	150/-130	160/-150	380	350	790
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	5560	200/-140	170	-240/820	150/-140	180/-160	380	390	890
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	4800	140/-130	140	-220/770	140/-120	140/-130	380	290	670
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	5220	200/-140	160	-230/800	150/-130	160/-150	380	350	790
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	5560	200/-140	170	-240/820	150/-140	180/-160	380	390	890

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	9630	240/-240	330	-530/1860	920/-630	290/-300	850	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	9340	380/-240	330	-530/1850	910/-620	290/-290	860	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	9020	340/-250	320	-410/1450	430/-350	340/-280	520	1370	3500
ANTI-SKID OFF (FLAPS 25)	VREF25	8640	260/-250	280	-530/1980	720/-470	290/-260	560	1310	3460
ANTI-SKID OFF (FLAPS 30)	VREF30	8450	350/-250	280	-530/1980	730/-480	290/-260	570	1230	3170
ENGINE FAILURE (FLAPS 20)	VREF20	7350	240/-220	240	-390/1390	450/-350	250/-220	570	0	1150
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	7710	260/-230	260	-390/1390	420/-330	270/-230	630	1060	2730
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	7180	210/-200	230	-400/1410	470/-350	240/-210	560	0	1030
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	7030	300/-210	230	-400/1410	470/-360	230/-210	570	0	950
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	7180	210/-200	230	-400/1410	470/-350	240/-210	560	0	1030
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	7030	300/-210	230	-400/1410	470/-360	230/-210	570	0	950
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	10360	440/-300	350	-510/1750	790/-580	370/-320	920	0	2440
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	11150	440/-290	350	-570/1950	1090/-760	360/-350	960	0	0
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	10360	440/-300	350	-510/1750	790/-580	370/-320	920	0	2440

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Medium Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)									
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ		
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV	
LE SLAT ASYM (FLAPS > 20)	VREF30+20	7230	290/-210	250	-370/1320	370/-290	260/-220	490	920	2270	
LE SLAT ASYM (FLAPS = 20)	VREF30+30	8070	320/-230	280	-400/1390	410/-330	300/-250	530	1110	2770	
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	8630	340/-250	310	-410/1430	430/-350	320/-270	540	1280	3250	
LE SLAT DISAGREE (FLAPS > 20)	VREF20	6700	220/-200	220	-360/1270	350/-280	230/-200	490	830	2040	
LE SLAT DISAGREE - ALTN FLAP EXT ACOMPLISHED (FLAPS = 20)	VREF20	6700	220/-200	220	-360/1270	350/-280	230/-200	490	830	2040	
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	7720	300/-220	260	-380/1360	380/-310	280/-240	490	1000	2460	
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	8970	350/-260	300	-440/1530	550/-430	320/-280	620	0	1580	
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	6700	220/-200	220	-360/1270	350/-280	230/-200	490	830	2040	
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	7290	300/-210	250	-370/1320	370/-290	260/-220	490	950	2370	
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	7770	300/-220	270	-380/1360	380/-310	280/-240	490	1050	2640	
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	6700	220/-200	220	-360/1270	350/-280	230/-200	490	830	2040	
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	7290	300/-210	250	-370/1320	370/-290	260/-220	490	950	2370	
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	7770	300/-220	270	-380/1360	380/-310	280/-240	490	1050	2640	

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	15350	340/-300	640	-1010/3750	4210/-1740	490/-490	1060	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	14810	500/-300	620	-990/3710	4120/-1700	480/-480	1050	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	11980	480/-370	470	-620/2260	990/-680	500/-390	640	2960	8700
ANTI-SKID OFF (FLAPS 25)	VREF25	11670	390/-370	420	-890/3770	4840/-1110	430/-410	630	3680	14100
ANTI-SKID OFF (FLAPS 30)	VREF30	11470	490/-370	410	-890/3770	4800/-1120	420/-410	630	3500	13210
ENGINE FAILURE (FLAPS 20)	VREF20	10180	360/-320	360	-620/2270	1170/-740	370/-330	700	0	2870
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	9910	360/-320	370	-580/2140	950/-620	380/-310	720	2220	6470
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	9940	300/-300	340	-640/2380	1280/-760	360/-310	670	0	2580
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	9740	410/-300	340	-640/2380	1290/-760	350/-310	670	0	2360
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	9940	300/-300	340	-640/2380	1280/-760	360/-310	670	0	2580
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	9740	410/-300	340	-640/2380	1290/-760	350/-310	670	0	2360
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	14070	600/-420	520	-800/2860	1980/-1170	550/-450	1040	0	5800
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	17420	620/-430	550	-1020/3640	3920/-1910	580/-540	1190	0	0
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	14070	600/-420	520	-800/2860	1980/-1170	550/-450	1040	0	5800

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Poor Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	9440	400/-290	350	-550/2060	850/-560	370/-310	570	1940	5350
LE SLAT ASYM (FLAPS = 20)	VREF30+30	10430	430/-320	400	-580/2150	920/-620	420/-340	610	2250	6270
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	11250	460/-350	440	-610/2210	970/-650	460/-370	630	2640	7610
LE SLAT DISAGREE (FLAPS > 20)	VREF20	8820	320/-280	320	-540/2010	820/-540	340/-280	580	1800	4970
LE SLAT DISAGREE - ALTN FLAP EXT ACOMPLISHED (FLAPS = 20)	VREF20	8820	320/-280	320	-540/2010	820/-540	340/-280	580	1800	4970
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	10000	410/-310	370	-570/2100	870/-580	390/-330	560	2050	5650
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	12190	500/-380	440	-680/2450	1340/-860	470/-400	730	0	3680
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	8820	320/-280	320	-540/2010	820/-540	340/-280	580	1800	4970
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	9590	410/-300	360	-560/2070	850/-570	380/-310	590	2100	5920
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	10170	420/-310	380	-570/2120	870/-590	410/-330	580	2220	6260
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	8820	320/-280	320	-540/2010	820/-540	340/-280	580	1800	4970
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	9590	410/-300	360	-560/2070	850/-570	380/-310	590	2100	5920
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	10170	420/-310	380	-570/2120	870/-590	410/-330	580	2220	6260

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (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
180	0	14.9	15.8	16.7	22.4	23.9	25.4	31.3	33.4	35.5	41.2	44.0	46.8	52.0	55.6	59.2			
	10	15.4	16.4	17.3	23.2	24.7	26.3	32.3	34.5	36.7	42.6	45.5	48.5	53.8	57.6	61.3			
	20	15.9	16.9	17.9	24.0	25.6	27.1	33.4	35.7	37.9	44.0	47.1	50.1	55.6	59.5	63.4			
	30	16.4	17.4	18.4	24.7	26.4	28.0	34.5	36.8	39.1	45.5	48.6	51.7	57.4	61.5	65.5			
	40	16.7	17.7	18.8	25.2	26.9	28.6	35.3	37.7	40.1	46.5	49.8	53.0	58.9	63.0	67.2			
	50	16.9	18.0	19.0	25.7	27.4	29.1	35.9	38.4	40.8	47.5	50.8	54.1	60.2	64.5	68.7			
160	0	13.4	14.3	15.1	20.2	21.5	22.8	28.1	30.0	31.8	36.9	39.4	41.9	46.5	49.8	53.0	56.8	60.8	64.8
	10	13.9	14.8	15.6	20.9	22.3	23.6	29.1	31.0	32.9	38.2	40.8	43.4	48.2	51.5	54.9	58.9	63.0	67.1
	20	14.4	15.2	16.1	21.6	23.0	24.4	30.0	32.0	34.0	39.5	42.2	44.9	49.8	53.3	56.7	60.9	65.2	69.4
	30	14.8	15.7	16.6	22.3	23.7	25.2	31.0	33.1	35.1	40.8	43.5	46.3	51.4	55.0	58.6	62.8	67.3	71.7
	40	15.0	16.0	16.9	22.7	24.2	25.7	31.7	33.8	35.9	41.7	44.6	47.4	52.7	56.4	60.1	64.5	69.0	73.6
	50	15.2	16.2	17.1	23.1	24.6	26.1	32.2	34.4	36.6	42.5	45.5	48.4	53.8	57.6	61.4	65.9	70.7	75.4
140	0	12.0	12.8	13.5	18.0	19.1	20.3	24.9	26.5	28.1	32.6	34.7	36.9	40.9	43.7	46.5	49.9	53.3	56.8
	10	12.4	13.2	13.9	18.6	19.8	21.0	25.7	27.4	29.1	33.7	36.0	38.2	42.4	45.3	48.2	51.6	55.2	58.8
	20	12.8	13.6	14.4	19.2	20.4	21.7	26.6	28.3	30.1	34.8	37.2	39.5	43.8	46.8	49.8	53.4	57.1	60.8
	30	13.2	14.0	14.8	19.8	21.1	22.3	27.4	29.2	31.0	35.9	38.4	40.8	45.2	48.3	51.4	55.1	58.9	62.8
	40	13.4	14.3	15.1	20.2	21.5	22.8	28.0	29.9	31.7	36.7	39.2	41.7	46.3	49.5	52.7	56.5	60.5	64.4
	50	13.6	14.4	15.3	20.5	21.8	23.1	28.5	30.4	32.3	37.4	40.0	42.6	47.2	50.5	53.8	57.7	61.8	65.9
120	0	10.6	11.2	11.9	15.7	16.7	17.7	21.6	23.0	24.4	28.1	29.9	31.8	35.1	37.5	39.9	42.6	45.5	48.4
	10	11.0	11.6	12.3	16.2	17.3	18.3	22.3	23.8	25.2	29.0	31.0	32.9	36.3	38.8	41.3	44.1	47.1	50.2
	20	11.3	12.0	12.7	16.8	17.8	18.9	23.1	24.6	26.1	30.0	32.0	34.0	37.5	40.1	42.7	45.6	48.7	51.8
	30	11.6	12.4	13.1	17.3	18.4	19.5	23.8	25.3	26.9	31.0	33.0	35.1	38.7	41.4	44.0	47.0	50.3	53.5
	40	11.8	12.5	13.3	17.6	18.7	19.9	24.3	25.9	27.4	31.6	33.8	35.9	39.6	42.4	45.1	48.2	51.5	54.9
	50	11.9	12.7	13.4	17.8	19.0	20.1	24.6	26.3	27.9	32.2	34.4	36.6	40.4	43.2	46.0	49.2	52.6	56.1
100	0	9.2	9.7	10.3	13.4	14.3	15.1	18.2	19.4	20.6	23.5	25.0	26.6	29.1	31.0	33.0	35.0	37.4	39.7
	10	9.5	10.0	10.6	13.9	14.7	15.6	18.9	20.1	21.3	24.3	25.9	27.5	30.1	32.1	34.1	36.2	38.7	41.1
	20	9.8	10.4	10.9	14.3	15.2	16.1	19.5	20.7	22.0	25.1	26.7	28.4	31.1	33.2	35.3	37.4	40.0	42.5
	30	10.1	10.7	11.3	14.8	15.7	16.6	20.1	21.4	22.7	25.9	27.6	29.3	32.1	34.2	36.4	38.6	41.3	43.9
	40	10.2	10.8	11.4	15.0	16.0	16.9	20.5	21.8	23.1	26.4	28.2	29.9	32.8	35.0	37.2	39.5	42.2	44.9
	50	10.3	10.9	11.6	15.2	16.2	17.1	20.8	22.1	23.5	26.8	28.6	30.4	33.4	35.7	37.9	40.3	43.1	45.8

*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, altitude, and OAT effects.

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
RTO MAX MAN		5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0
LANDING	MAX MAN	1.6	6.6	11.6	16.5	21.3	26.1	30.8	35.5	40.2	44.8	49.5	54.2
	MAX AUTO	2.3	6.6	10.7	14.9	19.1	23.3	27.5	31.8	36.0	40.3	44.7	49.0
	AUTOBRAKE 4	2.5	6.4	10.4	14.3	18.3	22.2	26.1	30.1	34.0	38.0	42.0	46.1
	AUTOBRAKE 3	2.4	6.1	9.8	13.5	17.1	20.8	24.5	28.1	31.8	35.5	39.2	43.0
	AUTOBRAKE 2	2.4	5.8	9.3	12.7	16.0	19.4	22.8	26.2	29.6	33.0	36.4	39.9
	AUTOBRAKE 1	2.3	5.4	8.4	11.5	14.4	17.4	20.3	23.3	26.2	29.2	32.2	35.2

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Two Engines Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	MAX MAN	0.7	5.7	10.5	15.3	19.9	24.5	29.0	33.5	37.9	42.3	46.6	51.0
	MAX AUTO	1.0	4.6	8.2	11.8	15.4	19.0	22.7	26.4	30.1	33.9	37.8	41.7
	AUTOBRAKE 4	0.6	3.8	6.9	10.0	13.2	16.3	19.5	22.7	26.0	29.3	32.6	36.0
	AUTOBRAKE 3	0.0	2.6	5.3	8.0	10.7	13.5	16.2	19.0	21.8	24.7	27.6	30.6
	AUTOBRAKE 2	0.0	1.2	3.5	5.7	8.0	10.3	12.6	15.0	17.3	19.8	22.2	24.8
	AUTOBRAKE 1	0.0	0.7	2.2	3.8	5.3	6.9	8.4	10.0	11.7	13.4	15.1	16.9

Cooling Time (Minutes)

Category "C" and "D" Brakes

		ADJUSTED BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
		14 & BELOW	15	16	18	20	24	28	34	35 TO 42	43 & ABOVE		
		BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON EICAS											
		UP TO 1	1	1	2	2	3	4	5	5 TO 6	7 & ABOVE		
INFLIGHT	NO SPECIAL	PROCEDURE REQUIRED	1	1	2	2	3	4	6	CAUTION	FUSE PLUG MELT ZONE		
GEAR DOWN			11	15	19	24	34	44	59				
GROUND													

Observe maximum quick turnaround limit.

Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.

Add 1.0 million foot pounds per brake for each taxi mile.

For one brake deactivated, increase brake energy by 15 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 6 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 10 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.



Performance Inflight

Engine Inoperative

Chapter PI

Section 53

ENGINE INOP

Initial Max Continuous EPR

Based on engine bleed for one pack on and APU off

PRESSURE ALTITUDE (FT)		CRUISE MACH NUMBER		
		.72	.76	.80
39000	EPR	1.69	1.69	1.69
	MAX TAT	-14	-11	-10
	EPR CORR	0.09	0.09	0.10
37000	EPR	1.70	1.69	1.69
	MAX TAT	-14	-11	-10
	EPR CORR	0.09	0.09	0.10
35000	EPR	1.70	1.69	1.69
	MAX TAT	-13	-11	-9
	EPR CORR	0.09	0.09	0.10
33000	EPR	1.70	1.70	1.69
	MAX TAT	-9	-8	-5
	EPR CORR	0.09	0.09	0.10
31000	EPR	1.70	1.70	1.68
	MAX TAT	-5	-4	0
	EPR CORR	0.10	0.10	0.11
29000	EPR	1.70	1.69	1.68
	MAX TAT	-2	1	3
	EPR CORR	0.09	0.10	0.10
27000	EPR	1.71	1.70	1.68
	MAX TAT	1	3	7
	EPR CORR	0.10	0.10	0.10

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous EPR

39000 FT to 22000 FT Pressure Altitudes

Based on engine bleed for one pack on and anti-ice off

PRESSURE ALTITUDE (FT)		KIAS				MACH NUMBER					
		150	200	250	300	.70	.72	.74	.76	.78	.80
39000	EPR		1.72	1.68		1.70	1.69	1.69	1.69	1.69	1.69
	MAX TAT		-17	-9		-14	-14	-12	-11	-10	-10
	EPR CORR		0.09	0.10		0.09	0.09	0.09	0.09	0.10	0.10
37000	EPR		1.73	1.69		1.70	1.70	1.69	1.69	1.69	1.69
	MAX TAT		-18	-10		-14	-14	-12	-11	-10	-10
	EPR CORR		0.08	0.10		0.09	0.09	0.09	0.09	0.10	0.10
35000	EPR	1.76	1.75	1.70		1.70	1.70	1.70	1.69	1.69	1.69
	MAX TAT	-21	-20	-13		-14	-13	-13	-11	-10	-9
	EPR CORR	0.07	0.08	0.09		0.09	0.09	0.09	0.09	0.10	0.10
33000	EPR	1.74	1.76	1.70	1.66	1.70	1.70	1.70	1.70	1.69	1.69
	MAX TAT	-12	-18	-10	-2	-10	-9	-8	-8	-6	-5
	EPR CORR	0.09	0.08	0.09	0.11	0.09	0.09	0.10	0.09	0.10	0.10
31000	EPR	1.75	1.76	1.71	1.68	1.70	1.70	1.70	1.70	1.69	1.68
	MAX TAT	-11	-14	-7	0	-6	-5	-5	-4	-2	0
	EPR CORR	0.09	0.09	0.09	0.10	0.09	0.10	0.10	0.10	0.10	0.11
29000	EPR	1.75	1.77	1.73	1.69	1.71	1.70	1.70	1.69	1.69	1.68
	MAX TAT	-10	-13	-6	1	-4	-2	-1	1	2	3
	EPR CORR	0.09	0.09	0.09	0.10	0.09	0.09	0.10	0.10	0.11	0.10
27000	EPR	1.75	1.78	1.74	1.70	1.71	1.71	1.70	1.70	1.69	1.68
	MAX TAT	-10	-12	-4	3	0	1	3	3	5	7
	EPR CORR	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10
25000	EPR	1.75	1.77	1.76	1.71	1.71	1.71	1.71	1.70	1.69	1.68
	MAX TAT	-10	-11	-3	4	3	4	5	7	9	10
	EPR CORR	0.09	0.09	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.10
24000	EPR	1.75	1.75	1.76	1.71	1.71	1.71	1.70	1.69	1.68	1.67
	MAX TAT	-10	-8	-2	4	4	5	7	9	10	12
	EPR CORR	0.09	0.09	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.10
22000	EPR	1.75	1.74	1.77	1.71	1.70	1.69	1.68	1.67	1.66	1.65
	MAX TAT	-11	-7	-1	6	7	9	11	12	14	16
	EPR CORR	0.08	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.10

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)				
	0	10000	20000	30000	40000
PACKS OFF	0.01	0.01	0.01	0.01	0.02
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.03	-0.04	-0.05
ENGINE & WING ANTI-ICE ON	-0.04	-0.06	-0.09	-0.10	-0.13

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous EPR

20000 FT to Sea Level Pressure Altitudes

Based on engine bleed for one pack on and anti-ice off

PRESSURE ALTITUDE (FT)		KIAS				MACH NUMBER					
		150	200	250	300	.70	.72	.74	.76	.78	.80
20000	EPR	1.75	1.73	1.77	1.72	1.69	1.68	1.67	1.66	1.65	1.63
	MAX TAT	-9	-5	1	7	10	12	14	15	17	19
	EPR CORR	0.09	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
18000	EPR	1.72	1.70	1.77	1.72	1.66	1.65	1.64	1.63	1.61	
	MAX TAT	-6	-1	4	10	15	17	18	20	22	
	EPR CORR	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	
16000	EPR	1.68	1.66	1.76	1.71	1.64	1.62	1.61	1.60		
	MAX TAT	-1	2	7	13	19	22	23	24		
	EPR CORR	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08		
14000	EPR	1.65	1.62	1.70	1.68	1.59	1.58	1.56			
	MAX TAT	2	5	10	16	24	25	27			
	EPR CORR	0.09	0.09	0.09	0.09	0.07	0.07	0.07			
12000	EPR	1.62	1.58	1.62	1.63	1.53					
	MAX TAT	5	9	13	18	28					
	EPR CORR	0.08	0.09	0.08	0.08	0.07					
10000	EPR	1.58	1.55	1.56	1.57						
	MAX TAT	10	13	16	22						
	EPR CORR	0.08	0.08	0.08	0.08						
5000	EPR	1.51	1.48	1.45	1.44						
	MAX TAT	18	22	25	29						
	EPR CORR	0.07	0.07	0.07	0.06						
1500	EPR	1.45	1.43	1.40	1.36						
	MAX TAT	26	29	31	35						
	EPR CORR	0.06	0.06	0.06	0.06						
0	EPR	1.41	1.39	1.36	1.32						
	MAX TAT	28	31	34	38						
	EPR CORR	0.06	0.06	0.05	0.05						

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)				
	0	10000	20000	30000	40000
PACKS OFF	0.01	0.01	0.01	0.01	0.02
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.03	-0.04	-0.05
ENGINE & WING ANTI-ICE ON	-0.04	-0.06	-0.09	-0.10	-0.13

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	184	276	18600	17700	16900
180	174	269	20000	19100	18300
170	165	261	21300	20500	19700
160	155	254	22700	22100	21200
150	145	246	24100	23700	22800
140	136	238	25700	25400	24500
130	126	230	27200	27100	26200
120	116	221	28900	28900	28100
110	106	212	30700	30700	30000
100	97	202	32700	32700	32000

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
274	255	239	224	211	200	190	180	172	164	157
548	510	477	448	423	400	380	361	344	329	315
819	763	715	672	634	600	570	542	517	494	473
1088	1015	951	895	845	800	760	723	690	660	633
1357	1266	1187	1118	1055	1000	950	905	864	826	792
1625	1518	1424	1340	1266	1200	1140	1086	1037	992	951
1896	1770	1661	1564	1477	1400	1330	1267	1210	1158	1110
2168	2025	1899	1787	1689	1600	1520	1448	1383	1323	1268
2445	2281	2138	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)										
	100	110	120	130	140	150	160	170	180	190	
200	1.7	1.9	2.0	2.2	2.4	2.5	2.7	2.8	2.9	3.0	0:32
400	3.8	4.2	4.5	4.9	5.2	5.5	5.9	6.3	6.5	6.9	1:05
600	5.7	6.3	6.8	7.3	7.9	8.4	8.9	9.4	9.9	10.4	1:36
800	7.6	8.3	9.0	9.8	10.5	11.1	11.8	12.5	13.2	13.9	2:07
1000	9.5	10.4	11.2	12.1	13.0	13.8	14.7	15.6	16.4	17.3	2:38
1200	11.3	12.4	13.4	14.5	15.5	16.5	17.5	18.6	19.6	20.6	3:08
1400	13.1	14.3	15.5	16.7	17.9	19.1	20.3	21.5	22.7	23.9	3:40
1600	14.8	16.2	17.6	19.0	20.3	21.7	23.0	24.4	25.7	27.2	4:12
1800	16.6	18.1	19.6	21.2	22.7	24.2	25.7	27.2	28.7	30.3	4:45

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
100 ft/min residual rate of climb and APU on

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	15700	14700	13500
185	16500	15600	14700
180	17300	16400	15600
175	18000	17200	16400
170	18800	17900	17200
165	19600	18700	18000
160	20300	19500	18800
155	21100	20400	19600
150	21900	21200	20400
145	22700	22100	21300
140	23500	23000	22200
135	24300	23900	23100
130	25200	24900	24000
125	26000	25800	25000
120	26900	26700	25900
115	27800	27600	26900
110	28700	28600	27900
105	29700	29700	29000
100	30700	30700	30000

With engine anti-ice on, decrease altitude capability by 1400 ft.
With engine and wing anti-ice on, decrease altitude capability by 3200 ft.

ENGINE INOP**MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	14	18	21	23	25	27	29	31
190	EPR	1.35	1.49							
	MACH	.559	.607							
	KIAS	310	313							
	FF/ENG	6670	7115							
180	EPR	1.32	1.44	1.64						
	MACH	.548	.588	.654						
	KIAS	304	303	313						
	FF/ENG	6254	6515	7071						
170	EPR	1.29	1.39	1.56						
	MACH	.538	.570	.628						
	KIAS	298	294	300						
	FF/ENG	5879	5999	6427						
160	EPR	1.26	1.35	1.49	1.65					
	MACH	.528	.556	.603	.657					
	KIAS	292	286	288	297					
	FF/ENG	5521	5547	5795	6219					
150	EPR	1.24	1.31	1.43	1.57					
	MACH	.517	.543	.581	.628					
	KIAS	286	279	277	283					
	FF/ENG	5167	5145	5265	5573					
140	EPR	1.21	1.28	1.37	1.49	1.60				
	MACH	.505	.532	.562	.600	.635				
	KIAS	279	273	268	270	275				
	FF/ENG	4822	4780	4784	4977	5237				
130	EPR	1.19	1.25	1.33	1.42	1.51	1.62			
	MACH	.493	.519	.547	.576	.604	.640			
	KIAS	273	267	260	258	261	266			
	FF/ENG	4492	4427	4366	4460	4637	4891			
120	EPR	1.17	1.22	1.29	1.36	1.42	1.52	1.63		
	MACH	.480	.505	.533	.556	.577	.607	.644		
	KIAS	266	259	253	249	249	251	257		
	FF/ENG	4178	4078	3996	4005	4119	4292	4534		
110	EPR	1.15	1.19	1.25	1.31	1.36	1.43	1.52	1.64	
	MACH	.466	.491	.518	.539	.555	.577	.607	.645	
	KIAS	258	252	246	241	239	239	241	246	
	FF/ENG	3866	3754	3646	3606	3655	3771	3929	4158	
100	EPR	1.13	1.16	1.21	1.26	1.31	1.36	1.43	1.52	1.64
	MACH	.448	.477	.502	.523	.538	.554	.575	.605	.643
	KIAS	248	244	238	234	231	228	228	230	235
	FF/ENG	3508	3456	3318	3262	3261	3305	3405	3552	3759

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
290	266	245	228	213	200	191	182	174	167	160
581	534	492	457	427	400	381	364	348	334	321
873	802	739	686	641	600	572	546	522	501	482
1166	1071	987	916	855	800	763	728	697	668	642
1461	1341	1235	1146	1069	1000	953	909	870	833	801
1756	1611	1483	1375	1283	1200	1144	1092	1044	1000	960
2052	1882	1732	1605	1497	1400	1334	1273	1217	1165	1119
2349	2153	1981	1836	1711	1600	1524	1453	1388	1330	1277
2647	2426	2231	2067	1926	1800	1714	1634	1561	1495	1435

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.7	0:42	2.4	0:40	2.2	0:39	2.0	0:38	1.9	0:35
400	5.7	1:19	5.3	1:17	4.9	1:14	4.7	1:10	4.6	1:05
600	8.7	1:57	8.1	1:53	7.6	1:49	7.4	1:43	7.3	1:34
800	11.6	2:35	10.9	2:30	10.3	2:24	10.0	2:16	9.9	2:04
1000	14.5	3:14	13.6	3:07	12.9	3:00	12.5	2:49	12.5	2:34
1200	17.3	3:52	16.3	3:44	15.4	3:36	15.0	3:23	15.0	3:05
1400	20.1	4:31	18.9	4:21	17.9	4:12	17.5	3:58	17.5	3:37
1600	22.9	5:11	21.6	4:59	20.4	4:48	19.9	4:32	19.9	4:08
1800	25.6	5:50	24.1	5:37	22.9	5:25	22.3	5:07	22.3	4:41

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.1	0.0	0.2	0.4
4	-0.6	-0.3	0.0	0.6	1.0
6	-1.0	-0.5	0.0	0.9	1.6
8	-1.3	-0.6	0.0	1.2	2.3
10	-1.7	-0.8	0.0	1.5	2.9
12	-2.1	-1.0	0.0	1.8	3.5
14	-2.4	-1.2	0.0	2.1	4.1
16	-2.8	-1.3	0.0	2.4	4.7
18	-3.2	-1.5	0.0	2.7	5.3
20	-3.6	-1.7	0.0	3.0	5.9
22	-4.0	-1.8	0.0	3.2	6.6
24	-4.4	-2.0	0.0	3.5	7.2
26	-4.7	-2.2	0.0	3.8	7.8

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
190	EPR	1.19	1.24	1.33	1.49			
	KIAS	259	259	259	259			
	FF/ENG	5820	5860	6040	6480			
180	EPR	1.18	1.22	1.30	1.44	1.69		
	KIAS	251	251	251	252	254		
	FF/ENG	5490	5500	5630	5980	6490		
170	EPR	1.16	1.20	1.27	1.39	1.61		
	KIAS	244	244	244	245	246		
	FF/ENG	5160	5160	5240	5490	5900		
160	EPR	1.15	1.18	1.25	1.35	1.53		
	KIAS	236	236	236	238	239		
	FF/ENG	4830	4820	4870	5030	5370		
150	EPR	1.13	1.16	1.22	1.31	1.47		
	KIAS	228	228	229	230	231		
	FF/ENG	4510	4500	4530	4600	4870		
140	EPR	1.12	1.15	1.20	1.28	1.41	1.65	
	KIAS	222	222	222	222	223	225	
	FF/ENG	4200	4180	4200	4220	4400	4850	
130	EPR	1.11	1.13	1.18	1.24	1.35	1.55	
	KIAS	217	217	217	217	217	217	
	FF/ENG	3900	3880	3890	3870	3960	4340	
120	EPR	1.09	1.11	1.16	1.21	1.30	1.47	
	KIAS	211	211	211	211	211	211	
	FF/ENG	3600	3580	3590	3560	3560	3870	
110	EPR	1.08	1.10	1.14	1.19	1.26	1.39	1.63
	KIAS	205	205	205	205	205	205	205
	FF/ENG	3300	3290	3290	3270	3230	3430	3790
100	EPR	1.07	1.09	1.12	1.16	1.22	1.33	1.52
	KIAS	199	199	199	199	199	199	199
	FF/ENG	3010	2990	3000	2980	2920	3030	3320

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Alternate EEC Mode

Chapter PI

Section 54

ALTERNATE EEC MODE

Takeoff Performance

PERFORMANCE LIMIT	WEIGHT ADJUSTMENT (1000 KG)						
	AIRPORT OAT						
	°C	15 & BELOW	20	25	27	30	33 & ABOVE
	°F	59 & BELOW	68	77	81	86	91 & ABOVE
FIELD		-12.8	-14.7	-17.4	-18.6	-19.6	-20.6
CLIMB		-20.0	-23.0	-26.8	-26.8	-30.8	-33.2
OBSTACLE		-20.2	-23.6	-27.5	-29.3	-31.4	-33.5

Takeoff Speeds Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEEDS ADJUSTMENTS (KTS)			
	AIRPORT OAT			
	°C	10 & BELOW	20	30 & ABOVE
	°F	50 & BELOW	68	86 & ABOVE
V1 (FLAPS 5)		3	4	5
V1 (FLAPS 15)		3	4	5
V1 (FLAPS 20)		2	3	4
VR		2	2	2
V2		1	1	1

Net Level Off Altitude Adjustment

NORMAL LIMIT ALTITUDE (FT)	ALTERNATE EEC MODE ALTITUDE CAPABILITY ADJUSTMENT (FT)
30000	-2300
25000	-2600
20000	-2600
19000	-2700
18000	-2800
17000	-4700
16000	-9800
15000	-12900

Landing Performance

PERFORMANCE LIMIT	WEIGHT ADJUSTMENT (1000 KG)					
	AIRPORT OAT					
	°C	15 & BELOW	20	25	30	33 & ABOVE
	°F	59 & BELOW	68	77	86	91 & ABOVE
LANDING CLIMB		-19.5	-23.1	-27.4	-31.3	-33.1

ALTERNATE EEC MODE

Takeoff EPR

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	-1000	0	2000	4000	6000	8000
55	131	1.37	1.37	1.36	1.36	1.35	1.36
50	122	1.41	1.41	1.41	1.40	1.40	1.40
45	113	1.43	1.43	1.43	1.43	1.43	1.43
40	104	1.46	1.46	1.46	1.46	1.46	1.46
35	95	1.49	1.49	1.48	1.48	1.48	1.48
30	86	1.51	1.51	1.51	1.51	1.51	1.51
25	77	1.53	1.54	1.54	1.53	1.53	1.54
20	68	1.53	1.56	1.57	1.56	1.56	1.56
15	59	1.53	1.56	1.58	1.59	1.59	1.59
10	50	1.53	1.56	1.58	1.60	1.62	1.62
5	41	1.53	1.56	1.58	1.60	1.62	1.64
0	32	1.53	1.56	1.58	1.60	1.62	1.64

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.01
WING ANTI-ICE ON	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

ALTERNATE EEC MODE

Go-around EPR

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F		-1000	0	2000	4000	6000	8000
55	131	58	1.37	1.36	1.35	1.35	1.35	1.35
50	122	53	1.41	1.40	1.40	1.40	1.40	1.40
45	113	48	1.43	1.43	1.43	1.43	1.43	1.43
40	104	43	1.46	1.46	1.46	1.46	1.46	1.46
35	95	38	1.49	1.49	1.48	1.48	1.48	1.48
30	86	33	1.52	1.52	1.51	1.51	1.51	1.51
25	77	28	1.54	1.55	1.54	1.54	1.54	1.54
20	68	23	1.54	1.57	1.57	1.57	1.57	1.57
15	59	18	1.54	1.57	1.60	1.61	1.60	1.60
10	50	13	1.54	1.57	1.60	1.62	1.63	1.63
5	41	8	1.54	1.57	1.60	1.62	1.63	1.66
0 & BELOW	32 & BELOW	3	1.54	1.57	1.60	1.62	1.63	1.66

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.01	0.01	0.01	0.01	0.02	0.02
WING ANTI-ICE ON	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02

ALTERNATE EEC MODE

Go-around %N1

No EPR available

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

AIRPORT OAT		TAT	AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	(°C)	-1000	0	2000	4000	6000	8000
55	131	58	94.6	94.6	94.5	94.5	94.4	94.4
50	122	53	96.3	96.3	96.2	96.1	96.1	96.0
45	113	48	97.2	97.1	97.0	97.0	96.9	96.9
40	104	43	97.8	97.8	97.7	97.6	97.6	97.5
35	95	38	98.4	98.3	98.2	98.2	98.1	98.1
30	86	33	99.0	98.9	98.8	98.8	98.7	98.7
25	77	28	99.3	99.5	99.4	99.4	99.3	99.3
20	68	23	98.2	100.1	100.0	100.0	99.9	99.9
15	59	18	97.4	99.2	100.4	100.8	100.5	100.5
10	50	13	96.6	98.4	99.4	100.5	101.1	101.1
5	41	8	95.7	97.5	98.6	99.5	100.2	101.5
0	32	3	94.9	96.6	97.7	98.6	99.3	100.4
-5	23	-2	94.0	95.7	96.8	97.7	98.4	99.5
-10	14	-7	93.1	94.8	95.9	96.8	97.5	98.6
-15	5	-13	92.1	93.8	94.8	95.7	96.4	97.4
-20	-4	-18	91.2	92.9	93.9	94.7	95.4	96.5
-25	-13	-23	90.3	91.9	92.9	93.8	94.5	95.5
-30	-22	-28	89.4	91.0	92.0	92.9	93.6	94.6
-35	-31	-33	88.5	90.1	91.1	91.9	92.6	93.6
-40	-40	-38	87.5	89.2	90.1	90.9	91.7	92.6
-45	-49	-43	86.6	88.1	89.1	90.0	90.7	91.6
-50	-58	-48	85.7	87.2	88.2	89.0	89.7	90.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.5	0.5	0.6	0.6	0.7	0.7
WING ANTI-ICE ON	-0.5	-0.5	-0.6	-0.6	-0.7	-0.7

ALTERNATE EEC MODE

ENGINE INOP

Initial Max Continuous %N1

No EPR available

Based on 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	101.3	99.7	98.2	96.6	95.0	94.9	94.8	94.8	94.7
15	102.6	101.1	99.6	98.0	96.4	96.4	96.3	96.2	96.1
10	104.2	102.5	100.9	99.4	97.8	97.8	97.7	97.6	97.5
5	104.7	104.0	102.3	100.7	99.2	99.1	99.0	99.0	98.9
0	103.5	103.7	103.6	102.0	100.5	100.4	100.3	100.3	100.2
-5	102.6	102.6	102.7	102.8	101.4	101.3	101.2	101.1	101.1
-10	101.6	101.6	101.8	101.9	102.1	102.1	102.0	102.0	101.9
-15	100.7	100.6	100.8	100.9	101.0	101.1	101.0	101.0	100.9
-20	99.7	99.7	99.8	99.9	100.0	100.1	100.1	100.0	99.9
-25	98.7	98.7	98.8	98.9	99.0	99.1	99.1	99.0	98.9
-30	97.7	97.7	97.8	97.9	98.0	98.1	98.1	98.0	97.9
-35	96.7	96.7	96.8	96.9	97.0	97.1	97.0	97.0	96.9
-40	95.7	95.6	95.8	95.9	96.0	96.1	96.0	96.0	95.9

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
PACKS OFF	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.1
ENGINE ANTI-ICE ON	-1.2	-1.2	-1.3	-1.3	-1.3	-1.4	-1.4	-1.5	-1.6
ENGINE & WING ANTI-ICE ON	-2.9	-2.9	-3.1	-3.1	-3.1	-3.3	-3.4	-3.6	-3.9

ALTERNATE EEC MODE**ENGINE INOP****Max Continuous %N1****No EPR available****Based on engine bleed for one pack on and anti-ice off****37000 FT to 20000 FT Pressure Altitudes**

37000 FT PRESS ALT			TAT (°C)										
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	.63	97.3	98.3	99.4	100.4	101.5	101.6	100.6	99.2	98.1	97.0	95.9	94.6
220	.69	96.3	97.3	98.3	99.3	100.3	101.3	100.6	99.8	98.9	97.8	96.7	95.2
240	.75	96.1	97.1	98.1	99.1	100.1	101.3	101.5	100.6	99.6	98.5	97.3	95.8
260	.80	96.1	97.1	98.1	99.1	100.1	101.1	102.1	101.3	100.4	99.1	97.8	96.4
33000 FT PRESS ALT			TAT (°C)										
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	.58	98.1	99.2	100.2	101.2	102.2	102.5	101.4	99.6	98.5	97.4	96.4	95.3
220	.63	97.4	98.4	99.5	100.5	101.5	102.6	102.0	100.4	99.3	98.3	97.2	95.9
240	.68	96.5	97.5	98.5	99.5	100.5	101.6	102.2	101.1	100.2	99.1	98.0	96.6
260	.74	96.2	97.2	98.2	99.2	100.2	101.2	102.3	102.1	101.0	99.9	98.7	97.3
29000 FT PRESS ALT			TAT (°C)										
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	.53	97.8	98.9	99.9	100.9	101.9	103.1	102.1	100.7	99.7	98.7	97.8	97.0
220	.58	98.0	99.1	100.1	101.1	102.1	103.3	103.6	101.8	100.7	99.6	98.6	97.5
240	.63	97.3	98.4	99.4	100.4	101.4	102.4	103.6	102.9	101.6	100.6	99.5	98.3
260	.68	96.6	97.7	98.7	99.7	100.7	101.7	102.7	103.6	102.6	101.6	100.5	99.1
25000 FT PRESS ALT			TAT (°C)										
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	.49	96.5	97.6	98.6	99.6	100.6	101.6	102.5	101.4	100.5	99.6	98.7	98.0
220	.53	96.8	97.8	98.9	99.9	100.9	101.9	103.1	102.9	101.7	100.8	99.8	99.0
240	.58	96.9	97.9	99.0	100.0	101.0	102.0	102.9	103.9	102.8	101.8	100.7	99.7
260	.63	96.8	97.8	98.8	99.9	100.9	101.9	102.8	104.0	104.1	102.9	101.8	100.6
22000 FT PRESS ALT			TAT (°C)										
CIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	
200	.46	101.0	102.1	102.4	101.3	100.3	99.4	98.5	97.6	96.7	95.9	95.1	
240	.55	101.6	102.6	103.7	103.8	102.6	101.7	100.8	100.0	99.2	98.4	97.7	
280	.63	101.3	102.3	103.3	104.4	104.5	103.3	102.1	101.0	100.2	99.4	98.7	
20000 FT PRESS ALT			TAT (°C)										
CIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	
200	.44	101.0	101.9	103.0	102.1	101.1	100.2	99.2	98.2	97.3	96.4	95.6	
240	.53	101.5	102.5	103.5	104.4	103.4	102.5	101.7	101.0	100.2	99.4	98.7	
280	.61	101.1	102.1	103.1	104.0	104.9	103.7	102.6	101.7	100.8	100.0	99.3	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	20	22	25	29	33	37
PACKS OFF	0.5	0.5	0.5	0.6	0.7	0.8
ENGINE ANTI-ICE ON	-1.2	-1.2	-1.2	-1.2	-1.3	-1.4
ENGINE & WING ANTI-ICE ON	-2.9	-2.9	-2.9	-2.9	-3.1	-3.3

ALTERNATE EEC MODE

ENGINE INOP

Max Continuous %N1**No EPR available****Based on engine bleed for one pack on and anti-ice off****18000 FT to 8000 FT Pressure Altitudes**

18000 FT PRESS ALT		TAT (°C)										
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35
200	.42	100.2	101.1	102.3	102.7	101.6	100.6	99.6	98.5	97.5	96.6	95.8
240	.51	101.4	102.4	103.4	104.5	104.7	103.6	103.0	102.3	101.6	100.9	100.1
280	.59	100.7	101.7	102.7	103.6	104.8	104.7	103.5	102.6	101.8	100.9	100.3
16000 FT PRESS ALT		TAT (°C)										
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35
200	.41	98.7	99.6	100.6	101.7	101.6	100.3	99.2	98.0	97.0	96.1	95.3
240	.49	100.4	101.3	102.3	103.2	104.3	103.8	103.0	102.3	101.5	100.8	100.0
280	.57	100.3	101.3	102.3	103.2	104.2	105.2	104.3	103.5	102.7	101.9	101.2
14000 FT PRESS ALT		TAT (°C)										
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35
200	.39	97.2	98.1	99.0	99.9	100.9	100.0	98.9	97.6	96.6	95.7	94.9
240	.47	98.0	99.0	99.9	100.8	101.7	102.5	101.6	100.7	99.9	99.1	98.3
280	.54	99.0	99.9	100.9	101.8	102.7	103.8	104.2	103.2	102.5	101.7	100.9
12000 FT PRESS ALT		TAT (°C)										
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.38	96.7	97.6	98.5	99.5	100.1	98.8	97.6	96.5	95.6	94.8	94.2
240	.45	96.8	97.7	98.6	99.5	100.6	100.6	99.4	98.5	97.7	96.9	96.2
10000 FT PRESS ALT		TAT (°C)										
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.36	95.3	96.2	97.1	98.0	99.1	98.9	97.6	96.5	95.6	94.8	94.1
240	.43	94.9	95.8	96.7	97.5	98.4	99.4	98.5	97.5	96.7	95.9	95.2
8000 FT PRESS ALT		TAT (°C)										
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.35	93.9	94.8	95.6	96.5	97.4	98.4	97.6	96.4	95.5	94.7	94.0
240	.42	93.1	94.0	94.8	95.7	96.6	97.5	98.0	96.9	96.0	95.2	94.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	8	10	12	14	16	18
PACKS OFF	0.5	0.5	0.5	0.5	0.5	0.5
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.1	-1.2
ENGINE & WING ANTI-ICE ON	-2.1	-2.1	-2.3	-2.4	-2.6	-2.8

ALTERNATE EEC MODE

ENGINE INOP

Max Continuous %N1

No EPR available

Based on engine bleed for one pack on and anti-ice off

6000 FT to Sea Level Pressure Altitudes

6000 FT PRESS ALT		TAT (°C)										
CIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.34	92.5	93.4	94.2	95.1	95.9	96.8	97.5	96.4	95.5	94.6	93.9
240	.40	91.6	92.5	93.3	94.2	95.0	95.9	96.9	96.8	95.6	94.9	94.2
4000 FT PRESS ALT		TAT (°C)										
CIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.32	91.2	92.0	92.9	93.7	94.6	95.4	96.4	96.6	95.4	94.6	93.9
240	.39	90.4	91.2	92.1	92.9	93.7	94.6	95.4	96.3	95.6	94.8	94.2
2000 FT PRESS ALT		TAT (°C)										
CIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.31	89.9	90.8	91.6	92.5	93.3	94.1	94.9	95.9	95.6	94.5	93.8
240	.38	89.2	90.1	90.9	91.8	92.6	93.4	94.2	95.0	95.7	94.8	94.1
0 FT PRESS ALT		TAT (°C)										
CIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.30	87.4	88.2	89.1	89.9	90.7	91.5	92.3	93.1	93.9	93.1	92.4
240	.36	86.9	87.7	88.5	89.3	90.1	90.9	91.7	92.5	93.4	93.5	92.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	0	2	4	6
PACKS OFF	0.4	0.5	0.5	0.5
ENGINE ANTI-ICE ON	-0.6	-0.7	-0.8	-0.9
ENGINE & WING ANTI-ICE ON	-1.5	-1.7	-1.9	-2.0



Performance Inflight

Gear Down

Chapter PI

Section 55

GEAR DOWN

200 KIAS Max Climb EPR

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	1.27														
50	1.29	1.31													
45	1.31	1.33	1.33												
40	1.34	1.36	1.35	1.35	1.35										
35	1.36	1.38	1.38	1.38	1.38	1.38									
30	1.36	1.42	1.41	1.41	1.41	1.41	1.41								
25	1.36	1.44	1.45	1.45	1.45	1.45	1.44	1.44	1.44						
20	1.36	1.44	1.49	1.49	1.49	1.49	1.48	1.48	1.48	1.48					
15	1.36	1.44	1.51	1.53	1.53	1.53	1.53	1.52	1.52	1.52	1.51				
10	1.36	1.44	1.51	1.54	1.57	1.57	1.57	1.57	1.57	1.57	1.56	1.55			
5	1.36	1.44	1.51	1.54	1.57	1.60	1.62	1.62	1.61	1.61	1.61	1.60	1.59	1.57	
0	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.66	1.66	1.65	1.64	1.63	1.62	1.59
-5	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.69	1.70	1.70	1.69	1.68	1.66	1.64
-10	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.69	1.71	1.73	1.73	1.72	1.71	1.68
-15	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.69	1.71	1.73	1.75	1.76	1.75	1.72
-20	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.69	1.71	1.73	1.75	1.76	1.76	1.75

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	18	20	22	24	26	28	30	34		
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.04	-0.04	-0.04	
ENGINE & WING ANTI-ICE ON	-0.02	-0.03	-0.04	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.06	-0.07	-0.07	

GEAR DOWN

Long Range Cruise Altitude Capability

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	18500	18500	16600
185	19500	19500	17600
180	20500	20400	18700
175	21300	21300	19700
170	22200	22200	20700
165	23200	23100	21700
160	24100	24100	22700
155	25100	25000	23700
150	26000	25900	24700
145	26900	26900	25700
140	27900	27900	26700
135	28900	28900	27700
130	29800	29800	28600
125	30700	30600	29600
120	31600	31600	30600
115	32700	32700	31600
110	33600	33500	32800
105	34400	34400	33700
100	35200	35200	34600
95	36000	36000	35400
90	36800	36800	36300



GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		10	14	18	21	23	25	27	29	31	33	35
190	EPR	1.25	1.32	1.43								
	MACH	.472	.506	.545								
	KIAS	261	260	259								
	FF/ENG	4961	5001	5116								
180	EPR	1.23	1.30	1.39								
	MACH	.462	.495	.532								
	KIAS	255	254	253								
	FF/ENG	4683	4690	4762								
170	EPR	1.21	1.27	1.35	1.45							
	MACH	.451	.482	.518	.549							
	KIAS	249	247	246	246							
	FF/ENG	4420	4386	4405	4512							
160	EPR	1.19	1.24	1.32	1.40	1.47						
	MACH	.440	.469	.504	.534	.555						
	KIAS	243	240	239	239	239						
	FF/ENG	4159	4093	4079	4162	4261						
150	EPR	1.17	1.22	1.29	1.36	1.42	1.49					
	MACH	.428	.457	.490	.518	.539	.560					
	KIAS	237	234	232	231	232	231					
	FF/ENG	3896	3827	3769	3809	3907	4007					
140	EPR	1.16	1.20	1.26	1.32	1.37	1.43	1.51				
	MACH	.415	.445	.475	.503	.522	.543	.565				
	KIAS	229	228	225	224	224	224	223				
	FF/ENG	3623	3576	3480	3481	3555	3655	3746				
130	EPR	1.14	1.18	1.23	1.28	1.32	1.38	1.45	1.53			
	MACH	.402	.431	.461	.486	.505	.525	.547	.569			
	KIAS	222	221	218	217	216	216	216	216			
	FF/ENG	3368	3327	3221	3188	3221	3299	3390	3483			
120	EPR	1.13	1.16	1.20	1.25	1.28	1.33	1.39	1.46	1.55		
	MACH	.388	.415	.446	.469	.487	.506	.527	.549	.572		
	KIAS	214	212	211	209	209	208	208	208	207		
	FF/ENG	3117	3061	2975	2917	2926	2964	3034	3120	3209		
110	EPR	1.11	1.14	1.18	1.22	1.25	1.29	1.33	1.39	1.46	1.56	
	MACH	.371	.400	.430	.453	.469	.487	.506	.528	.550	.574	
	KIAS	205	204	203	202	200	200	199	199	199	199	
	FF/ENG	2850	2814	2736	2674	2658	2669	2699	2767	2848	2929	
100	EPR	1.10	1.12	1.16	1.19	1.21	1.24	1.28	1.33	1.39	1.46	1.56
	MACH	.356	.383	.412	.436	.451	.467	.486	.505	.527	.549	.573
	KIAS	196	196	194	194	193	191	191	190	190	190	190
	FF/ENG	2600	2569	2488	2444	2421	2406	2410	2435	2497	2571	2646

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	287	259	236	217	200	189	179	170	161	154
646	578	520	473	434	400	378	357	339	323	308
976	872	782	711	652	600	567	536	509	484	462
1310	1168	1046	949	870	800	755	714	677	644	615
1649	1468	1312	1189	1088	1000	943	892	845	804	768
1992	1770	1580	1430	1307	1200	1132	1070	1014	964	920
2340	2076	1850	1671	1526	1400	1320	1247	1181	1122	1071
2694	2386	2122	1915	1746	1600	1508	1424	1348	1281	1222
3053	2698	2396	2159	1967	1800	1696	1601	1515	1439	1372
3417	3014	2671	2403	2187	2000	1883	1777	1682	1596	1522

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		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	5.0	0:49	4.5	0:47	4.0	0:45	3.7	0:44	3.4	0:41
400	10.3	1:36	9.5	1:31	8.6	1:27	8.1	1:23	7.7	1:17
600	15.5	2:23	14.4	2:16	13.2	2:09	12.3	2:03	11.9	1:53
800	20.6	3:11	19.1	3:01	17.6	2:52	16.4	2:43	15.9	2:30
1000	25.6	4:00	23.8	3:47	21.9	3:36	20.5	3:24	19.8	3:07
1200	30.4	4:50	28.4	4:34	26.1	4:20	24.5	4:06	23.7	3:45
1400	35.2	5:41	32.9	5:22	30.3	5:04	28.3	4:48	27.4	4:24
1600	39.8	6:34	37.2	6:11	34.4	5:50	32.1	5:31	31.0	5:03
1800	44.4	7:27	41.5	7:00	38.3	6:36	35.9	6:14	34.4	5:42
2000	48.8	8:21	45.7	7:51	42.3	7:24	39.5	6:58	37.8	6:22

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.4	0.0	0.6	1.2
10	-1.6	-0.8	0.0	1.3	2.6
15	-2.4	-1.2	0.0	1.9	3.9
20	-3.2	-1.6	0.0	2.6	5.3
25	-4.0	-2.0	0.0	3.2	6.6
30	-4.9	-2.4	0.0	3.9	7.9
35	-5.6	-2.8	0.0	4.6	9.2
40	-6.4	-3.2	0.0	5.2	10.5
45	-7.2	-3.7	0.0	5.9	11.8
50	-8.0	-4.1	0.0	6.6	13.1
55	-8.7	-4.5	0.0	7.2	14.4
60	-9.5	-4.9	0.0	7.9	15.7

Descent at VREF30 + 70

PRESSURE ALTITUDE (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	16	26	36	40	44	48	52	56	60	65	68	72	76
TIME (MINUTES)	7	10	12	13	14	15	16	17	17	18	19	20	20

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	EPR	1.14	1.17	1.24	1.33			
	KIAS	249	249	249	249			
	FF/ENG	4930	4890	4910	4980			
180	EPR	1.13	1.16	1.22	1.30	1.43		
	KIAS	241	241	241	241	241		
	FF/ENG	4640	4600	4600	4630	4770		
170	EPR	1.12	1.15	1.20	1.27	1.39		
	KIAS	234	234	234	234	234		
	FF/ENG	4360	4320	4300	4300	4390		
160	EPR	1.11	1.13	1.18	1.24	1.35	1.52	
	KIAS	226	226	226	226	226	226	
	FF/ENG	4080	4040	4010	3980	4020	4300	
150	EPR	1.10	1.12	1.16	1.22	1.31	1.46	
	KIAS	218	218	218	218	218	218	
	FF/ENG	3790	3750	3730	3680	3660	3910	
140	EPR	1.09	1.11	1.15	1.20	1.28	1.41	
	KIAS	212	212	212	212	212	212	
	FF/ENG	3560	3530	3500	3450	3400	3580	
130	EPR	1.08	1.10	1.13	1.18	1.25	1.36	1.55
	KIAS	207	207	207	207	207	207	207
	FF/ENG	3320	3300	3280	3230	3160	3270	3520
120	EPR	1.07	1.09	1.12	1.16	1.22	1.32	1.48
	KIAS	201	201	201	201	201	201	201
	FF/ENG	3100	3070	3050	3000	2920	2970	3190
110	EPR	1.06	1.08	1.11	1.14	1.19	1.28	1.41
	KIAS	195	195	195	195	195	195	195
	FF/ENG	2880	2840	2830	2780	2700	2720	2860
100	EPR	1.06	1.07	1.09	1.13	1.17	1.24	1.35
	KIAS	189	189	189	189	189	189	189
	FF/ENG	2670	2630	2610	2570	2500	2490	2560

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 56

GEAR DOWN

ENGINE INOP

Initial Max Continuous EPR

Based on engine bleed for one pack on and APU off

PRESSURE ALTITUDE (FT)		CRUISE MACH NUMBER		
		.40	.50	.60
29000	EPR	1.75	1.78	1.75
	MAX TAT	-10	-15	-8
	EPR CORR	0.09	0.09	0.09
27000	EPR	1.75	1.78	1.76
	MAX TAT	-10	-12	-6
	EPR CORR	0.09	0.09	0.09
25000	EPR	1.75	1.78	1.76
	MAX TAT	-10	-10	-3
	EPR CORR	0.09	0.09	0.09
23000	EPR	1.75	1.78	1.76
	MAX TAT	-11	-6	-1
	EPR CORR	0.08	0.09	0.09
21000	EPR	1.73	1.78	1.75
	MAX TAT	-7	-3	3
	EPR CORR	0.09	0.09	0.09
19000	EPR	1.71	1.78	1.74
	MAX TAT	-4	0	7
	EPR CORR	0.10	0.09	0.09
15000	EPR	1.63	1.76	1.70
	MAX TAT	4	9	15
	EPR CORR	0.09	0.09	0.09
10000	EPR	1.54	1.59	1.54
	MAX TAT	14	20	25
	EPR CORR	0.08	0.08	0.07

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
170	161	230	3200		
160	152	222	6000	4200	2300
150	142	215	8500	6900	5100
140	133	210	11000	9500	7800
130	123	205	13500	12100	10500
120	114	199	16200	14700	13300
110	105	193	18700	17600	16200
100	96	187	20900	20200	19000

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
155	3000		
150	4700		
145	6400	3800	
140	8100	5700	3000
135	9800	7500	5000
130	11400	9400	7000
125	12900	11200	8900
120	14400	12900	10800
115	16000	14600	12800
110	17500	16000	14600
105	18800	17500	16100
100	20100	19000	17600
95	21200	20400	19200
90	22300	21700	20700

**GEAR DOWN****ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		6	8	10	12	14	16	18	20
150	EPR	1.45							
	MACH	.383							
	KIAS	228							
	FF/ENG	7577							
140	EPR	1.40	1.45	1.52					
	MACH	.375	.384	.394					
	KIAS	223	220	217					
	FF/ENG	7003	7032	7128					
130	EPR	1.37	1.41	1.46	1.53				
	MACH	.365	.375	.384	.395				
	KIAS	217	215	212	210				
	FF/ENG	6464	6465	6489	6590				
120	EPR	1.33	1.36	1.41	1.46	1.53	1.63		
	MACH	.354	.365	.375	.384	.395	.409		
	KIAS	211	209	207	204	202	201		
	FF/ENG	5951	5930	5931	5966	6046	6250		
110	EPR	1.29	1.32	1.36	1.40	1.45	1.53	1.64	
	MACH	.342	.353	.363	.373	.383	.397	.413	
	KIAS	203	202	200	198	196	195	195	
	FF/ENG	5446	5422	5405	5408	5416	5541	5742	
100	EPR	1.25	1.28	1.32	1.35	1.39	1.45	1.54	1.64
	MACH	.328	.339	.350	.361	.371	.385	.400	.417
	KIAS	195	194	193	192	190	189	189	189
	FF/ENG	4937	4921	4900	4890	4858	4919	5043	5244

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	147	131	119	109	100	94	89	84	79	75
336	297	264	239	218	200	187	175	165	156	149
508	449	399	359	328	300	281	263	247	234	222
681	601	533	480	437	400	374	350	329	311	295
855	754	667	600	547	500	467	438	411	388	368
1030	908	803	722	657	600	560	524	493	465	441
1207	1062	938	843	766	700	653	611	574	541	513
1384	1217	1075	964	876	800	746	698	655	618	586
1563	1372	1211	1086	986	900	839	785	737	694	658
1742	1529	1348	1208	1097	1000	933	872	818	771	730

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		10		14		18	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	2.6	0:28	2.4	0:27	2.2	0:26	2.0	0:26
200	5.5	0:53	5.2	0:51	5.0	0:49	4.9	0:47
300	8.3	1:18	7.9	1:15	7.8	1:12	7.7	1:09
400	11.1	1:43	10.6	1:40	10.5	1:36	10.5	1:31
500	13.8	2:09	13.3	2:04	13.2	1:59	13.2	1:54
600	16.5	2:34	15.9	2:29	15.8	2:23	15.8	2:16
700	19.2	3:00	18.4	2:54	18.3	2:47	18.4	2:39
800	21.8	3:26	21.0	3:19	20.8	3:11	20.9	3:02
900	24.4	3:53	23.4	3:44	23.2	3:35	23.4	3:25
1000	26.9	4:20	25.9	4:10	25.6	4:00	25.8	3:48

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.2	0.0	0.2	0.4
4	-0.7	-0.4	0.0	0.5	1.0
6	-1.1	-0.6	0.0	0.8	1.5
8	-1.5	-0.7	0.0	1.0	2.0
10	-1.8	-0.9	0.0	1.3	2.6
12	-2.2	-1.1	0.0	1.6	3.1
14	-2.6	-1.3	0.0	1.9	3.7
16	-2.9	-1.5	0.0	2.2	4.2
18	-3.3	-1.7	0.0	2.5	4.8
20	-3.7	-1.9	0.0	2.8	5.4
22	-4.1	-2.1	0.0	3.1	6.0
24	-4.4	-2.2	0.0	3.4	6.5
26	-4.8	-2.4	0.0	3.7	7.1
28	-5.2	-2.6	0.0	4.0	7.7

Includes APU fuel burn.

GEAR DOWN**ENGINE INOP****MAX CONTINUOUS THRUST****Holding****Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
170	EPR	1.40				
	KIAS	234				
	FF/ENG	8600				
160	EPR	1.36	1.44			
	KIAS	226	226			
	FF/ENG	7960	8190			
150	EPR	1.32	1.40			
	KIAS	218	218			
	FF/ENG	7350	7460			
140	EPR	1.29	1.36	1.50		
	KIAS	212	212	212		
	FF/ENG	6850	6910	7260		
130	EPR	1.27	1.32	1.44		
	KIAS	207	207	207		
	FF/ENG	6370	6400	6610		
120	EPR	1.24	1.29	1.39	1.57	
	KIAS	201	201	201	201	
	FF/ENG	5900	5900	6010	6440	
110	EPR	1.21	1.26	1.35	1.49	
	KIAS	195	195	195	195	
	FF/ENG	5440	5430	5480	5730	
100	EPR	1.19	1.23	1.31	1.42	1.64
	KIAS	189	189	189	189	189
	FF/ENG	5000	4980	5000	5110	5510

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight**Text****Chapter PI****Section 57**

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, brakes deactivated, improved climb, contaminated runway situations, brake energy limits, or obstacle clearance with unbalanced V1. These speeds may be used for weights less than or equal to the performance limited weight.

Normal takeoff speeds, V1, VR, and V2, with anti-skid on and all brakes operative, are read from the table by entering with takeoff flap setting, brake release weight and appropriate column. The appropriate column is obtained by entering the Column Reference chart with the airport pressure altitude and the actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the V1 Adjustment chart. Adjusted V1 must not exceed VR. These takeoff speeds are not valid when the brake release weight is based on clearway, stopway, improved climb or is limited by tire speed or brake energy.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). Therefore compare the adjusted V1 to the V1(MCG). To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length.

Clearway and Stopway V1 Adjustments

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR.

Maximum allowable clearway limits are provided for guidance when more precise data is not available.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 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 Takeoff

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 assumes 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 13 mm (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 field/obstacle limit weight for the takeoff flap setting.
2. Enter the Weight Adjustment table with the 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 adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

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 the Takeoff Speeds table in this section.
2. If V1(MCG) limited, set $V1=V1(MCG)$. If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set $V1=V1(MCG)$.

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. 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.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal runway/obstacle limited weight and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE ADJUSTMENT		
FIELD LENGTH (FT)	WEIGHT (1000 KG)	V1 ADJUSTMENT (KTS)
8000	-59.7	-40
8100	-59.7	-40
8900	-44.6	-38
10000	-32.2	-35
12000	-24.3	-31
14000	-24.3	-27

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance adjusted for wind and slope exceeds approximately 8100 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Brakes Deactivated

When operating with brakes deactivated, the field 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 2900 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ONE BRAKE DEACTIVATED SPEED ADJUSTMENT	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KTS)
4000	-4
6000	-3
8000	-3
10000	-2
12000	-2
14000	-2

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance exceeds approximately 3800 ft for one brake deactivated.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of reduced thrust is not allowed on runways contaminated with water, ice, slush or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist. The assumed temperature reduced takeoff EPR is read from the Takeoff EPR table at the assumed temperature. The minimum allowable EPR for reduced thrust, based on 25% takeoff thrust reduction, is also shown. It is not recommended to set takeoff EPR lower than the scheduled climb EPR.

Max Climb EPR

This table shows Max Climb EPR for a 250/290/.78 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 packs off and anti-ice operation.

Go-around EPR

To find Max Go-around EPR based on normal engine bleed for packs on, enter the Go-around EPR table with airport pressure altitude and reported OAT or TAT and read EPR. EPR adjustments are shown for packs off and wing anti-ice on.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch 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 or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. 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 maximum cruise thrust at 0 ft/min residual rate of climb or maximum climb thrust at 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 12° 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 .80M approximates the Long Range Cruise Mach schedule.

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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 .78/290/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

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 table makes no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Distance and time for descent are shown for a .78/290/250 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 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. 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

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. 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 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 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, temperature, and speed conditions as well as thrust reverser configuration. Each adjustment is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landing at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight, the brakes on speed adjusted for wind and 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 Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse Thrust) 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 or brake temperature monitor system (BTMS) indication on EICAS. Times are provided for ground cooling and inflight gear down cooling.

If brake temperature monitor indication on EICAS is available, 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 the recommended cooling schedule by entering at the bottom of the chart. The brake temperature light illuminates when the hottest brake is registering 5 on the EICAS indication and extinguishes as the hottest brake cools with an EICAS indication of 4.

Engine Inoperative

Initial Max Continuous EPR

The Initial Max Continuous EPR setting for use following an engine failure is shown. The table shows a range of Cruise Mach numbers to provide a target EPR setting at the start of driftdown. Also shown is the maximum TAT at which the limit EPR can be set. 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 A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read EPR.

It is desirable to maintain engine thrust level within the limits of the Max Cruise Thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous Thrust rating. The Max Continuous Thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. The cruise segment is at a level off altitude which is based on 100 ft/min residual rate of climb.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude are used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target 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)					
	190	170	150	130	110	90
43					60	55
39				65	60	60
35		75	70	70	65	65
31	75	75	75	75	70	65
27	85	85	80	75	75	70
25	85	85	85	80	75	70
20	95	90	90	85	80	75
15	105	105	95	95	90	85
10	115	115	105	105	100	95
5	125	125	120	115	110	105

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/290/250 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 Fuel Required Adjustment 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.

Alternate EEC Mode

Introduction

This section contains performance data for airplane operation using with the Electronic Engine Controls (EEC) in the ALTERNATE Mode. The data includes engine bleed effects for normal air conditioning operation; i.e., two packs on at normal flow all engines operating, and one pack on at normal flow with engine inoperative.

Takeoff thrust setting with EEC's in ALTERNATE Mode is achieved by advancing both throttles together and setting the target EPR on the engine with EPR available. During takeoff roll, minor adjustments to the non-EPR engine throttle may be made prior to 80 kts to match %N1 to the %N1 on the engine set to EPR.

Takeoff Performance

A simplified method which conservatively accounts for the effects of EEC in the ALTERNATE Mode is to reduce the normal limit weights. The Takeoff Performance table provides takeoff field, climb and obstacle limit weight adjustments. To determine limit weight for operations enter the table with airport OAT and apply the weight reduction to the normal full rate limit weight. The most limiting of the takeoff weights must be used.

Improved climb performance procedure and reduced thrust operation using assumed temperature method is not permitted. Derate 1 and Derate 2 operation is not permitted. Use of autothrottle is not permitted.

Takeoff Speeds

Takeoff speeds for the reduced weights should be adjusted by the amount shown in the Takeoff Speeds table. The adjusted V1 should not exceed the adjusted VR.

NOTE: The FMC does not incorporate Alternate EEC Mode performance in its takeoff speeds calculations.

Net Level Off Altitude Adjustment

The Net Level Off Altitude Adjustment table provides an altitude adjustment that must be applied to the One Engine Inop - Net Level Off Altitude.

Landing Performance

The Landing Performance table provides the weight adjustment that must be applied to the Approach/Landing Climb limit weight. Enter the table with airport OAT and apply the weight reduction to the normal full rate limit weight. The ALTERNATE Mode EEC Approach/Landing Climb limit must be compared to the Landing Field Length limit and the most limiting of the two be used as the landing limit weight.

Takeoff EPR/Go-around EPR/Go-around %N1

Takeoff and Go-around power setting are presented for normal air conditioning bleed. Max Takeoff or Go-around EPR may be read directly from the tables for the desired pressure altitude and airport OAT. Go-around %N1 is provided in the event that EPR becomes unavailable during the flight.

Thrust protection is not provided in the Alternate EEC 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 EEC Mode, Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting, with normal engine bleed for packs on and anti-ice off, following engine failure in cruise is shown for a range of altitudes and TAT.

Max Continuous %N1

Max Continuous %N1 which can be set during engine out cruise conditions is presented. Enter the appropriate table with pressure altitude, TAT, and KIAS to obtain Maximum Continuous %N1. Intermediate airspeeds may be interpolated. Appropriate bleed adjustments are shown.

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 the 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

General

Chapter PI

Section 60

Takeoff Speeds

Max Takeoff Thrust

FLAPS	WEIGHT 1000 KG	V1	VR	V2
5	200	170	174	180
	190	164	169	175
	180	159	164	171
	170	153	158	166
	160	147	153	161
	150	141	147	156
	140	135	141	151
	130	128	134	145
	120	121	128	140
	110	114	121	134
	100	106	113	128
	90	99	106	122
15	200	164	167	173
	190	159	162	168
	180	154	157	164
	170	148	152	159
	160	142	146	155
	150	137	140	150
	140	131	135	145
	130	124	129	139
	120	117	122	134
	110	111	116	128
	100	103	108	122
	90	96	101	116
20	200	163	163	170
	190	157	158	164
	180	151	152	159
	170	145	147	154
	160	139	141	149
	150	133	135	145
	140	127	130	140
	130	120	124	135
	120	113	118	130
	110	106	111	124
	100	99	105	118
	90	92	98	112

CHECK V1(MCG) IN BOXED AREA

V1 ADJUSTMENT

OAT	PRESS	ALT	1000 FT				
°C	°F	-2	0	2	4	6	8
-60	-76	0	0	1	2	4	5
20	68	0	0	1	2	4	5
30	86	0	0	1	3	4	6
40	104	0	2	3	5	6	8
50	122	3	4	6	8	10	11
60	140	6	7	10	11		

VR ADJUSTMENT

OAT	PRESS	ALT	1000 FT				
°C	°F	-2	0	2	4	6	8
-60	-76	0	0	1	2	3	4
20	68	0	0	1	2	3	4
30	86	0	0	1	2	4	5
40	104	0	1	2	4	5	6
50	122	2	3	4	6	7	8
60	140	4	5	7	8		

DRY RUNWAY

SLOPE/WIND V1 ADJUSTMENTS*

WEIGHT 1000 KG	DN SLOPE % UP				TAIL		WIND	KTS	HEAD	
	-2	-1	1	2	-15	-10	10	20	30	40
90	-1	0	1	2	-4	-2	1	1	2	2
110	-1	-1	1	2	-3	-2	1	1	2	2
130	-2	-1	2	3	-3	-2	0	1	1	2
150	-2	-1	2	3	-2	-2	0	1	1	2
170	-2	-1	2	3	-2	-1	1	1	1	2
190	-3	-1	3	3	-1	-1	1	1	1	2

*V1 NOT TO EXCEED VR

V1(MCG)

Max Takeoff Thrust

ACTUAL OAT		PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
50	122	102	100	97	93		
40	104	108	106	102	98	95	91
30	86	111	111	106	102	98	95
20	68	111	111	108	105	101	97
10	50	111	111	108	105	101	98
-50	-58	112	111	108	105	102	98

Maximum Allowable Clearway

FIELD LENGTH (FT)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (FT)
4000	300
6000	450
8000	550
10000	650
12000	700
14000	800

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (FT)	NORMAL V1 (KIAS)		
	120	140	160
800	-3	-2	-2
600	-3	-2	-2
400	-3	-2	-1
200	-2	-1	-1
0	0	0	0
-200	2	1	1
-400	3	2	2
-600	3	3	2
-800	3	3	3

**Stab Trim Setting****Max Takeoff Thrust**

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	6 1/2	5 1/2	4 1/2	4	3	2
180	7	6	5 1/2	4 1/2	3 1/2	3	2
160	6 1/2	5 1/2	5	4	3	2 1/2	1 1/2
140	5 1/2	4 1/2	4	3	2	1 1/2	1/2
120	4	3 1/2	2 1/2	2	1	1/2	1/2
100	3 1/2	2 1/2	2	1	1/2	1/2	1/2



VREF (KIAS)

WEIGHT (1000 KG)	FLAPS		
	30	25	20
190	179	170	179
180	171	166	174
170	164	161	168
160	156	156	162
150	148	151	157
140	142	146	152
130	137	140	146
120	131	135	140
110	125	129	134
100	119	123	128

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF30 + 80
1	VREF30 + 60
5	VREF30 + 40
15	VREF30 + 20
20	VREF30 + 20
25	VREF25
30	VREF30

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	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
210	-22.9	-27.8	-32.7	-27.2	-32.1	-37.0	-36.9	-41.8	-46.7
200	-22.0	-26.9	-31.8	-25.9	-30.8	-35.7	-34.8	-39.7	-44.6
190	-21.0	-25.9	-30.8	-24.5	-29.4	-34.3	-32.6	-37.5	-42.4
180	-19.8	-24.7	-29.6	-23.0	-27.9	-32.8	-30.2	-35.1	-40.0
170	-18.4	-23.3	-28.2	-21.2	-26.1	-31.0	-27.7	-32.6	-37.5
160	-16.9	-21.8	-26.7	-19.4	-24.3	-29.2	-25.1	-30.0	-34.9
150	-15.2	-20.1	-25.0	-17.4	-22.3	-27.2	-22.3	-27.2	-32.1
140	-13.4	-18.3	-23.2	-15.2	-20.1	-25.0	-19.3	-24.2	-29.1
130	-11.4	-16.3	-21.2	-12.9	-17.8	-22.7	-16.2	-21.1	-26.0
120	-9.3	-14.2	-19.1	-10.5	-15.4	-20.2	-13.0	-17.9	-22.8
110	-7.0	-11.9	-16.8	-7.8	-12.7	-17.6	-9.6	-14.5	-19.4
100	-4.5	-9.4	-14.3	-5.1	-10.0	-14.9	-6.1	-11.0	-15.9
90	-1.9	-6.8	-11.7	-2.2	-7.1	-12.0	-2.4	-7.3	-12.2

V1(MCG) Limit Weight (1000 KG)

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
4600							80.7		
5000	70.1			80.4			99.6		
5400	90.2			100.1			119.0	88.3	
5800	110.7	78.1		120.5	88.3		139.1	107.3	76.9
6200	131.9	98.3		141.6	108.2	76.5	160.1	127.0	95.8
6600	154.2	119.1	86.2	163.8	128.8	96.1	181.9	147.4	115.1
7000	177.5	140.7	106.5	187.0	150.4	116.3	204.8	168.7	135.0
7400	202.2	163.4	127.6	211.5	172.9	137.3	228.8	191.0	155.8
7800	228.2	187.2	149.6		196.6	159.2		214.3	177.5
8200		212.5	172.8		221.7	182.2			200.2
8600			197.2			206.5			224.0
9000			223.0						

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -126 ft/+ 126 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 KG)	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
200	-21	-21	-21	-16	-16	-16	-8	-8	-8
190	-22	-22	-22	-17	-17	-17	-7	-7	-7
180	-22	-22	-22	-17	-17	-17	-7	-7	-7
170	-23	-23	-23	-18	-18	-18	-7	-7	-7
160	-24	-24	-24	-19	-19	-19	-8	-8	-8
150	-25	-25	-25	-20	-20	-20	-8	-8	-8
140	-25	-25	-25	-20	-20	-20	-10	-10	-10
130	-26	-26	-26	-22	-22	-22	-11	-11	-11
120	-27	-27	-27	-23	-23	-23	-13	-13	-13
110	-28	-28	-28	-24	-24	-24	-15	-15	-15
100	-29	-29	-29	-25	-25	-25	-18	-18	-18
90	-30	-30	-30	-27	-27	-27	-20	-20	-20

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).

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	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
200	-26.3	-31.2	-36.1	-30.4	-35.3	-40.2	-40.1	-45.0	-49.9
190	-25.0	-29.9	-34.8	-28.7	-33.6	-38.5	-37.4	-42.3	-47.2
180	-23.6	-28.5	-33.4	-26.9	-31.8	-36.7	-34.6	-39.5	-44.4
170	-22.0	-26.9	-31.8	-24.9	-29.8	-34.7	-31.7	-36.6	-41.5
160	-20.2	-25.1	-30.0	-22.8	-27.7	-32.6	-28.7	-33.6	-38.5
150	-18.3	-23.2	-28.1	-20.5	-25.4	-30.3	-25.5	-30.4	-35.3
140	-16.2	-21.1	-26.0	-18.1	-23.0	-27.9	-22.2	-27.1	-32.0
130	-13.9	-18.8	-23.7	-15.5	-20.4	-25.3	-18.8	-23.7	-28.6
120	-11.5	-16.4	-21.3	-12.8	-17.7	-22.6	-15.3	-20.2	-25.1
110	-8.9	-13.8	-18.7	-9.9	-14.8	-19.7	-11.6	-16.5	-21.4
100	-6.2	-11.1	-16.0	-6.8	-11.7	-16.6	-7.8	-12.7	-17.6
90	-3.4	-8.3	-13.2	-3.7	-8.6	-13.5	-3.9	-8.8	-13.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	.12 INCHES (3 mm)			.25 INCHES (6 mm)			.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							83.7		
6200							104.1	71.5	
6600				91.2			125.0	91.9	
7000	88.4			114.2	77.6		147.0	112.4	79.6
7400	114.0	73.2		138.2	100.3		170.3	133.7	100.0
7800	140.6	98.6		163.5	123.6	86.7	194.9	156.2	120.8
8200	168.9	124.4	83.3	190.6	148.1	109.5		179.9	142.5
8600	199.4	151.7	108.8	219.4	174.1	133.3		205.3	165.5
9000		180.9	135.2		201.9	158.3			189.9
9400		212.1	163.1			185.0			215.9
9800			193.1			213.6			

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -130 ft/+130 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for adjusted field length and pressure altitude.
4. Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.

ADVISORY INFORMATION**Slush/Standing Water Takeoff****No Reverse Thrust****V1 Adjustment (KIAS)**

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	.12 INCHES (3 mm)			.25 INCHES (6 mm)			.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
200	-28	-28	-28	-21	-21	-21	-10	-10	-10
190	-29	-29	-29	-22	-22	-22	-9	-9	-9
180	-29	-29	-29	-23	-23	-23	-9	-9	-9
170	-30	-30	-30	-24	-24	-24	-10	-10	-10
160	-31	-31	-31	-25	-25	-25	-11	-11	-11
150	-32	-32	-32	-26	-26	-26	-13	-13	-13
140	-32	-32	-32	-28	-28	-28	-15	-15	-15
130	-33	-33	-33	-29	-29	-29	-17	-17	-17
120	-33	-33	-33	-29	-29	-29	-20	-20	-20
110	-33	-33	-33	-30	-30	-30	-23	-23	-23
100	-32	-32	-32	-30	-30	-30	-25	-25	-25
90	-31	-31	-31	-30	-30	-30	-28	-28	-28

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).

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
190	-2.8	-2.8	-2.8	-13.2	-13.2	-13.2	-21.5	-21.5	-21.5
180	-3.3	-3.3	-3.3	-13.1	-13.1	-13.1	-20.8	-20.8	-20.8
170	-3.7	-3.7	-3.7	-12.8	-12.8	-12.8	-19.9	-19.9	-19.9
160	-3.9	-3.9	-3.9	-12.5	-12.5	-12.5	-18.9	-18.9	-18.9
150	-3.8	-3.8	-3.8	-11.9	-11.9	-11.9	-17.7	-17.7	-17.7
140	-3.6	-3.6	-3.6	-11.0	-11.0	-11.0	-16.2	-16.2	-16.2
130	-3.1	-3.1	-3.1	-9.8	-9.8	-9.8	-14.4	-14.4	-14.4
120	-2.3	-2.3	-2.3	-8.2	-8.2	-8.2	-12.4	-12.4	-12.4
110	-1.2	-1.2	-1.2	-6.1	-6.1	-6.1	-10.0	-10.0	-10.0
100	0.0	0.0	0.0	-3.6	-3.6	-3.6	-7.3	-7.3	-7.3
90	0.0	0.0	0.0	-0.8	-0.8	-0.8	-4.5	-4.5	-4.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	800	S.L.	4000	8000	S.L.	4000	8000
4000	103								
4400	143								
4800	183	131							
5200		171	119						
5600		209	159	117					
6000			198	146	109				
6400				176	137	101			
6800				207	167	129	92		
7200					197	158	108		
7600						188	125	94	
8000							142	110	
8400							161	126	95
8800							180	144	111
9200							201	163	128
9600								182	146
10000								203	165
10400									184
10800									206

1. Enter Weight Adjustment table with reported braking action and field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -80 ft/+ 80 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -80 ft/+ 80 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -145 ft/+145 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 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
190	-7	-7	-7	-18	-18	-18	-31	-31	-31
180	-8	-8	-8	-19	-19	-19	-32	-32	-32
170	-9	-9	-9	-21	-21	-21	-34	-34	-34
160	-10	-10	-10	-22	-22	-22	-36	-36	-36
150	-11	-11	-11	-23	-23	-23	-38	-38	-38
140	-12	-12	-12	-25	-25	-25	-39	-39	-39
130	-13	-13	-13	-26	-26	-26	-41	-41	-41
120	-13	-13	-13	-27	-27	-27	-43	-43	-43
110	-14	-14	-14	-28	-28	-28	-45	-45	-45
100	-14	-14	-14	-29	-29	-29	-47	-47	-47
90	-14	-14	-14	-30	-30	-30	-49	-49	-49

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).

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
200	-4.4	-5.4	-6.3	-16.8	-17.7	-18.7	-26.9	-27.9	-28.8
190	-5.0	-6.0	-6.9	-16.9	-17.8	-18.7	-26.2	-27.1	-28.1
180	-5.5	-6.4	-7.3	-16.7	-17.6	-18.6	-25.3	-26.2	-27.1
170	-5.7	-6.6	-7.5	-16.3	-17.2	-18.1	-24.1	-25.0	-26.0
160	-5.7	-6.6	-7.6	-15.6	-16.5	-17.5	-22.7	-23.7	-24.6
150	-5.6	-6.5	-7.4	-14.7	-15.6	-16.6	-21.2	-22.1	-23.0
140	-5.3	-6.2	-7.1	-13.5	-14.5	-15.4	-19.3	-20.3	-21.2
130	-4.8	-5.7	-6.6	-12.1	-13.1	-14.0	-17.3	-18.2	-19.2
120	-4.1	-5.0	-5.9	-10.5	-11.4	-12.3	-15.1	-16.0	-16.9
110	-3.2	-4.1	-5.0	-8.6	-9.5	-10.4	-12.6	-13.5	-14.5
100	-2.1	-3.1	-4.0	-6.4	-7.3	-8.3	-9.9	-10.9	-11.8
90	-1.0	-2.0	-2.9	-4.2	-5.1	-6.1	-7.2	-8.1	-9.0

V1(MCG) Limit Weight (1000 KG)

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	77.2								
4600	134.3								
5000	181.6	118.2							
5400		168.2	100.9						
5800		210.7	154.2						
6200			198.6						
6600				115.0					
7000				158.6	101.4				
7400				199.9	145.8	87.7			
7800					187.7	132.7			
8200						175.4			
8600						215.9			
9400							81.3		
9800							105.6		
10200							130.6	83.7	
10600							157.1	108.0	
11000							185.2	133.2	86.2
11400							215.4	159.8	110.5
11800								188.2	135.8
12200								218.5	162.6
12600									191.1

1. Enter Weight Adjustment table with reported braking action and field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -80 ft/+80 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -80 ft/+80 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -150 ft/+150 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for adjusted field length and pressure altitude.
4. Max allowable slippery runway limited weight is lesser of weights from 1 and 3.

ADVISORY INFORMATION
Slippery Runway Takeoff**No Reverse Thrust****V1 Adjustment (KIAS)**

WEIGHT (1000 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
200	-8	-8	-8	-20	-20	-20	-38	-38	-38
190	-9	-9	-9	-22	-22	-22	-41	-41	-41
180	-10	-10	-10	-24	-24	-24	-44	-44	-44
170	-11	-11	-11	-26	-26	-26	-46	-46	-46
160	-12	-12	-12	-28	-28	-28	-48	-48	-48
150	-14	-14	-14	-29	-29	-29	-49	-49	-49
140	-14	-14	-14	-31	-31	-31	-51	-51	-51
130	-15	-15	-15	-32	-32	-32	-52	-52	-52
120	-16	-16	-16	-33	-33	-33	-53	-53	-53
110	-17	-17	-17	-34	-34	-34	-54	-54	-54
100	-18	-18	-18	-35	-35	-35	-54	-54	-54
90	-18	-18	-18	-36	-36	-36	-55	-55	-55

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).

Takeoff EPR

Max Takeoff Thrust

Based on engine bleed for packs on and anti-ice on or off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
70	158	1.28	1.28	1.27	1.27	1.27	1.27
65	149	1.31	1.31	1.31	1.31	1.30	1.30
60	140	1.35	1.35	1.35	1.34	1.34	1.34
55	131	1.39	1.39	1.39	1.39	1.39	1.39
50	122	1.44	1.43	1.43	1.43	1.43	1.43
45	113	1.48	1.48	1.48	1.48	1.48	1.48
40	104	1.53	1.53	1.52	1.52	1.52	1.52
35	95	1.57	1.57	1.57	1.57	1.56	1.56
30	86	1.57	1.61	1.61	1.60	1.60	1.60
25	77	1.57	1.61	1.64	1.65	1.64	1.64
20	68	1.57	1.61	1.64	1.66	1.67	1.67
15	59	1.57	1.61	1.64	1.66	1.68	1.69
10 & BELOW	50 & BELOW	1.57	1.61	1.64	1.66	1.68	1.69

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	4500	4501	6000 8000
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.02	0.02 0.02



Assumed Temperature Reduced Thrust

Based on 25% thrust reduction

MINIMUM ALLOWABLE EPR FOR REDUCED THRUST	
MAX TAKEOFF EPR FOR ACTUAL OAT	MIN TAKEOFF EPR ALLOWED
1.75	1.44
1.70	1.42
1.65	1.40
1.60	1.38
1.55	1.35
1.50	1.33
1.45	1.30
1.40	1.27
1.35	1.24
1.31	1.21
1.25	1.21

Max Climb EPR

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (KIAS OR MACH)								
	0	5	10	15	20	25	30	35	40
	250	250	250	290	290	290	290	.78	.78
60	1.24	1.25	1.25	1.21	1.20	1.18	1.14	1.08	1.05
50	1.28	1.29	1.29	1.26	1.24	1.23	1.21	1.15	1.11
40	1.32	1.34	1.34	1.31	1.30	1.29	1.27	1.21	1.18
30	1.33	1.40	1.40	1.38	1.37	1.36	1.35	1.29	1.25
20	1.33	1.40	1.46	1.46	1.45	1.44	1.43	1.37	1.34
10	1.33	1.40	1.46	1.47	1.53	1.53	1.53	1.47	1.44
0	1.33	1.40	1.46	1.47	1.53	1.57	1.63	1.57	1.54
-10	1.33	1.40	1.46	1.47	1.53	1.57	1.64	1.67	1.63
-20 & BELOW	1.33	1.40	1.46	1.47	1.53	1.57	1.64	1.68	1.66

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	0	5	10	15	20	25	30	35	40
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03	-0.04	-0.04
ENGINE & WING ANTI-ICE ON	-0.02	-0.03	-0.04	-0.05	-0.05	-0.05	-0.07	-0.07	-0.08

Go-around EPR**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 (FT)					
°C	°F		-1000	0	2000	4000	6000	8000
55	131	58	1.40	1.39	1.39	1.39	1.39	1.39
50	122	53	1.44	1.44	1.44	1.44	1.44	1.44
45	113	48	1.49	1.49	1.49	1.49	1.49	1.49
40	104	43	1.54	1.54	1.54	1.54	1.54	1.54
35	95	38	1.59	1.59	1.59	1.58	1.58	1.58
30	86	33	1.59	1.63	1.63	1.63	1.63	1.63
25	77	28	1.59	1.63	1.66	1.67	1.67	1.67
20	68	23	1.59	1.63	1.66	1.70	1.71	1.71
15	59	18	1.59	1.63	1.66	1.70	1.71	1.72
10 & BELOW	50 & BELOW	13 & BELOW	1.59	1.63	1.66	1.70	1.71	1.72

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)							
	-1000	0	2000	4000	4500	4501	6000	8000
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
WING ANTI-ICE ON	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (290/.78)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	4.0	4.0			
	V/S (FT/MIN)	1500	900			
30000	PITCH ATT	4.0	4.0	3.5	3.5	4.0
	V/S (FT/MIN)	2600	2000	1600	1200	900
20000	PITCH ATT	6.5	6.0	6.0	5.5	5.5
	V/S (FT/MIN)	4000	3200	2600	2100	1700
10000	PITCH ATT	10.0	8.5	8.0	7.5	7.5
	V/S (FT/MIN)	5300	4300	3500	3000	2500
SEA LEVEL	PITCH ATT	12.5	11.0	10.0	9.5	9.0
	V/S (FT/MIN)	6000	4900	4100	3500	3000

Cruise (.78/290)

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	2.0	2.5	3.5		
	EPR	1.20	1.31	1.52		
	(Alt Mode %N1)	(82.7)	(86.3)	(93.0)		
35000	PITCH ATT	1.5	2.0	2.5	3.0	3.5
	EPR	1.11	1.16	1.23	1.34	1.53
	(Alt Mode %N1)	(79.8)	(81.8)	(84.3)	(87.8)	(93.7)
30000	PITCH ATT	1.0	1.5	2.0	2.0	2.5
	EPR	1.06	1.09	1.13	1.18	1.24
	(Alt Mode %N1)	(78.8)	(80.2)	(81.9)	(83.8)	(86.0)
25000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	EPR	1.02	1.04	1.07	1.10	1.14
	(Alt Mode %N1)	(75.1)	(76.5)	(78.2)	(80.1)	(82.2)
20000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	EPR	1.00	1.01	1.03	1.06	1.08
	(Alt Mode %N1)	(72.5)	(73.4)	(74.7)	(76.4)	(78.4)
15000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	EPR	0.99	1.00	1.01	1.03	1.05
	(Alt Mode %N1)	(70.1)	(70.5)	(71.4)	(73.0)	(74.8)

Descent (.78/290)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	-1.0	-0.5	0.0	0.5	0.5
	V/S (FT/MIN)	-2400	-2400	-2500	-3000	-3500
30000	PITCH ATT	-2.5	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2800	-2500	-2300	-2200	-2100
20000	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2600	-2300	-2100	-2000	-1900
10000	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2300	-2000	-1900	-1800	-1700
SEA LEVEL	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.0
	V/S (FT/MIN)	-2000	-1700	-1600	-1500	-1500

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF30 + 80)**Flaps Up, Set Thrust for Level Flight**

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	4.0	4.5	4.5	5.0	5.0
	EPR	1.01	1.02	1.04	1.05	1.05
	(Alt Mode %N1)	(54.8)	(59.3)	(63.5)	(67.1)	(70.1)
	KIAS	199	211	222	236	251
5000	PITCH ATT	4.0	4.5	5.0	5.0	4.5
	EPR	1.00	1.01	1.02	1.03	1.04
	(Alt Mode %N1)	(51.3)	(55.1)	(59.2)	(62.7)	(66.2)
	KIAS	199	211	222	236	251

Terminal Area (5000 FT)**Set Thrust for Level Flight**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS UP (VREF30+80) (GEAR UP)	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	EPR	1.02	1.03	1.04	1.05	1.06
	(Alt Mode %N1)	(51.9)	(56.0)	(60.2)	(63.8)	(67.2)
	KIAS	199	211	222	236	251
FLAPS 1 (VREF30+60) (GEAR UP)	PITCH ATT	6.0	6.5	6.5	6.5	6.5
	EPR	1.04	1.05	1.06	1.07	1.08
	(Alt Mode %N1)	(52.3)	(57.6)	(61.7)	(65.2)	(68.5)
	KIAS	179	191	202	216	231
FLAPS 5 (VREF30+40) (GEAR UP)	PITCH ATT	4.5	4.5	5.0	4.5	4.5
	EPR	1.05	1.07	1.08	1.10	1.11
	(Alt Mode %N1)	(55.2)	(60.2)	(64.2)	(67.9)	(71.3)
	KIAS	159	171	182	196	211
FLAPS 15 (VREF30+20) (GEAR UP)	PITCH ATT	5.5	5.5	6.0	6.0	5.5
	EPR	1.07	1.09	1.11	1.12	1.14
	(Alt Mode %N1)	(56.8)	(61.7)	(66.0)	(69.6)	(73.0)
	KIAS	139	151	162	176	191
FLAPS 20 (VREF30+20) (GEAR DOWN)	PITCH ATT	4.0	4.5	4.5	4.0	3.5
	EPR	1.10	1.12	1.15	1.18	1.21
	(Alt Mode %N1)	(63.3)	(68.0)	(72.3)	(76.5)	(80.3)
	KIAS	139	151	162	176	191

Final Approach (1500 FT)**Gear Down, Set Thrust for a 3° Glideslope**

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS 20 (VREF20 + 10)	PITCH ATT	1.5	1.5	1.5	1.5	1.5
	EPR	1.03	1.04	1.04	1.05	1.05
	(Alt Mode %N1)	(43.3)	(47.9)	(52.1)	(55.7)	(59.2)
	KIAS	138	150	162	172	184

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around (VREF 30 + 20)

Flaps 20, Gear Up, Set Go-Around Thrust

Normal Mode EEC

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	18.5	15.5	13.0	11.0	9.0
	V/S (FT/MIN)	4100	3400	2800	2400	2000
	KIAS	139	151	162	176	191
5000	PITCH ATT	23.0	18.5	16.0	13.0	11.0
	V/S (FT/MIN)	4800	4100	3500	3000	2700
	KIAS	139	151	162	176	191
SEA LEVEL	PITCH ATT	26.5	21.5	18.5	15.5	13.0
	V/S (FT/MIN)	5400	4600	3900	3500	3100
	KIAS	139	151	162	176	191

Alternate Mode EEC

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	17.5	14.5	12.0	10.0	8.5
	V/S (FT/MIN)	3800	3100	2600	2100	1800
	KIAS	139	151	162	176	191
5000	PITCH ATT	21.5	17.5	15.0	12.5	10.5
	V/S (FT/MIN)	4500	3800	3200	2800	2400
	KIAS	139	151	162	176	191
SEA LEVEL	PITCH ATT	24.5	20.0	17.0	14.5	12.0
	V/S (FT/MIN)	4900	4200	3600	3200	2800
	KIAS	139	151	162	176	191



Performance Inflight

All Engine

Chapter PI

Section 61

Long Range Cruise Maximum Operating Altitude

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°)
190	29000	-2	34000*	33500	32600	30900	29400
185	29600	-3	34600*	34000	33200	31500	29900
180	30200	-4	35100*	34600	33800	32000	30500
175	30800	-6	35700*	35200	34400	32700	31200
170	31500	-7	36200*	35800	35000	33300	31800
165	32100	-8	36800*	36400	35600	33900	32400
160	32800	-10	37400*	37100	36200	34600	33100
155	33400	-11	38100*	37700	36900	35200	33800
150	34100	-13	38700*	38400	37600	35900	34500
145	34900	-15	39400*	39100	38300	36600	35200
140	35600	-16	40100*	39800	39000	37300	35900
135	36400	-17	40800*	40600	39800	38100	36700
130	37100	-17	41600*	41400	40600	38900	37500
125	38000	-17	42400*	42200	41400	39700	38300
120	38800	-17	43000	43000	42200	40600	39100
115	39700	-17	43000	43000	43000	41400	40000
110	40600	-17	43000	43000	43000	42400	40900
105	41600	-17	43000	43000	43000	43000	41900
100	42600	-17	43000	43000	43000	43000	42900

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°)
190	29000	4	34000*	33500	32600	30900	29400
185	29600	3	34500*	34000	33200	31500	29900
180	30200	1	35100*	34600	33800	32000	30500
175	30800	0	35600*	35200	34400	32700	31200
170	31500	-1	36200*	35800	35000	33300	31800
165	32100	-3	36800*	36400	35600	33900	32400
160	32800	-4	37400*	37100	36200	34600	33100
155	33400	-6	38100*	37700	36900	35200	33800
150	34100	-7	38700*	38400	37600	35900	34500
145	34900	-9	39400*	39100	38300	36600	35200
140	35600	-11	40100*	39800	39000	37300	35900
135	36400	-12	40800*	40600	39800	38100	36700
130	37100	-12	41600*	41400	40600	38900	37500
125	38000	-12	42300*	42200	41400	39700	38300
120	38800	-12	43000	43000	42200	40600	39100
115	39700	-12	43000	43000	43000	41400	40000
110	40600	-12	43000	43000	43000	42400	40900
105	41600	-12	43000	43000	43000	43000	41900
100	42600	-12	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.

Long Range Cruise Maximum Operating Altitude
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°)
190	29000	10	33400*	33400*	32600	30900	29400
185	29600	8	34000*	34000	33200	31500	29900
180	30200	7	34500*	34500*	33800	32000	30500
175	30800	6	35100*	35100*	34400	32700	31200
170	31500	4	35700*	35700*	35000	33300	31800
165	32100	3	36300*	36300*	35600	33900	32400
160	32800	1	36900*	36900*	36200	34600	33100
155	33400	0	37500*	37500*	36900	35200	33800
150	34100	-2	38200*	38200*	37600	35900	34500
145	34900	-3	38800*	38800*	38300	36600	35200
140	35600	-5	39500*	39500*	39000	37300	35900
135	36400	-6	40200*	40200*	39800	38100	36700
130	37100	-6	41000*	41000*	40600	38900	37500
125	38000	-6	41800*	41800*	41400	39700	38300
120	38800	-6	42600*	42600*	42200	40600	39100
115	39700	-6	43000	43000	43000	41400	40000
110	40600	-6	43000	43000	43000	42400	40900
105	41600	-6	43000	43000	43000	43000	41900
100	42600	-6	43000	43000	43000	43000	42900

*Denotes altitude thrust limited in level flight.



Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		23	25	27	29	31	33	35	37	39	41	43
190	EPR	1.13	1.16	1.20	1.26	1.35	1.48					
	MACH	.776	.790	.797	.802	.802	.796					
	KIAS	340	333	323	311	298	283					
	FF/ENG	3255	3199	3125	3097	3119	3209					
180	EPR	1.12	1.15	1.18	1.22	1.29	1.40	1.57				
	MACH	.764	.782	.794	.799	.802	.800	.792				
	KIAS	335	329	321	310	298	284	269				
	FF/ENG	3095	3058	2998	2937	2934	2973	3145				
170	EPR	1.10	1.13	1.16	1.20	1.25	1.33	1.46				
	MACH	.752	.771	.787	.796	.801	.802	.797				
	KIAS	329	324	318	309	298	285	271				
	FF/ENG	2938	2904	2864	2801	2765	2779	2832				
160	EPR	1.09	1.11	1.14	1.17	1.21	1.27	1.37	1.53			
	MACH	.737	.758	.777	.791	.798	.802	.801	.794			
	KIAS	322	318	314	307	296	285	272	258			
	FF/ENG	2778	2746	2719	2674	2615	2601	2626	2750			
150	EPR	1.08	1.10	1.12	1.15	1.18	1.23	1.30	1.42			
	MACH	.720	.743	.763	.781	.794	.799	.802	.799			
	KIAS	314	312	308	303	295	284	273	259			
	FF/ENG	2618	2588	2561	2535	2488	2441	2438	2485			
140	EPR	1.06	1.08	1.10	1.13	1.16	1.20	1.25	1.33	1.47		
	MACH	.701	.725	.747	.767	.785	.796	.801	.802	.798		
	KIAS	305	303	301	297	291	283	272	260	247		
	FF/ENG	2457	2428	2405	2381	2355	2307	2272	2291	2368		
130	EPR	1.05	1.07	1.09	1.11	1.14	1.17	1.21	1.27	1.37	1.51	
	MACH	.681	.704	.728	.751	.771	.788	.797	.801	.802	.796	
	KIAS	296	294	293	290	286	280	271	260	249	235	
	FF/ENG	2295	2271	2246	2225	2206	2178	2130	2120	2161	2254	
120	EPR	1.04	1.06	1.07	1.09	1.11	1.14	1.18	1.22	1.29	1.39	1.55
	MACH	.659	.683	.707	.731	.753	.774	.790	.798	.802	.801	.794
	KIAS	286	285	283	281	278	274	268	259	249	237	224
	FF/ENG	2127	2110	2087	2068	2050	2034	2003	1971	1982	2021	2128
110	EPR	1.04	1.05	1.06	1.07	1.09	1.12	1.15	1.18	1.23	1.30	1.41
	MACH	.635	.659	.683	.707	.732	.755	.775	.791	.798	.802	.801
	KIAS	275	274	273	272	270	267	263	256	247	237	226
	FF/ENG	1971	1945	1933	1910	1893	1879	1861	1845	1830	1843	1871
100	EPR	1.03	1.04	1.05	1.06	1.08	1.10	1.12	1.15	1.19	1.24	1.31
	MACH	.609	.633	.657	.682	.706	.731	.754	.775	.791	.798	.802
	KIAS	263	263	262	261	260	258	255	251	245	236	226
	FF/ENG	1825	1794	1779	1761	1742	1724	1706	1704	1702	1691	1702

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
281	260	241	226	212	200	191	182	174	167	161
561	520	484	452	425	400	382	366	351	337	324
843	781	726	679	637	600	574	549	527	507	488
1126	1043	969	905	850	800	765	733	703	676	651
1410	1306	1212	1132	1063	1000	956	916	879	845	814
1696	1569	1456	1360	1276	1200	1148	1100	1055	1014	977
1983	1834	1701	1588	1489	1400	1339	1283	1231	1183	1140
2271	2099	1946	1816	1702	1600	1531	1466	1407	1352	1303
2562	2367	2193	2045	1916	1800	1722	1649	1582	1521	1465
2854	2635	2439	2274	2129	2000	1913	1832	1757	1689	1627

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.7	0:39	2.3	0:38	1.9	0:36	1.7	0:35	1.5	0:35
400	5.6	1:13	5.1	1:10	4.3	1:06	4.0	1:03	3.6	1:01
600	8.4	1:48	7.8	1:42	6.7	1:35	6.2	1:31	5.7	1:28
800	11.3	2:23	10.4	2:15	9.1	2:05	8.4	2:00	7.8	1:55
1000	14.1	2:59	13.1	2:48	11.5	2:36	10.6	2:28	9.8	2:22
1200	16.9	3:35	15.7	3:22	13.8	3:06	12.8	2:57	11.9	2:50
1400	19.7	4:11	18.3	3:56	16.1	3:37	14.9	3:26	13.9	3:17
1600	22.4	4:48	20.9	4:30	18.4	4:08	17.1	3:55	15.9	3:45
1800	25.1	5:26	23.4	5:04	20.7	4:39	19.2	4:25	17.9	4:13
2000	27.8	6:03	26.0	5:39	22.9	5:10	21.3	4:54	19.8	4:40

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.2	-0.1	0.0	0.1	0.2
4	-0.5	-0.3	0.0	0.3	0.6
6	-0.8	-0.4	0.0	0.5	0.9
8	-1.1	-0.5	0.0	0.6	1.3
10	-1.4	-0.7	0.0	0.8	1.6
12	-1.7	-0.8	0.0	1.0	2.0
14	-2.0	-1.0	0.0	1.2	2.3
16	-2.3	-1.1	0.0	1.3	2.7
18	-2.5	-1.3	0.0	1.5	3.0
20	-2.8	-1.4	0.0	1.7	3.4
22	-3.1	-1.6	0.0	1.9	3.7
24	-3.4	-1.7	0.0	2.0	4.1
26	-3.7	-1.9	0.0	2.2	4.4
28	-4.0	-2.0	0.0	2.3	4.8



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
1296	1224	1158	1100	1048	1000	957	918	881	848	817
1942	1835	1737	1650	1572	1500	1437	1378	1323	1273	1227
2590	2448	2318	2201	2096	2000	1916	1838	1765	1698	1637
3241	3062	2898	2752	2621	2500	2395	2297	2207	2124	2048
3895	3679	3481	3305	3146	3000	2875	2758	2650	2550	2459
4552	4297	4065	3858	3671	3500	3354	3218	3092	2976	2870
5213	4919	4651	4412	4197	4000	3834	3678	3534	3402	3280
5877	5543	5238	4968	4724	4500	4312	4138	3976	3827	3691
6545	6170	5828	5524	5251	5000	4792	4598	4418	4252	4101
7218	6800	6418	6081	5778	5500	5271	5058	4860	4678	4512
7895	7433	7013	6640	6306	6000	5750	5517	5301	5103	4922

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)
1000	9.7	2:21	9.4	2:19	9.1	2:18	8.9	2:18	8.9	2:19
1500	14.6	3:29	14.2	3:26	13.9	3:24	13.6	3:24	13.5	3:24
2000	19.5	4:38	19.0	4:33	18.5	4:30	18.1	4:29	18.0	4:29
2500	24.3	5:47	23.6	5:41	23.0	5:37	22.5	5:35	22.3	5:35
3000	28.9	6:58	28.1	6:50	27.4	6:44	26.8	6:41	26.5	6:40
3500	33.5	8:10	32.6	8:00	31.8	7:52	31.0	7:48	30.6	7:46
4000	38.0	9:23	36.9	9:10	36.0	9:01	35.1	8:56	34.7	8:53
4500	42.3	10:37	41.1	10:22	40.1	10:11	39.1	10:04	38.6	9:59
5000	46.6	11:53	45.3	11:36	44.1	11:22	43.1	11:13	42.4	11:07
5500	50.9	13:10	49.4	12:50	48.1	12:34	46.9	12:23	46.2	12:15
6000	55.0	14:28	53.4	14:06	52.0	13:47	50.7	13:34	49.9	13:24

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.8	-0.4	0.0	1.8	2.7
10	-1.5	-0.8	0.0	3.2	6.0
15	-2.2	-1.2	0.0	4.5	9.0
20	-3.0	-1.6	0.0	5.6	11.6
25	-3.7	-2.0	0.0	6.5	13.8
30	-4.5	-2.4	0.0	7.3	15.7
35	-5.2	-2.7	0.0	8.0	17.3
40	-6.0	-3.1	0.0	8.5	18.6
45	-6.8	-3.5	0.0	8.9	19.5
50	-7.7	-3.8	0.0	9.2	20.0
55	-8.5	-4.2	0.0	9.3	20.2
60	-9.3	-4.5	0.0	9.3	20.1

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)										
	190	180	170	160	150	140	130	120	110	100	90
43							68	34	12	1	1
41						57	29	10	1	1	8
39					45	23	8	1	1	8	21
37			58	34	16	5	0	1	8	19	36
35	66	42	23	10	2	0	2	8	19	34	53
33	28	14	5	1	0	3	10	20	34	51	71
31	8	2	0	1	5	12	22	35	50	68	88
29	0	0	2	7	15	25	37	51	67	86	106
27	1	5	11	18	28	40	53	68	85	103	122
25	8	14	22	32	43	56	69	85	101	119	138

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 .78/290/250

PRESSURE ALT (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	21	38	57	63	69	75	81	87	94	100	107	112	117	123	129	135	140
TIME (MINUTES)	8	11	15	16	17	18	18	19	20	21	22	23	23	24	25	26	27

**Holding****Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
190	EPR	1.05	1.06	1.08	1.11	1.15	1.21	1.32		
	KIAS	259	259	259	259	261	264	267		
	FF/ENG	3090	3050	2930	2860	2900	2900	2980		
180	EPR	1.05	1.06	1.08	1.10	1.13	1.19	1.29		
	KIAS	251	251	251	252	254	256	259		
	FF/ENG	2930	2890	2780	2700	2730	2730	2790		
170	EPR	1.04	1.05	1.07	1.09	1.12	1.17	1.26	1.46	
	KIAS	244	244	244	245	246	248	251	254	
	FF/ENG	2760	2740	2640	2550	2570	2570	2610	2840	
160	EPR	1.04	1.05	1.07	1.09	1.11	1.16	1.23	1.38	
	KIAS	236	236	236	238	239	241	243	246	
	FF/ENG	2600	2580	2490	2400	2400	2410	2440	2560	
150	EPR	1.04	1.05	1.06	1.08	1.10	1.14	1.21	1.32	
	KIAS	228	228	229	230	231	233	235	238	
	FF/ENG	2430	2420	2330	2260	2250	2250	2260	2340	
140	EPR	1.03	1.04	1.05	1.07	1.10	1.13	1.19	1.28	
	KIAS	222	222	222	222	223	225	226	229	
	FF/ENG	2270	2260	2180	2110	2100	2090	2100	2150	
130	EPR	1.03	1.03	1.05	1.06	1.08	1.12	1.17	1.25	1.43
	KIAS	217	217	217	217	217	217	218	220	222
	FF/ENG	2120	2110	2040	1970	1960	1940	1940	1980	2160
120	EPR	1.02	1.03	1.04	1.05	1.07	1.10	1.14	1.22	1.35
	KIAS	211	211	211	211	211	211	211	211	214
	FF/ENG	1970	1960	1900	1840	1820	1820	1790	1810	1920
110	EPR	1.02	1.02	1.03	1.05	1.06	1.09	1.12	1.18	1.29
	KIAS	205	205	205	205	205	205	205	205	205
	FF/ENG	1820	1810	1760	1710	1700	1690	1660	1660	1730
100	EPR	1.02	1.02	1.03	1.04	1.05	1.07	1.10	1.15	1.24
	KIAS	199	199	199	199	199	199	199	199	199
	FF/ENG	1670	1670	1630	1570	1570	1550	1530	1530	1570

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Advisory Information

Chapter PI

Section 62

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF25	ONE REV	NO REV
MAX MANUAL	3220	110/-70	80	-130	440	50	-40	80	-80	250	70	140
MAX AUTO	5370	130/-130	150	-250	840	0	0	160	-160	600	0	0
AUTOBRAKE 4	5540	140/-140	160	-260	880	0	0	160	-160	630	0	0
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	0	190	-190	740	0	0
AUTOBRAKE 2	7150	190/-190	220	-350	1190	30	-110	230	-210	660	60	60
AUTOBRAKE 1	7840	220/-220	260	-400	1370	170	-220	270	-230	580	430	520

Good Reported Braking Action

MAX MANUAL	4460	110/-100	130	-210	740	130	-110	130	-120	350	230	520
MAX AUTO	5380	130/-130	150	-250	860	20	-10	160	-160	600	20	80
AUTOBRAKE 4	5540	140/-140	160	-260	880	10	0	160	-160	630	10	50
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	0	190	-190	740	0	0

Medium Reported Braking Action

MAX MANUAL	6140	170/-160	200	-330	1220	310	-240	210	-180	450	640	1540
MAX AUTO	6140	170/-160	200	-330	1220	300	-170	210	-180	570	610	1510
AUTOBRAKE 4	6190	170/-160	200	-340	1220	270	-150	210	-190	620	550	1450
AUTOBRAKE 3	6710	180/-180	210	-360	1280	170	-90	220	-210	740	350	1080

Poor Reported Braking Action

MAX MANUAL	8000	240/-230	280	-500	1910	720	-460	310	-250	520	1400	3700
MAX AUTO	8000	240/-230	280	-500	1910	720	-460	310	-250	510	1400	3710
AUTOBRAKE 4	8000	240/-230	280	-500	1910	720	-460	310	-250	510	1400	3710
AUTOBRAKE 3	8010	240/-230	280	-500	1920	690	-370	300	-260	680	1340	3640

Reference distance assumes sea level, standard day, no wind or slope, VREF25 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 400 ft.

Reference distance for auto braking is applicable for auto or manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF30	ONE REV	NO REV
MAX MANUAL	3170	140/-70	80	-130	440	50	-50	80	-80	260	60	130
MAX AUTO	5220	210/-140	150	-240	830	0	0	150	-150	600	0	0
AUTOBRAKE 4	5380	220/-140	150	-250	870	0	0	160	-160	620	0	0
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	0	190	-190	730	0	0
AUTOBRAKE 2	6970	280/-200	210	-350	1180	10	-100	220	-210	670	30	30
AUTOBRAKE 1	7690	300/-220	250	-400	1360	160	-210	260	-230	580	350	440

Good Reported Braking Action

MAX MANUAL	4400	160/-110	120	-210	740	130	-110	130	-120	350	220	480
MAX AUTO	5230	210/-140	150	-250	850	20	-10	150	-150	600	20	80
AUTOBRAKE 4	5390	220/-140	160	-250	870	10	0	160	-160	620	10	50
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	0	190	-190	730	0	0

Medium Reported Braking Action

MAX MANUAL	6070	230/-170	200	-330	1220	320	-250	210	-180	450	600	1430
MAX AUTO	6070	250/-170	190	-330	1220	310	-190	210	-180	550	600	1420
AUTOBRAKE 4	6080	250/-170	200	-330	1220	290	-160	200	-190	600	550	1380
AUTOBRAKE 3	6550	280/-190	210	-350	1280	180	-100	210	-200	730	360	1030

Poor Reported Braking Action

MAX MANUAL	7920	310/-240	280	-500	1920	730	-470	300	-250	520	1320	3420
MAX AUTO	7920	310/-240	280	-500	1910	730	-470	300	-250	520	1320	3430
AUTOBRAKE 4	7920	310/-240	280	-500	1910	730	-470	300	-250	520	1320	3430
AUTOBRAKE 3	7920	330/-240	280	-500	1920	720	-380	300	-260	670	1290	3390

Reference distance assumes sea level, standard day, no wind or slope, VREF30 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 400 ft.

Reference distance for auto braking is applicable for both auto and manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Actual (unfactored) distances are shown.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Dry Runway

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	4180	90/-90	110	-170/560	80/-70	100/-100	420	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	4100	160/-100	110	-170/570	90/-80	100/-100	440	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	4580	260/-110	130	-170/570	80/-70	130/-130	330	180	390
ANTI-SKID OFF (FLAPS 25)	VREF25	6020	160/-150	170	-300/1040	200/-170	170/-160	450	380	870
ANTI-SKID OFF (FLAPS 30)	VREF30	5870	230/-160	160	-290/1030	200/-170	170/-160	450	350	800
ENGINE FAILURE (FLAPS 20)	VREF20	3480	150/-80	90	-140/470	60/-50	90/-90	280	0	90
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	4180	110/-100	100	-160/540	70/-60	110/-100	390	120	260
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	3460	90/-80	90	-140/480	60/-60	90/-80	300	0	90
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	3400	130/-80	90	-140/480	60/-60	90/-80	310	0	80
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	3830	90/-90	100	-160/560	80/-70	100/-100	340	0	130
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	3760	150/-90	100	-160/560	80/-80	100/-100	350	0	130
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	5140	200/-120	140	-190/640	120/-110	140/-140	570	0	250
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	5110	200/-120	140	-210/700	150/-130	150/-140	520	0	0
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	6260	260/-150	180	-250/850	210/-180	190/-180	670	0	510

***Reference distance assumes sea level, standard day with no wind or slope.**

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Dry Runway**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	3710	180/-80	100	-140/490	60/-50	100/-90	280	100	220
LE SLAT ASYM (FLAPS = 20)	VREF30+30	4180	170/-90	110	-160/520	70/-60	120/-110	310	140	290
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	4490	170/-100	120	-160/540	80/-70	130/-120	320	160	340
LE SLAT DISAGREE (FLAPS > 20)	VREF20	3420	140/-80	80	-130/460	50/-50	90/-80	270	80	180
LE SLAT DISAGREE - ALTN FLAP EXT ACOMPLISHED (FLAPS = 20)	VREF20	3420	140/-80	80	-130/460	50/-50	90/-80	270	80	180
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	3980	180/-90	100	-150/500	60/-60	110/-100	280	120	250
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	4280	180/-100	110	-160/540	80/-70	120/-110	330	0	150
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	3420	140/-80	80	-130/460	50/-50	90/-80	270	80	180
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	3710	180/-80	100	-140/490	60/-50	100/-90	280	100	220
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	3930	220/-90	100	-150/500	60/-60	110/-100	270	110	250
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	3420	140/-80	80	-130/460	50/-50	90/-80	270	80	180
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	3710	180/-80	100	-140/490	60/-50	100/-90	280	100	220
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	3930	220/-90	100	-150/500	60/-60	110/-100	270	110	250

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	6140	150/-150	180	-290/990	260/-220	170/-170	620	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	5990	250/-150	180	-290/990	270/-220	170/-170	630	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	6310	220/-160	200	-260/870	170/-150	210/-180	380	490	1120
ANTI-SKID OFF (FLAPS 25)	VREF25	6800	190/-180	200	-360/1280	300/-240	210/-190	490	590	1410
ANTI-SKID OFF (FLAPS 30)	VREF30	6630	260/-180	200	-360/1280	310/-240	200/-180	490	550	1290
ENGINE FAILURE (FLAPS 20)	VREF20	5030	150/-130	140	-230/810	160/-140	150/-140	410	0	360
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	5690	170/-150	170	-250/860	180/-150	170/-150	510	400	920
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	4950	130/-130	140	-240/820	170/-140	140/-140	430	0	330
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	4860	200/-130	140	-240/820	170/-150	140/-140	440	0	310
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	4950	130/-130	140	-240/820	170/-140	140/-140	430	0	330
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	4860	200/-130	140	-240/820	170/-150	140/-140	440	0	310
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	7270	300/-190	220	-310/1050	310/-260	230/-210	750	0	850
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	6970	280/-170	210	-310/1050	330/-270	210/-210	690	0	0
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	7270	300/-190	220	-310/1050	310/-260	230/-210	750	0	850

***Reference distance assumes sea level, standard day with no wind or slope.**

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Good Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	5210	200/-130	160	-230/800	150/-130	160/-150	380	340	770
LE SLAT ASYM (FLAPS = 20)	VREF30+30	5860	220/-150	180	-250/860	180/-150	190/-170	430	430	990
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	6280	230/-160	200	-260/890	190/-160	210/-180	430	480	1100
LE SLAT DISAGREE (FLAPS > 20)	VREF20	4800	140/-130	140	-220/770	140/-120	140/-130	380	290	670
LE SLAT DISAGREE - ALTN FLAP EXT ACOMPLISHED (FLAPS = 20)	VREF20	4800	140/-130	140	-220/770	140/-120	140/-130	380	290	670
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	5580	200/-140	170	-240/830	160/-140	180/-160	390	380	860
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	6210	230/-160	190	-270/910	210/-180	200/-180	470	0	540
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	4800	140/-130	140	-220/770	140/-120	140/-130	380	290	670
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	5220	200/-140	160	-230/800	150/-130	160/-150	380	350	790
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	5560	200/-140	170	-240/820	150/-140	180/-160	380	390	890
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	4800	140/-130	140	-220/770	140/-120	140/-130	380	290	670
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	5220	200/-140	160	-230/800	150/-130	160/-150	380	350	790
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	5560	200/-140	170	-240/820	150/-140	180/-160	380	390	890

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	9630	240/-240	330	-530/1860	920/-630	290/-300	850	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	9340	380/-240	330	-530/1850	910/-620	290/-290	860	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	9020	340/-250	320	-410/1450	430/-350	340/-280	520	1370	3500
ANTI-SKID OFF (FLAPS 25)	VREF25	8640	260/-250	280	-530/1980	720/-470	290/-260	560	1310	3460
ANTI-SKID OFF (FLAPS 30)	VREF30	8450	350/-250	280	-530/1980	730/-480	290/-260	570	1230	3170
ENGINE FAILURE (FLAPS 20)	VREF20	7350	240/-220	240	-390/1390	450/-350	250/-220	570	0	1150
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	7710	260/-230	260	-390/1390	420/-330	270/-230	630	1060	2730
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	7180	210/-200	230	-400/1410	470/-350	240/-210	560	0	1030
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	7030	300/-210	230	-400/1410	470/-360	230/-210	570	0	950
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	7180	210/-200	230	-400/1410	470/-350	240/-210	560	0	1030
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	7030	300/-210	230	-400/1410	470/-360	230/-210	570	0	950
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	10360	440/-300	350	-510/1750	790/-580	370/-320	920	0	2440
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	11150	440/-290	350	-570/1950	1090/-760	360/-350	960	0	0
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	10360	440/-300	350	-510/1750	790/-580	370/-320	920	0	2440

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Medium Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)							
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	7230	290/-210	250	-370/1320	370/-290	260/-220	490	920 2270
LE SLAT ASYM (FLAPS = 20)	VREF30+30	8070	320/-230	280	-400/1390	410/-330	300/-250	530	1110 2770
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	8630	340/-250	310	-410/1430	430/-350	320/-270	540	1280 3250
LE SLAT DISAGREE (FLAPS > 20)	VREF20	6700	220/-200	220	-360/1270	350/-280	230/-200	490	830 2040
LE SLAT DISAGREE - ALTN FLAP EXT ACOMPLISHED (FLAPS = 20)	VREF20	6700	220/-200	220	-360/1270	350/-280	230/-200	490	830 2040
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	7720	300/-220	260	-380/1360	380/-310	280/-240	490	1000 2460
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	8970	350/-260	300	-440/1530	550/-430	320/-280	620	0 1580
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	6700	220/-200	220	-360/1270	350/-280	230/-200	490	830 2040
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	7290	300/-210	250	-370/1320	370/-290	260/-220	490	950 2370
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	7770	300/-220	270	-380/1360	380/-310	280/-240	490	1050 2640
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	6700	220/-200	220	-360/1270	350/-280	230/-200	490	830 2040
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	7290	300/-210	250	-370/1320	370/-290	260/-220	490	950 2370
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	7770	300/-220	270	-380/1360	380/-310	280/-240	490	1050 2640

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	15350	340/-300	640	-1010/3750	4210/-1740	490/-490	1060	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	14810	500/-300	620	-990/3710	4120/-1700	480/-480	1050	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	11980	480/-370	470	-620/2260	990/-680	500/-390	640	2960	8700
ANTI-SKID OFF (FLAPS 25)	VREF25	11670	390/-370	420	-890/3770	4840/-1110	430/-410	630	3680	14100
ANTI-SKID OFF (FLAPS 30)	VREF30	11470	490/-370	410	-890/3770	4800/-1120	420/-410	630	3500	13210
ENGINE FAILURE (FLAPS 20)	VREF20	10180	360/-320	360	-620/2270	1170/-740	370/-330	700	0	2870
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	9910	360/-320	370	-580/2140	950/-620	380/-310	720	2220	6470
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	9940	300/-300	340	-640/2380	1280/-760	360/-310	670	0	2580
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	9740	410/-300	340	-640/2380	1290/-760	350/-310	670	0	2360
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	9940	300/-300	340	-640/2380	1280/-760	360/-310	670	0	2580
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	9740	410/-300	340	-640/2380	1290/-760	350/-310	670	0	2360
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	14070	600/-420	520	-800/2860	1980/-1170	550/-450	1040	0	5800
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	17420	620/-430	550	-1020/3640	3920/-1910	580/-540	1190	0	0
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	14070	600/-420	520	-800/2860	1980/-1170	550/-450	1040	0	5800

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Poor Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	9440	400/-290	350	-550/2060	850/-560	370/-310	570	1940	5350
LE SLAT ASYM (FLAPS = 20)	VREF30+30	10430	430/-320	400	-580/2150	920/-620	420/-340	610	2250	6270
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	11250	460/-350	440	-610/2210	970/-650	460/-370	630	2640	7610
LE SLAT DISAGREE (FLAPS > 20)	VREF20	8820	320/-280	320	-540/2010	820/-540	340/-280	580	1800	4970
LE SLAT DISAGREE - ALTN FLAP EXT ACOMPLISHED (FLAPS = 20)	VREF20	8820	320/-280	320	-540/2010	820/-540	340/-280	580	1800	4970
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	10000	410/-310	370	-570/2100	870/-580	390/-330	560	2050	5650
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	12190	500/-380	440	-680/2450	1340/-860	470/-400	730	0	3680
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	8820	320/-280	320	-540/2010	820/-540	340/-280	580	1800	4970
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	9590	410/-300	360	-560/2070	850/-570	380/-310	590	2100	5920
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	10170	420/-310	380	-570/2120	870/-590	410/-330	580	2220	6260
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	8820	320/-280	320	-540/2010	820/-540	340/-280	580	1800	4970
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	9590	410/-300	360	-560/2070	850/-570	380/-310	590	2100	5920
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	10170	420/-310	380	-570/2120	870/-590	410/-330	580	2220	6260

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (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
180	0	14.9	15.8	16.7	22.4	23.9	25.4	31.3	33.4	35.5	41.2	44.0	46.8	52.0	55.6	59.2			
	10	15.4	16.4	17.3	23.2	24.7	26.3	32.3	34.5	36.7	42.6	45.5	48.5	53.8	57.6	61.3			
	20	15.9	16.9	17.9	24.0	25.6	27.1	33.4	35.7	37.9	44.0	47.1	50.1	55.6	59.5	63.4			
	30	16.4	17.4	18.4	24.7	26.4	28.0	34.5	36.8	39.1	45.5	48.6	51.7	57.4	61.5	65.5			
	40	16.7	17.7	18.8	25.2	26.9	28.6	35.3	37.7	40.1	46.5	49.8	53.0	58.9	63.0	67.2			
	50	16.9	18.0	19.0	25.7	27.4	29.1	35.9	38.4	40.8	47.5	50.8	54.1	60.2	64.5	68.7			
160	0	13.4	14.3	15.1	20.2	21.5	22.8	28.1	30.0	31.8	36.9	39.4	41.9	46.5	49.8	53.0	56.8	60.8	64.8
	10	13.9	14.8	15.6	20.9	22.3	23.6	29.1	31.0	32.9	38.2	40.8	43.4	48.2	51.5	54.9	58.9	63.0	67.1
	20	14.4	15.2	16.1	21.6	23.0	24.4	30.0	32.0	34.0	39.5	42.2	44.9	49.8	53.3	56.7	60.9	65.2	69.4
	30	14.8	15.7	16.6	22.3	23.7	25.2	31.0	33.1	35.1	40.8	43.5	46.3	51.4	55.0	58.6	62.8	67.3	71.7
	40	15.0	16.0	16.9	22.7	24.2	25.7	31.7	33.8	35.9	41.7	44.6	47.4	52.7	56.4	60.1	64.5	69.0	73.6
	50	15.2	16.2	17.1	23.1	24.6	26.1	32.2	34.4	36.6	42.5	45.5	48.4	53.8	57.6	61.4	65.9	70.7	75.4
140	0	12.0	12.8	13.5	18.0	19.1	20.3	24.9	26.5	28.1	32.6	34.7	36.9	40.9	43.7	46.5	49.9	53.3	56.8
	10	12.4	13.2	13.9	18.6	19.8	21.0	25.7	27.4	29.1	33.7	36.0	38.2	42.4	45.3	48.2	51.6	55.2	58.8
	20	12.8	13.6	14.4	19.2	20.4	21.7	26.6	28.3	30.1	34.8	37.2	39.5	43.8	46.8	49.8	53.4	57.1	60.8
	30	13.2	14.0	14.8	19.8	21.1	22.3	27.4	29.2	31.0	35.9	38.4	40.8	45.2	48.3	51.4	55.1	58.9	62.8
	40	13.4	14.3	15.1	20.2	21.5	22.8	28.0	29.9	31.7	36.7	39.2	41.7	46.3	49.5	52.7	56.5	60.5	64.4
	50	13.6	14.4	15.3	20.5	21.8	23.1	28.5	30.4	32.3	37.4	40.0	42.6	47.2	50.5	53.8	57.7	61.8	65.9
120	0	10.6	11.2	11.9	15.7	16.7	17.7	21.6	23.0	24.4	28.1	29.9	31.8	35.1	37.5	39.9	42.6	45.5	48.4
	10	11.0	11.6	12.3	16.2	17.3	18.3	22.3	23.8	25.2	29.0	31.0	32.9	36.3	38.8	41.3	44.1	47.1	50.2
	20	11.3	12.0	12.7	16.8	17.8	18.9	23.1	24.6	26.1	30.0	32.0	34.0	37.5	40.1	42.7	45.6	48.7	51.8
	30	11.6	12.4	13.1	17.3	18.4	19.5	23.8	25.3	26.9	31.0	33.0	35.1	38.7	41.4	44.0	47.0	50.3	53.5
	40	11.8	12.5	13.3	17.6	18.7	19.9	24.3	25.9	27.4	31.6	33.8	35.9	39.6	42.4	45.1	48.2	51.5	54.9
	50	11.9	12.7	13.4	17.8	19.0	20.1	24.6	26.3	27.9	32.2	34.4	36.6	40.4	43.2	46.0	49.2	52.6	56.1
100	0	9.2	9.7	10.3	13.4	14.3	15.1	18.2	19.4	20.6	23.5	25.0	26.6	29.1	31.0	33.0	35.0	37.4	39.7
	10	9.5	10.0	10.6	13.9	14.7	15.6	18.9	20.1	21.3	24.3	25.9	27.5	30.1	32.1	34.1	36.2	38.7	41.1
	20	9.8	10.4	10.9	14.3	15.2	16.1	19.5	20.7	22.0	25.1	26.7	28.4	31.1	33.2	35.3	37.4	40.0	42.5
	30	10.1	10.7	11.3	14.8	15.7	16.6	20.1	21.4	22.7	25.9	27.6	29.3	32.1	34.2	36.4	38.6	41.3	43.9
	40	10.2	10.8	11.4	15.0	16.0	16.9	20.5	21.8	23.1	26.4	28.2	29.9	32.8	35.0	37.2	39.5	42.2	44.9
	50	10.3	10.9	11.6	15.2	16.2	17.1	20.8	22.1	23.5	26.8	28.6	30.4	33.4	35.7	37.9	40.3	43.1	45.8

*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, altitude, and OAT effects.

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
RTO MAX MAN		5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0
LANDING	MAX MAN	1.6	6.6	11.6	16.5	21.3	26.1	30.8	35.5	40.2	44.8	49.5	54.2
	MAX AUTO	2.3	6.6	10.7	14.9	19.1	23.3	27.5	31.8	36.0	40.3	44.7	49.0
	AUTOBRAKE 4	2.5	6.4	10.4	14.3	18.3	22.2	26.1	30.1	34.0	38.0	42.0	46.1
	AUTOBRAKE 3	2.4	6.1	9.8	13.5	17.1	20.8	24.5	28.1	31.8	35.5	39.2	43.0
	AUTOBRAKE 2	2.4	5.8	9.3	12.7	16.0	19.4	22.8	26.2	29.6	33.0	36.4	39.9
	AUTOBRAKE 1	2.3	5.4	8.4	11.5	14.4	17.4	20.3	23.3	26.2	29.2	32.2	35.2

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Two Engines Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	MAX MAN	0.7	5.7	10.5	15.3	19.9	24.5	29.0	33.5	37.9	42.3	46.6	51.0
	MAX AUTO	1.0	4.6	8.2	11.8	15.4	19.0	22.7	26.4	30.1	33.9	37.8	41.7
	AUTOBRAKE 4	0.6	3.8	6.9	10.0	13.2	16.3	19.5	22.7	26.0	29.3	32.6	36.0
	AUTOBRAKE 3	0.0	2.6	5.3	8.0	10.7	13.5	16.2	19.0	21.8	24.7	27.6	30.6
	AUTOBRAKE 2	0.0	1.2	3.5	5.7	8.0	10.3	12.6	15.0	17.3	19.8	22.2	24.8
	AUTOBRAKE 1	0.0	0.7	2.2	3.8	5.3	6.9	8.4	10.0	11.7	13.4	15.1	16.9

Cooling Time (Minutes)
Category "C" and "D" Brakes

		ADJUSTED BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
		14 & BELOW	15	16	18	20	24	28	34	35 TO 42	43 & ABOVE		
		BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON EICAS											
		UP TO 1	1	1	2	2	3	4	5	5 TO 6	7 & ABOVE		
INFLIGHT	NO SPECIAL	PROCEDURE REQUIRED	1	1	2	2	3	4	6	CAUTION	FUSE PLUG MELT ZONE		
GEAR DOWN			11	15	19	24	34	44	59				
GROUND													

Observe maximum quick turnaround limit.

Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.

Add 1.0 million foot pounds per brake for each taxi mile.

For one brake deactivated, increase brake energy by 15 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 6 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 10 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.



Performance Inflight

Engine Inoperative

Chapter PI

Section 63

ENGINE INOP

Initial Max Continuous EPR

Based on engine bleed for one pack on and APU off

PRESSURE ALTITUDE (FT)		CRUISE MACH NUMBER		
		.72	.76	.80
39000	EPR	1.69	1.69	1.69
	MAX TAT/SAT	-14/-38	-11/-38	-10/-40
	EPR CORR	0.09	0.09	0.10
37000	EPR	1.70	1.69	1.69
	MAX TAT/SAT	-14/-38	-11/-38	-10/-40
	EPR CORR	0.09	0.09	0.10
35000	EPR	1.70	1.69	1.69
	MAX TAT/SAT	-13/-37	-11/-38	-9/-39
	EPR CORR	0.09	0.09	0.10
33000	EPR	1.70	1.70	1.69
	MAX TAT/SAT	-9/-34	-8/-35	-5/-35
	EPR CORR	0.09	0.09	0.10
31000	EPR	1.70	1.70	1.68
	MAX TAT/SAT	-5/-30	-4/-32	0/-31
	EPR CORR	0.10	0.10	0.11
29000	EPR	1.70	1.69	1.68
	MAX TAT/SAT	-2/-27	1/-27	3/-28
	EPR CORR	0.09	0.10	0.10
27000	EPR	1.71	1.70	1.68
	MAX TAT/SAT	1/-25	3/-26	7/-25
	EPR CORR	0.10	0.10	0.10

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous EPR

39000 FT to 22000 FT Pressure Altitudes

Based on engine bleed for one pack on and anti-ice off

PRESSURE ALTITUDE (FT)		KIAS				MACH NUMBER					
		150	200	250	300	.70	.72	.74	.76	.78	.80
39000	EPR		1.72	1.68		1.70	1.69	1.69	1.69	1.69	1.69
	MAX TAT		-17	-9		-14	-14	-12	-11	-10	-10
	EPR CORR		0.09	0.10		0.09	0.09	0.09	0.09	0.10	0.10
37000	EPR		1.73	1.69		1.70	1.70	1.69	1.69	1.69	1.69
	MAX TAT		-18	-10		-14	-14	-12	-11	-10	-10
	EPR CORR		0.08	0.10		0.09	0.09	0.09	0.09	0.10	0.10
35000	EPR	1.76	1.75	1.70		1.70	1.70	1.70	1.69	1.69	1.69
	MAX TAT	-21	-20	-13		-14	-13	-13	-11	-10	-9
	EPR CORR	0.07	0.08	0.09		0.09	0.09	0.09	0.09	0.10	0.10
33000	EPR	1.74	1.76	1.70	1.66	1.70	1.70	1.70	1.70	1.69	1.69
	MAX TAT	-12	-18	-10	-2	-10	-9	-8	-8	-6	-5
	EPR CORR	0.09	0.08	0.09	0.11	0.09	0.09	0.10	0.09	0.10	0.10
31000	EPR	1.75	1.76	1.71	1.68	1.70	1.70	1.70	1.70	1.69	1.68
	MAX TAT	-11	-14	-7	0	-6	-5	-5	-4	-2	0
	EPR CORR	0.09	0.09	0.09	0.10	0.09	0.10	0.10	0.10	0.10	0.11
29000	EPR	1.75	1.77	1.73	1.69	1.71	1.70	1.70	1.69	1.69	1.68
	MAX TAT	-10	-13	-6	1	-4	-2	-1	1	2	3
	EPR CORR	0.09	0.09	0.09	0.10	0.09	0.09	0.10	0.10	0.11	0.10
27000	EPR	1.75	1.78	1.74	1.70	1.71	1.71	1.70	1.70	1.69	1.68
	MAX TAT	-10	-12	-4	3	0	1	3	3	5	7
	EPR CORR	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10
25000	EPR	1.75	1.77	1.76	1.71	1.71	1.71	1.71	1.70	1.69	1.68
	MAX TAT	-10	-11	-3	4	3	4	5	7	9	10
	EPR CORR	0.09	0.09	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.10
24000	EPR	1.75	1.75	1.76	1.71	1.71	1.71	1.70	1.69	1.68	1.67
	MAX TAT	-10	-8	-2	4	4	5	7	9	10	12
	EPR CORR	0.09	0.09	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.10
22000	EPR	1.75	1.74	1.77	1.71	1.70	1.69	1.68	1.67	1.66	1.65
	MAX TAT	-11	-7	-1	6	7	9	11	12	14	16
	EPR CORR	0.08	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.10

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)				
	0	10000	20000	30000	40000
PACKS OFF	0.01	0.01	0.01	0.01	0.02
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.03	-0.04	-0.05
ENGINE & WING ANTI-ICE ON	-0.03	-0.04	-0.06	-0.07	-0.08

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous EPR

20000 FT to Sea Level Pressure Altitudes

Based on engine bleed for one pack on and anti-ice off

PRESSURE ALTITUDE (FT)		KIAS				MACH NUMBER					
		150	200	250	300	.70	.72	.74	.76	.78	.80
20000	EPR	1.75	1.73	1.77	1.72	1.69	1.68	1.67	1.66	1.65	1.63
	MAX TAT	-9	-5	1	7	10	12	14	15	17	19
	EPR CORR	0.09	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
18000	EPR	1.72	1.70	1.77	1.72	1.66	1.65	1.64	1.63	1.61	
	MAX TAT	-6	-1	4	10	15	17	18	20	22	
	EPR CORR	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	
16000	EPR	1.68	1.66	1.76	1.71	1.64	1.62	1.61	1.60		
	MAX TAT	-1	2	7	13	19	22	23	24		
	EPR CORR	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08		
14000	EPR	1.65	1.62	1.70	1.68	1.59	1.58	1.56			
	MAX TAT	2	5	10	16	24	25	27			
	EPR CORR	0.09	0.09	0.09	0.09	0.07	0.07	0.07			
12000	EPR	1.62	1.58	1.62	1.63	1.53					
	MAX TAT	5	9	13	18	28					
	EPR CORR	0.08	0.09	0.08	0.08	0.07					
10000	EPR	1.58	1.55	1.56	1.57						
	MAX TAT	10	13	16	22						
	EPR CORR	0.08	0.08	0.08	0.08						
5000	EPR	1.51	1.48	1.45	1.44						
	MAX TAT	18	22	25	29						
	EPR CORR	0.07	0.07	0.07	0.06						
1500	EPR	1.45	1.43	1.40	1.36						
	MAX TAT	26	29	31	35						
	EPR CORR	0.06	0.06	0.06	0.06						
0	EPR	1.41	1.39	1.36	1.32						
	MAX TAT	28	31	34	38						
	EPR CORR	0.06	0.06	0.05	0.05						

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)				
	0	10000	20000	30000	40000
PACKS OFF	0.01	0.01	0.01	0.01	0.02
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.03	-0.04	-0.05
ENGINE & WING ANTI-ICE ON	-0.03	-0.04	-0.06	-0.07	-0.08



ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	184	276	18600	17700	16900
180	174	269	20000	19100	18200
170	165	262	21300	20500	19700
160	155	254	22700	22100	21200
150	145	246	24100	23700	22800
140	136	238	25700	25400	24500
130	126	230	27200	27100	26200
120	116	221	28900	28900	28100
110	107	212	30700	30700	30000
100	97	202	32700	32700	32000

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
275	256	239	225	212	200	190	180	172	164	157
548	510	477	448	423	400	380	361	344	329	315
818	762	714	671	634	600	570	542	517	495	474
1086	1014	950	894	845	800	760	724	691	661	633
1354	1265	1186	1117	1055	1000	950	905	864	827	793
1622	1516	1422	1339	1266	1200	1141	1087	1038	993	952
1892	1768	1659	1562	1477	1400	1331	1268	1211	1159	1111
2163	2021	1896	1786	1688	1600	1521	1449	1384	1324	1270
2437	2276	2135	2010	1899	1800	1711	1630	1556	1489	1427

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	100	110	120	130	140	150	160	170	180	190	
200	1.7	1.9	2.0	2.2	2.4	2.5	2.6	2.8	2.9	2.9	0:33
400	3.8	4.1	4.5	4.8	5.2	5.5	5.7	6.1	6.3	6.6	1:05
600	5.7	6.2	6.7	7.2	7.8	8.2	8.7	9.1	9.6	10.0	1:36
800	7.6	8.3	9.0	9.6	10.3	10.9	11.5	12.1	12.7	13.3	2:06
1000	9.4	10.3	11.1	12.0	12.8	13.6	14.3	15.1	15.8	16.6	2:37
1200	11.2	12.3	13.3	14.3	15.2	16.2	17.1	18.0	18.9	19.8	3:07
1400	13.0	14.2	15.4	16.5	17.7	18.8	19.8	20.9	21.9	23.0	3:38
1600	14.7	16.1	17.4	18.7	20.0	21.3	22.5	23.7	24.9	26.1	4:10
1800	16.4	17.9	19.4	20.9	22.3	23.8	25.1	26.5	27.8	29.2	4:42

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb and APU on

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10C & BELOW	ISA + 15°C	ISA + 20°C
190	15400	14200	12900
185	16200	15300	14200
180	17000	16100	15300
175	17800	16900	16100
170	18600	17700	16900
165	19400	18500	17700
160	20200	19300	18500
155	20900	20100	19300
150	21700	20900	20100
145	22500	21800	21000
140	23300	22700	21900
135	24100	23700	22800
130	25000	24600	23800
125	25800	25600	24800
120	26700	26500	25700
115	27600	27400	26700
110	28600	28400	27700
105	29500	29500	28700
100	30500	30500	29800

With engine anti-ice on, decrease altitude capability by 1400 ft.

With engine and wing anti-ice on, decrease altitude capability by 3200 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	14	18	21	23	25	27	29	31
190	EPR	1.36	1.52							
	MACH	.561	.617							
	KIAS	312	319							
	FF/ENG	6558	6954							
180	EPR	1.32	1.46	1.67						
	MACH	.547	.597	.661						
	KIAS	303	308	317						
	FF/ENG	6121	6454	6811						
170	EPR	1.29	1.40	1.60						
	MACH	.533	.576	.638						
	KIAS	296	297	305						
	FF/ENG	5704	5958	6272						
160	EPR	1.26	1.35	1.52	1.69					
	MACH	.520	.557	.613	.664					
	KIAS	288	287	293	300					
	FF/ENG	5298	5485	5757	6056					
150	EPR	1.24	1.31	1.45	1.61					
	MACH	.508	.541	.589	.638					
	KIAS	281	278	281	288					
	FF/ENG	4921	5052	5240	5526					
140	EPR	1.21	1.28	1.38	1.52	1.64				
	MACH	.496	.525	.566	.610	.644				
	KIAS	274	270	270	275	279				
	FF/ENG	4575	4643	4734	5000	5207				
130	EPR	1.19	1.25	1.33	1.43	1.54	1.66			
	MACH	.483	.510	.545	.583	.614	.650			
	KIAS	267	262	259	262	265	270			
	FF/ENG	4228	4255	4288	4475	4651	4877			
120	EPR	1.17	1.22	1.29	1.36	1.44	1.55	1.68		
	MACH	.469	.496	.527	.557	.585	.617	.653		
	KIAS	259	255	250	250	252	256	260		
	FF/ENG	3875	3906	3885	3998	4125	4299	4529		
110	EPR	1.15	1.19	1.25	1.31	1.37	1.45	1.56	1.68	
	MACH	.453	.482	.509	.535	.557	.585	.617	.654	
	KIAS	251	247	242	240	240	242	245	250	
	FF/ENG	3541	3559	3509	3579	3649	3765	3933	4165	
100	EPR	1.13	1.17	1.22	1.26	1.31	1.36	1.44	1.56	1.68
	MACH	.436	.465	.493	.515	.533	.554	.582	.615	.652
	KIAS	241	238	234	230	229	229	231	234	238
	FF/ENG	3213	3206	3177	3198	3233	3295	3400	3554	3774

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
292	268	247	229	214	200	191	182	174	167	160
585	537	494	458	427	400	381	364	348	334	321
880	807	742	688	641	600	572	546	522	501	481
1176	1078	991	918	856	800	763	728	697	668	642
1472	1349	1240	1149	1070	1000	953	910	871	834	801
1770	1621	1489	1379	1284	1200	1144	1091	1044	1000	961
2069	1894	1739	1610	1499	1400	1334	1273	1217	1166	1120
2370	2168	1990	1841	1714	1600	1524	1454	1390	1331	1279
2672	2443	2241	2072	1928	1800	1714	1635	1563	1496	1437

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:42	2.4	0:41	2.2	0:39	2.0	0:37	1.9	0:36
400	5.5	1:20	5.2	1:18	4.8	1:14	4.7	1:09	4.5	1:05
600	8.4	1:59	7.9	1:54	7.5	1:49	7.3	1:41	7.1	1:34
800	11.2	2:38	10.7	2:32	10.1	2:24	9.8	2:14	9.7	2:04
1000	13.9	3:17	13.3	3:09	12.7	3:00	12.4	2:47	12.2	2:34
1200	16.6	3:56	16.0	3:47	15.2	3:36	14.8	3:20	14.7	3:05
1400	19.3	4:36	18.6	4:25	17.7	4:12	17.3	3:54	17.2	3:35
1600	22.0	5:16	21.1	5:04	20.1	4:49	19.7	4:28	19.5	4:07
1800	24.6	5:57	23.6	5:42	22.5	5:26	22.1	5:03	21.9	4:38

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.2	0.0	0.2	0.5
4	-0.7	-0.4	0.0	0.5	1.1
6	-1.1	-0.6	0.0	0.7	1.6
8	-1.5	-0.8	0.0	1.0	2.2
10	-1.9	-1.0	0.0	1.3	2.8
12	-2.2	-1.2	0.0	1.6	3.4
14	-2.6	-1.4	0.0	1.8	3.9
16	-3.0	-1.6	0.0	2.1	4.5
18	-3.4	-1.7	0.0	2.4	5.0
20	-3.7	-1.9	0.0	2.6	5.6
22	-4.1	-2.1	0.0	2.9	6.1
24	-4.5	-2.3	0.0	3.2	6.6
26	-4.8	-2.5	0.0	3.4	7.1
28	-5.2	-2.7	0.0	3.7	7.6
30	-5.6	-2.9	0.0	4.0	8.1

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
190	EPR	1.20	1.24	1.34	1.51			
	KIAS	259	259	259	259			
	FF/ENG	5680	5740	5900	6220			
180	EPR	1.18	1.22	1.31	1.45	1.72		
	KIAS	251	251	251	252	254		
	FF/ENG	5350	5380	5480	5760	6280		
170	EPR	1.17	1.20	1.28	1.40	1.64		
	KIAS	244	244	244	245	246		
	FF/ENG	5030	5040	5070	5290	5770		
160	EPR	1.15	1.19	1.25	1.36	1.56		
	KIAS	236	236	236	238	239		
	FF/ENG	4710	4710	4690	4850	5280		
150	EPR	1.14	1.17	1.23	1.32	1.48		
	KIAS	228	228	229	230	231		
	FF/ENG	4400	4400	4330	4430	4810		
140	EPR	1.13	1.15	1.20	1.28	1.42	1.68	
	KIAS	222	222	222	222	223	225	
	FF/ENG	4090	4090	4000	4050	4350	4810	
130	EPR	1.12	1.14	1.18	1.25	1.36	1.58	
	KIAS	217	217	217	217	217	217	
	FF/ENG	3800	3790	3700	3700	3940	4290	
120	EPR	1.10	1.12	1.16	1.22	1.31	1.48	
	KIAS	211	211	211	211	211	211	
	FF/ENG	3520	3500	3410	3380	3560	3840	
110	EPR	1.09	1.11	1.14	1.19	1.27	1.40	1.66
	KIAS	205	205	205	205	205	205	205
	FF/ENG	3240	3220	3130	3090	3200	3430	3740
100	EPR	1.08	1.10	1.12	1.17	1.23	1.34	1.54
	KIAS	199	199	199	199	199	199	199
	FF/ENG	2960	2950	2850	2820	2890	3040	3270

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Alternate EEC Mode

Chapter PI

Section 64

ALTERNATE EEC MODE

Takeoff Performance

PERFORMANCE LIMIT	WEIGHT ADJUSTMENT (1000 KG)					
	AIRPORT OAT					
	°C	10 & BELOW	20	25	30	35 & ABOVE
	°F	50 & BELOW	68	77	86	91 & ABOVE
FIELD		-12.4	-17.4	-19.2	-21.0	-23.2
CLIMB		-20.2	-27.0	-30.5	-34.0	-35.5
OBSTACLE		-22.0	-28.5	-31.5	-34.5	-36.2

Takeoff Speeds Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEEDS ADJUSTMENTS (KTS)			
	AIRPORT OAT			
	°C	10 & BELOW	20	30 & ABOVE
	°F	50 & BELOW	68	86 & ABOVE
V1 (FLAPS 5)		3	4	6
V1 (FLAPS 15)		3	4	6
V1 (FLAPS 20)		2	3	5
VR		2	2	2
V2		1	1	1

Net Level Off Altitude Adjustment

NORMAL LIMIT ALTITUDE (FT)	ALTERNATE EEC MODE ALTITUDE CAPABILITY ADJUSTMENT (FT)
30000	-2300
25000	-2600
20000	-2600
19000	-2700
18000	-2800
17000	-4700
16000	-9800
15000	-12900

Landing Performance

PERFORMANCE LIMIT	WEIGHT ADJUSTMENT (1000 KG)					
	AIRPORT OAT					
	°C	10 & BELOW	20	25	30	35 & ABOVE
	°F	50 & BELOW	68	77	86	91 & ABOVE
LANDING CLIMB		-19.0	-27.5	-31.5	-33.7	-37.9

ALTERNATE EEC MODE

Takeoff EPR

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	-1000	0	2000	4000	6000	8000
50	122	1.39	1.39	1.39	1.39	1.39	1.39
45	113	1.43	1.43	1.43	1.43	1.43	1.43
40	104	1.47	1.47	1.47	1.46	1.46	1.46
35	95	1.50	1.50	1.50	1.50	1.50	1.50
30	86	1.53	1.53	1.53	1.53	1.53	1.53
25	77	1.57	1.57	1.56	1.56	1.56	1.56
20	68	1.57	1.60	1.60	1.59	1.59	1.59
15	59	1.57	1.61	1.63	1.63	1.63	1.62
10	50	1.57	1.61	1.63	1.66	1.65	1.65
5	41	1.57	1.61	1.63	1.66	1.68	1.69
0	32	1.57	1.61	1.63	1.66	1.68	1.69

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.01
WING ANTI-ICE ON	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

ALTERNATE EEC MODE

Go-around EPR

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F		-1000	0	2000	4000	6000	8000
50	122	53	1.40	1.40	1.40	1.40	1.40	1.40
45	113	48	1.43	1.43	1.43	1.43	1.43	1.43
40	104	43	1.47	1.47	1.47	1.47	1.47	1.47
35	95	38	1.51	1.51	1.51	1.51	1.51	1.51
30	86	33	1.55	1.55	1.55	1.55	1.55	1.55
25	77	28	1.59	1.58	1.58	1.58	1.58	1.58
20	68	23	1.59	1.64	1.62	1.62	1.62	1.62
15	59	18	1.59	1.64	1.66	1.65	1.65	1.65
10	50	13	1.59	1.64	1.66	1.69	1.69	1.68
5	41	8	1.59	1.64	1.66	1.69	1.71	1.72
0 & BELOW	32 & BELOW	3	1.59	1.64	1.66	1.69	1.71	1.72

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.01	0.01	0.01	0.01	0.02	0.02
WING ANTI-ICE ON	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02

ALTERNATE EEC MODE

Go-around %N1

No EPR available

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

AIRPORT OAT		TAT	AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	(°C)	-1000	0	2000	4000	6000	8000
55	131	58	93.4	93.3	93.2	93.1	93.1	93.0
50	122	53	95.3	95.2	95.1	95.0	95.0	94.9
45	113	48	96.7	96.7	96.6	96.5	96.4	96.4
40	104	43	98.0	98.0	97.8	97.8	97.7	97.7
35	95	38	99.1	99.1	99.0	98.9	98.9	98.8
30	86	33	100.1	100.0	100.0	100.0	100.0	99.9
25	77	28	101.0	101.0	100.9	100.8	100.8	100.8
20	68	23	100.4	102.1	101.8	101.7	101.7	101.6
15	59	18	99.4	101.8	102.9	102.6	102.6	102.5
10	50	13	98.5	100.7	102.2	103.6	103.6	103.4
5	41	8	97.6	99.8	101.2	102.9	104.0	104.1
0	32	3	96.8	98.9	100.3	101.9	102.9	103.1
-5	23	-2	95.9	98.0	99.4	101.0	101.9	102.1
-10	14	-7	95.0	97.1	98.5	100.0	101.0	101.1
-15	5	-13	94.1	96.1	97.5	99.0	100.0	100.2
-20	-4	-18	93.2	95.2	96.6	98.0	99.0	99.2
-25	-13	-23	92.2	94.2	95.6	97.0	98.0	98.2
-30	-22	-28	91.2	93.2	94.6	96.0	97.0	97.2
-35	-31	-33	90.3	92.2	93.6	95.0	95.9	96.2
-40	-40	-38	89.3	91.3	92.6	94.0	94.9	95.2
-45	-49	-43	88.4	90.3	91.6	93.0	93.9	94.1
-50	-58	-48	87.4	89.0	90.6	92.0	92.9	93.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.5	0.5	0.6	0.6	0.7	0.7
WING ANTI-ICE ON	-0.5	-0.5	-0.6	-0.6	-0.7	-0.7

ALTERNATE EEC MODE

ENGINE INOP

Initial Max Continuous %N1

No EPR available

Based on 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	101.3	99.7	98.2	96.6	95.0	94.9	94.8	94.8	94.7
15	102.6	101.1	99.6	98.0	96.4	96.4	96.3	96.2	96.1
10	104.2	102.5	100.9	99.4	97.8	97.8	97.7	97.6	97.5
5	104.7	104.0	102.3	100.7	99.2	99.1	99.0	99.0	98.9
0	103.5	103.7	103.6	102.0	100.5	100.4	100.3	100.3	100.2
-5	102.6	102.6	102.7	102.8	101.4	101.3	101.2	101.1	101.1
-10	101.6	101.6	101.8	101.9	102.1	102.1	102.0	102.0	101.9
-15	100.7	100.6	100.8	100.9	101.0	101.1	101.0	101.0	100.9
-20	99.7	99.7	99.8	99.9	100.0	100.1	100.1	100.0	99.9
-25	98.7	98.7	98.8	98.9	99.0	99.1	99.1	99.0	98.9
-30	97.7	97.7	97.8	97.9	98.0	98.1	98.1	98.0	97.9
-35	96.7	96.7	96.8	96.9	97.0	97.1	97.0	97.0	96.9
-40	95.7	95.6	95.8	95.9	96.0	96.1	96.0	96.0	95.9

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
PACKS OFF	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.1
ENGINE ANTI-ICE ON	-1.2	-1.2	-1.3	-1.3	-1.3	-1.4	-1.4	-1.5	-1.6
ENGINE & WING ANTI-ICE ON	-2.9	-2.9	-3.1	-3.1	-3.1	-3.3	-3.4	-3.6	-3.9

ALTERNATE EEC MODE**ENGINE INOP****Max Continuous %N1****No EPR available****Based on engine bleed for one pack on and anti-ice off****37000 FT to 20000 FT Pressure Altitudes**

37000 FT PRESS ALT			TAT (°C)										
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	.63	97.3	98.3	99.4	100.4	101.5	101.6	100.6	99.2	98.1	97.0	95.9	94.6
220	.69	96.3	97.3	98.3	99.3	100.3	101.3	100.6	99.8	98.9	97.8	96.7	95.2
240	.75	96.1	97.1	98.1	99.1	100.1	101.3	101.5	100.6	99.6	98.5	97.3	95.8
260	.80	96.1	97.1	98.1	99.1	100.1	101.1	102.1	101.3	100.4	99.1	97.8	96.4
33000 FT PRESS ALT			TAT (°C)										
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	.58	98.1	99.2	100.2	101.2	102.2	102.5	101.4	99.6	98.5	97.4	96.4	95.3
220	.63	97.4	98.4	99.5	100.5	101.5	102.6	102.0	100.4	99.3	98.3	97.2	95.9
240	.68	96.5	97.5	98.5	99.5	100.5	101.6	102.2	101.1	100.2	99.1	98.0	96.6
260	.74	96.2	97.2	98.2	99.2	100.2	101.2	102.3	102.1	101.0	99.9	98.7	97.3
29000 FT PRESS ALT			TAT (°C)										
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	.53	97.8	98.9	99.9	100.9	101.9	103.1	102.1	100.7	99.7	98.7	97.8	97.0
220	.58	98.0	99.1	100.1	101.1	102.1	103.3	103.6	101.8	100.7	99.6	98.6	97.5
240	.63	97.3	98.4	99.4	100.4	101.4	102.4	103.6	102.9	101.6	100.6	99.5	98.3
260	.68	96.6	97.7	98.7	99.7	100.7	101.7	102.7	103.6	102.6	101.6	100.5	99.1
25000 FT PRESS ALT			TAT (°C)										
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
200	.49	96.5	97.6	98.6	99.6	100.6	101.6	102.5	101.4	100.5	99.6	98.7	98.0
220	.53	96.8	97.8	98.9	99.9	100.9	101.9	103.1	102.9	101.7	100.8	99.8	99.0
240	.58	96.9	97.9	99.0	100.0	101.0	102.0	102.9	103.9	102.8	101.8	100.7	99.7
260	.63	96.8	97.8	98.8	99.9	100.9	101.9	102.8	104.0	104.1	102.9	101.8	100.6
22000 FT PRESS ALT			TAT (°C)										
CIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	
200	.46	101.0	102.1	102.4	101.3	100.3	99.4	98.5	97.6	96.7	95.9	95.1	
240	.55	101.6	102.6	103.7	103.8	102.6	101.7	100.8	100.0	99.2	98.4	97.7	
280	.63	101.3	102.3	103.3	104.4	104.5	103.3	102.1	101.0	100.2	99.4	98.7	
20000 FT PRESS ALT			TAT (°C)										
CIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	
200	.44	101.0	101.9	103.0	102.1	101.1	100.2	99.2	98.2	97.3	96.4	95.6	
240	.53	101.5	102.5	103.5	104.4	103.4	102.5	101.7	101.0	100.2	99.4	98.7	
280	.61	101.1	102.1	103.1	104.0	104.9	103.7	102.6	101.7	100.8	100.0	99.3	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	20	22	25	29	33	37
PACKS OFF	0.5	0.5	0.5	0.6	0.7	0.8
ENGINE ANTI-ICE ON	-1.2	-1.2	-1.2	-1.2	-1.3	-1.4
ENGINE & WING ANTI-ICE ON	-2.9	-2.9	-2.9	-2.9	-3.1	-3.3

ALTERNATE EEC MODE

ENGINE INOP

Max Continuous %N1

No EPR available

Based on engine bleed for one pack on and anti-ice off

18000 FT to 8000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)										
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35
200	.42	100.2	101.1	102.3	102.7	101.6	100.6	99.6	98.5	97.5	96.6	95.8
240	.51	101.4	102.4	103.4	104.5	104.7	103.6	103.0	102.3	101.6	100.9	100.1
280	.59	100.7	101.7	102.7	103.6	104.8	104.7	103.5	102.6	101.8	100.9	100.3
16000 FT PRESS ALT		TAT (°C)										
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35
200	.41	98.7	99.6	100.6	101.7	101.6	100.3	99.2	98.0	97.0	96.1	95.3
240	.49	100.4	101.3	102.3	103.2	104.3	103.8	103.0	102.3	101.5	100.8	100.0
280	.57	100.3	101.3	102.3	103.2	104.2	105.2	104.3	103.5	102.7	101.9	101.2
14000 FT PRESS ALT		TAT (°C)										
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35
200	.39	97.2	98.1	99.0	99.9	100.9	100.0	98.9	97.6	96.6	95.7	94.9
240	.47	98.0	99.0	99.9	100.8	101.7	102.5	101.6	100.7	99.9	99.1	98.3
280	.54	99.0	99.9	100.9	101.8	102.7	103.8	104.2	103.2	102.5	101.7	100.9
12000 FT PRESS ALT		TAT (°C)										
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.38	96.7	97.6	98.5	99.5	100.1	98.8	97.6	96.5	95.6	94.8	94.2
240	.45	96.8	97.7	98.6	99.5	100.6	100.6	99.4	98.5	97.7	96.9	96.2
10000 FT PRESS ALT		TAT (°C)										
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.36	95.3	96.2	97.1	98.0	99.1	98.9	97.6	96.5	95.6	94.8	94.1
240	.43	94.9	95.8	96.7	97.5	98.4	99.4	98.5	97.5	96.7	95.9	95.2
8000 FT PRESS ALT		TAT (°C)										
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40
200	.35	93.9	94.8	95.6	96.5	97.4	98.4	97.6	96.4	95.5	94.7	94.0
240	.42	93.1	94.0	94.8	95.7	96.6	97.5	98.0	96.9	96.0	95.2	94.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	8	10	12	14	16	18
PACKS OFF	0.5	0.5	0.5	0.5	0.5	0.5
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.1	-1.2
ENGINE & WING ANTI-ICE ON	-2.1	-2.1	-2.3	-2.4	-2.6	-2.8

ALTERNATE EEC MODE

ENGINE INOP

Max Continuous %N1

No EPR available

Based on engine bleed for one pack on and anti-ice off

6000 FT to Sea Level Pressure Altitudes

6000 FT PRESS ALT					TAT (°C)								
CIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	
200	.34	92.5	93.4	94.2	95.1	95.9	96.8	97.5	96.4	95.5	94.6	93.9	
240	.40	91.6	92.5	93.3	94.2	95.0	95.9	96.9	96.8	95.6	94.9	94.2	
4000 FT PRESS ALT					TAT (°C)								
CIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	
200	.32	91.2	92.0	92.9	93.7	94.6	95.4	96.4	96.6	95.4	94.6	93.9	
240	.39	90.4	91.2	92.1	92.9	93.7	94.6	95.4	96.3	95.6	94.8	94.2	
2000 FT PRESS ALT					TAT (°C)								
CIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	
200	.31	89.9	90.8	91.6	92.5	93.3	94.1	94.9	95.9	95.6	94.5	93.8	
240	.38	89.2	90.1	90.9	91.8	92.6	93.4	94.2	95.0	95.7	94.8	94.1	
0 FT PRESS ALT					TAT (°C)								
CIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	
200	.30	87.4	88.2	89.1	89.9	90.7	91.5	92.3	93.1	93.9	93.1	92.4	
240	.36	86.9	87.7	88.5	89.3	90.1	90.9	91.7	92.5	93.4	93.5	92.6	

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	0	2	4	6
PACKS OFF	0.4	0.5	0.5	0.5
ENGINE ANTI-ICE ON	-0.6	-0.7	-0.8	-0.9
ENGINE & WING ANTI-ICE ON	-1.5	-1.7	-1.9	-2.0



Performance Inflight

Gear Down

Chapter PI

Section 65

GEAR DOWN

200 KIAS Max Climb EPR

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	1.27														
50	1.29	1.31													
45	1.31	1.33	1.33												
40	1.34	1.36	1.35	1.35	1.35										
35	1.36	1.38	1.38	1.38	1.38	1.38									
30	1.36	1.42	1.41	1.41	1.41	1.41	1.41								
25	1.36	1.44	1.45	1.45	1.45	1.45	1.44	1.44	1.44						
20	1.36	1.44	1.49	1.49	1.49	1.49	1.48	1.48	1.48	1.48					
15	1.36	1.44	1.51	1.53	1.53	1.53	1.53	1.52	1.52	1.52	1.51				
10	1.36	1.44	1.51	1.54	1.57	1.57	1.57	1.57	1.57	1.57	1.56	1.55			
5	1.36	1.44	1.51	1.54	1.57	1.60	1.62	1.62	1.61	1.61	1.61	1.60	1.59	1.57	
0	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.66	1.66	1.65	1.64	1.63	1.62	1.59
-5	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.69	1.70	1.70	1.69	1.68	1.66	1.64
-10	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.69	1.71	1.73	1.73	1.72	1.71	1.68
-15	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.69	1.71	1.73	1.75	1.76	1.75	1.72
-20	1.36	1.44	1.51	1.54	1.57	1.60	1.63	1.66	1.69	1.71	1.73	1.75	1.76	1.76	1.75

EPR Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)													
	0	5	10	12	14	18	20	22	24	26	28	30	34	
PACKS OFF	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	
ENGINE ANTI-ICE ON	-0.01	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.04	-0.04	-0.04	
ENGINE & WING ANTI-ICE ON	-0.02	-0.03	-0.04	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.06	-0.07	-0.07	

GEAR DOWN

Long Range Cruise Altitude Capability

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	18500	18500	16600
185	19500	19500	17600
180	20500	20400	18700
175	21300	21300	19700
170	22200	22200	20700
165	23200	23100	21700
160	24100	24100	22700
155	25100	25000	23700
150	26000	25900	24700
145	26900	26900	25700
140	27900	27900	26700
135	28900	28900	27700
130	29800	29800	28600
125	30700	30600	29600
120	31600	31600	30600
115	32700	32700	31600
110	33600	33500	32800
105	34400	34400	33700
100	35200	35200	34600



GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		10	14	18	21	23	25	27	29	31	33	35
190	EPR	1.26	1.33	1.45								
	MACH	.472	.506	.545								
	KIAS	261	260	259								
	FF/ENG	4861	4976	5059								
180	EPR	1.24	1.31	1.41								
	MACH	.462	.495	.532								
	KIAS	255	254	253								
	FF/ENG	4570	4669	4713								
170	EPR	1.22	1.28	1.37	1.47							
	MACH	.451	.482	.517	.549							
	KIAS	249	247	246	246							
	FF/ENG	4295	4345	4363	4505							
160	EPR	1.20	1.25	1.33	1.42	1.50						
	MACH	.440	.469	.504	.534	.555						
	KIAS	243	240	239	239	239						
	FF/ENG	4023	4034	4056	4171	4246						
150	EPR	1.18	1.23	1.30	1.37	1.44	1.52					
	MACH	.428	.457	.490	.517	.539	.560					
	KIAS	237	234	232	231	232	231					
	FF/ENG	3753	3752	3751	3829	3912	3983					
140	EPR	1.17	1.21	1.27	1.33	1.38	1.45	1.55				
	MACH	.415	.445	.475	.503	.522	.543	.565				
	KIAS	229	228	225	224	224	224	223				
	FF/ENG	3482	3481	3447	3528	3578	3649	3725				
130	EPR	1.15	1.19	1.24	1.29	1.34	1.39	1.47	1.57			
	MACH	.402	.431	.461	.486	.505	.525	.547	.569			
	KIAS	222	221	218	217	216	216	216	216			
	FF/ENG	3236	3212	3169	3226	3264	3319	3380	3460			
120	EPR	1.14	1.17	1.21	1.26	1.29	1.34	1.40	1.48	1.59		
	MACH	.388	.415	.446	.469	.487	.506	.527	.549	.572		
	KIAS	214	212	211	209	209	208	208	208	207		
	FF/ENG	2994	2941	2913	2936	2967	2999	3051	3108	3188		
110	EPR	1.12	1.15	1.19	1.23	1.26	1.30	1.34	1.40	1.48	1.60	
	MACH	.371	.400	.430	.453	.469	.487	.506	.528	.550	.574	
	KIAS	205	204	203	202	200	200	199	199	199	199	
	FF/ENG	2735	2699	2658	2680	2684	2705	2731	2779	2838	2911	
100	EPR	1.11	1.13	1.17	1.20	1.22	1.25	1.29	1.34	1.40	1.48	1.60
	MACH	.356	.383	.412	.436	.451	.467	.486	.505	.527	.549	.573
	KIAS	196	196	194	194	193	191	191	190	190	190	190
	FF/ENG	2503	2457	2404	2432	2431	2429	2439	2464	2511	2567	2629

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	287	259	236	217	200	189	179	170	161	154
646	578	520	473	434	400	378	357	339	323	308
976	871	781	710	651	600	567	536	509	484	462
1309	1167	1045	949	869	800	755	714	677	644	615
1647	1467	1312	1189	1088	1000	943	892	845	804	768
1989	1768	1579	1429	1307	1200	1132	1070	1014	964	920
2336	2073	1848	1671	1526	1400	1320	1247	1181	1122	1071
2688	2381	2119	1913	1746	1600	1508	1424	1348	1281	1222
3045	2693	2393	2157	1966	1800	1696	1601	1515	1439	1372
3407	3008	2668	2402	2187	2000	1883	1777	1682	1596	1522

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		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	4.8	0:49	4.4	0:47	4.0	0:45	3.7	0:44	3.4	0:41
400	9.9	1:36	9.2	1:31	8.5	1:27	8.1	1:23	7.7	1:17
600	14.9	2:23	13.9	2:15	13.0	2:09	12.4	2:03	11.8	1:53
800	19.8	3:11	18.5	3:01	17.3	2:52	16.6	2:43	15.8	2:30
1000	24.6	4:00	23.0	3:47	21.5	3:36	20.7	3:24	19.7	3:07
1200	29.3	4:50	27.4	4:34	25.7	4:20	24.7	4:06	23.6	3:45
1400	33.9	5:41	31.7	5:21	29.7	5:04	28.6	4:48	27.3	4:24
1600	38.4	6:33	36.0	6:10	33.7	5:50	32.5	5:31	30.9	5:03
1800	42.8	7:26	40.1	6:59	37.6	6:36	36.2	6:15	34.4	5:42
2000	47.1	8:19	44.1	7:50	41.4	7:23	39.8	6:59	37.9	6:23

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.8	-0.4	0.0	0.7	1.3
10	-1.6	-0.8	0.0	1.3	2.7
15	-2.4	-1.2	0.0	2.0	4.1
20	-3.2	-1.6	0.0	2.6	5.5
25	-4.0	-2.0	0.0	3.2	6.8
30	-4.8	-2.4	0.0	3.8	8.0
35	-5.6	-2.8	0.0	4.4	9.2
40	-6.4	-3.2	0.0	5.0	10.4
45	-7.2	-3.6	0.0	5.6	11.5
50	-8.1	-4.0	0.0	6.1	12.6

Descent at VREF30 + 70

PRESSURE ALTITUDE (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	16	26	36	39	43	47	51	55	59	63	67	71	75
TIME (MINUTES)	7	9	12	12	13	14	15	16	16	17	18	19	20

GEAR DOWN

Holding Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	EPR	1.15	1.18	1.25	1.35			
	KIAS	249	249	249	249			
	FF/ENG	4850	4820	4810	4900			
180	EPR	1.14	1.17	1.23	1.31	1.46		
	KIAS	241	241	241	241	241		
	FF/ENG	4570	4540	4480	4560	4810		
170	EPR	1.13	1.16	1.21	1.28	1.41		
	KIAS	234	234	234	234	234		
	FF/ENG	4300	4270	4170	4220	4440		
160	EPR	1.12	1.15	1.19	1.26	1.37		
	KIAS	226	226	226	226	226		
	FF/ENG	4030	4000	3880	3890	4080		
150	EPR	1.11	1.13	1.17	1.23	1.33	1.49	
	KIAS	218	218	218	218	218	218	
	FF/ENG	3760	3730	3610	3580	3740	3960	
140	EPR	1.10	1.12	1.16	1.21	1.29	1.43	
	KIAS	212	212	212	212	212	212	
	FF/ENG	3530	3490	3380	3320	3450	3640	
130	EPR	1.09	1.11	1.14	1.19	1.26	1.38	1.60
	KIAS	207	207	207	207	207	207	207
	FF/ENG	3300	3270	3150	3080	3180	3320	3530
120	EPR	1.09	1.10	1.13	1.17	1.23	1.33	1.51
	KIAS	201	201	201	201	201	201	201
	FF/ENG	3080	3050	2930	2860	2920	3030	3190
110	EPR	1.08	1.09	1.12	1.15	1.20	1.29	1.43
	KIAS	195	195	195	195	195	195	195
	FF/ENG	2850	2830	2720	2650	2680	2750	2870
100	EPR	1.07	1.08	1.10	1.14	1.18	1.25	1.37
	KIAS	189	189	189	189	189	189	189
	FF/ENG	2640	2610	2510	2440	2460	2510	2590

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 66

GEAR DOWN

ENGINE INOP

Initial Max Continuous EPR

Based on engine bleed for one pack on and APU off

PRESSURE ALTITUDE (FT)		CRUISE MACH NUMBER		
		.40	.50	.60
29000	EPR	1.75	1.78	1.75
	MAX TAT	-10	-15	-8
	EPR CORR	0.09	0.09	0.09
27000	EPR	1.75	1.78	1.75
	MAX TAT	-10	-12	-6
	EPR CORR	0.09	0.09	0.09
25000	EPR	1.75	1.78	1.75
	MAX TAT	-10	-10	-3
	EPR CORR	0.09	0.09	0.09
23000	EPR	1.75	1.78	1.76
	MAX TAT	-11	-6	-1
	EPR CORR	0.09	0.09	0.09
21000	EPR	1.73	1.78	1.75
	MAX TAT	-7	-3	3
	EPR CORR	0.09	0.09	0.09
19000	EPR	1.71	1.78	1.74
	MAX TAT	-4	0	7
	EPR CORR	0.09	0.09	0.09
15000	EPR	1.63	1.76	1.70
	MAX TAT	4	9	15
	EPR CORR	0.09	0.09	0.09
10000	EPR	1.54	1.59	1.54
	MAX TAT	14	20	25
	EPR CORR	0.08	0.08	0.07

Decrease EPR by the EPR CORR for every 10°C above the MAX TAT shown.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
170	161	230	3000		
160	152	223	5800	4000	2100
150	143	216	8400	6800	5000
140	133	210	10900	9400	7700
130	124	205	13400	12000	10500
120	114	199	16100	14700	13300
110	105	193	18700	17500	16100
100	96	187	20900	20200	19000
90	86	181	23000	22700	21700

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
155	3000		
150	4700		
145	6400	3800	
140	8100	5700	3000
135	9800	7500	5000
130	11400	9400	7000
125	12900	11200	8900
120	14400	12900	10800
115	16000	14600	12800
110	17500	16000	14600
105	18800	17500	16100
100	20100	19000	17600

GEAR DOWN**ENGINE INOP****MAX CONTINUOUS THRUST****Long Range Cruise Control**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		6	8	10	12	14	16	18	20
150	EPR	1.46							
	MACH	.383							
	KIAS	228							
	FF/ENG	7333							
140	EPR	1.41	1.46	1.53					
	MACH	.375	.384	.394					
	KIAS	223	220	217					
	FF/ENG	6844	6751	6721					
130	EPR	1.37	1.42	1.47	1.54				
	MACH	.365	.375	.384	.395				
	KIAS	217	215	212	210				
	FF/ENG	6344	6255	6192	6222				
120	EPR	1.33	1.37	1.42	1.47	1.54	1.64		
	MACH	.354	.365	.375	.384	.395	.409		
	KIAS	211	209	207	204	202	201		
	FF/ENG	5832	5748	5685	5689	5705	5834		
110	EPR	1.29	1.33	1.37	1.41	1.46	1.54	1.65	
	MACH	.342	.353	.363	.373	.383	.397	.413	
	KIAS	203	202	200	198	196	195	195	
	FF/ENG	5320	5243	5176	5178	5151	5218	5433	
100	EPR	1.26	1.29	1.32	1.36	1.40	1.46	1.54	1.65
	MACH	.328	.339	.350	.361	.371	.385	.400	.417
	KIAS	195	194	193	192	190	189	189	189
	FF/ENG	4815	4745	4686	4683	4637	4636	4816	5068
90	EPR	1.22	1.25	1.28	1.31	1.35	1.40	1.46	1.54
	MACH	.313	.324	.335	.347	.358	.372	.387	.403
	KIAS	186	185	185	184	183	183	183	183
	FF/ENG	4318	4257	4200	4195	4159	4131	4254	4450

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	147	131	119	109	100	94	89	84	79	75
336	297	264	239	218	200	187	175	165	156	149
508	449	399	359	328	300	281	263	247	234	222
681	601	533	480	437	400	374	350	329	311	295
855	754	667	600	547	500	467	438	411	388	368
1030	908	803	722	657	600	560	524	493	465	441
1206	1061	938	843	766	700	653	611	574	541	513
1383	1216	1074	964	876	800	746	698	655	618	586
1562	1372	1211	1086	986	900	839	785	737	694	658
1741	1528	1348	1208	1097	1000	932	872	818	771	731

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		10		14		18	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	2.5	0:28	2.2	0:27	2.0	0:26	1.9	0:26
200	5.3	0:53	4.9	0:51	4.6	0:49	4.6	0:47
300	8.1	1:18	7.5	1:15	7.2	1:12	7.3	1:09
400	10.8	1:43	10.1	1:40	9.7	1:35	9.8	1:31
500	13.5	2:09	12.6	2:04	12.2	1:59	12.4	1:54
600	16.2	2:34	15.1	2:29	14.6	2:23	14.9	2:16
700	18.8	3:00	17.6	2:54	17.0	2:46	17.3	2:39
800	21.4	3:26	20.0	3:19	19.4	3:10	19.7	3:01
900	23.9	3:53	22.4	3:44	21.7	3:35	22.0	3:24
1000	26.4	4:19	24.8	4:10	24.0	3:59	24.3	3:47

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.3	-0.2	0.0	0.3	0.6
4	-0.7	-0.4	0.0	0.6	1.4
6	-1.1	-0.6	0.0	1.0	2.1
8	-1.5	-0.8	0.0	1.3	2.8
10	-1.9	-1.0	0.0	1.6	3.5
12	-2.3	-1.1	0.0	1.9	4.1
14	-2.6	-1.3	0.0	2.2	4.8
16	-3.0	-1.5	0.0	2.5	5.4
18	-3.4	-1.7	0.0	2.8	6.1
20	-3.8	-1.9	0.0	3.1	6.7
22	-4.2	-2.1	0.0	3.4	7.3
24	-4.5	-2.3	0.0	3.7	7.9
26	-4.9	-2.5	0.0	4.0	8.5
28	-5.3	-2.7	0.0	4.3	9.1

Includes APU fuel burn.

GEAR DOWN**ENGINE INOP****MAX CONTINUOUS THRUST****Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
170	EPR	1.41				
	KIAS	234				
	FF/ENG	8430				
160	EPR	1.37	1.46			
	KIAS	226	226			
	FF/ENG	7820	7970			
150	EPR	1.33	1.41			
	KIAS	218	218			
	FF/ENG	7210	7330			
140	EPR	1.30	1.37	1.51		
	KIAS	212	212	212		
	FF/ENG	6720	6810	6870		
130	EPR	1.27	1.33	1.45		
	KIAS	207	207	207		
	FF/ENG	6240	6290	6320		
120	EPR	1.24	1.29	1.40	1.58	
	KIAS	201	201	201	201	
	FF/ENG	5770	5790	5760	6020	
110	EPR	1.22	1.26	1.35	1.50	
	KIAS	195	195	195	195	
	FF/ENG	5320	5320	5250	5410	
100	EPR	1.20	1.23	1.31	1.43	1.65
	KIAS	189	189	189	189	189
	FF/ENG	4880	4880	4780	4820	5320

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight**Text****Chapter PI****Section 67**

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, brakes deactivated, improved climb, contaminated runway situations, brake energy limits, or obstacle clearance with unbalanced V1. These speeds may be used for weights less than or equal to the performance limited weight.

Normal takeoff speeds, V1, VR, and V2, with anti-skid on and all brakes operative, are read from the table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the V1 Adjustment chart. Adjusted V1 must not exceed VR. These takeoff speeds are not valid when the brake release weight is based on clearway, stopway, improved climb or is limited by tire speed or brake energy.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). Therefore compare the adjusted V1 to the V1(MCG). To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length.

Clearway and Stopway V1 Adjustments

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR.

Maximum allowable clearway limits are provided for guidance when more precise data is not available.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 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 Takeoff

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 assumes 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 13 mm (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 field/obstacle limit weight for the takeoff flap setting.

2. Enter the Weight Adjustment table with the 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 adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

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 the Takeoff Speeds table in this section.
2. If V1(MCG) limited, set $V1 = V1(MCG)$. If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set $V1 = V1(MCG)$.

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. 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.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal runway/obstacle limited weight and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE ADJUSTMENT		
FIELD LENGTH (FT)	WEIGHT (1000 KG)	V1 ADJUSTMENT (KTS)
8000	-54.2	-33
8400	-54.2	-33
8600	-52.2	-33
8800	-49.3	-32
9000	-47.0	-32
10000	-36.0	-32
12000	-26.5	-28
14000	-26.5	-26

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance adjusted for wind and slope exceeds approximately 8400 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Brakes Deactivated

When operating with brakes deactivated, the field 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 3000 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ONE BRAKE DEACTIVATED SPEED ADJUSTMENT	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KTS)
4000	-4
6000	-3
8000	-3
10000	-2
12000	-2
14000	-2

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance exceeds approximately 3800 ft for one brake deactivated.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of reduced thrust is not allowed on runways contaminated with water, ice, slush or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist. The assumed temperature reduced takeoff EPR is read from the Takeoff EPR table at the assumed temperature. The minimum allowable EPR for reduced thrust, based on 25% takeoff thrust reduction, is also shown. It is not recommended to set takeoff EPR lower than the scheduled climb EPR.

Max Climb EPR

This table shows Max Climb EPR for a 250/290/.78 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 packs off and anti-ice operation.

Go-around EPR

To find Max Go-around EPR based on normal engine bleed for packs on, enter the Go-around EPR table with airport pressure altitude and reported OAT or TAT and read EPR. EPR adjustments are shown for packs off and wing anti-ice on.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch 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 or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. 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 maximum cruise thrust at 0 ft/min residual rate of climb or maximum climb thrust at 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 12° 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 .80M approximates the Long Range Cruise Mach schedule.

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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 .78/290/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

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 table makes no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Distance and time for descent are shown for a .78/290/250 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 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. 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

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. 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 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 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, temperature, and speed conditions as well as thrust reverser configuration. Each adjustment is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landing at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight, the brakes on speed adjusted for wind and 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 Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse Thrust) 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 or brake temperature monitor system (BTMS) indication on EICAS. Times are provided for ground cooling and inflight gear down cooling.

If brake temperature monitor indication on EICAS is available, 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 the recommended cooling schedule by entering at the bottom of the chart. The brake temperature light illuminates when the hottest brake is registering 5 on the EICAS indication and extinguishes as the hottest brake cools with an EICAS indication of 4.

Engine Inoperative

Initial Max Continuous EPR

The Initial Max Continuous EPR setting for use following an engine failure is shown. The table shows a range of Cruise Mach numbers to provide a target EPR setting at the start of driftdown. Also shown is the maximum TAT at which the limit EPR can be set. 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 A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read EPR.

It is desirable to maintain engine thrust level within the limits of the Max Cruise Thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous Thrust rating. The Max Continuous Thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. The cruise segment is at a level off altitude which is based on 100 ft/min residual rate of climb.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude are used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target 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)					
	190	170	150	130	110	90
43					60	55
39				65	60	60
35		75	70	70	65	65
31	75	75	75	75	70	65
27	85	85	80	75	75	70
25	85	85	85	80	75	70
20	95	90	90	85	80	75
15	105	105	95	95	90	85
10	115	115	105	105	100	95
5	125	125	120	115	110	105

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/290/250 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 Fuel Required Adjustment 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.

Alternate EEC Mode

Introduction

This section contains performance data for airplane operation using with the Electronic Engine Controls (EEC) in the ALTERNATE Mode. The data includes engine bleed effects for normal air conditioning operation; i.e., two packs on at normal flow all engines operating, and one pack on at normal flow with engine inoperative.

Takeoff thrust setting with EEC's in ALTERNATE Mode is achieved by advancing both throttles together and setting the target EPR on the engine with EPR available. During takeoff roll, minor adjustments to the non-EPR engine throttle may be made prior to 80 kts to match %N1 to the %N1 on the engine set to EPR.

Takeoff Performance

A simplified method which conservatively accounts for the effects of EEC in the ALTERNATE Mode is to reduce the normal limit weights. The Takeoff Performance table provides takeoff field, climb and obstacle limit weight adjustments. To determine limit weight for operations enter the table with airport OAT and apply the weight reduction to the normal full rate limit weight. The most limiting of the takeoff weights must be used.

Improved climb performance procedure and reduced thrust operation using assumed temperature method is not permitted. Derate 1 and Derate 2 operation is not permitted. Use of autothrottle is not permitted.

Takeoff Speeds

Takeoff speeds for the reduced weights should be adjusted by the amount shown in the Takeoff Speeds table. The adjusted V1 should not exceed the adjusted VR.

NOTE: The FMC does not incorporate Alternate EEC Mode performance in its takeoff speeds calculations.

Net Level Off Altitude Adjustment

The Net Level Off Altitude Adjustment table provides an altitude adjustment that must be applied to the One Engine Inop - Net Level Off Altitude.

Landing Performance

The Landing Performance table provides the weight adjustment that must be applied to the Approach/Landing Climb limit weight. Enter the table with airport OAT and apply the weight reduction to the normal full rate limit weight. The ALTERNATE Mode EEC Approach/Landing Climb limit must be compared to the Landing Field Length limit and the most limiting of the two be used as the landing limit weight.

Takeoff EPR/Go-around EPR/Go-around %N1

Takeoff and Go-around power setting are presented for normal air conditioning bleed. Max Takeoff or Go-around EPR may be read directly from the tables for the desired pressure altitude and airport OAT. Go-around %N1 is provided in the event that EPR becomes unavailable during the flight.

Thrust protection is not provided in the Alternate EEC 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 EEC Mode, Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting, with normal engine bleed for packs on and anti-ice off, following engine failure in cruise is shown for a range of altitudes and TAT.

Max Continuous %N1

Max Continuous %N1 which can be set during engine out cruise conditions is presented. Enter the appropriate table with pressure altitude, TAT, and KIAS to obtain Maximum Continuous %N1. Intermediate airspeeds may be interpolated. Appropriate bleed adjustments are shown.

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 the 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

General

Chapter PI

Section 70

Takeoff Speeds

Max Takeoff Thrust

FLAPS	WEIGHT 1000 KG	V1	VR	V2
5	190	164	169	176
	180	158	164	171
	170	152	158	166
	160	146	153	161
	150	140	147	156
	140	134	141	151
	130	127	134	145
	120	120	128	139
	110	113	121	134
	100	105	114	127
	190	159	162	168
	180	153	157	164
15	170	147	151	159
	160	142	146	154
	150	135	141	149
	140	129	135	144
	130	123	129	139
	120	116	122	134
	110	109	116	128
	100	102	109	122
	190	157	158	164
	180	150	152	159
	170	144	147	154
	160	138	141	149
20	150	132	135	144
	140	126	130	140
	130	120	124	134
	120	113	118	129
	110	106	111	124
	100	98	105	118

CHECK V1(MCG) IN BOXED AREA

V1 ADJUSTMENT

OAT °C	PRESS	ALT	1000 FT			
	-1	0	2	4	6	8
70	9	10	12	14	16	16
60	7	8	10	11	13	14
50	4	5	7	9	11	12
40	2	3	5	7	9	11
30	0	0	2	5	7	9
20	0	0	1	3	5	7
10	0	0	1	3	4	6
-54	0	1	2	4	5	7

VR ADJUSTMENT

OAT °C	PRESS	ALT	1000 FT			
	-1	0	2	4	6	8
70	5	6	7	8	9	10
60	4	4	6	7	8	9
50	2	3	4	5	6	8
40	1	1	3	4	5	6
30	0	0	1	3	4	5
20	0	0	1	2	3	4
10	0	0	1	2	3	4
-54	0	0	1	2	3	4

SLOPE/WIND V1 ADJUSTMENTS*

WEIGHT 1000 KG	DN SLOPE % UP					TAIL		WIND KTS		HEAD			
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	1	3	-1	-1	-1	0	0	0	1	1
170	-4	-2	0	1	3	-2	-1	-1	0	0	0	1	1
150	-3	-2	0	1	3	-2	-2	-1	0	0	1	1	1
130	-2	-1	0	2	4	-3	-2	-1	0	1	1	1	2
110	-2	-1	0	2	4	-4	-3	-1	0	1	1	2	2

* V1 NOT TO EXCEED VR

V1(MCG)

Max Takeoff Thrust

ACTUAL OAT (°C)	PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
50	106	103	99			
40	110	108	104	100	96	91
30	114	112	108	103	100	95
20	114	113	109	106	102	98
10	114	113	110	106	103	99
-54	116	115	111	108	104	100

Maximum Allowable Clearway

FIELD LENGTH (FT)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (FT)
4000	300
6000	450
8000	550
10000	600
12000	700
14000	750

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (FT)	NORMAL V1 (KIAS)		
	120	140	160
800	-3	-3	-2
600	-3	-3	-2
400	-3	-2	-1
200	-2	-1	-1
0	0	0	0
-200	2	1	0
-400	3	2	1
-600	3	2	1
-800	3	2	1

Stab Trim Setting**Max Takeoff Thrust**

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	6 1/2	5 1/2	4 1/2	4	3	2
180	7	6	5 1/2	4 1/2	3 1/2	2 1/2	2
170	6 1/2	6	5	4	3 1/2	2 1/2	1 1/2
160	6 1/2	5 1/2	5	4	3	2 1/2	1 1/2
150	6	5	4 1/2	3 1/2	3	2	1
140	5 1/2	4 1/2	4	3	2 1/2	1 1/2	1/2
130	5	4	3	2 1/2	1 1/2	1	1/2
120	4	3 1/2	2 1/2	2	1 1/2	1/2	1/2
110	3 1/2	3	2 1/2	1 1/2	1	1/2	1/2
100	3 1/2	2 1/2	2	1	1/2	1/2	1/2



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VREF (KIAS)

WEIGHT (1000 KG)	FLAPS		
	30	25	20
190	179	170	179
180	171	166	173
170	164	161	168
160	156	156	162
150	148	151	157
140	142	146	151
130	137	141	146
120	131	135	141
110	125	129	135
100	119	123	128



Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF30 + 80
1	VREF30 + 60
5	VREF30 + 40
15	VREF30 + 20
20	VREF30 + 20
25	VREF25
30	VREF30

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-20.9	-25.6	-30.3	-25.1	-29.9	-34.6	-35.1	-39.8	-44.5
200	-20.3	-25.0	-29.7	-24.2	-28.9	-33.7	-33.3	-38.1	-42.8
190	-19.5	-24.2	-29.0	-23.1	-27.8	-32.5	-31.4	-36.1	-40.8
180	-18.5	-23.3	-28.0	-21.8	-26.5	-31.2	-29.2	-33.9	-38.6
170	-17.4	-22.1	-26.8	-20.3	-25.0	-29.7	-26.9	-31.6	-36.3
160	-16.0	-20.7	-25.4	-18.5	-23.3	-28.0	-24.3	-29.0	-33.7
150	-14.4	-19.1	-23.8	-16.6	-21.3	-26.1	-21.6	-26.3	-31.0
140	-12.6	-17.4	-22.1	-14.5	-19.2	-23.9	-18.6	-23.4	-28.1
130	-10.7	-15.4	-20.1	-12.2	-16.9	-21.6	-15.5	-20.2	-24.9
120	-8.5	-13.2	-17.9	-9.7	-14.4	-19.1	-12.2	-16.9	-21.6
110	-6.1	-10.9	-15.6	-6.9	-11.7	-16.4	-8.7	-13.4	-18.1
100	-3.6	-8.3	-13.0	-4.0	-8.7	-13.5	-5.0	-9.7	-14.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
4600							81.7		
5000				83.5			99.7		
5400	92.0			102.1	81.6		118.2	97.9	
5800	111.3	90.1		121.3	100.2		137.4	116.3	96.1
6200	131.3	109.3	88.2	141.3	119.3	98.3	157.3	135.5	114.5
6600	152.3	129.3	107.4	162.2	139.2	117.4	178.1	155.3	133.5
7000	174.3	150.1	127.3	184.1	160.0	137.2	199.9	176.0	153.3
7400	197.5	172.0	148.0	207.2	181.9	157.9	222.7	197.7	173.9
7800	222.0	195.1	169.8		204.9	179.6		220.4	195.4
8200		219.5	192.7		229.0	202.5			218.1
8600			217.0			226.6			

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -117 ft/+117 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 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
190	-21	-21	-21	-16	-16	-16	-7	-7	-7
180	-22	-22	-22	-17	-17	-17	-7	-7	-7
170	-22	-22	-22	-17	-17	-17	-7	-7	-7
160	-23	-23	-23	-18	-18	-18	-7	-7	-7
150	-23	-23	-23	-18	-18	-18	-8	-8	-8
140	-24	-24	-24	-19	-19	-19	-9	-9	-9
130	-25	-25	-25	-20	-20	-20	-10	-10	-10
120	-26	-26	-26	-22	-22	-22	-12	-12	-12
110	-27	-27	-27	-23	-23	-23	-15	-15	-15
100	-29	-29	-29	-24	-24	-24	-17	-17	-17

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).

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-27.2	-32.4	-37.6	-32.3	-37.5	-42.7	-44.3	-49.5	-54.7
200	-26.2	-31.3	-36.5	-30.7	-35.9	-41.0	-41.3	-46.5	-51.6
190	-24.9	-30.1	-35.3	-28.9	-34.1	-39.3	-38.2	-43.4	-48.6
180	-23.5	-28.7	-33.9	-27.0	-32.2	-37.4	-35.1	-40.3	-45.5
170	-21.9	-27.1	-32.3	-25.0	-30.2	-35.3	-32.0	-37.1	-42.3
160	-20.2	-25.4	-30.6	-22.8	-28.0	-33.2	-28.8	-33.9	-39.1
150	-18.3	-23.5	-28.6	-20.6	-25.7	-30.9	-25.5	-30.7	-35.8
140	-16.2	-21.4	-26.6	-18.1	-23.3	-28.5	-22.2	-27.4	-32.6
130	-14.0	-19.2	-24.3	-15.6	-20.8	-25.9	-18.9	-24.1	-29.2
120	-11.6	-16.8	-21.9	-12.9	-18.1	-23.2	-15.5	-20.7	-25.8
110	-9.0	-14.2	-19.4	-10.1	-15.3	-20.4	-12.1	-17.3	-22.4
100	-6.3	-11.5	-16.6	-7.1	-12.3	-17.5	-8.6	-13.8	-19.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (FT)	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
6200							86.7		
6600							106.5	84.8	
7000				90.7			127.2	104.5	82.8
7400	83.6			112.8	88.5		148.8	125.1	102.5
7800	108.9	81.0		136.2	110.5	86.3	171.7	146.6	123.0
8200	135.3	106.4		161.2	133.8	108.3	195.9	169.3	144.4
8600	163.4	132.6	103.8	188.1	158.6	131.4	221.4	193.4	167.0
9000	193.3	160.5	129.9	217.2	185.3	156.0		218.9	190.9
9400	224.8	190.2	157.6		214.3	182.5			216.3
9800		221.6	187.1			211.3			
10200			218.4						

1. Enter Weight Adjustment table with slush/standing water depth and field/obstacle limit weight to obtain slush/standing water weight adjustment.
2. Adjust field length available by -165 ft/+165 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 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
210	-31	-31	-31	-26	-26	-26	-17	-17	-17
200	-31	-31	-31	-24	-24	-24	-13	-13	-13
190	-31	-31	-31	-24	-24	-24	-11	-11	-11
180	-31	-31	-31	-24	-24	-24	-10	-10	-10
170	-31	-31	-31	-25	-25	-25	-10	-10	-10
160	-32	-32	-32	-26	-26	-26	-11	-11	-11
150	-33	-33	-33	-27	-27	-27	-13	-13	-13
140	-33	-33	-33	-29	-29	-29	-15	-15	-15
130	-34	-34	-34	-30	-30	-30	-18	-18	-18
120	-34	-34	-34	-31	-31	-31	-21	-21	-21
110	-34	-34	-34	-32	-32	-32	-24	-24	-24
100	-34	-34	-34	-32	-32	-32	-27	-27	-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).

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

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
210	0.0	-0.2	-0.9	-10.1	-10.8	-11.5	-19.6	-20.3	-21.0
200	-0.7	-1.4	-2.1	-11.0	-11.7	-12.4	-19.8	-20.5	-21.2
190	-1.6	-2.4	-3.1	-11.6	-12.3	-13.0	-19.7	-20.4	-21.2
180	-2.4	-3.1	-3.8	-11.9	-12.6	-13.3	-19.4	-20.1	-20.8
170	-2.8	-3.6	-4.3	-11.9	-12.6	-13.3	-18.8	-19.5	-20.2
160	-3.1	-3.8	-4.5	-11.5	-12.3	-13.0	-17.9	-18.6	-19.3
150	-3.1	-3.8	-4.5	-10.9	-11.7	-12.4	-16.7	-17.4	-18.1
140	-2.8	-3.5	-4.3	-10.0	-10.7	-11.5	-15.3	-16.0	-16.7
130	-2.3	-3.0	-3.7	-8.8	-9.5	-10.3	-13.5	-14.3	-15.0
120	-1.5	-2.3	-3.0	-7.3	-8.0	-8.7	-11.6	-12.3	-13.0
110	-0.6	-1.3	-2.0	-5.5	-6.2	-6.9	-9.3	-10.0	-10.7
100	0.0	0.0	-0.8	-3.4	-4.1	-4.8	-6.8	-7.5	-8.2

V1(MCG) Limit Weight (1000 KG)

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
3800	81.7								
4200	119.8	92.5							
4600	157.4	130.4	103.1						
5000	194.4	167.8	140.9						
5400		204.7	178.2	104.5	86.6				
5800			215.0	130.5	111.7	93.5			
6200				157.7	137.9	118.9			
6600				186.5	165.6	145.5	88.1		
7000				217.2	194.9	173.6	103.1		
7400					226.1	203.5	118.7	89.6	
7800							135.0	104.6	
8200							152.2	120.3	91.1
8600							170.3	136.7	106.2
9000							189.6	154.0	121.9
9400							210.4	172.2	138.4
9800								191.7	155.7
10200								212.5	174.1
10600									193.7
11000									214.7

1. Enter Weight Adjustment table with reported braking action and field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -81 ft/+81 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -81 ft/+81 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -171 ft/+171 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 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
190	-7	-7	-7	-18	-18	-18	-30	-30	-30
180	-8	-8	-8	-19	-19	-19	-31	-31	-31
170	-9	-9	-9	-20	-20	-20	-33	-33	-33
160	-10	-10	-10	-21	-21	-21	-34	-34	-34
150	-11	-11	-11	-22	-22	-22	-35	-35	-35
140	-11	-11	-11	-23	-23	-23	-37	-37	-37
130	-12	-12	-12	-24	-24	-24	-38	-38	-38
120	-12	-12	-12	-25	-25	-25	-40	-40	-40
110	-13	-13	-13	-26	-26	-26	-41	-41	-41
100	-13	-13	-13	-27	-27	-27	-43	-43	-43

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).

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 KG)

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
210	-2.4	-3.1	-3.7	-15.3	-15.9	-16.5	-26.4	-27.0	-27.7
200	-3.6	-4.2	-4.8	-15.9	-16.5	-17.2	-26.2	-26.8	-27.5
190	-4.5	-5.1	-5.8	-16.3	-16.9	-17.5	-25.7	-26.4	-27.0
180	-5.2	-5.8	-6.4	-16.4	-17.0	-17.6	-25.0	-25.6	-26.2
170	-5.6	-6.2	-6.8	-16.1	-16.8	-17.4	-23.9	-24.6	-25.2
160	-5.8	-6.4	-7.0	-15.6	-16.2	-16.9	-22.6	-23.2	-23.9
150	-5.7	-6.3	-6.9	-14.8	-15.4	-16.0	-21.0	-21.7	-22.3
140	-5.4	-6.0	-6.6	-13.7	-14.3	-14.9	-19.2	-19.8	-20.4
130	-4.8	-5.4	-6.0	-12.2	-12.9	-13.5	-17.0	-17.6	-18.3
120	-4.0	-4.6	-5.2	-10.5	-11.1	-11.8	-14.6	-15.2	-15.8
110	-2.9	-3.5	-4.1	-8.5	-9.1	-9.7	-11.9	-12.5	-13.1
100	-1.6	-2.2	-2.8	-6.2	-6.8	-7.4	-8.9	-9.5	-10.2

V1(MCG) Limit Weight (1000 KG)

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	103.9								
5000	158.3	124.7	84.4						
5400	202.0	174.4	143.4						
5800		215.9	189.7						
6200			229.8						
7000				120.0	88.2				
7400				165.1	136.2	105.6			
7800				206.7	180.1	152.0			
8200					220.8	194.6			
10200							97.7		
10600							122.3		
11000							148.4	98.9	
11400							176.5	123.5	
11800							206.9	149.7	100.1
12200								177.9	124.8
12600								208.5	151.1
13000									179.4
13400									210.1

1. Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust "Good" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Medium" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.
Adjust "Poor" field length available by -175 ft/+175 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for available 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
210	-7	-7	-7	-21	-21	-21	-42	-42	-42
200	-8	-8	-8	-22	-22	-22	-43	-43	-43
190	-9	-9	-9	-24	-24	-24	-44	-44	-44
180	-11	-11	-11	-25	-25	-25	-45	-45	-45
170	-12	-12	-12	-27	-27	-27	-47	-47	-47
160	-13	-13	-13	-28	-28	-28	-49	-49	-49
150	-14	-14	-14	-30	-30	-30	-51	-51	-51
140	-15	-15	-15	-32	-32	-32	-53	-53	-53
130	-16	-16	-16	-33	-33	-33	-55	-55	-55
120	-17	-17	-17	-35	-35	-35	-56	-56	-56
110	-18	-18	-18	-36	-36	-36	-56	-56	-56
100	-18	-18	-18	-37	-37	-37	-56	-56	-56

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).

Takeoff %N1

Max Takeoff Thrust

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F		-1000	0	2000	4000	6000	8000	10000
55	140	61	106.3	106.2	106.2	105.9	105.5	105.1	104.7
50	122	51	107.5	107.3	107.2	107.0	106.5	106.2	105.7
45	113	46	108.5	108.3	108.3	108.0	107.6	107.2	106.7
40	104	41	109.4	109.3	109.4	109.0	108.6	108.2	107.7
35	95	36	110.4	110.3	110.5	110.1	109.8	109.2	108.6
30	86	31	110.7	111.3	111.5	111.0	111.0	110.3	109.6
25	77	26	109.9	110.5	112.1	111.9	112.1	111.3	110.6
20	68	21	109.0	109.6	111.2	112.1	112.8	112.1	111.4
15	59	16	108.2	108.8	110.3	111.2	112.5	112.6	112.2
10	50	11	107.3	107.9	109.5	110.3	111.7	111.9	112.9
5	41	6	106.5	107.1	108.6	109.4	110.7	111.0	111.9
0	32	1	105.6	106.2	107.7	108.5	109.8	110.1	110.9
-10	14	-9	103.8	104.4	105.9	106.7	108.0	108.3	108.9
-20	-4	-19	102.0	102.6	104.0	104.8	106.1	106.4	106.8
-30	-22	-30	100.1	100.7	102.1	102.9	104.2	104.5	104.7
-40	-40	-40	98.2	98.8	100.2	101.0	102.2	102.6	102.6
-50	-58	-50	96.3	96.8	98.2	98.9	100.1	100.4	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	10000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5	0.5

Assumed Temperature Reduced Thrust

Minimum Assumed Temperature

MINIMUM ASSUMED TEMP	PRESSURE ALTITUDE (FT)										
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
°F	93	86	83	79	76	72	69	65	62	58	54
°C	34	30	28	26	24	22	20	18	16	14	12

Assumed Temperature Limit %N1

Based on engine bleed for packs on

ACTUAL OAT (°C)	ASSUMED TEMPERATURE (°C)										
	20	25	30	35	40	45	50	55	60	65	70
55									104.4	102.7	100.9
50								105.4	103.7	101.9	100.2
45							106.5	104.6	102.9	101.1	99.4
40						107.5	105.7	103.8	102.1	100.3	99.0
35					108.4	106.6	104.9	103.0	101.3	99.5	99.2
30				109.4	107.6	105.8	104.0	102.1	100.4	99.4	99.4
25			110.5	108.6	106.8	105.0	103.2	101.4	99.7	98.7	98.7
20		111.5	109.6	107.8	105.9	104.2	102.4	100.6	98.9	97.6	97.6
15	112.5	110.6	108.8	106.9	105.1	103.4	101.7	99.8	98.2	96.8	96.8
10	111.6	109.8	107.9	106.1	104.3	102.6	100.9	99.0	97.4	96.1	96.1
5	110.7	108.9	107.1	105.2	103.4	101.7	100.0	98.2	96.6	95.3	95.3
0	109.8	108.0	106.2	104.4	102.6	100.9	99.2	97.4	95.8	94.6	94.6
-10	107.9	106.2	104.4	102.6	100.9	99.2	97.6	95.8	94.2	93.0	93.0
-20	106.0	104.3	102.6	100.8	99.1	97.5	95.9	94.2	92.6	91.4	91.4
-30	104.1	102.4	100.7	99.0	97.3	95.7	94.1	92.4	90.9	89.4	89.4
-40	102.1	100.4	98.8	97.1	95.5	93.9	92.3	90.7	89.2	87.7	87.7
-50	100.1	98.4	96.8	95.1	93.6	92.0	90.5	88.9	87.4	86.0	86.0

%N1 Adjustment for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)										
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
PACKS OFF	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.5	0.5	0.5

%N1 Altitude Adjustment

ASSUMED TEMP (°C)	PRESSURE ALTITUDE (FT)										
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
70	0.2	0.0	0.0	-0.2	-0.3	-0.5	-0.7	-1.0	-1.2	-1.4	-1.5
60	0.1	0.0	0.0	-0.2	-0.3	-0.4	-0.6	-0.8	-1.0	-1.2	-1.4
50	0.3	0.0	0.0	-0.2	-0.3	-0.4	-0.6	-0.8	-0.9	-1.1	-1.4
32 & BELOW	0.1	0.0	0.1	0.0	-0.1	-0.3	-0.5	-0.7	-0.9	-1.0	-1.4
	0.0	0.0	0.1	0.1	-0.1	-0.3	-0.3	-0.4	-0.7	-1.0	-1.3

Assumed Temperature Reduced Thrust

Assumed Temperature Minimum %N1

Based on 25% takeoff thrust reduction

ACTUAL OAT (°C)	PRESSURE ALTITUDE (FT)											
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
54	97.5	97.4	97.2	97.2	97.0	97.2	96.9	97.1	97.6	98.1	98.7	99.2
50	97.9	97.8	97.7	97.6	97.5	97.7	97.5	97.2	97.3	97.5	98.1	98.6
45	98.5	98.5	98.3	98.3	98.2	98.0	98.2	97.9	97.6	97.5	97.3	97.9
40	98.8	99.1	99.0	98.9	98.8	98.7	98.5	98.6	98.3	98.2	98.0	97.8
35	99.3	99.3	99.2	99.2	99.1	98.9	99.1	98.9	98.6	98.5	98.3	98.5
30	98.6	98.9	99.4	99.4	99.3	99.2	99.0	99.2	99.3	99.1	98.6	98.4
25	97.9	98.1	98.7	99.0	99.2	99.4	99.3	99.4	99.5	99.0	98.8	98.6
20	97.1	97.4	97.6	98.2	98.5	98.7	98.8	99.3	99.1	98.9	99.1	98.9
15	96.4	96.6	96.8	97.5	97.7	97.9	98.1	98.2	98.6	98.8	98.6	98.7
10	95.6	95.9	96.1	96.7	96.9	97.1	97.3	97.4	97.9	97.7	97.8	97.9
5	94.9	95.1	95.3	96.0	96.2	96.4	96.5	96.6	97.1	96.9	97.0	97.1
0	93.8	94.3	94.6	94.9	95.4	95.6	95.7	95.9	95.9	96.1	96.2	96.4
-10	92.2	92.4	93.0	93.3	93.5	93.7	93.8	94.3	94.4	94.5	94.3	94.8
-20	90.6	90.8	91.4	91.7	91.9	92.1	92.2	92.3	92.7	92.6	92.8	92.9
-30	89.0	89.2	89.4	89.7	90.2	90.4	90.2	90.7	90.7	90.9	91.1	90.9
-40	87.0	87.5	87.7	88.0	88.2	88.4	88.5	88.9	89.0	89.2	89.1	89.3
-50	85.3	85.5	86.0	86.3	86.5	86.7	86.8	86.9	87.3	87.2	87.4	87.2
-54	84.6	84.8	85.3	85.6	85.8	85.9	86.1	86.2	86.5	86.5	86.4	86.5

1. Enter Minimum Assumed Temperature table with airport pressure altitude to determine minimum assumed temperature.
2. Enter Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature to determine assumed temperature limit %N1. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table.
3. Enter %N1 Altitude Adjustment table with assumed temperature and airport pressure altitude to determine altitude adjustment to %N1 found in step 2.
4. Ensure Takeoff %N1 from step 3 is greater than or equal to minimum %N1 allowed for airport conditions from Assumed Temperature Minimum %N1 table.

**TO1 Takeoff Speeds****10% Thrust Reduction**

FLAPS	WEIGHT 1000 KG	V1	VR	V2
5	190	167	171	176
	180	161	165	171
	170	155	160	166
	160	149	154	161
	150	143	148	156
	140	136	142	151
	130	130	136	145
	120	123	129	140
	110	115	123	134
	100	108	116	127
	90	99	107	121
15	190	161	163	169
	180	156	158	164
	170	150	153	159
	160	144	148	155
	150	138	142	150
	140	132	136	144
	130	125	130	139
	120	119	124	134
	110	112	117	128
	100	105	110	122
	90	96	104	117
20	190	159	160	164
	180	153	154	159
	170	147	148	154
	160	140	142	149
	150	134	137	145
	140	128	131	140
	130	122	126	135
	120	115	119	129
	110	108	113	124
	100	101	106	118
	90	92	100	113

CHECK V1(MCG) IN BOXED AREA

V1 ADJUSTMENT

OAT °C	PRESS ALT 1000 FT					
	-1	0	2	4	6	8
70	9	10	12	14	16	16
60	7	8	10	11	13	14
50	4	5	7	9	11	12
40	2	3	5	7	9	11
30	0	0	2	5	7	9
20	0	0	1	3	5	6
10	0	0	1	3	4	6
-50	0	1	2	4	5	7

VR ADJUSTMENT

OAT °C	PRESS ALT 1000 FT					
	-1	0	2	4	6	8
70	5	6	7	8	9	10
60	4	4	6	7	8	9
50	2	3	4	5	6	8
40	1	1	3	4	5	6
30	0	0	1	3	4	5
20	0	0	1	2	3	4
10	0	0	1	2	3	4
-50	0	0	1	2	3	4

 DRY RUNWAY
 SLOPE/WIND V1 ADJUSTMENTS*

SLOPE/WIND VS. APPROPRIATE													
WEIGHT 1000 KG	DN SLOPE % UP					TAIL		WIND		KTS		HEAD	
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	1	3	-1	-1	-1	0	0	0	1	1
170	-4	-2	0	1	3	-2	-1	-1	0	0	0	1	1
150	-3	-2	0	1	3	-2	-2	-1	0	0	1	1	1
130	-2	-1	0	2	4	-3	-2	-1	0	1	1	1	2
110	-2	-1	0	2	4	-4	-3	-1	0	1	1	2	2
90	-1	-1	0	2	4	-5	-3	-1	0	1	1	2	2

* V1 NOT TO EXCEED VR



TO1 V1(MCG)

10% Thrust Reduction

ACTUAL OAT		PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
50	122	103	101	97	93	89	85
40	104	107	105	101	97	93	89
30	86	110	108	105	100	97	92
20	68	110	109	106	102	99	95
10	50	111	109	106	103	100	96
-50	-58	113	111	108	104	101	97

TO1 Takeoff %N1**10% Thrust Reduction****Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off**

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
55	131	103.9	103.7	103.7	103.4	103.0	102.7
50	122	105.1	104.9	104.8	104.5	104.1	103.7
45	113	105.8	105.7	105.6	105.4	105.0	104.7
40	104	106.4	106.3	106.3	106.1	105.8	105.4
35	95	106.8	106.8	106.9	106.6	106.4	106.0
30	86	106.9	107.4	107.5	107.1	107.1	106.5
25	77	106.1	106.5	107.7	107.6	107.7	107.1
20	68	105.2	105.7	106.8	107.4	108.0	107.5
15	59	104.4	104.9	106.0	106.6	107.5	107.5
10	50	103.6	104.0	105.1	105.7	106.6	106.7
0	32	101.9	102.3	103.4	104.0	104.8	105.0
-10	14	100.1	100.5	101.6	102.2	103.0	103.2
-20	-4	98.3	98.8	99.9	100.4	101.1	101.3
-30	-22	96.5	96.9	98.0	98.5	99.2	99.4
-40	-40	94.6	95.0	96.1	96.6	97.3	97.5
-50	-58	92.7	93.1	94.1	94.6	95.3	95.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5

TO1 Stab Trim Setting

10% Thrust Reduction

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	7	6	5	4 1/2	3 1/2	2 1/2
180	7	6 1/2	6	5	4	3	2 1/2
170	7	6 1/2	5 1/2	4 1/2	4	3	2
160	7	6	5 1/2	4 1/2	3 1/2	3	2
150	6 1/2	5 1/2	5	4	3 1/2	2 1/2	1 1/2
140	6	5	4 1/2	3 1/2	3	2	1
130	5 1/2	4 1/2	3 1/2	3	2	1 1/2	1/2
120	4 1/2	4	3	2 1/2	2	1	1/2
110	4	3 1/2	3	2	1 1/2	1/2	1/2
100	4	3	2 1/2	1 1/2	1	1/2	1/2

TO2 Takeoff Speeds

20% Thrust Reduction

FLAPS	WEIGHT 1000 KG	V1	VR	V2
5	190	170	172	176
	180	164	167	171
	170	158	161	166
	160	152	156	161
	150	145	150	156
	140	139	144	151
	130	132	138	145
	120	125	131	140
	110	118	124	134
	100	110	117	127
15	90	102	111	121
	190	164	165	169
	180	158	160	164
	170	153	155	159
	160	147	149	155
	150	141	144	150
	140	134	138	144
	130	128	132	139
	120	121	125	134
	110	114	119	128
20	100	107	112	122
	90	99	106	117
	190	161	161	164
	180	155	155	159
	170	149	150	154
	160	143	144	149
	150	137	139	145
	140	131	133	140
	130	125	127	135
	120	118	121	129
	110	111	114	124
	100	103	108	118
	90	95	102	113

CHECK V1(MCG) IN BOXED AREA

V1 ADJUSTMENT

OAT °C	PRESS ALT 1000 FT						
	-1	0	2	4	6	8	
70	9	10	12	14	16	16	
60	7	8	10	11	13	14	
50	4	5	7	9	11	12	
40	2	3	5	7	9	11	
30	0	0	2	5	7	9	
20	0	0	1	3	5	6	
10	0	0	1	3	4	6	
-50	0	1	2	4	5	7	

VR ADJUSTMENT

OAT °C	PRESS ALT 1000 FT						
	-1	0	2	4	6	8	
70	5	6	7	8	9	10	
60	4	4	6	7	8	9	
50	2	3	4	5	6	8	
40	1	1	3	4	5	6	
30	0	0	1	3	4	5	
20	0	0	1	2	3	4	
10	0	0	1	2	3	4	
-50	0	0	1	2	3	4	

**DRY RUNWAY
SLOPE/WIND V1 ADJUSTMENTS***

WEIGHT 1000 KG	DN SLOPE % UP					TAIL		WIND		KTS		HEAD	
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	1	3	-1	-1	-1	0	0	0	1	1
170	-4	-2	0	1	3	-2	-1	-1	0	0	0	1	1
150	-3	-2	0	1	3	-2	-2	-1	0	0	1	1	1
130	-2	-1	0	2	4	-3	-2	-1	0	1	1	1	2
110	-2	-1	0	2	4	-4	-3	-1	0	1	1	2	2
90	-1	-1	0	2	4	-5	-3	-1	0	1	1	2	2

* V1 NOT TO EXCEED VR



TO2 V1(MCG)

20% Thrust Reduction

ACTUAL OAT		PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
50	122	97	95	92	88	85	81
40	104	102	100	96	92	88	85
30	86	105	103	99	95	92	88
20	68	105	104	101	97	94	90
10	50	105	104	101	98	95	91
-50	-58	107	106	103	99	96	92

T02 Takeoff %N1

20% Thrust Reduction

Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-1000	0	2000	4000	6000	8000
55	131	99.9	99.8	99.8	99.6	99.1	98.8
50	122	101.1	101.0	100.8	100.6	100.2	99.8
45	113	102.0	101.8	101.8	101.5	101.2	100.8
40	104	102.4	102.4	102.4	102.2	102.0	101.7
35	95	102.6	102.5	102.7	102.4	102.3	101.9
30	86	102.6	102.9	103.1	102.7	102.8	102.3
25	77	101.8	102.1	103.0	102.9	103.0	102.6
20	68	101.0	101.3	102.2	102.7	103.0	102.7
15	59	100.2	100.5	101.4	101.8	102.4	102.4
10	50	99.3	99.7	100.6	101.0	101.6	101.7
0	32	97.7	98.1	98.9	99.3	99.9	100.0
-10	14	96.0	96.4	97.2	97.6	98.1	98.2
-20	-4	94.3	94.6	95.4	95.8	96.3	96.4
-30	-22	92.5	92.9	93.6	94.0	94.5	94.6
-40	-40	90.7	91.0	91.8	92.1	92.6	92.7
-50	-58	88.9	89.2	89.9	90.2	90.7	90.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5



TO2 Stab Trim Setting
20% Thrust Reduction

WEIGHT (1000 KG)	C.G. %MAC						
	12	16	20	24	28	32	36
190	7	7	6 1/2	5 1/2	5	4	3
180	7	7	6 1/2	5 1/2	4 1/2	3 1/2	3
170	7	7	6	5	4 1/2	3 1/2	2 1/2
160	7	6 1/2	6	5	4	3 1/2	2 1/2
150	7	6	5 1/2	4 1/2	4	3	2
140	6 1/2	5 1/2	5	4	3 1/2	2 1/2	1 1/2
130	6	5	4	3 1/2	2 1/2	2	1
120	5	4 1/2	3 1/2	3	2 1/2	1 1/2	1/2
110	4 1/2	4	3 1/2	2 1/2	2	1	1/2
100	4 1/2	3 1/2	3	2	1 1/2	1	1/2

Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (KIAS OR MACH)								
	0	5	10	15	20	25	30	35	40
	250	250	250	290	290	290	290	.78	.78
60	96.5	97.2	97.0	97.4	96.7	95.1	96.1	95.1	94.7
50	97.6	98.7	99.0	99.6	98.9	97.3	98.2	95.0	93.8
40	98.8	99.8	100.4	101.2	101.0	99.3	100.1	97.0	95.8
30	99.1	101.1	101.6	102.4	102.5	101.2	101.9	98.8	97.7
20	97.5	101.3	103.3	103.8	104.1	102.8	103.4	100.5	99.4
10	95.8	99.6	102.9	104.4	105.6	104.6	104.7	102.6	100.9
0	94.2	97.8	101.1	102.6	105.0	106.9	106.5	104.3	102.4
-10	92.5	96.1	99.4	100.8	103.2	105.3	107.1	106.3	104.3
-20	90.8	94.3	97.6	99.0	101.5	103.4	105.1	106.5	106.4
-30	89.1	92.4	95.7	97.1	99.7	101.5	103.2	104.4	104.4
-40	87.3	90.5	93.9	95.2	97.8	99.5	101.2	102.2	102.2
-50	85.5	88.6	91.9	93.3	95.8	97.5	99.1	100.1	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	0	5	10	15	20	25	30	35	40
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.8	-0.9	-1.1	-1.4	-1.9
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.1	-1.3	-1.4	-1.7	-2.2	-2.4

Go-around %N1**Based on engine bleed for packs on, EEC NORM or ALTN and anti-ice on or off**

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F		-1000	0	2000	4000	6000	8000
55	131	58	106.3	106.2	106.2	105.9	105.5	105.1
50	122	53	107.5	107.3	107.2	107.0	106.5	106.2
45	113	48	108.5	108.3	108.3	108.0	107.5	107.2
40	104	43	109.4	109.3	109.4	109.0	108.6	108.2
35	95	38	110.4	110.3	110.5	110.1	109.8	109.2
30	86	33	110.7	111.3	111.5	111.0	111.0	110.2
25	77	28	109.9	110.5	112.1	111.9	112.1	111.2
20	68	23	109.0	109.6	111.2	112.1	112.8	112.1
15	59	18	108.2	108.8	110.3	111.2	112.5	112.6
10	50	13	107.3	107.9	109.5	110.3	111.6	111.9
0	32	3	105.6	106.2	107.7	108.5	109.8	110.1
-10	14	-7	103.8	104.4	105.9	106.7	108.0	108.3
-20	-4	-17	102.0	102.6	104.0	104.8	106.1	106.4
-30	-22	-27	100.1	100.7	102.1	102.9	104.1	104.5
-40	-40	-37	98.2	98.8	100.2	100.9	102.1	102.5
-50	-58	-47	96.3	96.8	98.2	98.9	100.1	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	-1000	0	2000	4000	6000	8000
PACKS OFF	0.3	0.3	0.3	0.4	0.5	0.5

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (290/.78)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	4.5	4.0	4.0		
	V/S (FT/MIN)	1800	1200	600		
30000	PITCH ATT	4.5	4.0	4.0	4.0	4.0
	V/S (FT/MIN)	2800	2200	1700	1400	1100
20000	PITCH ATT	7.0	6.5	6.0	6.0	6.0
	V/S (FT/MIN)	4200	3400	2800	2300	1900
10000	PITCH ATT	10.5	9.0	8.5	8.0	7.5
	V/S (FT/MIN)	5600	4500	3800	3200	2700
SEA LEVEL	PITCH ATT	13.5	11.5	10.5	9.5	9.5
	V/S (FT/MIN)	6300	5200	4300	3700	3200

Cruise (.78/290)

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	2.0	2.5	3.5		
	%N1	86.8	90.4	95.0		
35000	PITCH ATT	1.5	2.0	2.5	3.0	3.5
	%N1	84.3	86.3	88.8	91.9	95.2
30000	PITCH ATT	1.0	1.5	2.0	2.0	2.5
	%N1	83.7	85.2	86.7	88.4	90.3
25000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	80.6	82.0	83.3	84.9	86.9
20000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	76.7	78.0	79.4	81.0	82.9
15000	PITCH ATT	1.0	1.5	2.0	2.5	3.0
	%N1	72.6	74.0	75.5	77.2	78.9

Descent (.78/290)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
40000	PITCH ATT	-1.0	-0.5	0.5	1.0	1.5
	V/S (FT/MIN)	-2500	-2400	-2500	-2500	-2800
30000	PITCH ATT	-2.5	-1.5	-1.0	-0.5	0.5
	V/S (FT/MIN)	-2600	-2300	-2100	-2000	-1900
20000	PITCH ATT	-2.5	-1.5	-1.0	0.0	0.5
	V/S (FT/MIN)	-2400	-2100	-1900	-1800	-1700
10000	PITCH ATT	-2.5	-1.5	-1.0	0.0	0.5
	V/S (FT/MIN)	-2100	-1900	-1700	-1600	-1500
SEA LEVEL	PITCH ATT	-3.0	-2.0	-1.0	-0.5	0.5
	V/S (FT/MIN)	-1900	-1700	-1600	-1500	-1400

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF30 + 80)

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	57.4	61.7	65.6	68.9	72.2
	KIAS	199	211	222	236	251
5000	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	53.6	57.5	61.2	65.1	68.1
	KIAS	199	211	222	236	251

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS UP (VREF 30 + 80) (GEAR UP)	PITCH ATT	4.0	4.5	5.0	5.0	5.0
	%N1	54.6	58.8	62.9	66.7	69.6
	KIAS	199	211	222	236	251
FLAPS 1 (VREF 30 + 60) (GEAR UP)	PITCH ATT	6.0	6.5	6.5	6.5	6.5
	%N1	56.6	61.6	65.8	69.4	72.9
	KIAS	179	191	202	216	231
FLAPS 5 (VREF 30 + 40) (GEAR UP)	PITCH ATT	4.5	4.5	5.0	4.5	4.5
	%N1	57	62.3	66.2	70.0	73.7
	KIAS	159	171	182	196	211
FLAPS 15 (VREF 30 + 20) (GEAR UP)	PITCH ATT	5.5	5.5	6.0	6.0	5.5
	%N1	58.4	63.5	67.8	71.8	75.1
	KIAS	139	151	162	176	191
FLAPS 20 (VREF 30 + 20) (GEAR DOWN)	PITCH ATT	4.0	4.5	4.5	4.0	3.5
	%N1	65.7	71.2	75.4	79.8	83.5
	KIAS	139	151	162	176	191

Final Approach (1500 FT)

Gear Down, Set Thrust for a 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		100	120	140	160	180
FLAPS 20 (VREF20 + 10)	PITCH ATT	1.5	1.5	1.5	1.5	1.5
	%N1	46.4	49.9	53.3	56.3	59.3
	KIAS	138	150	162	172	184

Go-Around (VREF 30 + 20)

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		100	120	140	160	180
10000	PITCH ATT	18.5	15.5	13.0	11.0	9.0
	V/S (FT/MIN)	4100	3400	2900	2500	2100
	KIAS	139	151	162	176	191
5000	PITCH ATT	22.5	18.5	16.0	13.5	11.0
	V/S (FT/MIN)	4800	4100	3500	3000	2700
	KIAS	139	151	162	176	191
SEA LEVEL	PITCH ATT	26.5	21.5	18.0	15.5	13.0
	V/S (FT/MIN)	5300	4500	3900	3500	3100
	KIAS	139	151	162	176	191

Intentionally
Blank



Performance Inflight

All Engine

Chapter PI

Section 71

Long Range Cruise Maximum Operating Altitude

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°)
190	29600	-3	34400	33500	32700	31100	29700
185	30200	-5	35000	34100	33300	31700	30200
180	30800	-6	35500	34700	33900	32300	30800
175	31400	-7	36100	35300	34500	32900	31500
170	32000	-9	36700	35900	35100	33500	32100
165	32700	-10	37400	36500	35700	34200	32700
160	33300	-12	38000	37100	36300	34800	33400
155	34000	-13	38700	37800	37000	35500	34100
150	34700	-15	39300	38500	37700	36200	34700
145	35400	-16	40000	39200	38400	36900	35500
140	36100	-18	40800	39900	39100	37600	36200
135	36900	-18	41500	40700	39900	38300	36900
130	37700	-18	42300	41500	40700	39100	37700
125	38500	-18	43100	42300	41500	39900	38500
120	39300	-18	43100	43100	42300	40800	39400
115	40200	-18	43100	43100	43100	41700	40300
110	41100	-18	43100	43100	43100	42600	41200
105	42100	-18	43100	43100	43100	43100	42200
100	43100	-18	43100	43100	43100	43100	43100

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°)
190	29600	2	34400	33500	32700	31100	29700
185	30200	1	35000	34100	33300	31700	30200
180	30800	0	35500	34700	33900	32300	30800
175	31400	-2	36100	35300	34500	32900	31500
170	32000	-3	36700	35900	35100	33500	32100
165	32700	-5	37400	36500	35700	34200	32700
160	33300	-6	38000	37100	36300	34800	33400
155	34000	-8	38700	37800	37000	35500	34100
150	34700	-9	39300	38500	37700	36200	34700
145	35400	-11	40000	39200	38400	36900	35500
140	36100	-12	40800	39900	39100	37600	36200
135	36900	-12	41500	40700	39900	38300	36900
130	37700	-12	42300	41500	40700	39100	37700
125	38500	-12	43100	42300	41500	39900	38500
120	39300	-12	43100	43100	42300	40800	39400
115	40200	-12	43100	43100	43100	41700	40300
110	41100	-12	43100	43100	43100	42600	41200
105	42100	-12	43100	43100	43100	43100	42200
100	43100	-12	43100	43100	43100	43100	43100

Long Range Cruise Maximum Operating Altitude
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°)
190	29600	8	34400	33500	32700	31100	29700
185	30200	7	34900*	34100	33300	31700	30200
180	30800	5	35500	34700	33900	32300	30800
175	31400	4	36000*	35300	34500	32900	31500
170	32000	2	36500*	35900	35100	33500	32100
165	32700	1	37100*	36500	35700	34200	32700
160	33300	0	37600*	37100	36300	34800	33400
155	34000	-2	38300*	37800	37000	35500	34100
150	34700	-4	38900*	38500	37700	36200	34700
145	35400	-5	39600*	39200	38400	36900	35500
140	36100	-7	40300*	39900	39100	37600	36200
135	36900	-7	41000*	40700	39900	38300	36900
130	37700	-7	41800*	41500	40700	39100	37700
125	38500	-7	42700*	42300	41500	39900	38500
120	39300	-7	43100	43100	42300	40800	39400
115	40200	-7	43100	43100	43100	41700	40300
110	41100	-7	43100	43100	43100	42600	41200
105	42100	-7	43100	43100	43100	43100	42200
100	43100	-7	43100	43100	43100	43100	43100

*Denotes altitude thrust limited in level flight.



Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		23	25	27	29	31	33	35	37	39	41	43
190	%N1	88.2	89.0	90.3	91.5	93.2	95.1	98.1				
	MACH	.750	.769	.789	.794	.796	.797	.797				
	KIAS	328	323	319	308	296	283	271				
	FF/ENG	3049	2957	2931	2873	2857	2886	3011				
180	%N1	87.3	88.0	89.3	90.4	91.8	93.6	95.9	100.1			
	MACH	.742	.756	.780	.792	.795	.796	.797	.796			
	KIAS	324	318	315	307	295	283	271	258			
	FF/ENG	2930	2832	2811	2756	2715	2720	2775	2938			
170	%N1	86.3	87.2	88.0	89.5	90.5	92.2	94.1	97.3			
	MACH	.733	.746	.763	.788	.793	.795	.797	.797			
	KIAS	320	313	308	305	295	283	271	258			
	FF/ENG	2815	2719	2654	2657	2589	2567	2583	2689			
160	%N1	85.1	86.2	87.0	88.2	89.4	90.7	92.5	94.9	99.4		
	MACH	.716	.738	.750	.770	.789	.794	.796	.797	.797		
	KIAS	312	310	302	298	293	282	270	258	247		
	FF/ENG	2668	2611	2532	2500	2477	2429	2423	2473	2625		
150	%N1	83.7	85.0	86.0	86.9	88.3	89.3	90.7	93.0	96.3		
	MACH	.695	.723	.741	.755	.779	.792	.795	.796	.797		
	KIAS	303	303	298	291	289	281	270	258	247		
	FF/ENG	2506	2477	2415	2359	2352	2303	2270	2288	2377		
140	%N1	82.0	83.6	84.8	85.7	86.7	88.2	89.1	91.1	93.9	97.7	
	MACH	.673	.701	.728	.743	.760	.786	.793	.795	.797	.797	
	KIAS	292	293	293	287	281	279	269	258	247	236	
	FF/ENG	2336	2320	2295	2234	2192	2194	2135	2126	2168	2271	
130	%N1	80.1	81.8	83.3	84.5	85.3	86.4	87.7	89.2	91.7	94.5	98.7
	MACH	.650	.677	.705	.732	.746	.764	.788	.793	.796	.797	.797
	KIAS	282	282	283	282	275	270	267	257	246	236	225
	FF/ENG	2168	2155	2143	2121	2063	2026	2013	1974	1985	2033	2139
120	%N1	78.1	79.8	81.4	82.9	84.1	84.9	85.9	87.5	89.6	92.1	95.1
	MACH	.626	.652	.680	.709	.734	.748	.768	.789	.794	.796	.797
	KIAS	271	271	272	272	271	264	260	256	246	235	225
	FF/ENG	2002	1992	1981	1972	1953	1898	1862	1848	1828	1843	1894
110	%N1	76.0	77.6	79.3	80.9	82.4	83.6	84.4	85.8	87.7	89.8	92.4
	MACH	.601	.626	.652	.680	.710	.735	.749	.770	.790	.794	.796
	KIAS	259	260	260	261	261	259	253	249	244	235	225
	FF/ENG	1841	1832	1822	1813	1809	1790	1737	1708	1700	1683	1699
100	%N1	73.8	75.3	76.9	78.6	80.2	81.7	83.0	84.1	85.8	87.7	89.8
	MACH	.576	.599	.624	.650	.679	.709	.735	.749	.770	.790	.794
	KIAS	248	248	248	248	249	249	248	241	238	233	224
	FF/ENG	1689	1677	1665	1656	1651	1653	1630	1589	1565	1554	1538

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
286	264	244	227	213	200	191	182	174	167	160
572	527	488	455	426	400	382	365	349	336	323
860	793	733	683	639	600	573	549	526	505	486
1148	1059	979	911	853	800	764	732	701	673	648
1438	1325	1224	1139	1066	1000	955	914	877	842	811
1730	1593	1472	1369	1280	1200	1147	1097	1052	1010	973
2022	1861	1718	1598	1493	1400	1338	1280	1227	1179	1135
2316	2131	1966	1827	1707	1600	1529	1463	1402	1347	1296
2612	2402	2215	2058	1922	1800	1720	1646	1578	1515	1458
2909	2673	2464	2288	2136	2000	1911	1828	1752	1682	1619

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:40	2.3	0:39	1.9	0:37	1.7	0:36	1.5	0:35
400	5.4	1:17	4.9	1:13	4.3	1:08	3.9	1:05	3.5	1:03
600	8.3	1:53	7.5	1:47	6.7	1:40	6.1	1:34	5.6	1:30
800	11.0	2:30	10.1	2:22	9.0	2:11	8.3	2:04	7.6	1:58
1000	13.8	3:07	12.7	2:57	11.3	2:43	10.5	2:34	9.6	2:26
1200	16.5	3:45	15.2	3:32	13.6	3:15	12.6	3:04	11.6	2:54
1400	19.2	4:23	17.8	4:08	15.9	3:48	14.8	3:34	13.6	3:22
1600	21.9	5:01	20.3	4:44	18.1	4:20	16.9	4:05	15.6	3:50
1800	24.5	5:40	22.7	5:20	20.4	4:53	19.0	4:35	17.5	4:19
2000	27.1	6:19	25.2	5:57	22.6	5:26	21.0	5:06	19.5	4:48

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
2	-0.1	-0.1	0.0	0.1	0.2
4	-0.4	-0.2	0.0	0.2	0.5
6	-0.8	-0.4	0.0	0.4	0.8
8	-1.1	-0.5	0.0	0.5	1.1
10	-1.3	-0.7	0.0	0.7	1.4
12	-1.6	-0.8	0.0	0.8	1.7
14	-1.9	-1.0	0.0	0.9	1.9
16	-2.2	-1.1	0.0	1.1	2.2
18	-2.5	-1.2	0.0	1.2	2.5
20	-2.7	-1.4	0.0	1.4	2.8
22	-3.0	-1.5	0.0	1.5	3.1
24	-3.3	-1.7	0.0	1.7	3.4
26	-3.6	-1.8	0.0	1.8	3.7
28	-3.8	-2.0	0.0	2.0	4.0

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
1306	1231	1163	1103	1049	1000	957	918	881	848	817
1956	1845	1744	1655	1574	1500	1436	1377	1323	1273	1227
2610	2462	2327	2207	2099	2000	1916	1837	1764	1698	1637
3267	3080	2910	2760	2624	2500	2395	2297	2206	2123	2047
3928	3702	3496	3314	3150	3000	2874	2756	2648	2548	2456
4593	4327	4084	3870	3677	3500	3353	3216	3089	2971	2864
5262	4955	4675	4427	4204	4000	3831	3674	3529	3395	3272
5936	5586	5267	4985	4732	4500	4309	4132	3968	3817	3679
6615	6220	5861	5544	5260	5000	4787	4589	4406	4238	4085
7299	6858	6458	6104	5789	5500	5265	5047	4845	4659	4490
7987	7499	7056	6666	6318	6000	5743	5504	5283	5080	4895

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)
1000	9.4	2:25	9.1	2:24	8.8	2:21	8.5	2:20	8.4	2:20
1500	14.3	3:35	13.7	3:32	13.3	3:29	12.9	3:26	12.7	3:26
2000	19.1	4:45	18.4	4:41	17.8	4:37	17.3	4:32	17.0	4:32
2500	23.7	5:57	22.9	5:51	22.2	5:46	21.5	5:40	21.1	5:38
3000	28.4	7:10	27.4	7:01	26.5	6:55	25.7	6:48	25.1	6:44
3500	32.9	8:25	31.7	8:14	30.7	8:05	29.7	7:58	29.1	7:52
4000	37.3	9:40	36.1	9:26	34.9	9:15	33.8	9:07	33.0	8:59
4500	41.6	10:59	40.2	10:41	38.9	10:28	37.7	10:17	36.7	10:08
5000	45.9	12:17	44.4	11:56	43.0	11:40	41.6	11:28	40.5	11:17
5500	50.0	13:39	48.4	13:15	46.9	12:55	45.4	12:40	44.1	12:28
6000	54.1	15:00	52.4	14:33	50.8	14:10	49.1	13:51	47.8	13:38

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.6	-0.3	0.0	0.7	1.6
10	-1.4	-0.7	0.0	1.4	3.2
15	-2.2	-1.1	0.0	2.1	4.7
20	-3.0	-1.4	0.0	2.7	6.1
25	-3.8	-1.8	0.0	3.3	7.4
30	-4.6	-2.2	0.0	3.8	8.5
35	-5.5	-2.6	0.0	4.3	9.6
40	-6.3	-3.1	0.0	4.7	10.5
45	-7.2	-3.5	0.0	5.0	11.3
50	-8.1	-3.9	0.0	5.3	12.0
55	-9.1	-4.3	0.0	5.6	12.6

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)									
	190	180	170	160	150	140	130	120	110	100
43						74	36	13	1	0
41					58	28	10	1	0	8
39			75	43	20	6	0	1	8	21
37	85	53	29	13	3	0	2	9	21	37
35	35	18	6	1	0	3	11	22	37	54
33	9	2	0	1	5	13	24	38	54	72
31	0	0	3	8	17	28	40	55	71	89
29	1	6	12	21	31	43	57	72	88	106
27	9	17	25	36	47	60	74	89	105	121
25	22	30	40	52	64	77	90	105	120	135
23	36	46	56	68	80	93	106	120	134	148

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 .78/290/250

PRESSURE ALT (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	22	41	62	69	77	84	91	98	106	113	120	126	132	137	143	150	157
TIME (MINUTES)	8	12	16	17	18	19	20	21	22	23	24	25	26	27	28	28	29



Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
190	%N1	67.0	69.5	73.9	78.2	82.3	86.5	90.9		
	KIAS	259	259	259	259	259	259	259		
	FF/ENG	2760	2730	2700	2680	2670	2690	2720		
180	%N1	65.4	68.1	72.2	76.8	81.0	85.1	89.4		
	KIAS	251	251	251	251	251	251	251		
	FF/ENG	2620	2590	2560	2530	2520	2530	2560		
170	%N1	63.7	66.7	70.6	75.2	79.4	83.5	87.9		
	KIAS	244	244	244	244	244	244	244		
	FF/ENG	2490	2450	2420	2390	2370	2380	2400		
160	%N1	61.9	65.1	68.9	73.5	77.8	81.9	86.2	90.9	
	KIAS	236	236	236	236	236	236	236	239	
	FF/ENG	2350	2310	2270	2250	2230	2220	2250	2300	
150	%N1	60.1	63.1	67.2	71.5	76.0	80.3	84.5	89.0	
	KIAS	228	228	228	228	228	228	228	231	
	FF/ENG	2220	2170	2130	2100	2090	2080	2090	2130	
140	%N1	58.3	61.2	65.6	69.6	74.2	78.6	82.8	87.2	
	KIAS	222	222	222	222	222	222	222	222	
	FF/ENG	2090	2050	2000	1970	1950	1940	1940	1970	
130	%N1	56.6	59.4	63.8	67.7	72.4	76.7	80.9	85.3	
	KIAS	217	217	217	217	217	217	217	217	
	FF/ENG	1970	1930	1880	1850	1830	1820	1810	1820	
120	%N1	54.9	57.5	61.7	65.8	70.2	74.8	79.0	83.3	89.4
	KIAS	211	211	211	211	211	211	211	211	211
	FF/ENG	1850	1810	1760	1730	1700	1700	1680	1680	1750
110	%N1	53.1	55.6	59.6	64.0	68.0	72.8	77.1	81.3	87.2
	KIAS	205	205	205	205	205	205	205	205	205
	FF/ENG	1730	1700	1650	1610	1580	1570	1550	1560	1600
100	%N1	51.3	53.6	57.4	61.8	65.8	70.5	74.8	79.1	84.9
	KIAS	199	199	199	199	199	199	199	199	199
	FF/ENG	1610	1580	1530	1500	1460	1450	1430	1440	1470

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Advisory Information

Chapter PI

Section 72

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABOVE SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF25	ONE REV	NO REV
MAX MANUAL	3200	110/-60	80	-130	440	50	-40	80	-70	250	80	170
MAX AUTO	5370	130/-130	150	-250	840	0	0	160	-160	600	0	0
AUTOBRAKE 4	5540	140/-140	160	-260	880	0	0	160	-160	630	0	0
AUTOBRAKE 3	6370	160/-160	190	-300	1040	0	-20	190	-190	710	0	0
AUTOBRAKE 2	7090	190/-190	220	-350	1190	50	-120	220	-210	630	110	110
AUTOBRAKE 1	7740	220/-220	250	-390	1360	170	-220	250	-230	580	480	620

Good Reported Braking Action

MAX MANUAL	5060	120/-120	140	-240	830	140	-120	140	-130	400	300	660
MAX AUTO	6180	150/-150	180	-290	980	20	0	180	-180	700	20	90
AUTOBRAKE 4	6370	160/-160	180	-300	1010	10	0	190	-190	720	10	60
AUTOBRAKE 3	7320	190/-190	220	-350	1190	0	-20	220	-220	820	0	0

Medium Reported Braking Action

MAX MANUAL	6940	190/-190	220	-370	1360	340	-270	210	-190	510	790	1910
MAX AUTO	6970	190/-180	220	-380	1370	300	-180	210	-200	660	700	1820
AUTOBRAKE 4	7050	190/-190	220	-380	1380	280	-160	220	-200	710	610	1730
AUTOBRAKE 3	7670	210/-200	230	-400	1450	180	-120	230	-230	820	410	1270

Poor Reported Braking Action

MAX MANUAL	8960	270/-260	300	-550	2100	760	-500	290	-260	590	1670	4460
MAX AUTO	8960	270/-260	300	-550	2100	760	-500	290	-260	590	1670	4470
AUTOBRAKE 4	8960	270/-260	300	-550	2100	770	-500	290	-260	600	1670	4470
AUTOBRAKE 3	9050	270/-260	300	-550	2110	700	-410	290	-270	760	1530	4320

Reference distance assumes sea level, standard day, no wind or slope, VREF25 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 460 ft.

Reference distance for auto braking is applicable for auto or manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

Dry Runway

	LANDING DISTANCE AND ADJUSTMENT (FT)											
	REF DIST	WT 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	150000 KG LANDING WEIGHT	PER 5000 KG ABV/ BLW 150000 KG	PER 1000 FT ABV SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABV VREF 30	ONE REV	NO REV
MAX MANUAL	3150	140/-70	80	-130	440	50	-40	80	-70	250	80	160
MAX AUTO	5220	210/-140	150	-240	830	0	0	150	-150	600	0	0
AUTOBRAKE 4	5380	220/-140	150	-250	870	0	0	160	-160	620	0	0
AUTOBRAKE 3	6180	260/-170	180	-300	1020	0	-10	190	-190	720	0	0
AUTOBRAKE 2	6930	280/-200	210	-340	1180	40	-110	210	-210	640	80	80
AUTOBRAKE 1	7590	300/-220	240	-390	1350	160	-210	240	-230	580	410	540

Good Reported Braking Action

MAX MANUAL	5000	180/-130	140	-240	830	140	-120	140	-130	400	280	620
MAX AUTO	6010	250/-160	170	-280	970	20	0	170	-170	690	20	90
AUTOBRAKE 4	6190	260/-170	180	-290	1000	10	0	180	-180	710	10	60
AUTOBRAKE 3	7110	300/-200	210	-340	1180	0	-10	210	-210	830	0	0

Medium Reported Braking Action

MAX MANUAL	6860	260/-190	210	-370	1370	350	-270	210	-190	510	740	1770
MAX AUTO	6860	280/-190	210	-380	1370	320	-190	210	-200	650	690	1720
AUTOBRAKE 4	6920	290/-200	220	-380	1380	300	-170	210	-200	690	620	1650
AUTOBRAKE 3	7480	320/-210	230	-400	1440	190	-110	230	-220	830	410	1220

Poor Reported Braking Action

MAX MANUAL	8870	360/-270	300	-550	2110	780	-510	290	-260	600	1580	4140
MAX AUTO	8870	360/-270	300	-550	2100	780	-510	290	-260	590	1580	4150
AUTOBRAKE 4	8870	360/-270	300	-550	2100	780	-510	290	-260	590	1580	4150
AUTOBRAKE 3	8920	380/-270	300	-550	2110	730	-420	290	-270	770	1480	4050

Reference distance assumes sea level, standard day, no wind or slope, VREF30 approach speed and 2 engine reverse thrust.

Reference distance for manual braking is applicable for auto spoilers only, for manual spoilers operation increase landing distance by 460 ft.

Reference distance for auto braking is applicable for both auto and manual spoilers.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Distances for GOOD, MEDIUM, and POOR are increased by 15%.

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Dry Runway**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	4210	90/-90	100	-170/570	90/-80	110/-110	420	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	4130	160/-100	100	-170/570	90/-80	110/-110	440	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	4530	260/-110	130	-170/570	80/-70	130/-120	320	200	440
ANTI-SKID OFF (FLAPS 25)	VREF25	5920	160/-150	160	-290/1010	190/-160	160/-150	440	410	960
ANTI-SKID OFF (FLAPS 30)	VREF30	5770	230/-160	160	-290/1010	190/-160	160/-150	450	380	880
ENGINE FAILURE (FLAPS 20)	VREF20	3460	150/-80	90	-140/470	60/-50	90/-90	280	0	110
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	4140	110/-100	100	-160/530	70/-60	100/-100	380	140	300
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	3350	90/-80	80	-130/460	50/-50	80/-80	290	100	200
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	3300	130/-80	80	-130/460	60/-50	80/-80	300	90	190
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	3680	90/-90	90	-150/530	70/-60	90/-90	310	140	300
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	3620	140/-90	90	-150/530	70/-70	90/-90	330	130	280
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	4890	190/-110	130	-180/600	100/-90	130/-130	510	230	510
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	4570	180/-110	130	-180/610	110/-90	130/-120	420	260	570
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	5800	240/-150	170	-230/780	160/-140	170/-160	580	430	990

***Reference distance assumes sea level, standard day with no wind or slope.**

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Dry Runway**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
LE SLAT ASYM (FLAPS = 20)	VREF30+30	4140	170/-90	110	-150/520	70/-60	110/-110	310	160	340
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	4440	170/-100	120	-160/540	80/-70	120/-120	320	180	390
LE SLAT DISAGREE (FLAPS > 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	3940	180/-90	100	-150/500	60/-60	100/-100	280	140	290
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	4260	180/-100	110	-160/540	80/-70	120/-110	330	0	180
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	3390	140/-80	80	-130/450	50/-50	80/-80	260	100	220
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	3670	180/-80	90	-140/480	60/-50	90/-90	270	120	260
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	3890	210/-90	100	-150/490	60/-50	100/-100	270	130	290

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	6240	150/-150	180	-300/1010	270/-220	180/-180	620	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	6090	250/-150	180	-300/1010	280/-230	180/-180	640	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	6220	220/-160	190	-250/860	160/-150	190/-180	380	530	1220
ANTI-SKID OFF (FLAPS 25)	VREF25	6660	190/-180	190	-350/1240	290/-230	190/-180	490	630	1530
ANTI-SKID OFF (FLAPS 30)	VREF30	6500	260/-180	190	-350/1240	290/-230	190/-180	490	590	1410
ENGINE FAILURE (FLAPS 20)	VREF20	4980	150/-130	140	-230/800	160/-140	140/-140	410	0	410
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	5600	170/-150	160	-250/840	170/-150	160/-150	510	430	1010
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	4620	130/-120	130	-220/750	140/-120	130/-120	390	300	680
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	4550	190/-120	130	-220/750	140/-120	130/-120	400	280	640
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	5760	240/-160	180	-250/860	190/-170	180/-170	510	530	1250
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	6580	280/-180	200	-280/940	230/-190	200/-190	640	650	1560

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Good Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	5130	200/-130	150	-230/790	150/-130	150/-140	380	380	860
LE SLAT ASYM (FLAPS = 20)	VREF30+30	5770	220/-150	170	-250/840	170/-150	170/-170	420	470	1080
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	6180	230/-160	190	-260/870	180/-160	190/-180	430	520	1190
LE SLAT DISAGREE (FLAPS > 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	5500	200/-140	160	-240/810	150/-140	160/-160	380	420	950
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	6160	230/-160	180	-270/900	210/-180	190/-180	470	0	590
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	4730	140/-130	130	-220/750	130/-120	130/-130	370	330	750
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	5140	200/-140	150	-230/790	140/-130	150/-140	380	380	880
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	5470	200/-140	160	-230/810	150/-130	160/-150	370	430	980

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Medium Reported Braking Action**

		LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
LANDING CONFIGURATION	VREF	150000 KG LDG WT	PER 5000 KG ABV/BLW 150000KG	PER 1000FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	9940	240/-230	310	-560/1950	1000/-670	320/-320	870	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	9650	370/-230	310	-550/1940	1000/-670	320/-320	870	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	8820	340/-250	300	-400/1400	410/-330	300/-270	520	1430	3670
ANTI-SKID OFF (FLAPS 25)	VREF25	8370	260/-250	260	-500/1870	640/-440	250/-230	560	1370	3680
ANTI-SKID OFF (FLAPS 30)	VREF30	8180	350/-250	260	-500/1870	650/-440	250/-230	560	1290	3390
ENGINE FAILURE (FLAPS 20)	VREF20	7250	240/-220	230	-390/1360	440/-340	230/-220	560	0	1250
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	7520	260/-230	240	-380/1340	400/-310	240/-220	630	1120	2890
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	6320	190/-190	200	-340/1220	330/-260	200/-180	490	780	1900
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	6220	280/-190	200	-340/1220	340/-260	200/-180	500	740	1780
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	7850	350/-240	270	-390/1370	430/-340	260/-240	620	1300	3370
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	8720	390/-260	290	-420/1460	500/-390	290/-260	740	1530	4090

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION**Non-Normal Configuration Landing Distance****Medium Reported Braking Action**

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)							
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV NO REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	7070	290/-210	230	-360/1280	350/-280	230/-210	490	980 2430
LE SLAT ASYM (FLAPS = 20)	VREF30+30	7900	320/-230	260	-380/1350	390/-320	260/-240	530	1170 2930
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	8430	340/-250	290	-400/1380	410/-330	280/-260	540	1340 3430
LE SLAT DISAGREE (FLAPS > 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880 2200
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880 2200
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	7550	300/-220	250	-370/1310	360/-290	250/-230	490	1050 2620
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	8860	360/-260	290	-430/1510	530/-420	290/-280	610	0 1680
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880 2200
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010 2540
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110 2810
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	6540	220/-200	210	-340/1230	330/-260	200/-190	490	880 2200
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	7120	300/-210	230	-360/1280	350/-280	230/-210	490	1010 2540
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	7590	310/-220	250	-370/1310	360/-290	250/-230	490	1110 2810

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)								
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE REV	NO REV
AIR/GRD SYS (FLAPS 25)	VREF25	16490	320/-200	570	-1120/4230	6080/-2020	600/-590	1090	0	0
AIR/GRD SYS (FLAPS 30)	VREF30	15920	480/-200	550	-1100/4180	5960/-1970	580/-570	1080	0	0
ALL FLAPS AND SLATS UP LANDING	VREF30+50	11600	480/-370	430	-590/2140	900/-630	410/-370	640	3020	8970
ANTI-SKID OFF (FLAPS 25)	VREF25	10950	380/-360	370	-800/3310	3040/-940	350/-310	630	3540	14250
ANTI-SKID OFF (FLAPS 30)	VREF30	10760	480/-360	360	-800/3310	3040/-950	350/-310	630	3380	13380
ENGINE FAILURE (FLAPS 20)	VREF20	9970	360/-320	340	-600/2200	1100/-700	330/-310	690	0	3070
HYD SYS PRESS (C ONLY) (FLAPS 20)	VREF20	9560	360/-310	330	-550/2030	840/-570	320/-290	710	2280	6740
HYD SYS PRESS (L ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (L ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (R ONLY) (FLAPS 25)	VREF25	8130	280/-260	280	-500/1870	710/-480	270/-240	560	1610	4380
HYD SYS PRESS (R ONLY) (FLAPS 30)	VREF30	8030	370/-270	280	-500/1870	730/-490	270/-240	570	1530	4080
HYD SYS PRESS (L AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920
HYD SYS PRESS (L AND R) (FLAPS 20)	VREF30+20	10000	460/-330	360	-560/2060	890/-610	350/-310	690	2540	7490
HYD SYS PRESS (R AND C) (FLAPS 20)	VREF30+20	10910	510/-360	400	-600/2160	990/-670	380/-340	800	2910	8920

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Poor Reported Braking Action

LANDING CONFIGURATION	VREF	LANDING DISTANCES AND ADJUSTMENTS (FT)							
		REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ
		150000 KG LDG WT	PER 5000 KG ABV/BLW 150000 KG	PER 1000 FT ABV S.L.	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 10 KTS ABV VREF	ONE NO REV REV
LE SLAT ASYM (FLAPS > 20)	VREF30+20	9120	400/-290	320	-530/1950	760/-520	310/-280	570	2010 5610
LE SLAT ASYM (FLAPS = 20)	VREF30+30	10100	430/-320	360	-560/2040	820/-570	350/-320	600	2310 6530
LE SLAT ASYM (5 < FLAPS < 20)	VREF30+40	10880	460/-350	400	-570/2100	870/-610	380/-340	630	2700 7890
LE SLAT DISAGREE (FLAPS > 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
LE SLAT DISAGREE - ALTN FLAP EXT ACCOMPLISHED (FLAPS = 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
LE SLAT DISAGREE - ALTN FLAP EXT FAILED (FLAPS = 20)	VREF30+30	9680	410/-310	340	-540/1990	780/-540	330/-300	560	2120 5910
REVERSER UNLOCKED (FLAPS 20)	VREF30+30	11960	500/-380	420	-660/2380	1260/-830	410/-390	730	0 3880
TE FLAP ASYM (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
TE FLAP ASYM (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160 6210
TE FLAP ASYM (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290 6540
TE FLAP DISAGREE (FLAPS ≥ 20)	VREF20	8500	320/-280	290	-510/1900	730/-500	280/-260	580	1860 5230
TE FLAP DISAGREE (5 < FLAPS < 20)	VREF30+20	9250	410/-300	330	-530/1960	760/-520	320/-280	590	2160 6210
TE FLAP DISAGREE (FLAPS ≤ 5)	VREF30+30	9820	420/-310	350	-540/2000	780/-540	340/-300	580	2290 6540

*Reference distance assumes sea level, standard day with no wind or slope.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above runway threshold (1000 ft of air distance).

Assumes max manual braking and maximum reverse thrust when available on operating engine(s).



ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (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		
180	0	15.1	16.1	17.0	22.8	24.3	25.8	31.8	33.9	35.9	41.8	44.6	47.4	52.7	56.3	59.9					
	10	15.7	16.6	17.6	23.6	25.1	26.6	32.9	35.0	37.2	43.2	46.1	49.1	54.5	58.3	62.0					
	20	16.2	17.2	18.2	24.4	26.0	27.5	34.0	36.2	38.5	44.7	47.7	50.7	56.4	60.3	64.2					
	30	16.7	17.7	18.7	25.2	26.8	28.4	35.0	37.4	39.7	46.1	49.2	52.3	58.2	62.2	66.2					
	40	16.9	18.0	19.0	25.6	27.3	29.0	35.8	38.2	40.5	47.2	50.4	53.6	59.6	63.7	67.9					
160	0	13.7	14.5	15.3	20.6	21.9	23.2	28.5	30.4	32.3	37.5	40.0	42.5	47.2	50.4	53.6	57.6	61.6	65.6		
	10	14.1	15.0	15.9	21.3	22.6	24.0	29.5	31.5	33.4	38.8	41.4	44.0	48.9	52.2	55.5	59.6	63.8	67.9		
	20	14.6	15.5	16.4	22.0	23.4	24.8	30.5	32.5	34.5	40.1	42.8	45.4	50.5	54.0	57.4	61.7	65.9	70.2		
	30	15.0	16.0	16.9	22.7	24.1	25.5	31.5	33.5	35.6	41.3	44.1	46.9	52.1	55.7	59.3	63.7	68.1	72.5		
	40	15.3	16.2	17.2	23.1	24.5	26.0	32.1	34.2	36.3	42.3	45.1	48.0	53.4	57.0	60.7	65.2	69.8	74.3		
140	0	12.2	13.0	13.7	18.3	19.4	20.6	25.3	26.9	28.6	33.1	35.3	37.4	41.5	44.3	47.1	50.6	54.0	57.5		
	10	12.7	13.4	14.2	18.9	20.1	21.3	26.2	27.9	29.5	34.2	36.5	38.8	43.0	45.9	48.8	52.4	56.0	59.6		
	20	13.1	13.9	14.6	19.6	20.8	22.0	27.0	28.8	30.5	35.4	37.7	40.1	44.4	47.4	50.5	54.1	57.8	61.6		
	30	13.5	14.3	15.1	20.2	21.4	22.7	27.9	29.7	31.5	36.5	38.9	41.3	45.9	49.0	52.1	55.9	59.7	63.6		
	40	13.7	14.5	15.3	20.5	21.8	23.1	28.4	30.3	32.1	37.3	39.8	42.2	46.9	50.1	53.3	57.2	61.2	65.1		
120	0	10.8	11.5	12.1	16.0	17.0	18.0	22.0	23.4	24.8	28.6	30.5	32.3	35.7	38.1	40.5	43.3	46.2	49.1		
	10	11.2	11.9	12.5	16.6	17.6	18.6	22.8	24.2	25.7	29.6	31.5	33.4	37.0	39.4	41.9	44.8	47.8	50.9		
	20	11.6	12.2	12.9	17.1	18.2	19.3	23.5	25.0	26.5	30.6	32.6	34.6	38.2	40.7	43.3	46.3	49.4	52.6		
	30	11.9	12.6	13.3	17.7	18.8	19.9	24.2	25.8	27.3	31.5	33.6	35.7	39.4	42.0	44.7	47.8	51.0	54.3		
	40	12.1	12.8	13.5	18.0	19.1	20.2	24.7	26.3	27.9	32.2	34.3	36.4	40.3	43.0	45.7	48.9	52.2	55.6		
100	0	9.4	10.0	10.5	13.8	14.6	15.5	18.7	19.8	21.0	24.0	25.5	27.1	29.7	31.6	33.6	35.7	38.0	40.4		
	10	9.8	10.3	10.9	14.3	15.1	16.0	19.3	20.5	21.7	24.8	26.4	28.0	30.7	32.7	34.7	36.9	39.4	41.8		
	20	10.1	10.7	11.2	14.7	15.6	16.5	20.0	21.2	22.5	25.7	27.3	29.0	31.7	33.8	35.9	38.2	40.7	43.2		
	30	10.4	11.0	11.6	15.2	16.1	17.0	20.6	21.9	23.2	26.5	28.2	29.9	32.7	34.9	37.0	39.4	42.0	44.6		
	40	10.5	11.1	11.7	15.4	16.4	17.3	20.9	22.3	23.6	27.0	28.7	30.5	33.4	35.6	37.8	40.2	42.9	45.6		

*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, altitude, and OAT effects.

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	RTO MAX MAN	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0
	MAX MAN	1.0	6.1	11.2	16.1	21.0	25.8	30.5	35.2	39.8	44.5	49.1	53.8
	MAX AUTO	1.7	6.1	10.4	14.7	18.9	23.1	27.3	31.5	35.8	40.0	44.3	48.7
	AUTOBRAKE 4	1.9	6.0	10.1	14.1	18.1	22.0	26.0	29.9	33.8	37.8	41.8	45.8
	AUTOBRAKE 3	1.8	5.7	9.5	13.2	17.0	20.7	24.3	28.0	31.6	35.3	39.0	42.8
	AUTOBRAKE 2	1.7	5.4	9.0	12.5	15.9	19.3	22.7	26.1	29.4	32.8	36.2	39.7
	AUTOBRAKE 1	1.7	5.0	8.2	11.3	14.4	17.4	20.3	23.3	26.2	29.1	32.1	35.0



ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Two Engines Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		5	10	15	20	25	30	35	40	45	50	55	60
LANDING	MAX MAN	0.0	5.0	9.9	14.6	19.2	23.8	28.2	32.6	37.0	41.3	45.6	49.9
	MAX AUTO	0.2	3.7	7.3	10.8	14.3	17.9	21.5	25.1	28.7	32.4	36.2	40.0
	AUTOBRAKE 4	0.0	2.9	6.0	9.0	12.1	15.1	18.2	21.3	24.5	27.7	30.9	34.2
	AUTOBRAKE 3	0.0	1.8	4.3	6.9	9.5	12.1	14.8	17.4	20.1	23.9	25.7	28.6
	AUTOBRAKE 2	0.0	0.7	2.8	4.8	6.9	8.9	11.0	13.1	15.3	17.6	19.9	22.2
	AUTOBRAKE 1	0.0	0.4	1.8	3.2	4.6	6.0	7.5	9.0	10.5	12.1	13.8	15.5

Cooling Time (Minutes)
Category "C" and "D" Brakes

		ADJUSTED BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
		14 & BELOW	15	16	18	20	24	28	34	35 TO 42	43 & ABOVE
		BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON EICAS									
		UP TO 1	1	1	2	2	3	4	5	5 TO 6	7 & ABOVE
INFLIGHT	NO SPECIAL	PROCEDURE REQUIRED	1	1	2	2	3	4	6	CAUTION	FUSE PLUG MELT ZONE
GEAR DOWN			11	15	19	24	34	44	59		
GROUND											

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.
For one brake deactivated, increase brake energy by 15 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 6 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 10 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.



Performance Inflight

Engine Inoperative

Chapter PI

Section 73

ENGINE INOP

Initial Max Continuous %N1

Based on .80M, packs on or off and APU on

TAT (°C)	PRESSURE ALTITUDE (1000 FT)							
	29	31	33	35	37	39	41	43
20	103.8	103.4	102.5					
15	104.4	104.0	103.3	102.3	101.1	100.8	100.8	100.8
10	105.2	104.6	104.0	103.2	101.9	101.4	101.4	101.4
5	106.1	105.5	104.7	103.9	102.6	102.1	102.2	102.2
0	107.1	106.4	105.6	104.7	103.3	102.9	102.9	102.9
-5	106.9	107.5	106.6	105.7	104.3	103.9	103.9	103.9
-10	106.0	107.1	107.7	106.7	105.3	104.9	104.9	104.9
-15	105.1	106.2	107.1	107.8	106.5	106.2	106.2	106.2
-20	104.2	105.3	106.2	106.9	106.6	106.4	106.4	106.4
-25	103.2	104.3	105.3	105.8	105.8	105.6	105.6	105.6
-30	102.3	103.3	104.3	104.7	104.7	104.7	104.7	104.7
-35	101.3	102.4	103.3	103.6	103.6	103.6	103.6	103.6
-40	100.3	101.3	102.3	102.6	102.6	102.6	102.6	102.6

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

37000 FT to 27000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

37000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.63	102.6	103.6	104.7	105.8	106.9	105.8	104.8	104.1	103.3	101.8	98.8	95.7	
220	.69	102.6	103.6	104.7	105.8	106.9	105.9	104.8	104.0	103.3	102.4	100.4	97.5	
240	.74	102.6	103.6	104.7	105.8	106.9	106.1	105.0	104.0	103.3	102.5	101.7	99.4	
260	.80	102.6	103.6	104.7	105.8	106.6	106.5	105.3	104.3	103.3	102.6	101.9	101.1	
35000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.60	102.6	103.6	104.7	105.8	106.9	107.2	106.2	105.5	104.7	103.2	100.2	97.1	
220	.66	102.6	103.6	104.7	105.8	106.9	107.3	106.2	105.4	104.7	103.8	101.8	98.8	
240	.71	102.6	103.6	104.7	105.8	106.9	107.5	106.4	105.3	104.6	104.0	102.9	100.5	
260	.77	102.6	103.6	104.7	105.8	106.9	107.7	106.6	105.6	104.5	103.9	103.2	102.1	
33000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.58	102.6	103.6	104.7	105.8	106.9	107.9	107.2	106.5	105.8	104.9	102.6	99.6	
220	.63	102.6	103.6	104.7	105.8	106.9	107.9	107.3	106.3	105.7	105.0	104.1	101.2	
240	.68	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.4	105.5	104.9	104.1	102.7	
260	.74	102.6	103.6	104.7	105.8	106.9	107.9	107.4	106.5	105.5	104.7	104.1	103.3	
31000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.55	102.6	103.6	104.7	105.8	106.8	107.9	108.1	107.2	106.6	106.0	105.0	102.0	
220	.61	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.6	106.0	105.3	103.5	
240	.66	102.6	103.6	104.7	105.8	106.9	107.9	108.2	107.3	106.4	105.7	105.1	104.4	
260	.71	102.6	103.6	104.7	105.8	106.9	107.9	108.3	107.3	106.4	105.5	104.9	104.3	
29000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.5	106.8	106.1	105.5	103.6	100.7
220	.58	102.6	103.6	104.7	105.8	106.9	107.9	108.5	107.7	106.7	106.1	105.5	104.9	102.1
240	.63	102.6	103.6	104.7	105.8	106.9	107.9	108.7	107.7	106.8	106.0	105.4	104.8	103.5
260	.68	102.6	103.6	104.7	105.8	106.9	107.9	108.8	107.7	106.8	105.9	105.3	104.7	104.0
27000 FT PRESS ALT													TAT (°C)	
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
200	.51	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.1	101.4
220	.56	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.4	105.6	104.9	104.2	102.7
240	.60	102.6	103.6	104.7	105.8	106.9	107.9	108.6	107.6	106.7	105.7	105.0	104.3	103.6
260	.65	102.2	103.2	104.2	105.1	106.1	107.0	107.9	107.8	106.8	105.9	105.0	104.3	103.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	27	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.8	-0.9	-1.0	-1.1	-1.2	-1.4
ENGINE & WING ANTI-ICE ON	-1.7	-1.9	-2.1	-2.3	-2.5	-2.9

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

25000 FT to 16000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

25000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.49	102.6	103.6	104.7	105.8	106.8	107.8	107.8	106.9	105.9	104.9	104.1	103.3	101.8	99.0	
220	.53	102.3	103.3	104.3	105.3	106.2	107.1	107.9	107.1	106.1	105.0	104.2	103.4	102.7	100.3	
240	.58	101.6	102.6	103.6	104.5	105.5	106.4	107.2	107.2	106.3	105.3	104.3	103.6	102.8	101.5	
260	.63	100.8	101.8	102.8	103.8	104.7	105.6	106.5	107.3	106.6	105.6	104.6	103.8	103.0	102.2	
24000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.6	106.6	105.6	104.9	104.1	103.2	100.5	
220	.52	102.3	103.3	104.3	105.3	106.2	107.2	108.0	107.7	106.8	105.8	104.9	104.1	103.4	101.6	
240	.57	101.6	102.6	103.6	104.5	105.5	106.4	107.3	107.8	107.0	106.0	105.0	104.2	103.5	102.7	
260	.61	100.8	101.8	102.8	103.7	104.7	105.6	106.5	107.4	107.1	106.2	105.2	104.4	103.6	102.8	
22000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	108.9	107.9	106.9	106.1	105.2	103.7	
220	.50	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.8	109.0	108.0	107.0	106.1	105.3	104.4	
240	.55	102.6	103.6	104.7	105.7	106.6	107.6	108.5	109.4	109.2	108.2	107.2	106.3	105.4	104.6	
260	.59	102.0	103.0	104.0	105.0	105.9	106.9	107.8	108.7	109.3	108.5	107.5	106.5	105.6	104.8	
20000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.44	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.8	108.8	107.9	106.9	106.1	104.0
220	.48	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	109.9	108.9	108.0	107.0	106.1	104.8
240	.53	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.8	110.1	109.1	108.1	107.2	106.2	105.4
260	.57	102.4	103.4	104.4	105.4	106.4	107.4	108.3	109.3	110.2	110.1	109.3	108.3	107.4	106.4	105.6
18000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.42	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.4	109.4	108.4	107.5	106.7	105.6
220	.46	102.6	103.6	104.7	105.8	106.8	107.9	108.9	109.9	110.9	110.3	109.3	108.3	107.4	106.6	105.7
240	.51	102.3	103.3	104.3	105.3	106.3	107.2	108.2	109.1	110.1	110.2	109.4	108.4	107.4	106.6	105.7
260	.55	101.6	102.6	103.6	104.6	105.6	106.6	107.5	108.5	109.4	110.3	109.5	108.6	107.6	106.7	105.8
16000 FT PRESS ALT		TAT (°C)														
CIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.41	100.9	102.0	103.0	104.1	105.1	106.2	107.2	108.2	109.1	110.1	109.5	108.6	107.7	106.9	106.1
220	.45	100.6	101.7	102.7	103.7	104.8	105.8	106.8	107.8	108.8	109.8	109.4	108.5	107.6	106.8	105.9
240	.49	100.3	101.3	102.3	103.4	104.4	105.4	106.4	107.4	108.4	109.4	109.4	108.5	107.5	106.7	105.9
260	.53	99.9	101.0	102.0	103.0	104.0	105.0	106.1	107.1	108.0	109.0	109.5	108.6	107.7	106.8	106.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	16	18	20	22	24	25
ENGINE ANTI-ICE ON	-0.4	-0.4	-0.5	-0.6	-0.7	-0.7
ENGINE & WING ANTI-ICE ON	-1.1	-1.1	-1.2	-1.4	-1.5	-1.5

ENGINE INOP

MAX CONTINUOUS THRUST

Max Continuous %N1

14000 FT to 5000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

14000 FT PRESS ALT		TAT (°C)														
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.39	101.1	102.1	103.1	104.2	105.2	106.3	107.3	108.3	109.3	110.2	109.4	108.5	107.6	106.8	106.1
220	.43	100.8	101.8	102.8	103.9	104.8	105.8	106.8	107.7	108.6	109.6	109.4	108.4	107.6	106.7	106.0
240	.47	100.2	101.2	102.2	103.2	104.1	105.1	106.0	107.0	107.9	108.9	109.4	108.4	107.5	106.6	105.9
260	.51	99.5	100.5	101.5	102.5	103.4	104.4	105.3	106.2	107.2	108.1	109.1	108.4	107.5	106.7	105.9
12000 FT PRESS ALT		TAT (°C)														
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.38	100.0	101.0	101.9	102.9	103.9	104.8	105.8	106.7	107.7	108.6	109.2	108.2	107.4	106.6	105.8
220	.41	99.4	100.4	101.4	102.4	103.4	104.3	105.3	106.2	107.1	108.1	109.0	108.3	107.4	106.6	105.8
240	.45	98.9	99.9	100.9	101.9	102.8	103.8	104.7	105.6	106.6	107.5	108.4	108.4	107.5	106.7	105.9
260	.49	98.4	99.4	100.3	101.3	102.3	103.2	104.1	105.1	106.0	106.9	107.8	108.5	107.6	106.8	105.9
10000 FT PRESS ALT		TAT (°C)														
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.36	98.2	99.2	100.2	101.2	102.1	103.1	104.0	104.9	105.8	106.8	107.7	107.8	107.0	106.2	105.4
220	.40	97.7	98.7	99.7	100.7	101.6	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4
240	.43	97.4	98.4	99.3	100.3	101.3	102.2	103.1	104.1	105.0	105.9	106.8	107.7	107.2	106.4	105.6
260	.47	97.0	98.0	99.0	99.9	100.9	101.8	102.7	103.7	104.6	105.5	106.4	107.3	107.4	106.6	105.8
5000 FT PRESS ALT		TAT (°C)														
KLAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
200	.33	95.5	96.5	97.5	98.4	99.4	100.3	101.2	102.1	103.1	104.0	104.8	105.7	106.6	106.4	105.7
220	.36	95.1	96.1	97.1	98.0	99.0	99.9	100.8	101.7	102.7	103.6	104.4	105.3	106.2	106.4	105.7
240	.40	94.7	95.7	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	104.0	104.9	105.8	106.4	105.7
260	.43	94.4	95.4	96.4	97.3	98.3	99.2	100.1	101.0	101.9	102.8	103.7	104.6	105.5	106.3	105.9

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	5	10	12	14
ENGINE ANTI-ICE ON	-0.6	-0.5	-0.5	-0.6
ENGINE & WING ANTI-ICE ON	-1.2	-1.1	-1.2	-1.2



ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	184	278	19900	18900	17400
180	175	270	21100	20400	19400
170	165	263	22400	21600	20800
160	155	255	23700	22900	22000
150	145	247	25100	24300	23300
140	135	239	26700	26100	24700
130	126	231	28400	28100	27100
120	116	222	30200	30200	29600
110	107	213	32000	32000	31600
100	97	203	34000	33900	33700

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
272	254	237	223	211	200	189	180	172	164	158
545	508	476	447	422	400	379	361	344	329	315
818	762	714	671	633	600	569	542	517	494	473
1091	1017	952	895	845	800	759	722	689	659	631
1364	1272	1191	1119	1056	1000	949	903	861	823	789
1639	1527	1429	1344	1267	1200	1138	1083	1033	988	946
1913	1782	1668	1568	1479	1400	1328	1264	1205	1152	1103
2188	2038	1907	1792	1690	1600	1518	1444	1377	1316	1260
2464	2294	2147	2017	1902	1800	1707	1624	1549	1480	1417

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	100	110	120	130	140	150	160	170	180	190	
200	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.3	2.5	2.6	0:32
400	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.2	5.5	5.8	1:04
600	4.9	5.3	5.8	6.3	6.7	7.1	7.6	7.9	8.4	8.9	1:36
800	6.5	7.1	7.7	8.3	8.9	9.5	10.1	10.6	11.2	11.8	2:08
1000	8.1	8.9	9.6	10.4	11.1	11.8	12.6	13.2	14.0	14.7	2:40
1200	9.7	10.6	11.5	12.4	13.3	14.1	15.0	15.8	16.7	17.6	3:13
1400	11.3	12.3	13.3	14.4	15.4	16.4	17.4	18.4	19.4	20.5	3:45
1600	12.8	14.0	15.2	16.4	17.5	18.7	19.8	20.9	22.1	23.3	4:18
1800	14.3	15.6	17.0	18.3	19.6	20.9	22.2	23.4	24.7	26.0	4:51

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	17800	16200	13700
185	18700	17200	14800
180	19500	18200	15900
175	20300	19200	17100
170	20900	20100	18300
165	21600	20700	19600
160	22200	21400	20400
155	22900	22000	21000
150	23600	22700	21700
145	24300	23400	22300
140	25000	24100	23000
135	25900	24900	23700
130	26900	26000	24400
125	27900	27200	25300
120	28900	28400	26900
115	29900	29700	28400
110	30800	30700	30000
105	31800	31700	31100
100	32800	32700	32200

With engine anti-ice on, decrease altitude capability by 1400 ft.

With engine and wing anti-ice on, decrease altitude capability by 2900 ft.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	14	18	21	23	25	27	29	31
190	%N1	96.4	99.8	104.2						
	MACH	.554	.587	.625						
	KIAS	308	303	299						
	FF/ENG	5791	5827	5977						
180	%N1	94.8	98.2	102.2						
	MACH	.543	.576	.612						
	KIAS	301	297	292						
	FF/ENG	5465	5488	5597						
170	%N1	93.3	96.6	100.2	103.8					
	MACH	.531	.564	.599	.628					
	KIAS	294	291	286	283					
	FF/ENG	5142	5170	5231	5349					
160	%N1	91.5	94.8	98.3	101.5	104.2				
	MACH	.517	.551	.585	.614	.634				
	KIAS	286	284	279	276	274				
	FF/ENG	4813	4842	4873	4961	5060				
150	%N1	89.8	93.0	96.4	99.3	101.5				
	MACH	.503	.538	.572	.599	.618				
	KIAS	279	276	272	269	267				
	FF/ENG	4500	4522	4540	4594	4659				
140	%N1	87.9	91.1	94.4	97.1	99.2	101.6			
	MACH	.489	.522	.558	.583	.603	.623			
	KIAS	271	268	265	262	260	258			
	FF/ENG	4189	4195	4221	4241	4286	4356			
130	%N1	85.8	89.0	92.3	94.9	96.8	98.9	101.5		
	MACH	.474	.506	.542	.568	.586	.606	.626		
	KIAS	262	260	258	255	253	251	249		
	FF/ENG	3883	3878	3898	3915	3932	3975	4049		
120	%N1	83.7	86.9	90.2	92.7	94.4	96.3	98.5	101.2	
	MACH	.459	.490	.524	.551	.569	.587	.607	.628	
	KIAS	254	251	249	247	245	243	241	239	
	FF/ENG	3586	3569	3578	3593	3606	3621	3664	3736	
110	%N1	81.5	84.5	87.8	90.3	92.0	93.8	95.7	97.9	100.8
	MACH	.442	.473	.505	.533	.551	.569	.588	.608	.629
	KIAS	244	242	240	238	237	235	233	231	229
	FF/ENG	3290	3266	3262	3276	3285	3296	3309	3350	3417
100	%N1	78.6	82.1	85.3	87.7	89.4	91.1	92.9	94.9	97.1
	MACH	.423	.454	.486	.511	.530	.549	.568	.586	.607
	KIAS	234	233	230	229	228	226	225	222	221
	FF/ENG	2985	2971	2955	2955	2967	2976	2986	2997	3035

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
293	268	247	229	214	200	190	180	172	164	158
589	539	496	459	428	400	380	362	345	330	316
886	811	745	689	642	600	570	542	517	494	474
1184	1083	994	920	856	800	760	723	690	659	632
1483	1356	1244	1151	1071	1000	950	904	861	823	789
1784	1630	1495	1382	1286	1200	1140	1084	1033	987	946
2085	1905	1746	1614	1501	1400	1329	1264	1205	1151	1103
2389	2181	1998	1846	1716	1600	1519	1445	1377	1315	1260
2693	2457	2250	2077	1931	1800	1708	1624	1548	1479	1417

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.5	0:43	2.2	0:41	2.0	0:40	1.8	0:38	1.6	0:37
400	5.2	1:21	4.7	1:18	4.4	1:15	4.1	1:12	3.9	1:09
600	7.8	2:01	7.3	1:55	6.8	1:50	6.5	1:45	6.2	1:41
800	10.5	2:40	9.8	2:33	9.2	2:25	8.8	2:19	8.5	2:13
1000	13.1	3:20	12.3	3:10	11.6	3:01	11.0	2:53	10.7	2:46
1200	15.6	4:00	14.7	3:48	13.9	3:37	13.3	3:28	12.9	3:18
1400	18.2	4:40	17.1	4:27	16.2	4:14	15.5	4:02	15.0	3:51
1600	20.7	5:21	19.5	5:06	18.5	4:50	17.7	4:37	17.2	4:24
1800	23.2	6:02	21.9	5:45	20.8	5:27	19.9	5:12	19.3	4:58

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)									
	100	110	120	130	140	150	160	170	180	
2	-0.3	-0.2	-0.1	-0.1	0.0	0.1	0.2	0.3	0.4	
4	-0.6	-0.5	-0.3	-0.2	0.0	0.2	0.4	0.7	0.9	
6	-0.9	-0.7	-0.5	-0.2	0.0	0.3	0.7	1.1	1.5	
8	-1.3	-1.0	-0.6	-0.3	0.0	0.5	1.0	1.5	2.0	
10	-1.6	-1.2	-0.8	-0.4	0.0	0.6	1.2	1.9	2.6	
12	-2.0	-1.5	-1.0	-0.5	0.0	0.7	1.5	2.3	3.1	
14	-2.3	-1.7	-1.1	-0.6	0.0	0.8	1.7	2.7	3.6	
16	-2.6	-2.0	-1.3	-0.7	0.0	1.0	2.0	3.1	4.1	
18	-3.0	-2.2	-1.5	-0.7	0.0	1.1	2.2	3.4	4.7	
20	-3.3	-2.5	-1.6	-0.8	0.0	1.2	2.5	3.8	5.2	
22	-3.7	-2.7	-1.8	-0.9	0.0	1.3	2.7	4.2	5.7	
24	-4.0	-3.0	-2.0	-1.0	0.0	1.4	3.0	4.5	6.2	

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	85.2	88.3	92.7	97.7	104.2		
	KIAS	259	259	259	259	259		
	FF/ENG	5090	5110	5190	5350	5680		
180	%N1	83.6	86.6	91.0	95.9	101.7		
	KIAS	251	251	251	251	251		
	FF/ENG	4790	4810	4870	5000	5250		
170	%N1	81.8	84.8	89.2	93.9	99.4		
	KIAS	244	244	244	244	244		
	FF/ENG	4510	4520	4560	4670	4870		
160	%N1	79.7	83.0	87.4	91.9	97.2		
	KIAS	236	236	236	236	236		
	FF/ENG	4230	4230	4260	4330	4490		
150	%N1	77.7	81.0	85.4	89.9	95.0	101.4	
	KIAS	228	228	228	228	228	228	
	FF/ENG	3950	3950	3960	4010	4130	4380	
140	%N1	75.7	78.8	83.4	87.9	92.7	98.5	
	KIAS	222	222	222	222	222	222	
	FF/ENG	3690	3680	3680	3720	3810	3990	
130	%N1	73.7	76.7	81.4	85.9	90.5	95.9	
	KIAS	217	217	217	217	217	217	
	FF/ENG	3440	3420	3420	3440	3510	3650	
120	%N1	71.2	74.5	79.1	83.7	88.2	93.3	100.0
	KIAS	211	211	211	211	211	211	211
	FF/ENG	3190	3170	3170	3180	3220	3320	3530
110	%N1	68.8	72.2	76.7	81.4	85.9	90.8	96.5
	KIAS	205	205	205	205	205	205	205
	FF/ENG	2950	2930	2920	2920	2950	3020	3160
100	%N1	66.4	69.5	74.2	79.0	83.5	88.1	93.4
	KIAS	199	199	199	199	199	199	199
	FF/ENG	2710	2690	2680	2670	2690	2730	2830

This table includes 5% additional fuel for holding in a racetrack pattern.



Performance Inflight

Gear Down

Chapter PI

Section 74

GEAR DOWN

200 KIAS Max Climb %N1

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
55	96.7	97.4	97.0	97.0	96.6	96.7	97.0	97.1	96.1	95.2	96.3	98.2	99.9
50	97.2	98.3	98.1	98.1	97.8	97.9	98.3	98.3	97.3	96.2	96.2	97.5	99.2
45	97.9	98.8	99.1	99.1	98.9	99.0	99.5	99.5	98.5	97.4	97.4	98.1	98.8
40	98.5	99.3	99.9	100.1	99.9	100.2	100.6	100.7	99.6	98.6	98.5	99.3	99.9
35	99.1	100.0	100.4	100.7	100.9	101.2	101.7	101.8	100.7	99.7	99.6	100.4	101.0
30	99.6	100.6	101.1	101.2	101.4	102.1	102.8	102.9	101.8	100.8	100.7	101.4	102.1
25	98.7	101.4	101.7	101.9	102.0	102.6	103.5	103.9	102.9	101.8	101.7	102.5	103.1
20	97.9	101.9	102.5	102.6	102.7	103.3	104.1	104.6	103.7	102.8	102.7	103.4	104.1
15	97.1	101.0	103.5	103.4	103.4	104.0	104.9	105.3	104.5	103.6	103.6	104.4	105.0
10	96.3	100.2	103.6	104.4	104.2	104.8	105.7	106.2	105.3	104.5	104.4	105.2	105.9
5	95.5	99.3	102.7	103.9	104.9	105.6	106.5	107.0	106.2	105.4	105.3	105.9	106.6
0	94.7	98.4	101.8	103.0	104.0	105.6	107.3	107.8	107.2	106.3	106.2	106.7	107.2
-5	93.8	97.5	100.9	102.1	103.0	104.7	106.7	108.3	108.2	107.6	107.1	107.5	108.0
-10	93.0	96.6	100.0	101.2	102.2	103.7	105.8	107.3	108.2	108.5	108.5	108.5	108.5
-15	92.1	95.7	99.1	100.3	101.2	102.8	104.8	106.4	107.3	107.5	107.5	107.5	107.5
-20	91.3	94.8	98.2	99.3	100.3	102.0	103.9	105.5	106.3	106.5	106.5	106.5	106.5
-25	90.4	93.9	97.3	98.4	99.4	101.0	103.0	104.6	105.4	105.4	105.4	105.4	105.4
-30	89.5	93.0	96.4	97.5	98.5	100.0	102.0	103.7	104.4	104.4	104.4	104.4	104.4
-35	88.6	92.0	95.4	96.5	97.5	99.0	101.1	102.7	103.3	103.3	103.3	103.3	103.3
-40	87.7	91.1	94.5	95.6	96.5	98.1	100.1	101.8	102.2	102.2	102.2	102.2	102.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)												
	0	5	10	12	14	16	18	20	22	24	26	28	30
PACKS OFF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE ANTI-ICE ON	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.7	-0.8	-0.8	-0.9	-1.0	-1.0	-1.1
ENGINE & WING ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.1	-1.1	-1.2	-1.3	-1.3	-1.4	-1.5	-1.5	-1.7

GEAR DOWN

Long Range Cruise Altitude Capability

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	21200	19700	17900
185	22200	20700	19100
180	23200	21600	20200
175	24300	22500	21100
170	25400	23500	22000
165	26400	24400	23000
160	27300	25600	23900
155	28000	26900	24900
150	28800	28200	26300
145	29700	29500	27800
140	30400	30400	29300
135	31200	31200	30500
130	32000	32000	31400
125	32800	32800	32300
120	33700	33600	33300
115	34500	34500	34200
110	35400	35400	35200
105	36300	36300	36100
100	37200	37100	37000



GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		10	14	18	21	23	25	27	29	31	33	35
190	%N1	90.5	93.9	97.7	101.1							
	MACH	.472	.508	.546	.577							
	KIAS	261	261	260	259							
	FF/ENG	4585	4622	4709	4821							
180	%N1	89.0	92.3	96.0	99.1	101.6						
	MACH	.461	.495	.534	.563	.584						
	KIAS	255	254	254	253	252						
	FF/ENG	4323	4348	4419	4492	4574						
170	%N1	87.4	90.7	94.2	97.1	99.4	102.0					
	MACH	.449	.483	.520	.550	.571	.591					
	KIAS	248	248	247	246	246	244					
	FF/ENG	4071	4081	4124	4190	4256	4322					
160	%N1	85.7	88.8	92.3	95.2	97.2	99.6	102.4				
	MACH	.437	.469	.506	.536	.555	.577	.596				
	KIAS	241	240	240	240	239	238	236				
	FF/ENG	3822	3813	3844	3901	3938	4011	4071				
150	%N1	83.8	87.1	90.5	93.2	95.1	97.2	99.8	102.9			
	MACH	.424	.456	.491	.520	.540	.561	.583	.602			
	KIAS	234	233	233	232	232	231	231	229			
	FF/ENG	3574	3558	3576	3608	3650	3688	3761	3822			
140	%N1	81.9	85.2	88.4	91.1	93.0	95.0	97.2	99.8	103.2		
	MACH	.411	.442	.476	.504	.524	.544	.565	.587	.607		
	KIAS	227	226	225	225	225	224	224	223	221		
	FF/ENG	3326	3311	3312	3331	3361	3398	3442	3506	3572		
130	%N1	80.0	83.1	86.3	89.0	90.7	92.7	94.7	97.0	99.7		
	MACH	.398	.427	.460	.487	.506	.527	.548	.570	.591		
	KIAS	220	219	218	217	217	217	216	216	214		
	FF/ENG	3100	3066	3053	3068	3081	3112	3144	3194	3248		
120	%N1	77.7	80.9	84.2	86.6	88.4	90.2	92.2	94.2	96.6	99.4	
	MACH	.385	.411	.443	.469	.488	.508	.529	.550	.572	.593	
	KIAS	212	210	210	209	209	209	209	208	207	206	
	FF/ENG	2880	2820	2808	2805	2818	2830	2860	2890	2943	2987	
110	%N1	75.2	78.6	81.8	84.3	85.9	87.8	89.6	91.6	93.6	96.1	99.0
	MACH	.369	.396	.426	.451	.469	.488	.508	.529	.551	.574	.595
	KIAS	203	203	201	201	200	200	200	200	199	199	197
	FF/ENG	2642	2598	2567	2558	2557	2568	2579	2607	2638	2688	2729
100	%N1	72.7	75.9	79.2	81.7	83.4	85.0	86.9	88.7	90.7	92.8	95.3
	MACH	.353	.380	.408	.432	.449	.467	.487	.507	.528	.550	.574
	KIAS	195	194	192	192	192	191	191	191	191	190	190
	FF/ENG	2414	2378	2327	2317	2311	2310	2318	2329	2355	2386	2434

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	288	259	236	217	200	189	179	170	161	154
650	580	520	473	434	400	378	357	339	323	308
981	875	784	711	652	600	567	536	509	484	462
1316	1172	1048	950	870	800	755	714	677	644	615
1655	1472	1315	1190	1089	1000	944	893	846	805	768
1998	1774	1583	1431	1308	1200	1132	1071	1015	965	921
2346	2080	1852	1673	1527	1400	1320	1248	1182	1124	1072
2699	2389	2124	1915	1747	1600	1509	1426	1350	1283	1224
3056	2700	2397	2159	1967	1800	1697	1603	1518	1442	1375
3419	3016	2672	2404	2188	2000	1884	1779	1684	1599	1525

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		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	4.6	0:49	4.2	0:47	3.8	0:45	3.5	0:44	3.1	0:41
400	9.6	1:36	8.9	1:32	8.2	1:27	7.7	1:23	7.1	1:17
600	14.4	2:24	13.4	2:16	12.5	2:09	11.8	2:03	10.9	1:53
800	19.2	3:12	17.9	3:02	16.7	2:52	15.8	2:43	14.7	2:30
1000	23.9	4:01	22.2	3:49	20.9	3:36	19.7	3:24	18.4	3:07
1200	28.4	4:51	26.5	4:36	24.9	4:20	23.5	4:05	22.0	3:44
1400	32.9	5:43	30.7	5:24	28.9	5:05	27.3	4:47	25.5	4:22
1600	37.3	6:35	34.9	6:12	32.8	5:51	30.9	5:30	28.9	5:01
1800	41.6	7:28	38.9	7:02	36.6	6:37	34.5	6:13	32.3	5:40
2000	45.8	8:22	42.9	7:52	40.3	7:24	38.1	6:57	35.6	6:20

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	100	120	140	160	180
5	-0.7	-0.3	0.0	0.6	1.2
10	-1.5	-0.7	0.0	1.2	2.5
15	-2.3	-1.1	0.0	1.8	3.7
20	-3.1	-1.5	0.0	2.3	4.9
25	-3.9	-1.9	0.0	2.9	6.1
30	-4.7	-2.3	0.0	3.5	7.2
35	-5.5	-2.7	0.0	4.0	8.3
40	-6.3	-3.1	0.0	4.5	9.4
45	-7.0	-3.5	0.0	5.0	10.4
50	-7.8	-3.9	0.0	5.5	11.4

Descent at VREF30 + 70

PRESSURE ALTITUDE (1000 FT)	5	10	15	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	17	27	37	41	45	49	54	58	62	66	71	75	79
TIME (MINUTES)	7	9	12	12	13	14	15	16	16	17	18	19	19



GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	81.7	84.5	88.7	93.1	98.1		
	KIAS	249	249	249	249	249		
	FF/ENG	4500	4480	4490	4540	4690		
180	%N1	79.8	82.9	87.0	91.3	96.1		
	KIAS	241	241	241	241	241		
	FF/ENG	4240	4210	4200	4240	4350		
170	%N1	78.0	81.1	85.3	89.5	94.2	100.0	
	KIAS	234	234	234	234	234	234	
	FF/ENG	4000	3970	3950	3970	4050	4240	
160	%N1	76.1	79.0	83.3	87.6	92.1	97.5	
	KIAS	226	226	226	226	226	226	
	FF/ENG	3740	3710	3680	3690	3740	3880	
150	%N1	74.1	76.9	81.3	85.6	90.0	95.0	102.5
	KIAS	218	218	218	218	218	218	218
	FF/ENG	3480	3450	3420	3410	3450	3540	3790
140	%N1	72.1	75.1	79.5	83.7	88.1	92.9	99.2
	KIAS	212	212	212	212	212	212	212
	FF/ENG	3270	3240	3200	3190	3210	3270	3450
130	%N1	70.2	73.4	77.6	81.9	86.3	90.9	96.5
	KIAS	207	207	207	207	207	207	207
	FF/ENG	3080	3050	3010	2980	2990	3040	3170
120	%N1	68.2	71.3	75.6	80.1	84.4	88.8	94.0
	KIAS	201	201	201	201	201	201	201
	FF/ENG	2880	2850	2810	2780	2780	2810	2900
110	%N1	66.3	69.2	73.6	78.1	82.4	86.8	91.7
	KIAS	195	195	195	195	195	195	195
	FF/ENG	2700	2660	2620	2590	2580	2590	2660
100	%N1	64.2	67.0	71.5	75.7	80.2	84.6	89.3
	KIAS	189	189	189	189	189	189	189
	FF/ENG	2510	2480	2440	2400	2380	2380	2420

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank



Performance Inflight

Gear Down, Engine Inop

Chapter PI

Section 75

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Initial Max Continuous %N1

29000 FT to 10000 FT Pressure Altitudes

Based on engine bleed for packs on or off and anti-ice off

29000 FT PRESS ALT								TAT (°C)					
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.7	106.8	106.1	105.5	104.9	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.4	107.4	106.8	106.1	105.5	102.8	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.5	106.8	106.2	103.6	100.5	
27000 FT PRESS ALT								TAT (°C)					
MACH	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	
0.6	102.6	103.6	104.7	105.8	106.8	107.9	108.6	107.6	106.7	105.7	105.0	104.3	
0.5	102.6	103.6	104.7	105.8	106.8	107.9	108.2	107.2	106.3	105.6	104.8	104.0	
0.4	102.6	103.6	104.7	105.8	106.8	107.9	108.0	107.0	106.3	105.6	104.7	101.8	
25000 FT PRESS ALT								TAT (°C)					
MACH	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	
0.6	102.3	103.2	104.2	105.2	106.1	106.9	107.3	106.4	105.4	104.4	103.6	102.9	
0.5	103.6	104.7	105.8	106.8	107.6	107.8	106.9	105.9	104.9	104.1	103.4	102.1	
0.4	103.6	104.7	105.8	106.8	107.9	107.7	106.7	105.7	104.9	104.1	102.8	100.0	
23000 FT PRESS ALT								TAT (°C)					
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.2	104.2	105.2	106.1	107.0	107.9	108.0	107.2	106.2	105.3	104.5	103.7	
0.5	104.7	105.8	106.8	107.8	108.7	108.6	107.7	106.7	105.8	105.0	104.2	102.7	
0.4	104.7	105.8	106.8	107.9	108.9	108.6	107.6	106.6	105.8	105.0	103.4	100.8	
21000 FT PRESS ALT								TAT (°C)					
MACH	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	
0.6	103.9	104.8	105.8	106.8	107.7	108.6	109.5	109.4	108.5	107.5	106.6	105.7	
0.5	104.7	105.8	106.8	107.9	108.9	109.9	109.9	109.0	108.0	107.0	106.1	105.3	
0.4	104.7	105.8	106.8	107.9	108.9	109.9	109.8	108.8	107.8	106.9	106.1	104.2	
19000 FT PRESS ALT								TAT (°C)					
MACH	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	
0.6	104.3	105.3	106.2	107.2	108.1	109.0	110.0	109.6	108.7	107.7	106.8	105.9	
0.5	105.8	106.8	107.9	108.9	109.8	110.7	110.1	109.2	108.2	107.3	106.4	105.5	
0.4	105.8	106.8	107.9	108.9	109.9	110.9	110.1	109.1	108.2	107.2	106.4	104.3	
15000 FT PRESS ALT								TAT (°C)					
MACH	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
0.6	102.8	103.8	104.7	105.6	106.6	107.5	108.4	109.2	108.2	107.3	106.4	105.7	
0.5	104.3	105.2	106.2	107.1	108.1	109.0	109.4	108.4	107.5	106.7	105.9	105.1	
0.4	105.2	106.2	107.2	108.2	109.2	110.2	109.5	108.6	107.7	106.9	106.1	105.1	
10000 FT PRESS ALT								TAT (°C)					
MACH	-15	-10	-5	0	5	10	15	20	25	30	35	40	
0.6	100.3	101.2	102.1	103.0	103.9	104.8	105.6	106.5	107.4	106.7	106.0	105.2	
0.5	101.4	102.4	103.3	104.2	105.1	106.0	106.9	107.5	106.8	106.0	105.2	104.5	
0.4	102.6	103.5	104.4	105.4	106.3	107.2	107.8	107.0	106.2	105.4	104.7	104.1	

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
180	172	239	4900	3000	800
170	163	232	7500	5700	3700
160	153	224	10000	8600	6800
150	144	217	12300	11200	9600
140	134	211	14400	13600	12100
130	125	206	16100	15800	14700
120	115	201	17900	17800	17000
110	106	195	20000	19900	19300
100	96	189	21800	21700	21200

Includes APU fuel burn.

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
170	3300	300	
165	4800	2100	
160	6400	3800	900
155	8000	5400	2700
150	9400	7100	4400
145	10800	8700	6100
140	12200	10200	8000
135	13600	12100	9600
130	15000	13900	11500
125	16000	15500	13500
120	16900	16800	15400
115	18000	17900	17100
110	19100	19000	18300
105	20200	20100	19600
100	21200	21100	20600
95	22100	22000	21400
90	23100	22900	22300

With engine anti-ice on, decrease altitude capability by 1500 ft.

With engine and wing anti-ice on, decrease altitude capability by 3300 ft.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		6	8	10	12	14	16	18	20
160	%N1	101.7	103.7						
	MACH	.398	.409						
	KIAS	237	234						
	FF/ENG	7366	7381						
150	%N1	99.5	101.4	103.5					
	MACH	.389	.400	.410					
	KIAS	231	229	227					
	FF/ENG	6877	6875	6891					
140	%N1	97.4	99.1	101.0	103.2	105.9			
	MACH	.379	.390	.401	.412	.422			
	KIAS	225	223	221	219	216			
	FF/ENG	6405	6388	6386	6399	6425			
130	%N1	95.1	96.8	98.5	100.5	102.7	105.5		
	MACH	.367	.379	.391	.402	.412	.422		
	KIAS	218	217	215	213	211	208		
	FF/ENG	5932	5916	5902	5897	5907	5942		
120	%N1	92.7	94.3	96.0	97.8	99.8	102.0	105.3	
	MACH	.355	.367	.379	.390	.402	.412	.425	
	KIAS	211	210	209	207	205	203	201	
	FF/ENG	5467	5446	5432	5419	5410	5423	5515	
110	%N1	90.2	91.7	93.4	95.1	96.9	98.9	101.3	105.3
	MACH	.342	.353	.365	.377	.389	.401	.413	.430
	KIAS	203	202	201	200	199	197	195	195
	FF/ENG	5011	4985	4964	4952	4940	4929	4975	5146
100	%N1	87.4	89.0	90.6	92.2	94.0	95.8	97.9	100.9
	MACH	.328	.339	.351	.363	.375	.387	.400	.417
	KIAS	195	194	193	192	191	190	189	189
	FF/ENG	4543	4530	4508	4487	4476	4465	4483	4593

**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
164	146	131	118	109	100	94	89	84	79	75
334	296	263	238	218	200	187	175	165	156	148
505	447	398	359	327	300	281	263	247	234	222
677	598	531	479	437	400	374	350	329	311	295
850	751	666	600	546	500	467	438	411	388	368
1024	903	801	720	656	600	560	524	493	465	441
1199	1057	936	841	766	700	653	611	574	541	513
1375	1211	1072	963	876	800	746	698	655	618	586
1553	1366	1208	1084	986	900	839	785	737	695	659
1731	1522	1344	1206	1096	1000	932	872	818	771	731

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		10		14		18	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	2.4	0:27	2.1	0:27	1.9	0:26	1.7	0:26
200	5.0	0:52	4.6	0:50	4.3	0:49	4.1	0:47
300	7.5	1:17	7.0	1:14	6.6	1:12	6.5	1:09
400	10.1	1:42	9.5	1:38	9.0	1:35	8.8	1:31
500	12.6	2:08	11.9	2:02	11.3	1:58	11.1	1:54
600	15.1	2:33	14.2	2:27	13.6	2:21	13.4	2:16
700	17.6	2:59	16.6	2:51	15.8	2:45	15.6	2:38
800	20.0	3:25	18.9	3:16	18.0	3:08	17.8	3:01
900	22.4	3:51	21.2	3:40	20.2	3:32	19.9	3:24
1000	24.8	4:17	23.4	4:06	22.4	3:56	22.0	3:47

Fuel Required Adjustment (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)									
	100	110	120	130	140	150	160	170	180	
2	-0.3	-0.2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5	
4	-0.7	-0.5	-0.3	-0.2	0.0	0.3	0.5	0.8	1.1	
6	-1.0	-0.7	-0.5	-0.3	0.0	0.4	0.8	1.3	1.7	
8	-1.4	-1.0	-0.7	-0.3	0.0	0.5	1.1	1.7	2.3	
10	-1.7	-1.3	-0.8	-0.4	0.0	0.7	1.4	2.2	2.9	
12	-2.1	-1.5	-1.0	-0.5	0.0	0.8	1.7	2.6	3.5	
14	-2.4	-1.8	-1.2	-0.6	0.0	0.9	1.9	3.0	4.1	
16	-2.8	-2.1	-1.4	-0.7	0.0	1.1	2.2	3.4	4.6	
18	-3.2	-2.3	-1.5	-0.8	0.0	1.2	2.5	3.8	5.2	
20	-3.5	-2.6	-1.7	-0.9	0.0	1.4	2.8	4.3	5.8	
22	-3.9	-2.9	-1.9	-0.9	0.0	1.5	3.0	4.7	6.3	
24	-4.2	-3.1	-2.1	-1.0	0.0	1.6	3.3	5.1	6.9	
26	-4.6	-3.4	-2.2	-1.1	0.0	1.8	3.6	5.5	7.4	

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

**Holding
Flaps Up**

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
180	%N1	99.6				
	KIAS	241				
	FF/ENG	8240				
170	%N1	97.5	101.1			
	KIAS	234	234			
	FF/ENG	7710	7820			
160	%N1	95.3	98.6			
	KIAS	226	226			
	FF/ENG	7150	7220			
150	%N1	93.0	96.2	101.6		
	KIAS	218	218	218		
	FF/ENG	6610	6650	6820		
140	%N1	91.0	94.0	99.1		
	KIAS	212	212	212		
	FF/ENG	6160	6190	6300		
130	%N1	89.0	92.1	96.8	103.3	
	KIAS	207	207	207	207	
	FF/ENG	5760	5780	5850	6090	
120	%N1	87.0	89.9	94.4	100.1	
	KIAS	201	201	201	201	
	FF/ENG	5350	5360	5400	5550	
110	%N1	84.8	87.7	92.1	97.2	105.3
	KIAS	195	195	195	195	195
	FF/ENG	4960	4960	4990	5080	5400
100	%N1	82.4	85.5	89.7	94.5	100.9
	KIAS	189	189	189	189	189
	FF/ENG	4580	4570	4580	4630	4820

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight**Text****Chapter PI****Section 76**

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, brakes deactivated, improved climb, contaminated runway situations, brake energy limits, or obstacle clearance with unbalanced V1. These speeds may be used for weights less than or equal to the performance limited weight.

Normal takeoff speeds, V1, VR, and V2, with anti-skid on and all brakes operative, are read from the table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the V1 Adjustment chart. Adjusted V1 must not exceed VR. These takeoff speeds are not valid when the brake release weight is based on clearway, stopway, improved climb or is limited by tire speed or brake energy.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). Therefore compare the adjusted V1 to the V1(MCG). To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length.

Clearway and Stopway V1 Adjustments

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR.

Maximum allowable clearway limits are provided for guidance when more precise data is not available.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 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 Takeoff

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 assumes 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 13 mm (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 field/obstacle limit weight for the takeoff flap setting.

2. Enter the Weight Adjustment table with the 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 adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

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 the Takeoff Speeds table in this section.
2. If V1(MCG) limited, set $V1 = V1(MCG)$. If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set $V1 = V1(MCG)$.

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. 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.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal runway/obstacle limited weight and the V1 associated with the reduced weight by the amount shown in the table below.

767 Flight Crew Operations Manual

ANTI-SKID INOPERATIVE ADJUSTMENT		
FIELD LENGTH (FT)	WEIGHT (1000 KG)	V1 ADJUSTMENT (KTS)
8000	-50.5	-33
8500	-46.8	-33
9100	-39.6	-32
9400	-35.9	-32
9700	-32.3	-31
10000	-28.7	-31
10200	-26.5	-31
12000	-26.5	-28
14000	-26.5	-26

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance adjusted for wind and slope exceeds approximately 8700 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Brakes Deactivated

When operating with brakes deactivated, the field 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 3000 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ONE BRAKE DEACTIVATED SPEED ADJUSTMENT	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KTS)
4000	-2
6000	-2
8000	-2
10000	-2
12000	-2
14000	-2

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance exceeds approximately 4000 ft for one brake deactivated.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. %N1 adjustments are shown for packs off operation.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of reduced thrust is not allowed on runways contaminated with water, ice, slush or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

Enter the Minimum Assumed Temperature table with airport pressure altitude and read minimum assumed temperature. If assumed temperature is below this value, use the Takeoff %N1 table to set takeoff thrust. To find assumed temperature reduced thrust, obtain the assumed temperature %N1 by entering the Assumed Temperature Limit %N1 table with actual airport temperature and assumed temperature. If operating with packs off, apply the bleed adjustment shown in the %N1 Adjustment for Engine Bleeds table. Apply the altitude adjustment shown in the %N1 Altitude Adjustment table. Check the resulting value by entering the Minimum Assumed Temperature Limit %N1 table with actual airport temperature and pressure altitude. Use the greater of assumed temperature limit %N1 or minimum %N1 as the assumed temperature reduced thrust %N1. Determine takeoff speeds using the actual takeoff weight and assumed temperature.

Max Climb %N1

This table shows Max Climb %N1 for a 250/290/.78 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 packs off and anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for packs off and anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. 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 maximum cruise thrust at 0 ft/min residual rate of climb or maximum climb thrust at 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 12° 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 .80M 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 .78/290/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

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 table makes no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Distance and time for descent are shown for a .78/290/250 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 at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

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. Landing distances for slippery runways are 115% of the actual landing distances.

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 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 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, temperature, and speed conditions as well as thrust reverser configuration. Each adjustment is independently added to the reference landing distance. Landing distance includes the effects of max manual braking and reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landing at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight, the brakes on speed adjusted for wind and 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 Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse Thrust) 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 or brake temperature monitor system (BTMS) indication on EICAS. Times are provided for ground cooling and inflight gear down cooling.

If brake temperature monitor indication on EICAS is available, 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 the recommended cooling schedule by entering at the bottom of the chart. The brake temperature light illuminates when the hottest brake is registering 5 on the EICAS indication and extinguishes as the hottest brake cools with an EICAS indication of 4.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .80M 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 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/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. The cruise segment is at a level off altitude which is based on 100 ft/min residual rate of climb.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude are used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (KG/HR)					
	GROSS WEIGHT (1000 KG)					
	190	170	150	130	110	90
43					60	55
39				65	60	60
35		75	70	70	65	65
31	75	75	75	75	70	65
27	85	85	80	75	75	70
25	85	85	85	80	75	70
20	95	90	90	85	80	75
15	105	105	95	95	90	85
10	115	115	105	105	100	95
5	125	125	120	115	110	105

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/290/250 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 Fuel Required Adjustment 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

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 the 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.



**Airplane General, Emergency
Equipment, Doors, Windows
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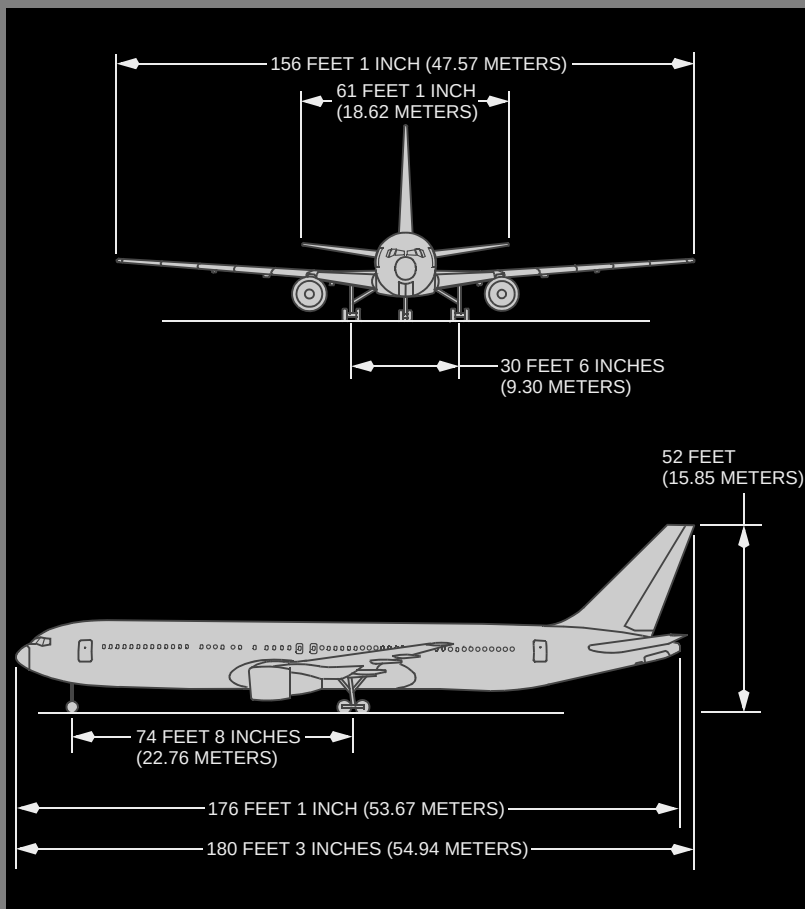
Airplane General, Emergency Equipment, Doors, Windows Dimensions

Chapter 1

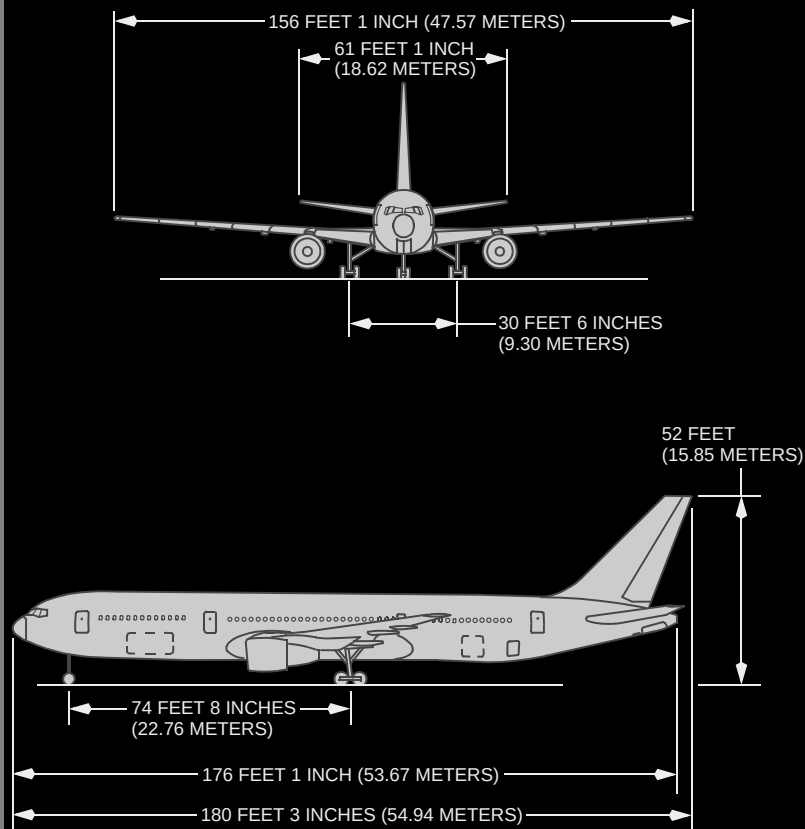
Section 10

Principal Dimensions

VP-BMC, VP-BRL, VQ-BOG

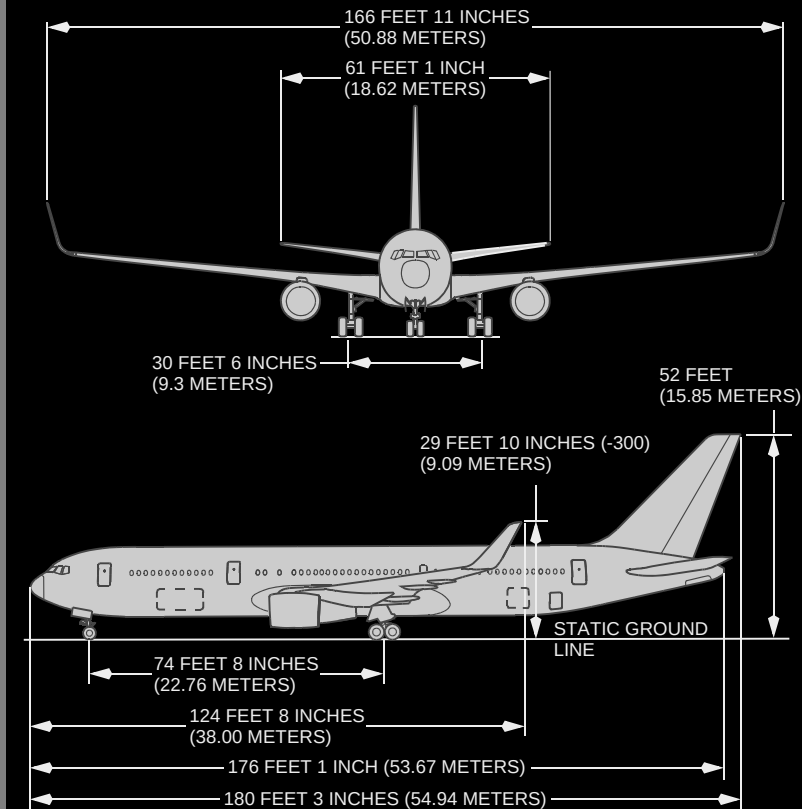


VP-BDI, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

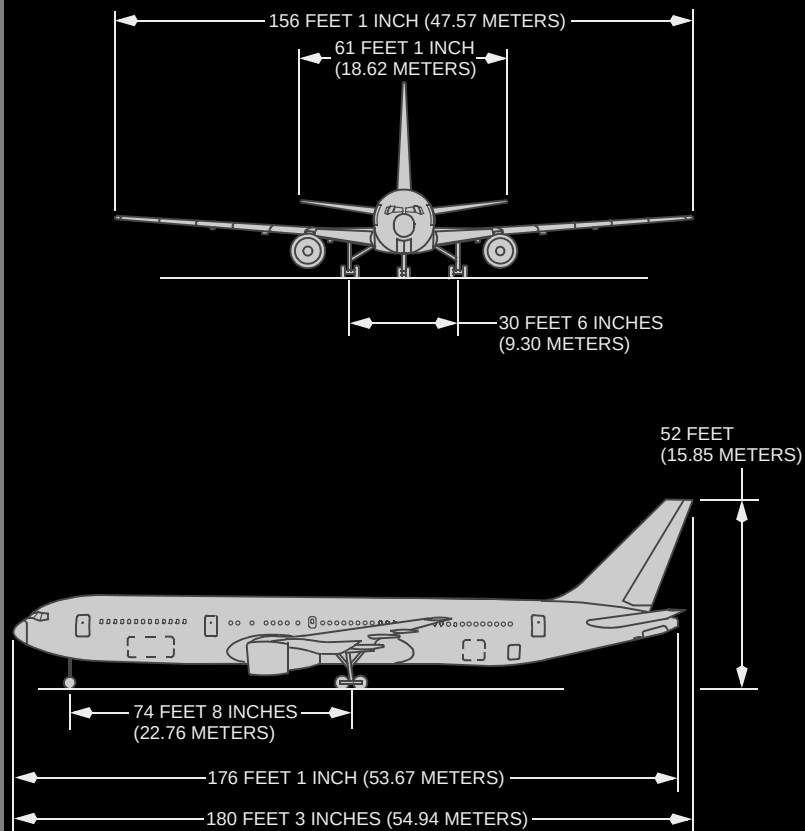




VP-BOQ



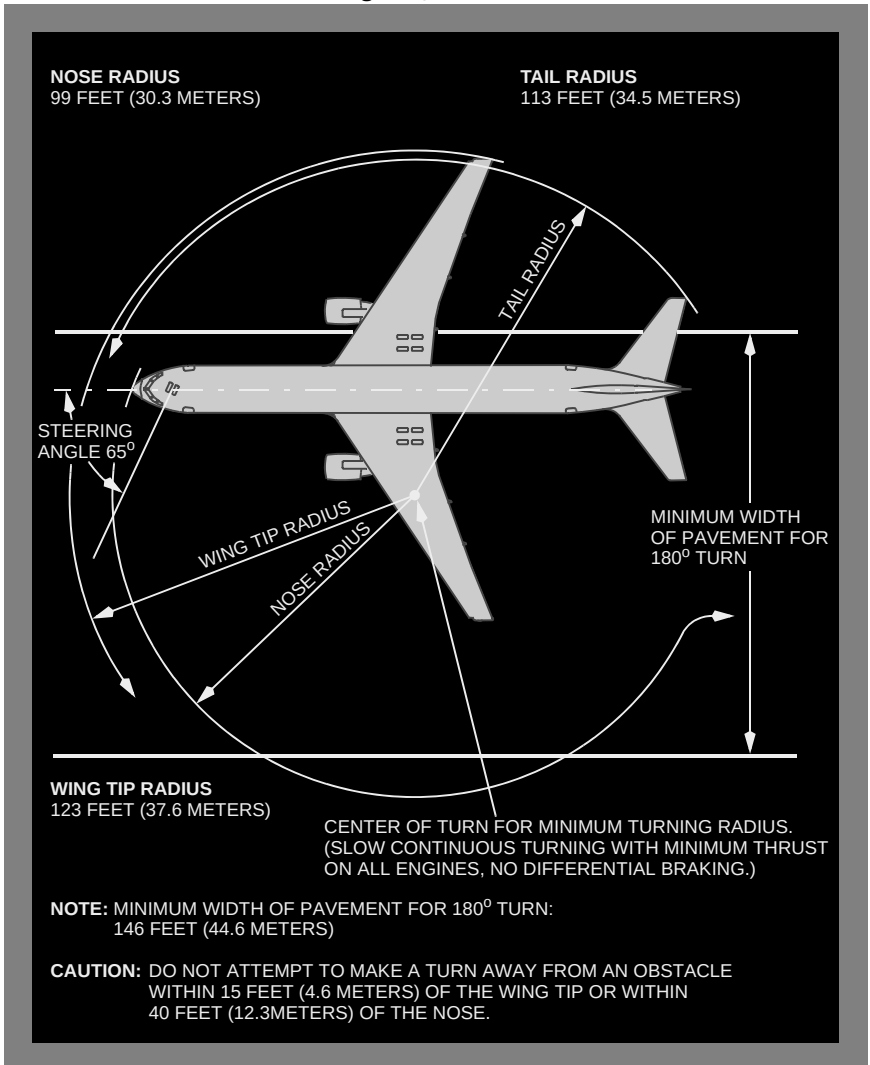
VP-BOY, VP-BOZ



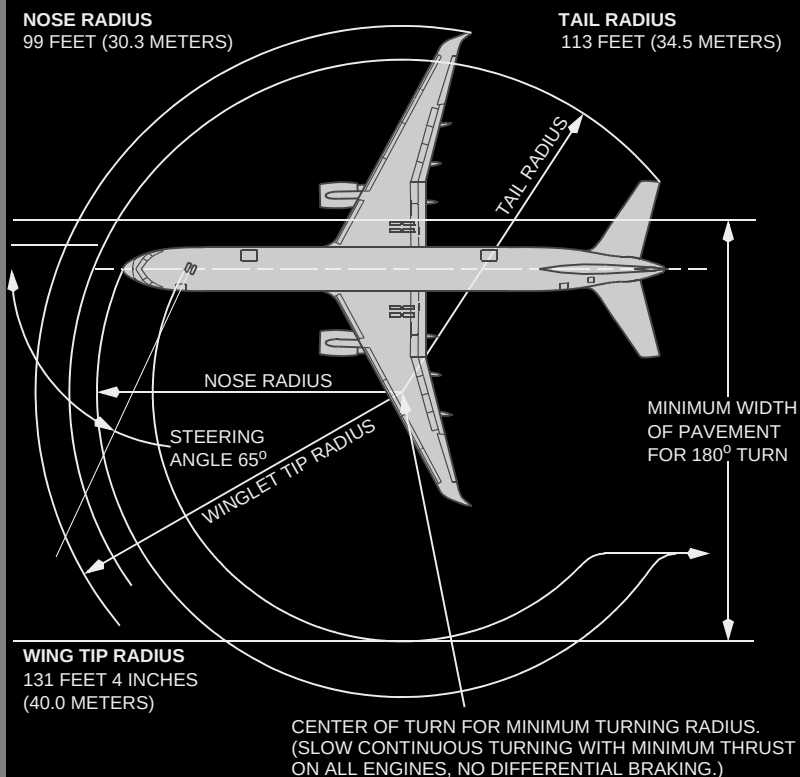
Turning Radius

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.

VP-BDI, VP-BMC, VP-BOY through VQ-BRA



VP-BOQ



NOTE: MINIMUM WIDTH OF PAVEMENT FOR 180° TURN:
146 FEET (44.6 METERS).

CAUTION: DO NOT ATTEMPT TO MAKE A TURN AWAY FROM AN OBSTACLE
WITHIN 26 FEET (8.0 METERS) OF THE WING TIP OR WITHIN
51 FEET (15.6 METERS) OF THE NOSE.

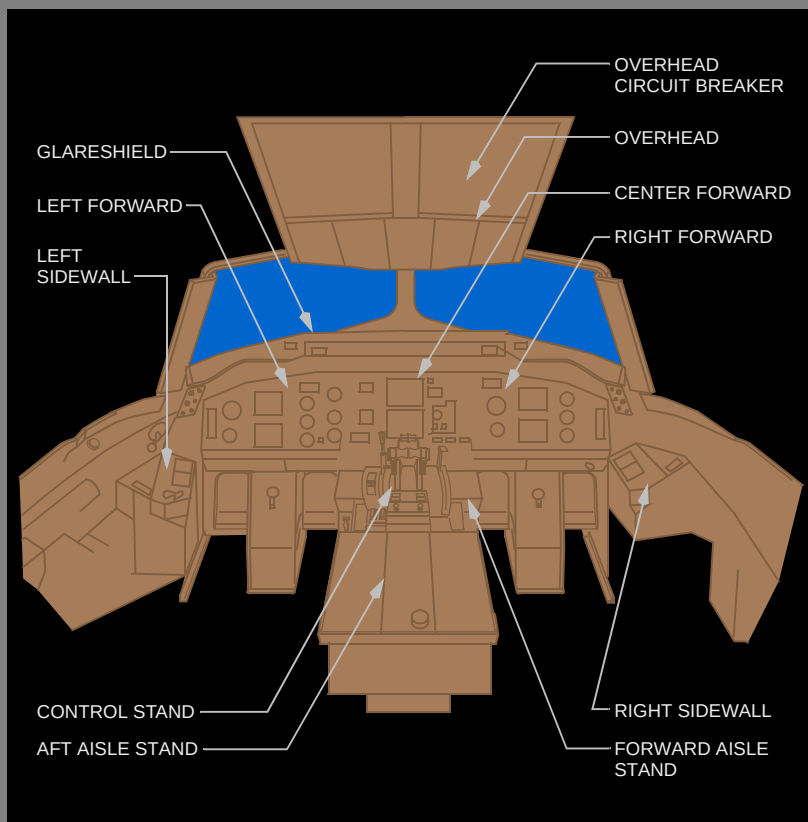


Airplane General, Emergency Equipment, Doors, Windows Instrument Panels

Chapter 1

Section 20

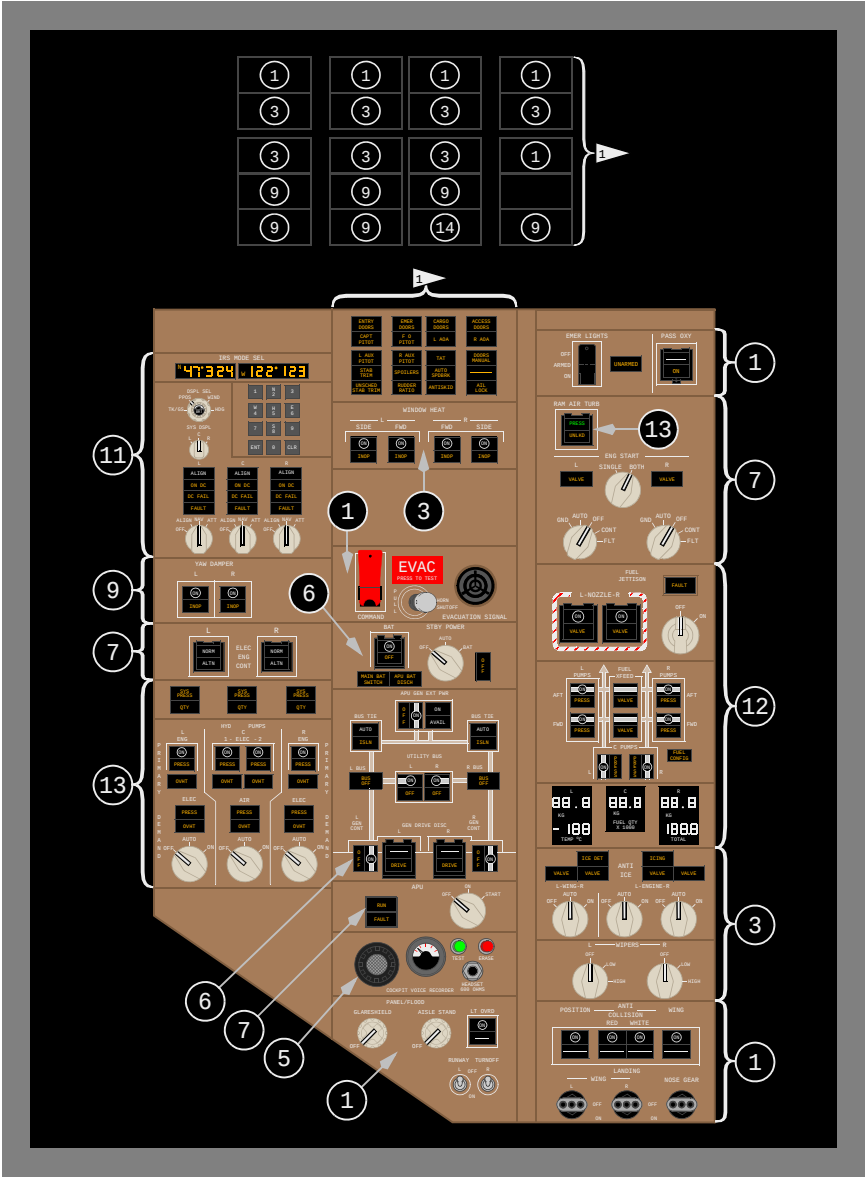
Flight Deck Panels

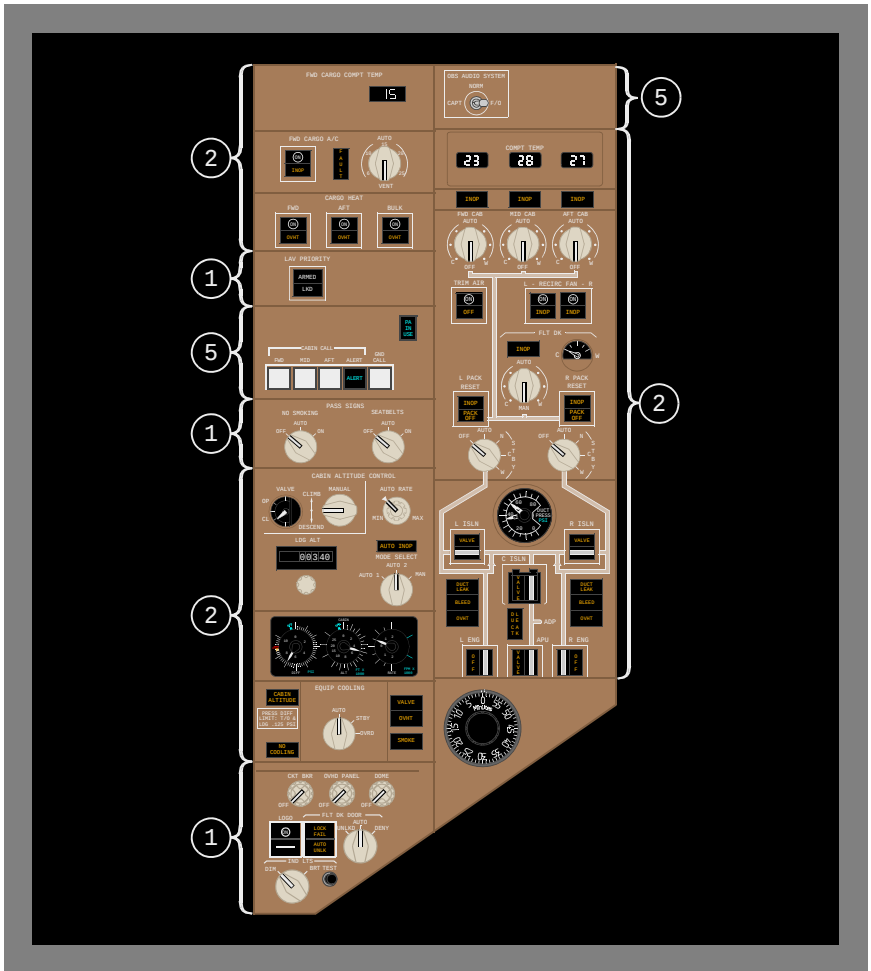


On the following pages, circled numbers refer to chapters where information on the item may be found.

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.

Left Overhead Panel





Intentionally
Blank

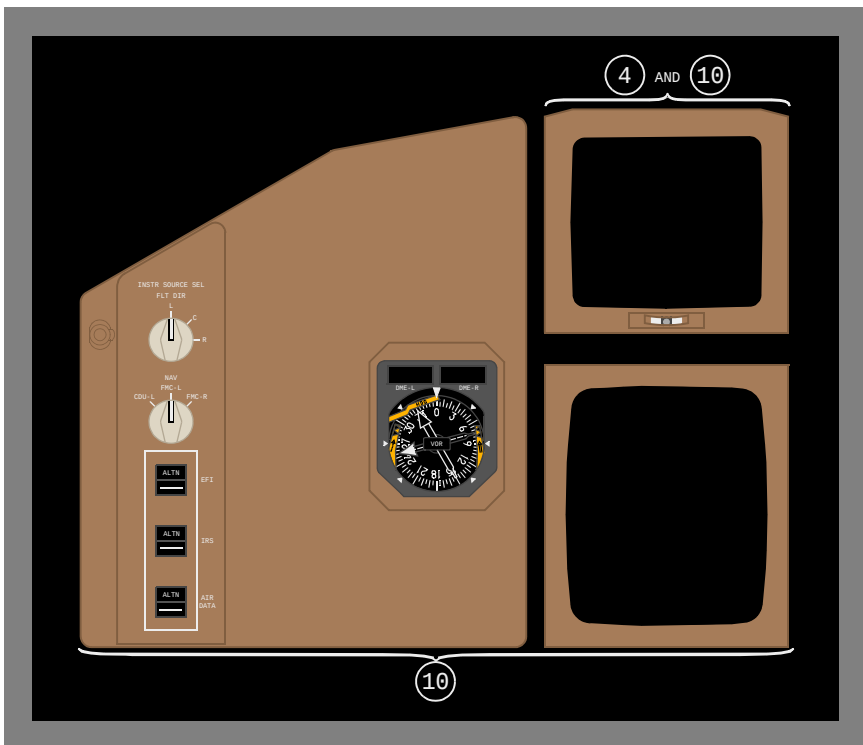


Airplane General, Emergency Equipment, Doors, Windows Instrument Panels

Chapter 1

Section 21

Left Forward Panel

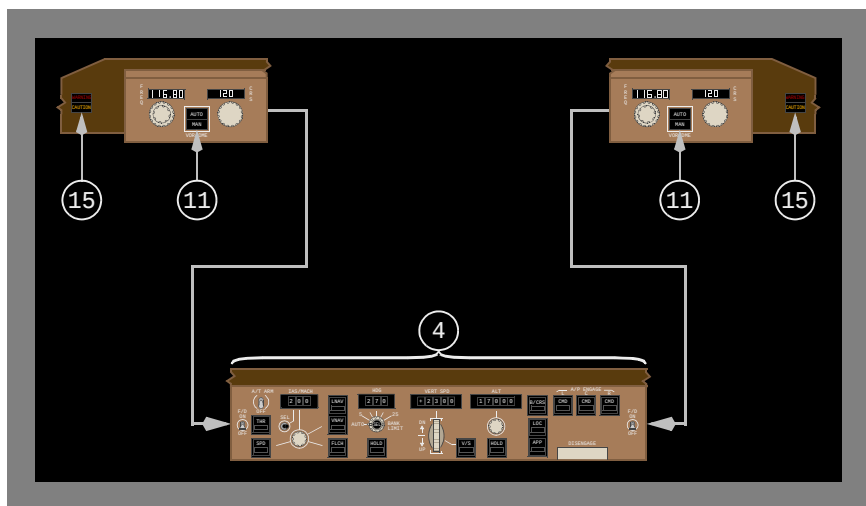




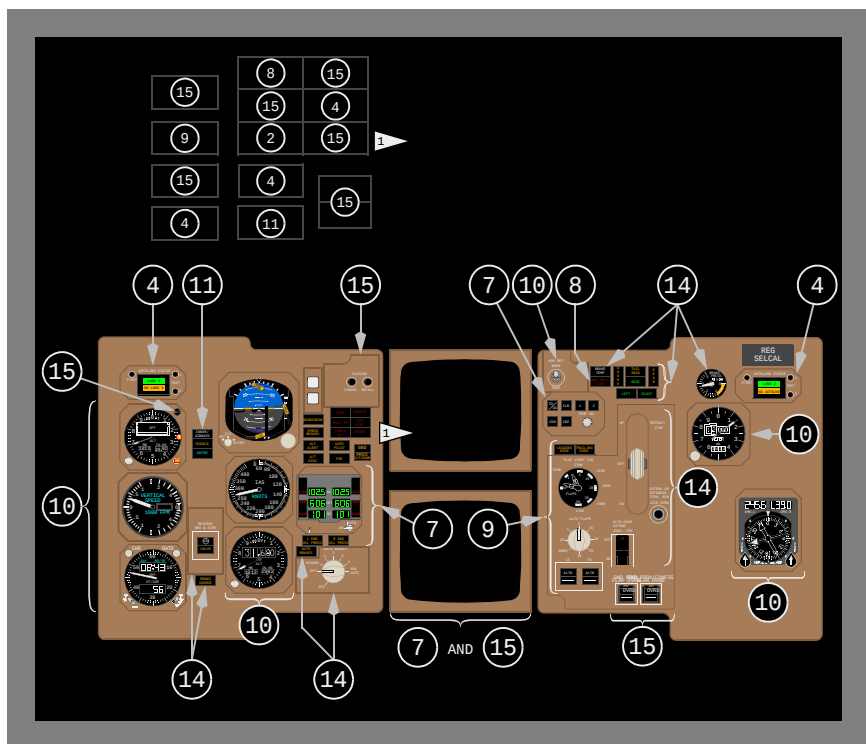
Right Forward Panel



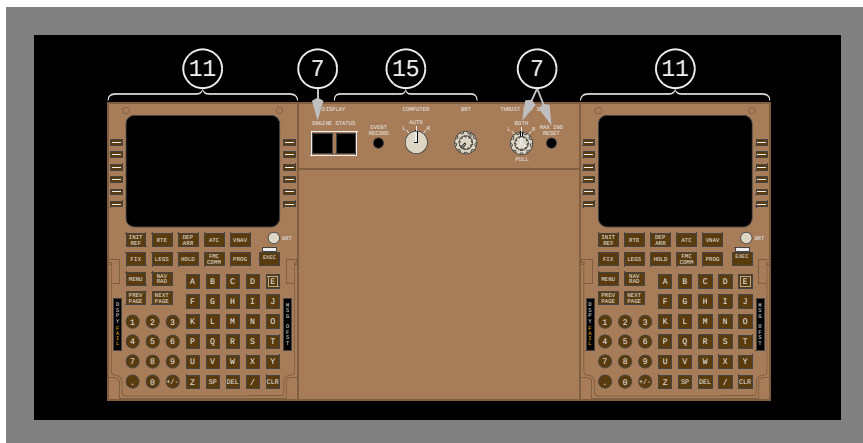
Glareshield Panel



Center Forward Panel



Forward Aisle Stand

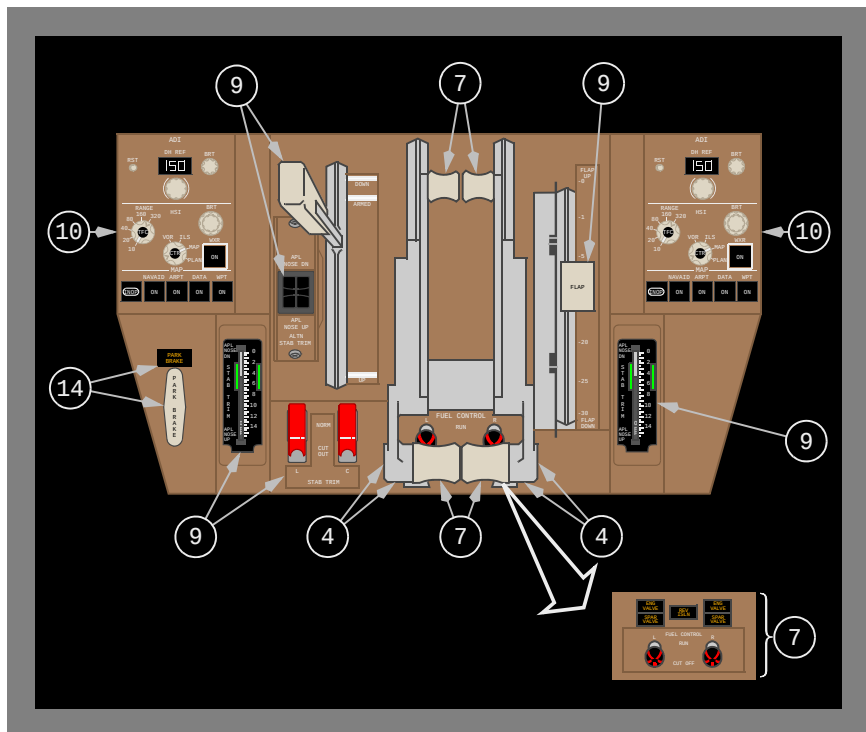




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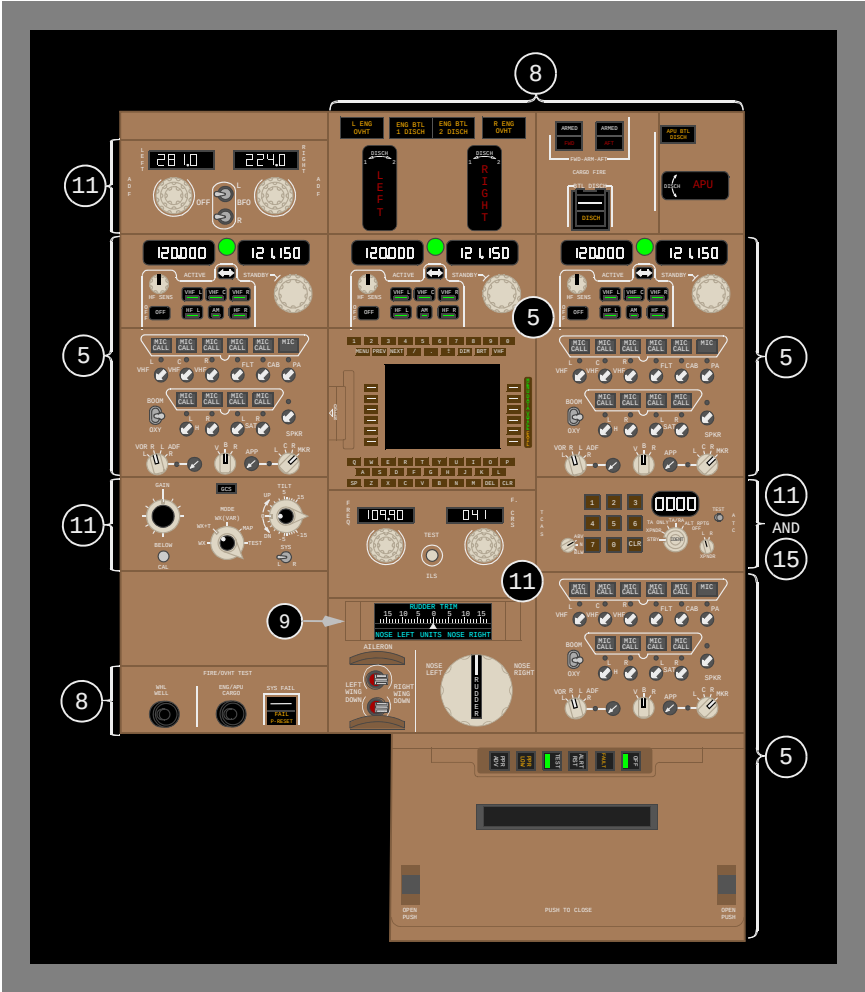
Section 22

Control Stand

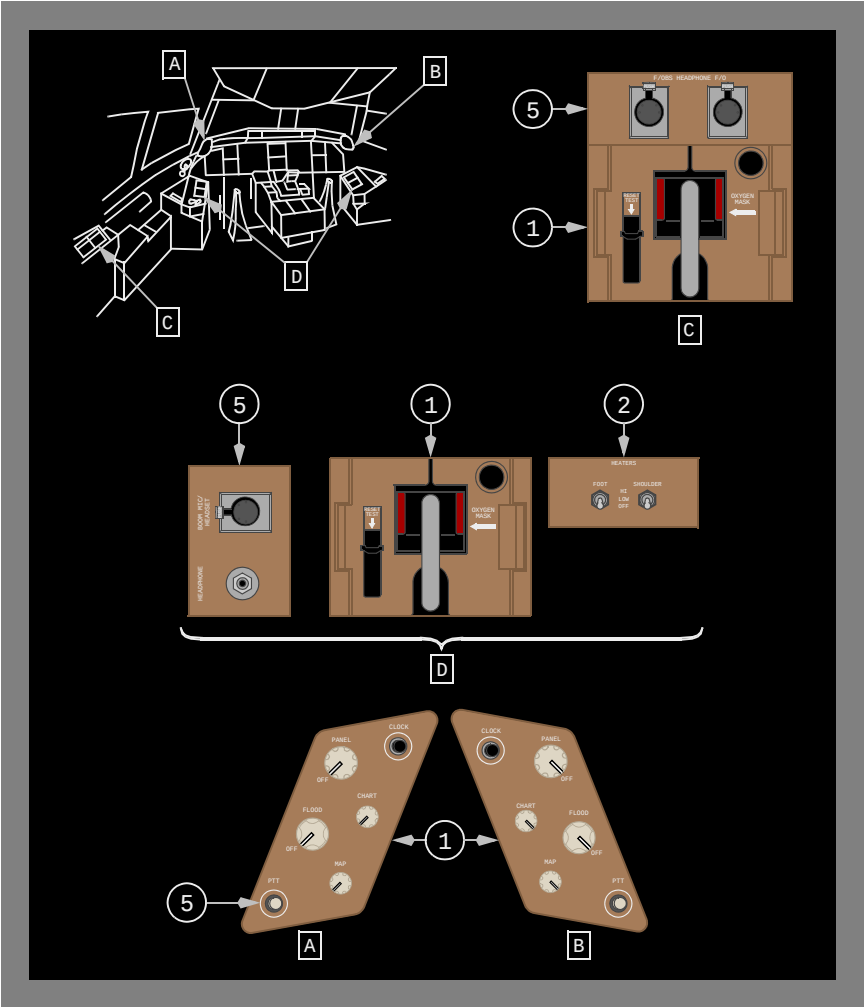




Aft Aisle Stand



Left, Right Sidewall, and 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. The switch may contain an indicator light that illuminates to indicate system status or faults. A line indicates there is no label for that portion of the switch.

Note: Maintenance personnel should be contacted for all relamping operations. Unintentional system operation can result from improper relamping.

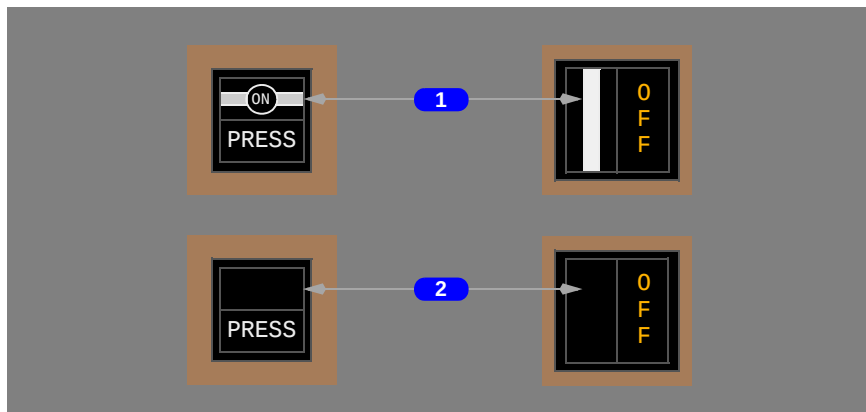
Alternate Action Switches

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 one 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 other half of many switches has a light to indicate system state, such as "PRESS", "FAIL", "INOP" or "OFF".



1 Switch is ON

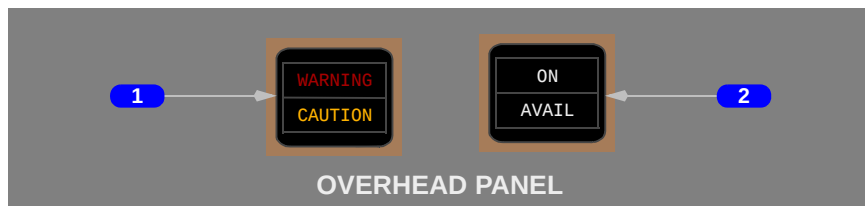
A mechanical shutter opens and a word, symbol or combination is visible.

2 Switch is OFF

A mechanical shutter closes and the ON indication is not visible.

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.

Passenger Cabin Signs

Passenger Sign Selectors



1 NO SMOKING Selector

OFF – the no smoking signs are extinguished.

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

AUTO – the no smoking signs illuminate or extinguish with reference to landing gear position (refer to Lighting System Description section).

VP-BOQ

AUTO – the no smoking signs illuminate or extinguish with reference to landing gear position or flaps (refer to Lighting System Description section).

ON – the no smoking signs illuminate.

2 SEAT BELTS Selector

OFF – the fasten seat belts and return to seats signs are extinguished.

AUTO – the fasten seat belts and return to seats signs illuminate or extinguish with reference to landing gear or flap position (refer to Lighting System Description section).

ON – the fasten seat belts and return to seats signs illuminate.

Note: Anytime passenger oxygen is deployed, the cabin signs revert to the following (regardless of selector position):

- No Smoking Illuminated
- Fasten Seat Belts Illuminated

VP-BOZ, VQ-BMU, VQ-BRA

- Return to seats extinguish if the cabin altitude is above 10,000 ft.

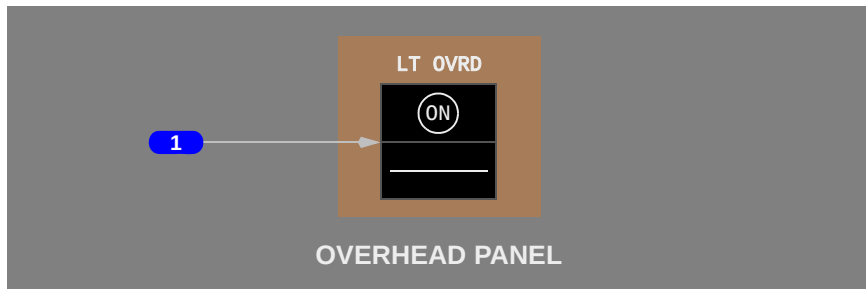
VP-BDI through VP-BOY, VP-BRL through VQ-BMQ, VQ-BOG, VQ-BPT

- Return to seats extinguish if the cabin altitude is above 10,000 ft. and passenger oxygen is on

Lighting

Flight Deck Lighting

Light Override Switch

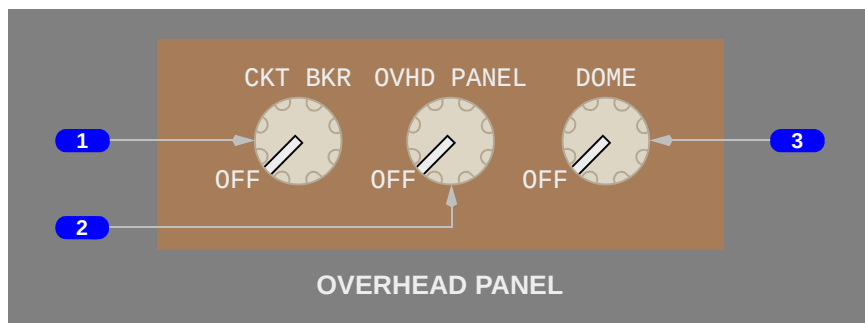


1 Light Override (LT OVRD) Switch

ON – overrides normal controls and illuminates the following lights at maximum brightness:

- forward panel flood lights
- illuminated indicator lights
- glareshield flood lights
- aisle stand flood lights
- dome lights

Circuit Breaker/Overhead Panel and Dome Lights Control



1 Circuit Breaker (CKT BKR) Panel Light Control

Rotate – controls circuit breaker panel light brightness.

2 Overhead (OVHD) Panel Lights Control

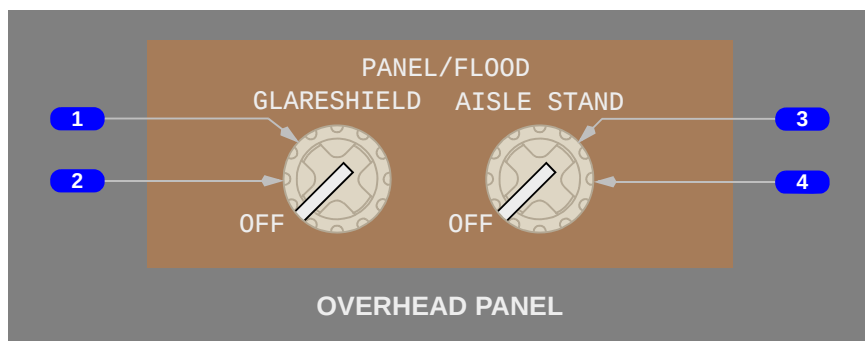
Rotate – controls overhead panel light brightness.

3 DOME Lights Control

Rotate – controls dome light brightness.

Note: Control is overridden with the Light Override Switch in the ON position.

Glareshield Panel/Flood Lights Control



1 GLARESHIELD FLOOD Light Control (inner)

Rotate – controls glareshield flood light brightness.

2 GLARESHIELD PANEL Light Control (outer)

Rotate – controls glareshield panel light brightness.

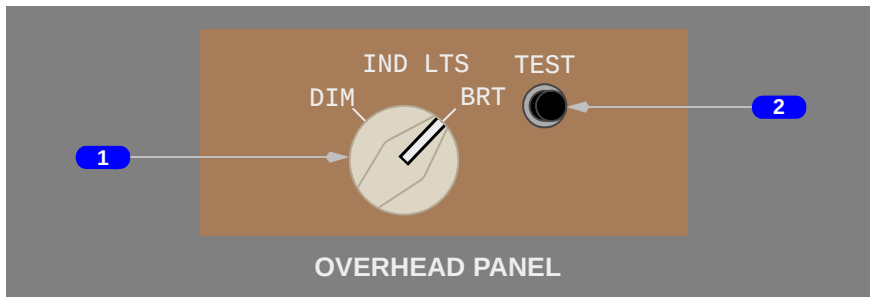
3 AISLE STAND FLOOD Light Control (inner)

Rotate – controls the aisle stand flood light brightness.

4 AISLE STAND PANEL Light Control (outer)

Rotate – controls the aisle stand instrument panel light brightness.

Indicator Lights Switch



1 Indicator Lights (IND LTS) Switch

BRT – sets all illuminated annunciator lights to full brightness.

DIM – sets all illuminated annunciator lights to low brightness.

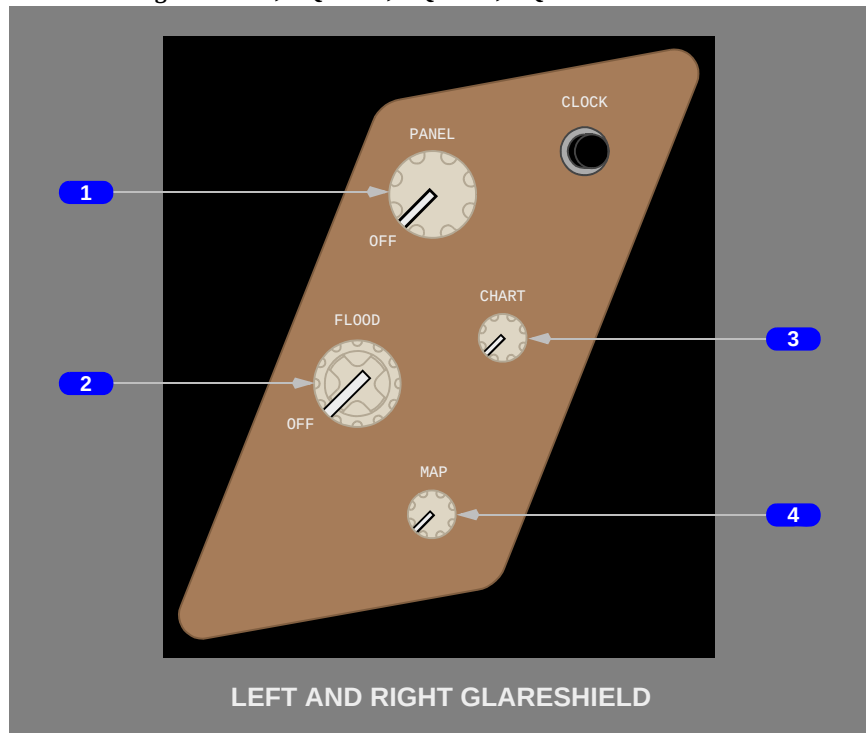
2 Indicator Lights (IND LTS) TEST Switch

Push and hold –

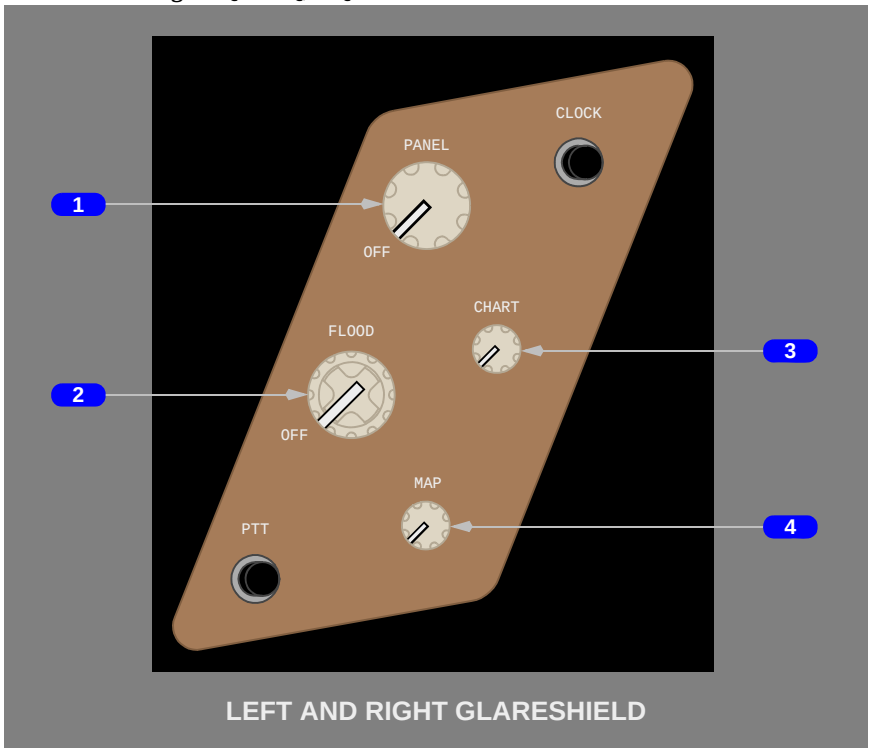
- Initiates an indicator lights test
- Lights illuminate at the intensity selected by the Indicator Lights selector
- Tests the ADI and HSI displays if the airplane is on the ground
- Illuminates the IRS data display characters

Pilot's Lighting Control Panel

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA



VP-BWW through VQ-BMQ, VQ-BPT



1 PANEL Light Control

Rotate –

- left controls left forward and center forward instrument panel lights and standby magnetic compass brightness
- right controls right forward panel lights brightness

2 FLOOD Light Control

Rotate –

- left controls left forward and center forward instrument panel flood lights brightness
- right controls right forward instrument panel flood lights brightness

3 CHART Light Control

Pull – on.

Push – off.

Rotate – adjusts chart light brightness.

4 MAP Light Control

Pull – on.

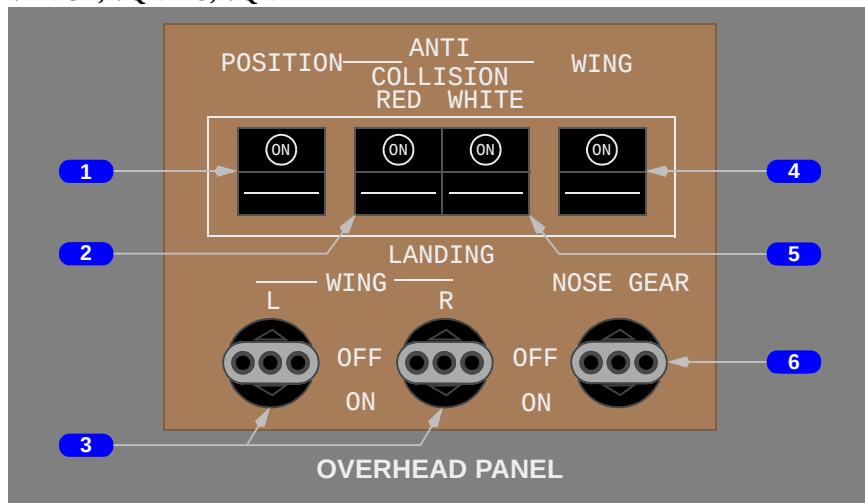
Push –off.

Rotate – adjusts map light brightness.

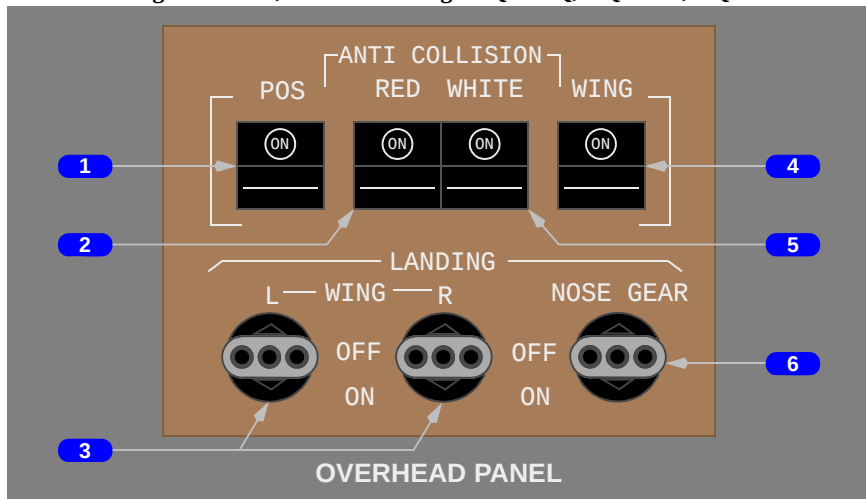
Exterior Lighting

Lighting Control Panel

VP-BOZ, VQ-BMU, VQ-BRA



VP-BDI through VP-BOY, VP-BRL through VQ-BMQ, VQ-BOG, VQ-BPT



VP-BOZ, VQ-BMU, VQ-BRA

1 POSITION Light Switch

ON – the red, green, and white position lights illuminate.

OFF (ON not visible) – the red, green, and white position lights extinguish.

VP-BDI through VP-BOY, VP-BRL through VQ-BMQ, VQ-BOG, VQ-BPT

1 Position (POS) Light Switch

ON – the red, green, and white position lights illuminate.

OFF (ON not visible) – the red, green, and white position lights extinguish.

2 ANTI-COLLISION RED Light Switch

ON – the red anti-collision strobe lights on the top and bottom of the fuselage operate.

OFF (ON not visible) – the red anti-collision strobe lights on the top and bottom of the fuselage do not operate.

3 WING LANDING Light Switches

ON – the landing light illuminates.

OFF – the landing light extinguishes.

4 WING Light Switch

ON – the wing leading edge illumination lights illuminate.

OFF – the wing leading edge illumination lights extinguish.

5 ANTI-COLLISION WHITE Light Switch

ON – the white anti-collision strobe lights on tips of each wing operate.

OFF (ON not visible) – the white anti-collision strobe lights on tips of each wing do not operate.

6 NOSE GEAR LANDING Light Switch

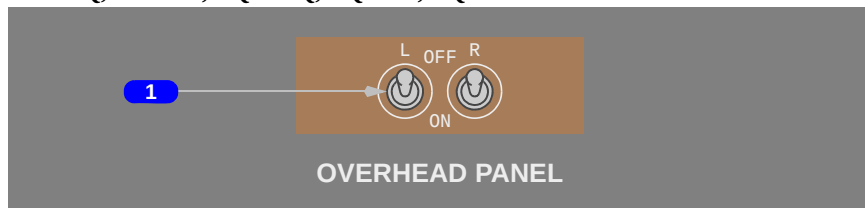
ON – the landing lights illuminate.

OFF – the landing lights extinguish.

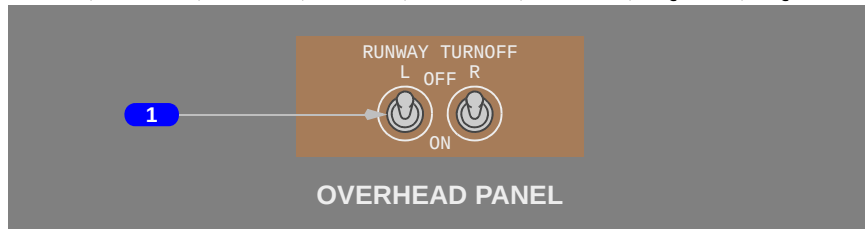
Note: The nose gear landing lights do not illuminate when the nose landing gear is not down and locked.

Runway Turnoff Light Switches

VP-BOQ, VP-BRL, VQ-BMQ, VQ-BPT, VQ-BRA



VP-BDL, VP-BMC, VP-BOY, VP-BOZ, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG



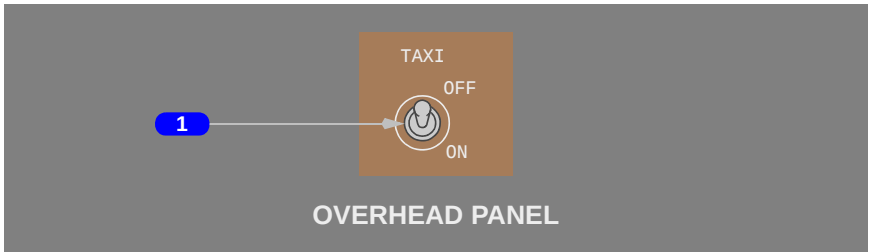
1 RUNWAY TURNOFF Light Switches

ON – the runway turnoff light illuminates.

OFF – the runway turnoff light extinguishes.

Taxi Light Switch

VP-BDI, VP-BMC, VP-BOY, VP-BOZ, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG



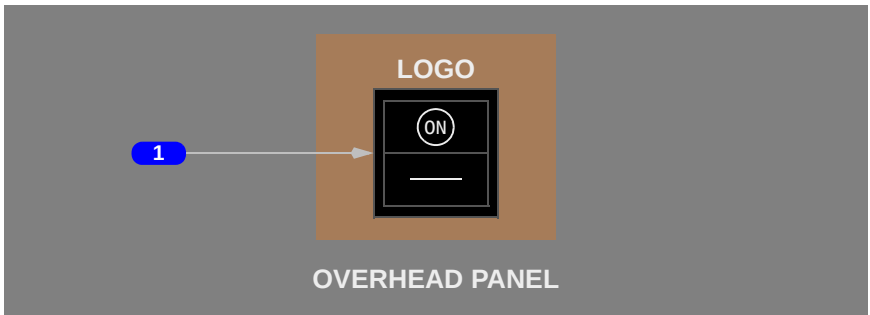
1 TAXI Light Switch

ON – the taxi light illuminates.

OFF – the taxi light extinguishes.

Note: The taxi light does not illuminate when the nose landing gear is not down and locked.

LOGO Lights

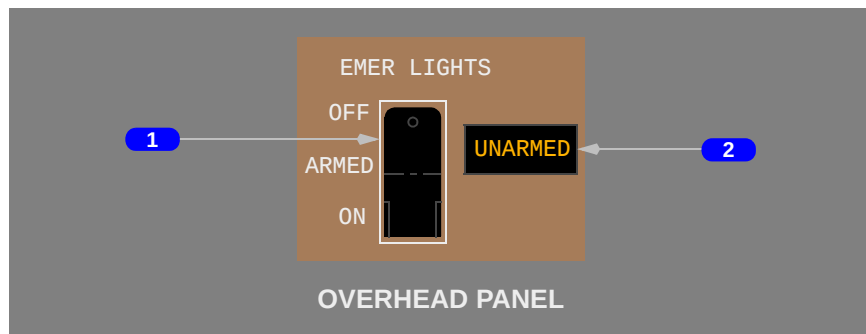


1 LOGO Light Switch

ON – the stabilizer mounted logo lights illuminate the vertical tail surface.

Emergency 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.

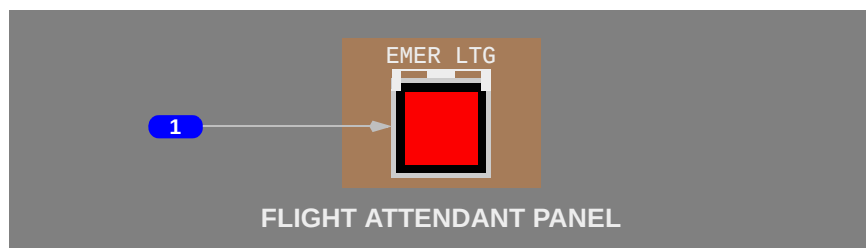
ARMED – all emergency lights illuminate if airplane electrical power fails or is turned off.

ON – all emergency lights illuminate.

2 Emergency Lights UNARMED Light

Illuminated (amber) – the emergency lighting system has been manually actuated or the emergency lights switch is OFF.

Passenger Cabin Emergency Lights Switch



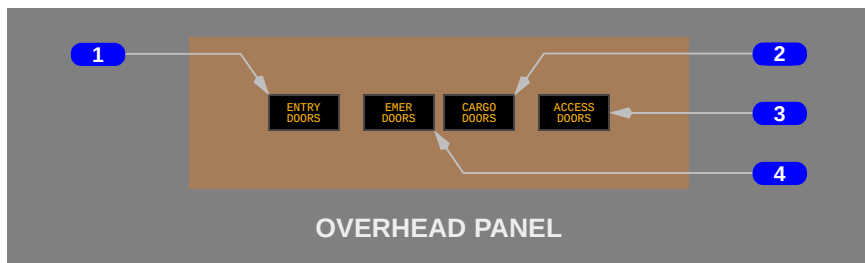
1 Passenger Cabin EMERGENCY LIGHTS Switch

Push –

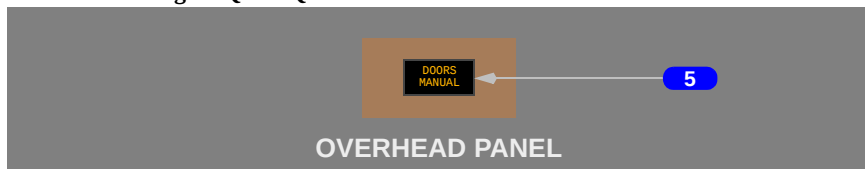
- Illuminated (red):
 - all passenger cabin and exterior emergency lights illuminate
 - bypasses the flight deck emergency lights switch
- Extinguished: all passenger cabin and exterior emergency lights extinguish

Doors and Windows

Exterior Door Annunciator Lights



VP-BWW through VQ-BMQ



1 ENTRY DOORS Light

Illuminated (amber) – an entry door is not closed, and latched and locked.

2 CARGO DOORS Light

Illuminated (amber) – the forward, aft, or bulk cargo door is not closed and latched and locked.

3 ACCESS DOORS Light

Illuminated (amber) – the forward equipment bay or the electrical equipment compartment door is not closed and latched and locked.

4 Emergency (EMER) DOORS Light

VP-BOY, VP-BOZ

Illuminated (amber) – an overwing emergency exit door, or a wing slide door is not closed and latched and locked.

VP-BMC, VP-BRL, VQ-BOG

Illuminated (amber) – a forward or aft overwing emergency exit door, or a wing slide door is not closed and latched and locked.

VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

Illuminated (amber) – an emergency door is not closed and latched and locked.

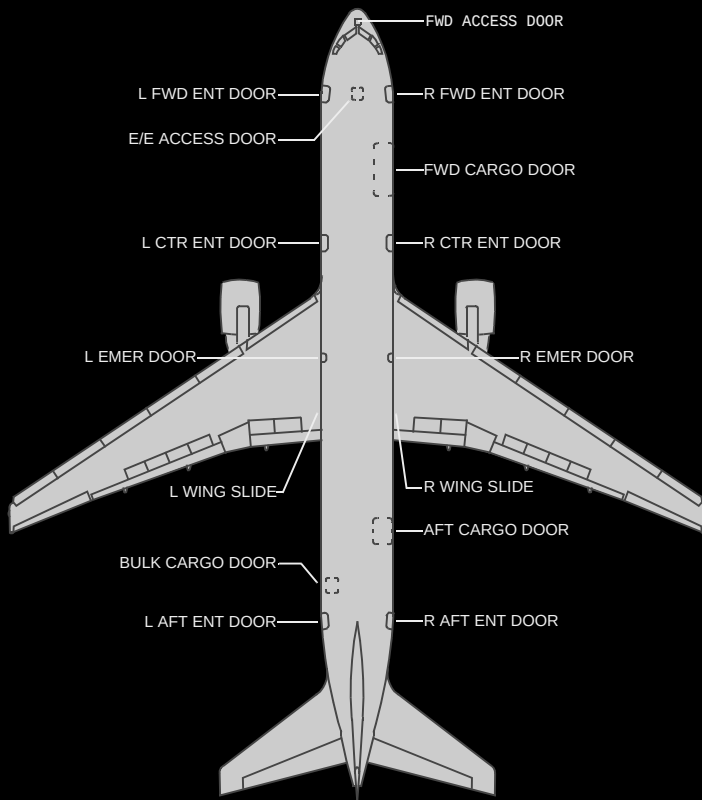
VP-BWW through VQ-BMQ

5 Doors Manual Light

Illuminated (amber) – One entry door is in manual mode.

Exterior Door Locations

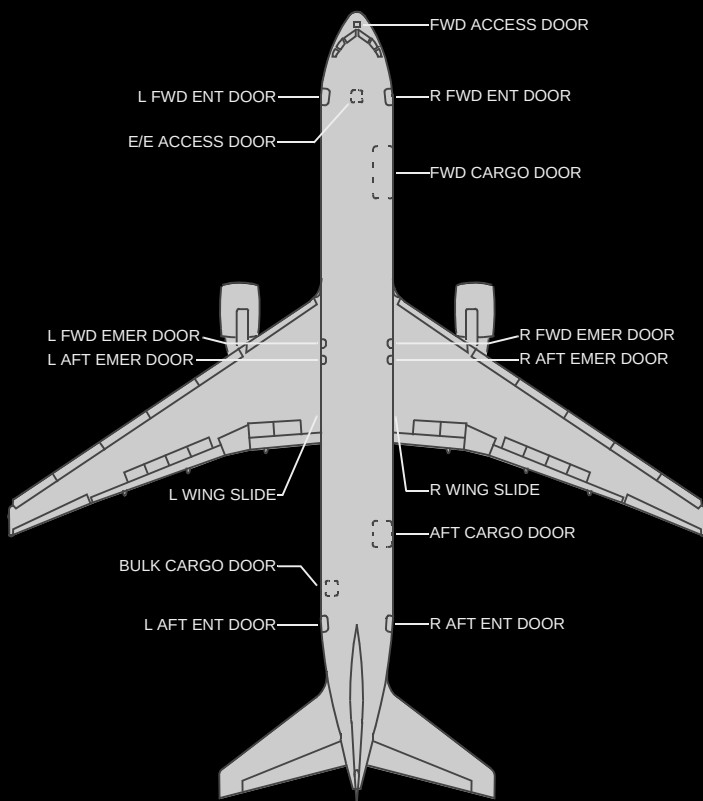
VP-BOY, VP-BOZ



EICAS MESSAGE NOMENCLATURE USED FOR DOORS IDENTIFICATION

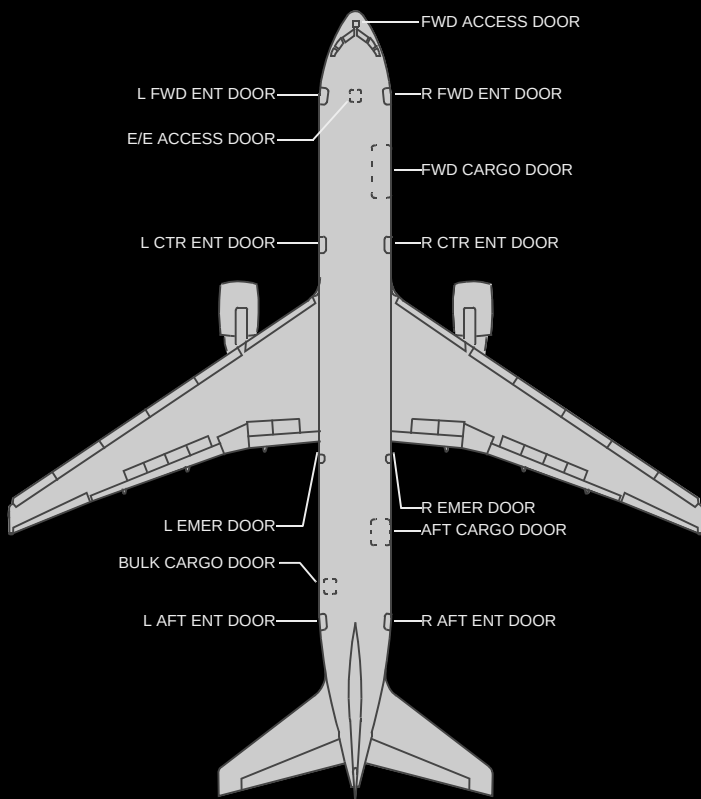


VP-BMC, VP-BRL, VQ-BOG



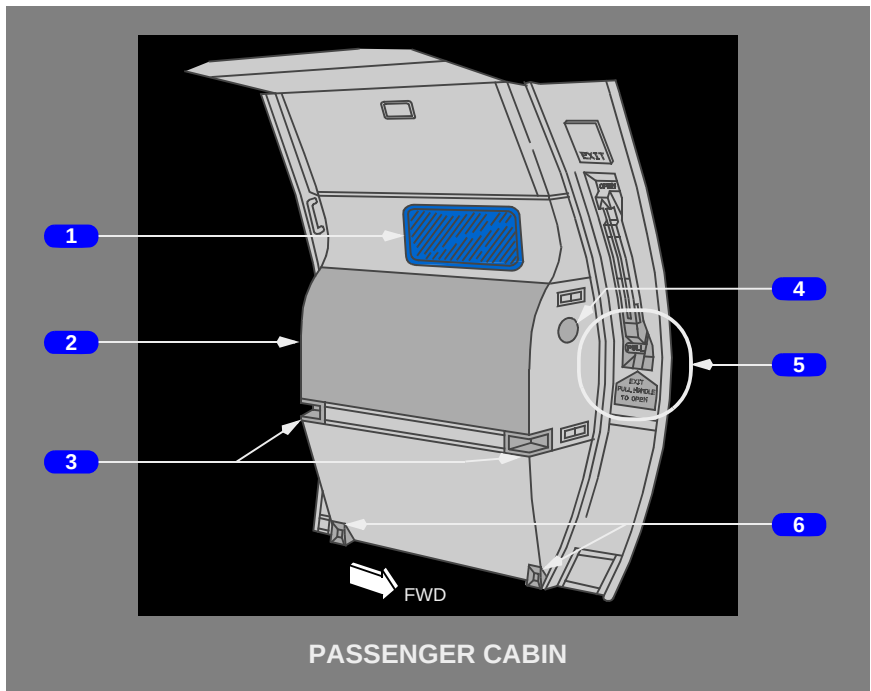
EICAS MESSAGE NOMENCLATURE USED FOR DOORS IDENTIFICATION

VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA



EICAS MESSAGE NOMENCLATURE USED FOR DOORS IDENTIFICATION

Passenger Entry Doors



1 Viewing Window

Allows observation outside the airplane.

2 Slide

The bustle contains the slide.

Note: The slide is also configured as a raft.

3 Recessed Door Assist Handles

Used to assist in raising/lowering the door.

4 Slide Gas Bottle Pressure Gage

Maintenance use only.

5 Door Control and Mode Select Panel

See following illustration.

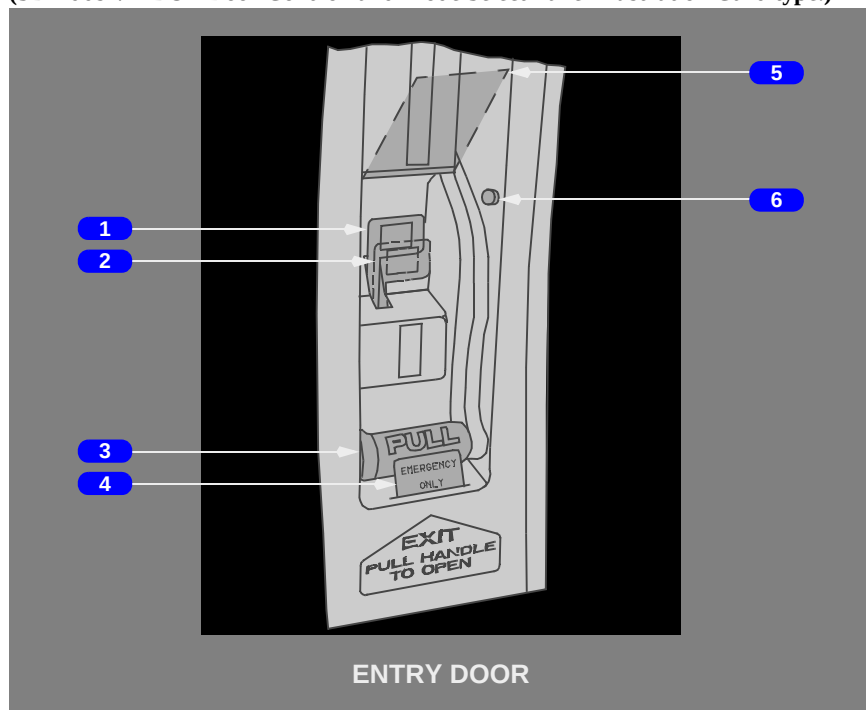
6 Direct Visual Indication—Girt Bar Lockdown

Indicator in view (yellow) – slide is armed.

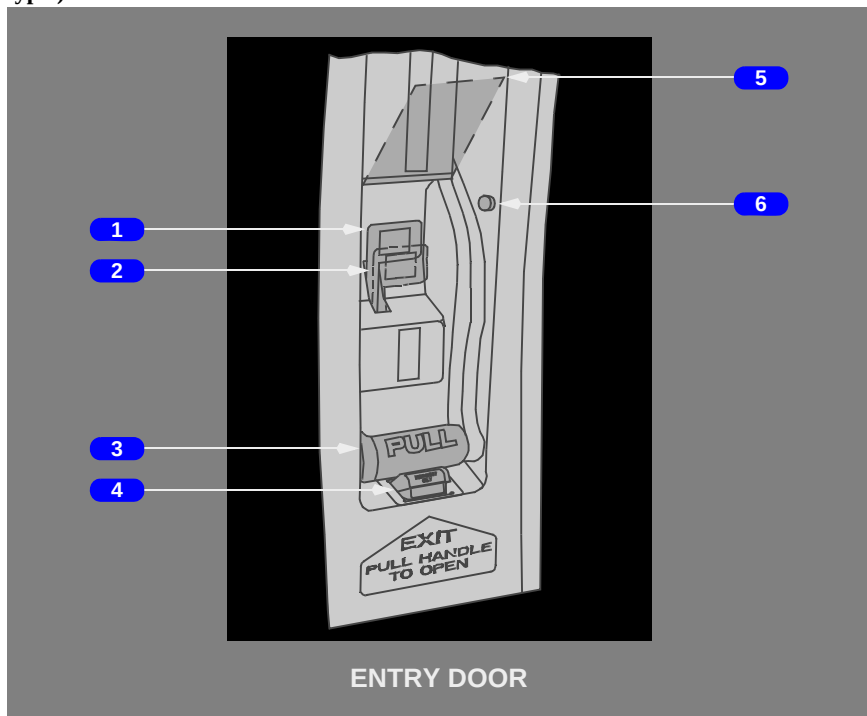
Indicator not in view – slide is disarmed.

Passenger Door Control and Mode Select Panel

VP-BDI through VP-BOY, VP-BRL through VQ-BRA
(SB Adds VP-BOZ Door Control and Mode Select Panel illustration Card type.)



(SB Deletes VP-BOZ Door Control and Mode Select Panel illustration Clam shell type.)



1 Slide Arming Lever

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

ARMED – if the door handle is moved to open, the slide deploys.

VP-BWW through VQ-BMQ, VQ-BPT

AUTOMATIC – if the door handle is moved to open, the slide deploys.

Note: If the door is opened from the outside, the slide is disarmed.

2 Slide Arming Lever

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

DISARMED – if the door handle is moved to open, the slide will not deploy.

VP-BWW through VQ-BMQ, VQ-BPT

MANUAL – if the door handle is moved to open, the slide will not deploy.

3 Door Operating Handle

To open the door – pull up in the direction of the arrow.

To close the door– push down in the opposite direction of the arrow.

4 Armed Indicator

In view – slide is armed.

Not in view– slide is disarmed.

5 Slide Arming Lever Cover

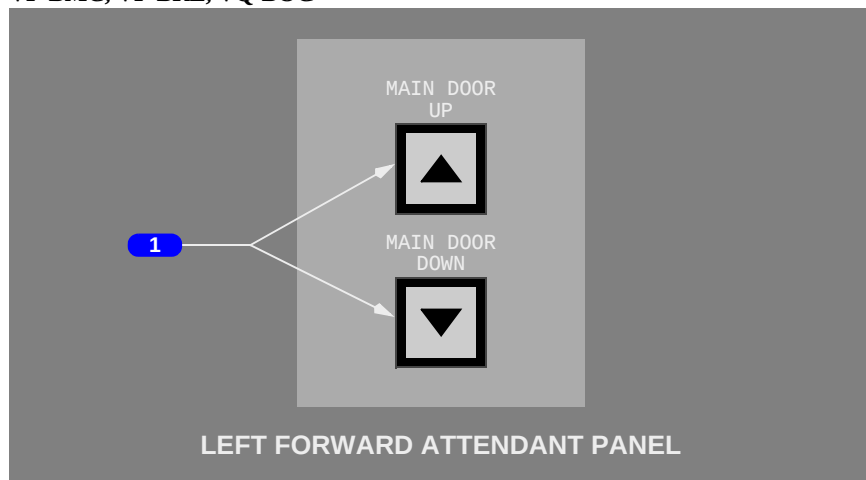
Protects against inadvertent movement of the slide arming lever.

6 Slide Arming Lever Release

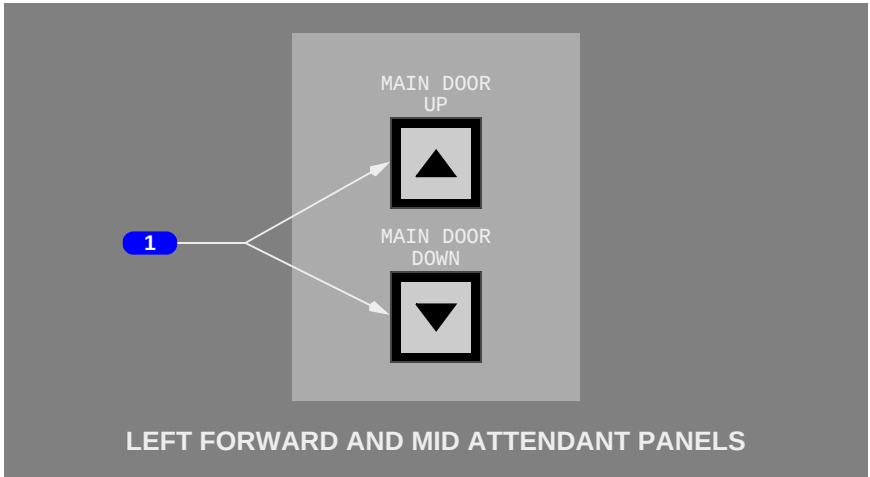
Push – releases slide arming lever from the slide disarmed position.

Interior Entry Door Electric Assist Controls

VP-BMC, VP-BRL, VQ-BOG



VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMU, VQ-BPT,
VQ-BRA



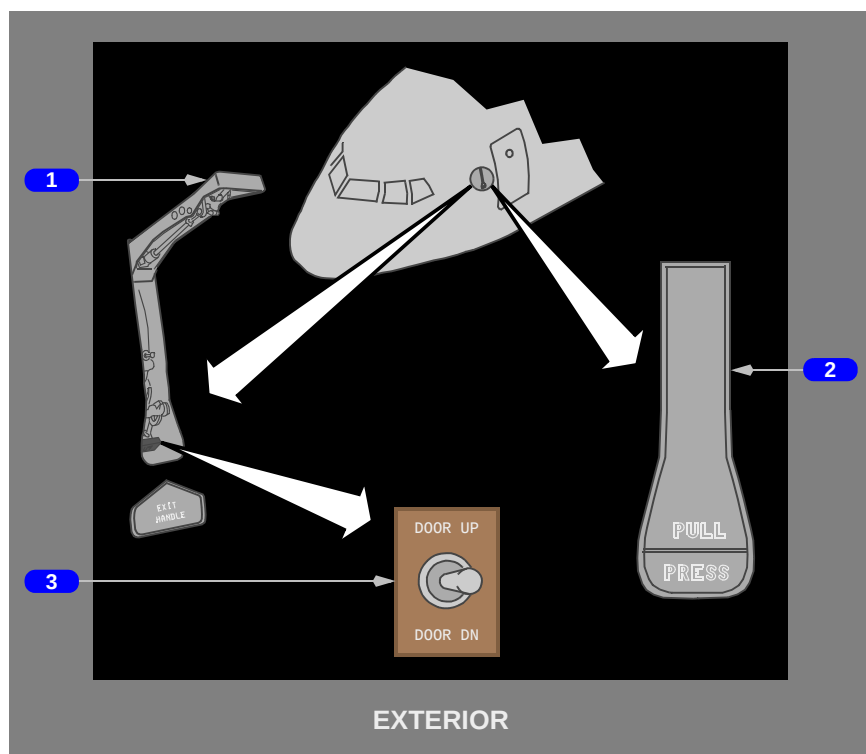
1 Main Door Switch

MAIN DOOR UP – powers electrical assist to raise the entry door.

MAIN DOOR DOWN – powers electrical assist to release the uplatch and lower the entry door.

Note: The switch must be held in position during door operation.

Exterior Entry Door Controls



1 Exterior Door Handle, Open - Door Unlocked

2 Exterior Door Handle, Closed - Door Locked

PRESS – disarms escape slide.

PULL - unlocks door.

3 Door Switch

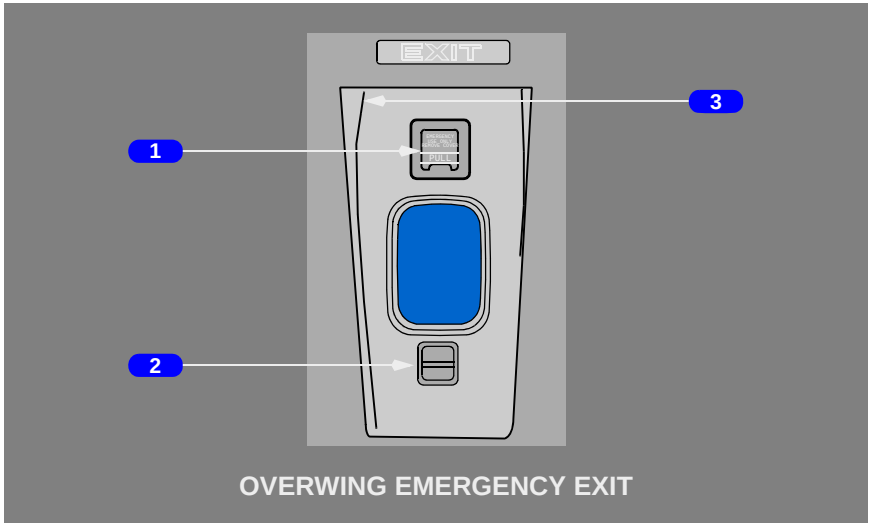
DOOR UP – powers electrical assist to raise the entry door.

DOOR DOWN (DN) – powers electrical assist to release the uplatch and lower the entry door.

Note: The switch must be held in position during door operation.

Overwing Emergency Exit Doors

VP-BMC, VP-BOY through VP-BRL, VQ-BOG



1 Emergency Handle

Note: Cover must be removed to access emergency handle.

To open the door and deploy the ramp slide – pull the handle.

2 Door Assist Handle

Used to assist in removing the door from the opening.

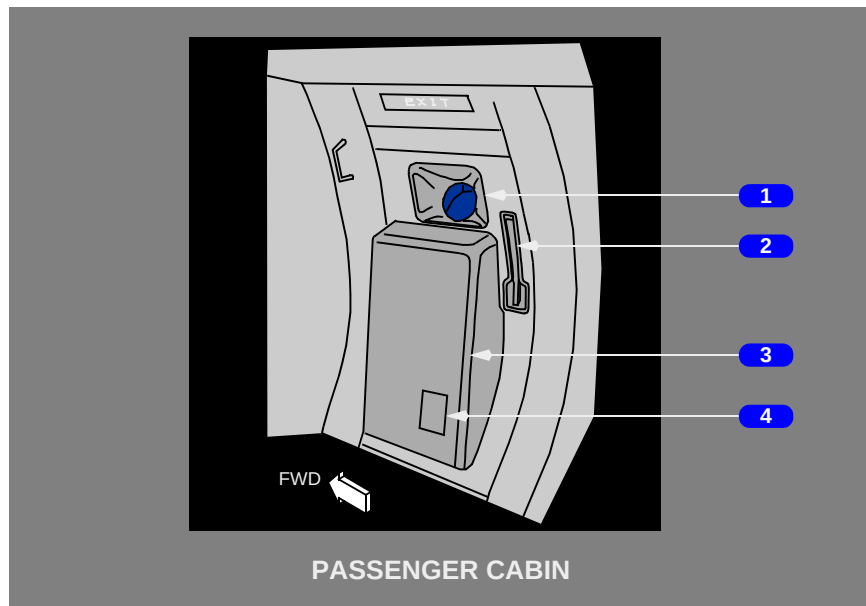
3 Alternate Slide Deployment Handle

Note: Door must be removed to access.

To manually deploy ramp slide in the event the normal system fails – remove the cover and pull the handle.

Emergency Doors

VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA



1 Viewing Window

Allows observation outside the airplane.

2 Door Operating Handle

Pull – opens door and deploys slide.

3 Slide

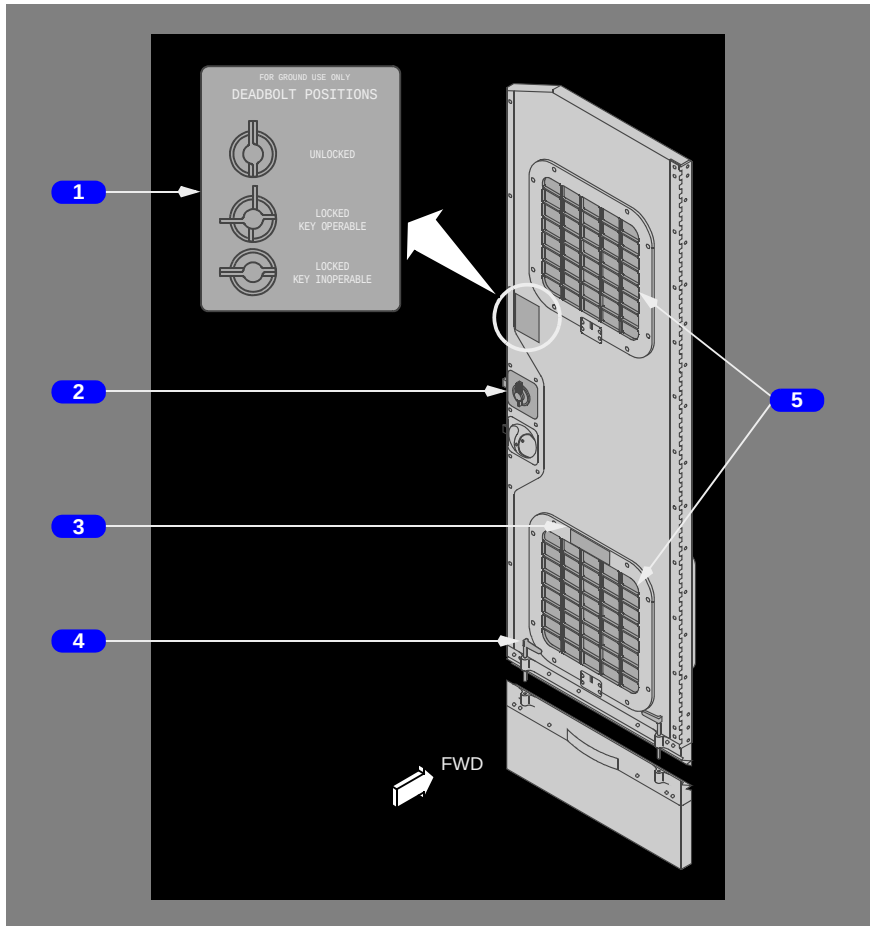
The bustle contains the slide.

4 Slide Gas Bottle Pressure Gage

Maintenance use only.

Flight Deck Security Door

VP-BMC, VP-BOQ, VP-BOZ through VQ-BMQ, VQ-BOG, VQ-BPT
(SB Adds VP-BDI, VP-BOY, VQ-BRA when flight deck security door installed.)



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.

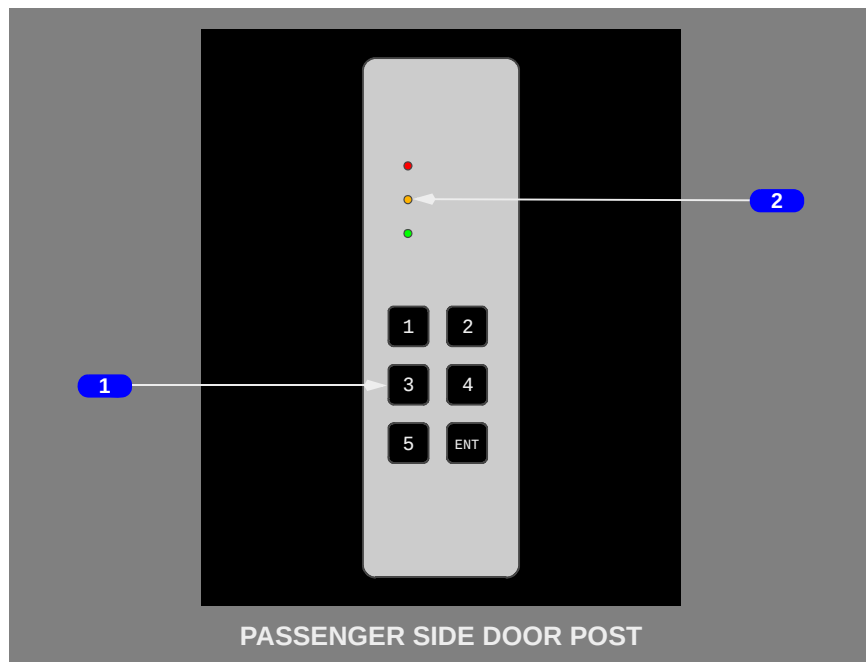
4 Shear Pins

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.

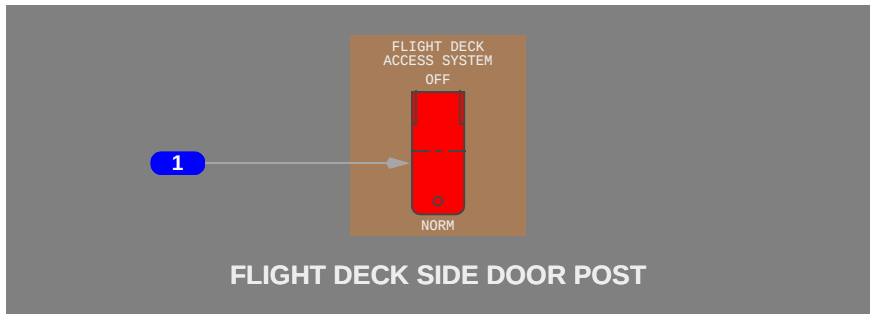
2 Access Lights

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

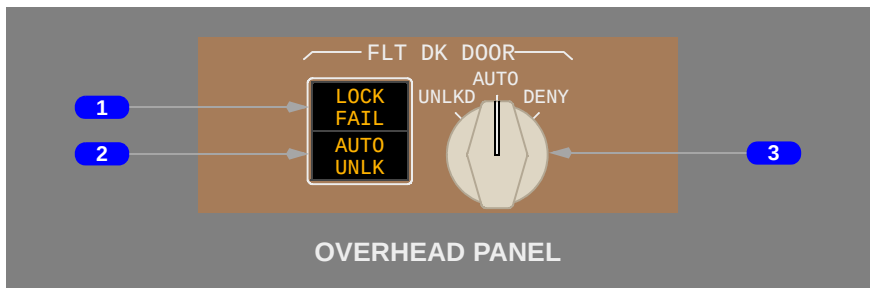


1 Flight Deck Access System Switch

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) - door lock selector in AUTO position and door lock has failed or the 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 Deck Door (FLT DK DOOR) Lock Selector

Spring loaded to AUTO. Selector must be pushed in to rotate from AUTO to UNLKD position. Selector must not be pushed in to rotate from AUTO to DENY position.

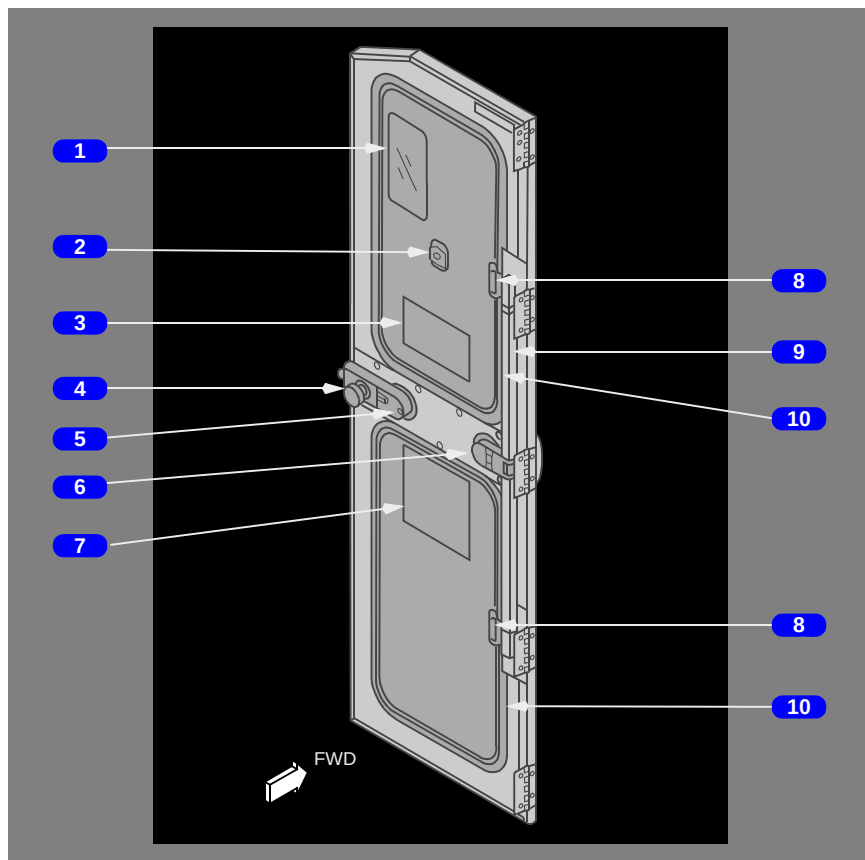
UNLKD - door unlocked while selector in UNLKD.

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 Security Door (JAMCO)

VQ-BMU



1 Mirror

2 Shielded Viewing Port

Viewing port provides wide angle view of cabin and is equipped with a cover to restrict cabin lights from entering the flight deck.

3 Emergency Exit Placard

See illustration.

Boeing Proprietary. Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details.

4 Door Latch Assembly

This unit provides normal egress from the flight deck by normal knob rotation. Additionally the unit provides unlock when flight deck decompresses.

5 Pressure-Differential Sensitive Latch mechanism

See following illustration.

6 Pressure-Sensitive Decompression Panel Latch Assembly Panel

Decompression latch opens when Cabin decompresses.

See emergency exit illustration.

7 Resetting Door Panels Placard

See illustration.

8 Panel Latch

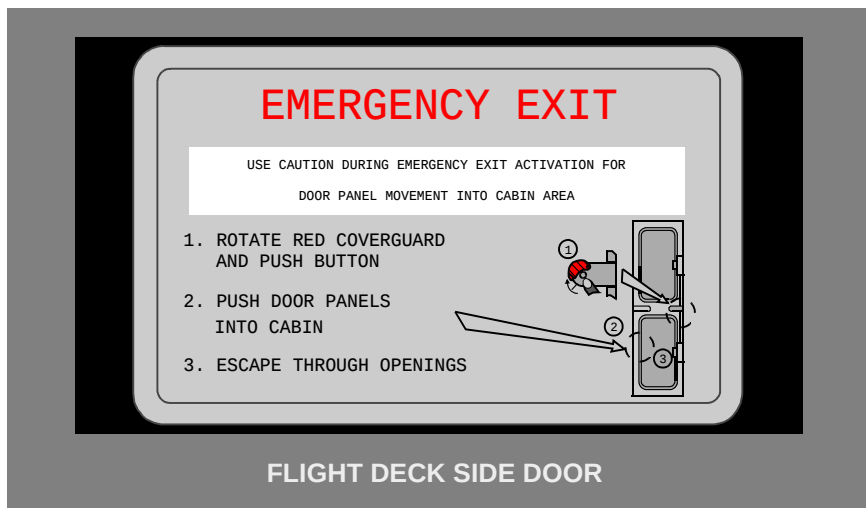
9 Latch assembly

Connects the two panel latches to the pressure assembly.

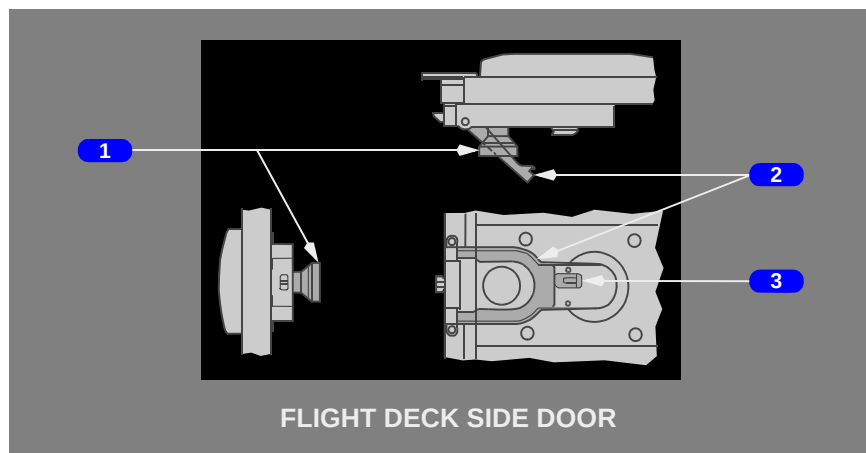
10 Decompression Panel

Prevents intrusion into flight deck if decompression panels open due to cabin depressurization.

Emergency Exit Placard



Door Latch Assembly and Pressure-Sensitive Latch Mechanism



1 Door Knob

Use to exit Flight Deck.

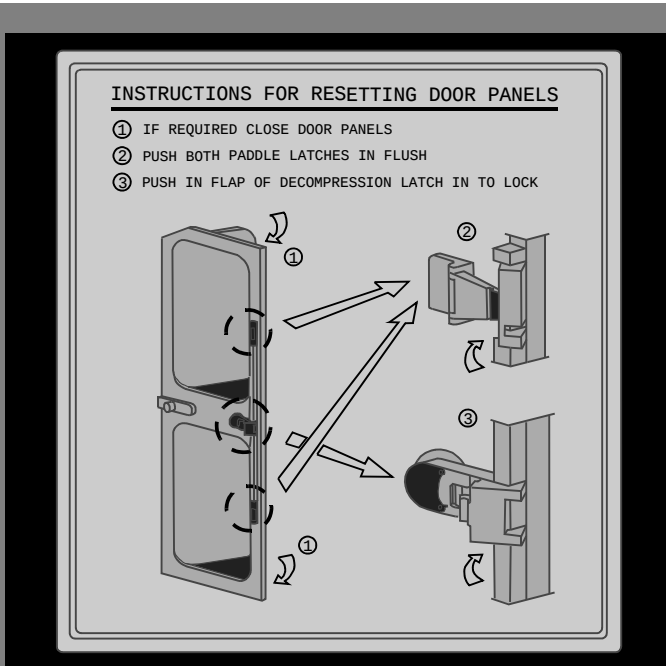
2 Door Latch Arm

Door Latch Arm swings open with rapid decompression at flight compartment side.

3 Decompression Panel Release Button

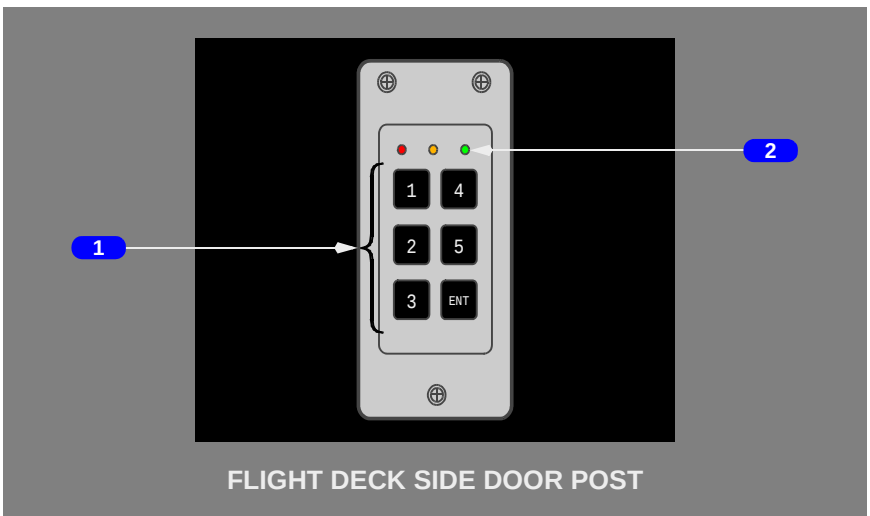
Causes Door Latch Arm Release with rapid decompression at flight compartment

Resetting Door Panels Placard



FLIGHT DECK SIDE DOOR

Flight Deck Emergency Access Panel



1 Keypad

Push -Use to enter emergency access code. Push "ENT ", then numbered keys and then "ENT" to enter code.

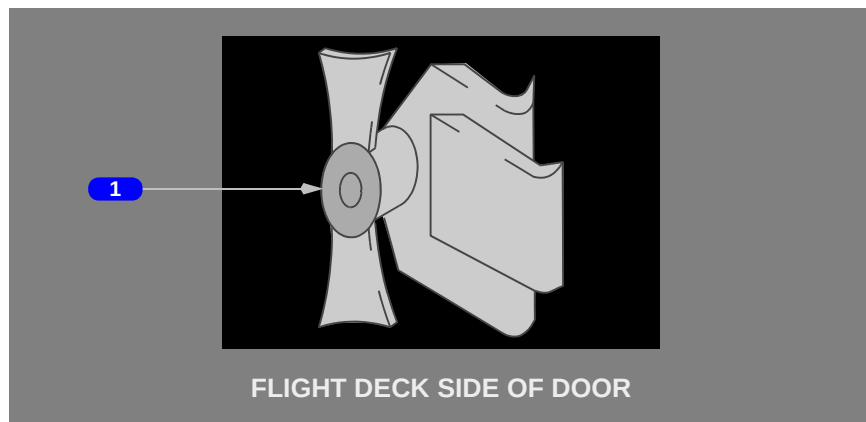
2 Access Lights

Illuminated (red) - Door is locked.

Illuminated (amber) - correct emergency access code has been entered.

Illuminated (green) - Door is Unlocked.

Door Mechanical Latch Pin (PIP)

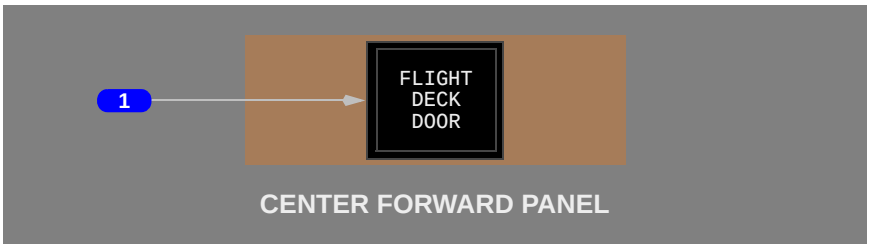


1 PIP

Use to lock door only when Automatic Electrical Locking System is inoperative. Stored cockpit side on lanyard near door latch. Insert with flap inboard over latching mechanism.

WARNING: Incorrect insertion of the Flight Deck Security Door Mechanical Latch Pin (PIP) with flap outboard over door frame creates a potential for inadvertent flight deck door lock-out.

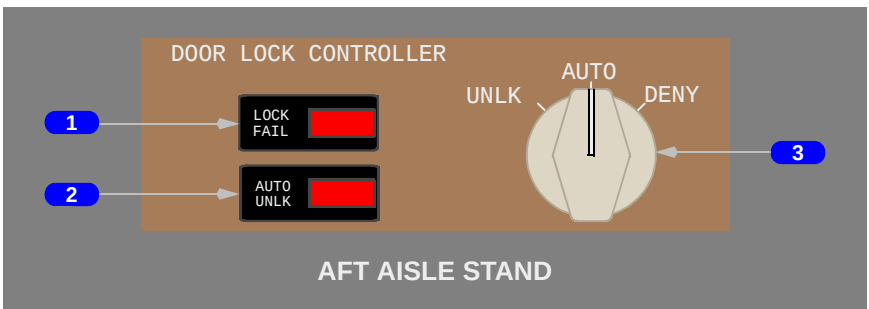
FLIGHT DECK DOOR LIGHT



1 FLIGHT DECK DOOR LIGHT

The Amber flight deck door light illuminates any time the door is unlocked.

Flight Deck Door Lock Panel



1 LOCK FAIL Light

Illuminated (red) - door lock selector in AUTO position and door lock has failed.

2 AUTO UNLOCK (UNLK) Light

Illuminated (red) - AUTO UNLK light flashes (and PinPon chime sounds) when Correct Emergency Access Code has been entered on cabin keypad.

3 Flight Deck Door Lock Selector

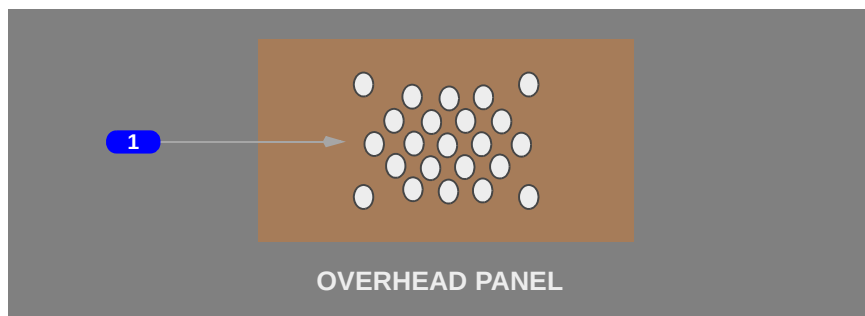
Spring loaded to AUTO position. Selector must be pushed in to rotate from AUTO to UNLK position. (Selector does not need to be pushed in to rotate from AUTO to DENY position.)

UNLK - Door is unlocked while selector in this position.

AUTO - Door is locked. Unless crew takes action, allows door to unlock (for 5 seconds) approximately 55 seconds after emergency access code is entered.

DENY - Rejects keypad entry request and prevents further emergency access code entry for 5 minutes.

AURAL WARNING SPEAKER PANEL

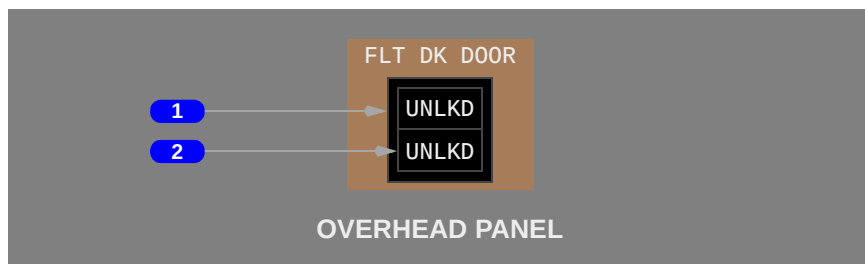


1 AURAL WARNING SPEAKER PANEL

All warnings for Flight Deck Door are transmitted through this speaker.

Flight Deck Door Switch

(SB Deletes VP-BDI, VP-BOY, VQ-BRA when flight deck security door installed.)



1 Flight Deck (FLT DK) DOOR Switch

Unlocked (UNLKD) –

- the door unlocks
- the door remains in the closed position

Locked (UNLKD not visible) – the lock engages when the door is closed.

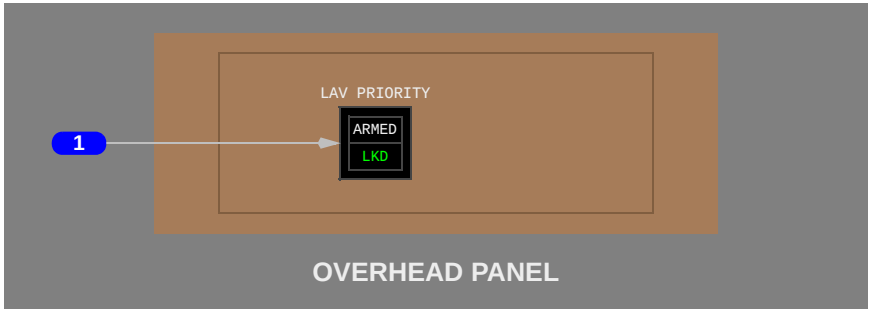
2 Flight Deck Door Unlocked (UNLKD) Light

Illuminated (white) – switch is in the door locked position but door is open and not locked.

Blank – door is closed and locked.

Lavatory F1 Remote Lock Control

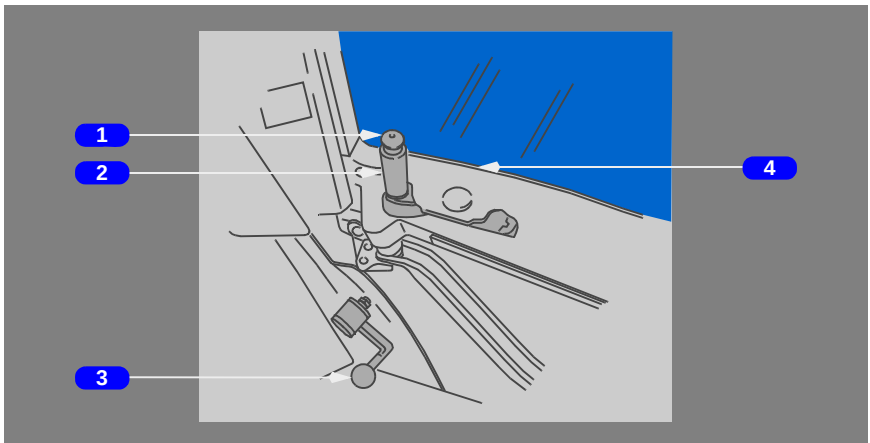
VP-BWW through VQ-BMQ, VQ-BPT



1 Lav Priority Switch

- ARMED: (white) The Lav is occupied and will lock when vacated
- LKD: (green) the Lav door is locked and a "RESERVED FOR CREW" sign is illuminated and will remain locked for 10 minutes.

Flight Deck Number Two Window



1 Window Lock Release Button

Button must be depressed to free the Window Lock Lever from the Forward Position.

2 Window Lock Lever

Forward Position– with the window fully closed (WINDOW NOT CLOSED decal not visible), locks the window.

Aft Position– unlocks the window so it can be cranked open.

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3 Window Crank

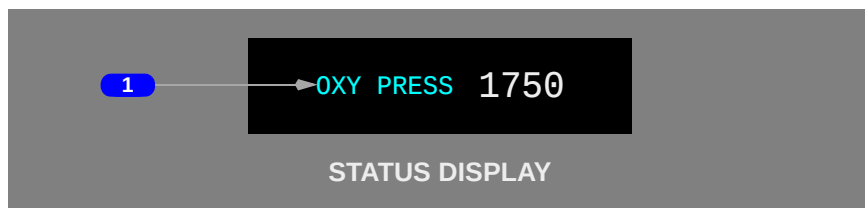
Used to position the window open or closed when the window lock lever is unlocked.

4 WINDOW NOT CLOSED Decal

Visual indication the window is not fully closed.

Oxygen Systems

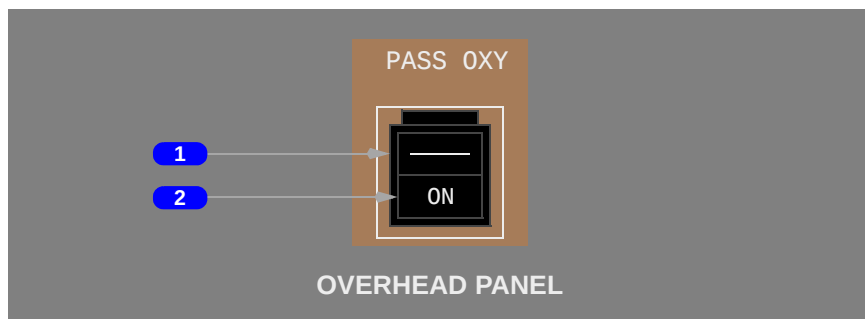
Oxygen Indications



1 Oxygen Pressure (OXY PRESS) Display

Displays crew oxygen cylinder pressure (psi).

Passenger Oxygen Switch



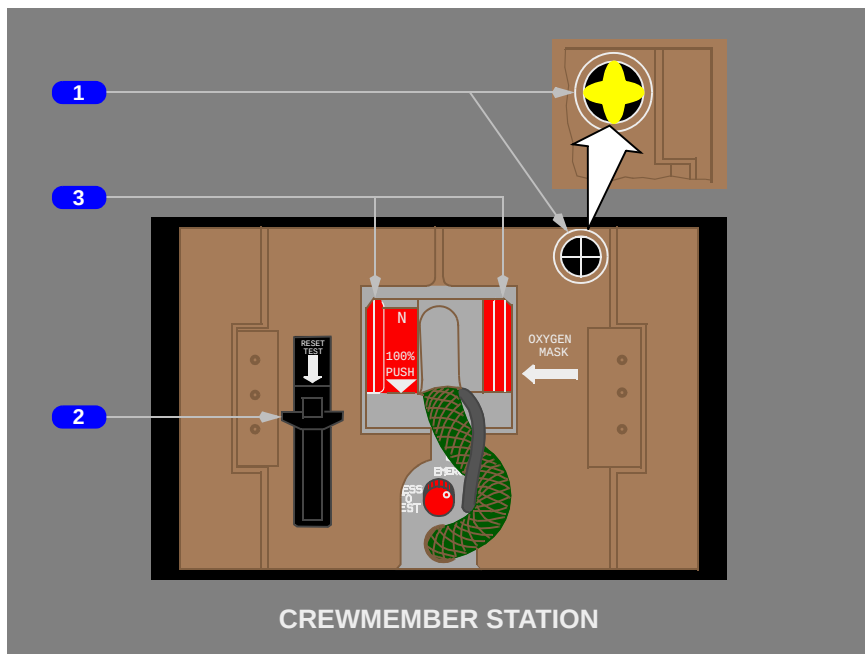
1 Passenger Oxygen (PASS OXY) Switch

Push – the passenger cabin oxygen masks drop.

2 Passenger Oxygen ON Light

Illuminated (amber) – the passenger oxygen system is operating and the masks have dropped.

Oxygen Mask Panel



1 Oxygen Flow Indicator

Shows a yellow cross when oxygen flowing.

2 RESET/TEST Switch

Push –

- with the left oxygen panel door closed and OXY ON flag not displayed, turns oxygen on momentarily to test the regulator

VP-BWW through VQ-BMQ, VQ-BPT

- 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

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

- with the left oxygen panel door closed and the OXY ON flag displayed, turns oxygen off

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

VP-BWW through VQ-BMQ, VQ-BPT

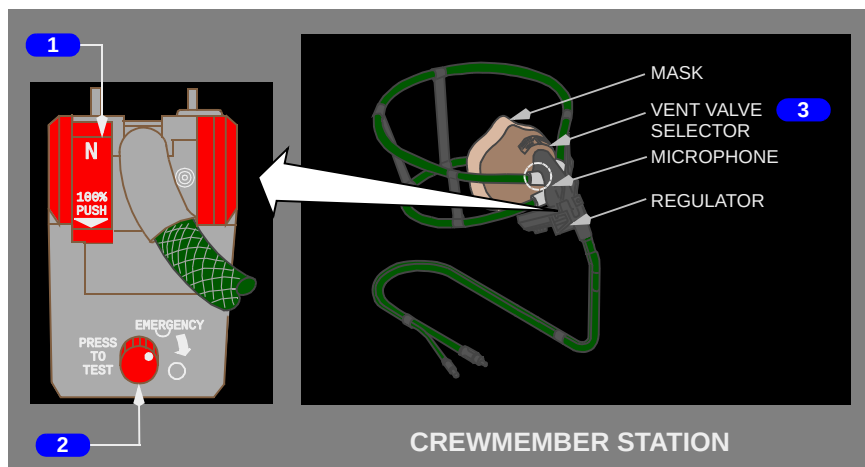
When the left oxygen panel door opens –

- selects the mask microphone
- disables the boom microphone

Squeeze (right lever) – inflates the mask harness.

Release – deflates the mask harness into position on the head and face.

Oxygen Mask and Regulator



1 Normal (N)/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 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).

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: Communications in EMER mode may be difficult. Switch to 100% or NORM mode if conditions allow.

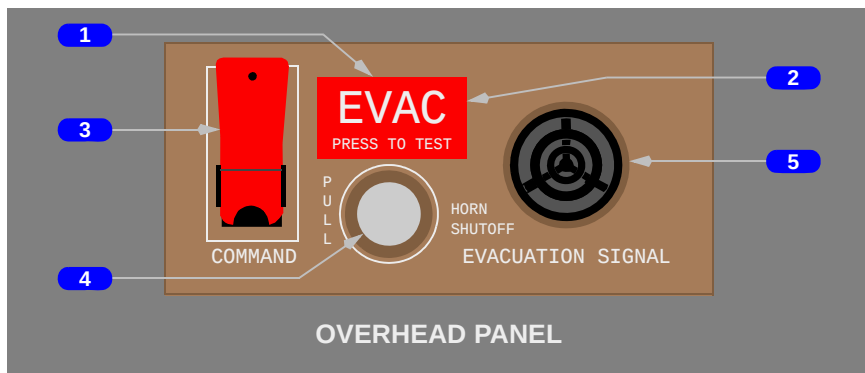
3 Smoke Vent Valve Selector

Up – vent valve closed

Down – vent valve open, allowing oxygen flow to smoke goggles.

Emergency Evacuation Panel

VP-BWW through VQ-BMQ, VQ-BPT



1 Evacuation (EVAC) PRESS TO TEST Switch

Push – tests the EVAC light.

2 Evacuation (EVAC) Light

Illuminated (red) – a command switch is in the ON position.

3 Evacuation COMMAND Switch

ON –

- activates evacuation signal system
- EVAC lights (flight deck and attendant panels) flash
- audio horn sounds at each panel

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OFF – prevents activation of emergency evacuation COMMAND signal at all flight attendant panels.

4 Evacuation HORN SHUTOFF Switch

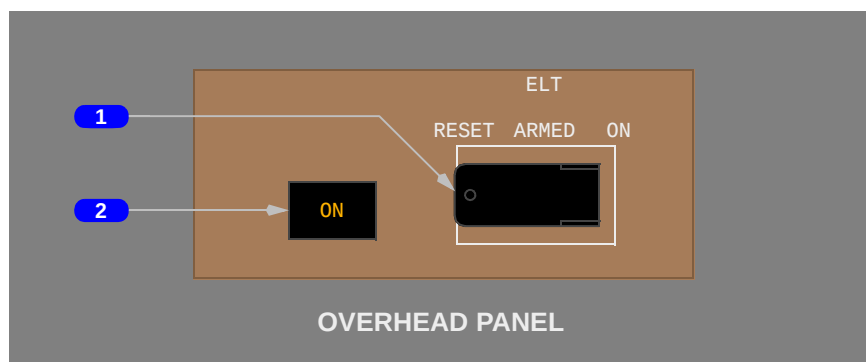
Pull – silences flight deck evacuation audio horn.

5 EVACUATION SIGNAL Horn

Sounds an audio signal.

Emergency Locator Transmitter

VP-BDI, VP-BOQ, VP-BOY



1 Emergency Locator Transmitter (ELT) Switch

ON – ELT transmits continuously.

ARMED – ELT starts transmitting if high deceleration is sensed.

RESET (spring loaded to ARMED position)

- stops ELT transmission - momentary selection (between 1 and 3 seconds) and release
- initiates self-test - select and hold (more than 3 seconds).

Note: The ELT self-test should only be performed by qualified maintenance personnel.

2 Emergency Locator Transmitter ON Light

Illuminated (amber) – ELT is transmitting.



Airplane General, Emergency Equipment, Doors, Windows Systems Description

Chapter 1

Section 40

Introduction

This chapter describes miscellaneous airplane systems, including:

- lighting systems
- oxygen systems
- doors and windows
- flight deck seats

Lighting Systems

Lighting systems described in this chapter include:

- exterior lighting
- flight deck lighting
- emergency lighting

Exterior Lighting

Exterior lighting consists of these lights:

- landing
- runway turnoff
- anti-collision
- navigation (position)
- wing leading edge illumination

**VP-BDI, VP-BMC, VP-BOY, VP-BOZ, VP-BWW, VP-BWX, VQ-BMU,
VQ-BOG**

- taxi
- logo

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 and are optimized for flare and ground roll. The two nose gear–located landing lights are optimized for approach.

The nose gear landing lights are inoperative when the nose landing gear is not down and locked.

Runway Turnoff Lights

Two runway turnoff lights are located in the left and right wing root.

White Anti-collision Lights

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

White anti-collision strobe lights are located on each wing tip.

VP-BOQ

When winglets have been installed, white anti-collision strobe lights are located on the outboard tip of each winglet.

Red Anti-collision Lights

The red anti-collision lights are strobe lights located on the top and bottom of the fuselage.

Navigation Lights

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

The navigation lights are standard red (left forward wingtip), green (right forward wingtip), and white (aft tip of both wings) position lights.

VP-BOQ

On airplanes modified with winglets, the navigation lights are standard red (left forward winglet), green (right forward winglet), and white (inboard trailing edge of both winglets) position lights.

Wing Lights

Wing lights are installed on the fuselage and illuminate the leading edge of the wing.

Taxi Light

VP-BDI, VP-BMC, VP-BOY, VP-BOZ, VP-BWW, VP-BWX, VQ-BMU

The taxi light is installed on the steerable portion of the nose landing gear. The light is inoperative when the nose landing gear is not down and locked.

Taxi Lights

VQ-BOG

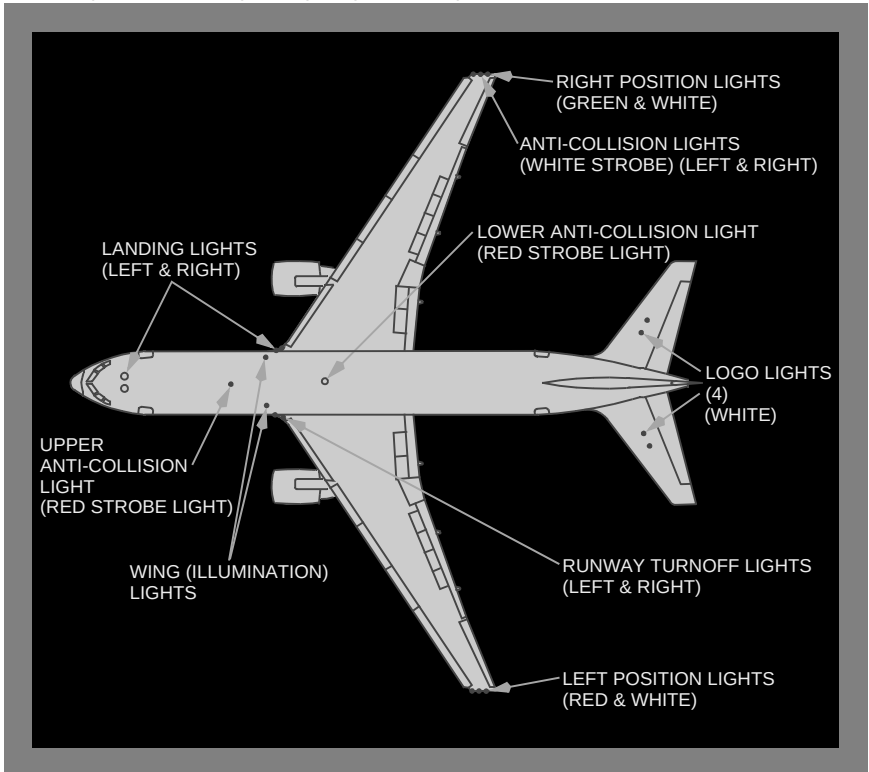
Two taxi lights are installed on the fixed portion of the nose landing gear. The lights are inoperative when the nose landing gear is not down and locked.

Logo Lights

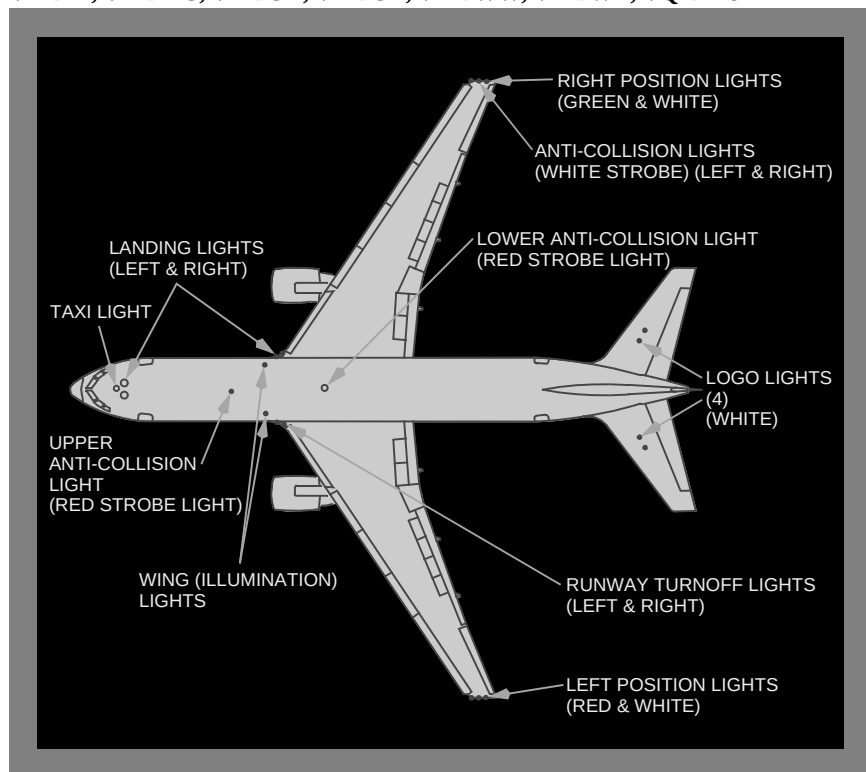
Logo lights are located on the stabilizer to illuminate the logo on the vertical tail surface.

Exterior Lighting Locations

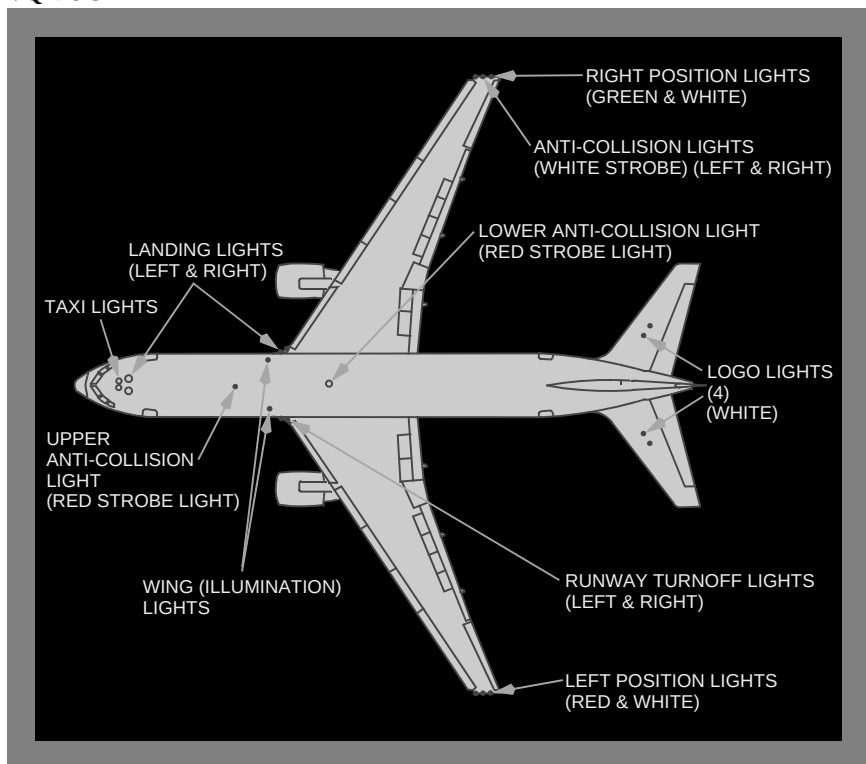
VP-BOQ, VP-BRL, VQ-BMQ, VQ-BPT, VQ-BRA



VP-BDI, VP-BMC, VP-BOY, VP-BOZ, VP-BWW, VP-BWX, VQ-BMU



VQ-BOG



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, chart lights, and utility lights provide localized illumination.

Panel and flood lights illuminate the forward panels, glareshield, and aisle stand panels. When the light override switch is ON, the forward panel flood lights, glareshield flood lights, dome lights, aisle stand flood lights, and all illuminated annunciator lights illuminate at full brightness.

If normal electrical power is lost, the standby magnetic compass light, forward panel flood lights, and integral lights for essential instruments on the left forward, center forward, and overhead panels are automatically switched to the Standby AC bus.

Indicator Lights

Indicator Light brightness can be set to DIM or BRT with the indicator lights selector. The system automatically overrides the DIM position and illuminates the indicator lights full bright under the following conditions:

- The ambient flight deck light level increases to a preset crossover light value as detected by system sensors located on the center forward panel
- Loss of equipment cooling air flow as detected in the flight deck or in the forward E/E compartment
- Equipment cooling air overheat as detected in the flight deck or in the forward E/E compartment or at the cooling air supply source.

Passenger Cabin Signs

The passenger cabin signs are controlled by overhead panel selectors. The passenger signs illuminate when any of the following conditions are satisfied:

FASTEN SEAT BELTS signs (AUTO selected):

- cabin altitude above 10,000 feet
- landing gear not up and locked
- flap lever not up

I VP-BDI through VP-BOY, VP-BRL through VQ-BMQ, VQ-BOG, VQ-BPT
• passenger oxygen on

NO SMOKING signs (AUTO selected):

- cabin altitude above 10,000 feet
- landing gear not up and locked

VP-BOQ

- flap lever not up

I VP-BDI through VP-BOY, VP-BRL through VQ-BMQ, VQ-BOG, VQ-BPT
• passenger oxygen on

VP-BOZ, VQ-BMU, VQ-BRA

All passenger signs can be controlled manually by positioning the respective selector to ON or OFF. When the FASTEN SEAT BELTS and NO SMOKING selectors are in the OFF position, and the cabin altitude exceeds 10,000 feet, the FASTEN SEAT BELTS and NO SMOKING signs illuminate.

I VP-BDI through VP-BOY, VP-BRL through VQ-BMQ, VQ-BOG, VQ-BPT
All passenger signs can be controlled manually by positioning the respective selector to ON or OFF. When the FASTEN SEAT BELTS and NO SMOKING selectors are in the OFF position, and cabin altitude is above 10,000 feet or passenger oxygen is on, the FASTEN SEAT BELTS and NO SMOKING signs illuminate.

VP-BOZ, VQ-BMU, VQ-BRA

RETURN TO SEAT signs are illuminated with the FASTEN SEAT BELTS signs and extinguish when cabin altitude exceeds 10,000 feet.

VP-BDI through VP-BOY, VP-BRL through VQ-BMQ, VQ-BOG, VQ-BPT

RETURN TO SEAT signs are illuminated with the FASTEN SEAT BELTS signs and extinguish when the passenger oxygen is on either automatically or manually.

When the passenger signs illuminate or extinguish, a low tone sounds over the PA system.

Emergency Lighting

The emergency lighting consists of:

- passenger cabin interior emergency lights
- passenger exterior emergency lights
- aft flight deck dome light (one bulb only)

VQ-BMU

- A single flight deck portable exit light

These lights are powered by the emergency lighting system. These lights provide illumination for evacuating the airplane. The system 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 flight attendant switch panel.

When the emergency lights switch on the flight deck is armed, and the slide arming lever is in the SLIDE ARMED position, moving the door handle to the open position will cause the exterior emergency lights on that side of the airplane to illuminate.

VP-BMC, VP-BOY through VP-BRL, VQ-BOG

In addition, when the emergency lights switch on the flight deck is armed, moving an overwing emergency exit door handle to the open position will cause the exterior emergency lights on that side of the airplane to illuminate.

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.

The UNARMED light illuminates and the EICAS advisory message EMER LIGHTS displays if the emergency lights switch is not in the ARMED position.

Interior Emergency Lighting

Interior emergency lighting consists of door, aisle, escape path, and lighted exit signs.

Escape path lighting consists of floor mounted locator lights spaced at intervals in the aisle and exit indicators by each door. When illuminated, escape path lighting provides visual guidance for emergency evacuation if 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.

Exterior Emergency Lighting

VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

Exterior emergency lights are located at each entry door and emergency door.

Lights are also installed in each slide to illuminate the ground at the end of the slide.

VP-BMC, VP-BOY through VP-BRL, VQ-BOG

Exterior emergency lights are located at each entry door and overwing emergency exit door. Lights are also installed in each slide to illuminate the ground at the end of the slide.

Oxygen Systems

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.

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 lower EICAS status display.

VP-BWW through VQ-BMQ, VQ-BPT

The EICAS advisory message LOW CREW OXYGEN 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

VP-BWW through VQ-BMQ, VQ-BPT

Removing the mask also selects the mask microphone and deselects the boom microphone in the removed mask. 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.

Passenger Oxygen System

The passenger oxygen system is supplied by individual chemical oxygen generators. The oxygen system provides oxygen to the passenger, attendant stations, and lavatory service units. The passenger oxygen masks and chemical oxygen generators are located above the passenger seats in passenger service units (PSUs). Oxygen flows from a PSU generator when any mask hanging from that PSU is pulled. The masks automatically drop from the PSUs if cabin altitude exceeds 14,000 feet. The passenger masks can be manually deployed from the flight deck by pushing the passenger oxygen switch. The passenger oxygen ON light illuminates and EICAS advisory message PASS OXYGEN ON displays when the system is activated.

Portable Oxygen Bottles

Portable oxygen bottles are stowed in various locations in the passenger cabin. The bottles are fitted with disposable masks and are used for first aid purposes or as walk-around units.

Doors and Windows

VP-BOY, VP-BOZ

The airplane has six passenger entry doors, two overwing emergency exit doors, one flight deck door (the flight deck/passenger cabin entry), and three cargo doors. It also has electrical equipment and forward equipment bay access doors.

VP-BMC, VP-BRL, VQ-BOG

The airplane has four passenger entry doors, four overwing emergency exit doors, one flight deck door (the flight deck/passenger cabin entry), and three cargo doors. It also has electrical equipment and forward equipment bay access doors.

VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

The airplane has six passenger entry doors, two emergency doors, one flight deck door (the flight deck/passenger cabin entry), and three cargo doors. It also has electrical equipment and forward equipment bay access doors.

The flight deck number two windows, one on the left and one on the right, can be opened by the flight crew.

VP-BMC, VP-BOY through VP-BRL, VQ-BOG

An EICAS message is displayed when a passenger entry door, overwing emergency exit door, cargo door or access door is not closed and latched, and locked.

VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

An EICAS message is displayed when a passenger entry door, emergency door, cargo door or access door is not closed and latched and locked.

Flight Deck Security Door

**VP-BMC, VP-BOQ, VP-BOZ through VQ-BMQ, VQ-BOG, VQ-BPT
(SB Adds VP-BDI, VP-BOY, VQ-BRA when flight deck security door installed.)**

The flight deck security door meets requirements for resistance to ballistic penetration and intruder entrance. The door opens into the flight deck. There is a step between the flight deck and the cabin. When closed, the door locks when electrical power is available and unlocks when electrical power is removed. A viewing lens in the door allows observation of the passenger cabin. The door can be manually opened from the flight deck by turning the door handle.

The door incorporates a deadbolt with a key lock. Rotating both concentric deadbolt levers to the locked (horizontal) position prevents the passenger cabin key from unlocking the door. Rotating only the forward deadbolt lever to locked allows the key to unlock the door.

The flight deck access system consists of an emergency access panel, chime module, Door Lock selector, two indicator lights, and an Access System switch. The emergency access panel includes a six button keypad for entering the numeric 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 overhead panel. Illumination of the amber LOCK FAIL light indicates the door lock has failed or the Access System switch is in the off position.

The emergency access code is used to gain access to the flight deck in case of pilot incapacitation. 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 Security Door

VQ-BMU

The flight deck security door meets requirements for resistance to ballistic penetration and intruder entrance. The door opens into the flight deck. There is a step between the flight deck and the cabin. When closed, the door locks when electrical power is available and unlocks when electrical power is removed. A viewing lens in the door allows observation of the passenger cabin. The door can be manually opened from the flight deck by turning the door handle.

The flight deck access system consists of an emergency access panel, chime module, Door Lock selector, two indicator lights, speaker, and an Access System switch.

The emergency access panel includes a six button keypad for entering the numeric 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 center Aisle stand.

Illumination of the red LOCK FAIL light indicates the door lock has failed.

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 60 seconds.

Annunciation of a flight deck chime and illumination of the red AUTO UNLK light indicates the correct emergency access code has been entered and the door is programmed to unlock after 55 seconds.

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 indicated above. 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.

Features are included to prevent a jammed door due to structural deformation and permit emergency egress. Emergency Egress Instructions are placarded on the cockpit side of the door.

A decompression panel may be utilized as an emergency egress hatch by:

1. Rotating the decompression latch red cover open (located near the center hinge of door) and then pushing the underlying button to unlock the latch.
2. Releasing the decompression door lanyard hook.
3. Pushing the panel into the cabin.

Flight Deck Door

(SB Deletes VP-BDI, VP-BOY, VQ-BRA when flight deck security door installed.)

The flight deck door is hinged and opens into the flight deck. There is a step between the flight deck and the cabin.

An electric lock latch mechanism, controlled by the flight deck door switch, allows the flight deck door to be locked. The door can be opened at any time from the flight deck side. When the door is locked, a key is required to open the door from the passenger cabin side. The door unlocks automatically with the loss of electric power.

A break-away feature allows the door to be forced open in either direction for emergency access to or evacuation from the flight deck.

CAUTION: Forcing the door open into the flight deck causes permanent damage.

Lavatory F1 Remote Lock Control

VP-BWW through VQ-BMQ, VQ-BPT

The F-1 lavatory has a lock system that can reserve the lavatory for use by the crew. The system is controlled by a switch on the pilots overhead panel. The switch when pressed will illuminate ARMED (white) or LKD (green). If the lavatory is in use when pressed the ARMED light will illuminate and will wait until the lavatory is vacated, at which time the LKD light will illuminate and also display a "Reserved For Crew" sign on the exterior wall of the lavatory. The LKD light will illuminate immediately if the lavatory is vacant. The signs will remain illuminated for 10 minutes from LKD light illumination

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. Pressing the Window Lock Release Button frees the Window Lock Lever. The Window Lock Lever locks or unlocks the window. Rotating the window crank opens and closes the window.

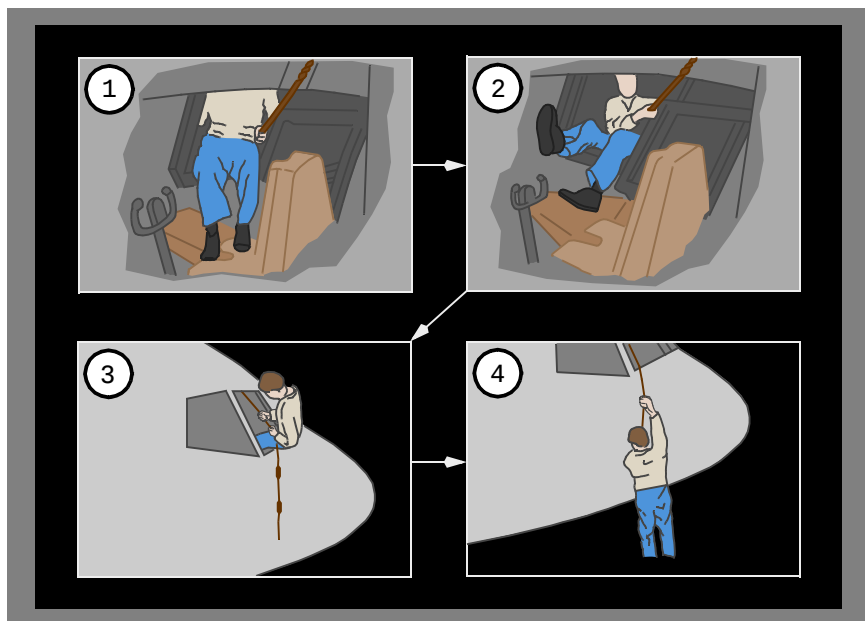
A WINDOW NOT CLOSED placard is visible when the window is open.

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.

Flight Deck Window Emergency Egress

If the flight deck number two windows must be used for emergency evacuation, exit in accordance with the following illustration.

CAUTION: Ensure the rope is securely fastened to the airplane.



Passenger Entry Doors

The passenger entry doors are used to enter and exit the airplane, and also serve as emergency exits. The passenger entry doors are paired along the airplane fuselage. The doors can be opened or closed manually from inside or outside of the airplane.

VP-BMC, VP-BRL, VQ-BOG

Door 1L may be opened or closed electrically through the electrical control panel located adjacent to the door.

VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

Door 1L or 2L may be opened or closed electrically through the electrical control panel located adjacent to the door.

The entry doors are plug-type doors. During opening, the door first moves inward, then upward into the ceiling. The weight of the door is counterbalanced so that very little effort is required for operation. The door is held open by a latch in the upper part of the door frame. In order to close the door it must initially be raised slightly, push and hold the uplatch release button, lower the door approximately 2 inches (5 centimeters). Release button and continue to lower the door.

WARNING: Stand clear of the door handle, the handle may move as the door is lowered.

A window in each door allows observation outside of the airplane.

VP-BMC, VP-BRL, VQ-BOG

The ENTRY DOORS light illuminates and the EICAS advisory message L AFT, L FWD, R AFT, or R FWD ENT DOOR displays when a passenger entry door is not closed and latched and locked. If two doors on the same side of the airplane are not closed and latched and locked, the EICAS advisory message L or R ENTRY DOORS displays.

VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

The ENTRY DOORS light illuminates and the EICAS advisory message L AFT, L CTR, L FWD, R AFT, R CTR or R FWD ENT DOOR displays when a passenger entry door is not closed and latched and locked. If two or more doors on the same side of the airplane are not closed and latched and locked, the EICAS advisory message L or R ENTRY DOORS displays.

Passenger Entry Door and Slide Operation

Emergency evacuation slide and door opening systems are provided for each passenger entry door. A cover in the lower face of the door contains the slide.

For normal operations, the slide must be disarmed before opening the door. Moving the arming lever to the SLIDE DISARMED position causes the door girt bar to detach from the floor, the girt bar visual indication window to completely blank, and the yellow armed indicator to be removed from view. Pulling the Door Handle up will unlock and unseat the door.

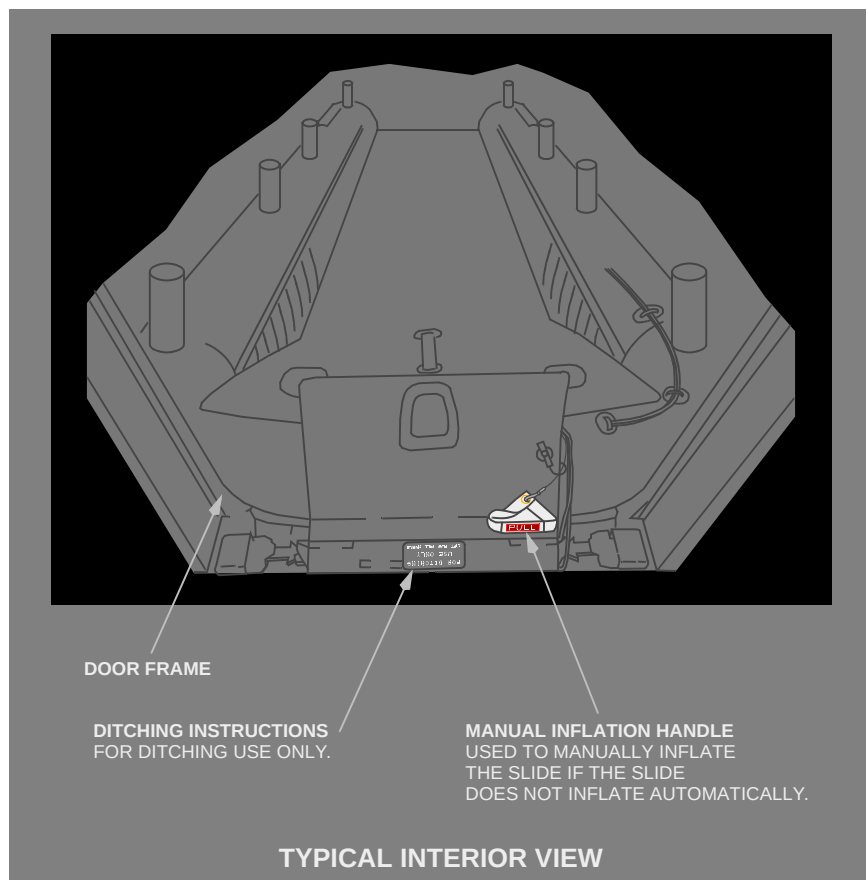
The emergency door opening system is armed by first pressing the arming lever release and then positioning the arming lever to the SLIDE ARMED position. This engages the door girt bar, the girt bar visual indication window will be completely yellow, and armed indicator will be in view. Once armed, rotating the door handle up to the OPEN position unlocks the door and causes the slide to deploy. The door will retract to the full open position, and the slide will inflate automatically.

A manual inflation handle can be pulled if the slide has not automatically inflated.

The emergency door opening system and the slide are automatically disarmed when the door is opened from the outside. If the arming lever is in the ARMED position and the door is opened using the exterior door handle, the arming lever automatically moves to DISARMED and the door opens without slide deployment.

The passenger door evacuation slides are also configured as rafts.

Escape Slide/Raft Deployed



Emergency Doors

VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

An emergency door is located aft of the wing on each side of the airplane. The emergency door is only used as an emergency exit. A slide bustle in the lower face of the door contains an evacuation slide. A window in the door allows observation outside of the airplane.

The emergency door is a plug-type door and is hinged on the bottom. Pulling the door operating handle up lifts the door inward and upward. The door can then be pushed out through the door frame and the slide automatically deploys and inflates.

A manual inflation handle can be pulled if the slide has not automatically inflated.

The EMER DOORS light illuminates and the EICAS advisory message L or R EMER DOOR displays when an emergency door is not closed and latched and locked. If both doors are not closed and latched and locked, the EICAS advisory message EMER DOORS displays.

The emergency door evacuation slides are not configured as rafts, however they may be used as auxiliary flotation devices.

Overwing Emergency Exit Doors

VP-BMC, VP-BOY through VP-BRL, VQ-BOG

Overwing emergency exit doors are located over the wing on each side of the airplane. The overwing emergency exit doors are only used as emergency exits. An overwing evacuation ramp and slide assembly is contained within each wing body fairing. A window in the door allows observation outside of the airplane.

The overwing emergency exit door is a plug-type hatch. The emergency PULL handle opens the door. The door can then be removed from the opening. Opening the overwing emergency exit door automatically deploys and inflates the ramp and slide. Simultaneously, on that side of the airplane, the inboard spoiler is retracted and the exterior emergency lights illuminate.

A manual inflation handle can be pulled if the ramp and slide has not automatically inflated.

The overwing emergency exit door ramp and slide is automatically disarmed when the door is opened from the outside.

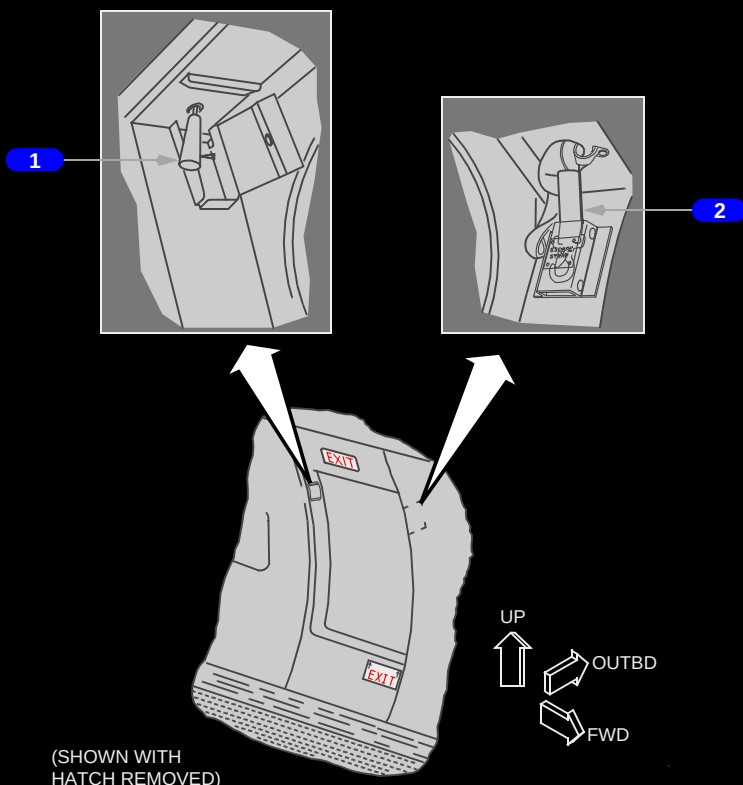
VP-BMC, VP-BRL, VQ-BOG

The EMER DOORS light illuminates and the EICAS advisory message L AFT, L FWD, R AFT or R FWD EMER DOOR displays when an overwing emergency exit door is not closed and latched and locked. The EMER DOORS light also illuminates and the EICAS advisory message L or R WING SLIDE displays if the door to the ramp slide stowage compartment is not closed and latched and locked. The EICAS advisory message EMER DOORS displays if two or more, overwing emergency exit doors or wing slide doors are not closed and latched and locked.

VP-BOY, VP-BOZ

The EMER DOORS light illuminates and the EICAS advisory message L EMER or R EMER DOOR displays when an overwing emergency exit door is not closed and latched and locked. The EMER DOORS light also illuminates and the EICAS advisory message L or R WING SLIDE displays if the door to the ramp slide stowage compartment is not closed and latched and locked. The EICAS advisory message EMER DOORS displays if two or more, overwing emergency exit doors or wing slide doors are not closed and latched and locked.

The overwing emergency exit door ramps and slides are not configured as raft and they may not be used as auxiliary flotation devices.



OVERWING EMERGENCY EXIT

1 Manual Inflation Handle

Pull – Deploys ramp slide in the event normal system fails.

- one per exit

VP-BOY, VP-BOZ

2 Escape Strap

Remove Cover – Pull out and attach hook to wing fitting.

VP-BMC, VP-BRL, VQ-BOG

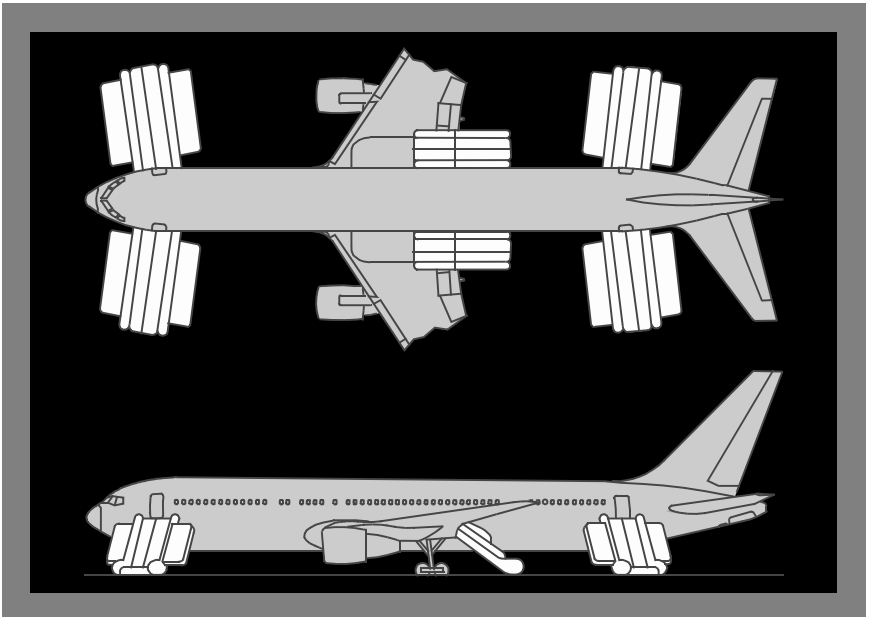
2 Escape Strap (FWD Door only)

Remove Cover – Pull out and attach hook to wing fitting.

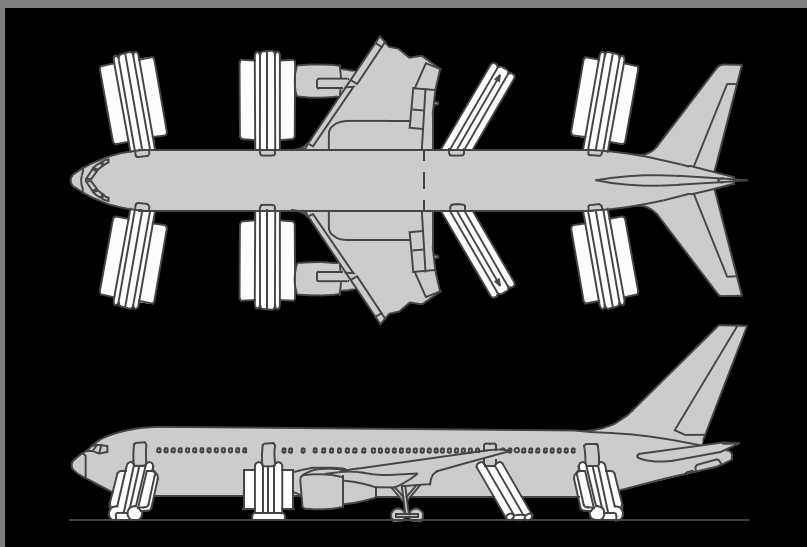
- installed on forward door only

Evacuation Slides

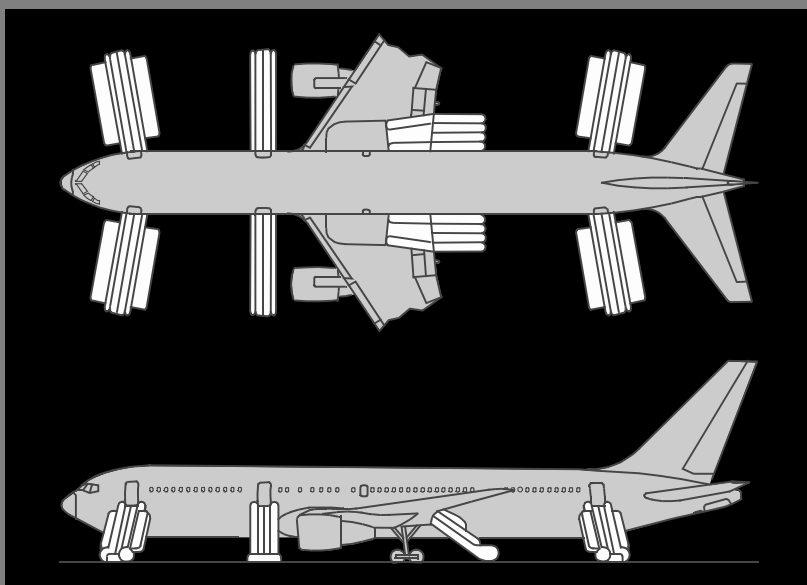
VP-BMC, VP-BRL, VQ-BOG



VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA



VP-BOY, VP-BOZ



Cargo Doors

There are three cargo doors: one AFT, one BULK, and one FWD. The AFT, and FWD doors are located on the right side of the airplane and open upward and outward. The BULK cargo door is on the left side of the airplane.

Both AFT and FWD cargo doors are normally operated electrically from an exterior or interior fuselage-mounted control panel located with each door. If necessary, the forward and aft cargo doors may be operated manually.

On airplanes with a large forward cargo door, locking is accomplished manually.

CAUTION: Do not operate the cargo doors with winds at the door of more than 40 knots. Do not keep the door open when wind gusts are more than 65 knots. Strong winds can cause damage to the structure of the airplane.

The CARGO DOORS light illuminates and the EICAS caution message FWD CARGO DOOR displays when the forward cargo door is not closed and latched and locked. The EICAS advisory message AFT or BULK CARGO DOOR displays when either cargo door is not closed and latched and locked. The EICAS advisory message CARGO DOORS displays if two or more of these cargo doors are not closed and latched and locked.

Flight Deck Seats

The pilot seats:

- recline
- adjust vertically
- adjust forward and aft
- adjust for thigh support
- adjust for the lumbar region of the back

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 four inches of travel. Manual controls provide forward, aft, and vertical adjustment.

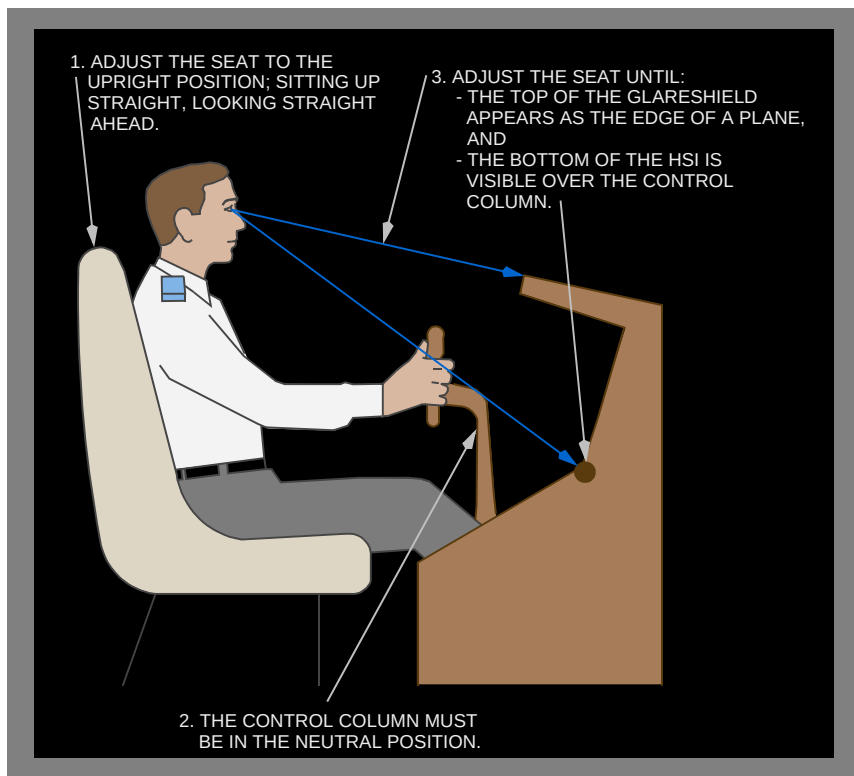
VP-BWW through VQ-BMQ, VQ-BPT

Electrical controls provide forward, aft, and vertical adjustment.

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.

Adjust the seat to obtain the optimum eye position as shown on the following illustration.

Pilot Seat Adjustment





Airplane General, Emergency Equipment, Doors, Windows Emergency Equipment

Chapter 1

Section 45

Introduction

This chapter describes miscellaneous airplane systems, including:

- emergency equipment
- emergency equipment locations

Emergency Equipment

Emergency equipment described in this section includes:

- fire extinguishers
- miscellaneous emergency equipment
- VP-BWW through VQ-BMQ, VQ-BPT**
- emergency evacuation signal system

Fire Extinguishers

Fire extinguishers are located throughout the aircraft. See emergency equipment diagram for location.

The type of fire extinguishers are as follows:

- Halon (BCF)
VP-BDI, VP-BMC, VP-BOY through VQ-BRA
- Water (H₂O)

WARNING: If a 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.

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.

Halon Fire Extinguishers

Halon fire extinguishers contain a liquefied gas agent under pressure. The extinguisher pressure indicator shows three pressure ranges:

- acceptable
- recharge
- overcharged

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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.

Direction for use of the fire extinguisher is printed on the extinguisher.

Water (H₂O) Fire Extinguishers

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

Water fire extinguishers contain a solution of water mixed with anti-freeze. The container is pressurized by a CO₂ cartridge. The extinguisher should be used on fabric, paper or wood fires only.

CAUTION: Do not use on electrical or grease type fires.

To use the Water fire extinguisher, hold the extinguisher upright and rotate the handle fully clockwise. Aim the extinguisher at the base of the flame and pull the trigger.

Miscellaneous Emergency Equipment

Additional equipment is stowed at strategic locations throughout the airplane. This may include a crash axe, megaphones, flashlights and first aid kits. Life vests are stowed at each crew member station and at each passenger seat.

Emergency Locator Transmitters (ELTs)

ELTs are installed in slide/raft bustles. The ELTs automatically transmit when submerged in water.

VP-BDI through VQ-BPT

Portable ELTs may be installed in the passenger cabin, as shown in the Emergency Equipment Locations diagram.

| VP-BDI, VQ-BOG

Portable ELTs may be installed on the flight deck, as shown in the Emergency Equipment Locations diagram.

| VP-BDI, VP-BOQ, VP-BOY, VQ-BOG

Fixed ELT is installed in left overhead panel.

Fuselage Mounted Emergency Locator Transmitter (ELT)

VP-BDI, VP-BOQ, VP-BOY

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 advisory message ELT ON is displayed if the transmitter is activated. The ELT can be deactivated by placing the ELT switch to RESET momentarily (between 1 and 3 seconds), then ARMED.

Escape Ropes

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. Prior to dropping the rope out of the window, ensure the rope is attached by pulling down.

Emergency Evacuation Signal System **VP-BWW through VQ-BMQ, VQ-BPT**

The emergency evacuation signal system alerts the flight attendants to evacuate the passenger cabin. Evacuation command switches are located on the flight deck and at selected flight attendant panels.

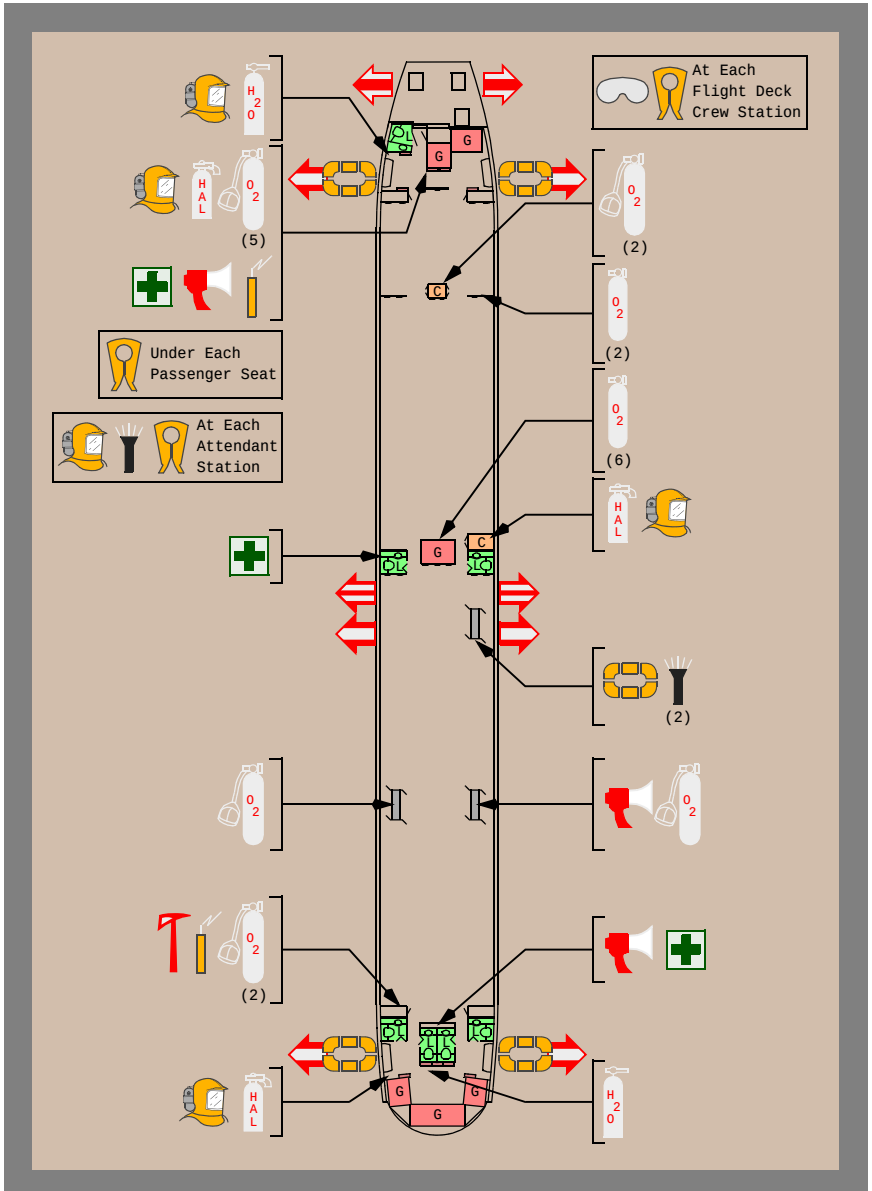
Emergency Equipment Symbols

																				
CO ₂ EXTINGUISHER	WATER EXTINGUISHER	HALON EXTINGUISHER	PRY BAR	FLARE KIT																
																				
PORTABLE OXYGEN BOTTLE	PORTABLE OXYGEN BOTTLE WITH MASK	DUAL O ₂ GENERATOR	PORTABLE BREATHING EQUIPMENT (PBE)	SMOKE HOOD	OXYGEN MASK															
																				
EMERGENCY EXIT PATH	EXIT PATH WITH ESCAPE ROPE	EXIT PATH WITH ESCAPE SLIDE	EXIT PATH WITH ESCAPE SLIDE AND ROPE	EXIT PATH WITH SLIDE/RAFT	SLIDE/RAFT SURVIVAL KIT															
																				
LIFE RAFT	ELT	LIFE VEST	PROTECTIVE GLOVES	SMOKE GOGGLES	CRASH AXE	MEGAPHONE														
																				
BATON	HANDCUFFS	FLASHLIGHT	EMERGENCY MEDICAL KIT	FIRST AID KIT	Defibrillator															
				<table border="1"> <tbody> <tr> <td>A = ATTENDANT STATION</td> <td></td> <td>= CEILING STORAGE</td> </tr> <tr> <td>P = PURSER STATION</td> <td></td> <td>= OVERHEAD STORAGE</td> </tr> <tr> <td>G = GALLEY</td> <td></td> <td></td> </tr> <tr> <td>L = LAVATORY</td> <td></td> <td></td> </tr> <tr> <td>C = CLOSET</td> <td></td> <td></td> </tr> </tbody> </table>		A = ATTENDANT STATION		= CEILING STORAGE	P = PURSER STATION		= OVERHEAD STORAGE	G = GALLEY			L = LAVATORY			C = CLOSET		
A = ATTENDANT STATION		= CEILING STORAGE																		
P = PURSER STATION		= OVERHEAD STORAGE																		
G = GALLEY																				
L = LAVATORY																				
C = CLOSET																				
AIR VIVA KIT	TRACHEOTOMY MASK	RESUSCITATOR	WHEEL CHAIR	NOTE: Some symbols do not apply to all configurations. NOTE: ("n") below symbol means quantity greater than one.																

Emergency Equipment Locations

VP-BMC, VP-BRL, VQ-BOG

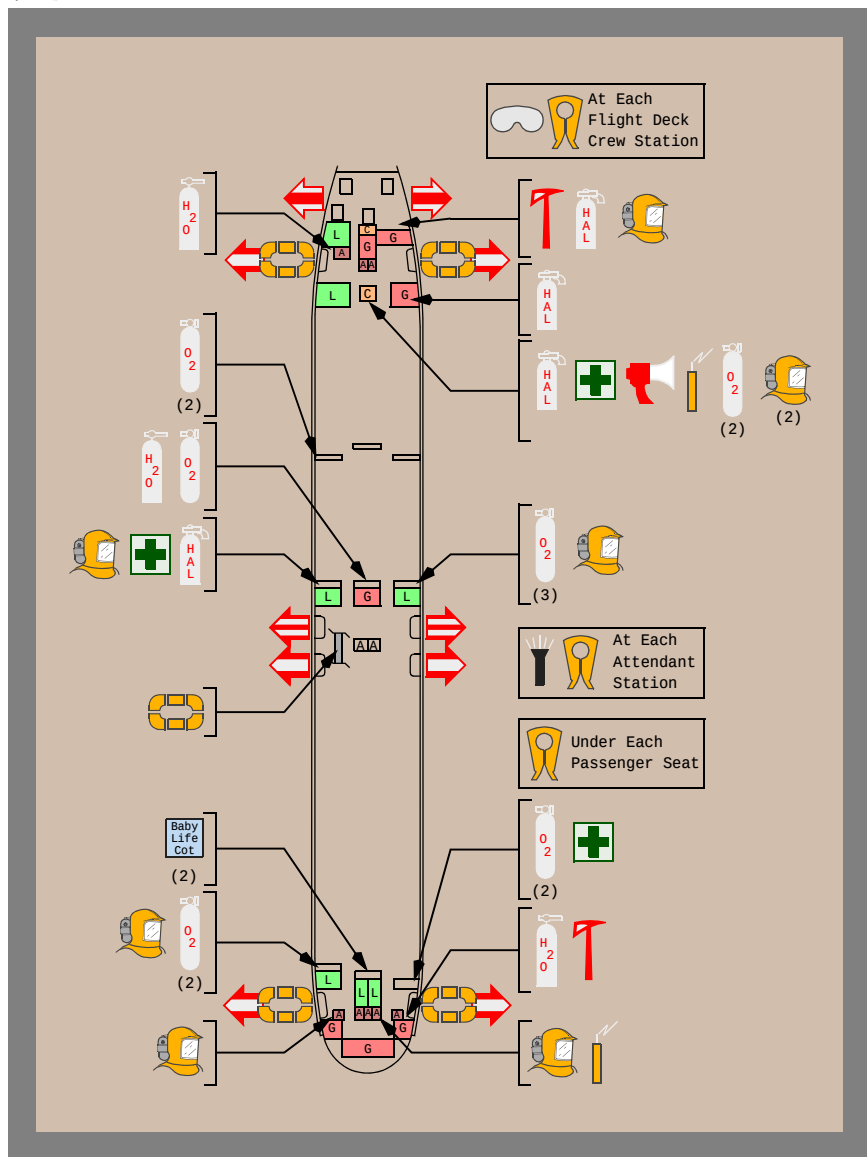
VQ-BOG



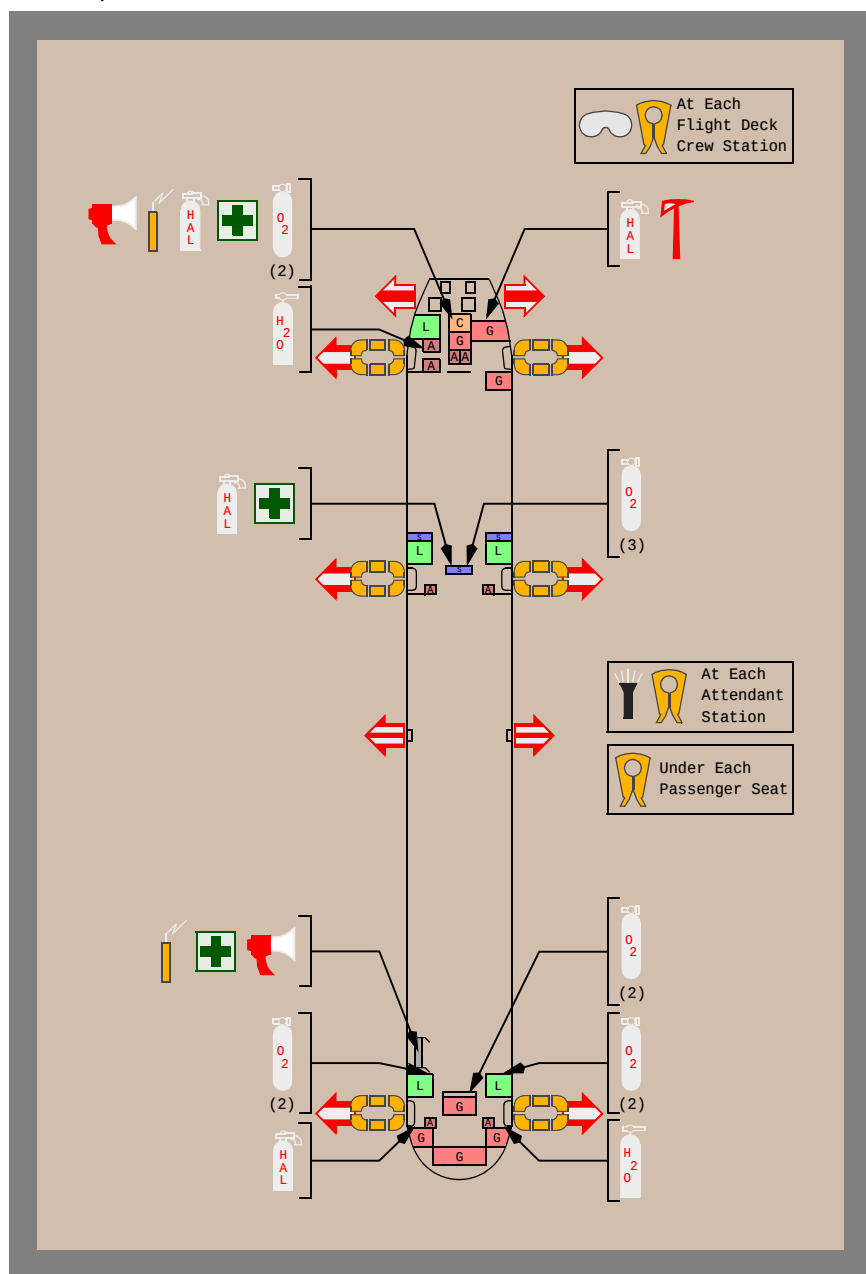
The diagram illustrates the layout of an aircraft cabin with various emergency equipment locations marked. Key features include:

- Legend:**
 - At Each Flight Deck Crew Station:** Oxygen mask, fire extinguisher, and first aid kit.
 - At Each Attendant Station:** Fire extinguisher and first aid kit.
 - Under Each Passenger Seat:** Oxygen mask.
- Equipment Locations:**
 - Flight Deck:** Oxygen mask, fire extinguisher, and first aid kit at each crew station.
 - Forward Cabin:**
 - First aid kit and fire extinguisher at the front attendant station.
 - First aid kit and fire extinguisher at the front passenger seat.
 - First aid kit and fire extinguisher at the front of the cabin.
 - Mid-Cabin:**
 - First aid kit and fire extinguisher at the mid-cabin attendant station.
 - First aid kit and fire extinguisher at the mid-cabin passenger seat.
 - First aid kit and fire extinguisher at the mid-cabin of the cabin.
 - Aft Cabin:**
 - First aid kit and fire extinguisher at the aft attendant station.
 - First aid kit and fire extinguisher at the aft passenger seat.
 - First aid kit and fire extinguisher at the aft of the cabin.

VP-BRL

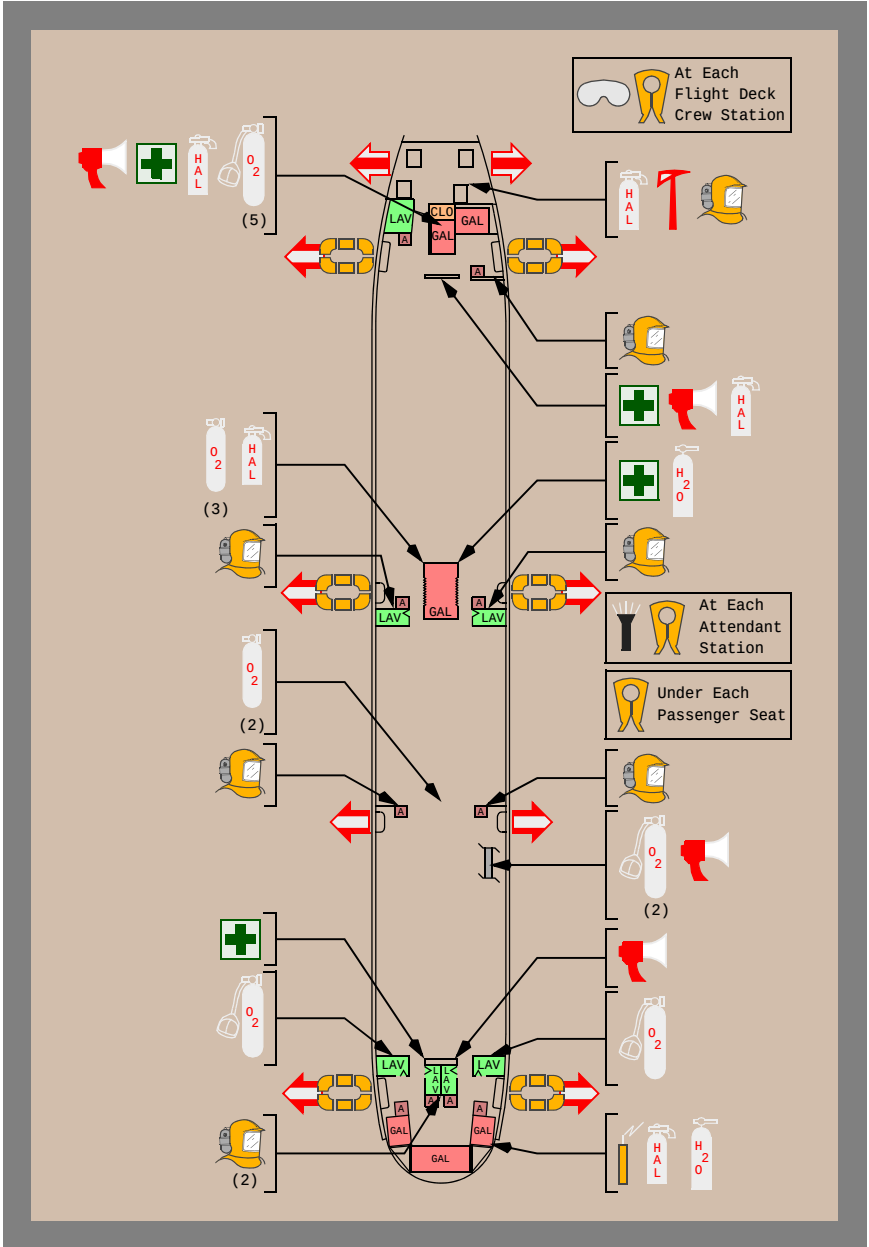


VP-BOY, VP-BOZ

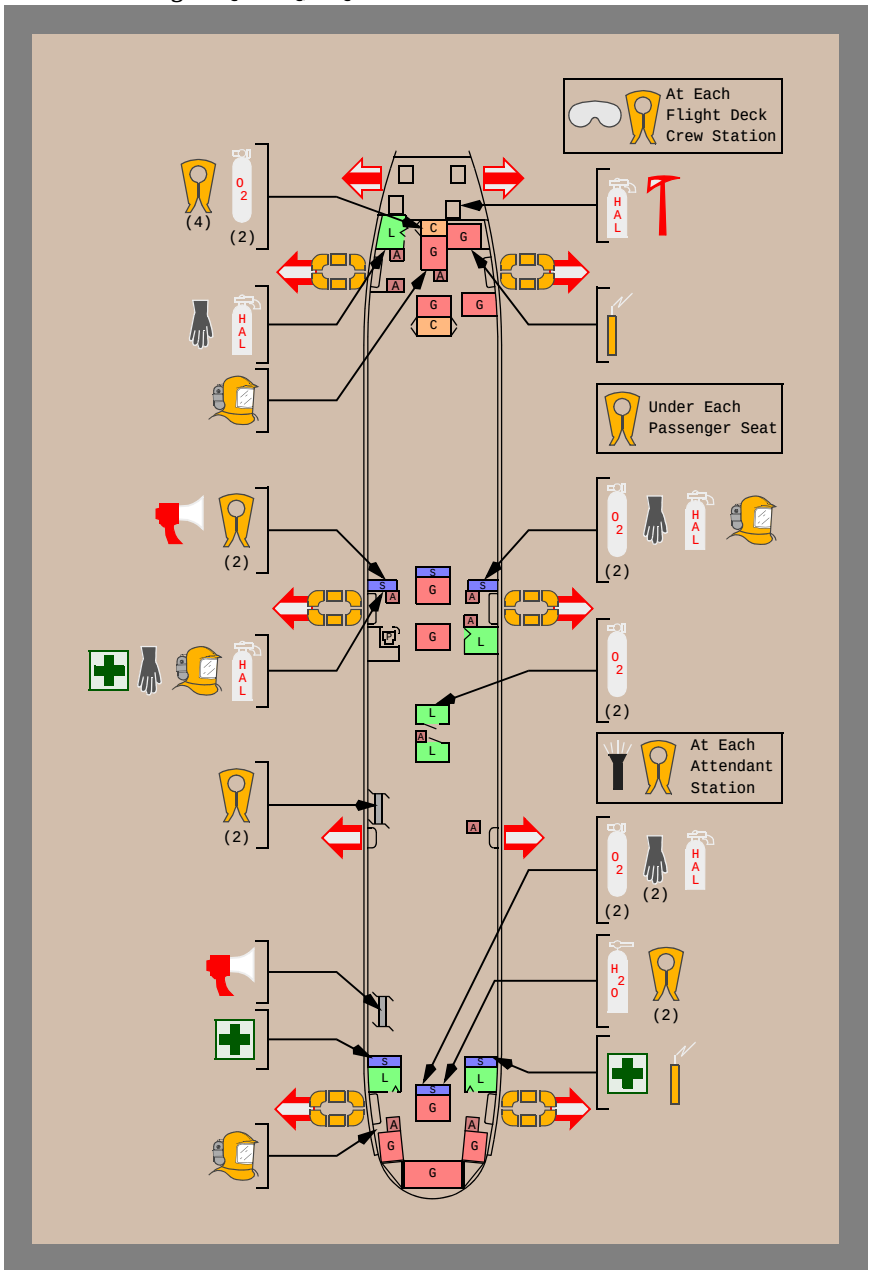


VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

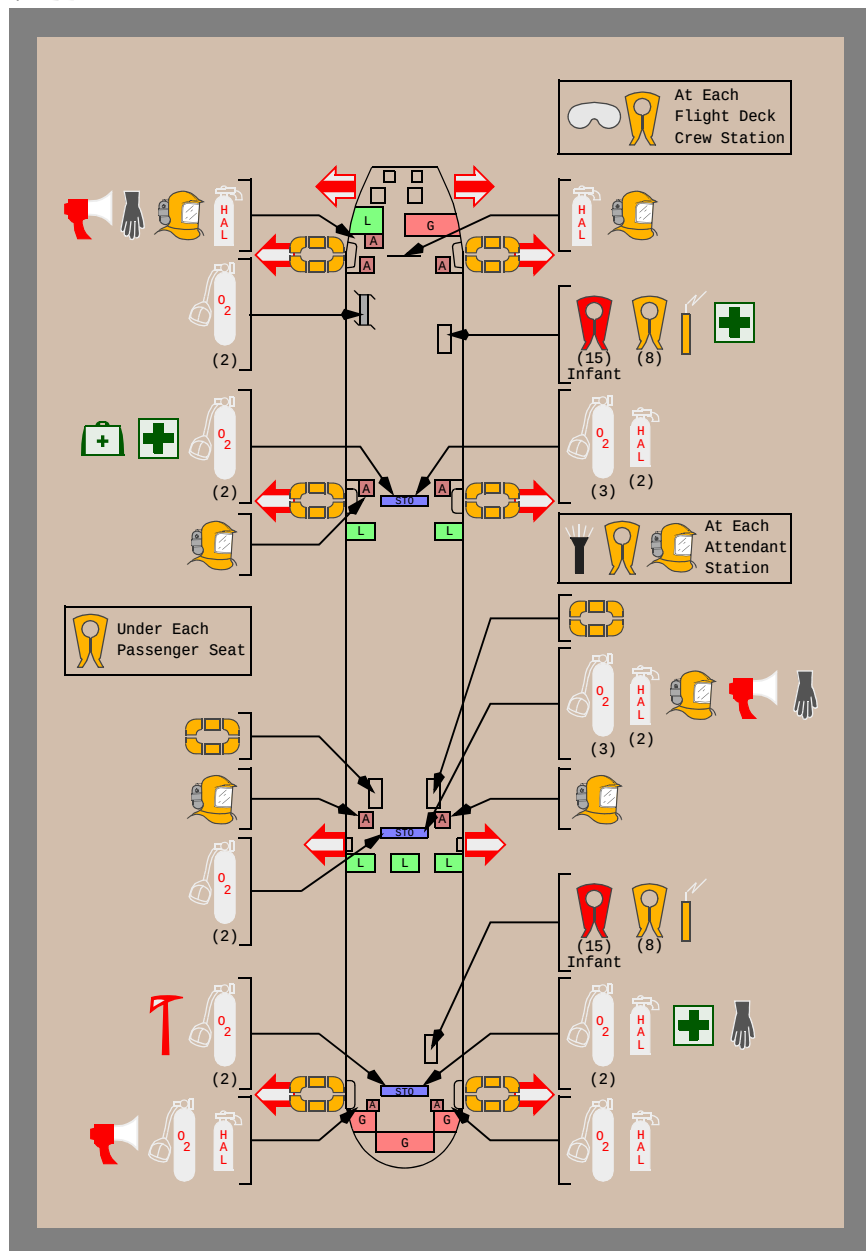
VQ-BRA



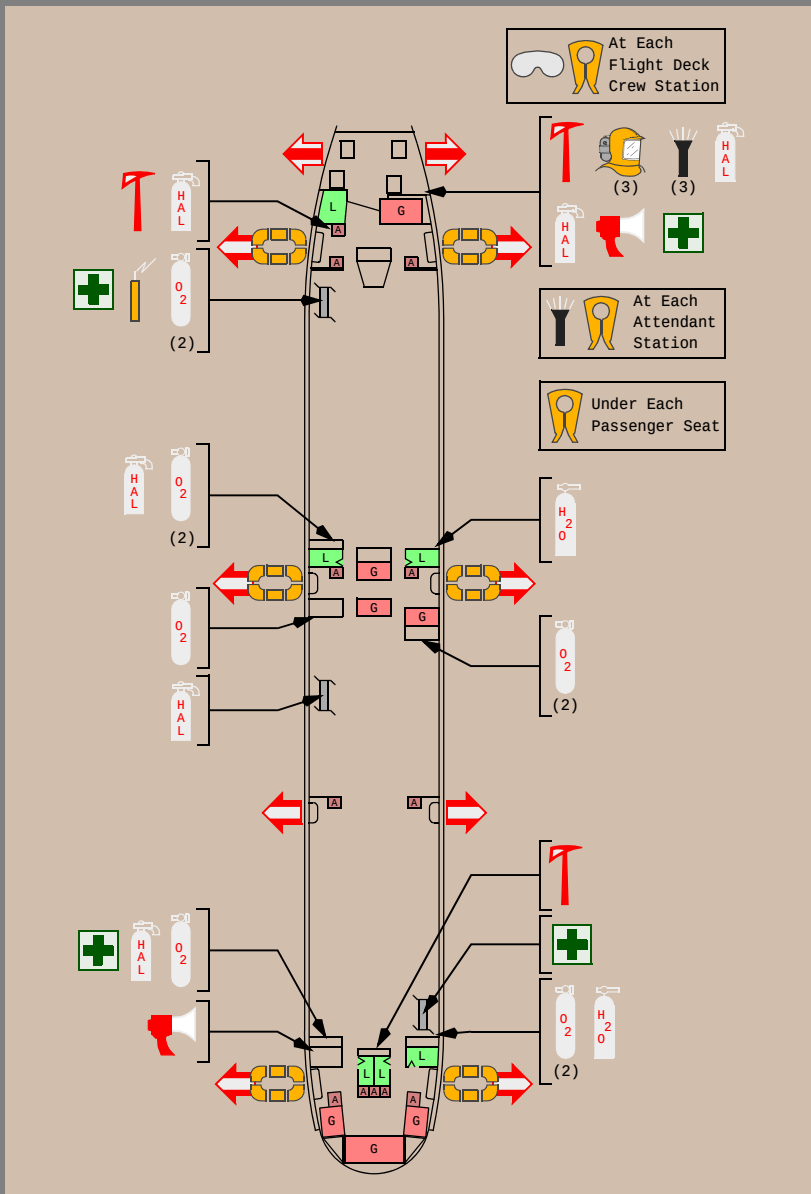
VP-BWW through VQ-BMQ, VQ-BPT



VP-BDI



VQ-BMU



Intentionally
Blank

**Airplane General, Emergency
Equipment, Doors, Windows
EICAS Messages****Chapter 1****Section 50****Airplane General, Emergency Equipment, Doors, Windows
EICAS Messages**

The following EICAS messages may be displayed.

Access Doors

Message	Level	Light	Aural	Condition
ACCESS DOORS	Advisory	ACCESS DOORS		Forward equipment bay and electrical equipment compartment access doors are not closed, latched, and locked.
E/E ACCESS DOOR	Advisory	ACCESS DOORS		Electrical equipment access door is not closed, latched, and locked.
FWD ACCESS DOOR	Advisory	ACCESS DOORS		The forward equipment bay access door is not closed, latched, and locked.

Cargo Doors

Message	Level	Light	Aural	Condition
CARGO DOORS	Advisory	CARGO DOORS		Two or more cargo doors are not closed, latched, and locked.
AFT CARGO DOOR	Advisory	CARGO DOORS		Cargo door is not closed, latched, and locked.
BULK CARGO DOOR	Advisory	CARGO DOORS		Cargo door is not closed, latched, and locked.

Message	Level	Light	Aural	Condition
FWD CARGO DOOR	Caution	CARGO DOORS		Cargo door is not closed, latched, and locked.

Entry Doors

Message	Level	Light	Aural	Condition
L ENTRY DOORS R ENTRY DOORS	Advisory	ENTRY DOORS		Two or more entry doors on the same side are not closed, latched, and locked.
L AFT ENT DOOR R AFT ENT DOOR	Advisory	ENTRY DOORS		Entry door is not closed, latched, and locked.

VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

L CTR ENT DOOR R CTR ENT DOOR	Advisory	ENTRY DOORS		Entry door is not closed, latched, and locked.

L FWD ENT DOOR R FWD ENT DOOR	Advisory	ENTRY DOORS		Entry door is not closed, latched, and locked.

Emergency Exit Doors

VP-BDI, VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

Message	Level	Light	Aural	Condition
EMER DOORS	Advisory	EMER DOORS		Both emergency doors are not closed, latched, and locked
L EMER DOOR R EMER DOOR	Advisory	EMER DOORS		Emergency door is not closed, latched, and locked.

Overwing Emergency Exit Doors

VP-BMC, VP-BOY through VP-BRL, VQ-BOG

Message	Level	Light	Aural	Condition
EMER DOORS	Advisory	EMER DOORS		Two or more emergency doors are not closed, latched, and locked (overwing emergency exit door) . or (wing slide compartment door).

VP-BOY, VP-BOZ

L EMER DOOR R EMER DOOR	Advisory	EMER DOORS		An overwing emergency exit door is not closed, latched, and locked.

VP-BMC, VP-BRL, VQ-BOG

L AFT EMER DOOR R AFT EMER DOOR	Advisory	EMER DOORS		An overwing emergency exit door is not closed, latched, and locked.

VP-BMC, VP-BRL, VQ-BOG

L FWD EMER DOOR R FWD EMER DOOR	Advisory	EMER DOORS		An overwing emergency exit door is not closed, latched, and locked.

L WING SLIDE R WING SLIDE	Advisory	EMER DOORS		Wing slide compartment door is not closed, latched, and locked.

Emergency Lights

Message	Level	Light	Aural	Condition
EMER LIGHTS	Advisory	UN-ARMED		The emergency lights switch is not in the Armed position.

Oxygen System

Message	Level	Light	Aural	Condition

VP-BWW through VQ-BMQ, VQ-BPT

LOW CREW OXYGEN	Advisory			Crew oxygen pressure is low.

PASS OXYGEN ON	Advisory	ON		Passenger oxygen system is activated.

Emergency Locator Transmitter (ELT)

VP-BDI, VP-BOQ, VP-BOY

Message	Level	Aural	Condition
ELT ON	Advisory		An ELT has been activated.

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Air Systems

Controls and Indicators

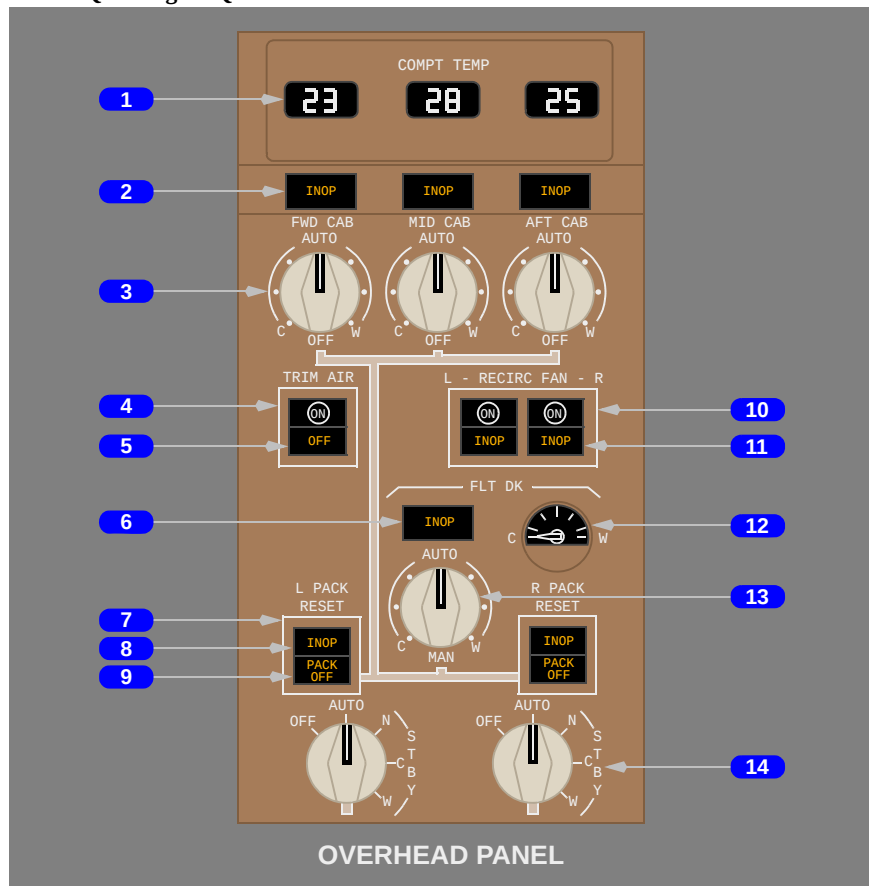
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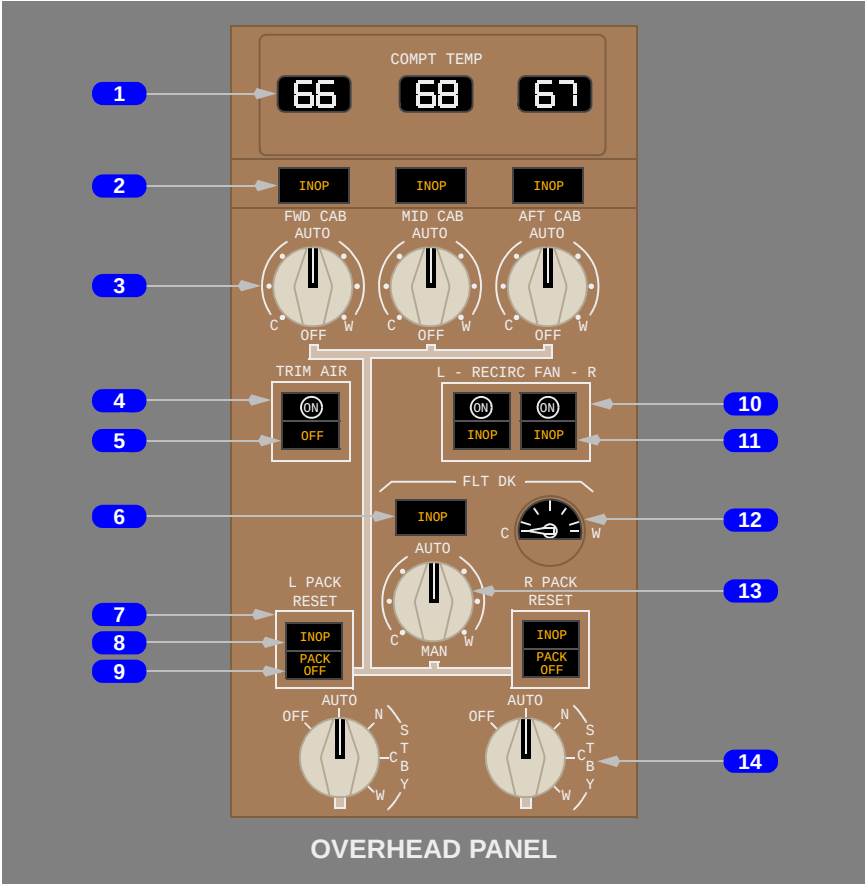
Air Conditioning System

Air Conditioning Control Panel

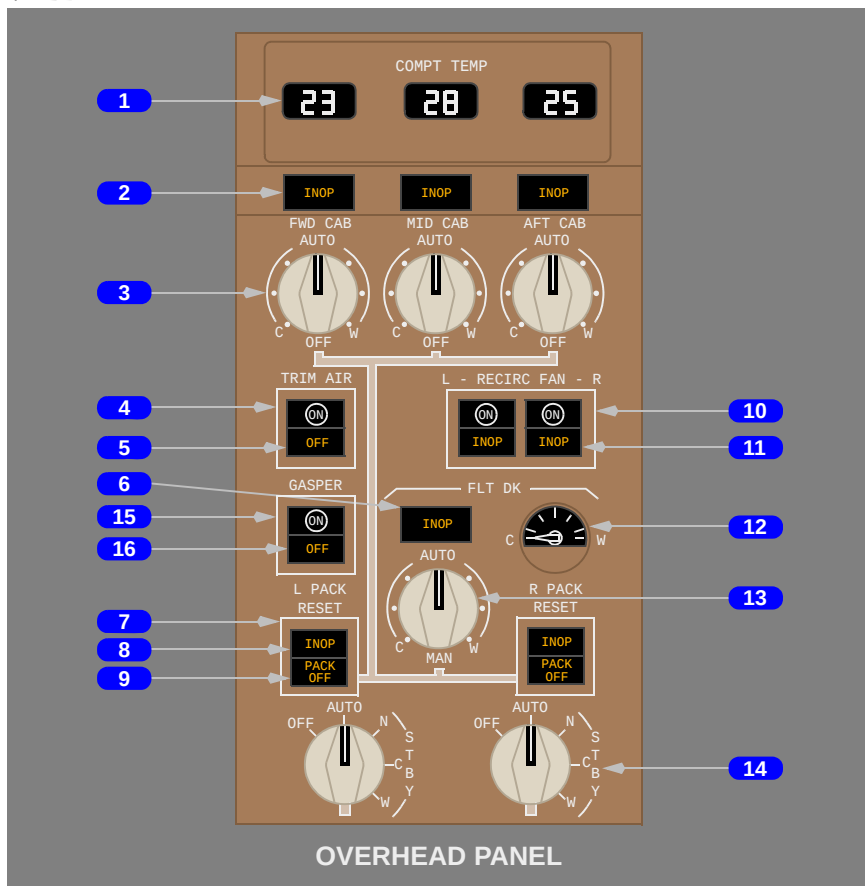
VP-BOQ through VQ-BRA



VP-BMC



VP-BDI



1 Compartment Temperature (COMPT TEMP) Indicators

Displays actual temperature sensed in the compartment.

2 Compartment Temperature Inoperative (INOP) Lights

Illuminated (amber) –

- fault in the zone temperature controller
- the Compartment Temperature Control is OFF
- the trim air switch is OFF.

3 Compartment Temperature Controls

AUTO –

- provides automatic compartment temperature control

VP-BDI, VP-BOQ through VQ-BRA

- rotating the control toward C (cool) or W (warm) sets the desired temperature between 18 degrees C and 30 degrees C.

VP-BMC

- rotating the control toward C (cool) or W (warm) sets the desired temperature between 65 degrees F and 85 degrees F.

OFF –

- closes the compartment trim air valve
- the compartment temperature INOP light illuminates.

4 TRIM AIR Switch

ON – the trim air valve is commanded open.

Off (ON not visible) – the trim air valve is commanded closed.

5 Trim Air OFF Light

Illuminated (amber) – the TRIM AIR switch is off.

6 Flight Deck (FLT DK) Temperature Inoperative (INOP) Light

Illuminated (amber) –

- fault in the zone temperature controller.
- the trim air switch is OFF.

7 PACK RESET Switches

Push – resets an overheated pack if the pack has cooled to a temperature below the overheat level.

8 Pack Inoperative (INOP) Light

Illuminated (amber) –

- the pack is overheated
- fault in the automatic control system.

9 PACK OFF Lights

Illuminated (amber) – pack valve is closed.

10 Recirculation Fan (RECIRC FAN) Switches

ON – the recirculation fan operates

767 Flight Crew Operations Manual

Off (ON not visible) – the recirculation fan does not operate.

11 Recirculation Fan Inoperative (INOP) Lights

Illuminated (amber) –

- the recirculation fan is failed or is not operating.
- the RECIRC FAN switch is off.

12 Flight Deck Trim Air Valve Position Indicator

C (cool) – valve closed.

W (warm) – valve open.

13 Flight Deck Compartment Temperature Control

AUTO –

- provides automatic flight deck temperature control

VP-BDI, VP-BOQ through VQ-BRA

- rotating the control toward C (cool) or W (warm) sets the desired temperature between 18 degrees C and 30 degrees C.

VP-BMC

- rotating the control toward C (cool) or W (warm) sets the desired temperature between 65 degrees F and 85 degrees F.

MAN –

- provides manual control of compartment trim air valve
- spring loaded to the 6 o'clock position in this sector.

14 PACK Control Selectors

OFF – closes the pack valve.

AUTO – the pack is automatically controlled.

STBY –

- N (normal) – regulates the pack outlet temperature to a constant, moderate temperature.
- C (cool) – sets the pack to full cold operation.
- W (warm) – sets the pack to full warm operation.

VP-BDI**15 GASPER Fan Switch**

ON – the gasper fan is signaled on.

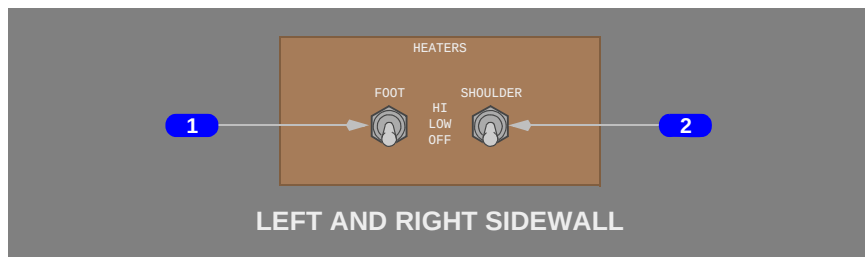
Off (ON not visible) – the gasper fan is signaled off.

VP-BDI

16 Gasper Fan OFF light

Illuminated (amber) – the GASPER fan switch is ON but the gasper fan is not operating.

Shoulder and Foot Heaters



1 FOOT HEATERS Switch

HIGH – the electric heater adds heat at high setting to the conditioned air flowing to the rudder pedal area in flight only.

LOW – the electric heater adds heat at low setting to the conditioned air flowing to the rudder pedal area in flight only.

OFF – the electric heater is not operating (no heat added to the conditioned air flowing to the rudder pedal area).

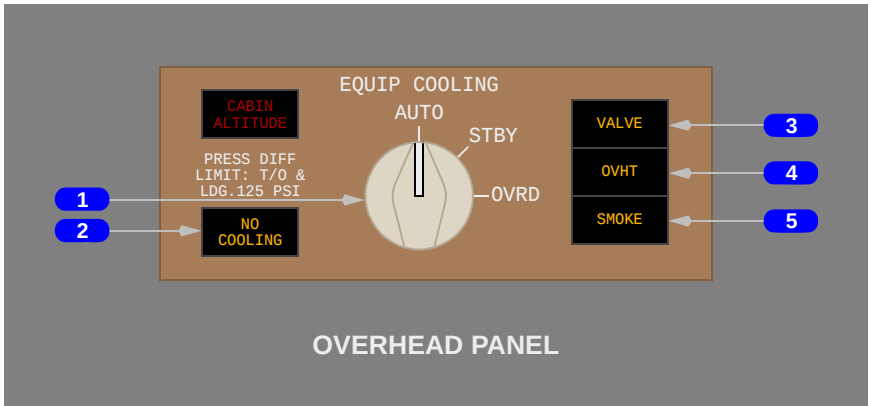
2 SHOULDER HEATERS Switch

HIGH – the electric heater adds heat at high setting to the conditioned air flowing to the side window area in flight only.

LOW – the electric heater adds heat at low setting to the conditioned air flowing to the side window area in flight only.

OFF – the electric heater is not operating (no heat added to the conditioned air flowing to the side window area).

Equipment Cooling Panel



1 Equipment (EQUIP) COOLING Selector

AUTO – automatically controls equipment cooling system.

STBY – positions equipment cooling system for inboard air flow.

OVRD – positions equipment cooling system for reverse air flow.

2 NO COOLING Light

Illuminated (amber) –

- active in OVRD only
- no reverse air flow through the E/E compartment avionics.

3 VALVE Light

Illuminated (amber) – equipment cooling valves are not in their commanded position.

4 Overheat (OVHT) light

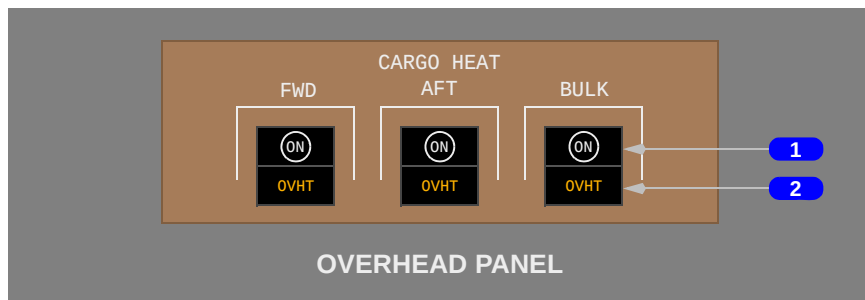
Illuminated (amber) – high temperature or low airflow in the equipment cooling system.

5 SMOKE Light

Illuminated (amber) – smoke in the equipment cooling system.

Cargo Heating

Cargo Heat Panel



1 CARGO HEAT Switches

ON – provides power for heat valves to cycle open and closed for automatic temperature control

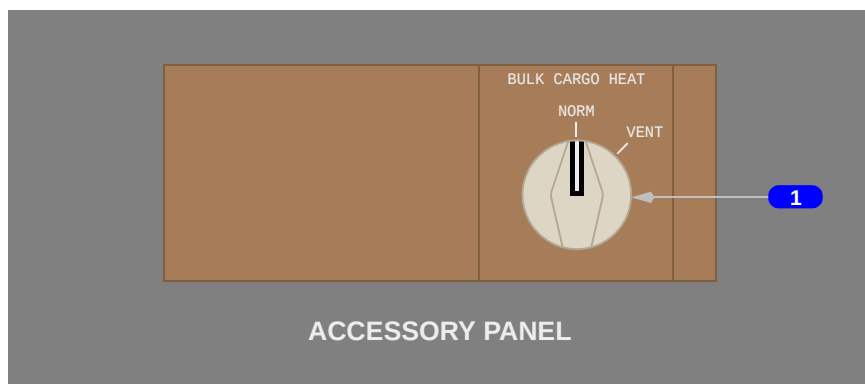
Off (ON not visible)– the heat valves are commanded closed

2 Cargo Heat Overheat (OVHT) Lights

Illuminated (amber) –

- cargo compartment temperature above standard control range
- shutoff valve signaled closed

Bulk Cargo Heat Panel



1 BULK CARGO HEAT Selector

Bulk cargo heat switch must be on

NORM – standard cargo heating range

VENT –

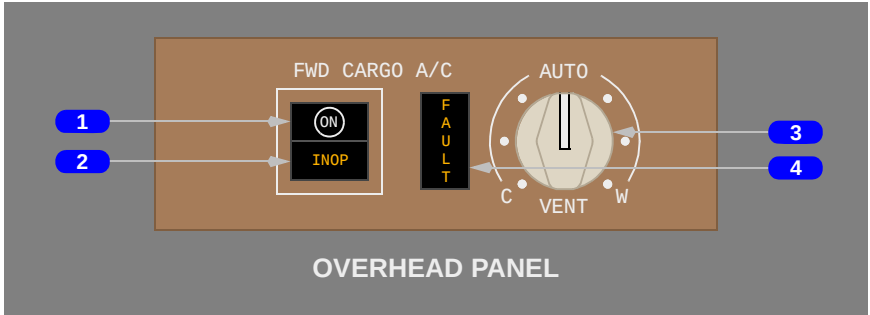
- requests higher temperature control range than NORM
- turns on ventilating fan for bulk cargo compartment

Cargo Air Conditioning

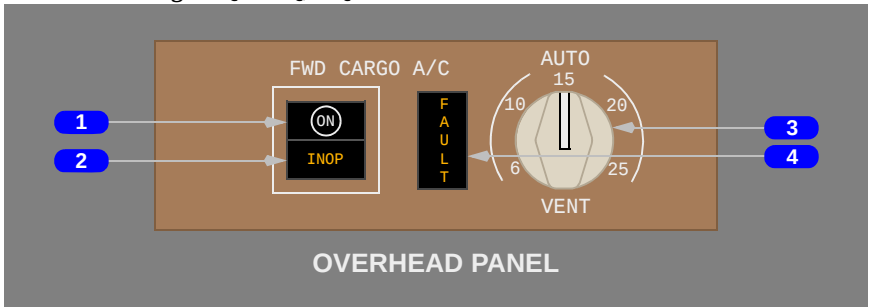
VP-BWW through VQ-BMU, VQ-BPT

Forward Cargo Air Conditioning Panel

VQ-BMU



VP-BWW through VQ-BMQ, VQ-BPT



VQ-BMU

1 Forward Cargo Air Conditioning (FWD CARGO A/C)/Vent Fan Switch

ON – provides power to the system

OFF (ON not visible)

- removes power from the system
- inhibits INOP light

VP-BWW through VQ-BMQ, VQ-BPT

1 Forward Cargo Air Conditioning (FWD CARGO A/C) Switch

ON – provides power to the system

OFF (ON not visible) – inhibits INOP light

- removes power from the system
- inhibits INOP light

2 Inoperative (INOP) Light

Illuminated (amber) – system has failed

VQ-BMU

3 Forward Cargo Air Conditioning Temperature Control

AUTO –

- provides automatic temperature control for forward cargo compartment
- changes desired temperature output by rotating the control towards C (cool) or W (warm)

VENT – selects ventilation operation only

VP-BWW through VQ-BMQ, VQ-BPT

3 Forward Cargo Air Conditioning Temperature Control

AUTO

- provides automatic temperature control for forward cargo compartment
- changes temperature output by rotating the control toward the desired setting

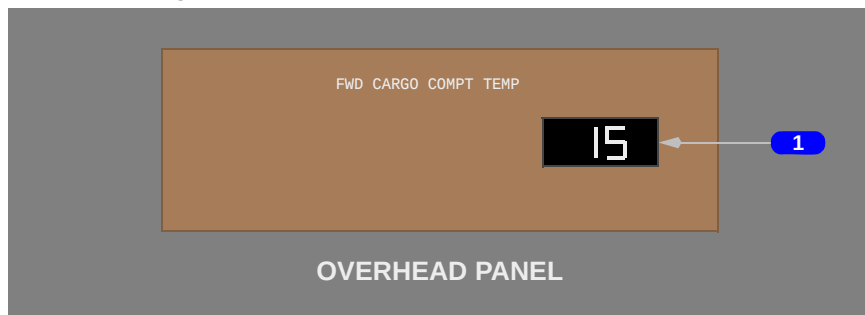
VENT – selects ventilation operation only

4 FAULT Light

Illuminated (amber) –

- fault in forward cargo compartment temperature control system
- both cargo ground valves failed open
- system is operating in backup mode

VP-BWW through VQ-BMQ, VQ-BPT

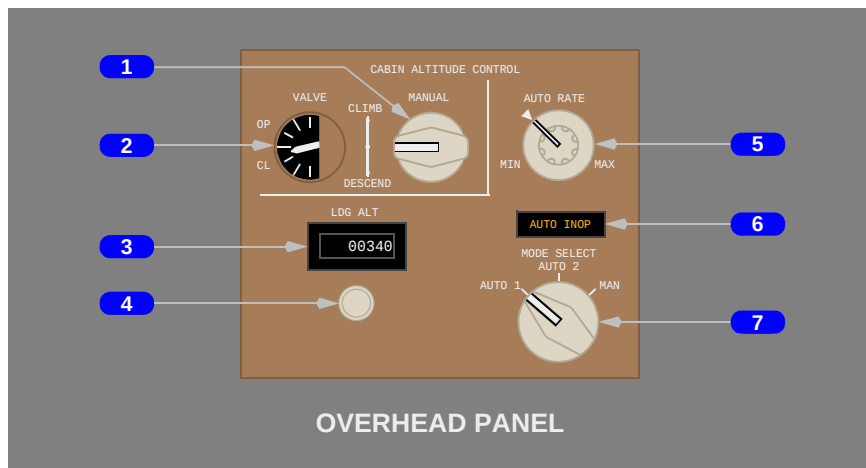


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1 Forward Cargo Compartment Temperature (FWD CARGO COMPT TEMP) Indicator

Displays actual temperature sensed in the compartment

Pressurization System Cabin Altitude Controls



1 Cabin Altitude MANUAL Control

Spring – loaded to center.

Controls cabin outflow valve position with the Cabin Altitude Mode Selector in manual (MAN) mode.

CLIMB – moves outflow valve toward open.

DESCEND – moves outflow valve toward closed.

2 Outflow VALVE Position Indicator

OP – Open.

CL – Closed

3 Landing Altitude (LDG ALT) Indicator

Feet.

Displays selected landing altitude.

4 Landing Altitude (LDG ALT) Selector

Rotate – sets landing altitude indicator.

5 Cabin Altitude AUTO RATE Control

Rotate –

- sets limit for cabin altitude rate of climb or descent during auto control
- index mark establishes approximately 500 fpm climb and 300 fpm descent.

6 AUTO Inoperative (INOP) Light

Illuminated (amber) –

- AUTO 1 and AUTO 2 cabin altitude control functions are inoperative
- MAN mode is selected.

7 Cabin Altitude MODE SELECTOR

AUTO 1 –

- activates Auto 1 cabin altitude control for automatic operation
- outflow valve positioned automatically.

AUTO 2 –

- activates Auto 2 cabin altitude control for automatic operation
- outflow valve positioned automatically.

MAN (Manual) –

- outflow valve position is controlled by the cabin altitude MANUAL control
- AUTO INOP light illuminates.

Cabin Altitude Indicators



1 Cabin Differential Pressure Indicator

Pounds per square inch (psi).

2 Cabin Altitude

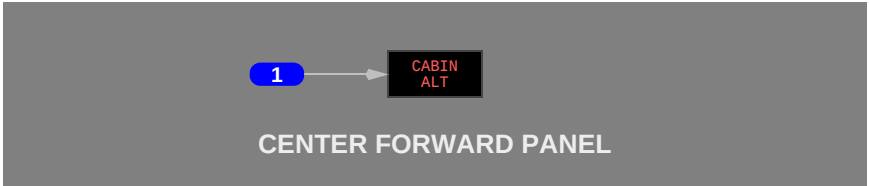
Feet x 1,000.

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3 Cabin Altitude Rate

Feet per minute (fpm x 1,000).

Cabin Altitude (CABIN ALT) Light

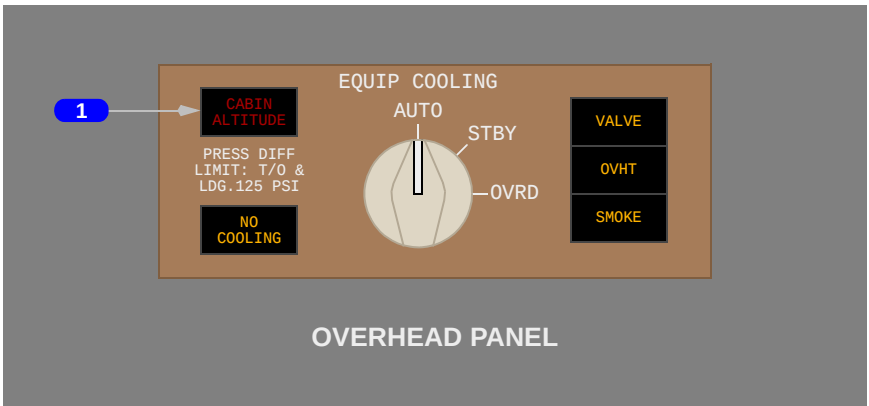


1 Cabin Altitude Light

Illuminated (red) –

- cabin altitude exceeds 10,000 feet
- extinguishes when cabin altitude descends below 8,500 feet.

Cabin Altitude Light



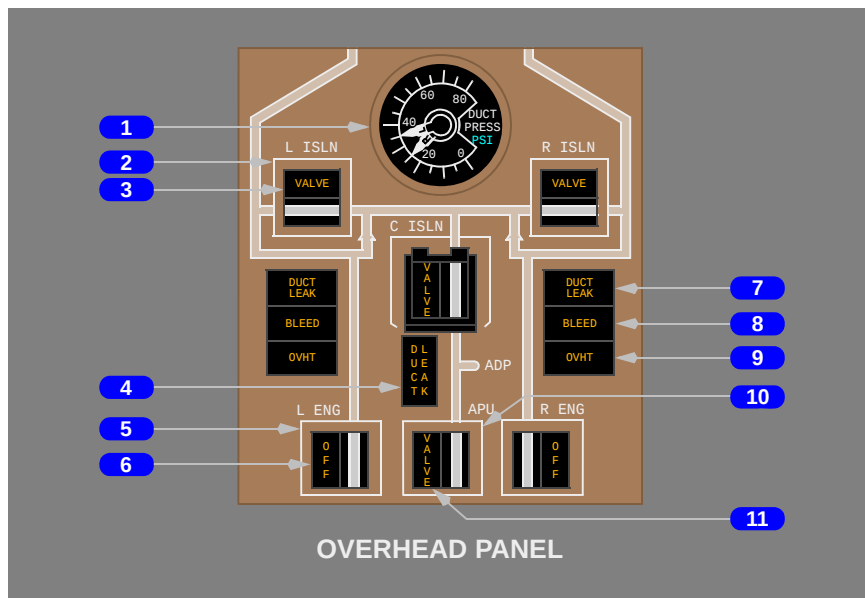
1 Cabin Altitude Light

Illuminated (red) –

- cabin altitude exceeds 10,000 feet
- extinguishes when cabin altitude descends below 8,500 feet.

Bleed Air System

Bleed Air Control Panel



1 Duct Pressure (DUCT PRESS) Indicators

Pounds per square inch (PSI).

2 Isolation (ISLN) Switches

On (bar in view) – commands isolation valves to open.

Off (bar not in view) – commands isolation valves to close.

3 Isolation VALVE Lights

Illuminated (amber) – isolation valve position disagrees with commanded position.

4 DUCT LEAK Light

Illuminated (amber) – a high temperature bleed air leak is detected in the center pneumatic duct.

5 Engine (ENG) Bleed Air Switches

On (bar in view) – the engine bleed air valve opens when engine bleed air is available.

767 Flight Crew Operations Manual

Off (bar not in view) – valve is manually commanded closed.

6 Engine Bleed Air OFF Lights

Illuminated (amber) – engine bleed air valve is closed:

- automatically due to a system fault
- the switch is OFF
- the engine is not running.

7 DUCT LEAK Lights

Illuminated (amber) – a high temperature bleed air leak is detected in the left, right, or engine strut pneumatic duct.

8 Engine BLEED Lights

Illuminated (amber) – the engine high pressure bleed air valve and/or pressure regulating valves are open when they should be closed.

9 Engine Bleed Air Overheat (OVHT) Lights

Illuminated (amber) –

- engine bleed air overtemp
- engine bleed valves automatically closed.

10 APU Bleed Air Switch

On (bar in view) – the APU bleed air valve is automatically controlled

Off (bar not in view) – commands APU bleed air valve to close.

11 APU Bleed Air VALVE Light

Illuminated (amber) – APU bleed air valve position disagrees with commanded position.

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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.

The system supplies ventilation for the cabin:

- lavatories
- galleys.

Pack control, zone temperature control, cabin air recirculation, fault detection, and overheat protection are all automatic.

The airplane is divided into four temperature zones: the flight deck and three cabin zones.

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. The packs are controlled by two identical pack controllers. Pack output is automatically increased during high pack demand periods to compensate for a failed pack or recirculation fan. This increase in pack output is inhibited during high bleed air demand periods (such as with an engine inoperative).

Air Conditioning Automatic Mode

With the pack selector in the AUTO position, pack output temperature is determined by the left and right cabin temperature controllers:

Air Conditioning Standby Mode

With the pack selector in the standby mode, pack output temperature is determined by the position of the pack selector:

- N (normal) - constant, moderate temperature
- C (cool) - full cold
- W (warm) - full warm.

Ground Conditioned Air Operation

When a ground source of conditioned air is available, it 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.

The pack INOP light illuminates and the EICAS advisory message L or R PACK TEMP displays for all pack control system faults and overheats.

When an automatic control system fault or a pack outlet overheat is detected, the pack continues to operate in an uncontrolled, degraded condition, requiring crew interaction.

The pack valve closes and the pack is shut down automatically when an internal pack overheat is detected. The PACK OFF light illuminates and the EICAS advisory message L or R PACK OFF displays in addition to the PACK TEMP indications.

If the INOP light remains illuminated after selecting STBY, the fault is a pack overheat. After the pack has cooled, an attempt to restore pack operation may be made by pushing the PACK RESET switch.

Air Distribution

Conditioned air from the packs flows into a mix manifold where it mixes with air from two recirculation fans. Recirculation fans maintain overall cabin air circulation while allowing a reduction of cabin air ventilation, permitting the packs to be operated at a reduced flow. The mixed air is then ducted into the cabin.

The recirculation fans may be turned off for several minutes to provide a more rapid exchange of air.

The recirculation fan INOP light illuminates and the EICAS advisory message L or R RECIR FAN displays whenever a recirculation fan fails or is not operating. A slight increase in fuel consumption occurs for each fan that is OFF.

Temperature Control

The airplane is divided into four temperature control zones:

- flight deck
- forward cabin
- mid cabin
- aft cabin.

The pack controllers regulate the pack output air temperature to satisfy the temperature requirement of the compartment requiring the coolest air. Hot trim air from the bleed air system is added through trim air valves to control the temperature in each of the other compartments. Each temperature control compartment has an associated temperature control.

A compartment INOP light illuminates, and the EICAS advisory message FLT DECK TEMP, FWD CABIN TEMP, MID CABIN TEMP, or AFT CABIN TEMP displays to indicate:

- zone temperature controller failure
- trim air switch is OFF
- compartment temperature control is in the OFF position (FWD, MID, and AFT CAB only).

Temperature Control With Loss of Trim Air System

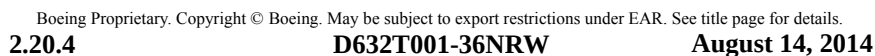
During operation with the trim air system off, the packs attempt to maintain all compartments at an average temperature. The trim air OFF light illuminates and the EICAS advisory message TRIM AIR displays when a TRIM AIR switch is off.

Gasper System

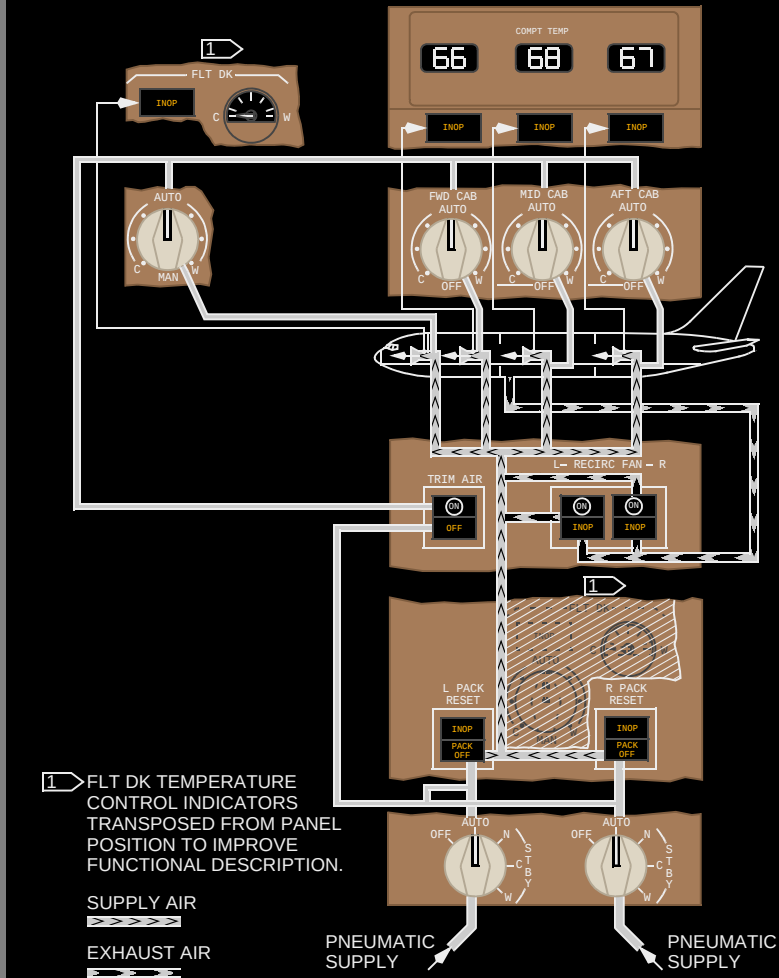
VP-BDI

The gasper system draws air from the forward cabin overhead air conditioning ducts and discharges it from gasper outlets in the passenger service units located above each passenger seat. Gasper air is controlled by the GASPER fan switch.

VP-BDI, VP-BOQ through VQ-BRA



VP-BMC



Shoulder and Foot Heaters

Flight crew shoulder and foot heat is provided by electric heaters in the ducts that supply conditioned air to the side windows and rudder pedal areas respectively. The heaters operate in flight only.

Equipment Cooling System

Forward Equipment Cooling

The forward equipment cooling system supplies cooling air to equipment in the forward electronic equipment racks and the flight deck avionics.

System operation is automatic with the EQUIP COOLING selector in AUTO.

On the ground, engine operation, pack operation, air/ground logic, airplane skin temperature and ambient temperature are all factors that determine system configuration. A supply fan and an exhaust fan either recirculate the cooling air back through the system, or port it overboard.

In flight, only the exhaust fan operates, and the air is recirculated through the system.

Non-Normal Operation

The VALVE light illuminates and the EICAS advisory message FWD EQPT VAL displays if the system valves fail to reconfigure during automatic operation. Placing the EQUIP COOLING selector in STBY provides an alternate command to reconfigure the system for recirculating the cooling air back through the system.,.

The OVHT light illuminates and the EICAS advisory message FWD EQPT OVHT displays if low airflow or high temperature is sensed. Placing the EQUIP COOLING selector in STBY may correct the condition by reconfiguring the system.

The SMOKE light illuminates and the EICAS advisory message FWD EQPT SMOKE displays if smoke is sensed in the forward equipment cooling ducts. Placing the EQUIP COOLING selector in OVRD allows conditioned air to be drawn in reverse through the system by differential pressure and exhausted overboard.

The NO COOLING light illuminates and the EICAS caution message FWD EQPT COOLING displays if no cooling airflow is sensed after selecting OVRD.

Cargo Heat System

The forward, aft, and bulk cargo compartments are provided heat from the bleed air system.

Normal Operation

Separate switches control a shutoff valve and a heat control valve in each compartment. The system automatically maintains compartment temperature above approximately 45°F (7°C).

Bulk Cargo Heat Selector

A BULK CARGO HEAT selector allows a higher temperature to be selected for the bulk compartment. With the selector in the NORM position, the bulk compartment operates the same as the forward and aft compartments. With the selector in the VENT position, the bulk compartment is maintained above approximately 65°F (18°C), and a vent fan draws cabin discharge air into the compartment.

Non-Normal Operation

VP-BDI through VP-BRL, VQ-BOG, VQ-BRA

The cargo heat switch OVHT light illuminates and the EICAS advisory message FWD, AFT or BULK CARGO OVHT displays when the cargo compartment temperature is above the standard control range. The compartment shutoff valve closes automatically if a compartment temperature exceeds approximately 90°F (32°C). When the compartment temperature decreases below the overheat temperature setting, the OVHT light extinguishes, the EICAS message is removed, and the compartment shutoff valve re-opens.

VP-BWW through VQ-BMU, VQ-BPT

The forward cargo heat switch OVHT light illuminates and the EICAS advisory message CGO FLOOR OVHT displays, or the aft or bulk cargo heat switch OVHT lights illuminate and the EICAS advisory messages AFT or BULK CARGO OVHT display when the cargo compartment temperature is above the standard control range. The compartment shutoff valve closes automatically if a compartment temperature exceeds approximately 90°F (32°C). When the compartment temperature decreases below the overheat temperature setting, the OVHT light extinguishes, the EICAS message is removed, and the compartment shutoff valve re-opens.

Forward Cargo Air Conditioning and Ventilation System

VP-BWW through VQ-BMU, VQ-BPT

The Forward Cargo Air Conditioning and Ventilation System supplies conditioned air or ventilation to the forward cargo compartment. The alternate action ON switch enables and disables both the air conditioning and ventilation systems. System controls are located on the overhead panel.

Compartment temperature is displayed on the EICAS Status page.

Forward Cargo Air Conditioning

Compartment temperature is selected with the Forward Cargo Air Conditioning Temperature Control in the AUTO range. A temperature below 45°F (7°C) requires selecting the Forward Cargo Heat Switch OFF.

Conditioned air is supplied from the left air conditioning pack, and bleed air provides temperature control.

Forward Cargo Ventilation

Ventilation is selected by placing the Forward Cargo Air Conditioning Temperature Control in the VENT position. On the ground, ventilation is provided by an exhaust fan and two ground exhaust valves. During flight, ventilation is provided by differential pressure through a single exhaust valve.

Non-Normal Operation

The FAULT light illuminates, and the EICAS advisory message FWD CGO BACKUP displays when the forward cargo air conditioning system fails to the backup mode. The backup mode helps to keep the compartment temperature as close to the selected temperature as possible. Manual adjustment of the Forward Cargo Air Conditioning Temperature Control may be necessary to maintain the appropriate compartment temperature.

The INOP light illuminates and the EICAS advisory message FWD CARGO A/C displays if the forward cargo air conditioning fails, or for one of the following:

- either pack valve closed
- either engine bleed valve closed
- forward cargo conditioning shutoff valve failed closed
- auxiliary zone controller failure
- forward cargo temperature selector failure
- arming either cargo fire switch

The INOP light illuminates and the EICAS advisory message CARGO AC CONT displays if the forward cargo air conditioning controller fails.

The FAULT light illuminates and the EICAS advisory message CGO GND EX VALS displays if Ground Exhaust Valves fail in the open position.



Air Systems

Pressurization System Description

Chapter 2

Section 30

Introduction

Cabin pressurization is controlled by adjusting the discharge of conditioned cabin air through the outflow valve.

Positive pressure relief valves and negative pressure relief doors protect the fuselage against excessive pressure differential.

The pressurization system has automatic and manual operating modes.

Pressurization System Automatic Operation

The pressurization system is in the automatic mode when the cabin altitude mode selector is set to AUTO 1 or AUTO 2. If the selected auto mode fails, control is automatically switched to the other auto mode.

In the automatic mode, the pressurization system uses ambient pressure data from the air data system in conjunction with the selected cabin auto rate, the takeoff altitude and the indicated landing altitude to calculate the cabin pressurization schedule.

Takeoff

For takeoff, the system supplies a small positive pressurization to cause a smooth cabin altitude transition.

Climb

During climb, cabin altitude increases on a schedule related to the takeoff field elevation, airplane altitude, and the selected auto climb rate limit.

If the maximum cabin pressure differential is reached, cabin climb rate becomes a function of airplane climb rate, while maintaining the maximum differential pressure.

Cruise

Shortly after the airplane levels off, the system enters the cruise mode. The landing altitude and the scheduled cabin altitude are compared and the higher of these two is selected for the cruise cabin altitude. If necessary, the cabin climbs to the cruise cabin altitude at one-half the auto rate or descends to the cruise cabin altitude at the auto rate.

The cruise cabin altitude does not change for minor altitude variations. A significant altitude change causes the system to re-enter the climb mode or to enter the descent mode.

Descent and Landing

During descent, cabin altitude decreases to slightly below the selected landing altitude. This ensures that the airplane lands pressurized. Landing altitude barometric pressure correction comes from the captain's altimeter.

At touchdown, the outflow valve opens to depressurize the airplane.

Non-Normal Indications

If the cabin altitude climbs above 10,000 feet, the CABIN ALT and CABIN ALTITUDE lights illuminate and the EICAS warning message CABIN ALTITUDE displays. The lights extinguish and the EICAS message blanks when the cabin altitude descends below 8,500 feet.

The AUTO INOP light illuminates and the EICAS caution message CABIN AUTO INOP displays when automatic pressurization control fails or when cabin altitude MODE SELECT is MAN. Manual operation is needed if the AUTO INOP light illuminates and the EICAS caution message CABIN AUTO INOP displays. Positive pressure relief valves and negative pressure relief doors operate independently from the pressurization control system to protect the fuselage against excessive pressure differential.

VP-BOQ

Both the automatic and manual modes are equipped with aneroid switches that automatically close the outflow valve when the cabin exceeds 11,000 feet.

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

Only the automatic mode is equipped with an aneroid switch that automatically closes the outflow valve when the cabin exceeds 11,000 feet. The manual mode has no auto closure feature.

To operate the pressurization system manually:

- set the cabin altitude MODE SELECT to MAN
- hold the cabin altitude MANUAL control to CLIMB to move the outflow valve toward open and cause the cabin altitude to climb
- hold the cabin altitude MANUAL control to DESCEND to move the outflow valve toward closed and cause the cabin altitude to descend.

**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
- engine start
- wing and engine anti-ice
- center hydraulic system air driven pump (ADP)
- hydraulic reservoir pressurization

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

- thrust reversers

Engine Bleed Air Supply

Engine bleed air comes from either the high pressure (HP) or the low pressure (LP) engine compressor sections. LP air is used during high power setting operations. HP air is used during descent and other low power setting operations.

The engine bleed air valves are armed when the engine bleed switches are selected ON. The valves are pressure actuated and remain closed until engine bleed air pressure is sufficient to cause forward flow. The valves may close when the APU is starting either engine. The valves may close when ground pneumatic air is connected or during periods of low engine bleed air demand, such as when the air conditioning packs are off.

The engine bleed air OFF light illuminates and the EICAS advisory message L or R ENG BLEED OFF displays when the engine bleed air valve is closed for a system fault.

The OVHT light illuminates and the EICAS advisory message L or R ENG BLD OVHT displays when the engine bleed air temperature is excessive.

VP-BOQ through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

The BLEED light illuminates and the EICAS caution message L or R ENG HPSOV displays when the engine high pressure bleed air valve is open when commanded closed.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

The BLEED light illuminates and the EICAS advisory message L or R ENG HPSOV displays when the engine high pressure bleed air valve is open when commanded closed.

VP-BOQ through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

The BLEED light illuminates and the EICAS caution message L or R ENG PRV displays when the pressure regulating valve is open when commanded closed.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

The BLEED light illuminates and the EICAS advisory message L or R ENG PRV displays when the pressure regulating valve is open when commanded closed.

APU Bleed Air Supply

APU bleed air is used primarily during ground operations for air conditioning pack operation and engine starting. In flight, APU bleed air is available up to approximately 17,000 feet.

The check valve in the APU supply line prevents reverse flow of bleed air from the duct into the APU.

The VALVE light illuminates and the EICAS advisory message APU BLEED VAL displays when the APU bleed valve position disagrees with the commanded position.

Ground Pneumatic 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 duct pressure indicator displays the pressure in the left and right bleed air ducts.

Isolation valves separate the bleed air ducts into isolated segments. The left and right isolation valves are normally closed except for engine start or single bleed source operation. The center isolation valve normally remains open.

The isolation VALVE lights illuminate and the EICAS advisory message C, L or R BLD ISLN VAL displays when the bleed isolation valve position disagrees with the commanded position.

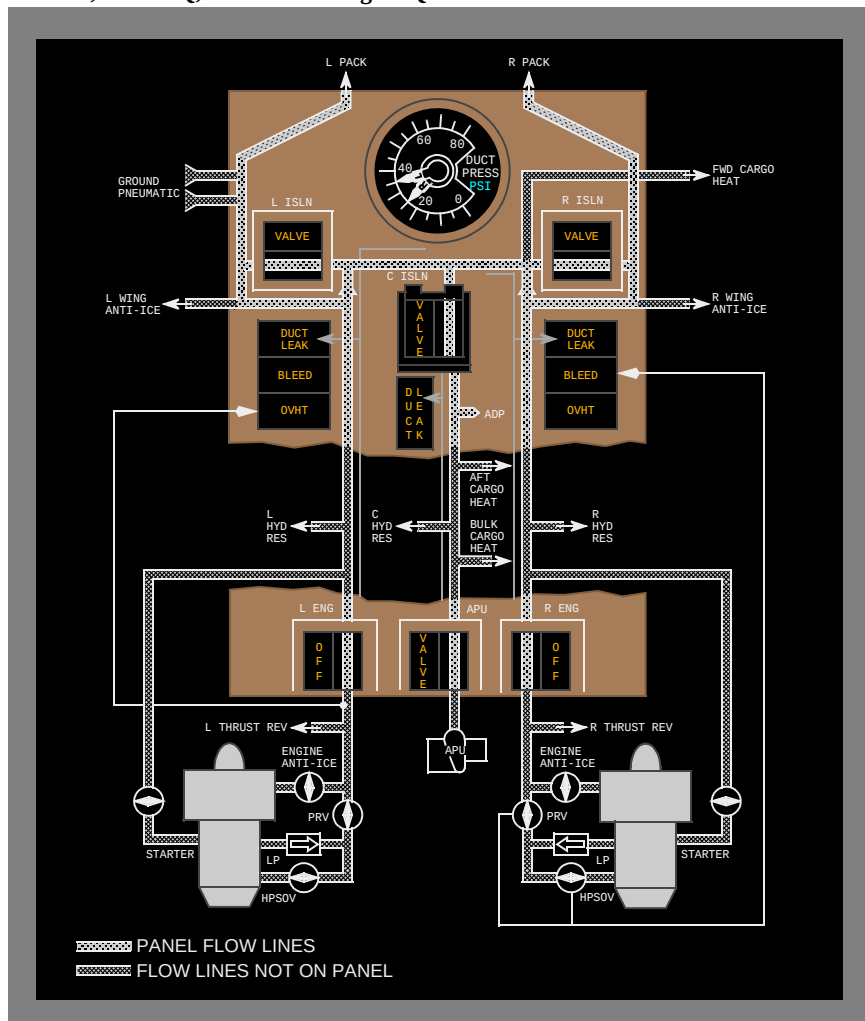
The DUCT LEAK light illuminates and the EICAS caution message L or R BLD DUCT LEAK, BODY DUCT LEAK or STRUT DCT LEAK displays when a high temperature bleed air leak is detected.

Bleed Air System Non-normal Operations

Bleed air overheat protection is provided by a bleed air temperature sensor. A higher than normal temperature causes a L or R ENG BLD OVHT advisory message to appear and the engine bleed air OVHT light to illuminate. If a bleed overheat occurs, the engine bleed air valve is automatically closed. With the engine bleed air valve closed, the HPSOV and PRV are closed. Activation of engine anti-ice will cause the PRV to open to provide cowl anti-ice unless a strut duct leak exists.

Bleed Air System Schematic

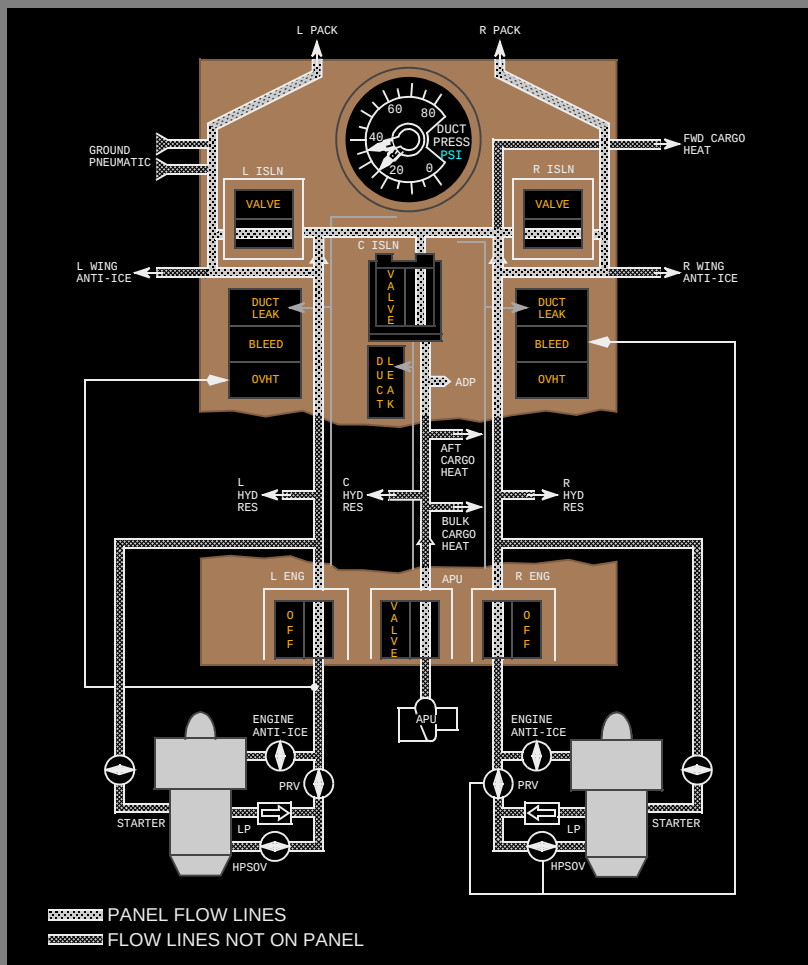
VP-BDI, VP-BOQ, VP-BRL through VQ-BRA





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VP-BMC, VP-BOY, VP-BOZ



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**Air Systems****Air Systems EICAS Messages****Chapter 2****Section 50****Air Systems EICAS Messages**

The following EICAS messages can be displayed.

Message	Level	Light	Aural	Condition
APU BLEED VAL	Advisory	VALVE		APU bleed valve position disagrees with the commanded position.
L BLD DUCT LEAK R BLD DUCT LEAK BODY DUCT LEAK	Caution	DUCT LEAK	Beeper	A high temperature bleed air leak is detected.
C BLD ISLN VAL L BLD ISLN VAL R BLD ISLN VAL	Advisory	VALVE		Bleed isolation valve position disagrees with the commanded position.
CABIN ALTITUDE	Warning	CABIN ALTITUDE CABIN ALT	Siren	Cabin altitude excessive.
CABIN AUTO INOP	Caution	AUTO INOP	Beeper	Automatic pressurization control has failed or the cabin altitude mode selector is in manual.
AFT CABIN TEMP FWD CABIN TEMP MID CABIN TEMP	Advisory	INOP		A fault in the zone temperature controller, compartment temperature control is in the OFF position, or trim air switch OFF.

Message	Level	Light	Aural	Condition

| VP-BWW through VQ-BMU, VQ-BPT

FWD CARGO A/C	Advisory	INOP		Forward cargo air conditioning has failed.

| VP-BWW through VQ-BMU, VQ-BPT

CARGO A/C CONT	Advisory	INOP		A fault in the forward cargo air conditioning controller.

| VP-BWW through VQ-BMU, VQ-BPT

FWD CGO BACKUP	Advisory	FAULT		The forward cargo air conditioning system has failed to the backup mode of operation.

| VP-BWW through VQ-BMU, VQ-BPT

CGO FLOOR OVHT	Advisory	OVHT		The forward cargo compartment floor temperature has exceeded limit.

| VP-BWW through VQ-BMU, VQ-BPT

CGO GND EX VALS	Advisory	FAULT		The forward cargo compartment ground exhaust valves are failed in the open position.



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Message	Level	Light	Aural	Condition

VP-BDI through VP-BRL, VQ-BOG, VQ-BRA

AFT CARGO OVHT BULK CARGO OVHT FWD CARGO OVHT	Advisory	OVHT		Cargo compartment temperature above standard control range.

VP-BWW through VQ-BMU, VQ-BPT

AFT CARGO OVHT BULK CARGO OVHT	Advisory	OVHT		Cargo compartment temperature above standard control range.

L ENG BLEED OFF R ENG BLEED OFF	Advisory	OFF		Engine bleed air valve is closed for a system fault.
L ENG BLD OVHT R ENG BLD OVHT	Advisory	OVHT		Engine bleed air temperature is excessive.

VP-BOQ through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

L ENG HPSOV R ENG HPSOV	Caution	BLEED	Beeper	High pressure bleed air valve is open when commanded closed.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

L ENG HPSOV R ENG HPSOV	Advisory	BLEED		High pressure bleed air valve is open when commanded closed.

VP-BOQ through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

L ENG PRV R ENG PRV	Caution	BLEED	Beeper	Pressure regulating valve is open when commanded closed.

Message	Level	Light	Aural	Condition

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

L ENG PRV R ENG PRV	Advisory	BLEED		Pressure regulating valve is open when commanded closed.

FWD EQPT COOLING	Caution	NO COOLING	Beeper	OVRD selected and no reverse airflow detected through the E/E compartment avionics.

FWD EQPT OVHT	Advisory	OVHT	Ground crew call horn on ground	High temperature or low airflow in equipment cooling system.

FWD EQPT SMOKE	Advisory	SMOKE		Smoke detected in the forward equipment cooling ducts.

FWD EQPT VAL	Advisory	VALVE		An equipment cooling valve not in commanded position.

FLT DECK TEMP	Advisory	INOP		A fault in the zone temperature controller or trim air switch OFF.

L PACK OFF R PACK OFF	Advisory	PACK OFF		Pack valve is closed.

L PACK TEMP R PACK TEMP	Advisory	INOP		Automatic control system fault or overheat.

L RECIR FAN R RECIR FAN	Advisory	INOP		Fan is failed or not operating.

L STRUT DCT LEAK R STRUT DCT LEAK	Caution	DUCT LEAK	Beeper	A high temperature bleed air leak is detected.



767 Flight Crew Operations Manual

Message	Level	Light	Aural	Condition
TRIM AIR	Advisory	OFF		Trim air switch OFF.

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**Anti-Ice, Rain**
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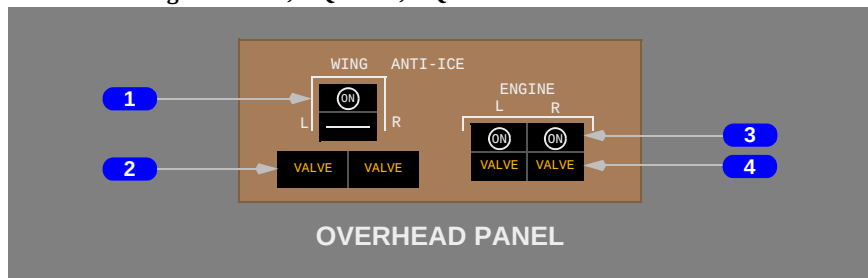
Anti-Ice, Rain Controls and Indicators

Chapter 3 Section 10

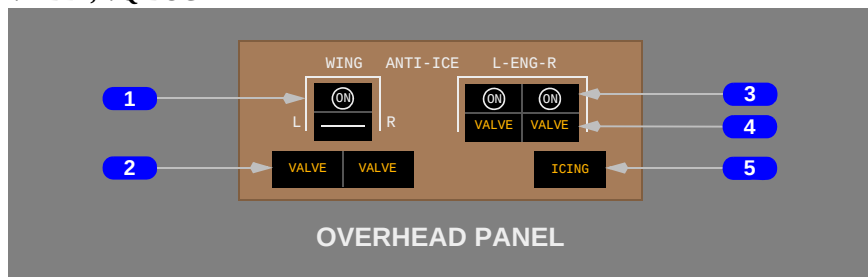
Manual Anti-Ice Panel

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

VP-BMC through VP-BRL, VQ-BMU, VQ-BRA



VP-BDI, VQ-BOG



1 WING ANTI-ICE Switch

ON – in flight, both wing anti-ice valves are commanded open.

Off (ON not visible) – both wing anti-ice valves are commanded closed.

2 Wing Anti-Ice VALVE Lights

Illuminated (amber) – wing anti-ice valve position disagrees with the switch position.

3 ENGINE ANTI-ICE Switches

ON – the engine anti-ice valve is commanded open.

Off (ON not visible) – the engine anti-ice valve is commanded closed.

4 Engine Anti-Ice VALVE Lights

Illuminated (amber) – engine anti-ice valve position disagrees with the switch position.

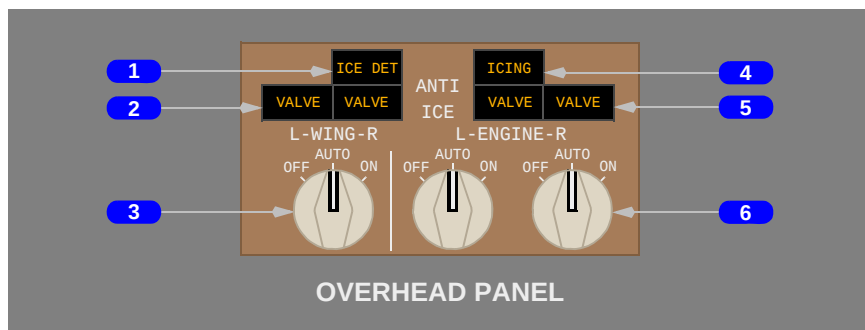
VP-BDI, VQ-BOG

5 ICING Light

Illuminated (amber) – ice detection system indicates ice buildup on the airplane.

Automatic Anti-Ice Panel

VP-BWW through VQ-BMQ, VQ-BPT



1 Ice Detector (ICE DET) Light

Illuminated (amber) – ice detector system is failed.

2 Wing Anti-Ice VALVE Lights

Illuminated (amber) – wing anti-ice valve position disagrees with the commanded position.

3 WING ANTI-ICE Selector

OFF – wing anti-ice commanded off.

AUTO – wing anti-ice automatically commanded on or off as directed by the primary ice detection system.

ON – wing anti-ice commanded on.

4 ICING Light

Illuminated (amber) – engine or wing anti-ice is manually selected OFF or an anti-ice valve is closed and engine/wing icing is detected.

767 Flight Crew Operations Manual
5 Engine Anti-Ice VALVE Lights

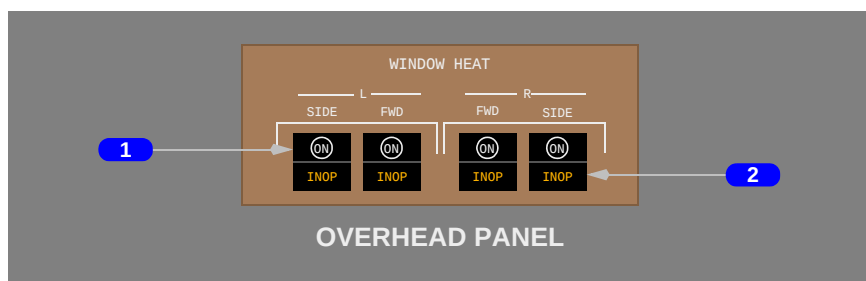
Illuminated (amber) – engine anti-ice valve position disagrees with the commanded position.

6 ENGINE ANTI-ICE Selectors

OFF – engine anti-ice valve is commanded closed.

AUTO – engine anti-ice valve is automatically commanded open or closed as directed by the primary ice detection system.

ON – the engine anti-ice valve is commanded open.

Window Heat and Wiper Panels
Window Heat Panel

1 WINDOW HEAT Switches

ON – window heat is applied to the selected windows.

Off (ON not visible) – window heat is removed from the selected windows

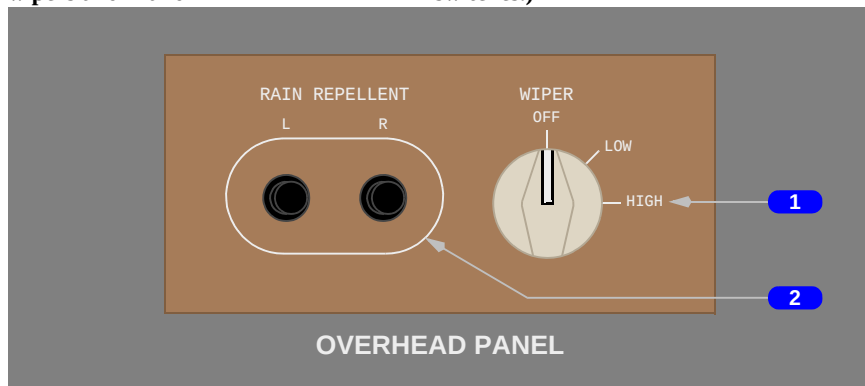
2 Window Heat Inoperative (INOP) Lights

Illuminated (amber) – the window is not being heated.

Wiper Panel

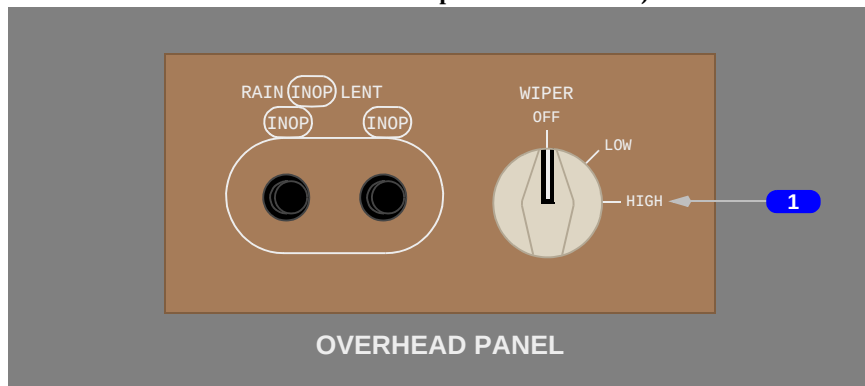
VQ-BRA

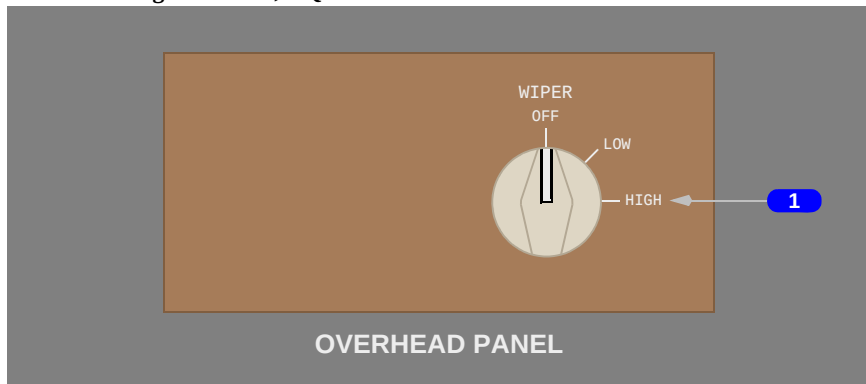
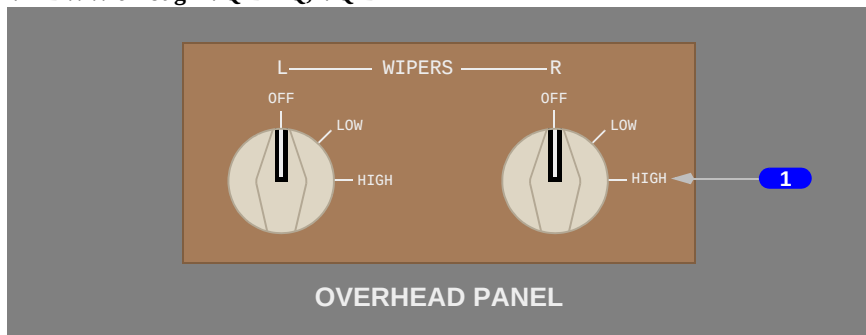
(SB Deletes VP-BRL when Wiper Panel does not have a single selector for two speed wipers and L and R RAIN REPELLENT switches.)



VQ-BMU

(SB Adds VP-BRL when the Wiper Panel has a single selector for two speed wipers and the RAIN REPELLENT switches are placarded as INOP.)



767 Flight Crew Operations Manual
VP-BDI through VP-BOZ, VQ-BOG

VP-BWW through VQ-BMQ, VQ-BPT

1 WIPER Selector

OFF – the wipers are stowed at the base of the windows.

LOW – the wipers operate at low speed.

HIGH – the wipers operate at high speed.

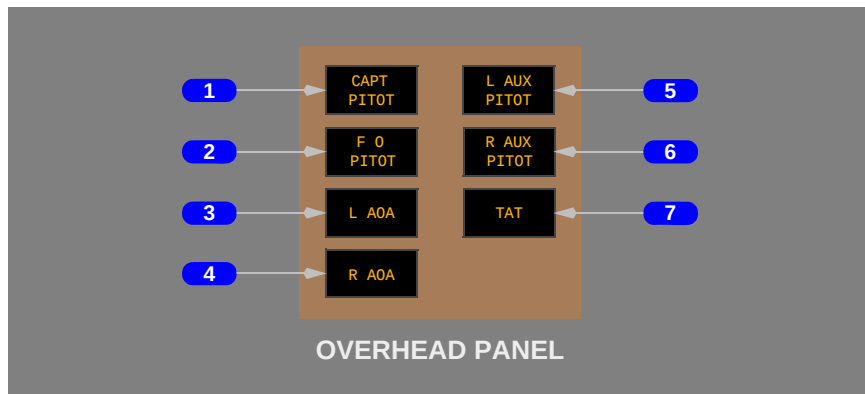
VQ-BRA

(SB Deletes VP-BRL when the Wiper Panel RAIN REPELLENT switches are marked INOP or removed.)

2 RAIN REPELLENT Switches

Push– applies measured amount of rain repellent to windshield.

Probe Heat Lights



1 Captain Pitot (CAPT PITOT) Light

Illuminated (amber) – probe is not being heated in flight or neither engine is running on the ground.

2 First Officer Pitot (F O PITOT) Light

Illuminated (amber) – probe is not being heated in flight or neither engine is running on the ground.

3 Left Angle of Attack (L AOA) Probe Light

Illuminated (amber) – probe is not being heated in flight or neither engine is running on the ground.

4 Right Angle of Attack (R AOA) Probe Light

Illuminated (amber) – probe is not being heated in flight or neither engine is running on the ground.

5 Left Auxiliary Pitot (L AUX PITOT) Light

Illuminated (amber) – probe is not being heated in flight or neither engine is running on the ground.

6 Right Auxiliary Pitot (R AUX PITOT) Light

Illuminated (amber) – probe is not being heated in flight or neither engine is running on the ground.

7 Total Air Temperature (TAT) Probe Light

Illuminated (amber) – probe is not being heated in flight.



Anti-Ice, Rain System Description

Chapter 3 Section 20

Introduction

The anti-ice and rain systems include:

- engine anti-ice
- wing anti-ice
- flight deck window heat
- windshield wipers
- probe heat

Engine Anti-Ice System

The engine anti-ice system uses engine bleed air to provide engine cowl inlet ice protection. Engine anti-ice can be operated in flight or on the ground. The left and right engines have identical, independent anti-ice systems. This allows the remaining system to operate if one engine fails.

VP-BMC, VP-BOY, VP-BOZ

The engine thermal anti-ice (TAI) annunciation appears above the EICAS N1 indication when an engine anti-ice switch is on.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

The engine thermal anti-ice (TAI) annunciation appears below the EICAS N1 indication when an engine anti-ice switch is on.

The VALVE light illuminates and the EICAS advisory message L or R ENG ANTI-ICE displays when the engine anti-ice valve disagrees with the switch position.

Wing Anti-Ice System

The wing anti-ice system provides bleed air to the three outboard leading edge slats on each wing. Wing anti-ice can be operated in flight only. It is inhibited on the ground.

The VALVE light illuminates and the EICAS advisory message L or R WING ANTI-ICE displays if the wing anti-ice valve disagrees with the switch position.

Manual Anti-Ice System Operation

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Engine Anti-Ice Operation

On the ground or in flight, pushing the ENGINE ANTI-ICE switches ON commands the engine anti-ice valves to open, and allows engine bleed air to anti-ice the engine cowl inlets. Pushing the ENGINE ANTI-ICE switches again commands the engine anti-ice valves to close, and stops engine bleed air from anti-icing the engine cowl inlets.

Wing Anti-Ice Operation

In flight, pushing the WING ANTI-ICE switch ON commands the wing anti-ice valve in each wing to open, allowing bleed air to flow from the bleed air manifold to the affected slats. Pushing the WING ANTI-ICE switch again commands the wing anti-ice valve in each wing to close, stopping bleed air from flowing from the bleed air manifold to the affected slats.

Advisory Ice Detection System

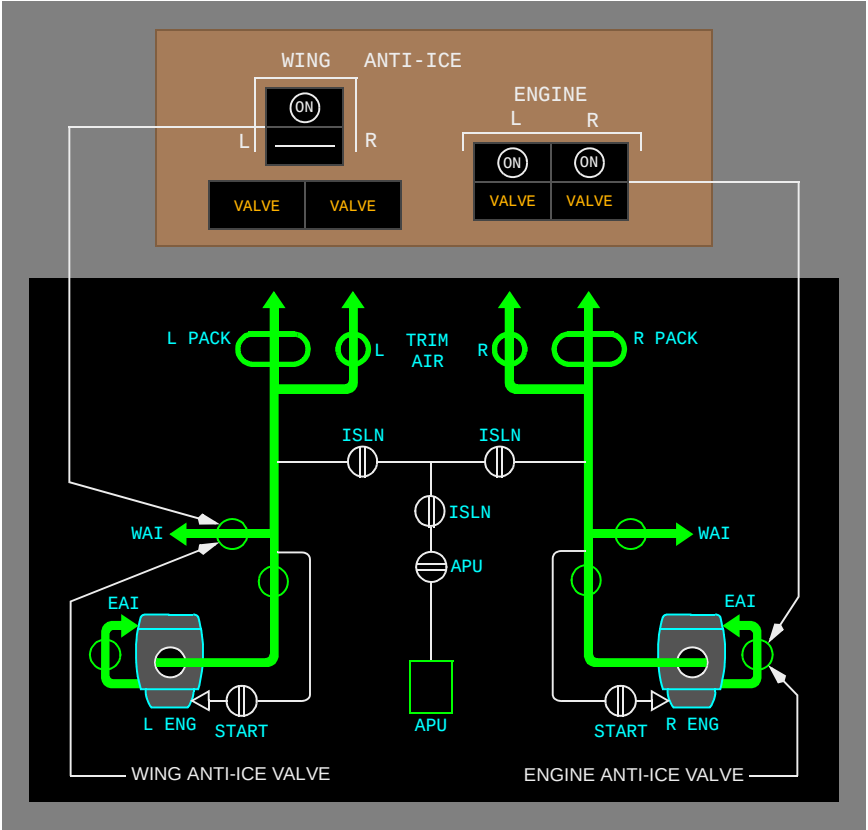
VP-BDI, VQ-BOG

An ice detecting sensor is installed on the nose of the airplane. When the sensor detects ice, the amber ICING light illuminates and the EICAS advisory message, ICE DET ON displays. When the sensor no longer detects ice, the ICING light extinguishes and the EICAS message ICE DET OFF displays.

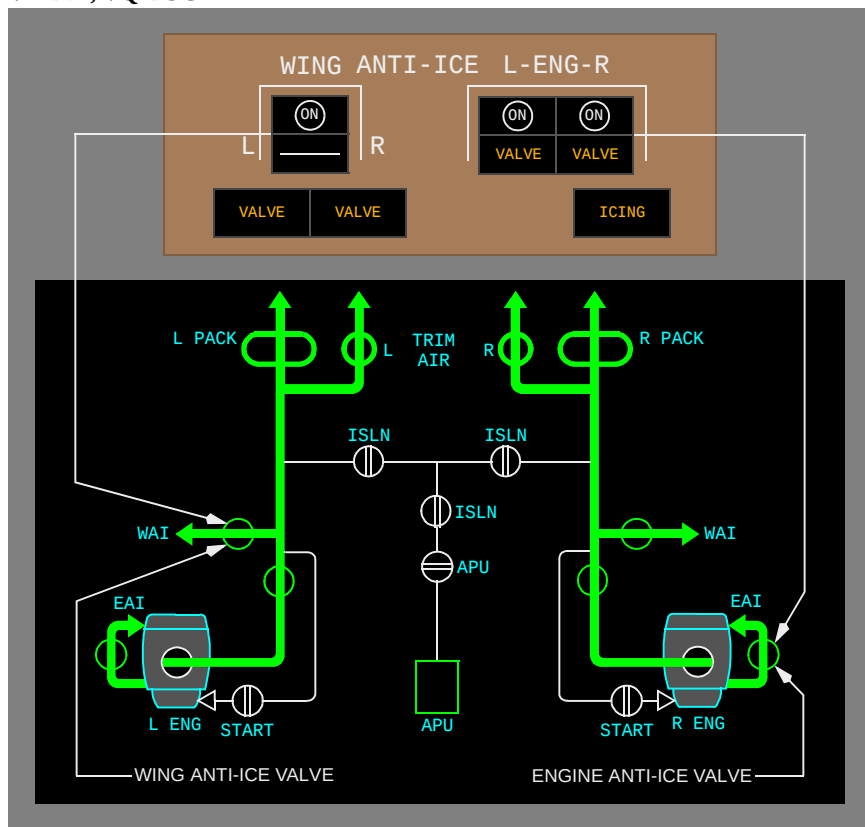
The system operates in an advisory capacity only. Flight crew action is required to activate and deactivate the engine and wing anti-ice systems.

Anti-Ice System Schematic

VP-BMC through VP-BRL, VQ-BMU, VQ-BRA



VP-BDI, VQ-BOG



Automatic Ice Detection System

VP-BWW through VQ-BMQ, VQ-BPT

The automatic ice detection system detects airplane icing in flight. Automatic ice detection is inhibited on the ground. The system provides signals to control the engine and wing anti-ice system when those systems are in the automatic mode.

The system consists of two ice detector probes, one on each side of the forward fuselage. If the probes detect ice build-up they are automatically de-iced. Each occurrence of ice build-up and subsequent deicing of the probes is accounted for by system logic as a cycle.

When system logic determines that the predetermined number of cycles for engine anti-ice activation have occurred, it activates engine anti-ice. Likewise, when system logic determines that the predetermined number of cycles for wing anti-ice activation have occurred, it activates wing anti-ice.

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When icing is no longer detected, system logic deactivates engine anti-ice and wing anti-ice.

The ICE DET light illuminates and the EICAS advisory message ICE DETECTOR displays if the ice detector system is failed.

Engine Anti-Ice

The ICING light illuminates and the EICAS caution message ICING ENGINE displays in flight when the ice detection system detects ice and either the Engine Anti-Ice Selector is OFF or the anti-ice valve is closed.

Engine Anti-Ice Automatic Operation

In flight, when the Engine Anti-Ice Selectors are in AUTO, engine anti-ice system operation is automatic. When system logic determines that engine anti-ice is required, it opens the engine anti-ice valves, and bleed air is automatically supplied to the engine cowl inlets.

When system logic determines that engine anti-ice is no longer required, it closes the engine anti-ice valves, and bleed air is no longer supplied to the engine cowl inlets.

Engine Anti-Ice Manual Operation

On the ground or in flight, placing the Engine Anti-Ice Selectors ON opens the engine anti-ice valves and allows engine bleed air to anti-ice the engine cowl inlets. Placing the Engine Anti-Ice Selector OFF closes the engine anti-ice valves and removes engine bleed air from the engine cowl inlets.

Wing Anti-ice

The ICING light illuminates and the EICAS advisory message ICING WING displays in flight when the ice detection system detects ice and either the Wing Anti-Ice Selector is OFF or the anti-ice valve is closed.

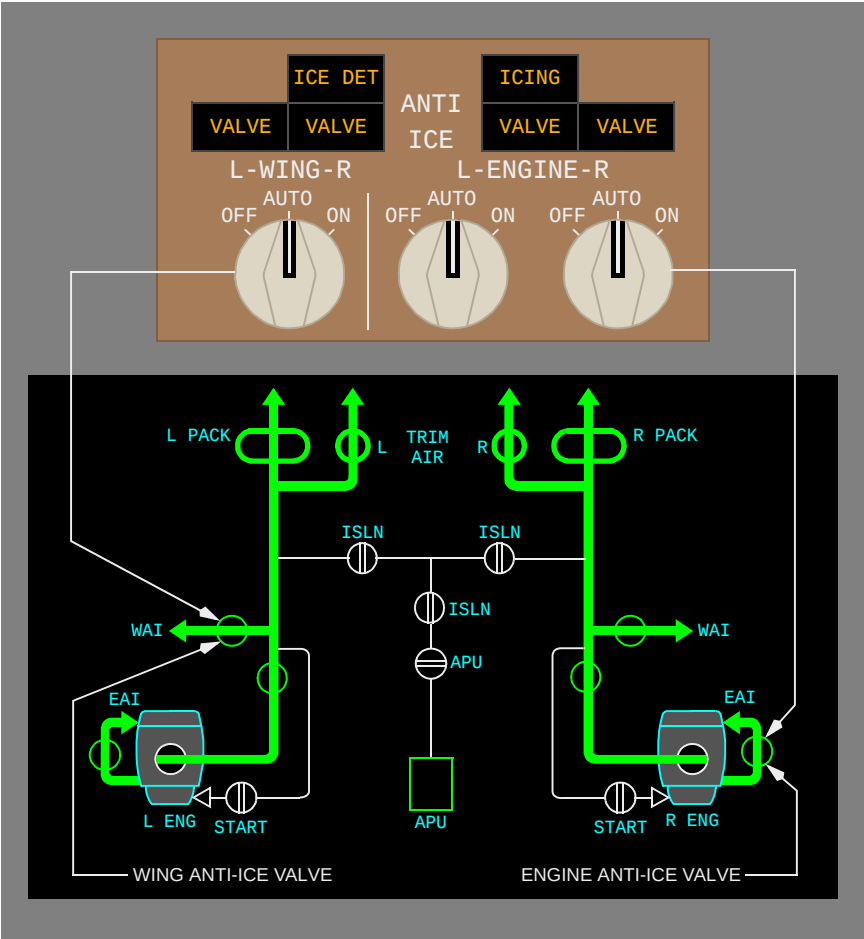
Wing Anti-Ice Automatic Operation

In flight, when the Wing Anti-Ice Selector is in AUTO, wing anti-ice system operation is automatic. When system logic determines that wing anti-ice is required, it opens the wing anti-ice valves, and bleed air is automatically supplied to the affected slats. When system logic determines that wing anti-ice is no longer required, it closes the wing anti-ice valves, and bleed air is no longer supplied to the slats.

Wing Anti-Ice Manual Operation

In flight, placing the Wing Anti-Ice Selector ON opens the wing anti-ice valve in each wing, allowing bleed air to flow from the bleed air manifold to the affected slats. Placing the Wing Anti-Ice Selector OFF closes the wing anti-ice valve in each wing, preventing bleed air from flowing from the bleed air manifold to the slats.

Anti-Ice System Schematic



Flight Deck Window Heat

All flight deck windows are electrically heated. The forward windows have anti-icing protection and anti-fogging. The side windows have anti-fogging protection only.

The WINDOW HEAT switches control heating for all flight deck windows. With the switches ON, window heat operates as soon as electrical power is established. The windows are protected from thermal shock when the switches are initially placed ON.

In addition to the electric heating, conditioned air is ducted to the top of the forward windows and then flows along the inside surface to provide supplemental anti-fogging. The anti-fogging airflow is continuous and is independent of electric window heat.

One INOP light illuminates and the EICAS advisory message L or R FWD WINDOW or L or R SIDE WINDOW displays to indicate a window is not being heated. If two or more INOP lights illuminate, the EICAS advisory message WINDOW HEAT displays.

The WINDOW HEAT EICAS message displays, and electrical power for the aft-most cockpit window heat is load shed when the Fuel Jettison Switch is selected ON. Electrical power is reset, and the WINDOW HEAT EICAS message no longer displays when the Fuel Jettison Switch is selected OFF.

Windshield Wipers

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

The forward windows are equipped with two-speed wipers. One selector controls both wipers. With the WIPER selector in the OFF position, the wipers are off and stowed.

VP-BWW through VQ-BMQ, VQ-BPT

The forward windows are equipped with two-speed wipers. Each wiper is equipped with its own selector. With a WIPER selector in the OFF position, the associated wiper is off and stowed.

Rain Repellent

VQ-BRA

(SB Deletes VP-BRL when the Wiper Panel is not equipped with RAIN REPELLENT switches.)

Rain repellent may be applied to the windshields to augment the windshield wipers in creating a clear field of vision when rain is particularly intense. It should not be applied to both windshields simultaneously because it obscures vision initially until it has been evenly spread over the windshield surface. It should also never be applied to a dry windshield because it will obscure vision.

A push button switch is provided on the overhead panel for each windshield. Each push of a button delivers a pre-measured amount of repellent to the windshield.

A rain repellent can with a sight gage and shutoff valve is located in the cockpit.

Probe Heat

Operation of the probe heat system is fully automatic. Power to the electrically heated pitot and angle of attack probes is applied any time an engine is running. The total air temperature (TAT) probes are heated when airborne.

An individual probe heat light illuminates and the associated EICAS advisory message displays when a probe is not being heated. If two or more probe lights illuminate, the EICAS advisory message PROBE HEAT displays.

**Anti-Ice, Rain
EICAS Messages****Chapter 3
Section 30****Anti-Ice EICAS Messages**

The following EICAS messages can be displayed.

Message	Level	Light	Aural	Condition
L AOA PROBE R AOA PROBE	Advisory	L AOA R AOA		AOA probe heat is inoperative.
L AUX PITOT R AUX PITOT	Advisory	L AUX PITOT R AUX PITOT		Left aux or right aux pitot heat is inoperative.
CAPT PITOT	Advisory	CAPT PITOT		Captain's pitot probe heat is inoperative.
L ENG ANTI-ICE R ENG ANTI-ICE	Advisory	VALVE		Engine anti-ice valve disagrees with switch position.
F/O PITOT	Advisory	F O PITOT		First officer's pitot probe heat is inoperative.

VP-BDI, VQ-BOG

ICE DET OFF	Advisory			Icing is no longer detected.
ICE DET ON	Advisory	ICING		Icing is detected.

Message	Level	Light	Aural	Condition

VP-BWW through VQ-BMQ, VQ-BPT

ICE DETECTOR	Advisory	ICE DET		Ice detection system is failed.
ICING ENGINE	Caution	ICING	Beeper	Ice detection system detects ice and either Engine Anti-Ice Selector is OFF or anti-ice valve is closed.
ICING WING	Advisory	ICING		Ice detection system detects ice and either Wing Anti-Ice Selector is OFF or anti-ice valve is closed.

PROBE HEAT	Advisory	Two or more PITOT, AOA or TAT		Two or more probe heats are inoperative.
TAT PROBE	Advisory	TAT		TAT probe heat is inoperative.
L FWD WINDOW R FWD WINDOW	Advisory	INOP		Window is not being heated.
L SIDE WINDOW R SIDE WINDOW	Advisory	INOP		Window is not being heated.
WINDOW HEAT	Advisory	Two or more INOP		Two or more windows are not being heated.
L WING ANTI-ICE R WING ANTI-ICE	Advisory	VALVE		Wing anti-ice valve disagrees with switch position.

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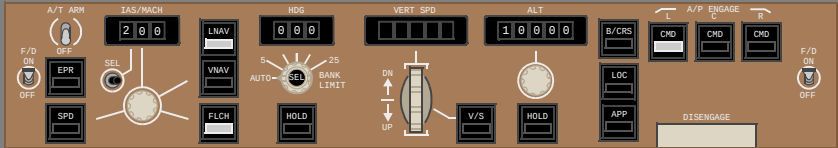


Automatic Flight Controls and Indicators

Chapter 4 Section 10

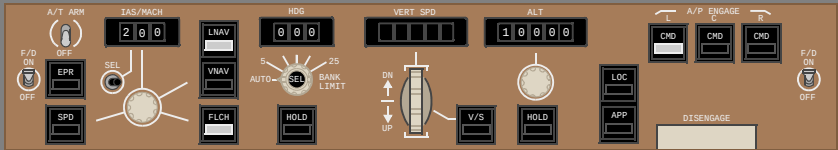
Mode Control Panel (MCP)

VP-BOY



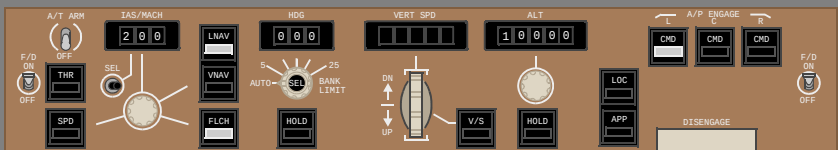
GLARESHIELD

VP-BMC, VP-BOZ



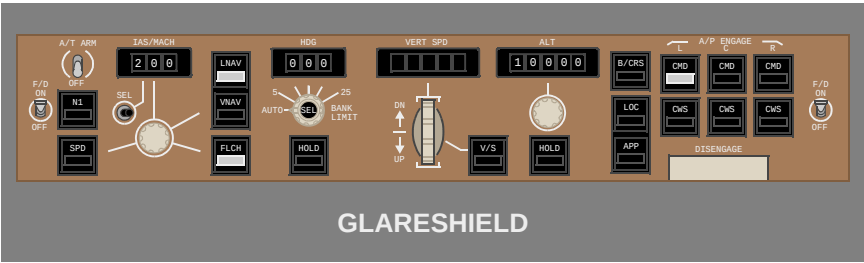
GLARESHIELD

VP-BWW through VQ-BMQ, VQ-BPT

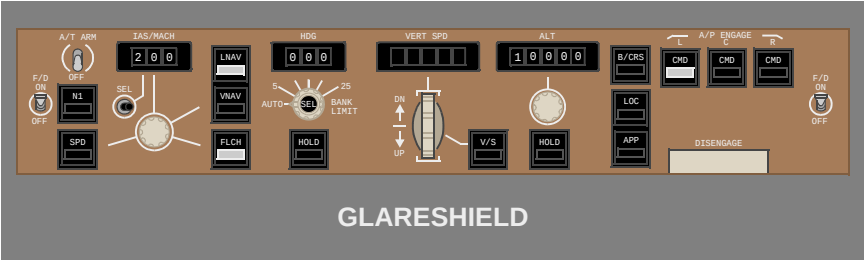


GLARESHIELD

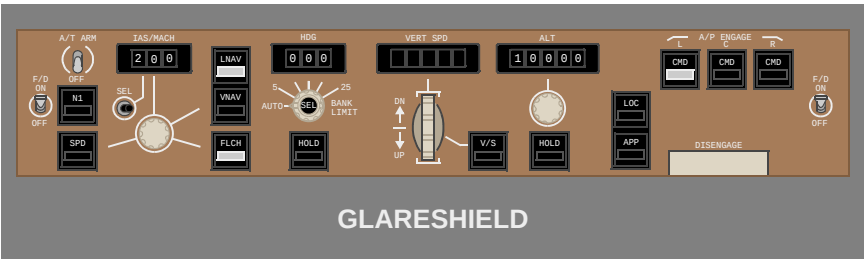
VP-BRL



VP-BOQ, VQ-BMU, VQ-BOG, VQ-BRA

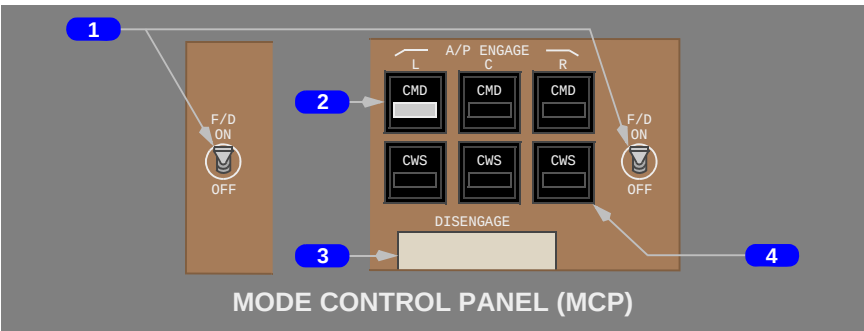


VP-BDI



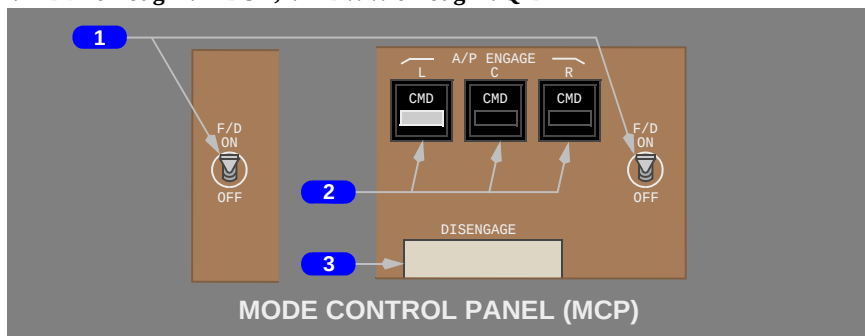
Autopilot Flight Director System (AFDS) Controls

VP-BRL



767 Flight Crew Operations Manual

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA



1 Flight Director (F/D) Switches

The left and right flight director switches activate flight director steering indications on their respective flight mode annunciator (FMA).

ON – respective pilots command bars operate in current AFDS mode.

- On the ground with no autopilot engaged and both F/D switches OFF, the first F/D switch positioned to ON arms the flight director in the takeoff (TO) roll and pitch modes. Positioning the second F/D switch to ON displays the flight director steering indications on the second FMA
- In flight, with the autopilot engaged and both F/D switches OFF, the first F/D switch positioned to ON activates the flight director in the selected autopilot mode(s)
- In flight with the autopilot disengaged and both F/D switches OFF, the first F/Ds switch positioned to ON engages the flight director in:

- V/S as the pitch mode and HDG HOLD as the roll mode

VP-BMC, VP-BOY through VP-BRL, VQ-BMQ through VQ-BPT

- or V/S and attitude (ATT) mode if bank angle is greater than five degrees

VQ-BMU, VQ-BRA

- command bars not in view if the autopilot, corresponding to the FCC selected for the flight director, is engaged in CMD

OFF –

- flight director steering indications do not display unless:
 - the go-around switch is pushed when airspeed is greater than 80 knots
 - and the flaps are not retracted.

2 Autopilot (A/P) ENGAGE Switches

Push (any switch can engage the autopilot) –

- CMD displays on each FMA

VQ-BMQ, VQ-BOG, VQ-BPT

- if either F/D switch is ON, the autopilot engages in the selected flight director mode(s)

VP-BDI through VP-BWX, VQ-BMU, VQ-BRA

- if either F/D switch is ON, the autopilot engages in the selected flight director mode(s) except TO and GA
- if both F/D switches are OFF, the autopilot engages in:
 - V/S as the pitch mode and HDG HOLD as the roll mode

VP-BMC, VP-BOY through VP-BRL, VQ-BMQ through VQ-BPT

- or V/S and attitude (ATT) mode if bank angle is greater than five degrees

3 Autopilot DISENGAGE Bar

Push down –

- disengages all three autopilots
- prevents autopilot engagement
- exposes amber stripe.

Lift up –

- enables autopilot engagement
- conceals amber stripe.

VP-BRL

4 Control Wheel Steering (CWS) Switches

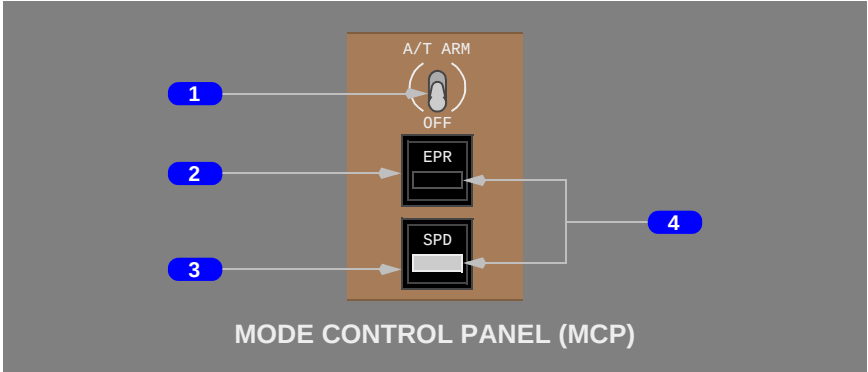
Push (any switch can engage the control wheel steering) –

- if airplane attitude at engagement exceeds autopilot limits of 30 degrees nose up, 30 degrees nose down or 30 degrees bank, the autopilot returns to these attitude limits
- if control wheel force is released with less than 3 degrees bank (1 degree after LOC capture), autopilot levels wings and holds heading
- with an autopilot in CWS, the flight directors can be operated in command modes
- CWS appears on each FMA
- autopilot pitch and roll are controlled through control wheel and control column pressures.

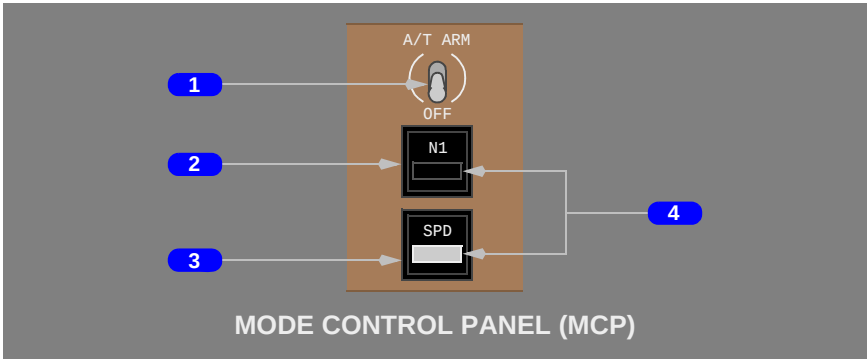
767 Flight Crew Operations Manual

Autothrottle (A/T) System Controls

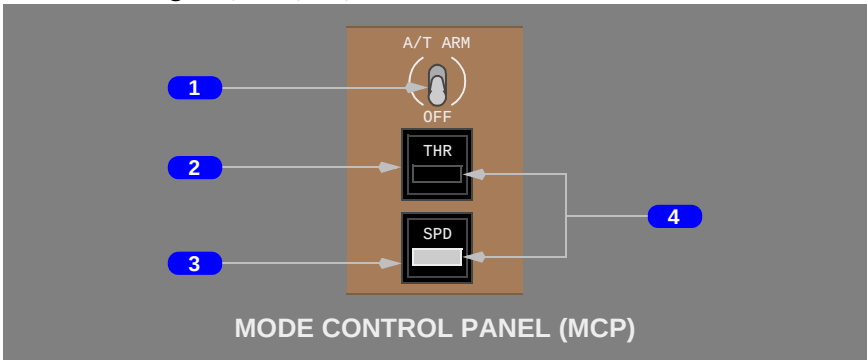
VP-BMC, VP-BOY, VP-BOZ



VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA



VP-BWW through VQ-BMQ, VQ-BPT



1 Autothrottle (A/T) ARM Switch

ARM –

- arms autothrottle system for mode selection

VP-BMC, VP-BOY, VP-BOZ

- autothrottle operates when EPR, SPD, V NAV, FL CH, or GA switch pushed

VP-BWW through VQ-BMQ, VQ-BPT

- autothrottle operates when THR, SPD, V NAV, FL CH, or GA switch pushed

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

- autothrottle operates when N1, SPD, V NAV, FL CH, or GA switch pushed
- autothrottle operates when SPD switch pushed and pitch mode is ALT HOLD, V/S or G/S.

OFF – disconnects autothrottle and prevents autothrottle engagement.

VP-BWW through VQ-BMQ, VQ-BPT

2 Thrust (THR) Switch

Push –

- selects autothrottle N1 mode
- N1 annunciates on each FMA
- autothrottle holds reference thrust value displayed on EICAS subject to maximum speed limits
- changes thrust reference from TO to CLB if above 400 feet radio altitude
- updates FMC position to takeoff runway threshold position when selected for takeoff only if GPS NAV is OFF (i.e. GPS NAV data not available to the FMC).

VP-BMC, VP-BOY, VP-BOZ

2 Engine Pressure Ratio (EPR) Switch

Push –

- selects autothrottle EPR mode
- EPR annunciates on each FMA
- autothrottle holds reference thrust value displayed on EICAS subject to maximum speed limits
- changes thrust reference from TO to CLB if above 400 feet radio altitude

VP-BOZ

- updates FMC position to takeoff runway threshold position when selected for takeoff.

767 Flight Crew Operations Manual**VP-BMC, VP-BOY**

- updates FMC position to takeoff runway threshold position when selected for takeoff only if GPS NAV is OFF (i.e. GPS NAV data not available to the FMC).

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA**2 N1 Switch**

Push –

- selects autothrottle N1 mode
- N1 annunciates on each FMA
- autothrottle holds reference thrust value displayed on EICAS subject to maximum speed limits
- changes thrust reference from TO to CLB if above 400 feet radio altitude

VP-BOQ, VP-BRL, VQ-BRA

- updates FMC position to takeoff runway threshold position when selected for takeoff.

VP-BDI, VQ-BMU, VQ-BOG

- updates FMC position to takeoff runway threshold position when selected for takeoff only if GPS NAV is OFF (i.e. GPS NAV data not available to the FMC).

3 Speed (SPD) Switch

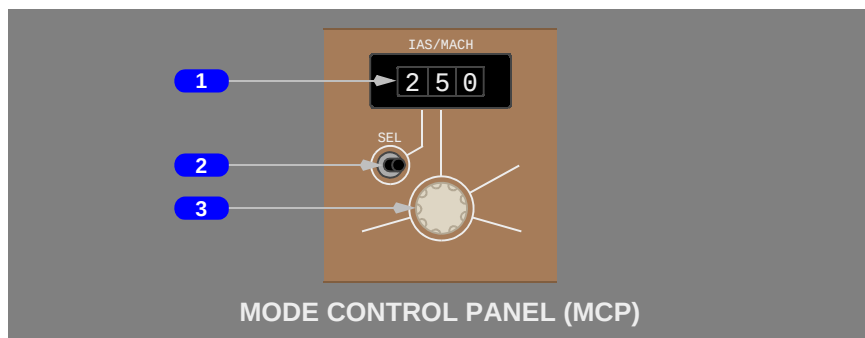
Push –

- selects autothrottle SPD mode
- SPD appears on each FMA
- autothrottle controls thrust to maintain IAS or MACH displayed in the speed window subject to minimum and maximum speed limits
- changes thrust reference from TO to CLB if above 400 feet radio altitude

4 MCP Mode Switch Lights

All MCP mode switches contain an annunciator light that illuminates when the mode switch is selected to indicate the mode is either engaged or armed.

Autopilot Flight Director IAS/MACH Controls



1 IAS/MACH Window

Displays selected speed when IAS/MACH selector controls command speed.

Displays 200 knots when power first applied.

Blank when FMC is controlling command airspeed bugs.

Display range:

- 0.40 – 0.95 MACH
- 100 – 399 KIAS

In climb, changes from IAS to MACH at approximately .80 MACH.

In descent, changes from MACH to IAS at approximately 300 KIAS.

2 Select (SEL) Switch

Push – alternately changes the IAS/MACH window between IAS and MACH.

3 IAS/MACH Selector

Rotate –

- sets speed in IAS/MACH window and positions command airspeed bugs
- inoperative when IAS/MACH window blank.

VP-BDI through VP-BWX, VQ-BMU, VQ-BOG, VQ-BRA

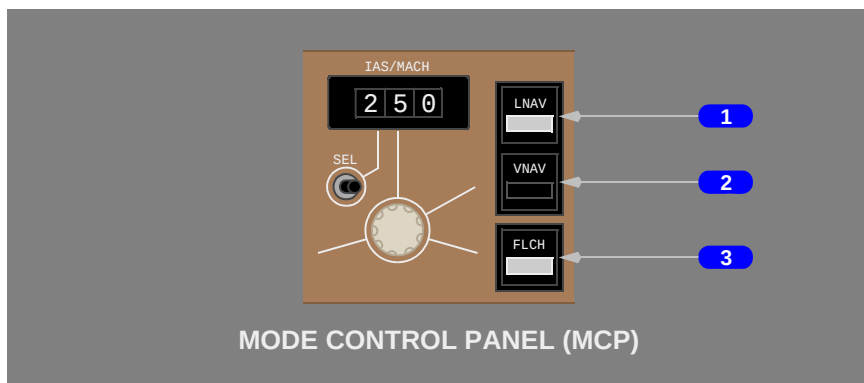
Push – when VNAV mode is engaged, alternately changes IAS/MACH window between current IAS or MACH and a blank display.

VQ-BMQ, VQ-BPT

Push – when VNAV mode is engaged, alternately changes IAS/MACH window between FMC target IAS or MACH and a blank display

- VNAV active, window opens and speed control transfers from FMC target speed to IAS/MACH selector
- descending in VNAV PTH, pitch mode changes to VNAV SPD. Selected speed maintained by pitch until airplane intercepts an altitude constraint and VNAV PTH reengages. Although, if on approach, pitch mode remains in VNAV PTH and autothrottle controls speed.

Autopilot Flight Director Roll and Pitch Controls



1 Lateral Navigation (L NAV) Switch

Push –

- Arms, engages or disarms LNAV as the roll mode
- Displays LNAV in white (armed) on the roll flight mode annunciator when armed; the previous roll mode remains active.
- LNAV engages if the airplane is above 50 feet radio altitude and:
 - within 2.5 NM of the active leg
 - if not within 2.5 NM of the active leg and on an intercept heading to the active leg, remains armed then engages when approaching the active leg
 - when engaged, displays LNAV in green on roll flight mode annunciator.
- selection of LNAV with the airplane not on a heading which intercepts the active leg, displays NOT ON INTERCEPT HEADING in the CDU scratch pads
- 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 the last active route waypoint
- passing the last waypoint prior to a route discontinuity
- passing the last route offset waypoint
- activating the inactive route or activating an airway intercept and not within LNAV engagement criteria.

LNAV deactivates:

- by selecting heading hold (HDG HOLD) or heading select (HDG SEL)
- when localizer is captured
- if there is a dual FMC failure
- by pushing LNAV switch a second time when LNAV is armed.

2 Vertical Navigation (V NAV) Switch

Push –

- engages AFDS and A/T in VNAV mode
- VNAV PTH or VNAV SPD displays on each FMA
- AFDS and autothrottle follow vertical path and thrust guidance from FMCS
- changes thrust reference from TO to CLB if above 400 feet radio altitude.

During climbs or descents, AFDS captures and holds altitude displayed in altitude window or FMC target altitude, whichever is reached first.

VQ-BPT

When reaching a point on the VNAV profile to begin a climb or descent, with the MCP altitude window set at the current altitude, or reaching the altitude in the MCP altitude window before the FMC target altitude, VNAV ALT will be displayed on the FMA.

With VNAV engaged, pushing IAS/MACH selector permits manual speed selection. FMCs then use manually selected speeds for speed control.

VNAV deactivates:

VP-BMC, VP-BOY, VP-BOZ

- by selecting GA, FL CH, SPD or EPR, V/S or ALT HOLD

VP-BWW through VQ-BMQ, VQ-BPT

- by selecting GA, FL CH, SPD or THR, V/S or ALT HOLD

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

- by selecting GA, FL CH, SPD or N1, V/S or ALT HOLD
- by pushing VNAV switch a second time when VNAV is armed
- when glideslope is captured

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VP-BDI through VQ-BOG, VQ-BRA

- in climb or descent, reaching altitude displayed in altitude window prior to reaching FMCs target altitude

VP-BDI through VQ-BOG, VQ-BRA

- passing top of descent point if the MCP is not set to an altitude below cruise altitude.

3 Flight Level Change (FL CH) Switch

Push –

VQ-BMQ, VQ-BPT

- selects FLCH mode

VP-BDI through VP-BWX, VQ-BMU, VQ-BOG, VQ-BRA

- selects FLCH mode and sets IAS/MACH window and command airspeed bugs to current airspeed
- FLCH displays on each FMA
- AFDS pitch holds existing airspeed and A/T sets required thrust, limited by the thrust limit for climb and idle for descent. When selected altitude is reached, pitch mode changes to ALT HOLD and A/T changes to SPD mode

VP-BDI through VP-BWX, VQ-BMU, VQ-BOG, VQ-BRA

- with FLCH mode displayed, pushing switch resets IAS/MACH window and commands airspeed bugs to current airspeed

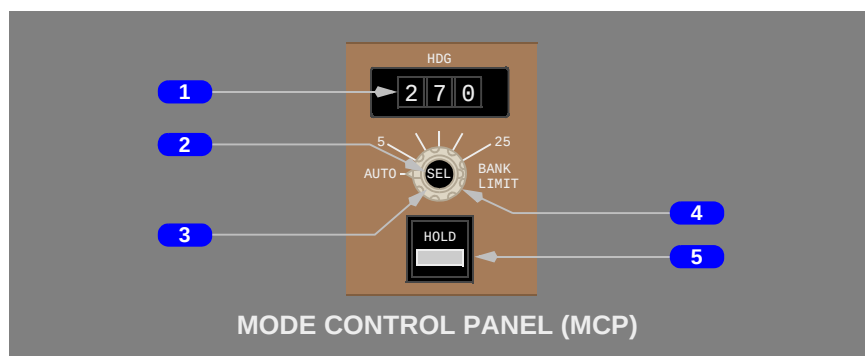
VQ-BMQ, VQ-BPT

- if selected while in TO or GA mode resets speed window and command airspeed bugs to current airspeed if current airspeed is greater than window speed

VQ-BMQ, VQ-BPT

- if selected with speed window blank, window unblanks and command speed bugs are set to FMC command speed
- changes thrust reference from TO to CLB if above 400 feet radio altitude.

Autopilot Flight Director Heading and Bank Angle Controls



1 Heading (HDG) Window

Displays selected heading and positions map display selected heading markers. HDG window and map display headings set to 000 when power first applied. Automatically changes to ILS front course heading at LOC capture.

2 Heading Select (SEL) Switch

Push –

- engages HDG SEL roll mode
- HDG SEL roll mode displays on each FMA
- AFDS controls roll to acquire and hold heading shown in heading window and on map display heading markers
- bank is limited by bank limit selector.

3 Heading Selector (inner)

Rotate – sets heading in HDG window and positions selected heading marker on both map displays.

4 BANK LIMIT Selector (outer)

Rotate – sets AFDS commanded bank limit when in HDG SEL roll mode as follows:

AUTO – bank angle varies between 15 – 25 degrees, depending on true airspeed.

- at slower true airspeeds the bank angle limit is 25 degrees
- as true airspeed increases, the bank angle limit decreases.

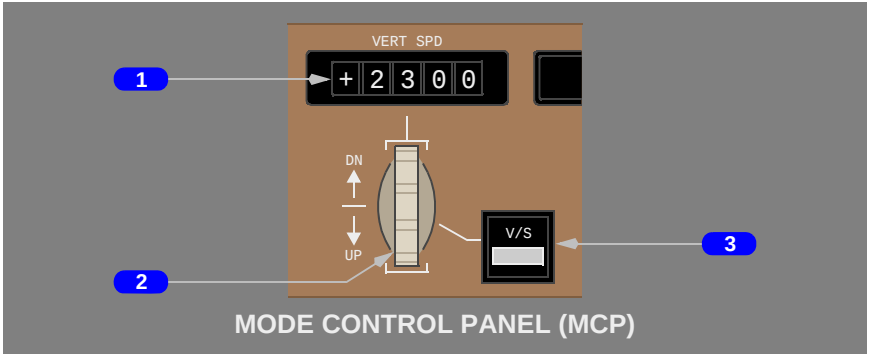
Manually selected – 5, 10, 15, 20, or 25 selected value is maximum regardless of airspeed.

5 Heading HOLD Switch

Push –

- selects HDG HOLD roll mode and displays on each FMA
- AFDS rolls wings level, then holds present heading.

Autopilot Flight Director Vertical Speed (V/S) Controls



1 Vertical Speed (VERT SPD) Window

Displays selected vertical speed.

Blank when V/S pitch mode not selected.

Display range is from (–8000 to +6000 fpm) in 100 fpm increments.

2 Vertical Speed Selector (DN/UP)

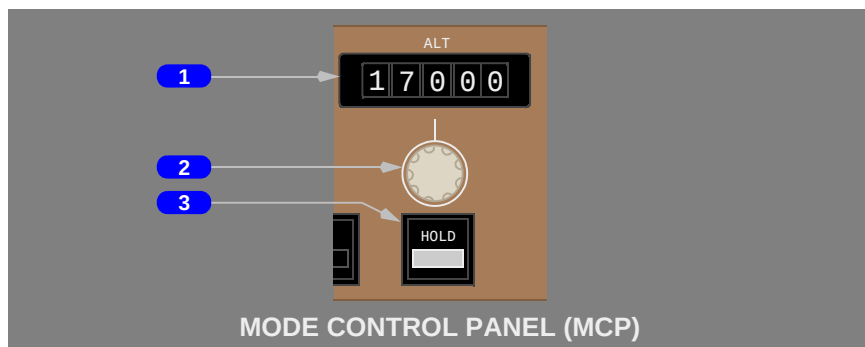
UP or Down (DN) – sets vertical speed in VERT SPD window.

3 Vertical Speed (V/S) Switch

Push –

- selects V/S pitch mode and displays on each FMA
- displays current vertical speed in VERT SPD window
- when selected altitude reached, pitch flight mode annunciation changes to ALT HOLD
- AFDS pitch maintains vertical speed displayed in the VERT SPD window
- if AFDS is engaged in V/S from FLCH or from VNAV, A/T automatically engages in SPD mode if armed.

Autopilot Flight Director Altitude Controls



1 Altitude (ALT) Window

Displays selected altitude in 100 feet increments. Range: 0 to 50,000 feet. Displayed altitude is reference altitude, for altitude alerting and level off. ALT window set to 10,000 feet when power is first applied.

| VP-BDI through VQ-BOG, VQ-BRA

2 Altitude Selector

Rotate – sets altitude in ALT window.

VQ-BPT

2 Altitude Selector

Rotate – sets altitude in ALT window.

Push – climb or descent:

- during climb or descent with altitude constraints, each push deletes the next waypoint constraint between the airplane altitude and the MCP altitude window setting
- during climb with no altitude constraints, and the MCP altitude window is set above the FMC cruise altitude, changes cruise altitude to the MCP altitude window value.

During 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 the DES NOW feature.

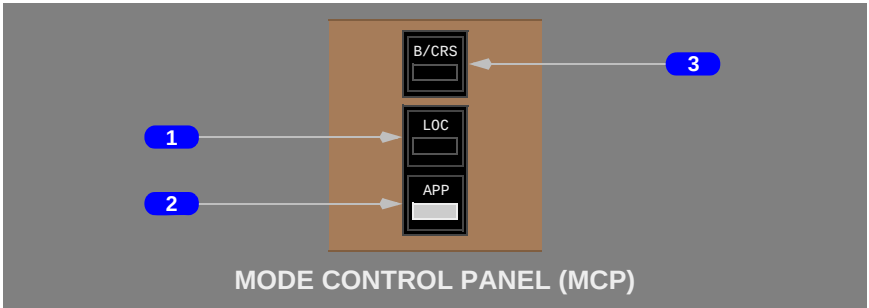
3 Altitude HOLD Switch

Push –

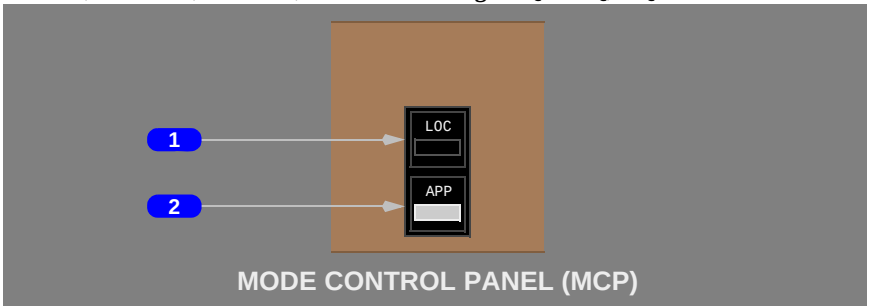
- selects altitude ALT HOLD pitch mode
- ALT HOLD pitch mode displays on FMA pitch mode annunciation
- AFDS commands pitch to maintain the altitude when the switch was pushed.

Autopilot Flight Director Approach Mode Controls

VP-BOQ, VP-BOY, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA



VP-BDI, VP-BMC, VP-BOZ, VP-BWW through VQ-BMQ, VQ-BPT



1 Localizer (LOC) Switch

Push –

- arms, disarms, captures LOC as roll mode
- displays LOC on both FMA roll flight mode annunciations before localizer capture; current roll mode LNAV, HDG SEL or HDG HOLD remains active until LOC capture
- displays LOC on FMA 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.

Note: After localizer capture, flight director roll commands may appear inconsistent with A/P roll maneuvers for one to two minutes.

Localizer mode can be disarmed before localizer capture by:

- pushing localizer switch a second time
- arming LNAV.

Localizer mode can be deactivated after localizer capture by:

- pushing a GA switch
- selecting a roll mode other than LNAV
- disengaging the autopilot and turning both F/D switches off.

Note: The LOC mode is a single autopilot function only. Multiple autopilots cannot be engaged with this mode.

2 Approach (APP) Switch

Push –

- autopilot systems powered by separate sources with three autopilots engaged
- arms, disarms, or captures LOC as roll mode and glideslope (G/S) as pitch mode
- displays LOC and G/S on FMA roll and pitch flight mode annunciations prior to localizer and glideslope capture
- displays LOC and G/S on both FMA roll and pitch flight mode annunciations after each is captured
- localizer captures when intercept track angle is within 120 degrees of localizer course

Note: After localizer capture, flight director roll commands may appear inconsistent with A/P roll maneuvers for one to two minutes.

- glideslope captures when intercept track angle to the localizer is within 80 degrees of localizer course

VP-BDI, VP-BMC, VP-BWW, VP-BWX

- localizer must be captured before glideslope

VP-BOQ through VP-BRL, VQ-BMQ through VQ-BRA

- either localizer or glideslope can be captured first
- AFDS captures and tracks localizer and glideslope upon intercepting the respective localizer and glideslope radio signals

767 Flight Crew Operations Manual
VP-BDI, VP-BOQ through VQ-BRA

- arms the other autopilot systems (CMD switch bars in view) for subsequent automatic engagement which occurs when localizer and glideslope are captured, and radio altitude is below 1500 feet.

VP-BMC

- permits multi-autopilot selection. Automatic engagement subsequently occurs when localizer and glideslope are captured, and radio altitude is below 1500 feet.

Approach mode can be disarmed before localizer or glideslope capture by:

- pushing approach switch a second time
- pushing LOC switch (G/S disarms, LOC remains armed)
- pushing LNAV switch and LNAV arms (does not immediately engage)
- pushing VNAV switch and VNAV arms (does not immediately engage).

Approach mode deselects:

- with LOC captured and G/S armed, by selecting another roll mode other than LNAV; selecting LOC mode initiates a localizer approach

VP-BOQ through VP-BRL, VQ-BMQ through VQ-BRA

- with G/S captured and LOC armed, by selecting another pitch mode other than VNAV
- after LOC and/or G/S are captured, by selecting GA mode or disengaging the autopilot and turning both F/D switches OFF.

VP-BOQ, VP-BOY, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA
3 Backcourse (B/CRS) Switch

Push – (Must be used concurrently with LOC switch), arms or engages AFDS in B/CRS mode as follows:

B/CRS appears on each FMA prior to localizer capture.

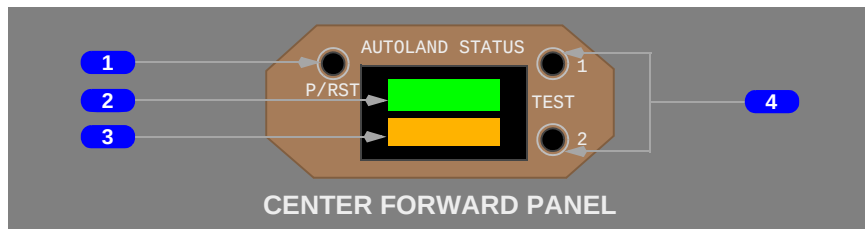
- AFDS is armed to capture and track inbound on backcourse of localizer
- capture point varies based on range and intercept angle
- initial roll modes; LNAV, HDG SEL or HDG HOLD remain engaged until B/CRS capture
- before localizer capture, pushing the LOC switch a second time disarms both the LOC and B/CRS modes. Pushing only the B/CRS switch a second time, disarms the B/CRS mode but the LOC mode remains armed.

B/CRS appears on each FMA after localizer capture.

- AFDS tracks inbound on backcourse
- if the LOC switch is selected and localizer is captured before B/CRS switch is pushed, AFDS will track the localizer front course (outbound) and B/CRS cannot be selected
- G/S, FLARE and ROLLOUT functions are not available.

Note: The B/CRS mode is a single autopilot function only. Multiple autopilots cannot be engaged with this mode.

Autoland Status



1 Push/Reset (P/RST) Switch

Push – resets both pilots annunciators as follows:

Before APP mode selected:

- changes NO AUTOLND or NO LAND 3 to blank,
- if condition is still present when switch release, annunciation returns.

After APP mode selected:

- if NO LAND 3 displayed, becomes blank and remains blank until after landing and autopilots disengaged
- if NO AUTOLND displayed, remains displayed until autopilots are disengaged.

2 AUTOLAND STATUS Annunciator (Upper)

Normal (blank) –

LAND 3 – (green)

- indicates all three autopilot systems and their associated supporting airplane system inputs are operating normally
- appears below 1500 feet radio altitude with LOC and G/S captured.

LAND 2 – (green)

- indicates a minimum of two autopilot systems and their associated supporting airplane system inputs are operating normally
- appears below 1500 feet radio altitude with LOC and G/S captured.

767 Flight Crew Operations Manual
3 AUTOLAND STATUS Annunciator (Lower)

Normal (blank) –

NO AUTOLND (amber) – indicates fault conditions exist which preclude the use of the autopilots for an automatic landing.

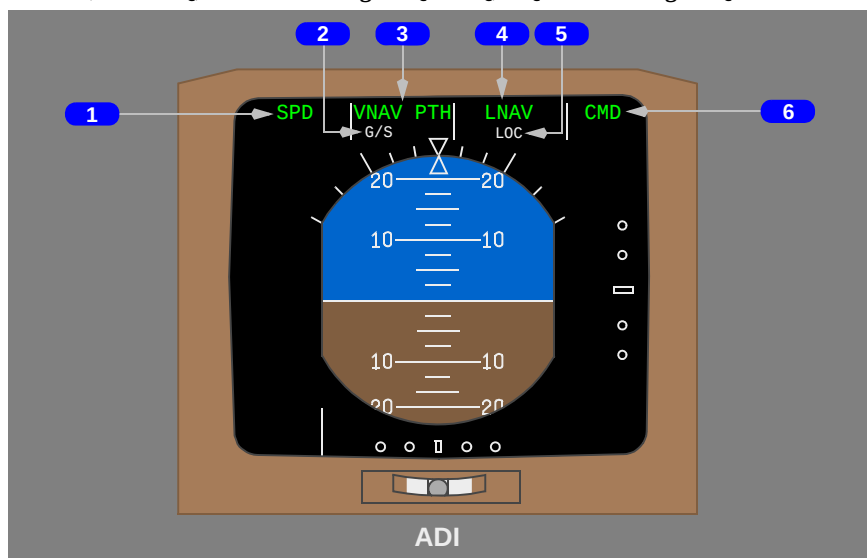
NO LAND 3 (amber) – indicates a fault condition exists which results in a LAND 2 condition

4 TEST Switches

Push – activates autoland status annunciator tests.

ADI Flight Mode Annunciations (FMAs)

VP-BDL, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA


1 Autothrottle Modes (Active)

Displayed (green) – ***

- N1
- SPD
- FLCH
- GA
- IDLE
- THR HLD

Autothrottle Limits: displayed (green) – */***

- FLAP LIM
- ALPHA
- SPD LIM

2 AFDS Pitch Modes (Armed)

Displayed (white) –

- G/S
- FLARE
- VNAV

3 AFDS Pitch Modes (Active)

Displayed (green) – **/ ***

- TO
- ALT HOLD
- V/S
- VNAV PTH
- VNAV SPD
- SPD
- G/S
- FLARE
- ALT CAP
- GA

VQ-BPT

- VNAV ALT

AFDS Pitch Limits: displayed (green) – */***

- FLAP LIM
- SPD LIM

4 AFDS Roll Modes (Active)

Displayed (green) – **/ ***

- HDG HOLD
- HDG SEL
- LNAV
- LOC
- ROLLOUT
- TO
- GA

VP-BRL, VQ-BMQ, VQ-BOG, VQ-BPT

- ATT

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VP-BOQ, VP-BRL, VQ-BOG, VQ-BRA

- B/CRS

5 AFDS Roll Modes (Armed)

Displayed (white) –

- LOC
- ROLLOUT
- LNAV

VP-BOQ, VP-BRL, VQ-BOG, VQ-BRA

- B/CRS

6 AFDS (Active)

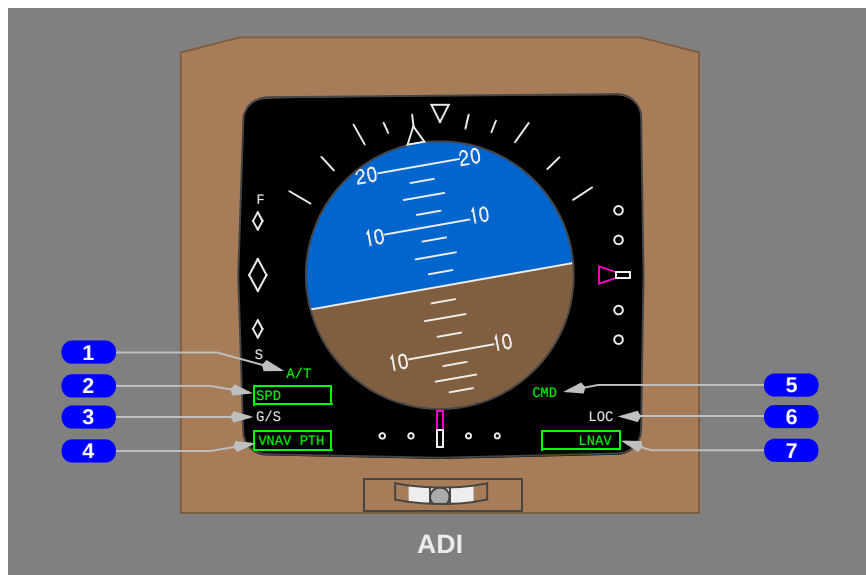
Displayed (green) –

- CMD
- FD

VP-BRL

- FD CWS
- CWS

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU



1 Autothrottle Status

Displayed (green) – ****

- A/T
- F/S

2 Autothrottle Modes (Active)

Displayed (green) – ***

VQ-BMU

- N1

VP-BMC, VP-BOY, VP-BOZ

- EPR
- SPD
- FLCH
- GA
- IDLE
- THR HOLD

Autothrottle Limits: displayed (green) – */***

- FLAP LIM
- ALPHA
- SPD LIM

3 AFDS Pitch Modes (Armed)

Displayed (white) –

- G/S
- FLARE
- VNAV

4 AFDS Pitch Modes (Active)

Displayed (green) – **/**

- TO
- ALT HOLD
- V/S
- VNAV PTH
- VNAV SPD
- SPD
- G/S
- FLARE
- ALT CAP
- GA

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AFDS Pitch Limits: displayed (green) – */***

- FLAP LIM
- SPD LIM

5 AFDS (Active)

Displayed (green) –

- CMD
- FD

6 AFDS Roll Modes (Armed)

Displayed (white) –

- LOC
- ROLLOUT
- LNAV
- **VP-BOY, VQ-BMU**
- B/CRS

7 AFDS Roll Modes (Active)

Displayed (green) – **/ ***

- HDG HOLD
- HDG SEL
- LNAV
- LOC
- ROLLOUT
- TO
- GA
- ATT
- **VP-BOY, VQ-BMU**
- B/CRS

* Mode is operating with angle of attack (alpha) or airspeed limit. Limit mode annunciation replaces engaged mode annunciation.

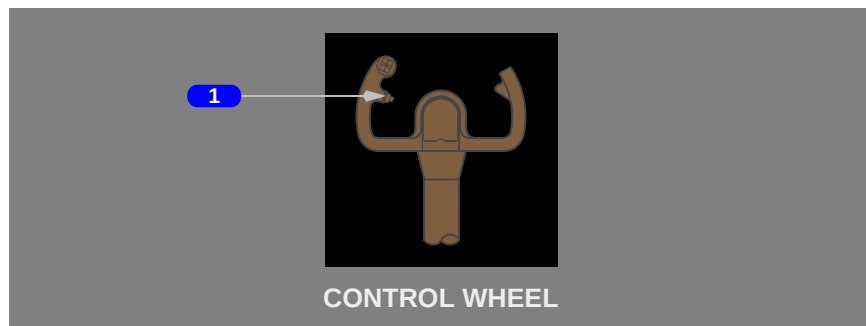
** An amber horizontal line is drawn through the appropriate autopilot pitch or roll mode annunciation when a flight mode fault is detected.

*** AFDS/Autothrottle mode changes are emphasized for 10 seconds by a box (green) drawn around the annunciated mode.

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

****F/S appears only when autothrottle is disengaged, AFDS is not operating in a speed mode (FLCH or GA) and the present airspeed is approaching either the SPD LIM, ALPHA or FLAP LIM.

Autopilot Disengage Switch



1 Autopilot Disengage Switches

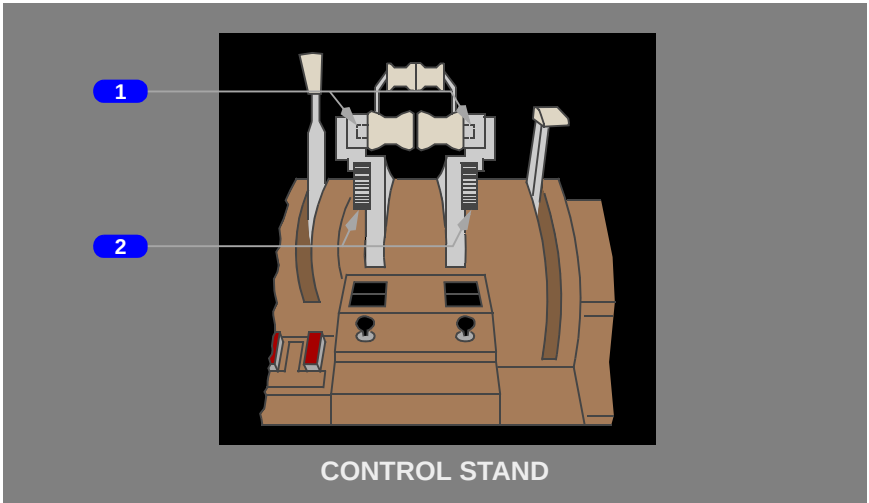
Push (either switch) –

- disconnects the autopilot
- A/P DISC and master warning lights illuminate
- displays the EICAS warning message AUTOPILOT DISC
- sounds an aural warning
- if the autopilot automatically disengages, resets the master warning lights, EICAS warning message, and the aural warning.

Second push – resets

- the master warning light
- EICAS warning message
- the aural warning.

Autothrottle Disconnect and Go-Around Switches



1 Autothrottle Disconnect Switches

Push (either switch) –

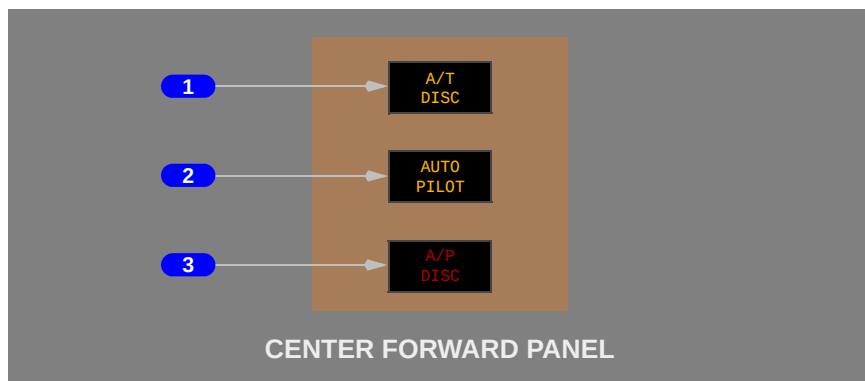
- disconnects autothrottle and A/T DISC light illuminates
- autothrottle remains armed
- subsequent push extinguishes A/T DISC light.

2 Go-Around Switches

Push (either switch) –

- automatic arming occurs at glide slope capture or with extension of wing flaps
- engages AFDS and autothrottle in GA mode if previously armed
- provides windshear guidance during GA if windshear detected
- if flight director off, activates flight director in GA mode
- cancels all thrust derates if selected after takeoff.

Autoflight Lights



1 Autothrottle Disconnect (A/T DISC) Light

Illuminated (amber) –

- autothrottle has disconnected
- extinguished by pushing either autothrottle disconnect switch.

2 Autopilot (AUTO PILOT) Light

Illuminated (amber) –

- a degraded operating condition exists in engaged autopilot
- extinguished when condition is corrected or an alternate autopilot is selected, provided fault is not common to alternate autopilot.

3 Autopilot Disconnect (A/P DISC) Light

Illuminated (red) –

- an autopilot has been automatically or manually disconnected
- extinguished by pushing either autopilot disengage switch.



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 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 flight control computers (FCCs) and the MCP.

The MCP provides control of the autopilot, flight director, altitude alert, and autothrottle systems. The MCP selects and activates AFDS modes, and establishes altitudes, speeds, and climb/descent profiles.

The three FCCs, left, center, and right, control separate hydraulically powered autopilot control servos to operate flight controls. The autopilot controls ailerons and elevators. Rudder commands are added only during a multiple autopilot approach. Nose wheel steering is also added during rollout from an automatic landing. During an ILS approach with all three autopilots engaged, separate electrical sources power the three FCCs.

The FCCs also provide inputs for AFDS operating mode displays and flight director commands on the FMA.

MCP Switches

MCP switches select automatic flight control and flight director modes. A light in the lower half of the switch illuminates to indicate the mode is armed or active. Respective roll and pitch flight mode annunciations on the FMA will also display. Autothrottle modes are discussed later in this section.

The following modes activate with a single push. These modes include:

- flight level change (FLCH)
- heading hold (HDG HOLD)
- heading select (HDG SEL)
- vertical speed (V/S)
- altitude hold (ALT HLD)

Other modes arm or activate with a single push. These modes are:

- lateral navigation (LNAV)
- vertical navigation (VNAV)
- localizer (LOC)
- approach (APP)

VP-BOQ, VP-BOY, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

- back course localizer (B/CRS)

VP-BRL

- control wheel steering (CWS)

All modes deactivate by disengaging the autopilot and turning both flight directors off. After localizer and glideslope capture, the localizer and glideslope modes can only be deactivated by disengaging the autopilot and turning both flight directors off or by selecting GA mode.

Desired target values can be selected on the MCP for:

- airspeed
- mach
- heading
- vertical speed
- altitude

All parameters except vertical speed can be preselected before autopilot and/or flight director engagement.

Autopilot Engagement

VP-BMC, VP-BOQ, VP-BWW through VQ-BPT

Autopilot engagement requires at least one FCC and pushing one of the MCP autopilot engage switches.

VP-BDI, VP-BOY through VP-BRL, VQ-BRA

Autopilot engagement requires at least two FCCs and pushing one of the MCP autopilot engage switches.

Autopilot Disengagement

Normal autopilot disengagement is through either control wheel autopilot disengage switch.

The autopilots can also be disengaged by the MCP autopilot disengage bar.

The A/P DISC light illuminates and the EICAS warning message AUTOPILOT DISC displays when the autopilot has been manually or automatically disconnected.

AFDS Failures

During autopilot operation, failures affecting the active mode annunciate on the FMA. If the failure affects only the active mode:

- the autopilot remains engaged in an attitude stabilizing mode
- an amber line is drawn through the mode annunciation
- the AUTO PILOT light illuminates
- the EICAS caution message AUTOPILOT displays.

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If unwanted operation is noticed or when an autopilot failure is annunciated, the autopilot should be disconnected and the airplane flown manually.

Failures affecting all autopilot modes result in an autopilot disengagement accompanied by an aural warning. Depending on the system failure, it may be possible to reengage an autopilot by pushing the autopilot engage switch.

Flight Director Display

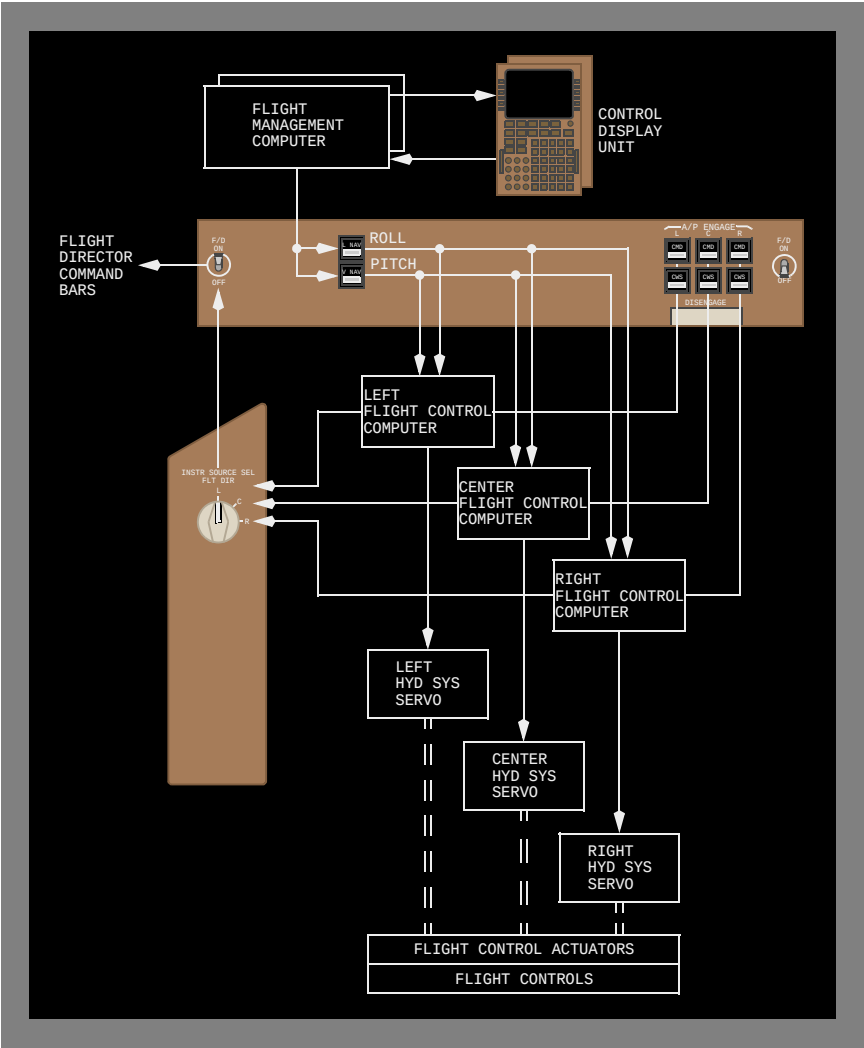
Flight director steering indications normally display any time the related F/D switch is ON.

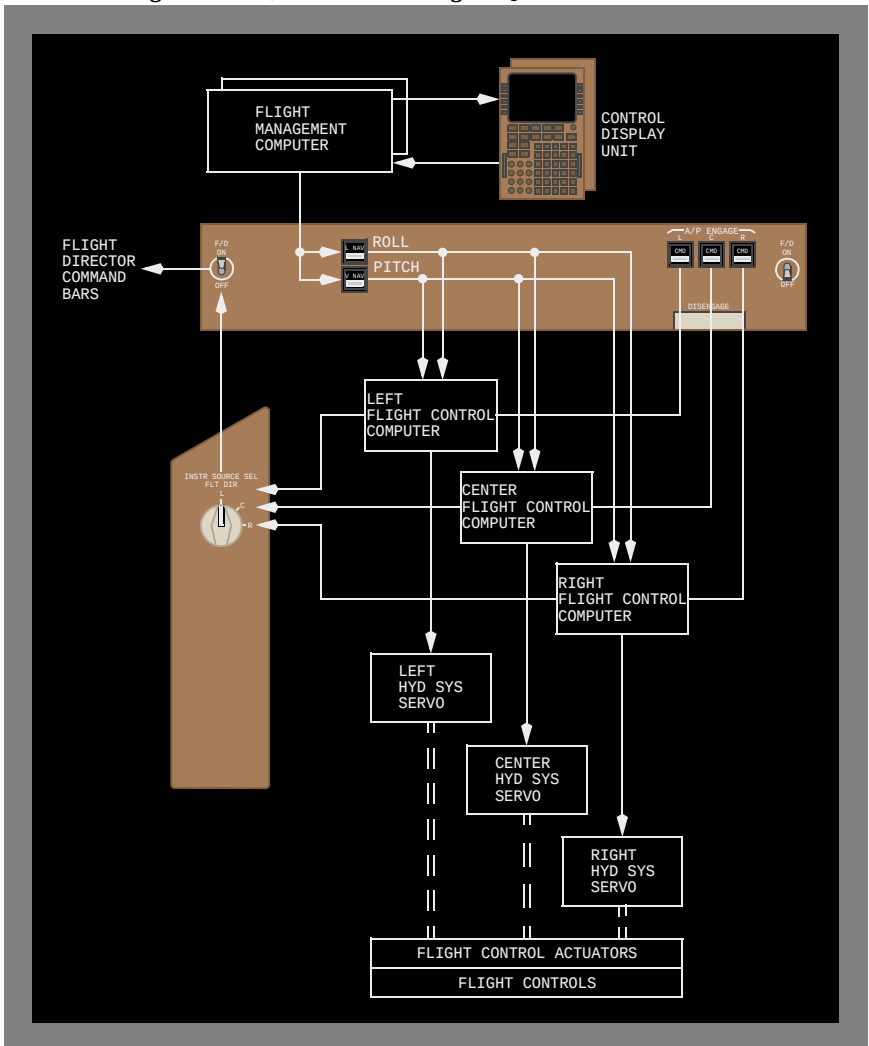
The steering indications are also displayed when the related flight director switch is OFF and a go-around switch is pushed, if airspeed is greater than 80 knots and the flaps are not retracted. In this case, the flight director display can be removed by cycling the respective flight director switch on and then off.

A flight director failure in either pitch or roll, causes the respective steering bars to disappear.

Autopilot Flight Director System Schematic

VP-BRL



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VP-BDI through VP-BOZ, VP-BWW through VQ-BRA


Autoland Status Annunciators (ASA)

The following AFDS status annunciations can be displayed:

- **LAND 3** – three autopilots engaged and operating normally for an automatic landing
- **LAND 2** – AFDS redundancy reduced, in some cases only two autopilots available

- NO LAND 3 – indicates a fault condition exists which results in a LAND 2 condition
- NO AUTOLND – AFDS 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).

Below 200 feet radio altitude the ASA display cannot change except to indicate a NO AUTOLND condition. Faults not requiring immediate crew action or awareness are annunciated after touchdown.

AFDS Flight Mode Annunciations

Flight mode annunciations are displayed on the ADI. Mode annunciations include:

- autothrottle
- pitch
- roll
- AFDS status

Active modes are displayed in green letters. When a mode changes the new active mode is highlighted with a green rectangle around it for several seconds. Armed modes display in smaller white letters.

Autothrottle Modes

Autothrottle annunciations are:

- SPD – autothrottle controlling thrust to maintain speed selected in IAS/Mach or, if VNAV engaged, the speed as programmed by the FMC
- IDLE – autothrottle is reducing or has reduced thrust to flight idle. It may engage in a VNAV descent. It will, after FLARE is engaged

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

- THR HLD – thrust levers remain in existing position or where manually placed

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

- THR HOLD – thrust levers remain in existing position or where manually placed

VP-BMC, VP-BOY, VP-BOZ

- EPR – autothrottle controlling to the selected EPR reference thrust

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

- N1 – autothrottle controlling to the selected N1 reference thrust
- FLCH – autothrottle controlling to a maximum of the selected mode reference thrust during climb, and to a minimum thrust during descent

767 Flight Crew Operations Manual**VP-BDI through VP-BOZ, VP-BWW through VQ-BRA**

- GA – autothrottle controlling to a maximum reference thrust to maintain a climb rate of at least 2000 fpm. If both flight directors and the autopilot are off, autothrottle controls to go-around reference thrust subject to flap and VMO limit speeds

VP-BRL

- GA – autothrottle controlling to a maximum reference thrust with adjustment, as necessary, to maintain a climb rate of 2000 fpm. If both flight directors and the autopilot are off, autothrottle controls to GA reference thrust subject to flap and VMO limit speeds

Roll Modes

Roll annunciations are:

LNAV –

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

Arm LNAV by pushing the L NAV switch. The light illuminates and LNAV annunciates on the FMA roll mode annunciator in white characters above the current roll mode.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

Arm LNAV by pushing the L NAV switch. The light illuminates and LNAV annunciates on the FMA roll mode annunciator in white characters below the current roll mode.

- LNAV (armed) – LNAV is armed to activate when parameters are met
- LNAV (active) – LNAV activates when 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 selected in the MCP heading window
- HDG HOLD (active) – AFDS holds present heading. When turning, AFDS holds the heading reached after rolling wings level.

VP-BMC, VP-BOY through VP-BRL, VQ-BMQ through VQ-BPT

ATT –

- 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 returns to wings level HDG HOLD
- when the bank angle is greater than 30 degrees, AFDS returns to 30 degrees of bank.

LOC –

- LOC (armed) – AFDS captures the localizer when within range and within 120 degrees of the localizer course
- LOC (active) – AFDS follows the localizer course.

VP-BOQ, VP-BOY, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA
B/CRS –

- B/CRS (armed) – AFDS is armed to capture and track inbound on backcourse of localizer after localizer capture
- B/CRS (active) – AFDS tracks inbound on backcourse of localizer.

TO –

- On the ground, TO annunciates by selecting either F/D switch ON when both flight directors are OFF
- TO roll and pitch guidance become active at lift-off.

GA –

- In flight, go-around arms with flaps out of up or at glideslope capture. There is no flight mode annunciation for go-around armed in flight; although the reference thrust limit changes to GA. Go-around is activated in flight by pushing a GA switch. The roll steering indication provides guidance to maintain the ground track present at mode engagement.

ROLLOUT –

- ROLLOUT (armed) – displays below 1500 feet radio altitude and activates below 5 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 –

On the ground, TO annunciates by selecting either F/D switch ON when both flight directors are OFF. The flight director pitch bar indicates an initial pitch of approximately eight degrees up.

After takeoff, the AFDS commands a pitch attitude to maintain:

- pitch command greater of $V_2 + 15$ knots or liftoff speed + 15
- if current airspeed remains above the target speed for 5 seconds, target airspeed resets to current airspeed, to a maximum of $V_2 + 25$ knots
- IAS/MACH window speed if IAS/MACH window speed is changed to a speed greater than the target speed.

Note: AFDS uses the speed set in the IAS/MACH window prior to takeoff for V_2

GA –

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Go-around arms and the reference thrust limit changes to GA when flaps are out of up or glideslope is captured.

When a go-around is initiated, the commanded speed is the MCP IAS/Mach window or current airspeed, whichever is higher. If the airspeed increases and remains above the initial target airspeed for five seconds, target airspeed resets to current airspeed to a maximum of the IAS/MACH window speed plus 25 knots. If airspeed at initiation of go-around is greater than IAS/Mach window plus 25 knots, that speed is maintained. GA displays as the reference thrust limit on the primary EICAS engine display.

VNAV –

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

Arm VNAV by pushing the V NAV switch. The light illuminates and VNAV annunciates on the FMA pitch mode annunciator in white characters above the current pitch mode.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

Arm VNAV by pushing the V NAV switch. The light illuminates and VNAV annunciates on the FMA pitch mode annunciator in white characters below the current pitch mode.

VNAV provides pitch commands to maintain the FMC computed airspeed/path:

- VNAV SPD (active) – the AFDS maintains the FMC speed displayed on the FMA and/or the CDU CLIMB or DESCENT pages. During speed intervention, use the MCP IAS/MACH selector to manually set the speed
- VNAV PTH (active) – the AFDS maintains FMC altitude or descent path with pitch commands. For a non-entered headwind, thrust may increase to maintain the VNAV descent path. If the MCP altitude window is set to the current cruise altitude as the airplane approaches the top of descent, the CDU scratchpad message RESET MCP ALT displays

VQ-BPT

- 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. VNAV ALT maintains altitude
- when a VNAV descent is initiated before the top of descent (T/D) and the airplane descent path subsequently intercepts the VNAV descent path, the pitch annunciation changes from VNAV SPD to VNAV PTH.

V/S –

Pushing the V/S switch opens the vertical speed window and displays the current vertical speed. It also opens the IAS/MACH window (if blanked). Pitch commands maintain the rate of climb or descent selected in the V/S window.

SPD –

Pushing the SPD switch opens the IAS/MACH window (if blanked). Pitch commands maintain IAS/MACH window airspeed or Mach.

ALT CAP –

A transition maneuver entered automatically from a V/S, FLCH, or VNAV climb or descent to selected MCP altitude. Engages but does not annunciate during VNAV transition.

ALT HOLD –

Altitude hold mode is activated by:

- pushing the MCP altitude HOLD switch, or
- capturing the selected altitude from a V/S or FLCH climb or descent.

G/S –

Autopilot flight director system follows the ILS glideslope.

FLARE –

- FLARE (armed) – during autoland, FLARE displays below 1500 feet radio altitude
- FLARE (active) – during autoland, flare activates at 50 feet radio altitude. FLARE deactivates at touchdown and the nosewheel smoothly lowers to the runway.

Autothrottle System

The autothrottle system provides thrust control from takeoff through landing.

Autothrottle mode and speed selection is controlled from the MCP and the thrust mode select panel (TMSP). When in VNAV, the FMC selects autothrottle modes and target thrust values. Refer to Chapter 11, Flight Management, Navigation, for FMS and CDU operation.

With a command speed of VREF + 5 knots and landing flaps, there is sufficient wind and gust protection available with the autothrottle engaged. The autothrottle adjusts thrust quickly when the airspeed decreases below the command speed. The autothrottle decreases thrust slowly when the airspeed is more than the command speed. In turbulence, the result is that the thrust average is higher than necessary to keep the command speed. This causes the speed average to be more than the command speed.

The autothrottle can be operated without using the flight director or the autopilot.

The autothrottle can be manually overridden or disconnected by using either A/T disconnect switch.

Thrust Management Computer

The thrust management computer (TMC) controls the autothrottle system through manual inputs from the MCP or automatically from the FMCs while VNAV is engaged. The basic TMC functions are to:

- calculate thrust limits and settings or follow FMC thrust settings
- detect and transmit autothrottle failures
- actuate the thrust levers

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

- generate fast slow indications for display on the ADIs

Thrust Mode Select Panel

The thrust mode select panel (TMSP) provides the following functions:

- selection of reference thrust modes (TO, GA, CLB, CON, CRZ)
- selection of fixed and assumed temperature derated reference thrust values

Autothrottle Thrust Lever Operation

The autothrottle system moves both thrust levers together to control speed or thrust, depending on the engaged mode.

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

Thrust levers can be manually positioned without disconnecting the autothrottle. After manual positioning and release, the autothrottle repositions the thrust levers to comply with the engaged mode. The autothrottle system does not reposition the thrust levers while in THR HOLD mode.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

Thrust levers can be manually positioned without disconnecting the autothrottle. After manual positioning and release, the autothrottle repositions the thrust levers to comply with the engaged mode. The autothrottle system does not reposition the thrust levers while in THR HLD mode.

Autothrottle Disconnect

The autothrottle system can be disconnected manually by positioning the A/T arm switch to OFF or by pushing either thrust lever A/T disconnect switch.

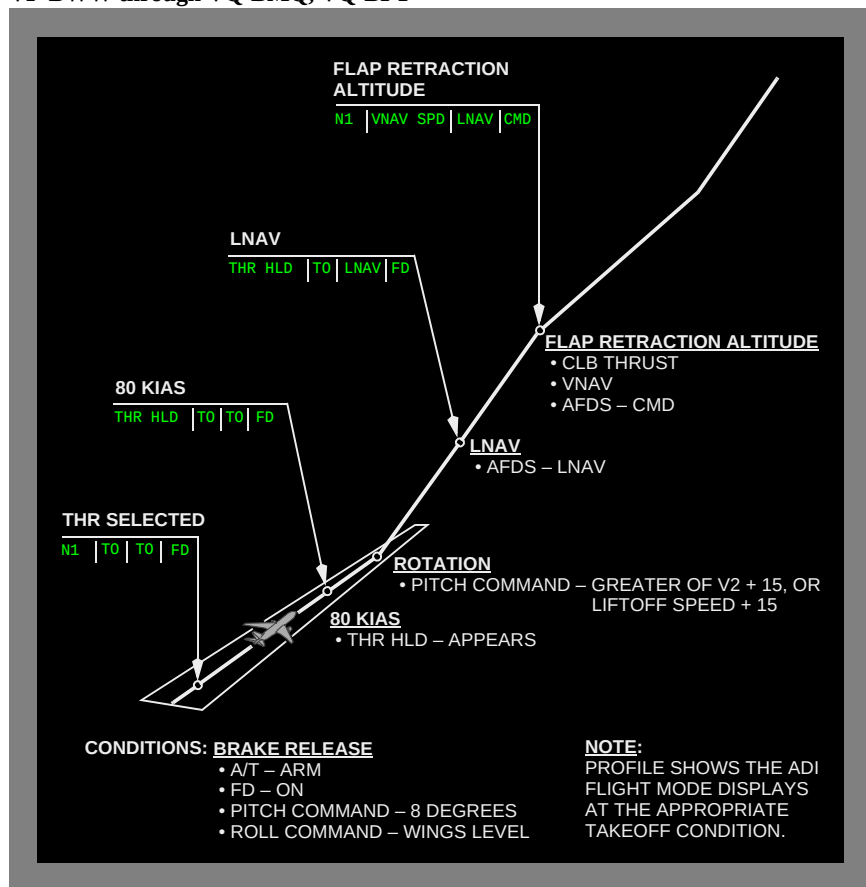
Autothrottle disconnect occurs if a fault in the active autothrottle mode is detected, or when a reverse thrust lever is raised to reverse idle.

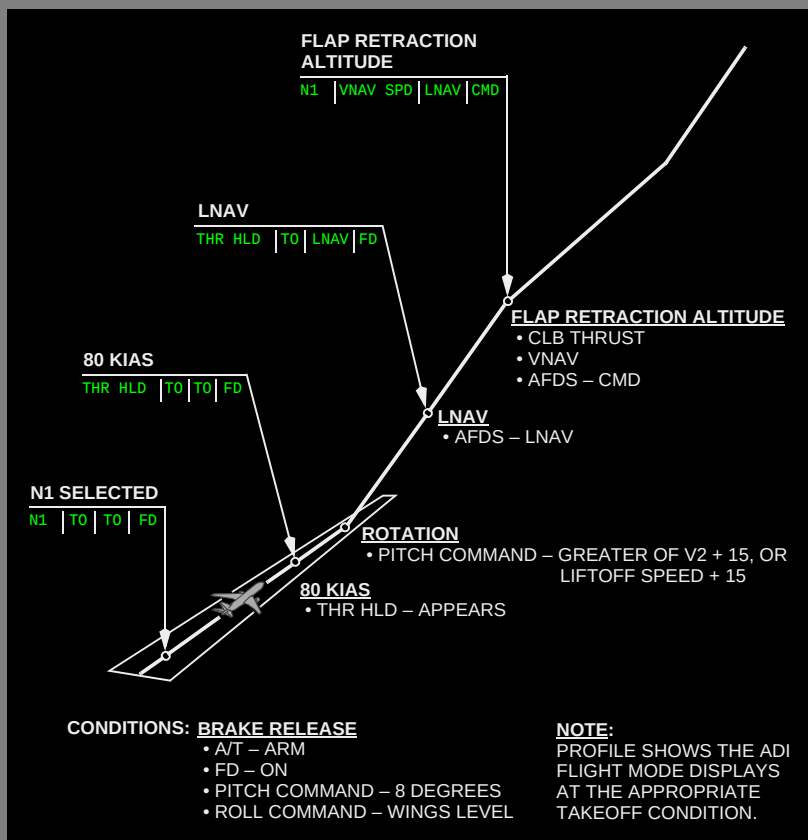
The A/T DISC light illuminates and the EICAS caution message AUTOTHROT DISC displays.

Automatic Flight Operations

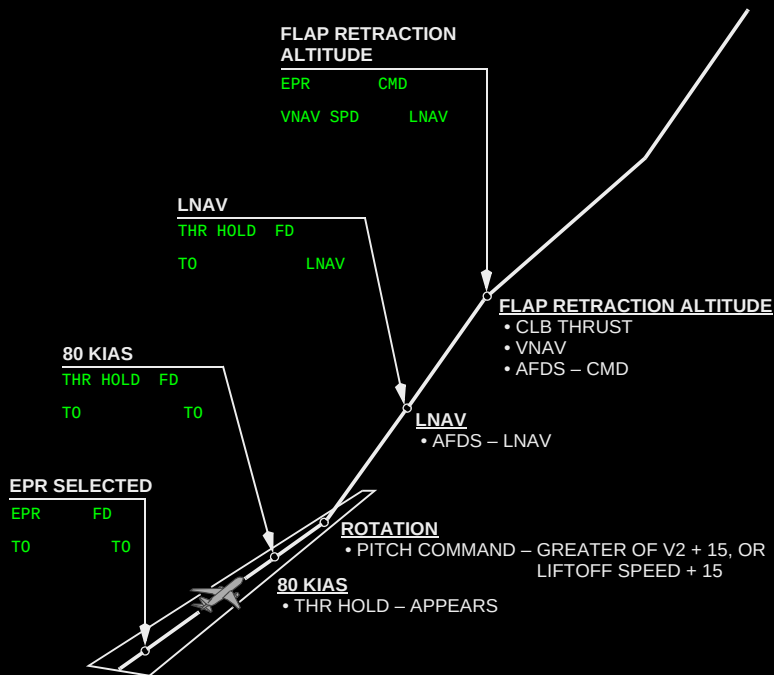
Automatic Flight – Takeoff and Climb Profile

VP-BWW through VQ-BMQ, VQ-BPT



767 Flight Crew Operations Manual
VP-BDI, VP-BOQ, VP-BRL, VQ-BOG, VQ-BRA


VP-BMC, VP-BOY, VP-BOZ

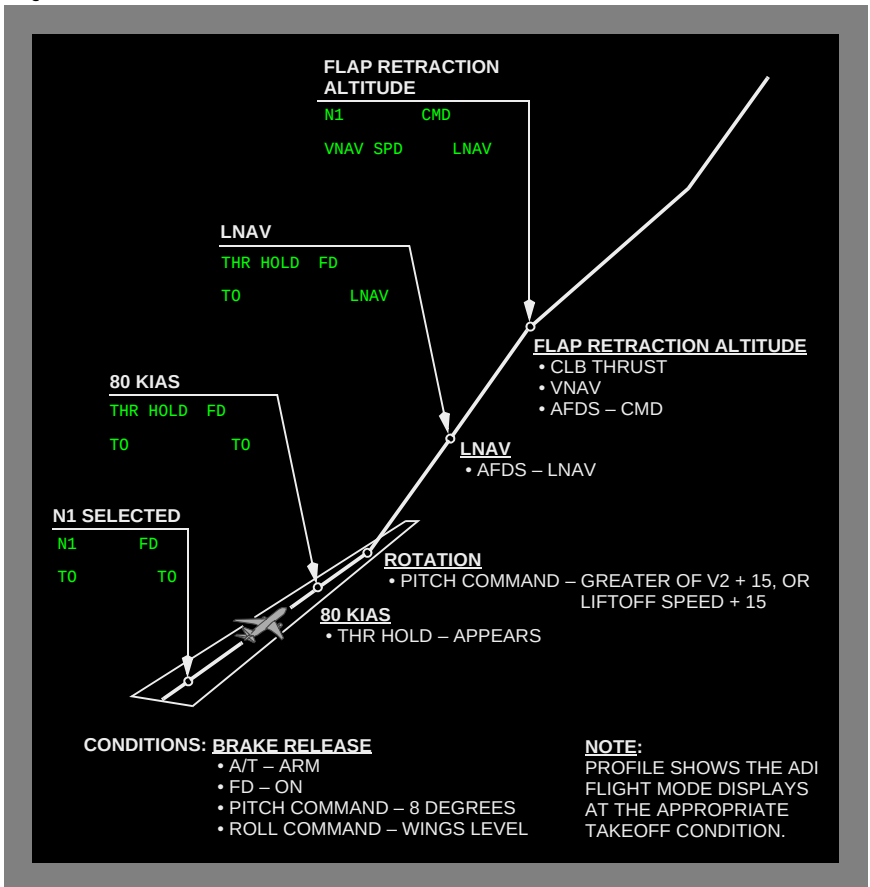


CONDITIONS: BRAKE RELEASE

- A/T – ARM
- FD – ON
- PITCH COMMAND – 8 DEGREES
- ROLL COMMAND – WINGS LEVEL

NOTE:

PROFILE SHOWS THE ADI
FLIGHT MODE DISPLAYS
AT THE APPROPRIATE
TAKEOFF CONDITION.

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VQ-BMU


Takeoff is a flight director only function and can only be engaged on the ground. The autopilot is not used during the takeoff roll but may be engaged after liftoff.

During preflight:

- with the autopilot disengaged and both F/D switches OFF, activation of TO roll and pitch mode occurs when the first F/D switch is positioned ON
- FD displays as AFDS status and TO as the pitch and roll flight mode annunciations
- command steering bars come into view

On takeoff, prior to 80 knots IAS:

- pitch command is set to approximately eight degrees up
- roll command is wings level

VP-BMC, VP-BOY, VP-BOZ

- autothrottle is engaged by pushing EPR switch, thrust levers advance to selected takeoff power

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

- autothrottle is engaged by pushing N1 switch, thrust levers advance to selected takeoff power

VP-BWW through VQ-BMQ, VQ-BPT

- autothrottle is engaged by pushing THR switch, thrust levers advance to selected takeoff power

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

- FMAs display N1 for autothrottle and TO for both pitch and roll modes.

VP-BMC, VP-BOY, VP-BOZ

- FMAs display EPR for autothrottle and TO for both pitch and roll modes.

During takeoff prior to lift-off:

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

- at 80 knots, autothrottle annunciation changes to THR HOLD.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

- at 80 knots, autothrottle annunciation changes to THR HLD.

At lift-off:

- pitch command greater of $V_2 + 15$ or liftoff speed + 15
- 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:

VP-BDI through VP-BWX, VQ-BMU, VQ-BRA

- FD TO modes are terminated by engaging an A/P in CMD, or selecting any other pitch or roll mode

VQ-BMQ, VQ-BOG, VQ-BPT

- FD TO modes are terminated by selecting any other pitch or roll mode

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

- A/T remains in THR HOLD mode at takeoff thrust until a pitch mode, A/T mode, or thrust reference mode select switch is pushed. The A/T then sets climb thrust or the selected reference thrust

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

- A/T remains in THR HLD mode at takeoff thrust until a pitch mode, A/T mode, or thrust reference mode select switch is pushed. The A/T then sets climb thrust or the selected reference thrust

767 Flight Crew Operations Manual**VP-BMC, VP-BOY, VP-BOZ, VQ-BMU**

- Fast/Slow pointer appears on ADIs following selection of a thrust mode other than TO and a FD mode other than TO.

Note: Autopilot elevator authority during a single autopilot operation is limited to reduce the effects of an autopilot malfunction. During altitude capture, there may be insufficient elevator authority and stabilizer trim rate to counteract pitch down, caused by the combination of thrust reduction, flap retraction and aft c.g.

Note: An altitude capture from a climb that includes a significant airspeed increase or thrust reduction may result in the autopilot descending away from the selected altitude in an attempt to increase the airspeed.

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 FMC. Using LNAV and VNAV ensures the most economical operation.

Automatic Flight – Approach and Landing**VP-BMC**

The AFDS provides guidance for single or multiple autopilot precision approaches. Pushing the APP switch arms localizer in the roll mode and glideslope in the pitch mode. With any single autopilot engaged, manual arming of one, or both of the remaining two (by selecting them to CMD) is necessary for a multiple autopilot approach.

VP-BDI, VP-BOQ through VQ-BRA

The AFDS provides guidance for multiple autopilot precision approaches. Pushing the APP switch arms localizer in the roll mode and glideslope in the pitch mode. Also, with an autopilot engaged, the remaining two autopilots automatically arm for a multiple autopilot approach.

VP-BDI, VP-BMC, VP-BWW, VP-BWX

Glideslope capture is inhibited until the localizer is captured.

VP-BOQ through VP-BRL, VQ-BMQ through VQ-BRA

Either localizer or glideslope can be captured first.

Pushing the LOC switch arms the AFDS for localizer tracking. Descent on the localizer can be accomplished using VNAV, FLCH, or V/S pitch modes. The localizer mode cannot capture if the intercept angle exceeds 120 degrees. All other nonprecision approaches can be flown using LNAV and VNAV modes, or HDG SEL or V/S modes.

VP-BOQ, VP-BOY, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Pushing the B/CRS switch in conjunction with the LOC switch will enable localizer backcourse tracking.

Runway Alignment and Asymmetric Thrust Compensation

AFDS controls rudder during multiple autopilot ILS approaches to compensate for engine-out asymmetric thrust conditions during an ILS approach.

With LAND 3 or LAND 2 annunciated, autopilot control of the rudder is active.

The runway align submode is operative during multiple autopilot ILS approach. It reduces the crab angle established during crosswind conditions prior to automatic landing. The submode operates as follows:

- actuated at 500 feet radio altitude with LAND 3 or LAND 2 annunciated
- activation not displayed
- autopilot systems initiate a slip with a maximum bank angle of two degrees when the crab angle exceeds five degrees
- wing leveling from the slip is initiated when the ROLLOUT mode is engaged.

If the autopilots are disengaged, manually or automatically, in an asymmetric thrust condition with rudder control active, the rudder moves to the trimmed position. The pilot may need to exert rudder pedal force to maintain a smooth transition to manual flying.

Flare

The flare maneuver brings the airplane to a smooth automatic landing touchdown. The flare submode is a multiple autopilot mode, and is not intended for single autopilot or flight director only operation.

At approximately 50 feet radio altitude, the autopilots start the flare maneuver. FLARE replaces the G/S pitch flight mode annunciation.

Flare arms when LAND 3 or LAND 2 annunciates.

During flare:

- at 15 feet radio altitude the autothrottle retards thrust levers to idle
- IDLE replaces the SPD autothrottle flight mode annunciation
- if slip exists due to runway align submode, wings leveled when ROLLOUT mode engaged
- autopilots start lowering nose wheel to runway at five feet radio altitude plus two seconds with pitch attitude less than two degrees
- at touchdown, the FLARE annunciation no longer displays, and the nose lowers to the runway.

Note: During an approach with LAND 2 annunciated and below 100 feet radio altitude an increment of nose up trim is automatically applied for flare. If the autopilots are subsequently disengaged in the approach, a forward control column force of 20–30 pounds may be required to counter the automatic trim condition. If an automatic multi-autopilot go-around is performed, the increment of automatic trim is removed.

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Rollout

Rollout arms when LAND 3 or LAND 2 annunciates.

At approximately five feet radio altitude, rollout activates. ROLLOUT replaces the LOC roll flight mode annunciation.

The autopilot controls the rudder and nose wheel steering to keep the airplane on the localizer centerline.

VP-BDI through VQ-BMQ, VQ-BOG, VQ-BPT

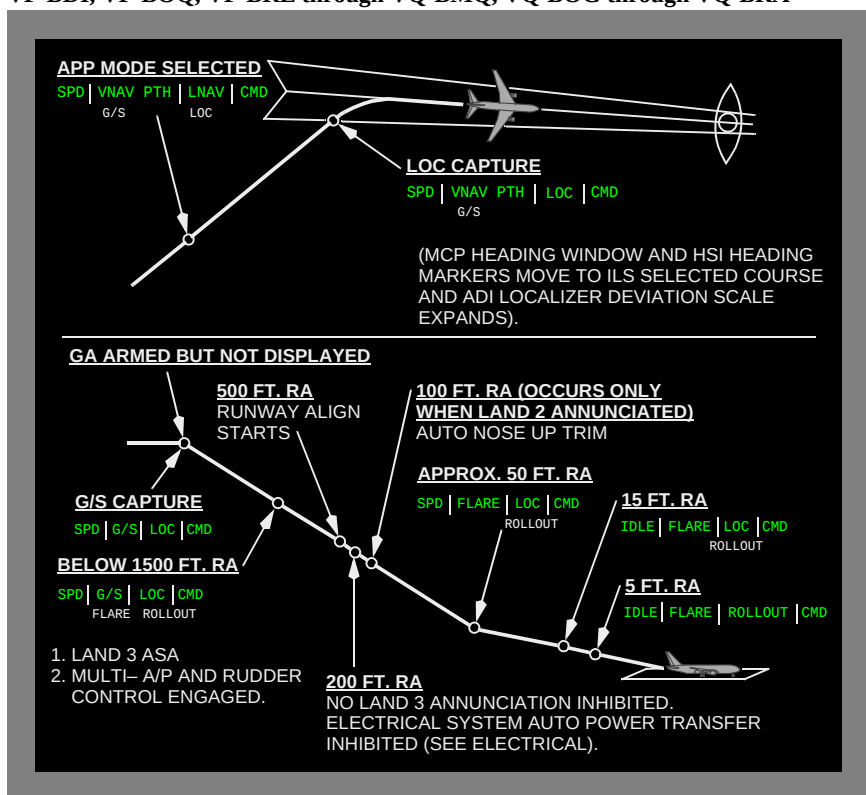
Roll command bar provides directional steering.

Rollout guidance continues until a full stop or until the autopilots are disengaged.

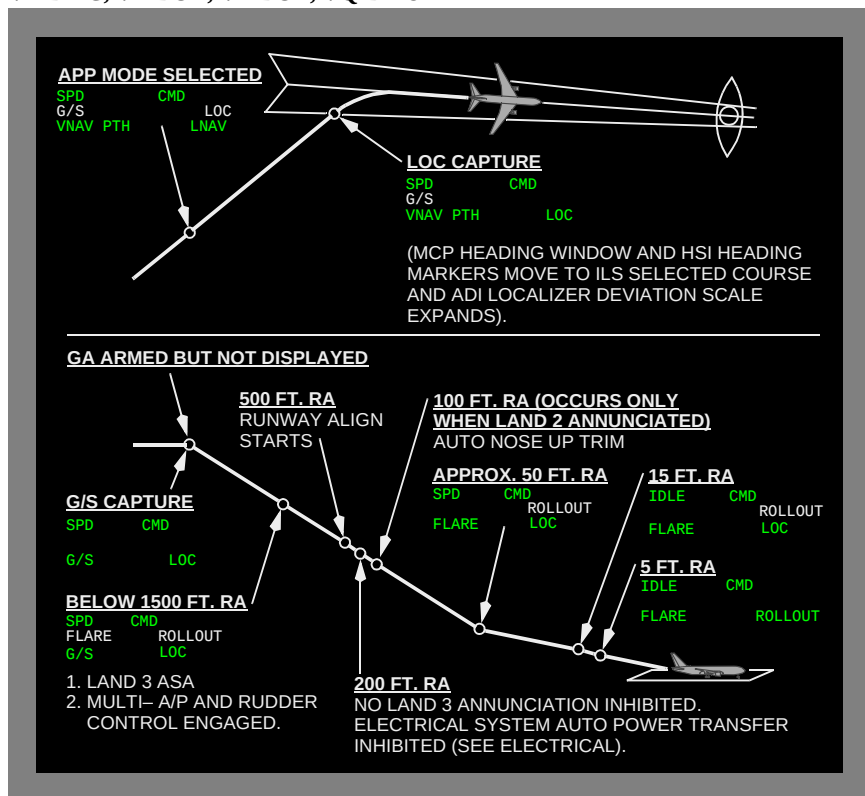
During rollout, autothrottle IDLE mode remains active until the autothrottle disengages. Autothrottle disengagement occurs when either thrust lever is set in reverse thrust position. When selecting reverse thrust the A/T DISC caution light, AUTOTHROT DISC EICAS message and aural warning will not be activated.

Automatic Flight – Approach Profile

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA



VP-BMC, VP-BOY, VP-BOZ, VQ-BMU



Automatic Flight – Go-Around

Pushing either GA switch activates a go-around using multiple autopilot, single autopilot or flight director only.

When the F/D switches are not on, pushing either GA switch displays the flight director bars.

Go-around arms and the reference thrust limit changes to GA when the flaps are out of up or glideslope is captured. Arming is not annunciated. GA remains armed until two seconds after five feet radio altitude. Pushing either GA switch during this period of the approach engages the GA mode. The mode remains active even if the airplane touches down while executing the go-around.

If the airplane is floating within five feet radio altitude for more than two seconds when the GA switch is pushed, the autopilot pitch mode will remain in FLARE and the autothrottle go-around mode will engage.

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If the airplane is on the ground but has been below five feet radio altitude for less than two seconds when the GA switch is pushed, the autopilot GA pitch mode will engage but the A/T mode will remain IDLE.

The GA switches are interlocked with the thrust reversers to prevent go-around mode engagement during reverse thrust operation.

When pushing either GA switch:

- roll and pitch activate in GA on the FMA

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

- autothrottle increases thrust to maintain a climb rate of at least 2000 fpm

VP-BRL

- autothrottle increases thrust with adjustment, as necessary, to maintain a climb rate of 2000 fpm
- roll commands bank to maintain ground track
- AFDS increases pitch to hold existing speed or the selected MCP speed, whichever is higher, as thrust increases
- if flap setting is 20 or less, a thrust mode other than go-around can be selected.

Note: Autopilot elevator authority during a single autopilot approach is limited to reduce the effects of an autopilot malfunction. If a go-around is initiated during a single autopilot approach, there may be insufficient elevator authority and stabilizer trim rate to counteract pitch up, caused by a rapid application of full go-around thrust. There is sufficient elevator authority to counteract pitchup when the go-around is flown using multiple autopilots, or manually (no autopilot), or when the autothrottle go-around mode is used to set a 2000 FPM climb rate.

GA level-off:

- at the selected altitude, the AFDS pitch flight mode annunciation changes to ALT CAP, then to ALT HOLD and autothrottle mode changes to SPD
- GA remains the active roll mode until another mode is selected
- landing gear and flaps must be operated manually.

GA Mode Termination:

Below 400 feet radio altitude –

- if flap setting is 25 or 30, autothrottle remains in GA mode unless disengaged
- disengaged autopilot and turn off both flight directors.

Above 400 feet radio altitude –

- select a different roll or pitch mode; all autopilots, except first in CMD, disengage.

Note: If the autopilot systems are compensating for an asymmetric thrust condition when they revert to a single autopilot in CMD configuration, the rudder will return to the trimmed position unless the pilot exerts the rudder pedal force required to maintain the rudder position.

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 GA switch commands a pitch-up of 15 degrees or slightly below the pitch limit, whichever is lower.

When 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 or engaged, the thrust levers must be advanced manually.

Auto Flight Limit Modes

Autothrottle Limit Modes

- FLAP LIM
- ALPHA
- SPD LIM

Pitch Limit Modes

- FLAP LIM
- SPD LIM

Flap placards speeds, airplane maximum angle of attack and maximum speed limit are automatically monitored by the AFDS and TMC in all modes except V/S pitch. The appropriate speed limit mode annunciation of FLAP LIM, ALPHA, or SPD LIM is displayed when a speed limit is approached and the MCP selected speed or FMC target speed is set to exceed a limit. When the limit mode is displayed, the limit speed becomes the reference speed for the autothrottle and AFDS.

When the AFDS is engaged in a speed mode (FLCH, GA), the speed limit monitoring is accomplished by the AFDS. When approaching a speed limit, the appropriate limit mode annunciation, replaces the existing pitch mode.

The AFDS will not annunciate ALPHA when approaching maximum angle of attack speed, however, the alpha safe speed will be maintained by AFDS pitch.

767 Flight Crew Operations Manual

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

When the AFDS is not controlling speed, speed limit monitoring is accomplished by the TMC. When a speed limit is exceeded, the appropriate limit mode annunciation appears at the autothrottle mode position. The speed limit mode annunciations may appear when the autothrottles are engaged or not engaged.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

When the AFDS is not controlling speed, speed limit monitoring is accomplished by the TMC. When a speed limit is exceeded, the appropriate limit mode annunciation appears at the autothrottle mode position. The speed limit mode annunciations may appear only when the autothrottles are engaged.

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

The Fast/Slow pointer changes color to amber and the pointer flashes when a speed limit is exceeded.

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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	Light	Aural	Condition
AUTOPILOT	Caution	AUTO PILOT	Beeper	The engaged autopilot is operating in a degraded mode. Engaged roll and/or pitch mode may have failed.

VP-BMC, VP-BOY, VQ-BOG, VQ-BRA

AUTOPILOT DISC	Warning	A/P DISC	Siren	The autopilot has disconnected.

VP-BDI, VP-BOQ, VP-BOZ through VQ-BMU, VQ-BPT

AUTOPILOT DISC	Warning	A/P DISC	Wailer	The autopilot has disconnected.

AUTOTHROT DISC	Caution	A/T DISC	Beeper	The autothrottle has disconnected.

Intentionally
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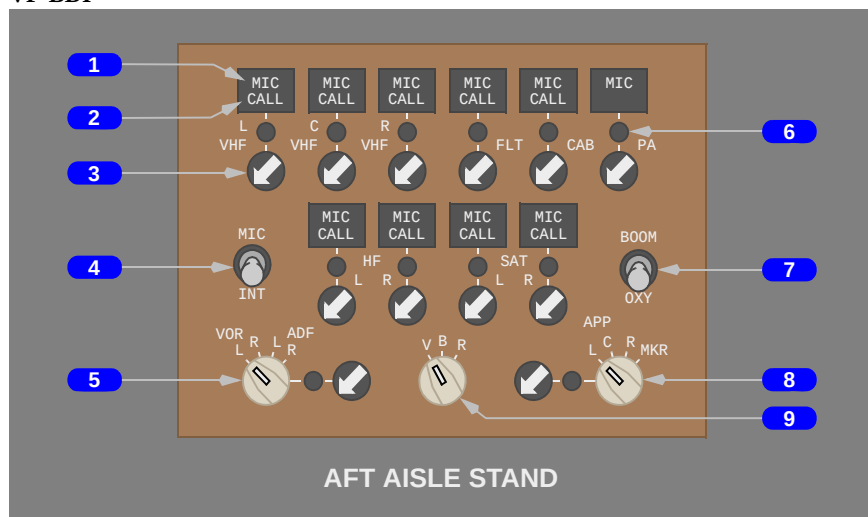
Communications Controls and Indicators

Chapter 5 Section 10

Audio Control Panel (ACP)

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT

VP-BDI



VP-BWW through VQ-BMQ, VQ-BPT



1 Microphone Selector Switches/Lights

Push –

- the selected transmitter MIC light illuminates
- the MIC light for any other transmitter extinguishes
- selects the respective transmitter (radio or intercommunications) for transmission from this crew station (only one can be selected at a time for each crew station)
- selects the receiver audio on, if not already manually selected on

2 CALL Lights

Illuminated (white) –

- indicates a call on SELCAL (VHF or HF radio), the flight interphone (FLT), or the cabin interphone (CAB)
- resets when the respective transmitter select switch is pushed or, if already pushed, by pressing a MIC/INTERPHONE switch
- PA does not have a CALL light

3 Receiver Control

Push – turns respective receiver ON/OFF at any volume setting.

Rotate – varies respective receiver volume.

VP-BWW through VQ-BMQ, VQ-BPT

Note: Will not select off when 121.500 is tuned in the RTP Active Frequency Indicator.

VP-BDI

4 Microphone/Interphone (MIC/INT) PTT Switch

MIC – keys microphone for transmission on system selected with MIC select switches.

INT – keys microphone for transmission on flight interphone system.

VP-BWW through VQ-BMQ, VQ-BPT

4 Radio Transmit/Interphone (R/T /INT) PTT Switch

R/T – keys boom microphone/oxygen mask microphone on transmitter selected.

Center – off position (spring-loaded to center).

INT – keys boom microphone/oxygen mask microphone on flight interphone.

5 VOR/ADF Receiver Selector

Selects the left or right VOR or ADF receiver to be monitored.

6 Receiver Selected Lights

Illuminated – indicates respective receiver audio volume control is manually selected on.

VP-BDI**7 Boom/Oxygen (BOOM/OXY) PTT Switch**

BOOM – transmit from the boom microphone.

OXY – transmit from the oxygen mask microphone.

VP-BWW through VQ-BMQ, VQ-BPT**7 Speaker (SPKR) Control**

Push – selects respective speaker ON/OFF at any volume setting.

Rotate – varies respective speaker volume.

8 Approach Receiver (APP) Selector

Selects respective receiver to be monitored.

- L – left ILS is monitored
- C – center ILS is monitored
- R – right ILS is monitored
- MKR – marker beacon is monitored

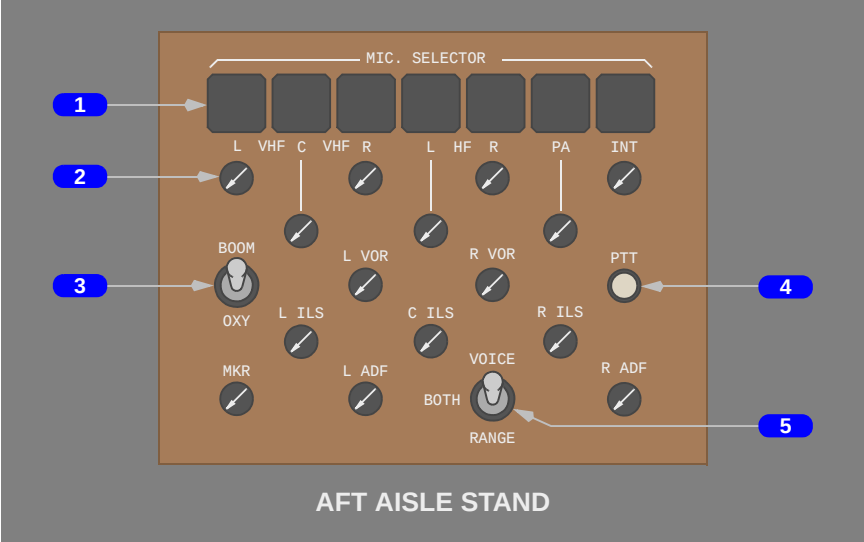
9 NAV Filter Selector

Filters VOR, ADF, ILS, or DME audio

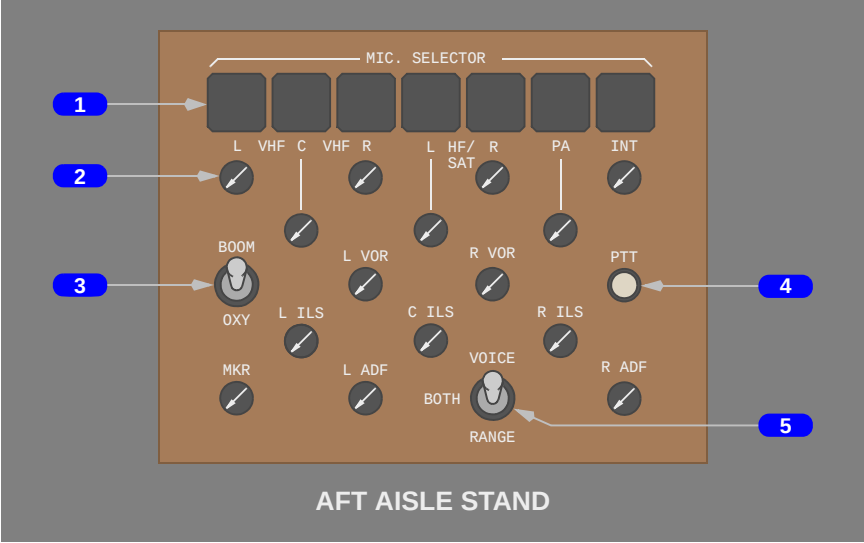
- V (Voice) – only the voice audio is heard
- B (Both) – both the voice and range audio are heard
- R (Range) – range audio (navigation aid Morse code identifier) is heard

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

VP-BMC through VP-BRL, VQ-BMU, VQ-BRA



VQ-BOG



1 Microphone Selector Switches/Lights

Push –

- the selected transmitter light illuminates
- the light for any other transmitter extinguishes
- selects the respective transmitter (radio or intercommunications) for transmission from this crew station (only one can be selected at a time for each crew station)
- selects the receiver audio on, if not already manually selected on

2 Receiver Control

Push – turns respective receiver ON/OFF at any volume setting.

Rotate – varies respective receiver volume.

3 Boom/Oxygen (BOOM/OXY) Switch

BOOM – transmit from the boom microphone.

OXY – transmit from the oxygen mask microphone.

4 Push-To-Talk (PTT) Switch

Push and hold – transmits on selected system.

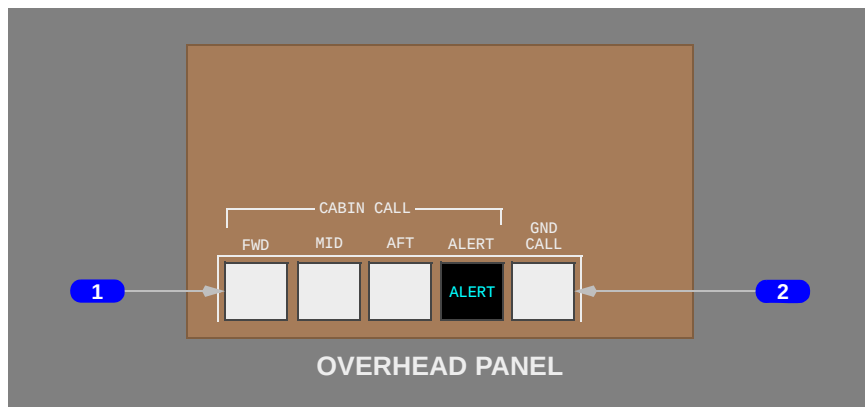
5 Navigation Filter Selector

Filters VOR, ADF, or ILS audio:

- VOICE – only voice transmissions can be heard
- BOTH – voice transmissions and station identifiers can be heard
- RANGE – only station identifiers can be heard

Pilot Call Panel

VP-BDI



1 CABIN CALL Switch/Lights

Illuminated – indicates a flight attendant call:

- resets when call is answered or cancelled
- FWD, MID, and AFT also reset when light is pushed

Push – calls selected station or ALERT calls all stations.

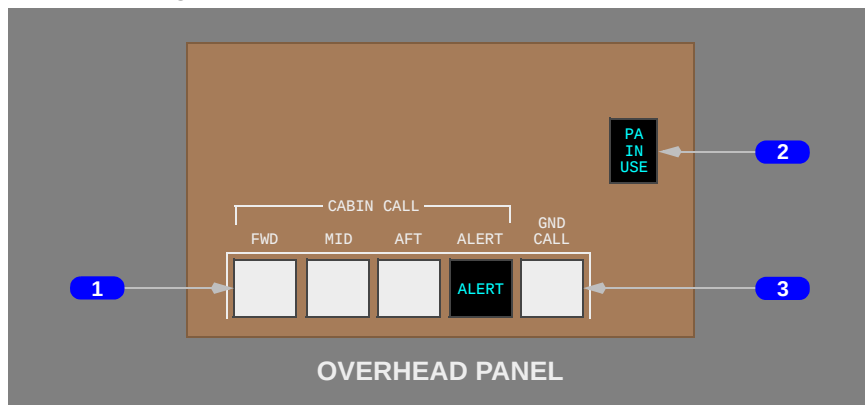
2 Ground Call (GND CALL) Switch/Light

Illuminated – indicates a call from ground personnel:

- extinguishes after 30 seconds

Push – calls ground personnel as long as switch is pushed.

VP-BWW through VQ-BMQ, VQ-BPT



767 Flight Crew Operations Manual

1 CABIN CALL Switch/Lights

Illuminated – indicates a flight attendant call:

- resets when call is answered or cancelled

Push – calls selected station or ALERT calls all stations.

2 PA IN USE Light

Illuminated – PA system in use.

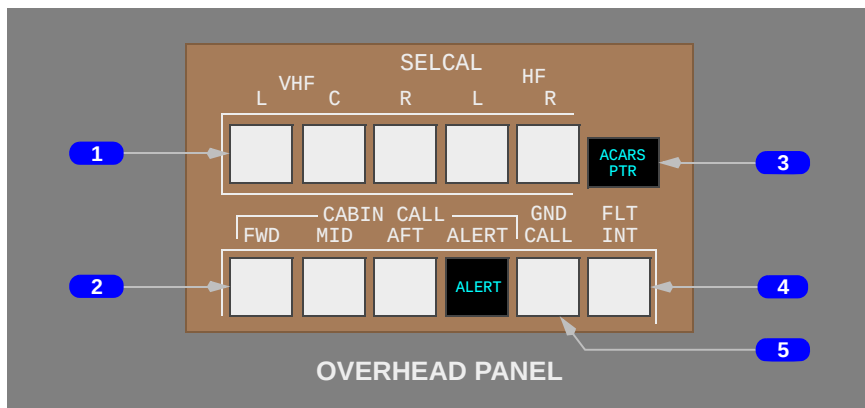
3 Ground Call (GND CALL) Switch/Light

Illuminated – indicates a call from ground personnel:

- extinguishes after 30 seconds

Push – calls ground personnel as long as switch is pushed.

VP-BOY



1 Selective Calling (SELCAL) Switches / Lights

Illuminated – indicates a radio call on SELCAL:

- resets when the respective transmitter is keyed or when light is pushed

Note: INOP placard indicates radio is not installed.

2 CABIN CALL Switch/Lights

Illuminated – indicates a flight attendant call:

- resets when call is answered or cancelled
- FWD, MID, and AFT also reset when light is pushed

Push – calls selected station:

- ALERT calls all stations

3 ACARS Printer (PTR) Light

Illuminated – ACARS printer is printing data.

4 Flight Interphone (FLT INT) Switch/Light

Push – interconnects flight and cabin interphone systems.

Illuminated (Blue) – flight and cabin interphone systems are connected.

Push again – returns to normal operation – light is extinguished.

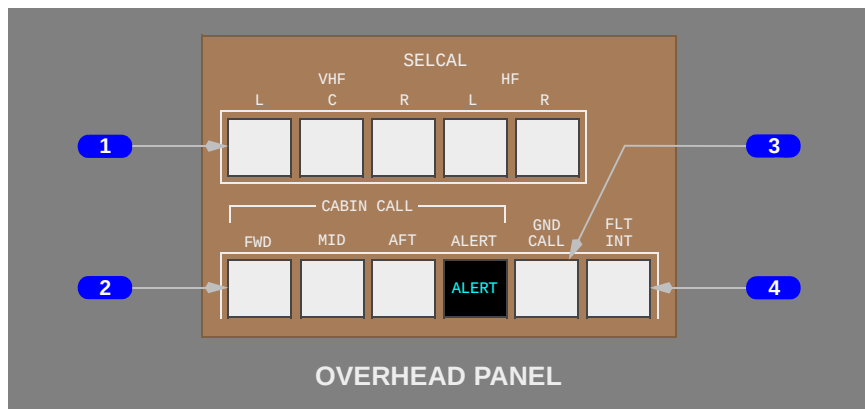
5 Ground Call (GND CALL) Switch/Light

Illuminated – indicates a call from ground personnel:

- extinguishes after 30 seconds

Push – calls ground personnel as long as switch is pushed.

VP-BMC, VP-BOQ, VP-BOZ



1 Selective Calling (SELCAL) Switch/Lights

Illuminated – indicates a radio call on SELCAL:

- resets when the respective transmitter is keyed or when light is pushed

2 CABIN CALL Switch/Lights

Illuminated – indicates a flight attendant call:

- resets when call is answered or cancelled
- FWD, MID, and AFT also reset when light is pushed

Push – calls selected station or ALERT calls all stations.

3 Ground Call (GND CALL) Switch/Light

Illuminated – indicates a call from ground personnel:

- extinguishes after 30 seconds

Push – calls ground personnel as long as switch is pushed.

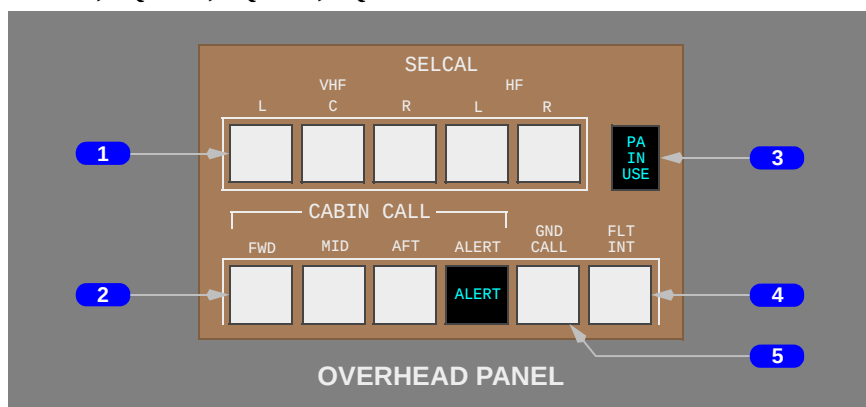
4 Flight Interphone (FLT INT) Switch/Light

Push – interconnects flight and cabin interphone systems.

Illuminated – flight and cabin interphone systems are connected.

Push again – returns to normal operation – light is extinguished.

VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA



1 Selective Calling (SELCAL) Switch/Lights

Illuminated – indicates a radio call on SELCAL:

- resets when the respective transmitter is keyed or when light is pushed

2 CABIN CALL Switch/Lights

Illuminated – indicates a flight attendant call:

- resets when call is answered or cancelled
- FWD, MID, and AFT also reset when light is pushed

Push – calls selected station or ALERT calls all stations.

3 PA IN USE Light

Illuminated – PA system in use.

4 Flight Interphone (FLT INT) Switch/Light

Push – interconnects flight and cabin interphone systems.

Illuminated – flight and cabin interphone systems are connected.

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Push again – returns to normal operation – light is extinguished.

5 Ground Call (GND CALL) Switch/Light

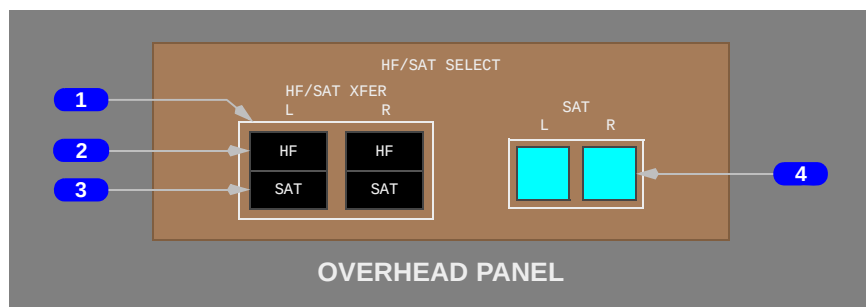
Illuminated – indicates a call from ground personnel:

- extinguishes after 30 seconds

Push – calls ground personnel as long as switch is pushed.

HF/SATCOM Select Panel

VP-BOY, VP-BOZ



1 HF/SATCOM Transfer (HF/SAT XFER) Switch

Push – alternates HF and SATCOM radio transmit/receive control.

Note: INOP placard indicates radio is not installed.

2 HF Transfer Light

Illuminated – indicates the associated HF radio is being used to transmit/receive.

3 SATCOM (SAT) Transfer Light

Illuminated – indicates the associated SATCOM radio is being used to transmit/receive.

4 SATCOM (SAT) Light

Illuminated – flight crew being called by ground station via SATCOM radio.

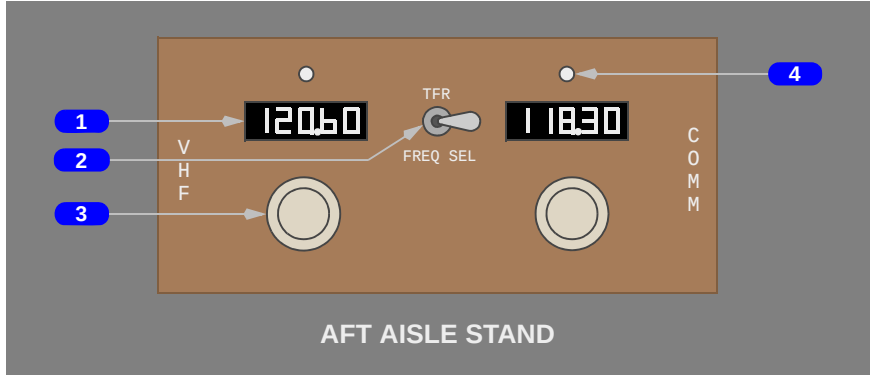
Note: INOP placard indicates radio is not installed.

Radio System

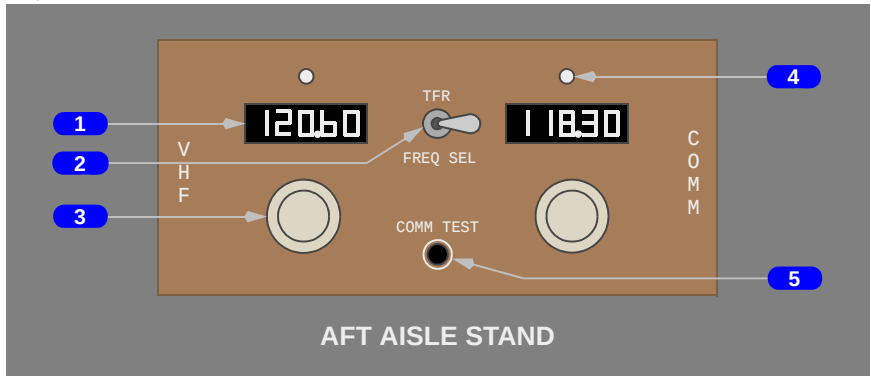
VHF Communication Panel

VP-BOZ, VP-BRL, VQ-BMU, VQ-BRA

VP-BOZ, VP-BRL, VQ-BRA



VQ-BMU



1 Frequency Window

Indicates the selected frequency.

2 Frequency Transfer (TFR) Switch

Selects which frequency is active for the transceiver.

3 Frequency Selector

Rotate – changes frequency of related radio:

- outer selector changes digits to the left of the decimal point
- inner selector changes digits to the right of the decimal point

4 Active Frequency Light

Illuminated – indicates which frequency has been selected by the frequency transfer switch.

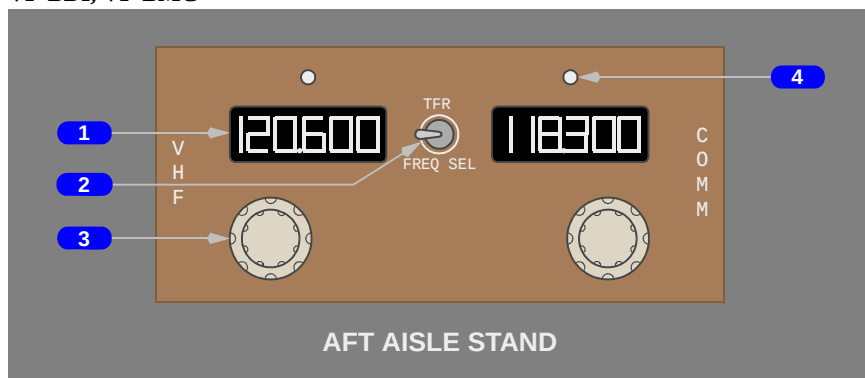
VQ-BMU

5 COMM TEST Switch

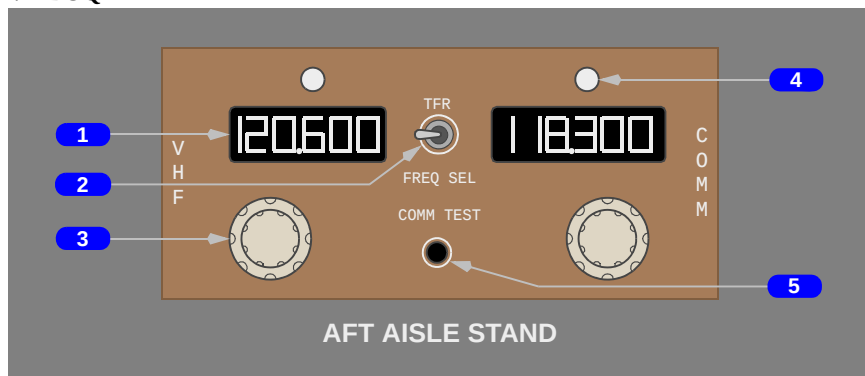
Push – removes automatic squelch and permits reception of background noise to verify VHF receiver operation.

VP-BDI through VP-BOQ

VP-BDI, VP-BMC



VP-BOQ



1 Frequency Window

Indicates the selected frequency.

2 Frequency Transfer (TFR) Switch

Selects which frequency is active for the transceiver.

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3 Frequency Selector

Rotate – changes frequency in the window above:

- outer selector changes digits to the left of the decimal point
- inner selector changes digits to the right of the decimal point

4 Active Frequency Light

Illuminated – indicates which frequency has been selected by the frequency transfer switch.

VP-BOQ

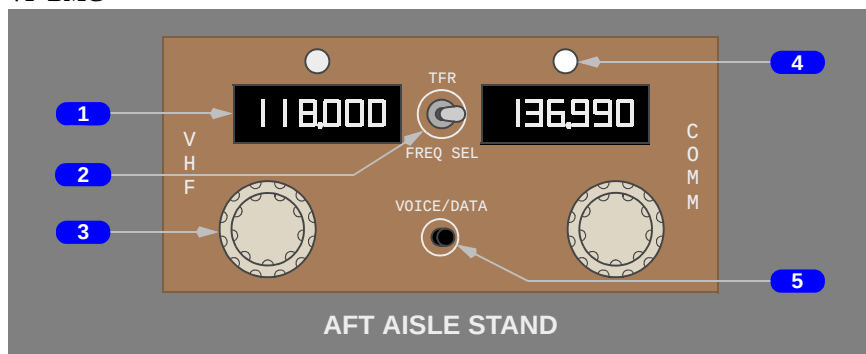
5 COMM TEST Switch

Push – removes automatic squelch and permits reception of background noise to verify VHF receiver operation.

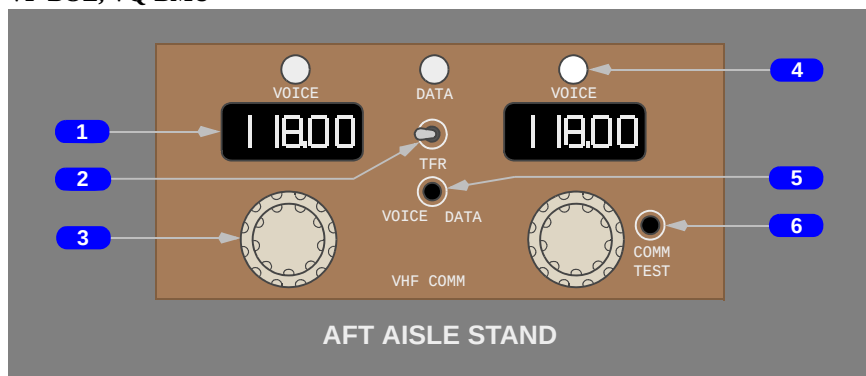
Note: Test operates only with radio in the voice mode.

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU, VQ-BOG

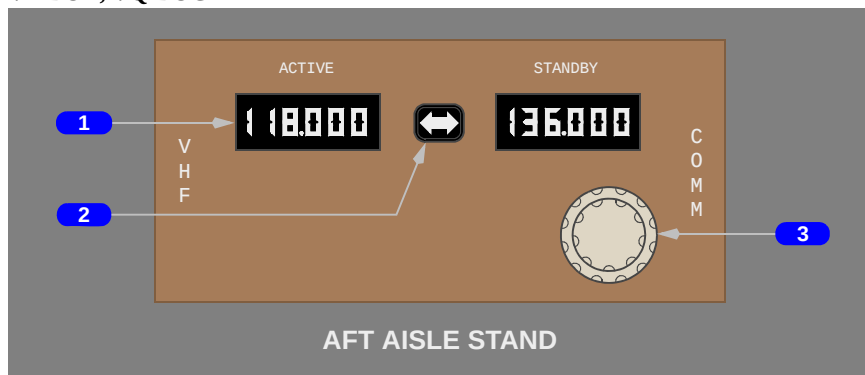
VP-BMC



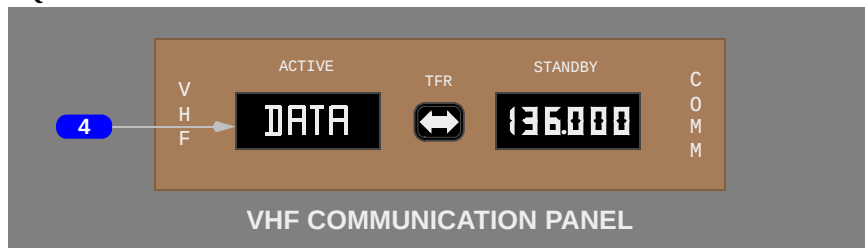
VP-BOZ, VQ-BMU



VP-BOY, VQ-BOG



VQ-BOG



VP-BMC, VP-BOZ, VQ-BMU

1 Frequency Window

Indicates the selected frequency.

VP-BOY, VQ-BOG

1 Frequency Window (ACTIVE)

Indicates the selected, active frequency.

2 Frequency Transfer (TFR) Switch

Selects which frequency is active for the transceiver.

VP-BMC, VP-BOZ, VQ-BMU

3 Frequency Selector

Rotate – changes frequency in the window above:

- outer selector changes digits to the left of the decimal point
- inner selector changes digits to the right of the decimal point

VP-BOY, VQ-BOG**3 Frequency Selector**

Rotate – changes frequency in the STANDBY window:

- outer selector changes digits to the left of the decimal point
- inner selector changes digits to the right of the decimal point

VP-BMC**4 Active Frequency Light**

Illuminated – indicates which frequency has been selected by the frequency transfer switch.

VP-BOZ, VQ-BMU**4 Active Frequency Light (VOICE)**

Illuminated – indicates which voice frequency has been selected by the frequency transfer switch.

VQ-BOG**4 Data Mode**

Displays DATA in the ACTIVE frequency window when the selected radio is being used in the data mode.

Data mode is enabled by:

- rotating the frequency selector until DATA is displayed in the STANDBY window
- transferring DATA to the ACTIVE window

VP-BMC, VP-BOZ, VQ-BMU**5 VOICE/DATA Select Switch**

Push – selects voice or data mode. Second push returns to previous mode.

VP-BOZ, VQ-BMU

Note: VOICE/DATA switch inoperative without operational ACARS.

VP-BMC

Note: VOICE/DATA switch inoperative. Center VHF radio is dedicated to ACARS.

VP-BOZ, VQ-BMU**6 COMM TEST Switch**

Push – removes automatic squelch and permits reception of background noise to verify VHF receiver operation.

Note: Test operates only with radio in the voice mode.

Contran Annunciator Light

VP-BOQ



1 Contran Annunciator Light

Illuminated –

- steadily – indicates an attempted VHF transmission on a frequency when another transmission is already taking place on that frequency, or a continuous VHF transmission of greater than 20 seconds but less than 30 seconds duration
- flashing – indicates a continuous VHF transmission of greater than 30 seconds duration

HF Communication Panel

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

VP-BDI, VP-BMC



VP-BOQ through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

1 Frequency Window

Indicates the selected frequency.

2 Frequency Selectors

Selects the frequency shown in the Frequency Window:

Rotate left knob – changes the digits to the left of the decimal point.

Rotate right knob – changes the digits to the right of the decimal point.

3 Mode Selector

OFF – power removed from unit.

USB – sets the upper side band (USB) mode.

AM – sets the amplitude modulation (AM) mode.

4 Radio Frequency Sensitivity (RF SENS) Control

Rotate – adjusts the sensitivity of the HF receiver:

- (clockwise) increases sensitivity for reception of weak or distant stations
- (counter clockwise) decreases sensitivity to reduce noise and static

Note: Decreasing sensitivity too far prevents reception, including SELCAL monitoring of HF radio.

Radio Tuning Panel

VP-BWW through VQ-BMQ, VQ-BPT



1 Offside Tuning Light

Illuminated –

- 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 RTP is normally associated with VHF L and HF L. The right RTP is normally associated with VHF R and HF R. The center RTP is normally associated with VHF C.

2 ACTIVE Frequency Window

Displays the tuned frequency of the selected radio.

VP-BWW, VP-BWX, VQ-BPT

Displays DATA if the selected radio is in the data mode (shows only when selected radio is the ACARS radio).

3 Radio Tuning Panel OFF Switch/Light

Push – connects/disconnects the panel from the communications radios.

Illuminated – the RTP is OFF.

4 HF Sensitivity (HF SENS) Control

Rotate – adjusts the sensitivity of the on-side HF receiver.

Note: Decreasing sensitivity too far prevents reception, including SELCAL monitoring of HF radio.

5 AM Switch/Light

Push – sets the AM (amplitude modulation) mode.

AM light illuminated – HF AM is selected.

Push again – sets the USB (upper side band) mode for the selected HF.

AM light extinguished – HF USB is selected.

6 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

7 STANDBY Frequency Window

Displays the preselected or previously tuned frequency of the selected radio.

VP-BWW, VP-BWX, VQ-BPT

Displays DATA when selection of the frequency transfer switch has placed the ACARS radio to the voice mode (shows only when selected radio is ACARS radio). Voice frequency shows in the ACTIVE frequency window.

8 Frequency Selector

Rotate – selects the standby frequency of the selected radio:

- 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

9 Radio Selection Switch/Lights

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

Illuminated (green) – indicates which radio is selected.

Radio Tuning Panel Failure Indications



1 Panel Fail

The radio tuning panel has failed.

Radio Tuning Panel ACARS Indications

VP-BWW, VP-BWX, VQ-BPT

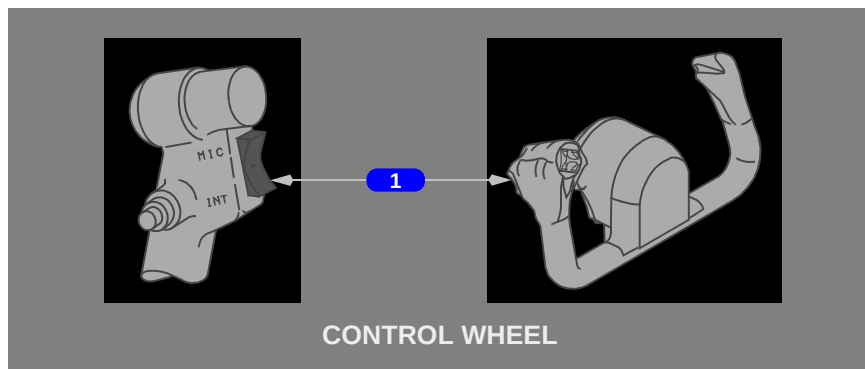


1 DATA Mode

Displays DATA in the ACTIVE frequency window when the selected radio is being used in the data mode.

Miscellaneous Communication Controls

Control Wheel Microphone/Interphone Switch



767 Flight Crew Operations Manual

1 Control Wheel Microphone/Interphone (MIC/INT) Switch

Spring loaded to center (off) position.

MIC – allows transmission on the selected transmitter.

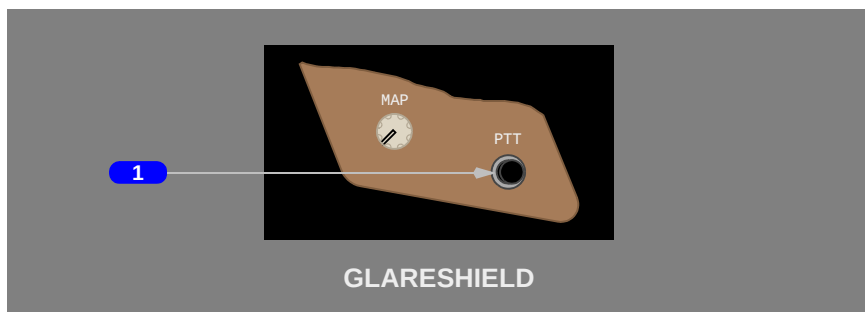
INT – allows transmission on the flight interphone system.

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Locks in interphone position.

Glareshield Push-To-Talk Switch

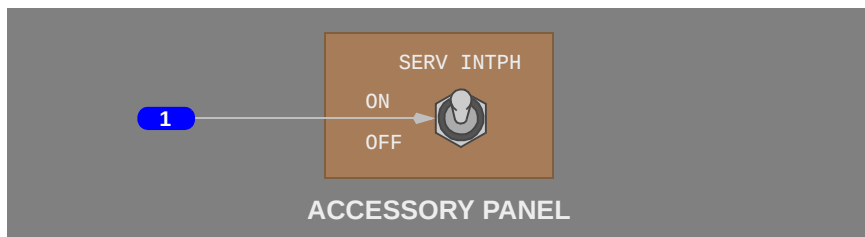
VP-BWW through VQ-BMQ, VQ-BPT



1 Glareshield Push-To-Talk (PTT) Switch

Push – allows transmission on the selected transmitter.

Service Interphone Switch



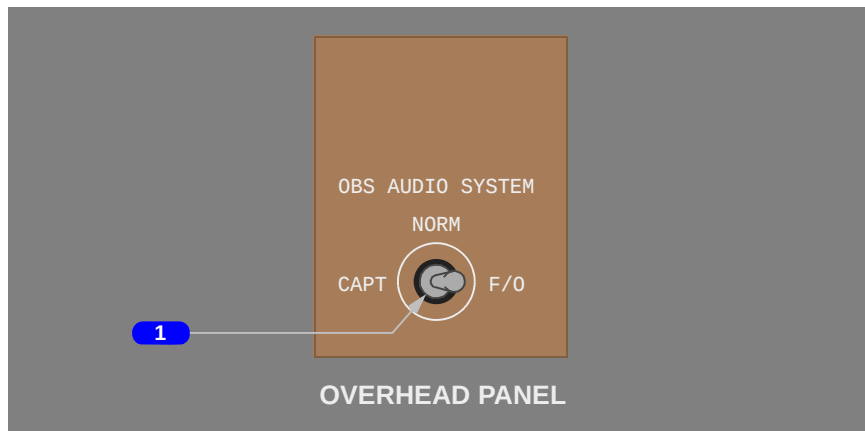
1 Service Interphone (SERV INTPH) Switch

ON – adds external (unpressurized area) headphone jacks to cabin interphone system.

OFF – deactivates external (unpressurized area) headphone jacks, except jack marked FLIGHT at the APU ground control panel.

Observer (OBS) AUDIO SYSTEM Switch

VP-BWW through VQ-BMQ, VQ-BPT



1 Observer (OBS) AUDIO SYSTEM Switch

This switch allows the Captain or First Officer to use the Observer's audio panel.

CAPT – connects Observer's audio panel to Captain's:

- hand microphone
- boom microphone/headset
- headphone
- oxygen mask microphone
- speaker
- PTT switches

NORM – audio panel normal operation.

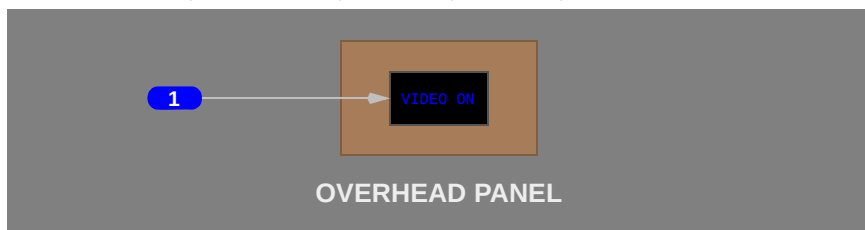
F/O – connects Observer's audio panel to First Officer's:

- hand microphone
- boom microphone/headset
- headphone
- oxygen mask microphone
- speaker
- PTT switches

Video/PA Annunciator Lights

VP-BDI through VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

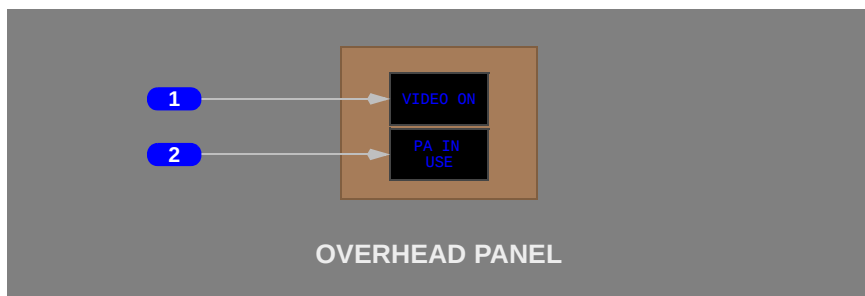
VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA



1 VIDEO ON Light

Illuminated – video system is on.

VP-BMC



1 VIDEO ON Light

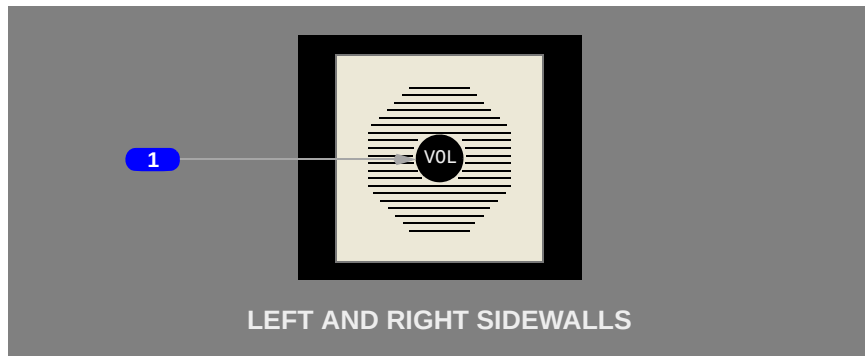
Illuminated – video system is on.

2 PA IN USE Light

Illuminated – public address system is in use.

Flight Deck Speaker

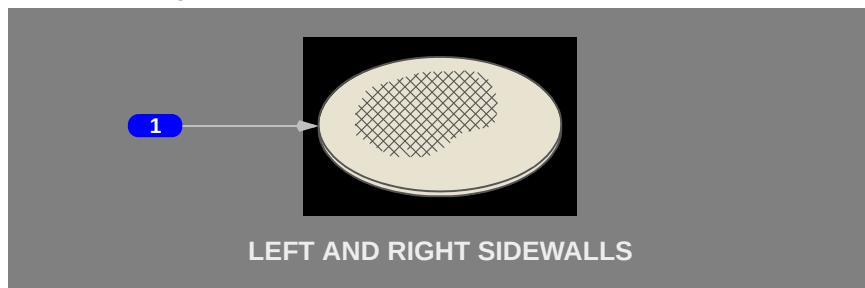
VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA



1 Flight Deck Speaker Volume Control

Rotate – adjusts speaker volume.

VP-BWW through VQ-BMQ, VQ-BPT

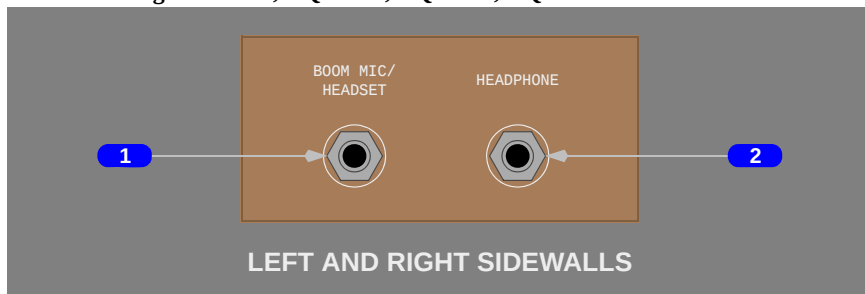


1 Flight Deck Speaker

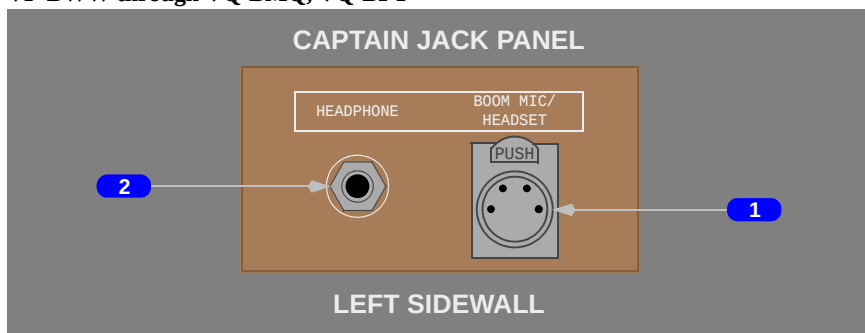
Controlled by the speaker volume control on the respective audio control panel.

Captain/First Officer Jack Panels

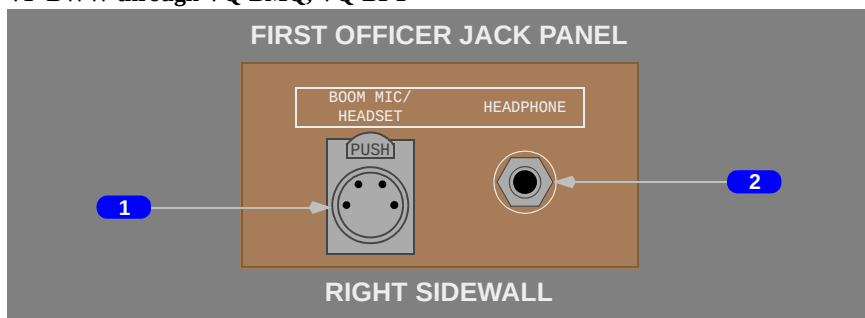
VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA



VP-BWW through VQ-BMQ, VQ-BPT



VP-BWW through VQ-BMQ, VQ-BPT



1 BOOM MIC/HEADSET Jack

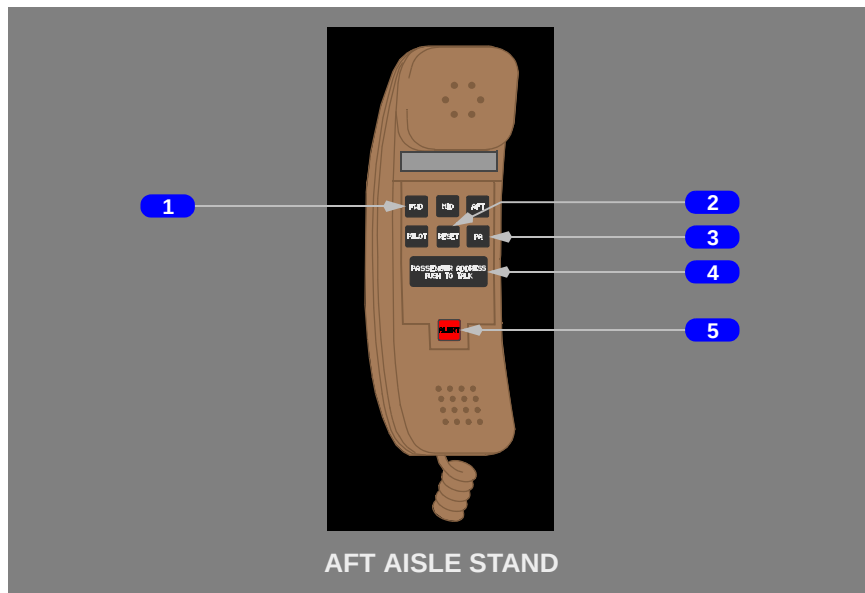
Accepts a flight crew boom microphone/headset plug.

2 HEADPHONE Jack

Accepts a flight crew headphone plug.

Handset

VP-BDI, VQ-BMU, VQ-BOG, VQ-BRA



1 Cabin Call Switches (FWD, MID, AFT)

Push – calls the respective station.

2 RESET Switch

Push – cancels a call.

3 PA Call Switch

Push – selects the PA system for subsequent announcement.

4 PASSENGER ADDRESS Switch

Push – calls all stations:

- connects the handset microphone to the PA system
- only used in the PA mode

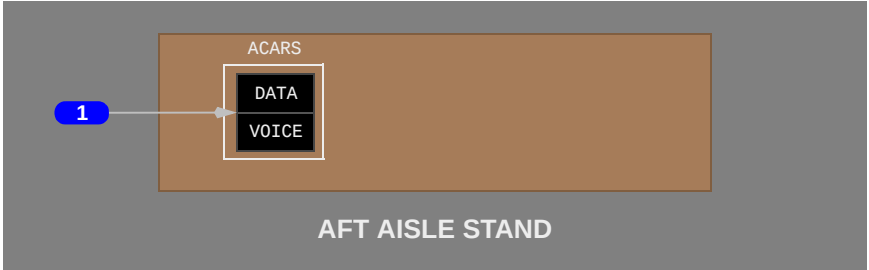
5 ALERT Call Switch

Push – calls all stations.

ACARS Switching Panels

VP-BOZ

ACARS Voice/Data Switch



1 ACARS Mode Switch

Push – switches center VHF radio (VHF-C) between data and voice mode

Illuminated –

- DATA - VHF-C is controlled by the ACARS management unit
- VOICE - VHF-C is controlled by the VHF communications panel

Note: ACARS equipment installed but not operational.

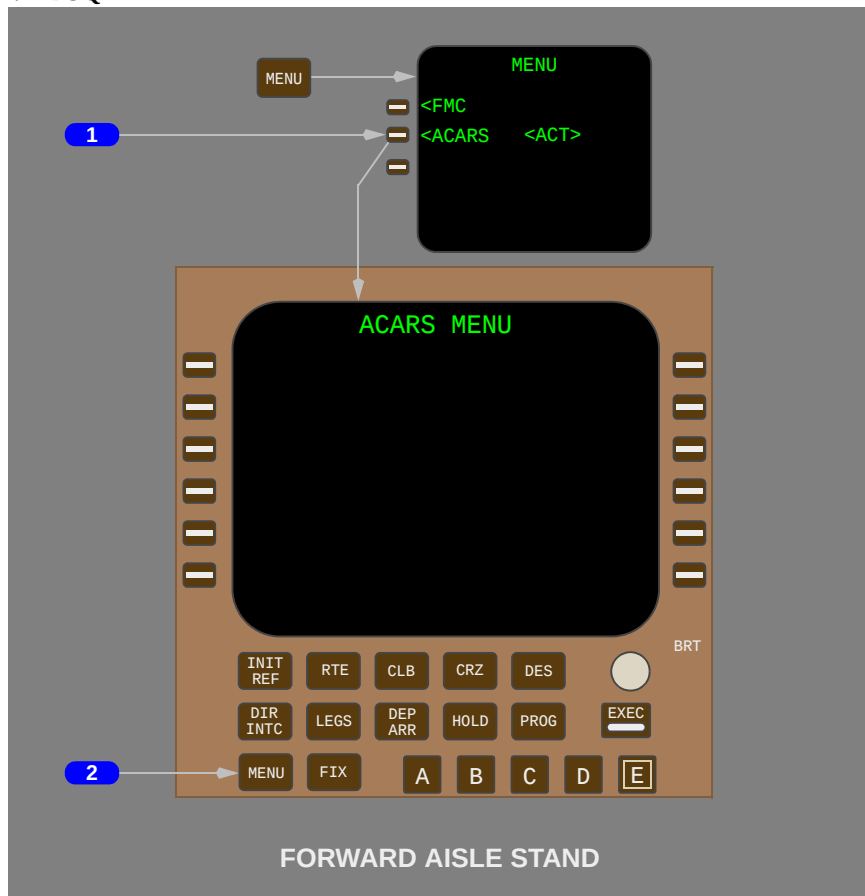
ACARS or SATCOM Control

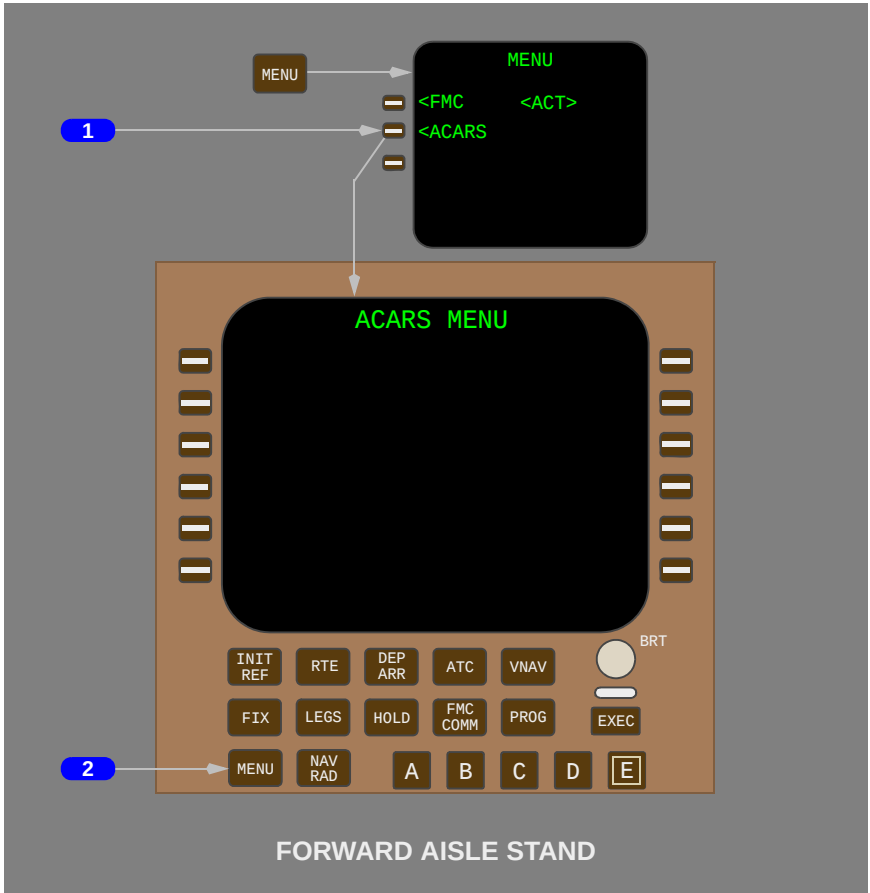
VP-BDI through VP-BOQ, VP-BWW through VQ-BMQ, VQ-BOG, VQ-BPT

ACARS Access Through Control Display Units (CDU)

VP-BDI through VP-BOQ, VP-BWX, VQ-BOG

VP-BOQ



767 Flight Crew Operations Manual
VP-BDI, VP-BMC, VP-BWX, VQ-BOG

1 ACARS Line Select Key

Push – displays ACARS MENU page.

See section 40 of this chapter for description of ACARS operation.

2 MENU KEY

Push – displays MENU page.

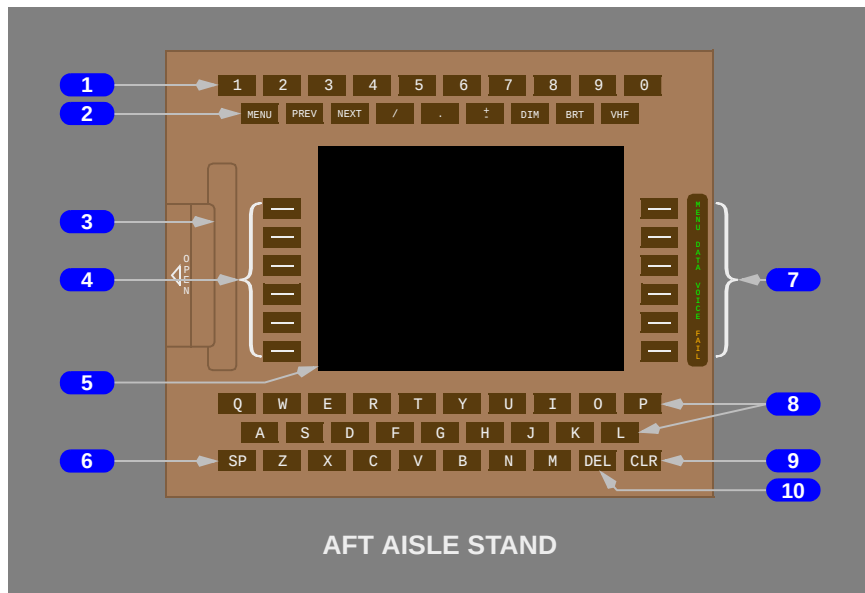
See Chapter 11, Flight Management, Navigation for description of the FMC and associated software functions.

VP-BWX

Note: ACARS control also available through separate ACARS control panel (IDU or CU) located on the Aft Aisle Stand.

ACARS Multipurpose Interactive Display Unit (MIDU)

VP-BWW through VQ-BMQ, VQ-BPT



1 Numeric Keys

Push – displays number characters in scratch pad.

2 Data Entry/Editing Keys

Keys to enter or manipulate data.

3 PCMCIA Card Loading Slot

Maintenance use only.

4 Line Select Keys (LSK)

Push – selects prompted function.

5 Scratch Pad

Display field for displaying alphanumeric characters.

6 Space Key

Push – enters a space in line of characters

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7 Mode Annunciator Lights

MENU (green) – illuminated indicates main menu displayed.

DATA (green) – illuminated indicates ACARS radio in data mode.

VOICE (green) – illuminated indicates ACARS radio in voice mode.

FAIL (amber) – illuminated indicates detected IDU failure.

8 Alpha Keys

Push – displays alpha characters in scratch pad.

9 Clear (CLR) Key

Push – clears scratch pad entry.

10 Delete (DEL) Key

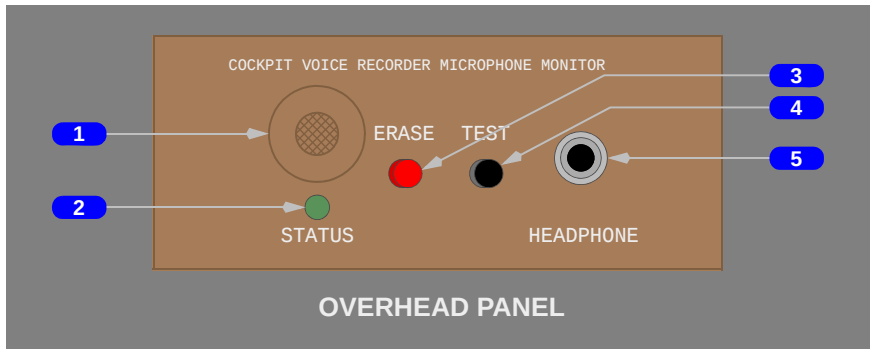
Push – displays DELETE in scratch pad. When line selected, deletes data from display field adjacent LSK.

VQ-BMQ

Note: ACARS equipment installed but not operational.

Cockpit Voice Recorder Panel

VP-BDI through VP-BOY, VP-BWW, VP-BWX, VQ-BOG



1 Microphone

Area microphone for the voice recorder.

2 STATUS Light

Illuminated – test completed successfully. Extinguished after one second.

3 ERASE Switch

Push and hold – erases the voice recorder (if on the ground, AC power on, and the parking brake is set).

4 TEST Switch

Push and hold – initiates cockpit voice recorder test.

5 HEADPHONE Jack

A headphone may be plugged in to monitor playback of voice audio, or to monitor tone transmission during test.

VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA



1 Monitor

During test, needle displaces to green band if all four channels are operating.

2 Microphone

Area microphone for the voice recorder.

3 TEST Switch

Push and hold – initiates cockpit voice recorder test.

4 ERASE Switch

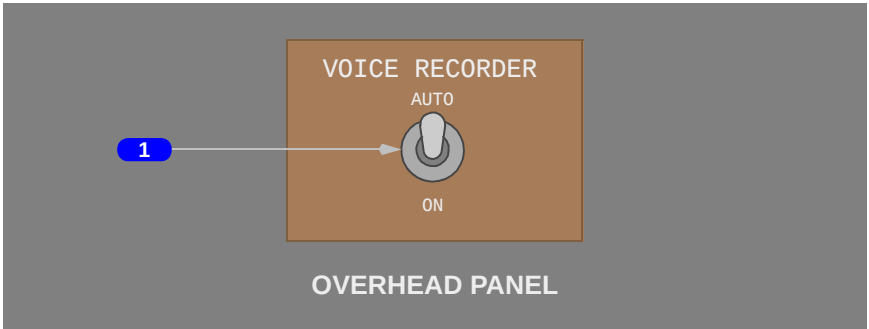
Push (2 seconds) – erases the voice recorder (if on the ground, AC power on, and the parking brake is set).

5 HEADSET Jack

A headset may be plugged in to monitor playback of voice audio, or to monitor tone transmission during test.

Voice Recorder Switch

VP-BOY



1 VOICE RECORDER Switch

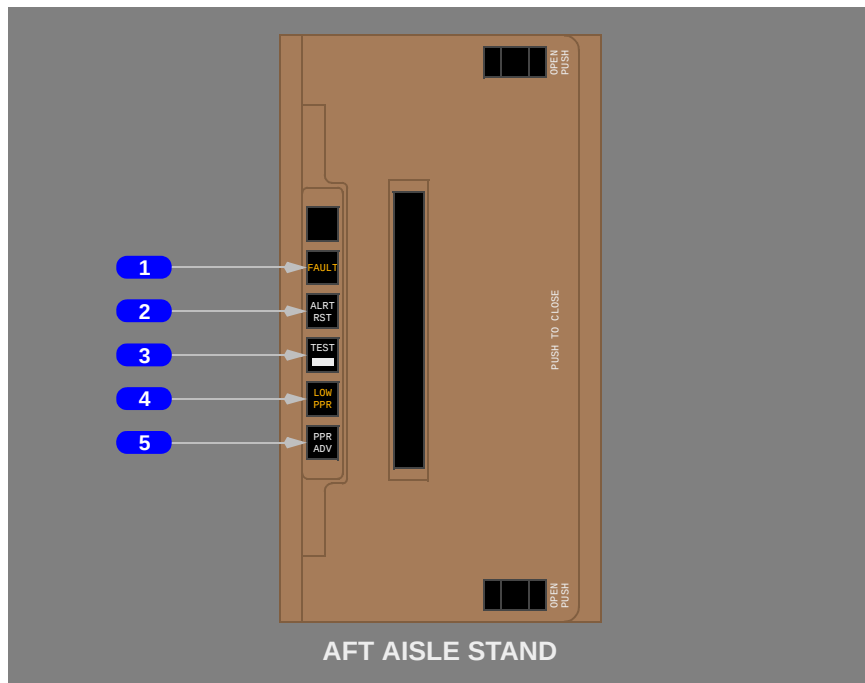
AUTO – runs voice recorder from first engine start until 5 minutes after last engine shut down. Voice recorder always runs in flight.

ON – runs voice recorder before engine start. Spring loaded to auto at engine start.

Printer

VP-BDI through VP-BOQ, VP-BWW through VQ-BPT

VQ-BMQ, VQ-BPT



1 FAULT Light

Illuminated – indicates a printer fault.

2 Alert Reset (ALRT RST) Switch

Push – resets the printer if it stops operating.

3 TEST Switch

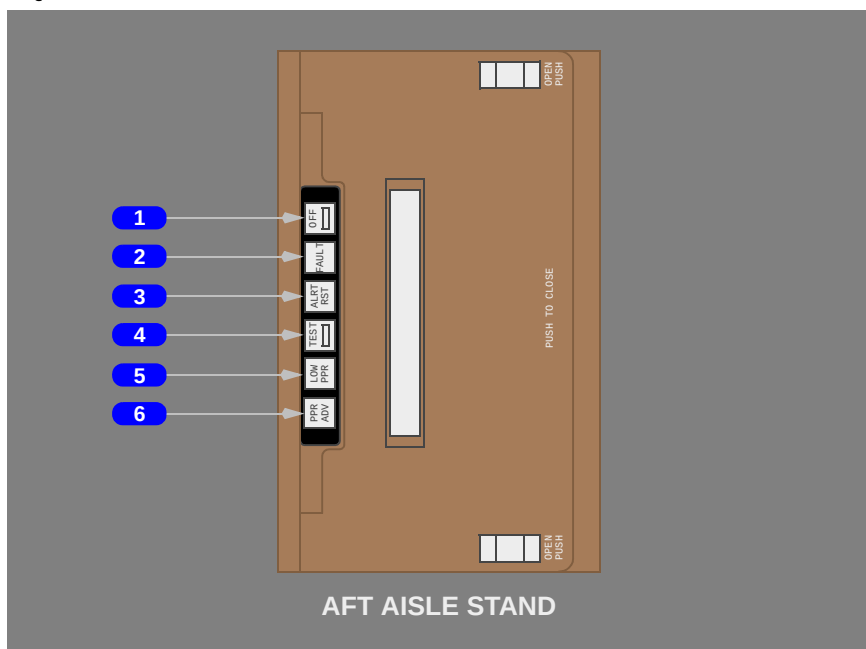
Push – causes the printer to do a self test and print a test pattern.

4 Low Paper (LOW PPR) Light

Illuminated – the printer is low on paper.

5 Paper Advance (PPR ADV) Switch

Push – advances the printer paper while the switch is held.

VQ-BOG

1 OFF/PWR Switch/Light

Push – applies power to the printer and illuminates light.

Push again – disconnects power from the printer and extinguishes light.

2 FAIL/FAULT Light

Illuminated (amber) – indicates a printer fault condition.

3 Alert Reset (ALRT RST) Switch

Push – resets the aural/visual printer alert functions.

4 TEST Switch

Push – causes the printer to do a self test and print a test pattern.

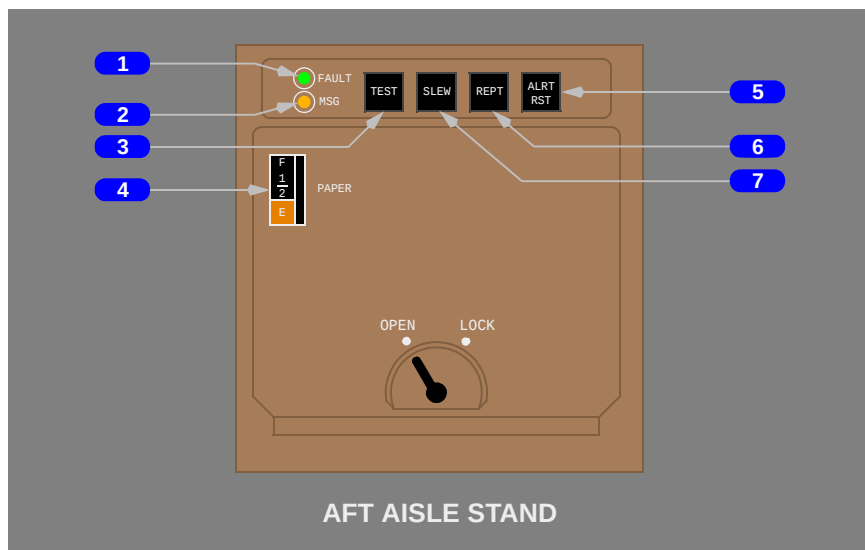
5 Low Paper (LOW PPR) Light

Illuminated – the printer is low on paper.

6 Paper Advance (PPR ADV) Switch

Push – advances the printer paper while the switch is held.

VQ-BMU



1 FAULT Light

Illuminated – indicates any of these situations:

- printer failure
- printer out of paper
- printer door open
- printer test in progress

2 Message (MSG) Light

Illuminated –

- incoming message to printer or test in progress
- remains illuminated until ALRT RST switch pushed or test completed

3 TEST Switch

Push – causes the printer to do a self test and print a test pattern.

4 Paper Quantity Indicator

Indicates quantity of paper remaining.

5 Alert Reset (ALRT RST) Switch

Push – resets printer message (MSG) light.

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6 Reprint (REPT) Switch

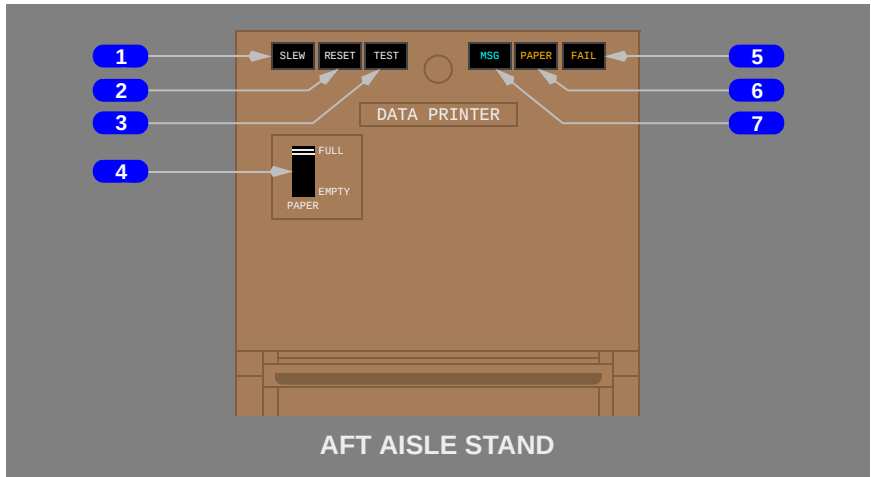
Push –

- reprints the last message received
- subsequent pushes provide additional copies

7 SLEW Switch

Push and hold – advances the printer paper.

VP-BDI through VP-BOQ, VP-BWW, VP-BWX



1 SLEW Switch

Push and hold – advances the printer paper.

2 RESET Switch

Push – resets printer message light.

3 TEST Switch

Push – causes the printer to do a self test and print a test pattern.

4 Paper Quantity Indicator

Indicates quantity of paper remaining.

5 FAIL Light

Illuminated – indicates printer failure.

6 PAPER Light

Illuminated – indicates the printer is out of paper.

7 Message (MSG) Light

Illuminated – indicates incoming message.



Communications System Description

Chapter 5 Section 20

Introduction

The communication systems include:

- radio communication system
- interphone communication system (refer to section 30 of this chapter)
- SELCAL system
- cockpit voice recorder system
- communication crew alerting system

VP-BDI through VP-BOQ, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

- data communication system (refer to section 40 of this chapter)

VP-BWW, VP-BWX, VQ-BOG

- ATC data link system (refer to section 45 of this chapter)

The communication systems are controlled using the:

- audio control panels (ACP)
- pilots call panel (PCP)

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

- control panels for each communication radio

VP-BWW through VQ-BMQ, VQ-BPT

- radio tuning panels (RTP) for control of all communication radios

VP-BDI through VP-BOQ, VP-BWX, VQ-BOG

- control display unit (CDU) for controlling the data link (refer to section 40 of this chapter)

VP-BWW, VP-BWX, VQ-BPT

- control panel (MIDU, IDU, or CU) for controlling the data link (refer to section 40 of this chapter)

Audio Control Panels

The audio control panels (ACP) are used to manage the radio and interphone communication systems. Navigation receiver audio can also be monitored.

Systems are monitored using headphones or speakers. Receiver volume is controlled on the ACP by rotating the knob beneath the respective receiver.

VP-BWW through VQ-BMQ, VQ-BPT

A speaker volume control is located on each audio control panel.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

A speaker volume control is located in the center of the speaker.

Microphones are keyed by pushing the desired audio control panel transmitter select switch and holding in a push-to-talk (PTT) switch. The PTT switches are located on:

- the control wheels

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

- the audio control panels

VP-BWW through VQ-BMQ, VQ-BPT

- the audio control panel switch labeled INT - R/T

VP-BDI

- the audio control panel switch labeled MIC/ INT

VP-BWW through VQ-BMQ, VQ-BPT

- the glareshield
- any hand microphone

There is a boom microphone on the headset, a microphone in the oxygen mask, and a hand microphone jack at all flight crew member stations.

VP-BWW through VQ-BMQ, VQ-BPT

When the oxygen mask stowage door is open, the oxygen mask microphone is enabled and the boom microphone is disabled. When the oxygen mask stowage box door is closed, the oxygen mask microphone is disabled and the boom microphone is enabled.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

When the BOOM/OXY switch on the ACP is in the OXY position, the oxygen mask microphone is enabled and the boom microphone is disabled. When the BOOM/OXY switch on the ACP is in the BOOM position, the oxygen mask microphone is disabled and the boom microphone is enabled.

Radio Tuning Panels

VP-BWW through VQ-BMQ, VQ-BPT

The radio tuning panels (RTP) 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. Any radio can be controlled by any RTP.

Normally, the right RTP is used for tuning the right VHF (or HF) radio, the left RTP is used for tuning the left VHF (or HF) radio, and the center RTP is used to tune the center VHF radio. This is called "on-side" tuning.

An off-side tuning light on each RTP indicates that a communication radio normally associated with that RTP has been selected by, and may be tuned by, another RTP, or that RTP is selected to a radio normally associated with another RTP.

Each HF radio can be tuned by any radio tuning panel. However, HF radio sensitivity can only be set on the "on-side" RTP.

Radio Communication Systems

The radio communication systems consist of:

- the high frequency (HF) communication system
- the very high frequency (VHF) communication system
- the selective calling (SELCAL) system

HF Communication System

Two independent HF communication radios are installed. These are designated HF L (left) and HF R (right). The ACPs are used to control voice transmission and receiver monitoring.

VP-BWW through VQ-BMQ, VQ-BPT

Tuning and sensitivity control for the HF radio is provided through a radio tuning panel (RTP).

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

To tune the HF radio, rotate the frequency selectors on the HF communication panel. The left knob changes the digits to the left of the decimal point, and the right knob changes the digits to the right of the decimal point.

The sensitivity is adjusted by rotating the control knob. Rotating clockwise increases the sensitivity to receive weak or distant stations. Rotating counter clockwise decreases the sensitivity to decrease noise and static.

Note: Decreasing sensitivity too far prevents reception, including SELCAL monitoring of the HF radio.

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.

When an HF transmitter is keyed after a frequency change, the antenna tunes. While the antenna is being tuned, a tone can be heard through the audio system (tuning takes a maximum of 15 seconds).

VHF Communication System

- Three independent VHF radios are installed, designated VHF L (left), VHF C (center), and VHF R (right).

VP-BWW through VQ-BMQ, VQ-BPT

Tuning is accomplished through the radio tuning panels (RTP).

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Tuning is accomplished through communication panels (CP) for each radio.

VP-BMC

The center VHF radio is dedicated to ACARS data link and there is no center VHF CP or RTP installed.

Each VHF radio allows the tuning of two independent frequencies, an active and a standby frequency. These can be interchanged with the frequency transfer switch. The ACPs are used to control voice transmission and receiver monitoring.

VP-BOQ

Contran, a VHF radio anti-blocking device, is installed to prevent transmitting on a VHF frequency when another transmission is already taking place on that frequency. The other transmission will be heard at increased volume or as a loud noise in the absence of a voice modulation. This feature may be overridden by pushing the PTT switch twice in rapid succession.

VP-BOQ

Contran also alerts the flight crew to a stuck mic condition. After 20 seconds continuous VHF transmission, a VHF light on the center instrument panel will illuminate steadily. After 30 seconds, the light will begin to flash and the transmission will be terminated. To resume transmitting, release and push the PTT switch again.

Stuck Mic Protection

(SB Adds VQ-BMU with updated EICAS.)

In the event an HF or VHF radio transmits for more than 30 seconds, the EICAS advisory message RADIO TRANSMIT is displayed. The message is removed when the transmission stops.

Selective Calling (SELCAL) System

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

The SELCAL system monitors all of the communication radios. When the system receives a properly encoded call from a ground station, the crew is alerted through the illumination of the corresponding light on the pilot's call panel.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT

The SELCAL system monitors all of the communication radios. When the system receives a properly encoded call from a ground station, the crew is alerted through the illumination of the corresponding CALL light on the pilot's audio control panel.

The flight crew is also alerted to an incoming call by an aural chime and the SELCAL communication message on the EICAS display. Refer to section 50 of this chapter for a list of possible messages.

Aircraft Communication Addressing and Reporting System (ACARS)

VP-BDI through VP-BOQ, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

ACARS data and voice modes provide automatic and manual means to transmit and receive operational, maintenance, and administrative information between the airplane and a ground station. ACARS is operational when electrical power is established. The ACARS systems descriptions provided in this section are limited to manual selection of ACARS radio operating modes. Refer to section 40 of this chapter for additional information about ACARS operation and control.

ACARS communicates incoming and outgoing data and messages through:

- the center VHF radio

VP-BMC

The center VHF radio is dedicated to ACARS and does not have a VHF communication panel. Tuning and mode selection are controlled by the ACARS management unit. The ACARS radio is automatically tuned to a standard data link frequency for data transmission. Refer to section 40 of this chapter for description of this function.

VP-BDI, VP-BOQ, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

ACARS provides for automatic and manual control, including mode selection, of the dedicated ACARS radio through the ACARS management unit. Refer to section 40 of this chapter for description of this function.

VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

The dedicated ACARS radio is normally operated in data mode for automatic transmission of data and message traffic. In the data mode, the radio is controlled by the ACARS management unit. The flight crew should ensure that the ACARS radio is in data mode with an appropriate data frequency selected. An offline voice mode is also available for regular voice communications.

VP-BDI, VP-BOQ

The VHF communication panel for the ACARS dedicated radio does not provide a means to select offline voice mode and ACARS switching panels are not installed. Control of the ACARS dedicated radio may be transferred to the VHF communication panel through menu selection on the CDU/ACARS IDU or depressing the VOICE/VOX mode switch on the ACARS MIDU/CU. Refer to section 40 of this chapter for description of this function.

VQ-BOG

The ACARS dedicated VHF radio may be used for voice communication, such as ATC reporting, while ACARS is active.

Manual ACARS Mode Selection

VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

ACARS also provides for manual selection of the ACARS dedicated radio operating mode through:

VP-BWW, VP-BWX, VQ-BPT

- the frequency selector and transfer switch on radio tuning panels

VQ-BOG

- the frequency selector and transfer switch on VHF communication panels

Manual ACARS Mode Selection Through Radio Tuning Panels (RTP)

VP-BWW, VP-BWX, VQ-BPT

Select data mode by rotating the frequency selector for the standby frequency window either direction until the word DATA is displayed and then transferring DATA into the active frequency window.

- If the selected VHF radio is the dedicated ACARS radio, then the word DATA is displayed in the active frequency window. When a standby voice frequency is transferred to the active window, DATA is now 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.
- A VHF radio can be set to the voice communication mode by manually transferring a voice frequency into the ACTIVE frequency window.

Manual ACARS Mode Selection Through VHF Communication Panels

VQ-BOG

Select data mode by rotating the frequency selector for the active frequency window either direction until the word DATA is displayed or by selecting DATA in the standby frequency window and then transferring DATA into the active frequency window.

- The VHF radio is in data mode when the word DATA is displayed in the active frequency window. When a standby frequency is transferred to the active window, DATA is now displayed in the standby window.
- A VHF radio can be set to the voice mode by manually transferring a voice frequency into the ACTIVE frequency window.

Voice Recorder System

The cockpit voice recorder records any transmitted or received flight deck audio transmissions from the flight deck made through 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.

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VP-BDI through VP-BOQ, VP-BOZ through VQ-BRA

All inputs are recorded continuously anytime AC power is applied to the airplane.

VP-BOY

With the VOICE RECORDER switch in AUTO the voice recorder is activated when first engine is started. Placing the VOICE RECORDER switch ON activates the recorder any time AC power is applied to the airplane. The switch automatically returns to the AUTO position when an engine is started.

VP-BOY

Recording continues for five minutes after the last engine is shut down.

Fuselage Mounted Emergency Locator Transmitter (ELT)

VP-BDI, VP-BOQ, VP-BOY

Refer to Chapter 1, Section 45 for ELT systems description.

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 communication level messages preceded by a white bullet symbol (•). The aural alert is a single 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.

Communication Alert Categories

Alert Category	Aural	Visual	Remarks
Medium	Chime	EICAS communication alert. Illumination of appropriate switch/light on the PCP or ACP.	Message awareness required. Crew action may be required.
Low	None	EICAS communication alert.	Crew action may be required.

Crew Communication or Selective Calling (SELCAL) Messages

The communication crew alerting system also provides a supplementary method of notifying the flight crew about incoming calls from the cabin, ground personnel, or an incoming radio call. The •SELCAL message is a medium category alert. The flight crew should respond by establishing interphone communications with the calling station or transmitting on the corresponding radio.

Intentionally
Blank



Communications

Interphone Systems

Chapter 5

Section 30

Interphone Communication System

The interphone communication system includes the:

- flight interphone system
- service interphone system
- cabin interphone system
- passenger address (PA) system

The interphone systems allow the flight crew to communicate with the flight attendants, ground personnel, or maintenance technicians. The PA system allows flight attendants or the flight crew to make announcements in the passenger cabin. The flight interphone, service interphone, cabin interphone, and passenger address systems are normally operated through the audio control panel (ACP) in conjunction with the pilot call panel (PCP).

VP-BDI, VQ-BMU, VQ-BOG, VQ-BRA

The cabin interphone and passenger address systems may also be operated with the flight deck handset.

Flight Interphone System

The flight interphone system (FIS) permits communication between flight deck crew members and, on the ground, with ground personnel.

The system is used by the following methods:

- pushing the interphone (INT) position of a control wheel mic/interphone switch to transmit

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT

- selecting the flight (FLT) transmitter select switch on the ACP and pushing a PTT switch

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

- selecting interphone (INT) transmitter select switch on the ACP and pushing a PTT switch

VP-BWW through VQ-BMQ, VQ-BPT

- selecting the INT position on the INT – R/T switch on the audio control panel

Ground personnel are able to communicate on the FIS through a jack located on the APU ground control panel mounted on the nose wheel strut.

The pilots are alerted to an incoming call from the ground crew by the following methods:

- an aural chime sounds in the flight deck
- an illuminated GND CALL light on the PCP
- the EICAS communication message GROUND CALL is displayed

The flight crew should respond to the call using the FIS. Any of the PTT switches may be used to communicate

The flight crew initiates a call to ground personnel by pushing the GND CALL switch. A horn in the nose wheel well activates as long as the switch is pushed. Communication can then take place over the FIS.

Cabin Interphone System

The cabin interphone system (CIS) provides voice communications between the flight deck and the flight attendant stations. Flight deck crew members communicate on the CIS using their ACP and the PCP. The flight crew may use the boom microphones, oxygen mask microphones, or hand microphones to transmit.

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Pressing the FLT INT switch on the pilot's call panel (PCP) will connect the flight interphone system to the cabin interphone system and illuminate the FLT INT light. The pilot should then select the destination (FWD, MID, AFT) for the call on the PCP.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT

A call can be placed by selecting the appropriate station (FWD, MID, AFT, or ALERT) on the PCP, selecting the cabin (CAB) transmitter select switch on an audio control panel, and pressing the PTT switch to speak when the call is answered.

The pilots are alerted to incoming calls from the cabin by the following methods:

- a light illuminates on the PCP (FWD, MID, AFT, or ALERT)
- ### **VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT**
- a cabin (CAB) CALL light illuminates on the ACP
 - an aural chime sounds in the flight deck
 - EICAS communications messages CABIN ALERT or CABIN CALL

VP-BWW through VQ-BMQ, VQ-BPT

Note: The chime in the flight deck is inhibited during a portion of the takeoff and landing. The takeoff inhibit begins when either engine is accelerated towards takeoff thrust and ends when climbing through 800 feet radio altitude. The landing inhibit begins descending through 800 feet radio altitude and ends at touchdown.

767 Flight Crew Operations Manual**VP-BDI, VQ-BMU, VQ-BOG, VQ-BRA**

The flight crew can also use the handset to call all other stations by pushing the ALERT switch on the handset.

The ALERT function calls all other interior stations simultaneously. The ALERT is initiated by pressing the ALERT switch on the PCP which then illuminates the call lights and sounds a chime at all interior stations except for the originating station. Alert calls automatically override other cabin interphone calls.

The flight attendants communicate between flight attendant stations or with the flight deck using any of the handsets in the cabin. The system is a party line in that anyone who picks up a handset is automatically connected to the system.

VP-BDI, VQ-BMU, VQ-BOG, VQ-BRA

If CIS power is lost, the handsets will automatically be connected to the PA system. Pushing the PTT switch then allows PA announcements.

Flight Deck Handset**VP-BDI, VQ-BMU, VQ-BOG, VQ-BRA**

The flight crew can also communicate with the flight attendant stations using the flight deck handset. The pilot picks up the handset from the aft aisle stand and presses the button (FWD, MID, AFT or ALERT) to select the destination station.

Service Interphone System

The service interphone system consists of additional internal and external jacks connected to the flight/cabin interphone system for use by maintenance personnel. The flight/cabin interphone system can be connected to the service interphone system by placing the service interphone switch in the ON position. To reduce external noise in the flight/cabin interphone system, the service interphone switch can be left OFF during normal flight operations. This disconnects the microphone jacks at all exterior (unpressurized) service interphone stations except the jack on the nose wheel strut. This switch does not affect the interior flight/cabin interphone stations.

Passenger Address System

The passenger address (PA) system allows flight deck crew members and flight attendants to make announcements throughout the cabin. Flight deck crew members can make announcements with any microphone by pushing the PA transmitter select switch on an audio control panel. Then, pressing any of the PTT switches will key the system for PA announcements.

VP-BDI, VQ-BMU, VQ-BOG, VQ-BRA

Flight deck crew members can also use the handset located on the aft aisle stand to make PA announcements. The pilot lifts the handset from the cradle and presses PA button to initialize the system. Pressing the passenger address PTT switch will key the system for announcements. Flight attendants can utilize any of the handsets in the cabin for PA announcements.

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

The VIDEO ON light is installed on the overhead panel in the flight deck. When this light is illuminated, the pilot is alerted that making a PA announcement would interrupt a video currently being viewed by the passengers.

VP-BMC

The PA IN USE and VIDEO ON lights are installed on the overhead panel. When either light is illuminated, the pilot is alerted that making an announcement on the PA system would interrupt a current pre-recorded message, cabin announcement, or a video being viewed by the passengers.

VP-BRL through VQ-BRA

The PA IN USE light is installed on the overhead panel. When this light is illuminated, the pilot is alerted that making an announcement on the PA system would interrupt a current pre-recorded message or announcement being made in the passenger cabin.

- The PA system is monitored on the flight deck by pushing the PA receiver volume control on an audio control panel and adjusting the volume. This will adjust the audio volume to the pilot's headset only. It does not adjust the volume of the output broadcast over the PA system.

The cabin PA announcement priorities are:

- flight deck announcements
- cabin announcements made from any flight attendant station
- pre-recorded announcements
- boarding music

PA announcements from any station override all passenger cabin pre-recorded announcements and passenger entertainment outputs.

**Communications****Chapter 5****Data Link System****Section 40**

This Section Applies to VP-BDI through VP-BOQ, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

Aircraft Communication Addressing and Reporting System (ACARS)

The Aircraft Communications Addressing and Reporting System (ACARS) is a data link system designed to automatically communicate flight data, performance data, and routine reports between the airplane and a network of ground stations.

The primary airborne system component is the ACARS management unit (MU). The MU provides the central clock, memory, and data processor for ACARS. For airborne event sensing and flight crew alerting, the MU interfaces with:

- digital flight data acquisition unit (DFDAU)

VP-BMC, VQ-BOG

- the flight management computers (FMC)

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

- the EICAS computers
- the SELCAL system

VP-BMC, VP-BOQ, VP-BWX, VQ-BOG

- the flight deck printer

The ACARS MU collects, controls, and processes incoming and outgoing data and messages through:

- the VHF radio system

The dedicated ACARS radio is normally operated in data mode for automatic transmission of data and message traffic. Refer to section 20 of this chapter for a description of the ACARS capable VHF or HF radio systems.

Additional ACARS Functionality

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

Air Traffic Control (ATC) Data Link

VP-BWW, VP-BWX, VQ-BOG

The ACARS interface provides for direct data link communications with Air Traffic Control (ATC) agencies. The ATC data link system provides for automatic airplane periodic and event reporting through the Automatic Dependent Surveillance (ADS) system. The ATC data link system also provides for the flight crew and ATC agencies to exchange requests and text messages which may involve clearances, reporting points, climb or descend requests, or other ATC functions. Refer to section 45 of this chapter, Air Traffic Control Data Link, for control and operation of the ATC data link system.

Airline Operation Communication (AOC) Data Link

The ACARS interface provides for company specific data link operations through the Airline Operation Communication (AOC) Data Link system. AOC data link provides for the automatic programming of FMC data, such as performance parameters and flight plan routes. In addition, AOC data link provides for the automatic downlink of FMC data to the company. Refer to section 34 of chapter 11, Company Data Link, for control and operation of the AOC data link system.

Control and Status Display

The flight crew access to ACARS status or control is through:

VP-BDI through VP-BOQ, VP-BWX, VQ-BOG

- control display unit (CDU)

VP-BWW, VP-BWX, VQ-BPT

- multipurpose interactive display unit (MIDU)

ACARS installations include airline modifiable buyer furnished equipment (BFE). The ACARS system descriptions and menu page illustrations presented represent typical installations. Airline configuration of BFE equipment can make significant changes in operational menus which are not presented here.

Control Through CDUs

VP-BDI through VP-BOQ, VP-BWX, VQ-BOG

Flight crew access to ACARS is through a control display unit (CDU). Selecting the line select key adjacent to the <ACARS prompt will call up the ACARS Main Menu Page. From this page all ACARS functions may be accessed, such as pre-flight initialization, systems status checks, ACARS radio control, message status or display, printer functions, and ACARS configuration.

The specific software providing ACARS functionality is defined by the airline and is not covered here.

Access Through MIDU Menu Page

VP-BWW, VP-BWX, VQ-BPT



1 MENU Key

Push –

- displays MCDU MENU page

2 ACARS Line Select Key

Push –

- activates MIDU control of ACARS
- displays ACARS main menu page

Control Through the MIDU

VP-BWW, VP-BWX, VQ-BPT

Flight crew access to ACARS is through a multipurpose interactive display unit (MIDU). In addition to transmitting routine data automatically, the ACARS MIDU allows manual data entry to the MU for subsequent transmission to ground stations. Engine parameters, fuel status, and other information can be conveyed to a ground station. The MIDU also provides access to other airplane data or communication functions, such as ACMS or SATCOM.

Access to ACARS functions and message displays is provided by depressing the appropriate function key on the MIDU. In addition, depressing the MENU or MCDU MENU line select key provides the <ACARS prompt on the display. Selecting the line select key adjacent to the <ACARS prompt will call up the ACARS Main Menu Page. From this page all ACARS functions may be accessed, such as pre-flight initialization, systems status checks, ACARS radio control, message status or display, printer functions, and ACARS configuration.

The specific software providing ACARS functionality is defined by the airline and is not covered in this manual.

Data Mode

ACARS is normally operated in the data mode, allowing automatic transmission of routine reports, engine and performance data. In data mode, the system monitors and stores the times of the following events:

- OUT – airplane departure from the gate, based on customer defined parameters (e.g. closure of all passenger entry doors and parking brake released)
- OFF – takeoff (main gear tilted)
- ON – landing (main gear not tilted)
- IN – airplane arrival at destination gate, based on customer defined parameters (e.g. parking brake set and at least one passenger entry door open)

The system automatically transmits OOOI events at occurrence. In data mode, the MU automatically tunes the ACARS dedicated radio to a standard link frequency. ACARS monitors this frequency for messages addressed to that airplane as well as sending messages to the ground.

In addition to transmitting routine data automatically, ACARS allows manual data entry for subsequent transmission to ground stations. Engine parameters, fuel status, and other information can be conveyed to a ground station by entering values on the appropriate page and pressing the SEND key.

Pre-flight data such as flight number, fuel on board, and departure/destination station can be entered in the ACARS system manually, or received by data uplink.

Message Display

VP-BDI through VP-BOQ, VP-BWX, VQ-BOG

ACARS messages to or from the airplane can be displayed on the CDU through the STORED MESSAGES pages. Message titles appear in large characters until displayed. Messages can be sent to the printer by pressing the PRINT line select key.

VP-BWW, VP-BWX, VQ-BPT

ACARS messages can be displayed on the MIDU for review by the flight crew. The MIDU also allows for the entry of data for transmission to the ground stations. Messages can be sent to the printer by pressing the PRINT line select key.

VP-BMC, VP-BOQ, VP-BWX, VQ-BOG

The printer allows data, such as flight plans, to be transmitted by ground stations and printed automatically in flight.

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VP-BMC, VP-BWX, VQ-BOG

- The EICAS communication message •PRINTER displays when a message is sent to the printer
 - the message is accompanied by an aural chime
 - The ACARS PTR light on the PCP illuminates when a message is sent to the printer
 - the message is accompanied by an aural chime
-

Voice Mode

The ACARS system provides a voice mode to facilitate voice communications between the airplane and groundstations. The ACARS system descriptions presented are general in scope and represent typical installations. Airline configuration of BFE equipment can make significant changes in operational menus which are not presented here.

Online ACARS Voice Mode

Online voice mode provides an ARINC compatible communication link to ground based telephone systems. ACARS voice mode communications are initiated either from the airplane or the ground. When online voice mode is initiated the ACARS MU will continue to compile, but not transmit, data and message traffic. The MU will notify the flight crew whenever voice mode operations exceed two minutes.

Air-to-Ground Voice Calls (Typical)

To initiate an ACARS voice call, use the ACARS menu pages and request the call. The applicable phone number is automatically dialed with the downlink request and voice mode is automatically selected when the call is connected. When the call is connected, the ACARS system will annunciate the call with an aural chime and the appropriate SELCAL switchlight on the PCP or ACP (VHF C or VHF R) will illuminate.

To complete the call push the applicable microphone selector switch on the ACP and adjust the volume (if required). Push a push-to-talk (PTT) switch for microphone operation. Use a boom microphone headset or other flight interphone system to speak and listen to the call. When the call is stopped the MU will automatically return to data mode.

Ground-to-Air Voice Calls (Typical)

When an ACARS voice radio communication is received, the corresponding SELCAL light illuminates and an aural chime sounds on the flight deck. Received calls are automatically connected. ACARS voice mode is automatically selected and does not require flight crew action from the ACARS menu pages. To receive a call push the illuminated VHF C or VHF R microphone selector switch on the ACP, push a PTT switch, and begin the call.

The flight crew may also respond to a ground initiated voice call by selecting the appropriate responses on the ACARS menu pages and pushing the illuminated CALL microphone selector switch on the ACP.

Manual ACARS Override

| VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

Manually tuning the ACARS dedicated radio to a normal voice frequency or deselecting data mode places that VHF or HF radio into voice mode. Refer to section 20 of this chapter, Systems Description, for the operation and control of ACARS compatible radios.

Data Link Related EICAS Messages

| VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

Data Link Advisory Messages

A temporary loss of data link connectivity, failure of the data link system, or failure of HF radio data function will cause a data link related advisory message to display on EICAS. Refer to section 50 of this chapter for a list of possible messages.

The EICAS advisory message DATALINK LOST will be displayed when data communication is lost. During the period that communication is lost, information to be transmitted is stored and will transmit automatically when communication is regained.

Data Link Communications Alert Messages

| VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

During the routine operation of ACARS, several communication alert messages may be generated to keep the pilots aware of the status and functioning of the data link. Individual airplane software or options may preclude or alter some of these messages. Refer to section 50 of this chapter for EICAS communications alert messages related to data link operations.

| VP-BWW, VP-BWX, VQ-BOG

An ACARS communication alert message related to Air Traffic Control (ATC) which may involve clearances, reporting points, climb or descend, or other ATC function will cause the •ATC communications alert message to display on EICAS and the aural chime to sound. Refer to section 45 of this chapter for information on the ATC Data Link.

An ACARS communication that is loadable into the FMC, such as winds or route data, will cause the •FMC communication alert message to display on EICAS and the aural chime to sound. A CDU scratchpad message will provide information on the type of uplink.

**Communications****Chapter 5****Air Traffic Control Data Link****Section 45****This Section Applies to VP-BWW, VP-BWX, VQ-BOG****Air Traffic Control Data Link**

Air Traffic Control data link provides direct communication between the airplane and an air traffic control facility. ATC data link functions include Air Traffic Services Facilities Notification (AFN), Automatic Dependent Surveillance (ADS), and Air Traffic Control (ATC) data link.

ATC data link communications begins with a logon to the appropriate Air Traffic Control facility. Once the aircraft is logged on, data link messages can be sent from the ATC facility to the airplane (uplinked) and from the airplane to the ATC facility (downlinked). Also, once the aircraft is logged on, the transfer to adjacent ATC facilities is normally automatic.

The flight crew is alerted by a chime and the EICAS communications message •ATC when an uplink message is received. To display a data link message which has just been received, press the ATC function key on the CDU.

The CDU is used to display messages, input data for downlink messages and to respond to uplink messages. Uplink messages which contain route modifications are loaded into the FMC using the LOAD prompts on the ATC CDU pages. Execution of an ATC loaded modification is accomplished using normal FMC modification procedures.

The ATC LOGON/STATUS page provides the capability to establish a downlink connection with a specified ATS facility and to display the ADS, ATC DL, and data link status.

An uplink delay timer feature allows select ability of maximum uplink delay.

The ATC UPLINK pages display messages uplinked by an ATS facility and provide the capability to respond to uplinked messages and to load clearances which contain loadable data.

The ATC REQUEST pages provide the capability to create downlink requests for altitude, route, and speed changes.

The FMC formats reports in response to requests from an ATS facility. These reports are accessible via the ATC REPORT page and are displayed for review or modification on the VERIFY REPORT page. Some reports can be armed for automatic transmission.

The ATC LOG page provides a list of all uplinks and downlinks stored in the log.

Downlink messages are created by inputting data to the ATC communications pages which provide standard formatting and selectable message elements. The message is sent by selecting a SEND prompt. The status of the message is then indicated as follows:

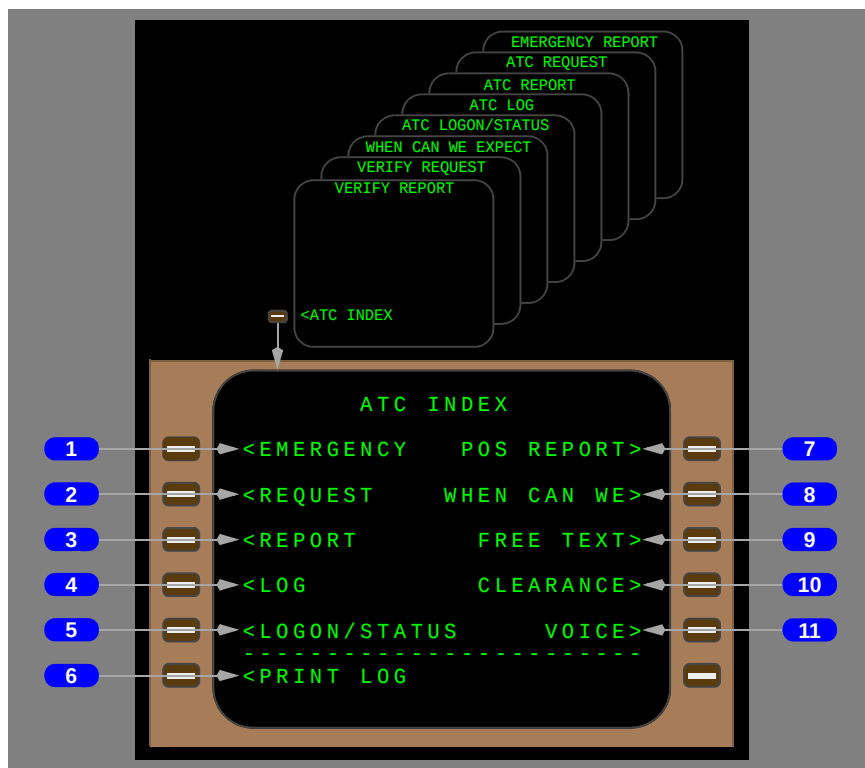
- displays SENDING while waiting for network acknowledgment
- displays NO ATC COMM if not logged on to ATC

ATC Communication Pages

The following graphics show all ATC Communications Pages.

ATC Index Page

The ATC INDEX page provides access to pages for ATC data link functions.



1 EMERGENCY

Push – displays EMERGENCY REPORT page.

2 REQUEST

Push – displays ATC REQUEST page.

3 REPORT

Push – displays ATC REPORT page.

4 LOG

Push – displays ATC LOG page.

5 LOGON/STATUS

Push – displays ATC LOGON/STATUS page.

6 PRINT LOG

Push – transmits contents of ATC log to printer.

7 POSITION REPORT

Push – displays POS REPORT page.

8 WHEN CAN WE

Push – displays WHEN CAN WE EXPECT page.

9 FREE TEXT

Push – displays the verify report page with only the free text message element.

10 CLEARANCE

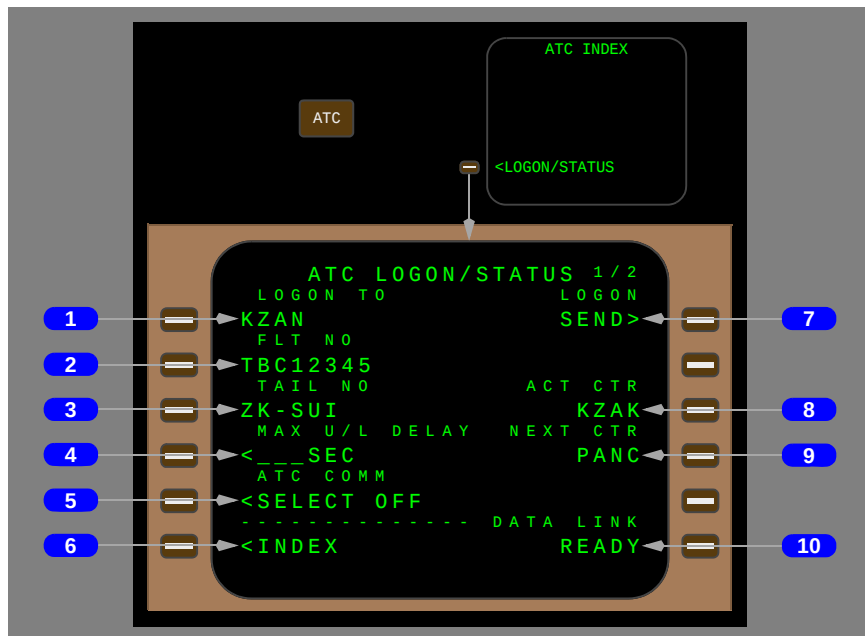
Push – displays VERIFY REQUEST page for clearance request.

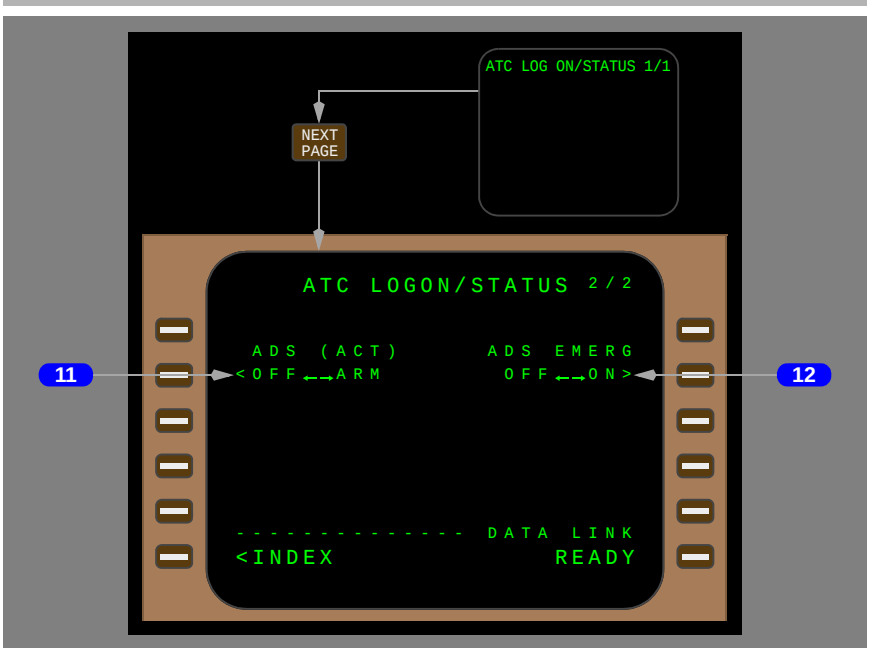
11 VOICE

Push – displays VERIFY REQUEST page for voice contact request.

ATC Logon/Status Pages

The ATC LOGON/STATUS pages are used to initiate ATC data link connection. It displays the status of the data link system, ATC data link connection, Automatic Dependent Surveillance (ADS), and crew-entered maximum uplink delay.





1 LOGON TO

Displays empty character boxes if no ATC COMM connection exists. Dashes display when ATC COMM is established. Valid entry is a four letter ATC center identifier. Entering an identifier and a flight number displays the SEND prompt in the LOGON field (1R) if data link status is ready.

2 Flight Number (FLT NO)

Displays the flight number entered on the ROUTE page or may be entered directly. The entry is cleared at flight completion. Entering a different flight number during operation terminates ATC COMM connections.

3 Tail Number (TAIL NO)

The airplane tail number is automatically loaded when power is applied to the FMC. Display boxes for pilot input appear if automatic load is not successful. Entering a different tail number terminates any active ATC connections.

4 MAX U/L DELAY

Default display is three dashes followed by SEC. Valid entry is a time in seconds between 1 and 999. Entry of an invalid value results in the display of INVALID ENTRY in the scratch pad. Selection of DELETE to the MAX U/L DELAY field (4L) returns the display to dashes.

5 ATC COMM

Push – the SELECT OFF prompt terminates the A TC data link connection.
Blank with no active ATC COMM connection.

6 INDEX

Push – displays the ATC INDEX page.

7 LOGON

Push – sends logon message to the ATC center listed on the LOGON TO line; displays SENT. If no network acknowledgment is received, displays RESEND. After ATC response, displays ACCEPTED or REJECTED.
Display is blank without valid entry in LOGON TO line, then displays SEND.

8 Active Center

Displays the four character identifier of the active center.

9 NEXT Center

Displays the four character identifier of the next center if known; otherwise blank.

10 DATA LINK Status

Displays status of the data link system:

- READY
- NOCOMM
- VOICE
- FAIL

11 ADS

Push – alternates ADS between OFF and ARM. Status is indicated by large font. (ACT) in the title indicates one or more ADS connection exists.

12 ADS EMERGENCY

Push – alternately selects ADS EMERGENCY mode ON or OFF; status is indicated by large font. Operates only when ADS is armed or active. Display is blank when ADS is off.

ATC Uplink Page

The ATC UPLINK page displays messages uplinked by ATC and provides the crew the capability to respond to and load clearances into the FMC. The title displays the time the message was received.

ATC UPLINK page 1/X

1 REQUEST

Displays REQUEST when the displayed uplink is in response to a downlink request which is still listed in the ATC log.

Push – displays the corresponding XXXXZ ATC REQUEST page.

Blank if the displayed message is not in response to a downlink request or if the request has been removed from the log.

2 MESSAGE TEXT

Displays the text of the uplink message in lines 2 through 5. If more space is needed additional pages are added.

3 STATUS

Displays the status of the ATC uplink message. The status is also shown on the ATC LOG page.

4 ARM

ARM is displayed adjacent to required reports that can be sent automatically based on certain parameters.

Push –

- arms the report for automatic transmission
- displays ARMED
- deleting ARMED returns the ARM prompt and disarms the report

5 LOG, REPORT

Displays REPORT when the uplink message includes a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request. Displays LOG when the uplink message does not contain any of those elements.

Push – displays the ATC LOG or ATC REPORT page as indicated.

ATC UPLINK page X/X

The last ATC UPLINK page continues the text of the uplink message if required. The last page also provides prompts to respond to the message and to load clearances.



1 MESSAGE TEXT (continued)

The first 3 lines of the last page are available to continue the text of the message.

2 STANDBY SEND

Displayed on the last page if a response is required.

Push – sends a STANDBY response to ATC.

3 REJECT

The REJECT prompt is displayed on the last page if UNABLE or NEGATIVE is a valid response.

Push – displays the REJECT DUE TO page.

4 PRINT

Push – prints complete text of displayed uplink message.

5 LOAD

Displays LOAD on the last page only if the message contains loadable data, otherwise the display is blank.

Push – loads data into route.

6 ACCEPT SEND

Displays ACCEPT SEND on the last page when WILCO, ROGER, or AFFIRM is a valid response to the displayed message, otherwise the line is blank.

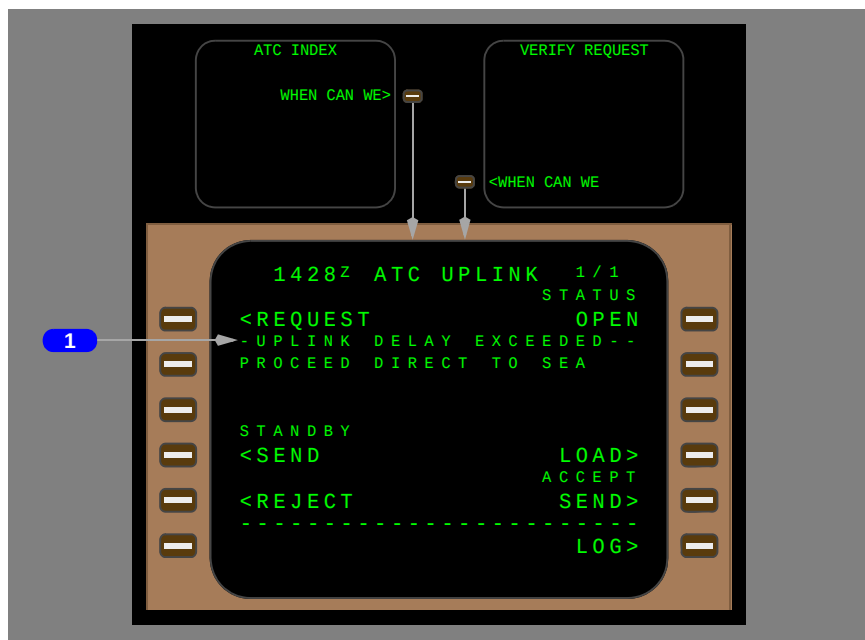
Push – sends a downlink response with WILCO, ROGER, or AFFIRM, as appropriate.

7 LOG, REPORT

Displays REPORT when the uplink message includes a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request. Displays LOG when the uplink message does not contain any of those elements.

Push – displays the ATC LOG or ATC REPORT page as indicated.

Uplink Delay Exceeded message

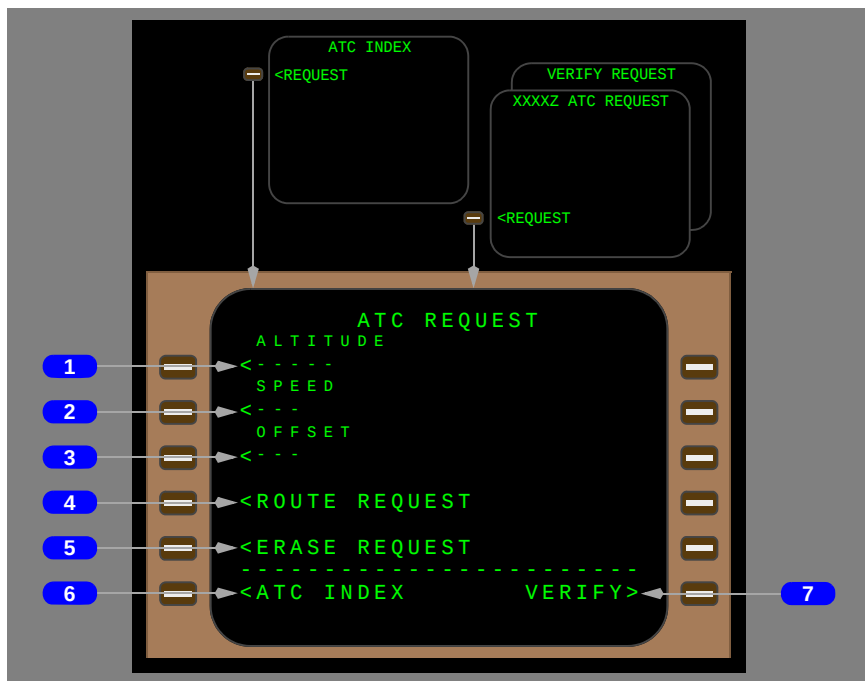


1 UPLINK DELAY EXCEEDED

When a received uplink message exceeds the MAX U/L DELAY time entered on the ATC LOGON/STATUS page, the UPLINK DELAY EXCEEDED message is displayed in the message text.

ATC Request Page

Provides access to various ATC REQUEST pages and allows entry of altitude, speed, and offset information to be requested.



1 ALTITUDE

Push – displays ATC Altitude Request (ALT REQUEST) page.

If selected with valid altitude in the scratch pad, that altitude will be displayed on the ALTITUDE REQUEST page.

Valid entry is XXX (feet), FLXXX, XXXXX (flight level), XXXXXM (meters), XXXXX/XXXXX (block altitude feet), FLXXX/FLXXX (block altitude flight level), or XXXXXM/XXXXXX (block altitude meters).

If selected with dashes displayed and no scratch pad entry, a blank ATC ALT REQUEST page is displayed.

2 SPEED

Push – displays ATC SPEED REQUEST page.

If selected with a valid IAS or Mach number in the scratch pad, that speed will be displayed on the ATC SPEED REQUEST page.

If selected with dashes displayed and no scratch pad entry, a blank ATC SPEED REQUEST page is displayed.

3 OFFSET

Push – displays the ATC OFFSET REQUEST page.

If selected with a valid offset entry in the scratch pad, that offset will display on the ATC OFFSET REQUEST page. Valid entry format denotes offset Left, Right, or Either side and the offset distance: LXX, RXX, or XX for either side. (where XX is any number between 0 and 99 nautical miles).

If selected with dashes displayed and no scratch pad entry, a blank ATC OFFSET REQUEST page is displayed.

4 ROUTE REQUEST

Push – displays ATC ROUTE REQUEST page.

5 ERASE REQUEST

Push – erases all entered or selected data and any of the four ATC REQUEST pages that have data entered.

6 ATC INDEX

Push – displays the ATC INDEX page.

7 VERIFY

Push – displays the VERIFY REQUEST page.

ATC Altitude Request (ALT REQUEST) Page

The ATC ALT (Altitude) REQUEST page is used to create a downlink message requesting an altitude change.



1 ALTITUDE

Initially displays dashes or the altitude entered on the ATC REQUEST page. Entered value may be deleted or modified.

Entering an altitude selects a message requesting a climb or descent based on the current altitude.

2 STEP AT

Allows the optional entry of a position or time. If an entry is made it is included with the altitude request message to specify a step climb or descent at the specified position or time.

Valid STEP AT entries are: fix name, navaid, airport, latitude/longitude, place bearing/distance, or time.

3 At Pilot's Discretion (AT PILOT DISC)

Push – displays AT PILOT DISC in large font and selects it as a message element in the altitude request.

The DELETE key can be used to return the display to small font and remove the message element.

4 REQUEST

Push – displays the ATC REQUEST page.

5 Request Cruise Climb (REQUEST CRZ CLB)

Push – displays CRZ CLB in large font and selects a message element requesting a cruise climb to the entered altitude.

The DELETE key can be used to return the display to small font and remove the message element.

6 MAINTAIN OWN SEPARATION/VMC

Push – displays SEPARATION/VMC prompt in large font and selects the MAINTAIN OWN SEPARATION/VMC message element.

The DELETE key can be used to return the display to small font and remove the message element.

7 DUE TO PERFORMANCE

Push – displays the PERFORMANCE prompt in large font and selects the DUE TO PERFORMANCE message element.

The DELETE key can be used to return the display to small font and remove the message element.

8 DUE TO WEATHER

Push – displays WEATHER in large font and selects the DUE TO WEATHER message element.

The DELETE key can be used to return the display to small font and remove the message element.

9 VERIFY

Push – displays the VERIFY REQUEST page where all the selected message elements can be confirmed and the message can be sent.

ATC Speed Request Page

The ATC SPEED REQUEST page is used to create a downlink message requesting a speed change.



1 SPEED

Initially displays dashes or the speed entered on the ATC REQUEST page. Entered value may be deleted or modified.

Entering an IAS or Mach number creates a message requesting that speed.

2 REQUEST

Push – displays the ATC REQUEST page.

3 DUE TO PERFORMANCE

Push – displays the PERFORMANCE prompt in large font and selects the DUE TO PERFORMANCE message element.

The DELETE key can be used to return the display to small font and remove the message element.

4 DUE TO WEATHER

Push – displays WEATHER in large font and selects the DUE TO WEATHER message element.

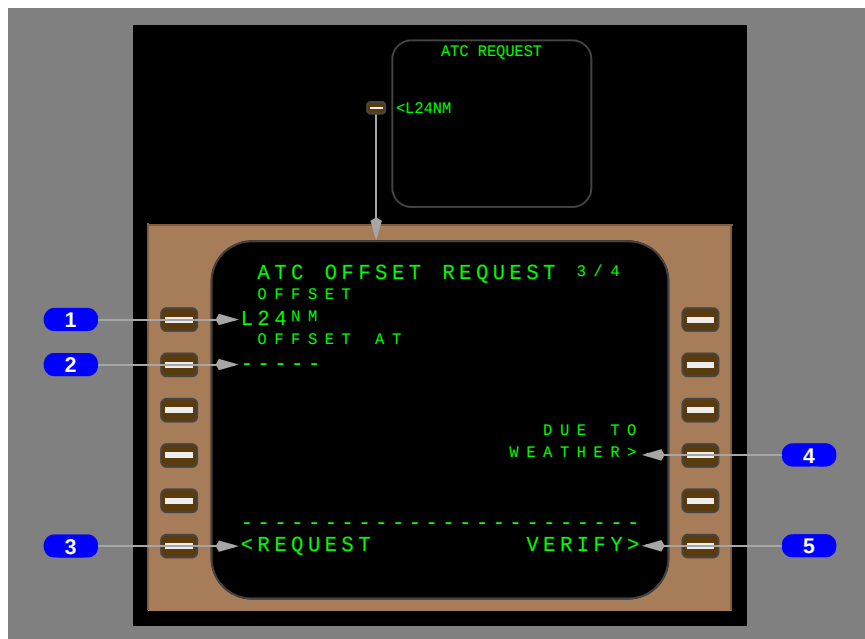
The DELETE key can be used to return the display to small font and remove the message element.

5 VERIFY

Push – displays the VERIFY REQUEST page where all the selected message elements can be confirmed and the message can be sent.

ATC Offset Request Page

The ATC OFFSET REQUEST page is used to create a downlink request for an offset.



1 OFFSET

Initially displays dashes or the offset entered on the ATC REQUEST page. Entered value may be deleted or modified.

If selected with a valid offset entry in the scratch pad, that offset will display on the ATC OFFSET REQUEST page. Valid entry format denotes offset left, right, or either side and the offset distance: LXX, RXX, or XX for either side. (where XX is any number between 0 and 99 nautical miles) A valid entry creates a message requesting the offset.

2 OFFSET AT

Allows the optional entry of a position or time. If an entry is made it is included with the offset request message to specify a position to start the offset.

Valid entries are: fix name, navaid, airport, latitude/longitude, place bearing/distance, or time.

3 REQUEST

Push – displays the ATC REQUEST page.

4 DUE TO WEATHER

Push – displays WEATHER in large font and selects the WEATHER DEVIATION message element.

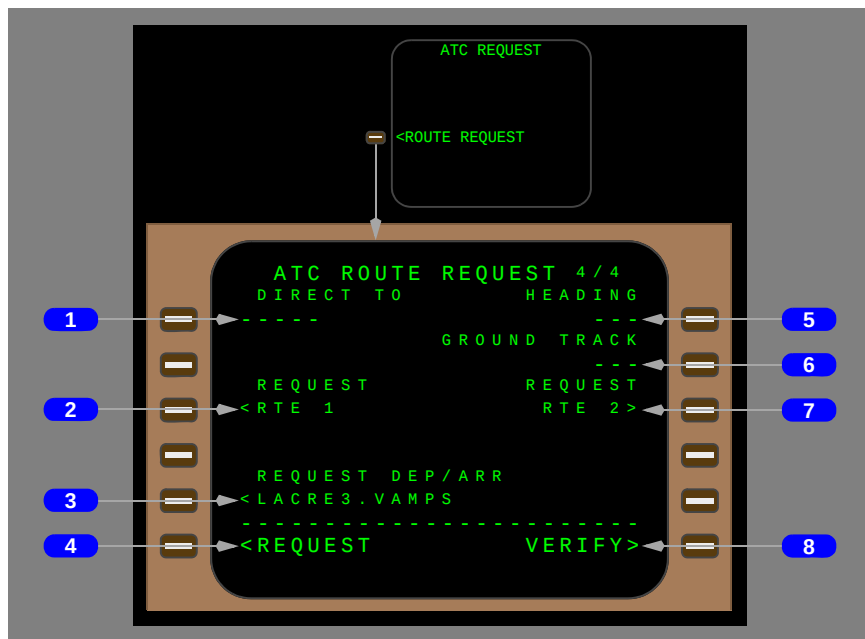
The DELETE key can be used to return the display to small font and remove the message element.

5 VERIFY

Push – displays the VERIFY REQUEST page where all the selected message elements can be confirmed and the message can be sent.

ATC Route Request Page

The ATC ROUTE REQUEST page is used to create a downlink request for a route clearance.



1 DIRECT TO

A position entry creates a message requesting a clearance direct to the specified position. Valid entries are: fix name, navaid, airport, latitude/longitude, or place bearing/distance.

2 REQUEST RTE 1

Push – selects the route stored in RTE 1 for the route request message. If the selected route has a pending modification, the modified route is selected for the route request.

3 REQUEST DEP/ARR

Allows entry of a procedure to be included in the route request. A departure or arrival, or approach and, if applicable, a transition may be entered.

If a procedure has been selected on the DEPARTURES or ARRIVALS page, that procedure will be displayed in small font.

Push – when a procedure is displayed in small font, that procedure changes to large font and is included in the PROCEDURE REQUEST.

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If no selection is made on the DEP/ARR page, dashes are displayed. If dashes are displayed, a procedure can be entered into the scratch pad and then line selected to be included as a message element in the request.

4 REQUEST

Push – displays the ATC REQUEST page.

5 HEADING

Entering a heading creates a message requesting the specified heading.

6 GROUND TRACK

Entering a ground track selects a message requesting the specified ground track.

7 REQUEST RTE 2

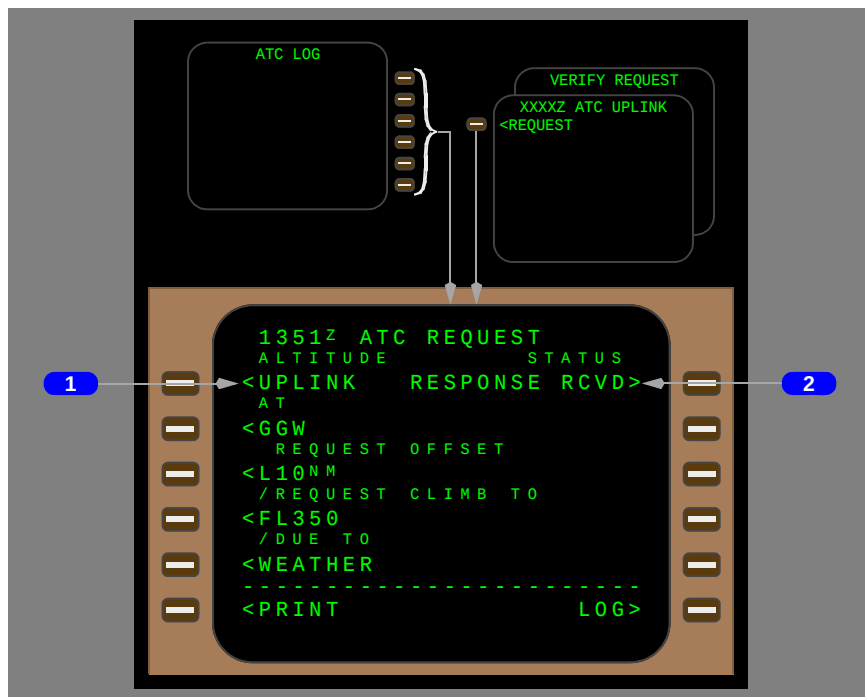
Push – selects the route stored in RTE 2 for the route request message. If the selected route has a pending modification, the modified route is selected for the route request.

8 VERIFY

Push – displays the VERIFY REQUEST page where all the selected message elements can be confirmed and the message can be sent.

XXXXZ ATC Request Page

The ATC REQUEST pages display the transmitted request. XXXXZ is the time request was transmitted.



1 Lines 1- 5

Pages 1/X to X/X display data transmitted to ATC at the time in page title.

Page 1/X line 1 displays UPLINK when ATC response to displayed downlink request exists.

Response time of ATC uplink displays following text.

UPLINK -

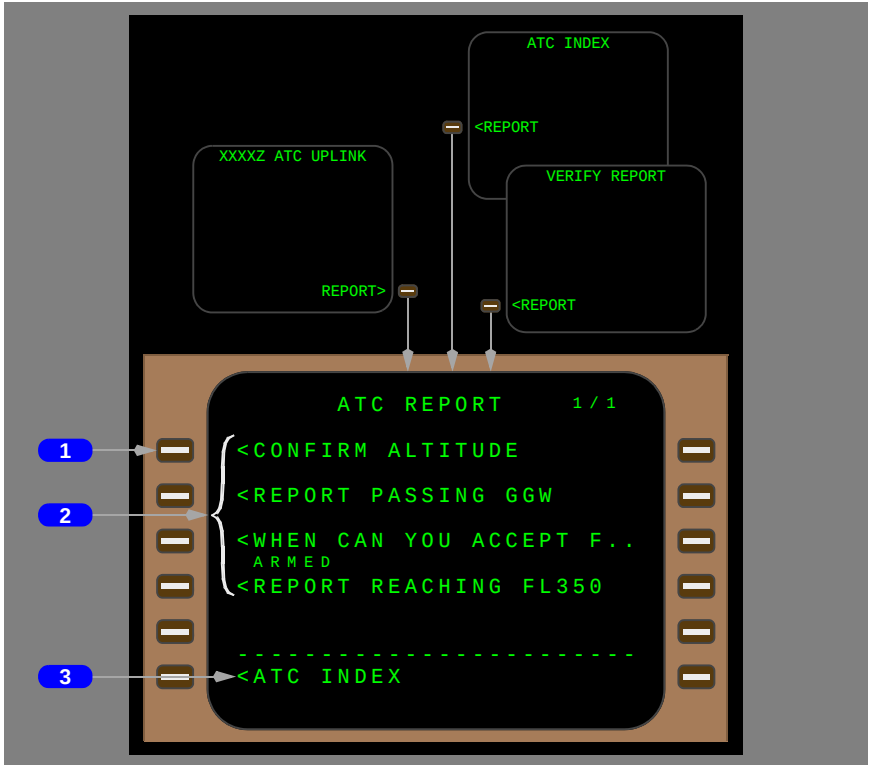
Push - displays the XXXXZ ATC UPLINK 1/X page displaying ATC uplink to displayed request.

2 STATUS

Displays request downlink message status from ATC LOG page.

ATC Report Page

The ATC REPORT page lists all (maximum 10) ATC requested reports or confirmations. Provides access to the VERIFY REPORT pages for listed reports.



1 VERIFY REPORT Line Select Keys

Push – displays the VERIFY REPORT page for the report listed. There is a separate page for each report.

2 List of ATC Requested Reports

Lists all reports or confirmations requested by ATC with the most recent request at the bottom of the list. A maximum of 10 report requests can be listed. If a report request is received while the list is full, the ATC REPORT LIST FULL scratch pad message is displayed. Long messages are abbreviated and followed by two periods.

Items are removed from the list when the report has been sent.

ARMED is displayed in the header if the report armed for automatic transmission.

Deleting a line deletes the report.

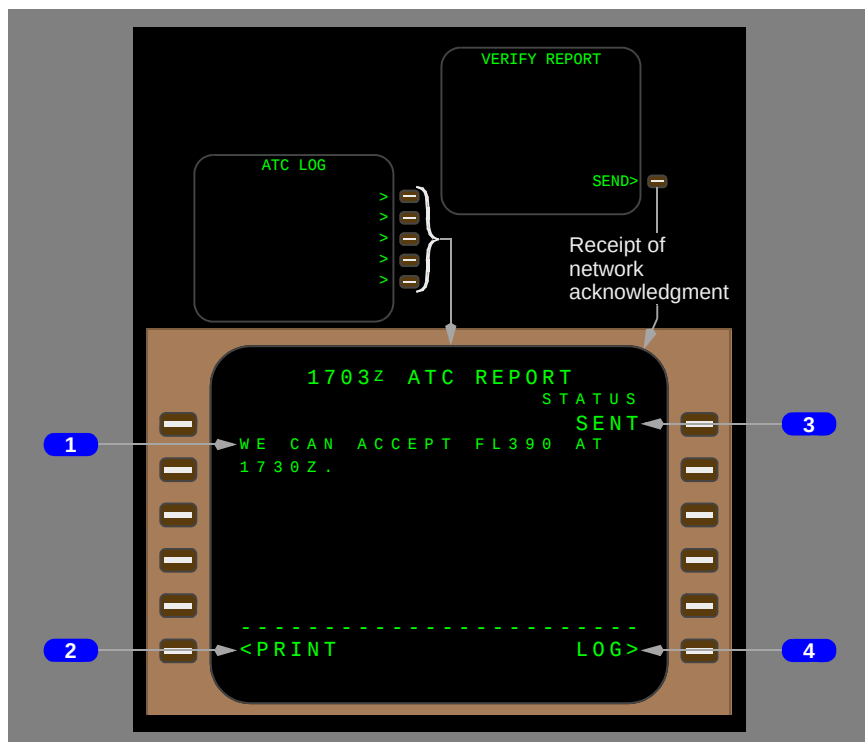
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3 ATC INDEX

Push – selects the ATC INDEX page.

XXXXZ ATC Report Page

Displays text of message downlinked to ATC, where XXXXZ is the time the transmission was initiated.



1 Message Text

Displays the message text which was transmitted to ATC at the time indicated in the page title.

2 PRINT

Push – prints the displayed report.

3 MESSAGE STATUS Line

Displays the status of the downlinked message. The status is also displayed on ATC LOG page.

4 LOG

Push – displays the ATC LOG page.

Reject Due To Page

The REJECT DUE TO page allows the crew to include a reason for rejecting an ATC UPLINK message.



1 DUE TO PERFORMANCE

Push – selects the DUE TO AIRCRAFT PERFORMANCE message element to be included in the downlink response. Displays PERFORMANCE in large font after selected.

2 UNLOADABLE CLEARANCE

Push – selects the UNLOADABLE CLEARANCE message element to be included in the downlink response. Displays UNLOADABLE CLEARANCE in large font after selected.

3 NOT CONSISTENT. RESEND

Push – selects the NOT CONSISTENT. RESEND message element to be included in the downlink response. Displays NOT CONSISTENT. RESEND in large font after selected.

4 FREE TEXT

Allows free text to be included in the downlink message.

5 UPLINK

Push – displays the ATC UPLINK page.

6 WEATHER

Push – selects the DUE TO WEATHER message element to be included in downlink response. Displays WEATHER in large font after selected.

7 VERIFY

Push – displays the VERIFY RESPONSE page to review the response message prior to sending.

Verify Report Page

Displays text of message to be sent to ATC in response to a report request. Allows insertion, modification and review of free text before the report is sent.



1 Message Text

Message text is displayed in line titles and specific data elements are displayed on data lines 1 through 4.

2 Data Line

Displays data elements to be included in message. Empty input boxes or dashes are displayed for pilot entry. Deleting entered data returns boxes or FMC default data.

3 CANNOT ACCEPT Line Select Key

Push – selects a CANNOT ACCEPT message. A selected message may be deleted prior to sending.

Displayed only in response to WHEN CAN YOU ACCEPT uplink messages.

4 FREE TEXT

Allows entering free text to the scratchpad. Every VERIFY REPORT page has at least one line available for free text. If the VERIFY REPORT page is accessed from the FREE TEXT prompt on the ATC INDEX page, all 4 data lines are provided for a free text message.

5 REPORT

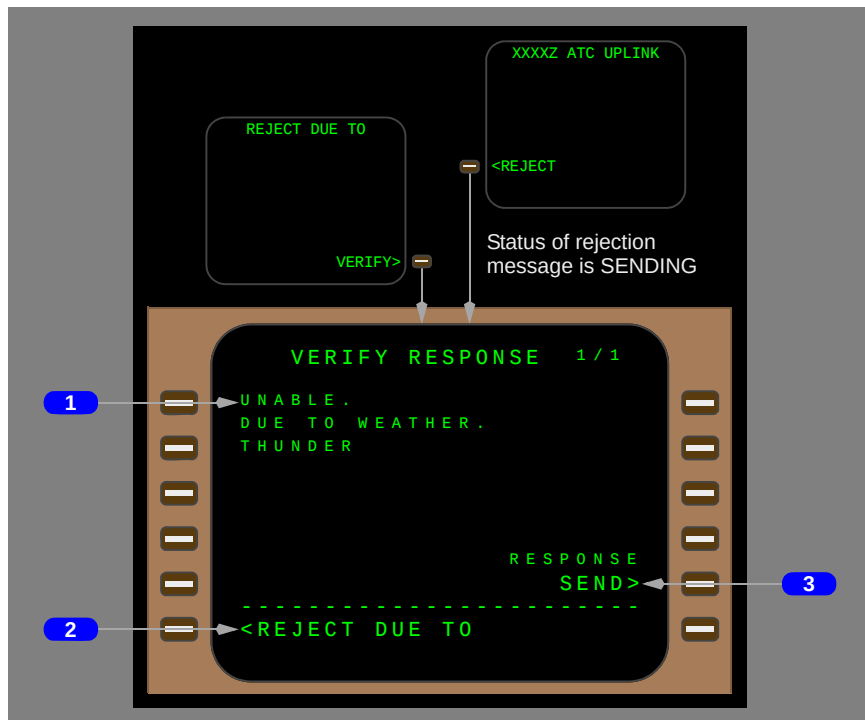
Push – displays the ATC REPORT page.

6 REPORT SEND

Push – transmits ATC REPORT and creates an ATC LOG entry of transmitted message.

Verify Response Page

The VERIFY RESPONSE page allows the crew to create and review a rejection response to an ATC UPLINK message before sending it.



1 UNABLE or NEGATIVE

Displays the message text as selected or entered on the REJECT DUE TO page. Message elements are displayed in the order they were selected. Selected elements are followed by free text.

2 REJECT DUE TO or UPLINK

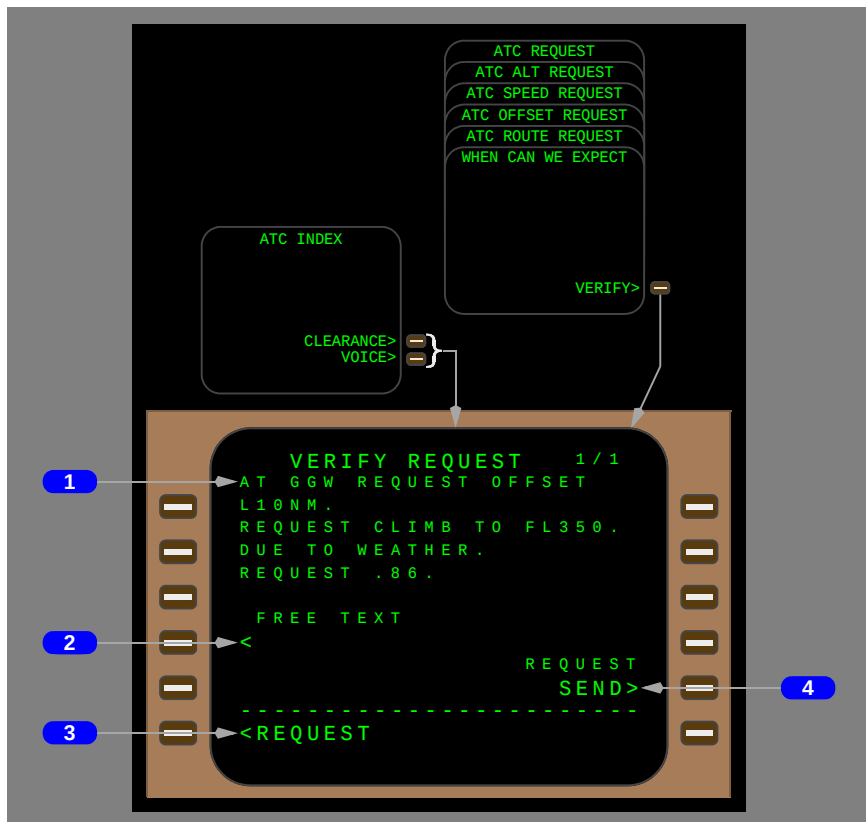
Push – if REJECT DUE TO is displayed, selects the REJECT DUE TO page. If UPLINK is displayed, selects the XXXXZ ATC UPLINK page.

3 RESPONSE SEND

Push – transmits the downlink response.

Verify Request Page

The VERIFY REQUEST page is used to confirm the elements included in a downlink request, add free text and send the request.



1 Message Text

Displays the text and data as created on any of the request pages or the WHEN CAN WE EXPECT page. Message elements are listed in the order they were entered.

2 FREE TEXT

At least one line is available for free text entry. Entered text is included in the downlink request. Additional pages are added as required to provide for additional free text.

3 ATC INDEX, REQUEST, WHEN CAN WE

Displays the prompt for the page from which the VERIFY page was selected.

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Push – displays the listed page.

4 REQUEST SEND

Push – sends the ATC REQUEST downlink message, creates a log entry of transmitted message and displays standard SEND information.

When Can We Expect Page

The WHEN CAN WE EXPECT page is used to create a downlink query about the timing of a clearance or request.



1 CRZ CLB TO

Entering an altitude creates a message asking when to expect a cruise climb to the entered altitude. Valid entry is in normal altitude format. The entry may be deleted.

2 CLIMB TO

Entering an altitude creates a message asking when to expect a climb to the entered altitude. Valid entry is in normal altitude format. The entry may be deleted.

3 DESCENT TO

Entering an altitude creates a message asking when to expect a descent to the entered altitude. Valid entry is in normal altitude format. The entry may be deleted.

4 SPEED

Entering a speed creates a message asking when to expect clearance to the entered speed. Valid entry is an IAS or Mach number. The entry may be deleted.

5 ERASE WHEN CAN WE

Push – erases all entered or selected data and returns default values.

6 ATC INDEX

Push – displays the ATC INDEX page.

7 HIGHER ALTITUDE

Push – creates a message asking when to expect a higher altitude. Selection may be deleted.

8 LOWER ALTITUDE

Push – creates a message asking when to expect a lower altitude. Selection may be deleted.

9 BACK ON RTE

Push – creates a message asking when to expect clearance back to the flight plan route. Selection may be deleted.

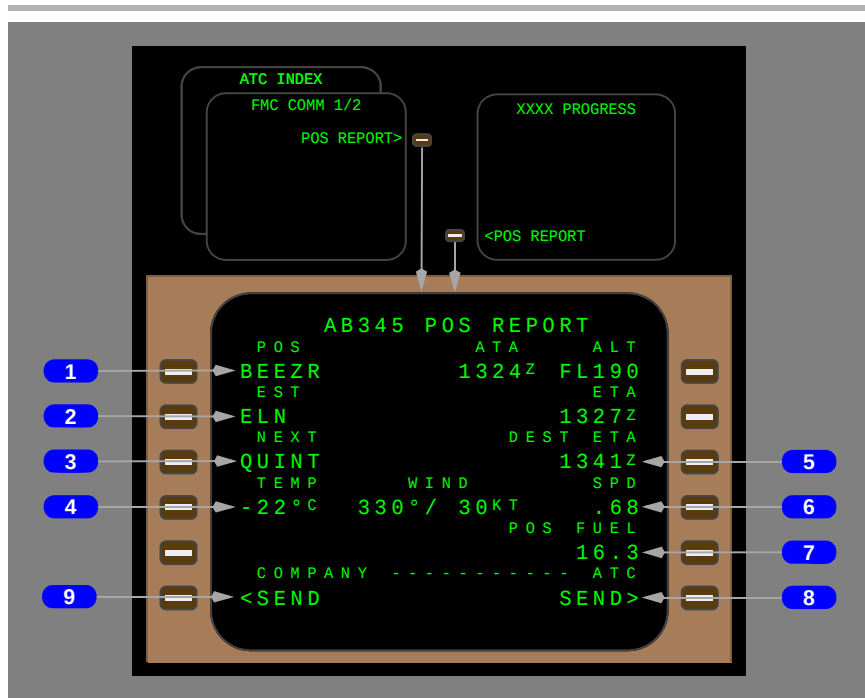
10 VERIFY

Push – displays the VERIFY REQUEST page where all the selected message elements can be confirmed and the message can be sent.

Position Report (POS REPORT) Page

The POS REPORT page enables the crew to send position reports to ATC via data link. Data fields are populated automatically by the FMC. Many FMC waypoints are not compulsory reporting points. To facilitate ATC compulsory waypoint position reporting, certain fields are modifiable. Modification of these fields does not affect the flight path and is for data link purposes only. The reporting points must be in the active flight path, or entry will not be allowed.

Modifications made to facilitate ATC compulsory position reporting do not affect company position reports which use the FMC provided data only.



1 Position (POS)

Waypoint used to report position. This is the previous active waypoint.

The actual time of arrival (ATA) and altitude (ALT) at the waypoint follow the waypoint name.

2 Estimate (EST)

The active waypoint is displayed with the ETA to that waypoint.

Valid entries are waypoint identifiers in the navigational database or defined geographic points.

Entry overrides displayed waypoint.

Deletion of entry returns current leg waypoint.

3 NEXT

Displays waypoint identifier of leg following the TO leg.

Valid entries are waypoint identifiers in the navigational database or defined geographic points.

Entry overrides displayed waypoint.

Deletion of entry returns default waypoint.

4 Temperature and Wind (TEMP WIND)

TEMP displays the OAT in degrees C.

WIND displays the wind direction and speed. Wind direction is shown in degrees true.

5 Destination Estimated Time of Arrival (DEST ETA)

Displays ETA at destination.

Valid entry is XXXXZ.

Entry overrides displayed time.

Deletion of entry returns default time.

6 Speed (SPD)

Displays current airspeed/Mach.

Valid entry is airspeed or Mach.

Entry overrides displayed airspeed/Mach.

Deletion or page change returns default airspeed/Mach.

7 Position Fuel (POS FUEL)

Displays the fuel on board at the POS waypoint.

8 ATC SEND

Push – sends a position report to ATC via data link.

- displays SENDING
- creates ATC LOG entry of transmitted message
- displays RESEND when message is not acknowledged within time limit.
- displays SENT when message is acknowledged.
- displays NO ATC COM when data link READY and no ATC connection
- displays DATA LINK header and NO COMM, VOICE, or FAIL as appropriate for data link fault.

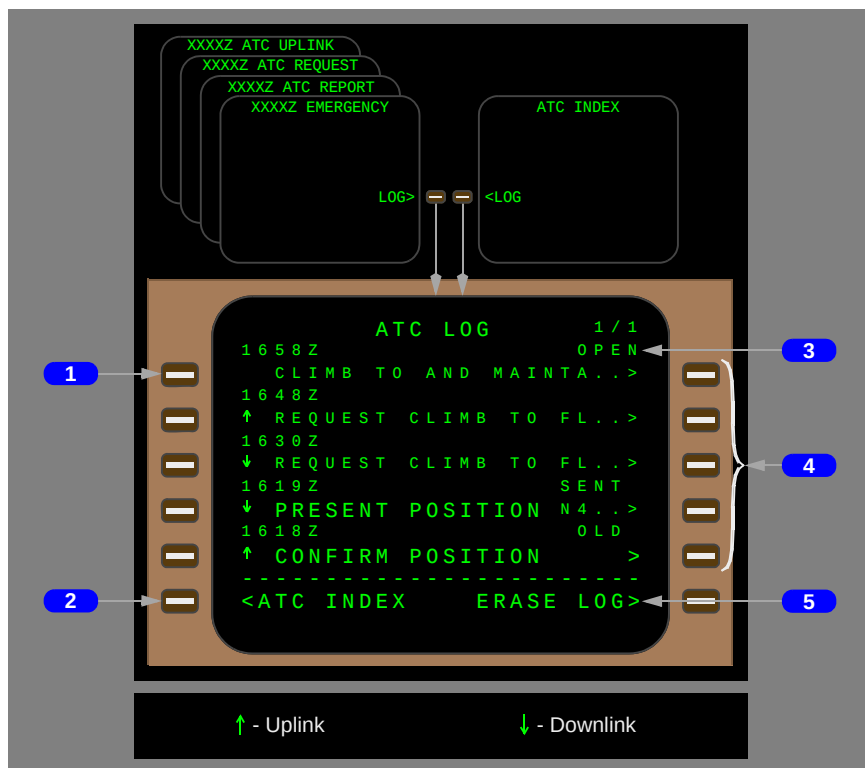
9 COMPANY SEND

Push – sends a position report to the company via data link. Refer to chapter 11-34 for further company data link information.

ATC Log Page

The ATC LOG pages display stored uplinks and downlinks. Log automatically erases after flight completion.

The page becomes active after contact with ATC and more than one new, or no new and more than one pending uplink.



1 Lines 1 - 5

Display text of uplink and downlink messages. Long messages abbreviated and followed by two periods.

Deleting a line deletes the log entry.

Title displays message receipt (uplink) or transmission (downlink) time.

2 ATC INDEX

Push – displays the ATC INDEX page.

3 Message Status

Title displays one of six possible uplink or six possible downlink states:

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Uplink -

- NEW - message not reviewed by crew; message considered pending
- OLD - message reviewed by crew and message does not require response;
- OPEN - message reviewed by crew; message requires response; crew has not sent response or has sent STANDBY or network acknowledgement of response not received; message considered pending
- ACCEPTED - message reviewed by crew; message requires response; positive response sent; network acknowledgement of positive response received; message considered non-pending
- REJECTED - message reviewed by crew; message requires response; negative response sent; network acknowledgement of negative response received; message considered non-pending
- ABORTED - message pending when all connections terminated or transfer of communications performed

Downlink -

- SENDING - SEND prompt selected; network acknowledgement not yet received; message considered pending
- SENT - SEND prompt selected; network acknowledgement received; message does not require response; message considered non-pending
- OPEN - SEND prompt selected; network acknowledgement received; message requires response; response not received or STANDBY response received; message considered pending
- DEFERRED - SEND prompt selected; network acknowledgement received; message requires response; REQUEST DEFERRED response received; message considered pending
- RESPONSE RCVD - SEND prompt selected; network acknowledgement received; message requires response; response other than STANDBY or REQUEST DEFERRED received; message considered non-pending
- ABORTED - message pending when all connections terminated or transfer of communications performed

Push - displays XXXXZ: ATC UPLINK, ATC REQUEST, ATC REPORT, or EMERGENCY page related to line selected.

4 Line 1 – 5 Line Select Keys

Push – displays the corresponding message in its entirety on the associated page. If the message has been ACCEPTED or REJECTED by the flight crew, this page will also show the response and the time that the response was sent.

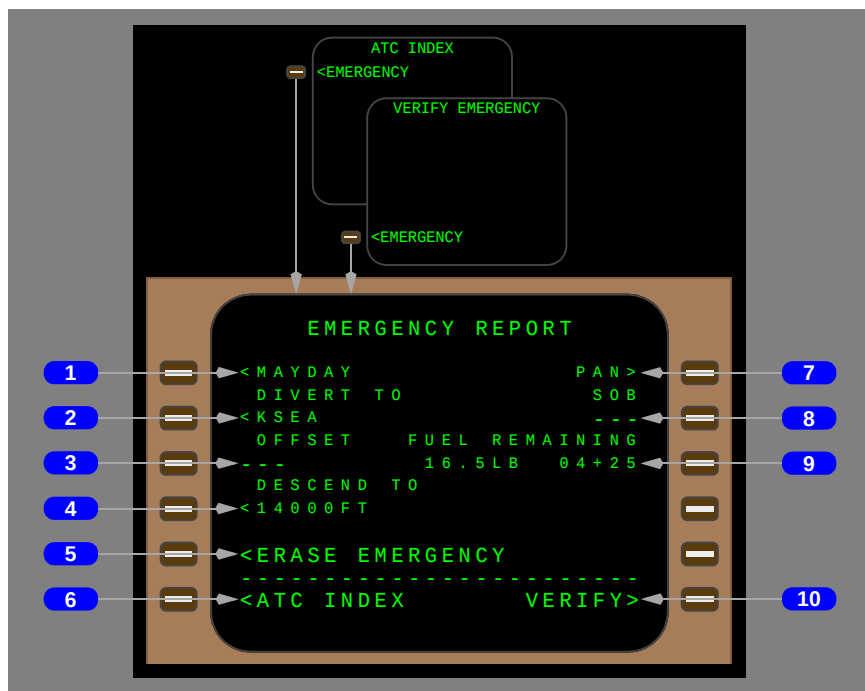
5 ERASE LOG

PUSH -

- arms deletion of all non-pending messages in ATC log
- Displays CONFIRM
- Selection of CONFIRM deletes all non-pending messages in ATC log
- Leaving the page without selecting CONFIRM returns ERASE LOG

Emergency Report Page

The EMERGENCY REPORT page is used to generate an emergency message to ATC.



1 MAYDAY

Push – selects the MAYDAY MAYDAY MAYDAY message element and displays the VERIFY EMERGENCY page.

If the current altitude is more than 150 feet above the altitude shown in 4L, DESCENDING TO is displayed on the VERIFY EMERGENCY page.

2 DIVERT TO

Default display is the active destination airport.

Valid entries are:

- fix name
- navaid
- airport
- latitude/longitude
- or place bearing/distance

Push – if the default airport is displayed, the remainder of the route is included in the message. If a position other than the destination is entered, the direct route to that position is included in the message.

The entered position may be deleted.

3 OFFSET

Valid entry format denotes offset left, right, or either side and the offset distance: LXX, RXX, or XX for either side. (where XX is any number between 0 and 99 nautical miles) A valid entry creates a message requesting the offset.

4 DESCEND TO

Default display is the MCP altitude. Valid entry is XXX (feet), FLXXX, XXXXX (flight level), or XXXXXm (meters). Entered altitude is displayed in large font and may be deleted.

Push – inserts message element indicating intention to descend to the displayed altitude.

If the current altitude is more than 150 feet above the altitude shown in the DESCEND TO prompt (4L), then the DESCENDING TO prompt is displayed on the VERIFY EMERGENCY page.

5 ERASE EMERGENCY

Display is blank until a message element is selected. Entry or selection of data on any line causes the ERASE EMERGENCY prompt to be displayed.

After the EMERGENCY REPORT is transmitted the display changes to the CANCEL EMERGENCY prompt.

Push –

- if ERASE EMERGENCY is displayed, erases all emergency data
- if CANCEL EMERGENCY is displayed, generates a CANCEL EMERGENCY message

The CANCEL EMERGENCY message may be deleted after it is selected.

6 ATC INDEX

Push – displays ATC INDEX page.

7 PAN

Push – selects PAN PAN PAN message and displays the VERIFY EMERGENCY page.

8 Souls On Board (SOB)

Allows entry of the number of people on board. When a number is entered the fuel remaining is displayed and a message element with the number of people on board and the fuel remaining is inserted.

Deleting the entry deselects the message element.

9 FUEL REMAINING

Displays the FMC computed fuel remaining in quantity and time when an number is displayed on the SOB line. Display is blank prior to making the SOB entry.

Valid entry is HH+MM. One or two digits can be entered for hours or minutes.

10 VERIFY

Push – displays the VERIFY EMERGENCY page.

Verify Emergency Page

The VERIFY EMERGENCY page is used to verify and transmit an emergency message to ATC after it has been generated on the EMERGENCY REPORT page. It also allows inserting a free text message into the generated message.



1 Message Text

LINES 1 through 5 on all but the last page, and lines 1 through 4 on the last page display the message text. Pages are added as required leaving at least one line for free text on the last page.

The text includes all the elements selected on the EMERGENCY REPORT page.

2 FREE TEXT

At least one line is available for free text on the last page. If the line is filled, an additional page will be generated to provide more space for free text.

3 EMERGENCY

Push – displays the EMERGENCY REPORT page.

4 REPORT SEND

Push –

- transmits EMERGENCY REPORT
- creates a log entry of transmitted message and,

if MAYDAY is selected:

- transmits a POSITION REPORT
- activates ADS in emergency mode
- transmits an AOC emergency report

**Communications**
EICAS Messages**Chapter 5**
Section 50**EICAS Advisory Messages**

VP-BDI through VP-BOY, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT
(SB Adds VQ-BMU with EICAS advisory messages.)

This section describes the various EICAS advisory messages that can be displayed.

Radios

(SB Adds VQ-BMU with EICAS alerting.)

Message	Level	Aural	Condition
RADIO TRANSMIT	Advisory		A VHF or HF radio is keyed for 30 seconds or more.

Data Link

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

Message	Level	Aural	Condition
DATALINK LOST	Advisory		Data link is temporarily lost.
DATALINK SYS	Advisory		Data link system has failed.

EICAS Communication Alert Messages

This section describes the various EICAS communications alert messages that can be displayed.

Crew Communication Messages

Message	Level	Condition	Crew Action/Remarks
• CABIN ALERT	Medium	Pilot alert received over cabin interphone.	Respond to the alert. Message accompanied by aural chime and ALERT cabin call light.
• CABIN CALL	Medium	Pilot call received over cabin interphone.	Respond to the call. Message accompanied by aural chime and FWD/MID/AFT cabin call light.

Message	Level	Condition	Crew Action/Remarks
• GROUND CALL	Medium	Pilot call received from the nose wheel well over the flight interphone.	Respond to the call. Message accompanied by aural chime and GND CALL light.

Selective Calling (SELCAL)

Message	Level	Condition	Crew Action/Remarks
• SELCAL	Medium	SELCAL received on VHF or HF radio.	Determine which radio received call. Respond to the call. Message is accompanied by aural chime and VHF/HF SELCAL light.

Data Link

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

Message	Level	Condition	Crew Action/Remarks

VP-BMC, VP-BWX, VQ-BOG

• ACARS	Medium	A medium level company data link message has been received.	Select ACARS from the CDU menu page and respond to message. Message is accompanied by aural chime.

VP-BMC, VP-BWX, VQ-BOG

• ACARS	Low	A low level company data link message has been received.	Select ACARS from the CDU menu page and respond to message.

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Message	Level	Condition	Crew Action/Remarks

VP-BMC, VP-BWX, VQ-BOG

• PRINTER	Medium/ Low	A company data link message has been received and sent to the printer.	Review the printed message and press the reset button on the printer. Message is accompanied by aural chime.

VP-BWW, VP-BWX, VQ-BOG

• ATC	Medium	An ATC data link message has been received.	Select the ATC mode key on the CDU and respond to the message. Message is accompanied by aural chime.

• FMC	Medium	An FMC communications related data link message has been received.	Select the FMC COMM mode key on the CDU. View the message title in the CDU scratch pad. View the message on the appropriate CDU page. Message is accompanied by aural chime and a MSG light on the CDU.

VP-BDI, VP-BMC

• DATALINK AVAIL	Low	A lost data link connection has been re-established.	Resume use of data link communication.

VP-BDI, VP-BMC, VQ-BOG

• VHF DATA OFF	Low	VHF radio is in voice mode - Data cannot be sent.	Switch radio to data mode to establish data link communication.



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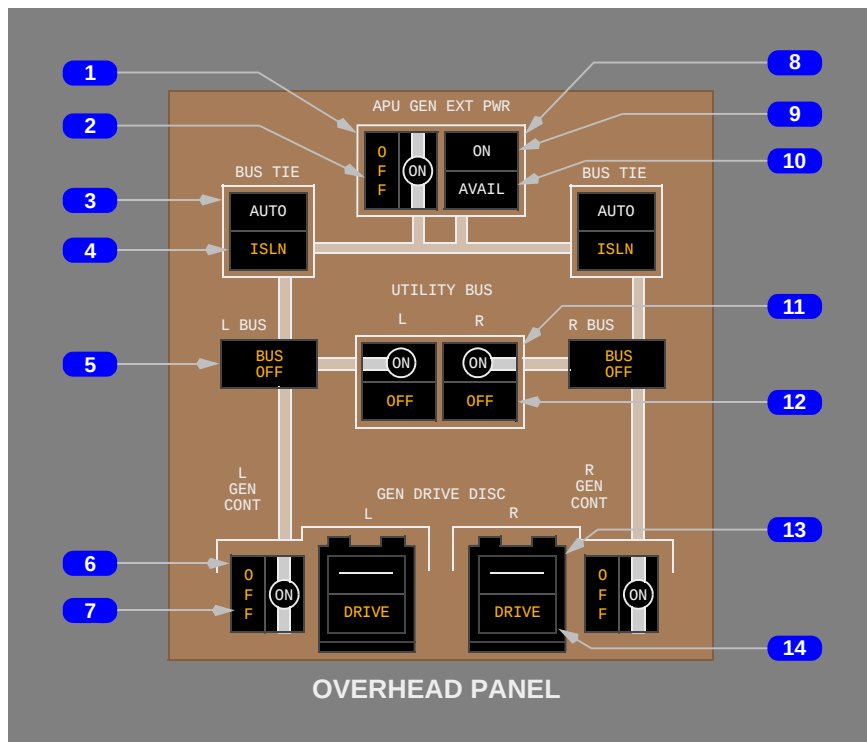


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Electrical Controls and Indicators

Chapter 6 Section 10

Electrical Panel



1 APU Generator (APU GEN) Control Switch

ON (bar in view) –

- arms APU generator breaker to automatically close.

OFF (bar not visible) –

- opens APU generator breaker
- resets fault trip circuitry.

2 APU Generator OFF Light

Illuminated (amber) –

- the APU generator breaker is open because of a fault with APU running
- the APU generator control switch is selected OFF.

3 BUS TIE Switches

AUTO –

- arms automatic AC bus tie circuits
- arms automatic DC bus tie circuits
- arms automatic flight instrument transfer bus circuits.

OFF (AUTO not visible) –

- commands the AC bus tie open
- commands the DC bus tie open
- commands the flight instrument bus tie open
- resets fault trip circuitry.

4 AC Bus Isolation (ISLN) Lights

Illuminated (amber) –

- a fault has occurred, automatically opening the AC bus tie breaker
- the BUS TIE switch is OFF.

5 AC BUS OFF Lights

Illuminated (amber) – the AC bus is unpowered.

6 Generator Control (GEN CONT) Switches

ON (bar in view) – arms the generator breaker to close automatically when generator power is available.

OFF (bar not visible)

- opens generator breaker
- resets fault trip circuitry.

7 Generator OFF Lights

Illuminated (amber) – the generator breaker is open.

8 External Power (EXT PWR) Switch

Push – if AVAIL light is illuminated, closes external power contactor

Subsequent push – opens external power contactor.

9 External Power ON Light

Illuminated (white) – external power is powering the bus(es).

10 External Power Available (AVAIL) Light

Illuminated (white) – external power is plugged in and power quality is acceptable.

11 UTILITY BUS Switches

ON (bar in view) – if no load shed signal is present, connects utility and galley busses to main AC bus.

OFF (bar not visible) –

- disconnects utility and galley busses from main AC bus
- resets overload load shed circuitry.

12 Utility Bus OFF Lights

Illuminated (amber) – the utility and galley busses are unpowered.

13 Generator Drive Disconnect (GEN DRIVE DISC) Switches

Push –

- disconnects generator drive from the engine
- requires maintenance action on the ground to reconnect the generator drive.

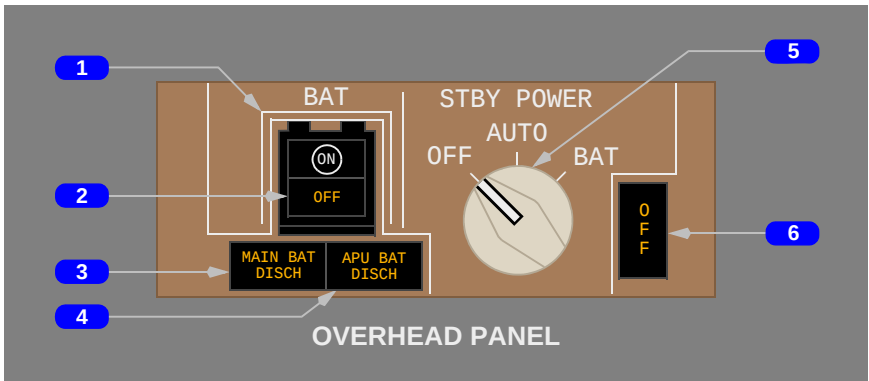
14 Generator DRIVE Lights

Illuminated (amber) –

- the generator drive oil temperature is high
- the generator drive oil pressure is low.

Battery/Standby Control Panel

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA



1 Battery (BAT) Switch

ON –

- Unpowered airplane on the ground:
 - a few annunciator lights illuminate
 - allows the APU to be started
- Powered airplane inflight or on the ground when AC power is removed or lost:
 - the standby and battery busses are powered.

OFF (ON not visible) – turns battery power off.

2 Battery OFF Light

Illuminated (amber) – the battery switch is off.

3 MAIN Battery Discharge (BAT DISCH) Light

Illuminated (amber) – the main battery is discharging.

4 APU Battery Discharge (BAT DISCH) Light

Illuminated (amber) – the APU battery is discharging.

5 Standby (STBY) POWER Selector –

OFF – the standby busses are unpowered.

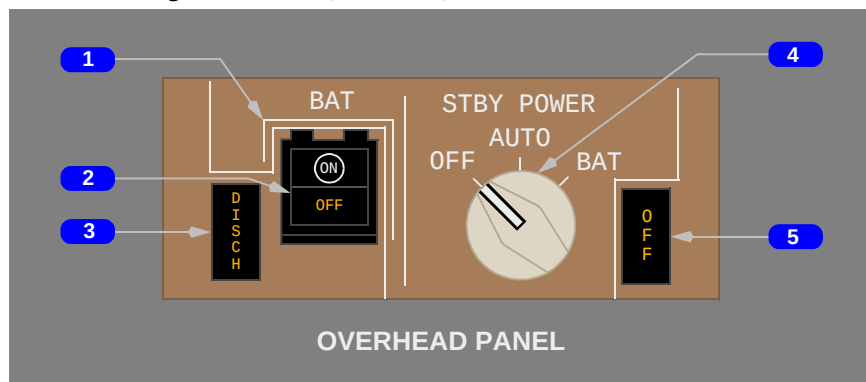
AUTO – the standby busses transfer to battery power if normal AC power is lost.

BAT – the standby busses are powered from the main and APU batteries.

6 Standby Power Bus OFF Light

Illuminated (amber) – the standby AC or DC bus is unpowered.

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG



1 Battery (BAT) Switch

ON –

- Unpowered airplane on the ground:
 - a few annunciator lights illuminate
 - allows the APU to be started
- Powered airplane inflight or on the ground when AC power is removed or lost:
 - the standby and battery busses are powered.

OFF (ON not visible) – turns battery power off.

2 Battery OFF Light

Illuminated (amber) – the battery switch is off.

3 Battery Discharge (DISCH) Light

Illuminated (amber) – the main battery is discharging.

4 Standby (STBY) POWER Selector –

OFF – the standby busses are unpowered.

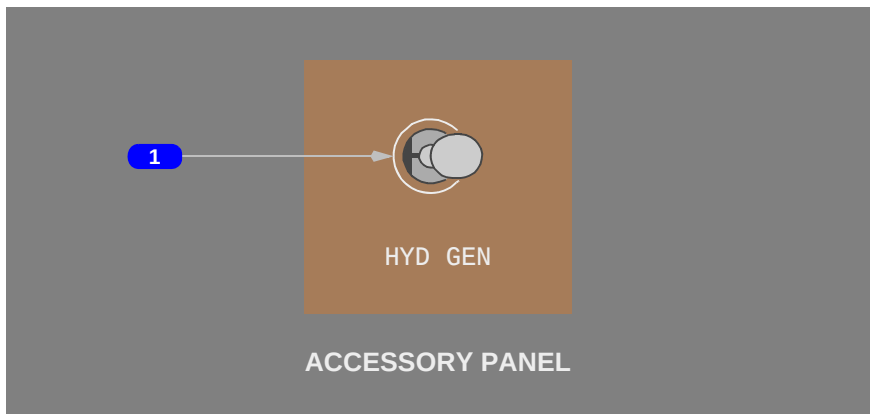
AUTO – the standby busses transfer to battery power if normal AC power is lost.

BAT – the standby busses are powered from the main battery.

5 Standby Power Bus OFF Light

Illuminated (amber) – standby AC or DC bus not powered.

Hydraulic Generator Test Switch



1 Hydraulic Generator Test Switch

Spring-loaded to center.

HYD GEN – initiates hydraulic driven generator system test.



Electrical System Description

Chapter 6 Section 20

Introduction

The electrical system generates and distributes AC and DC power to other airplane systems, and is comprised of: main AC power, main DC power, and battery/standby power. System operation is automatic. Electrical faults are automatically detected and isolated.

A hydraulic driven generator operates automatically as a backup source of power in the event that both main AC buses become inoperative.

AC Electrical System

The AC electrical system is the main source for airplane electrical power.

AC Electrical System Power Sources

The entire airplane AC electrical load can be supplied by any two main airplane AC power sources.

The main airplane AC electrical power sources are:

- left and right engine integrated drive generators (IDGs)
- APU generator.

The entire airplane AC electrical load also can be supplied by external power.

The power sources operate isolated from one another.

Integrated Drive Generators (IDGs)

Each engine has an IDG. Each IDG has automatic control and system protection functions.

When an engine starts, with the GEN CONT 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 GEN CONT switch to OFF. The IDG can also be electrically disconnected from its respective bus by selecting external power prior to engine shutdown. (See External Power in this section.)

VP-BMC, VP-BOY, VP-BOZ, VQ-BOG

The OFF light in the GEN CONT switch illuminates, and the EICAS Advisory message L or R GEN OFF displays whenever the generator control breaker is open.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMU, VQ-BPT, VQ-BRA

The OFF light in the GEN CONT switch illuminates, and the EICAS Caution message L or R GEN OFF displays whenever the generator control breaker is open.

The DRIVE light illuminates and the EICAS Advisory message L or R GEN DRIVE displays when low oil pressure or high oil temperature is detected in an IDG. The IDG drive can be disconnected from the engine by pushing the respective DRIVE DISC switch. The IDG cannot be reconnected by the flight crew.

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 external source is powering both main busses, the external source continues to power both main busses.

The APU Generator OFF light illuminates, and the EICAS advisory message APU GEN OFF displays when the APU is operating and the APU generator breaker is open because of a fault or the APU GEN switch is selected OFF. When the APU GENERATOR switch is ON and a fault is detected, the APU generator cannot connect to the busses.

External Power

External power can power the left and right main busses. When the power source voltage and frequency are within limits, the external power AVAIL light illuminates.

Pushing the EXT PWR switch ON connects external power to both main busses and removes the IDGs and the APU generator from the busses, if they were powering the busses. When external power is connected to a main bus, the EXTERNAL POWER ON light illuminates.

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. External power may also be connected and will also power both main busses.

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Bus tie breakers, 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.

The AC bus ISLN light illuminates and the EICAS advisory message L or R BUS ISOLATED displays when the bus tie breaker is open because of a fault or the BUS TIE switch is OFF.

The BUS OFF light illuminates and the EICAS caution message L or R AC BUS OFF displays if an AC bus is unpowered.

The source order for powering left and right main busses is the:

- respective IDG
- APU generator
- opposite IDG.

Utility Busses

Left and right utility busses, powered by their respective main AC bus, are controlled by UTILITY BUS switches. Left and right galley busses are powered by their respective utility busses, and have no direct controls or indicators. The utility bus OFF lights illuminate and the EICAS advisory message L or R UTIL BUS OFF displays when a galley and utility bus are unpowered.

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
- external power.

The ground service bus powers:

- the main battery charger
- miscellaneous cabin and system loads.
- the APU battery charger

Ground Handling Bus

The ground handling bus can be powered only on the ground and only from the APU generator or from the external power source. It is provided for loads such as cargo handling and equipment energized only during ground operations.

Autoland

During autoland, the busses isolate to allow three independent sources to power the three autopilots:

- the left main system powers the left autopilot and the captain's flight instrument transfer bus
- the right main system powers the right autopilot and the first officer's flight instrument transfer bus
- the battery/standby system powers the center autopilot.

Above 200 feet, loss of a generator results in:

- both bus tie breakers closing and the operating generator powers both left and right AC busses
- the left main system powers the center autopilot
- NO LAND 3 appears on the Autoland Status Annunciator.

Below 200 feet, loss of a generator results in:

- both bus tie breakers remaining open
- the autopilot associated with a failed generator is unpowered
- the flight instruments remain powered through the flight instrument transfer busses
- the autoland continues using the remaining two autopilots.

When the autopilots are disengaged or an autopilot go-around is performed, the electrical system reverts to normal, non-isolated operation.

Flight Instrument Transfer Busses

Normally, the captain's flight instruments are powered by the left main AC Bus, and the first officer's flight instruments are powered by the right main AC Bus. If the respective bus tie breakers are in AUTO, the flight instrument transfer busses transfer to the opposite main AC bus in the event power is lost to a main AC Bus.

If power is lost to both main AC busses, the captain's flight instruments are powered by the hydraulic driven generator.

AC Transfer Busses

Left and right AC transfer busses power items considered necessary for ETOPS flights, which are not powered by the battery/standby system. Transfer busses are normally powered by their associated main AC busses, but also can be powered by the Hydraulic Driven Generator when both AC busses are unpowered.

Electrical Load Shedding

Electrical load shedding occurs automatically to ensure power is available to critical and essential equipment.

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If the electrical loads exceed the power available, the electrical system automatically sheds AC loads by priority until the loads are within the capacity of the generators. The load shedding is galley power 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 load decreases, the electrical system automatically restores power to the shed systems (in the reverse order).

Examples of load shedding that may be observed during normal operations include:

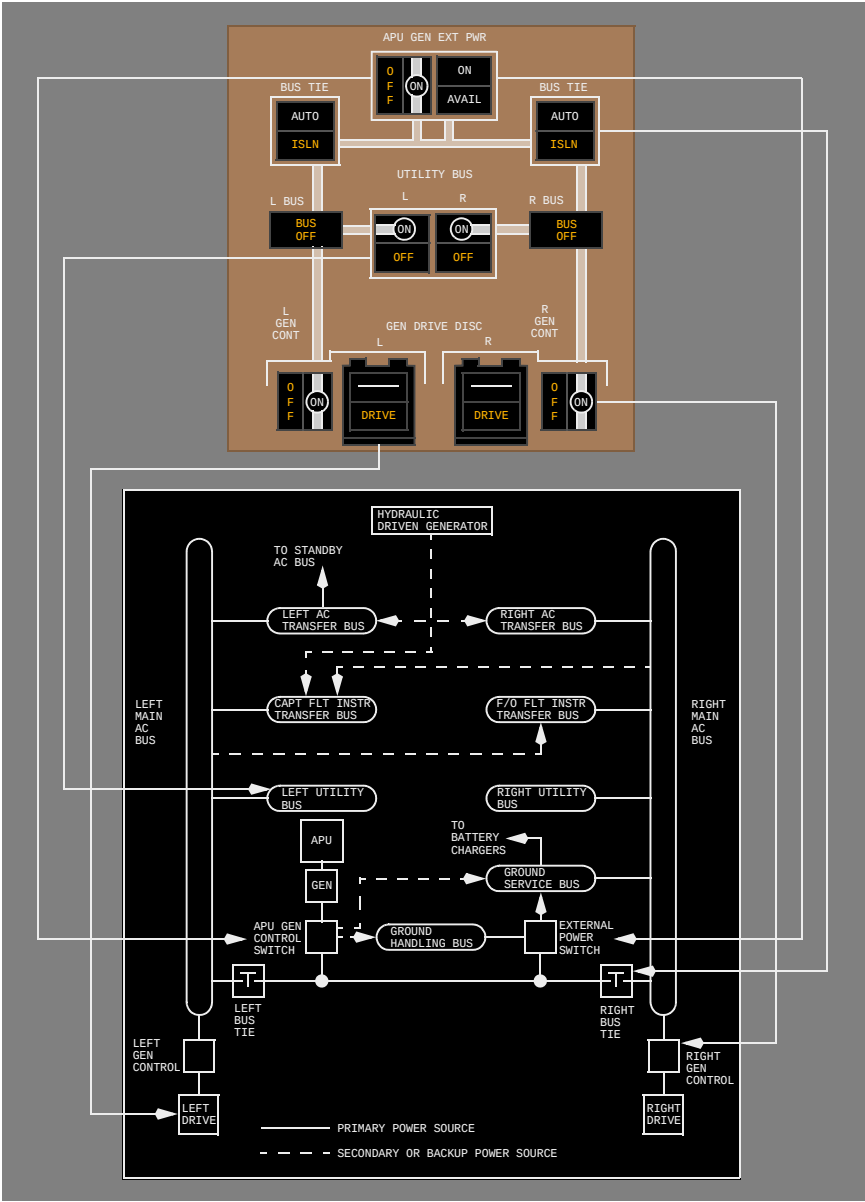
- an electric hydraulic pump prior to engine start
- center tank fuel pumps prior to engine start
- utility busses during engine start.

Examples of load shedding that may be observed during non-normal operations include:

- utility busses after a generator failure
- center tank fuel pump after an engine failure
- cabin ceiling lights after an engine failure.

On the ground, advancing the thrust levers into the takeoff range with the engines shut down may cause inadvertent load shedding of the utility busses to occur. Returning the thrust levers to idle, then pushing the UTILITY BUS switches OFF, then ON will reset this inadvertent load shedding.

AC Electrical System Schematic (Hydraulic Driven Generator)



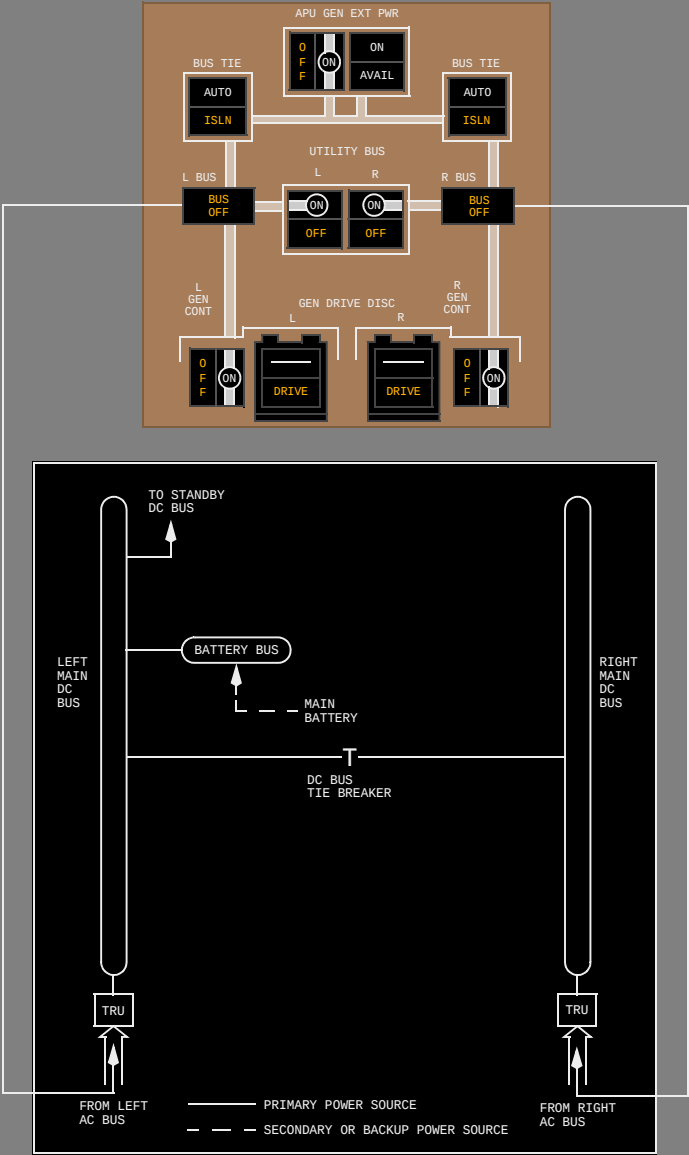
DC Electrical System

The main DC electrical system uses transformer-rectifier units (TRUs) to produce DC power. The TRUs are powered by the main AC busses.

The TRUs operate isolated from one another. If one TRU fails, the DC bus tie breaker closes to keep both DC busses powered. Both BUS TIE switches must be in AUTO for the DC bus tie breaker to close.

There are no flight deck controls for the main DC electrical system.

DC Electrical System Schematic



Battery/Standby Power System

The battery/standby power electrical system can supply DC and AC power to selected flight instruments, communications and navigation systems, and other critical systems, if there are main AC and DC electrical power system failures.

The Battery/Standby Power System consists of the following busses:

- the hot battery bus
- the battery bus
- the standby AC bus
- the standby DC bus

Hot Battery Bus

The hot battery bus provides power to items which must be continuously powered, such as the clock's time reference.

Prior to establishing electrical power, the main battery powers the hot battery bus.

After establishing electrical power, the main battery charger powers the hot battery bus.

Battery Bus

Prior to establishing electrical power, when the battery switch is ON, the main battery powers the battery bus.

After establishing electrical power, the left DC system powers the battery bus, and the main battery provides a backup source of power.

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG

The Battery DISCH light illuminates when the main battery is discharging. If EICAS is powered, the advisory message MAIN BAT DISCH also displays.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

The MAIN BAT DISCH light illuminates when the main battery is discharging. If EICAS is powered, the advisory message MAIN BAT DISCH also displays.

The battery OFF light illuminates and the EICAS advisory message BATTERY OFF displays if the battery switch is OFF after electrical power is established.

Standby DC Bus

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG

The standby DC bus can be powered by several sources. Prior to establishing electrical power, when the battery switch is ON and the standby power selector is in AUTO, the main battery powers the standby DC bus. The Battery DISCH light illuminates when the main battery is discharging. After establishing electrical power, the left DC system powers the standby DC bus and the main battery provides a backup source of power. When the standby power selector is in BAT, the main battery powers the standby DC bus.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

The standby DC bus can be powered by several sources. Prior to establishing electrical power, when the battery switch is ON and the standby power selector is in AUTO, the main battery and the APU battery are paralleled to power the standby DC bus. The MAIN BAT DISCH light and the APU BAT DISCH light illuminate when the main battery and APU battery are discharging. After establishing electrical power, the left DC system powers the standby DC bus and the main battery and APU battery provide a backup source of power. When the standby power selector is in BAT, the main battery and the APU battery are paralleled to power the standby DC bus.

The standby bus OFF light illuminates and the EICAS advisory message STANDBY BUS OFF displays if the standby DC bus is not powered. In addition, these indications display if power is lost to the battery bus even though the standby DC bus may still be powered.

Standby AC Bus

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG

The standby AC bus can be powered by several sources. Prior to establishing electrical power, when the battery switch is ON and the standby power selector is in AUTO, the main battery powers the standby inverter which provides AC power to the standby AC bus. After establishing electrical power, the left AC system powers the standby AC bus and the main battery and standby inverter provide a backup source of power. When the standby power selector is in BAT, the main battery and standby inverter power the standby AC bus.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

The standby AC bus can be powered by several sources. Prior to establishing electrical power, when the battery switch is ON and the standby power selector is in AUTO, the main battery and the APU battery parallel to power the standby inverter which provides AC power to the standby AC bus. After establishing electrical power, the left AC system powers the standby AC bus and the main battery, APU battery, and standby inverter provide a backup source of power. When the standby power selector is BAT, the main battery, APU battery, and standby inverter power the standby AC bus.

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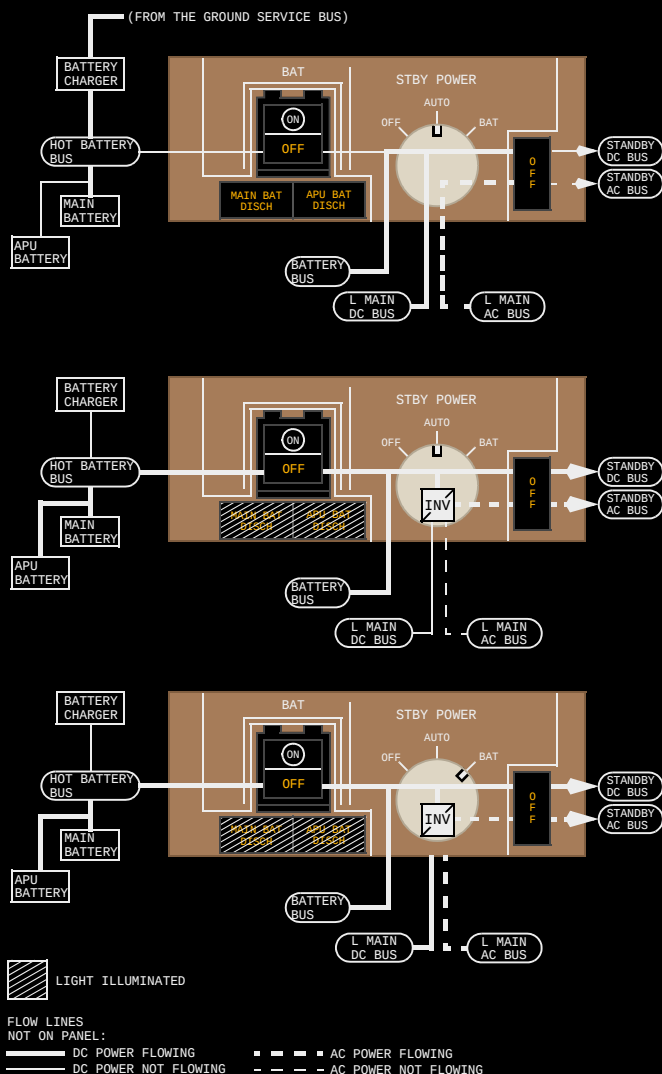


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The standby bus OFF light illuminates and the EICAS advisory message STANDBY BUS OFF displays if the standby AC bus is not powered. In addition, these indications display if power is lost to the battery bus even though the standby AC bus may still be powered.

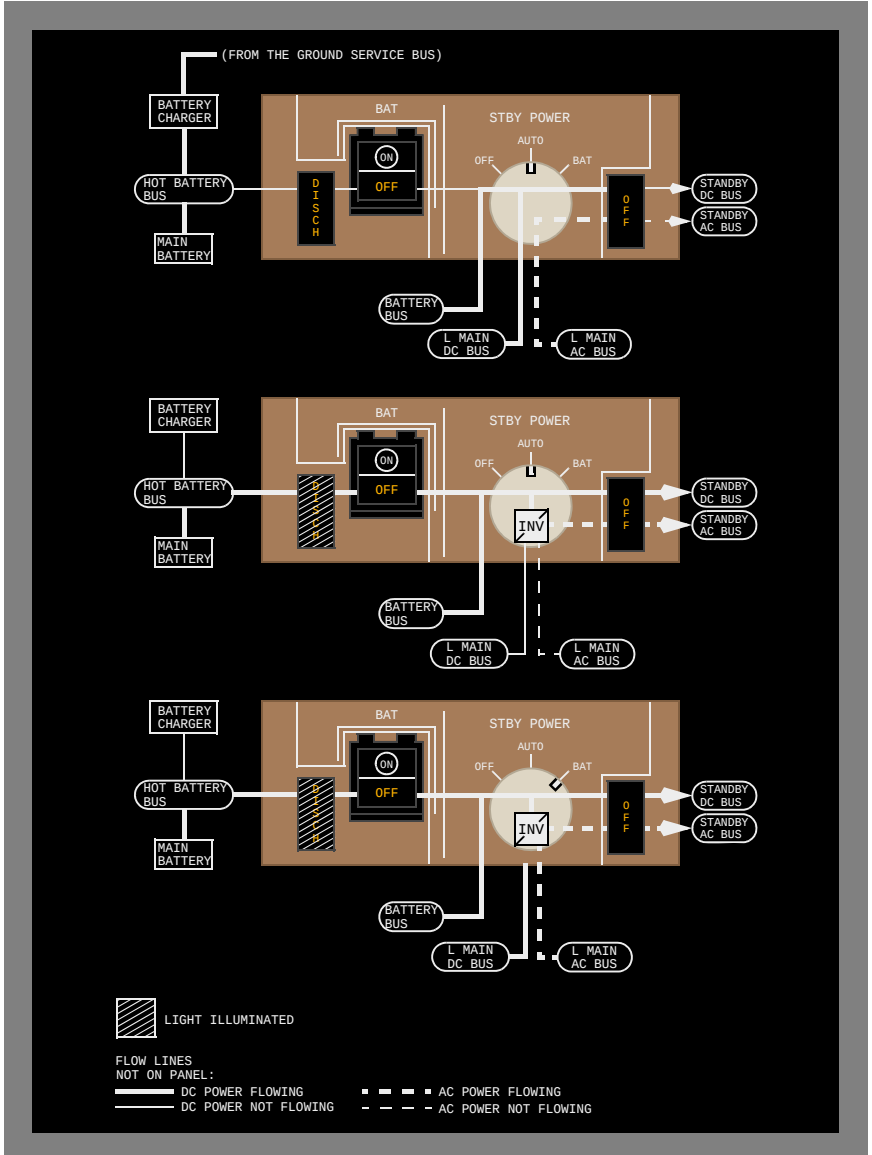
Battery/Standby System Schematic

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA



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VP-BMC through VP-BRL, VQ-BMU, VQ-BOG



Hydraulic Driven Generator

The hydraulic driven generator (HDG) activates automatically when both the left and right main AC busses are unpowered. The Hydraulic Driven Generator (HDG) is powered by the Center Hydraulic System.

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The HDG provides AC power to:

- the left AC transfer bus
- the right AC transfer bus
- the standby AC bus (through the left AC transfer bus)
- the captain's flight instrument transfer bus

The HDG provides DC power to:

- the hot battery bus
- the battery bus
- the standby DC bus.

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG

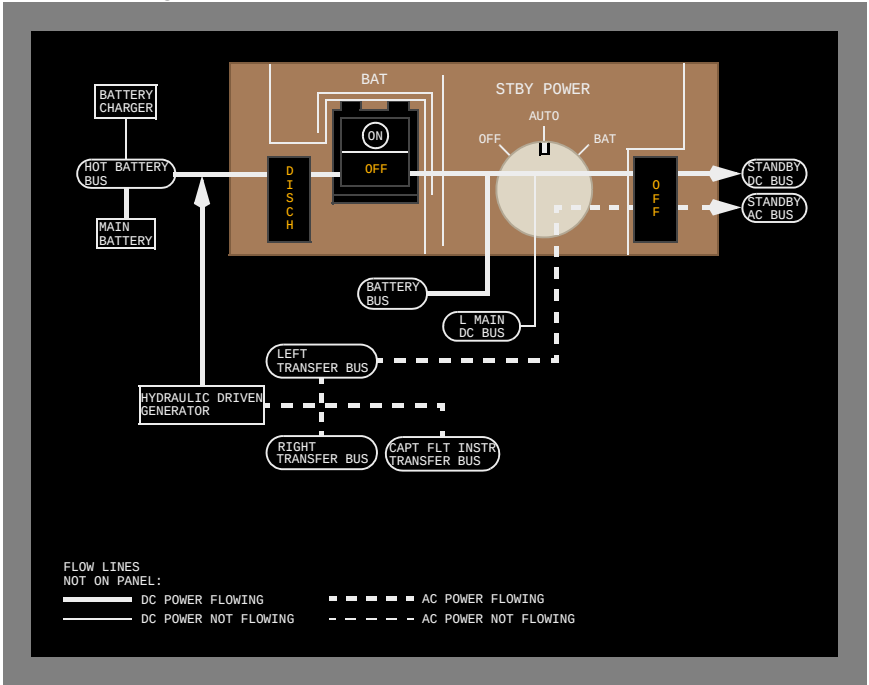
The amount of DC power produced by the HDG is less than the DC power produced by a fully charged battery. When the HDG first begin to operate, the battery DISCH light may illuminate, until the battery power decreases to the power level produced by the HDG.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

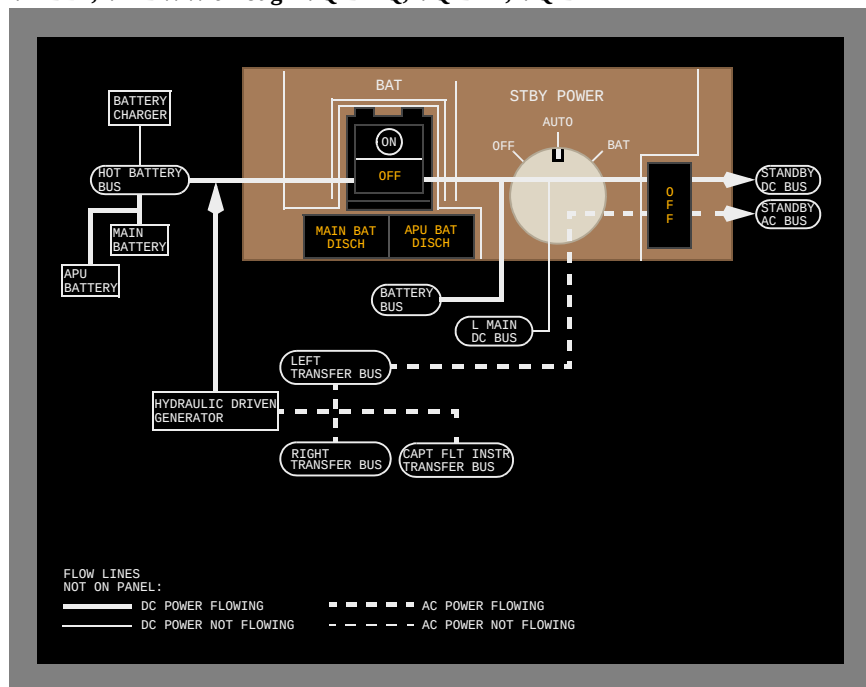
The amount of DC power produced by the HDG is less than the DC power produced by fully charged main and APU batteries. When the HDG first begins to operate, the MAIN BAT DISCH and APU BAT DISCH lights may illuminate, until the battery power decreases to the power level produced by the HDG.

Battery/Standby System Schematic (Hydraulic Driven Generator Operating)

VP-BMC through VP-BRL, VQ-BMU, VQ-BOG



VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA



**Electrical**
EICAS Messages**Chapter 6**
Section 30**Electrical EICAS Messages**

The following EICAS messages can be displayed.

Message	Level	Light	Aural	Condition
L AC BUS OFF R AC BUS OFF	Caution	BUS OFF	Beeper	AC Bus is unpowered.

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

APU BAT DISCH	Advisory	APU BAT DISCH		APU battery is discharging.

APU GEN OFF	Advisory	OFF		APU generator control breaker is open due to a fault with the APU running.
BATTERY OFF	Advisory	OFF		Battery switch is OFF.
L BUS ISOLATED R BUS ISOLATED	Advisory	ISLN		Bus tie breaker is open due to an AC electrical system fault.
L GEN DRIVE R GEN DRIVE	Advisory	DRIVE		Generator drive oil pressure is low or generator drive oil temperature is high.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMU, VQ-BPT, VQ-BRA

L GEN OFF R GEN OFF	Caution	OFF	Beeper	Generator control breaker is open.

VP-BMC, VP-BOY, VP-BOZ, VQ-BOG

L GEN OFF R GEN OFF	Advisory	OFF		Generator control breaker is open.



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Message	Level	Light	Aural	Condition

VP-BDI, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA

MAIN BAT DISCH	Advisory	MAIN BAT DISCH		Main battery is discharging.

| VP-BMC through VP-BRL, VQ-BMU, VQ-BOG

MAIN BAT DISCH	Advisory	DISCH		Main battery is discharging.

STANDBY BUS OFF	Advisory	OFF		Standby AC or DC bus is unpowered.
L UTIL BUS OFF R UTIL BUS OFF	Advisory	OFF		Galley and utility busses are unpowered.

**Engines, APU**
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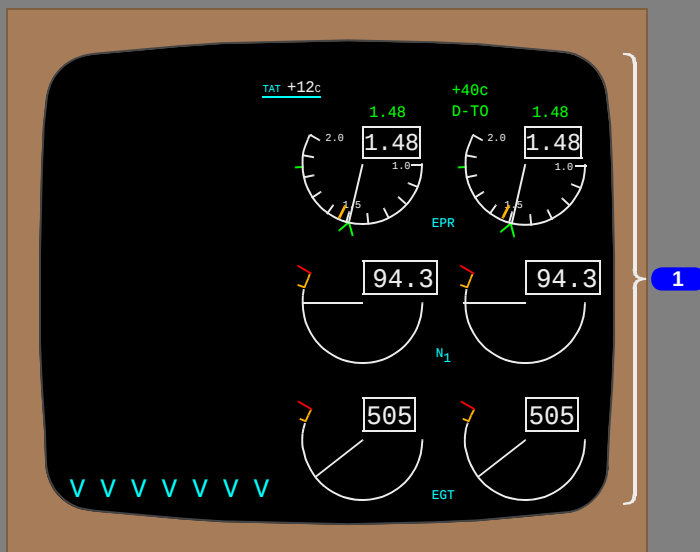


Engines, APU Controls and Indicators (PW)

Chapter 7 Section 11

This Section Applies to VP-BMC, VP-BOY, VP-BOZ

EICAS Displays Primary Engine Indications



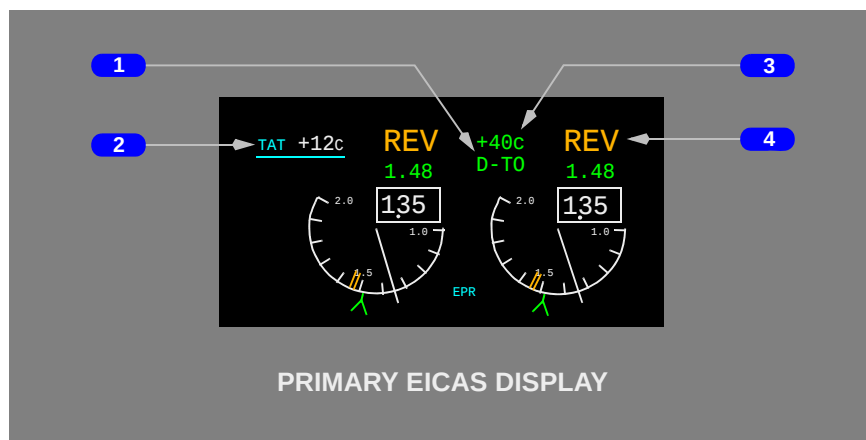
PRIMARY EICAS DISPLAY

1 Primary Engine Indications

Displayed full time on the EICAS display:

- EPR
- N1
- EGT

Mode Indications



1 Thrust Reference Mode

Displayed (green) – selected FMS thrust reference mode:

Takeoff:

- TO – maximum rated takeoff thrust
- TO 1 * – maximum rated takeoff thrust, climb one preselected
- TO 2 * – maximum rated takeoff thrust, climb two preselected

Assumed Temperature Takeoff:

- D-TO – assumed temperature derated takeoff thrust
- D-TO 1 * – assumed temperature derated takeoff thrust, climb one preselected
- D-TO 2 * – assumed temperature derated takeoff thrust, climb two preselected

Climb:

- CLB – maximum rated climb thrust
- CLB 1 – climb thrust one
- CLB 2 – climb thrust one

Cruise:

- CRZ – maximum rated cruise thrust
- CRZ 1 * – maximum rated cruise thrust, climb one preselected
- CRZ 2 * – maximum rated cruise thrust, climb two preselected

Continuous:

- CON – maximum rated continuous thrust
- CON 1 * – maximum rated continuous thrust, climb one preselected
- CON 2 * – maximum rated continuous thrust, climb two preselected

Go-around and Manual:

- G/A – go-around thrust
- MAN – reference EPR manually selected

Note: * WHITE NUMBER – indicates reduced climb thrust is preselected

2 Total Air Temperature (TAT)

Displayed (cyan) – "TAT" and underline

Displayed (white) - temperature (degrees C)

3 Assumed Temperature

Displayed (green) – selected assumed temperature (degrees C) for reduced thrust takeoff

4 Thrust Reverser Indication

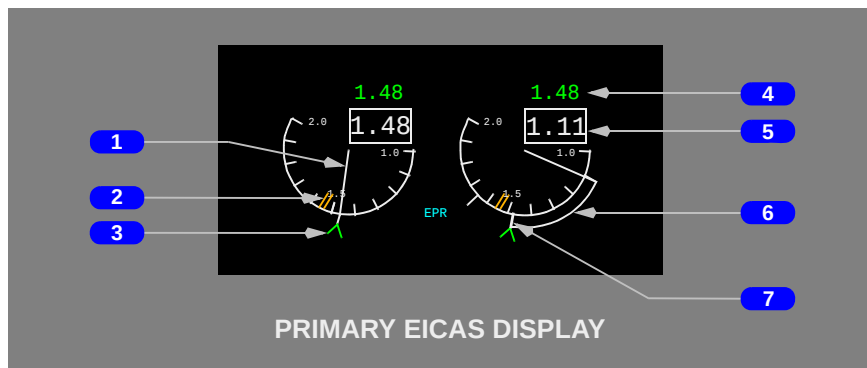
Displayed REV (amber) – reverser in transit

Displayed REV (green) – reverser fully deployed

EPR Indications

Note: When reverse thrust is activated, the following indications are not displayed:

- reference/target EPR indication
- thrust reference mode
- reference EPR



1 EPR Pointer

Displayed (white)

2 Maximum EPR Line

Displayed (amber)

3 EPR bug

Displayed (green) – reference EPR limit

Displayed magenta – target FMC commanded EPR when VNAV is engaged

4 Reference EPR

Displayed (green)

5 Actual EPR

Displayed (white)

6 Commanded EPR Sector

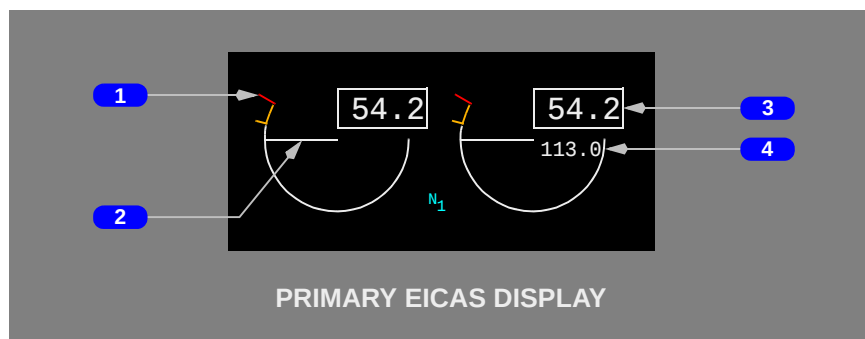
Displays momentary difference between engine EPR and EPR commanded by thrust lever position

7 Command Thrust Level

Displayed (white):

- end of command sector
- appears as extension of EPR pointer when engine stabilized
- EPR commanded by thrust lever position

N1 Indications



1 N1 Red Line Limit

Displayed (red) – N1 RPM operating limit

2 N1 Pointer

- (white) – points at value equal to that shown in the N1 counter
- (red) – operating limit reached or exceeded

3 N1

N1 RPM (%), displayed:

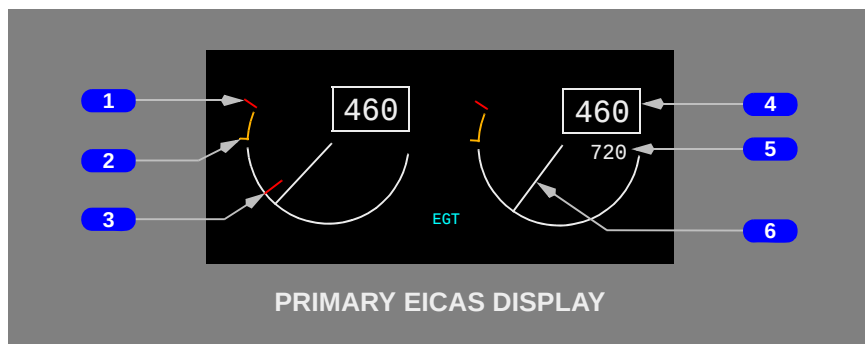
- (white) – normal operating range
- (red) – operating limit reached or exceeded

4 Maximum Exceedance

Displayed (white):

- red line limit is reached or exceeded
- highest value attained

EGT Indications



1 EGT Red Line

Displayed (red) – maximum takeoff EGT limit

2 EGT Amber Band

Displayed (amber) – maximum continuous EGT limit

3 EGT Start Limit Line

Displayed (red) – during start until engine is stabilized at minimum idle RPM

4 EGT

EGT (degrees C), displayed:

- (white) – normal operating range
- (amber) – maximum continuous limit reached*
- (red) – maximum start or takeoff limit reached

VP-BOY, VP-BOZ

Note: * Pointer and counter remain white during TO or GA for 5 minutes after amber band is entered.

VP-BMC

Note: * Pointer and counter remain white during TO or GA for 5 minutes after amber band is entered. If engine failure occurs during 5 minute amber band inhibit time period then total amber band inhibit time period is extended to 10 minutes.

5 EGT Maximum Exceedance

Displayed (white):

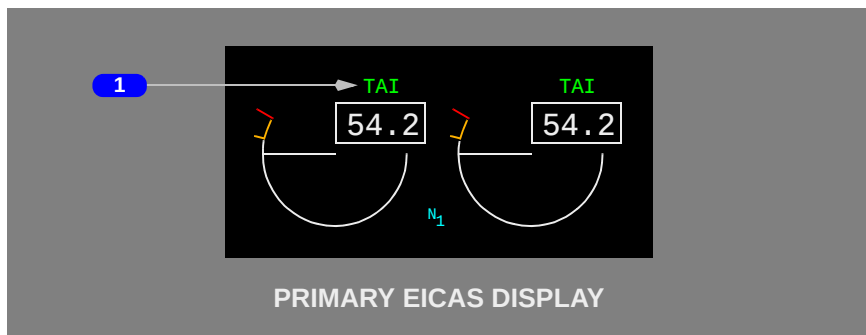
- red line limit or start EGT limit is reached or exceeded
- displays the highest value attained

6 EGT Pointer

Displayed:

- (white) – normal operating range
- (amber) – maximum continuous limit reached
- (red) – maximum start or takeoff limit reached

Anti-Ice Indications

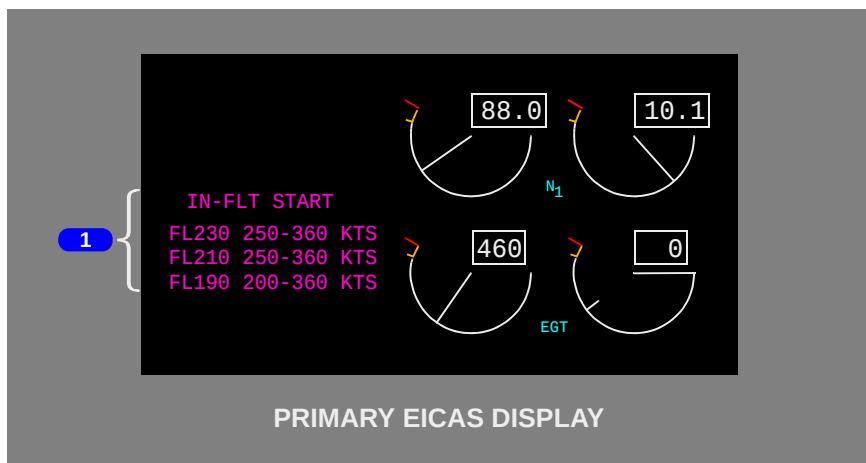


1 Thermal Anti-Ice (TAI) Indication

Displayed (green) –

- engine anti-ice is on

In-Flight Start Envelope

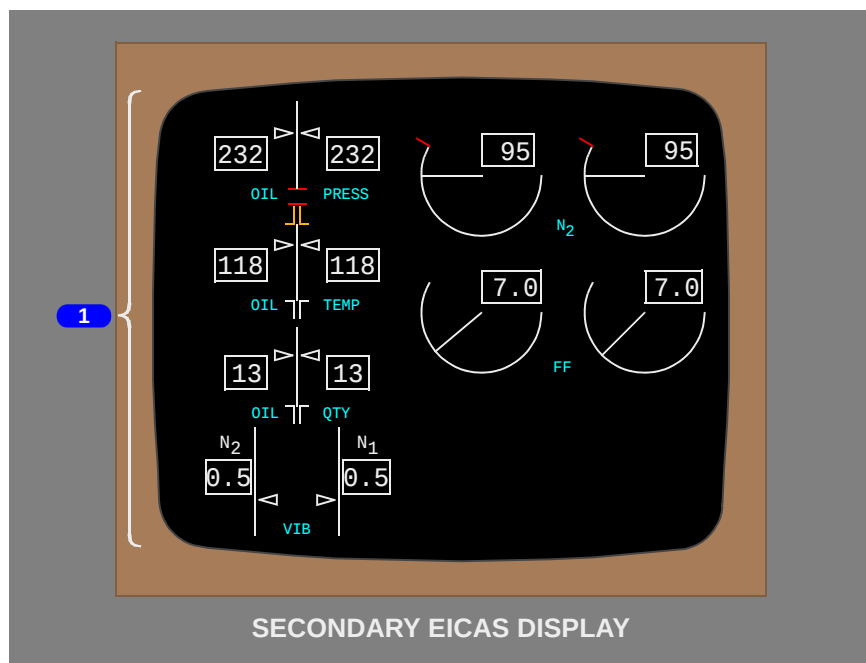


1 In-Flight Start Envelope

Displayed (magenta) – airspeed range for an inflight start for the closest starting flight level and two descending flight levels at two thousand foot intervals when the respective engine fire switch is in and:

- a FUEL CONTROL switch is in CUT OFF, and
- engine N2 RPM is below idle, and
- primary and secondary EICAS displayed

Secondary Engine Indications

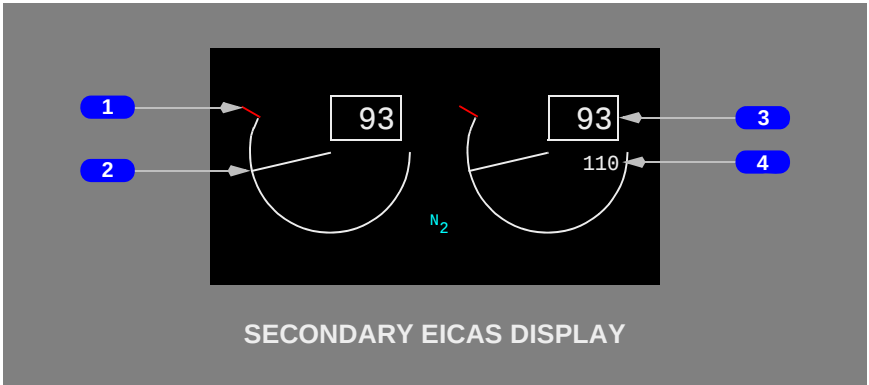


1 Secondary Engine Display

Displays:

- N2 RPM
- fuel flow (FF)
- oil pressure
- oil temperature
- oil quantity
- vibration

N2 Indications



1 N2 Red Line

N2 RPM operating limit, displayed (red)

2 N2 Pointer

N2 RPM, displayed:

- (white) – normal operating range
- (red) – operating limit reached or exceeded

3 N2

N2 RPM (%), displayed:

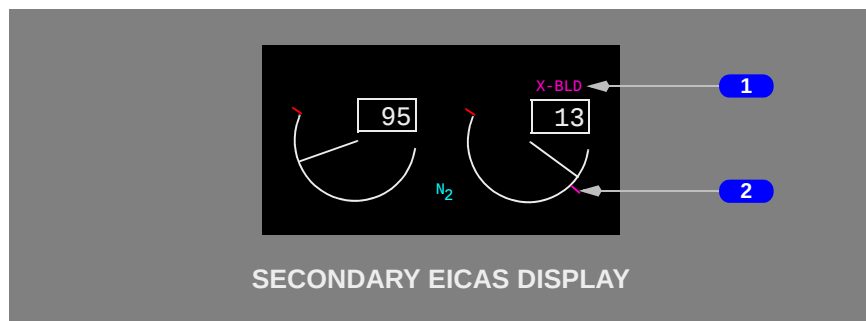
- (white) – normal operating range
- (red) – operating limit reached

4 Maximum Exceedance

Displayed (white):

- red line limit is exceeded
- highest value attained

Crossbleed Start Indications



1 Crossbleed Start (X-BLD) Indication

Indicates crossbleed air is recommended for an inflight start.

Displayed (magenta):

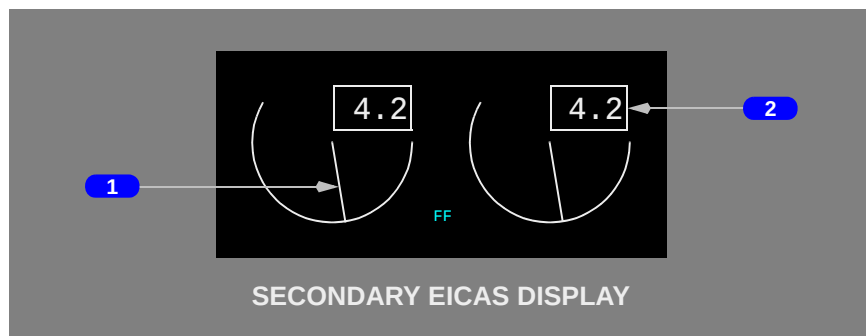
- the inflight start envelope is displayed, and
- airspeed is lower than that for a windmilling start

2 Fuel On Command Bug

Displayed (magenta):

- engine is shutdown on the ground or inflight when X-BLD is displayed
- minimum fuel on selection point during starter cranking

Fuel Flow Indications



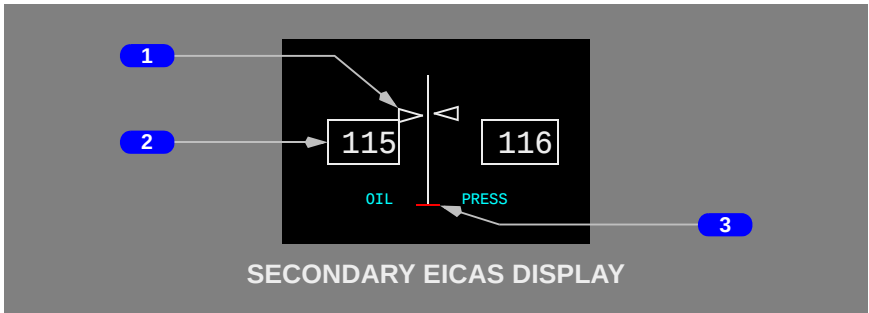
1 Fuel Flow Pointer

Displayed (white) – points at a value equal to that shown in the Fuel Flow

2 Fuel Flow (FF)

Displayed (white) – fuel flow to the engine (kilograms per hour x 1000)

Oil Pressure Indications



1 Oil Pressure Pointer

Engine oil pressure, displayed:

- (white) – normal operating range
- (red) – operating limit reached

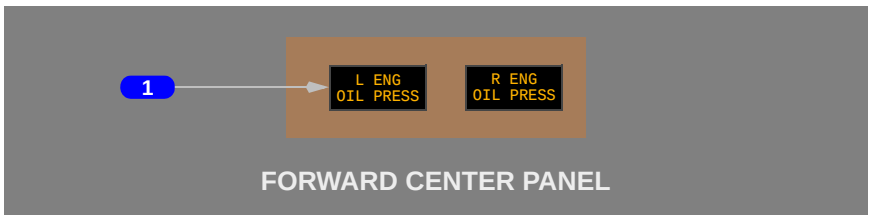
2 Oil Pressure (OIL PRESS)

Engine oil pressure (psi), displayed:

- (white) – normal operating range
- (red) – operating limit reached

3 Oil Pressure Red Line

Displayed (red) – low oil pressure operating limit

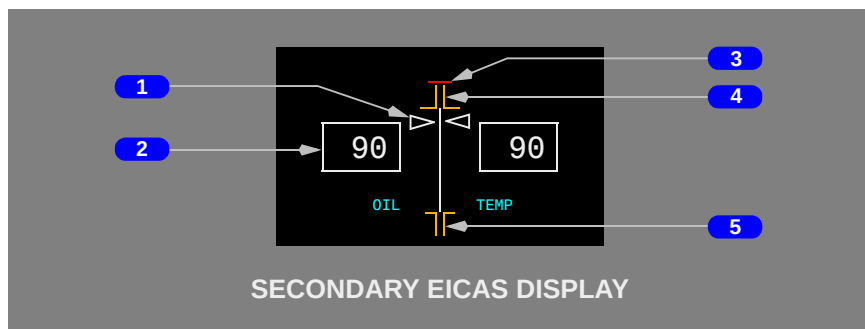


1 Engine Oil Pressure (L or R ENG OIL PRESS) Lights

Illuminated (amber):

- respective engine oil pressure is at or below minimum
- oil pressure switch malfunction

Oil Temperature Indications



1 Oil Temperature Pointer

Engine oil temperature, displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached

2 Oil Temperature

Engine oil temperature (degrees C), displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached

3 Oil Temperature Red Line

Displayed (red) – oil temperature operating limit

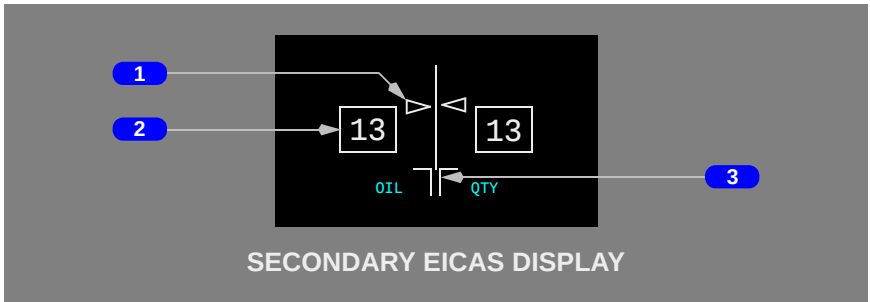
4 Oil Temperature Amber Band

Displayed (amber) – upper oil temperature caution range

5 Oil Temperature Amber Band

Displayed (amber) – lower oil temperature caution range

Oil Quantity Indications



1 Oil Quantity Pointer

Displayed (white) – points at a value equal to that shown in the Oil Quantity

2 Oil Quantity

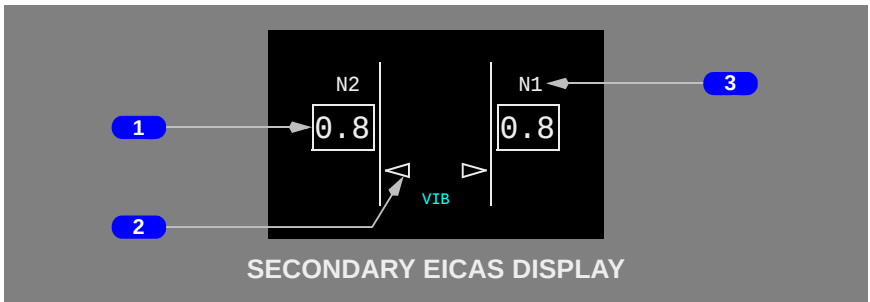
Usable oil quantity (liters), displayed:

- (white) – normal quantity

3 Low Oil Quantity Band

Displayed (white) – awareness range for low oil quantity

Engine Vibration Indications



1 Engine Vibration

Displayed (white) – normal operating range

2 Engine Vibration Pointer

Displayed (white) – engine vibration

3 Vibration Source

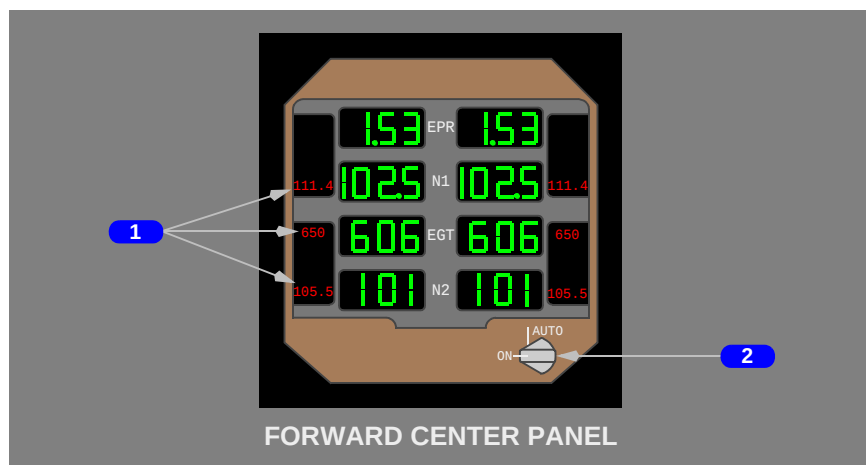
Identifies the vibration source being displayed

Displayed (white) – vibration source with the highest vibration:

- N1 rotor vibration
- N2 rotor vibration

If the vibration source BB (broad band vibration) is displayed, the source is unknown and average vibration is displayed

Standby Engine Indicator (SEI)



1 Maximum Engine Limits

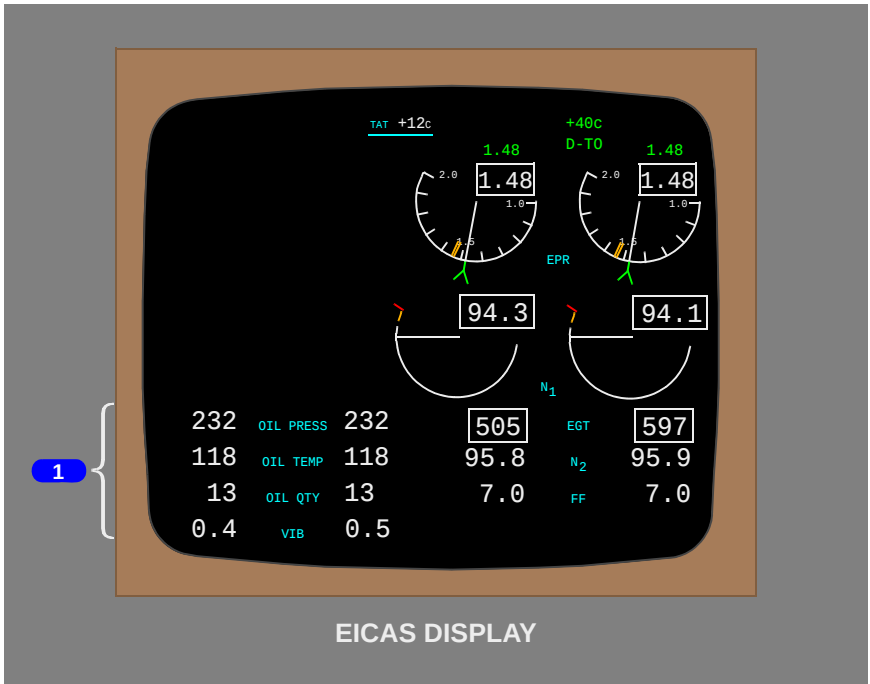
2 Standby Engine Indicator Selector

AUTO –

- display is blank with AC power on the airplane and EICAS operative
- standby engine indications in view when:
 - AC power is lost
 - either CRT failed and STATUS selected on the ground
 - EICAS failed

ON – standby engine indications in view

Compact Engine Indications



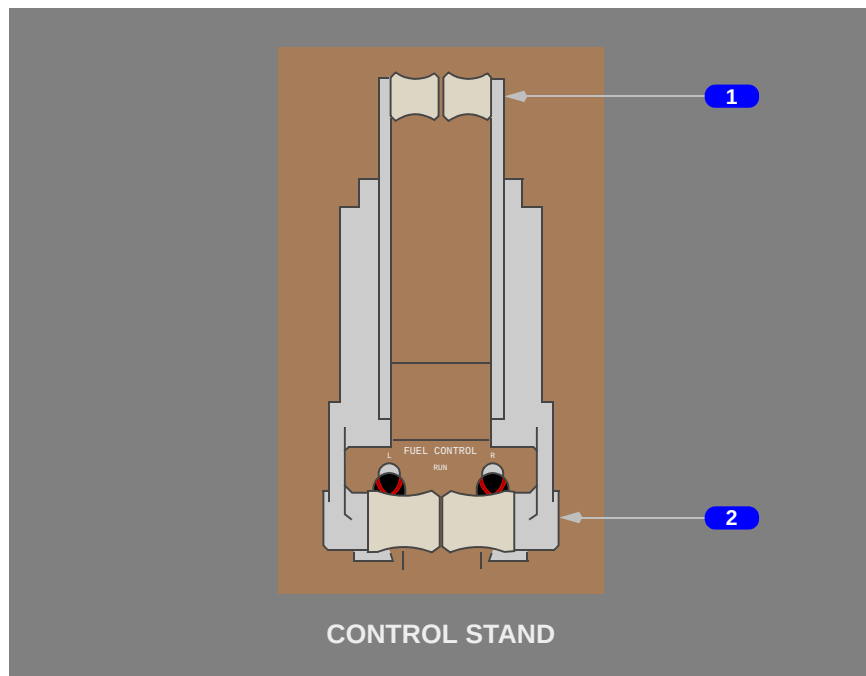
1 Compact Engine Indications

The following changes to EICAS and the normal secondary engine display occur:

- EGT and N2 change from round dial displays to digital displays. The EGT digital display and box turn amber or red if the limit is exceeded. The N2 digital display turns red if the limit is exceeded
- FF, OIL PRESS and OIL TEMP are displayed as digital readouts only. The OIL PRESS and OIL TEMP 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.

Engine Controls

Thrust Levers



1 Reverse Thrust Levers

Controls engine reverse thrust

Reverse thrust can only be selected when the forward thrust levers are closed

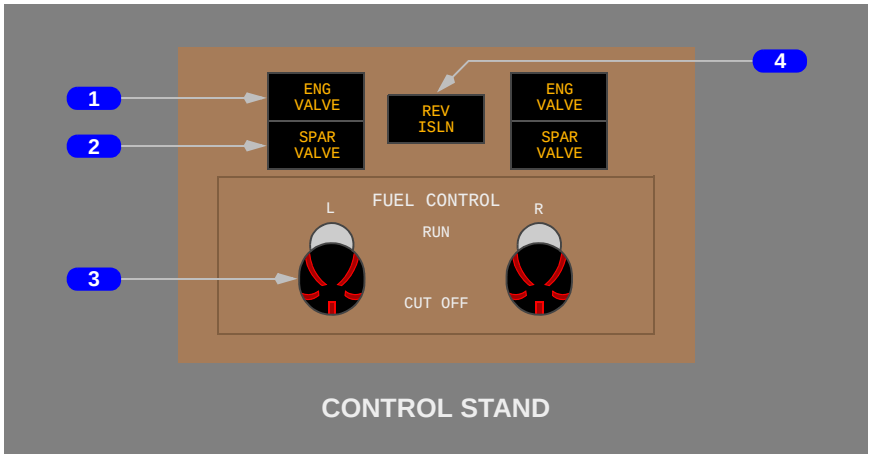
Actuates automatic speedbrakes (refer to Chapter 9, Flight Controls)

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



1 Engine Valve (ENG VALVE) Lights

Illuminated (amber) – engine fuel valve is not in commanded position

2 SPAR VALVE Lights

Illuminated (amber) – fuel spar valve is not in commanded position

3 FUEL CONTROL Switches

RUN –

- normal position for flight
- opens engine and spar fuel valves
- activates selected ignitor(s)

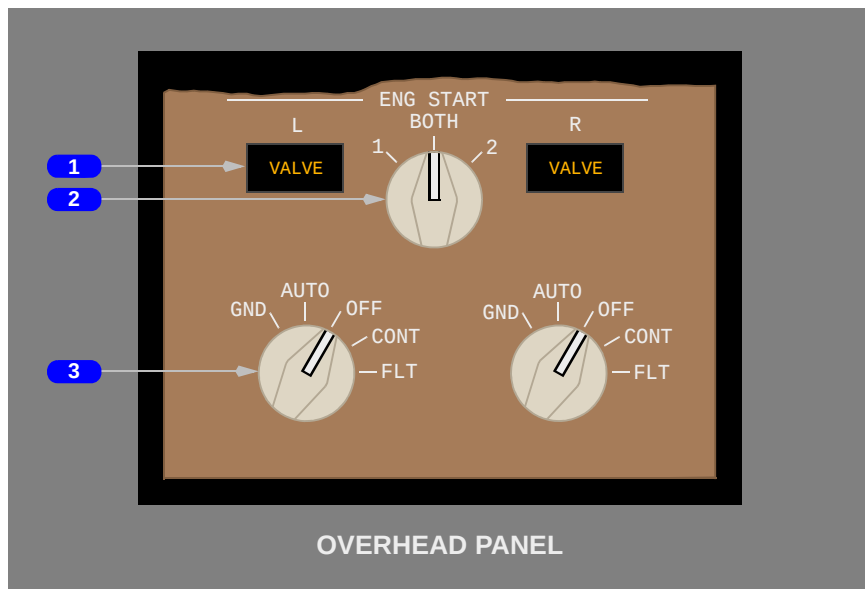
CUT OFF –

- closes engine and spar fuel valves
- terminates ignition

4 Reverser Isolation Valve (REV ISLN) Light

Illuminated (amber) – a fault has been detected in the thrust reverser system

Engine Control Panel



1 Engine Start Valve (VALVE) Lights

Illuminated (amber):

- valve is not in commanded position
- N2 RPM exceeds 50% and starter valve open

2 Ignition Selector

BOTH – both igniters in each engine operate when directed by Engine Start Selector

1 or 2 – selected igniter in each engine operate when directed by Engine Start Selector

3 Engine Start Selectors

GND (push-in and rotate) –

- opens start valve to supply starter air
- arms selected igniter(s)
- selector magnetically held in GND position until 50% N2 RPM

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AUTO –

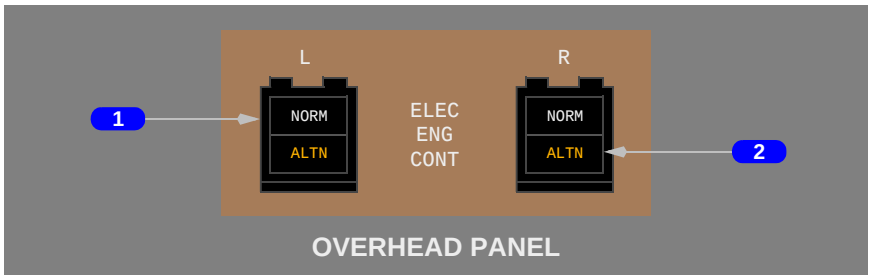
- selector releases to AUTO at 50% N2 RPM
- closes start valve and terminates ignition
- selected igniter(s) operate continuously with L.E. slats extended or engine anti-ice on

OFF – no ignition
CONT –

- selected igniter(s) operate continuously
- no time limit
- engine operates at a minimum of approach idle

FLT –

- both igniters operate continuously regardless of ignition selector position
- no time limit

Electronic Engine Control (EEC)

1 EEC (ELEC ENG CONT) Switches

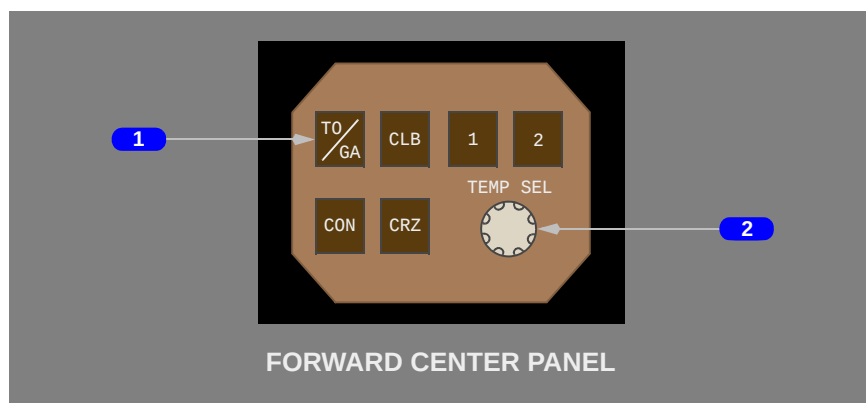
NORM – EEC is operating in normal (EPR) mode

ALTN (NORM not visible) – EEC is operating in alternate (N1) mode

2 EEC Alternate Mode (ALTN) Lights

Illuminated (amber) – EEC is operating in alternate (N1) mode

Thrust Mode Select Panel (TMSP)



1 Thrust Reference Mode Select Switches

Push –

- manually selects desired thrust reference mode
- selected thrust reference mode and reference EPR are displayed

TO/GA –

- selects TO mode on the ground or GA mode inflight
- cancels preselected climb one or two
- cancels selected assumed temperature
- selecting 1 or 2 with TO or D-TO reference mode displayed:
 - preselects CLB 1 or CLB 2 on the ground if autothrottles not engaged
 - subsequent push cancels any preselected 1 or 2
 - cancels selected assumed temperature

CLB –

- selects CLB
- selects CLB 1 or CLB 2 if 1 or 2 is preselected

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- selecting 1 or 2 with CLB Reference mode displayed:
 - selects CLB 1 or CLB 2
- with CLB 1 or CLB 2 reference mode displayed:
 - subsequent push of active mode switch cancels 1 or 2
- with CLB 2 reference mode displayed:
 - switch 1 selects CLB 1

CON –

- selects CON mode
- selecting 1 or 2 with CON reference mode displayed:
 - preselects CLB 1 or CLB 2

CRZ –

- selects CRZ mode
- selecting 1 or 2 with CRZ reference mode displayed:
 - preselects CLB 1 or CLB 2

2 Assumed Temperature Selector (TEMP SEL)

Functions only with TO, TO 1* or TO 2* mode displayed

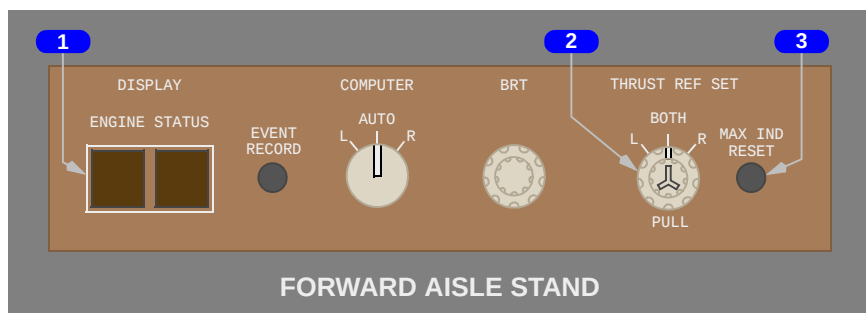
Sets assumed temperature

Rotate clockwise –

- assumed temperature appears on EICAS
- one click equals 1 degree centigrade

Note: * WHITE NUMBER - indicates reduced climb thrust is preselected

EICAS Control Panel



1 ENGINE Display Switch

Push – displays the secondary engine parameters on the lower EICAS CRT

VP-BOY, VP-BOZ

If secondary engine parameters are already displayed and no limits have been exceeded, the display reverts to fuel flow only

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VP-BMC

If secondary engine parameters are already displayed and no limits have been exceeded, the display blanks

2 Manual Thrust Reference Set (THRUST REF SET) Controls

Outer Knob:

- BOTH – both EPR bugs may be set to the same value
- L or R – only the selected EPR bug may be set to the desired value. Bugs may be set at different values.

Inner Knob:

- Push – reference EPR is set automatically
- Pull – reference EPR is set manually. MAN appears in EPR thrust reference mode display and EPR bug moves to 1.55.
- Rotate – in manual mode, sets EPR bug and reference EPR to desired value

3 Maximum Indication Reset (MAX IND RESET) Switch

Push – resets and blanks all maximum exceedance values on EGT, N1 and N2



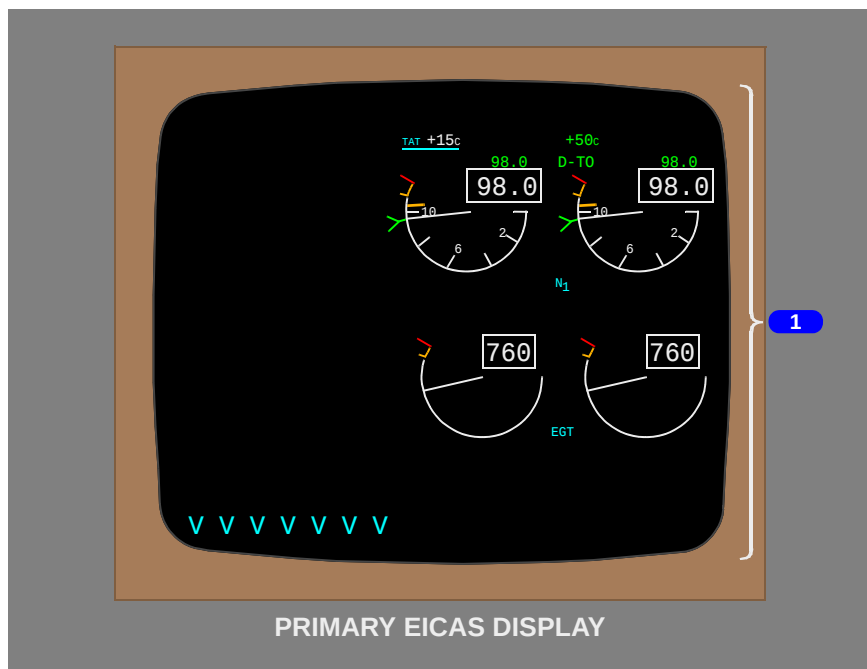
Engines, APU Controls and Indicators (GE)

Chapter 7 Section 12

This Section Applies to VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

EICAS Displays

Primary Engine Indications

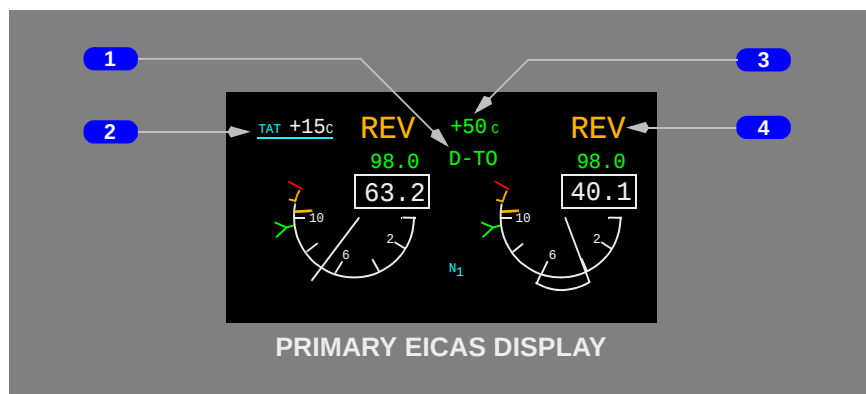


1 Primary Engine Indications

Displayed full time on the EICAS display:

- N₁
- EGT

Mode Indications



1 Thrust Reference Mode

Displayed (green) – selected FMS thrust reference mode:

Takeoff:

- TO – maximum rated takeoff thrust

VP-BDI, VQ-BMU, VQ-BOG

- TO 1 – takeoff thrust one, climb one preselected

VP-BDI, VQ-BMU, VQ-BOG

- TO 2 – takeoff thrust two, climb two preselected

VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA

- TO 1 * – maximum rated takeoff thrust, climb one preselected

VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA

- TO 2 * – maximum rated takeoff thrust, climb two preselected

Assumed Temperature Takeoff:

- D-TO – assumed temperature derated takeoff thrust

VP-BDI, VQ-BMU, VQ-BOG

- D-TO 1 – assumed temperature derated takeoff thrust one, climb one preselected

VP-BDI, VQ-BMU, VQ-BOG

- D-TO 2 – assumed temperature derated takeoff thrust two, climb two preselected

VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA

- D-TO 1 * – assumed temperature derated takeoff thrust, climb one preselected

VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA

- D-TO 2 * – assumed temperature derated takeoff thrust, climb two preselected

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Climb:

- CLB – maximum rated climb thrust
- CLB 1 – climb thrust one
- CLB 2 – climb thrust two

Cruise:

- CRZ – maximum rated cruise thrust
- **VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA**
- CRZ 1 * – maximum rated cruise thrust, climb one preselected
- **VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA**
- CRZ 2 * – maximum rated cruise thrust, climb two preselected

Continuous:

- CON – maximum rated continuous thrust
- **VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA**
- CON 1 * – maximum rated continuous thrust, climb one preselected
- **VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA**
- CON 2 * – maximum rated continuous thrust, climb two preselected

Go-around and Manual:

- G/A – go-around thrust
- MAN – reference N1 manually selected

VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA

Note: * WHITE NUMBER – indicates reduced climb thrust is preselected

2 Total Air Temperature (TAT)

Displayed (cyan) – "TAT" and underline

Displayed (white) - temperature (degrees C)

3 Assumed Temperature

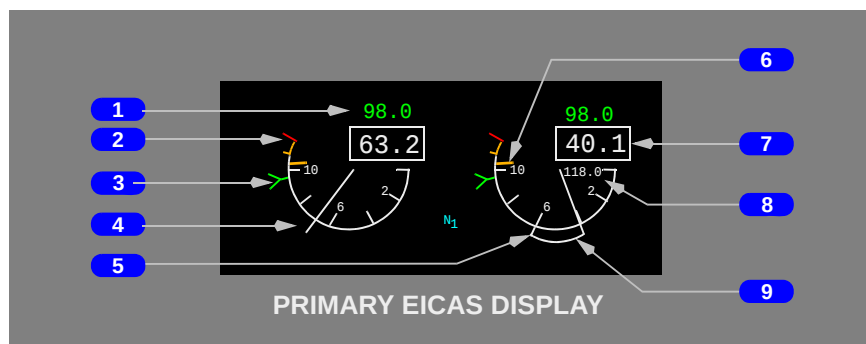
Displayed (green) – selected assumed temperature (degrees C) for reduced thrust
takeoff

4 Thrust Reverser Indication

Displayed:

- REV (amber) – reverser in transit
- REV (green) – reverser fully deployed

N1 Indications



1 Reference N1 (Green)

Digital N1 display for Thrust Reference mode selected

2 N1 Red Line Limit

Displayed (red) – N1 RPM operating limit

3 N1 Bug

Displayed (green) – reference N1 for:

- thrust reference mode selected by the FMC
- thrust reference mode selected by the thrust mode select panel
- manual mode selected with thrust reference control

Displayed (magenta) – target FMC commanded N1 when VNAV is engaged

4 N1 Pointer

Displayed:

- (white) – points at value equal to that shown in the N1 counter
- (red) – operating limit reached or exceeded

5 Command Thrust Level

Displayed (white):

- end of command sector
- appears as extension of N1 pointer when engine stabilized
- N1 commanded by thrust lever position

6 Limit N1

Displayed (amber) – maximum limit N1

7 N1

N1 RPM (%), displayed:

- (white) – normal operating range
- (red) – operating limit reached or exceeded

8 Maximum Exceedance

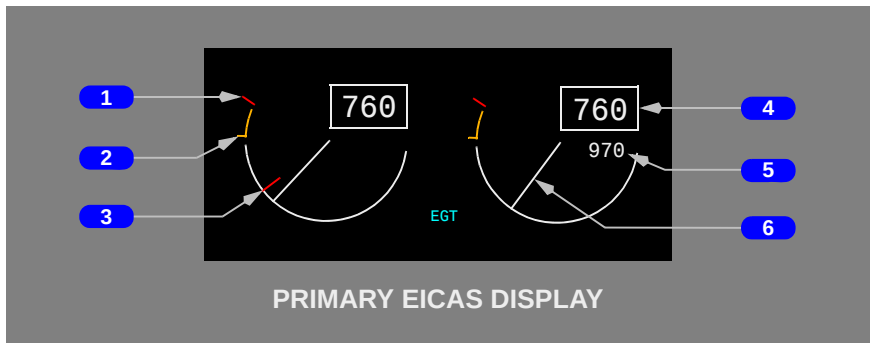
Displayed (white):

- red line limit is reached or exceeded
- highest value attained

9 Command N1 Sector

Displayed (white) – momentary difference between engine N1 and N1 commanded by thrust lever position

EGT Indications



1 EGT Red Line

Displayed (red) – maximum takeoff EGT limit

2 EGT Amber Band

Displayed (amber) – maximum continuous EGT limit

3 EGT Start Limit Line

Displayed (red) – during start until engine is stabilized at minimum idle RPM

4 EGT

EGT (degrees C), displayed:

- (white) – normal operating range
- (amber) – maximum continuous limit reached*
- (red) – maximum start or takeoff limit reached

VP-BDI, VP-BOQ, VP-BRL

Note: * Pointer and counter remain white during TO or GA for 5 minutes after amber band is entered.

VP-BWW through VQ-BRA

Note: * Pointer and counter remain white during TO or GA for 5 minutes after amber band is entered. If engine failure occurs during 5 minute amber band inhibit time period then total amber band inhibit time period is extended to 10 minutes.

5 EGT Maximum Exceedance

Displayed (white):

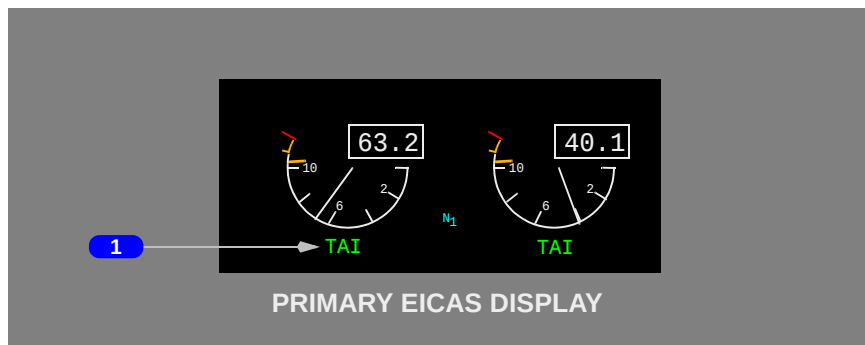
- red line limit or start EGT is reached or exceeded
- displays the highest value attained

6 EGT Pointer

Displayed:

- (white) – normal operating range
- (amber) – maximum continuous limit reached
- (red) – maximum start or takeoff limit reached

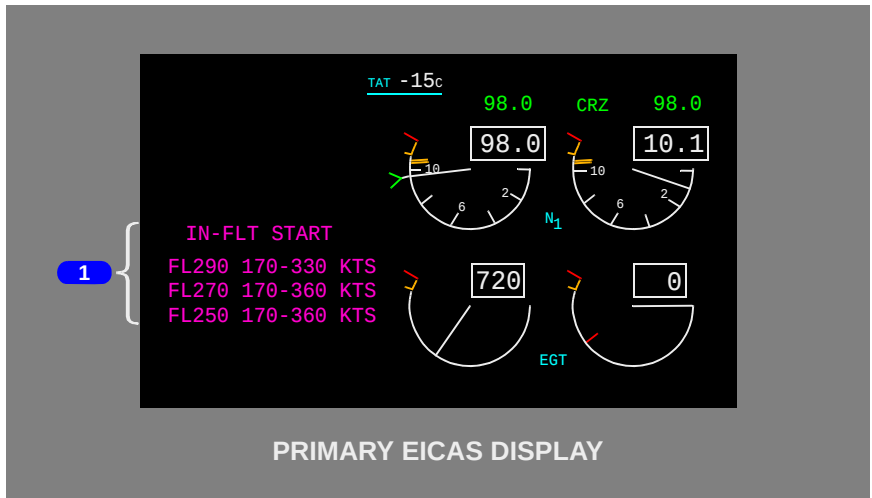
Anti-Ice Indications



1 Thermal Anti-Ice (TAI) Indication

Displayed (green) – engine anti-ice is on

In-Flight Start Envelope

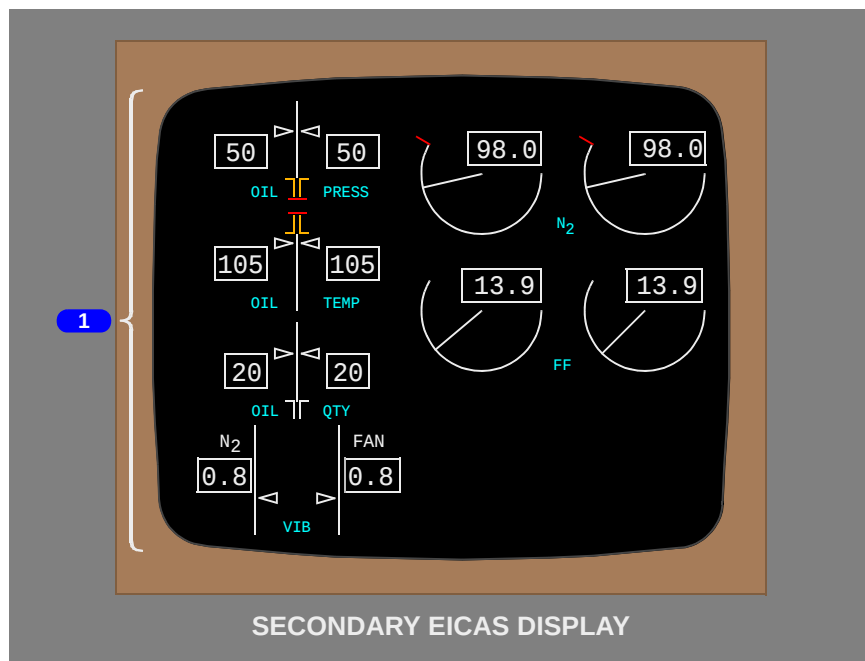


1 In-Flight Start Envelope

Displayed (magenta) – airspeed range for an inflight start for the closest starting flight level and two descending flight levels at two thousand foot intervals when the respective engine fire switch is in and:

- a FUEL CONTROL switch is in CUT OFF, and
- engine N2 RPM is below idle, and
- primary and secondary EICAS displayed

Secondary Engine Indications

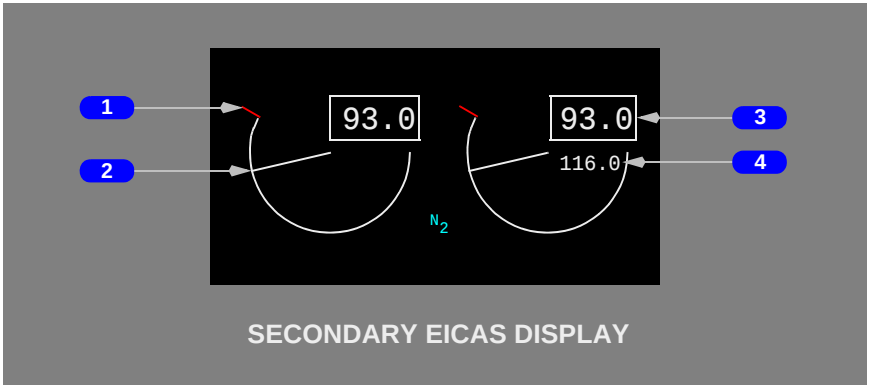


1 Secondary Engine Display

Displays:

- N2 RPM
- fuel flow (FF)
- oil pressure
- oil temperature
- oil quantity
- vibration

N2 Indications



1 N2 Red Line

N2 RPM operating limit, displayed (red)

2 N2 Pointer

N2 RPM, displayed:

- (white) – normal operating range
- (red) – operating limit reached or exceeded

3 N2

N2 RPM (%), displayed:

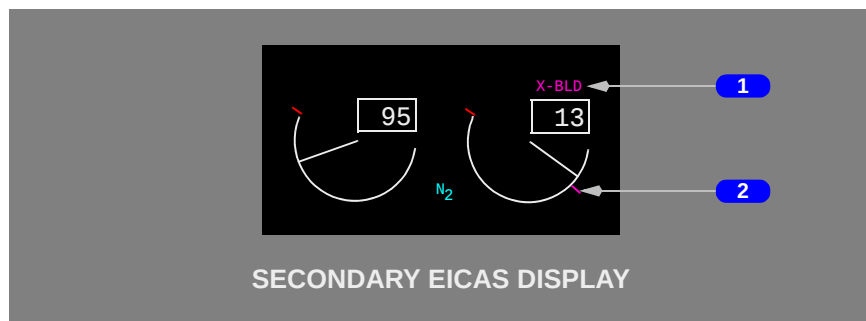
- (white) – normal operating range
- (red) – operating limit reached

4 Maximum Exceedance

Displayed (white):

- red line limit is exceeded
- highest value attained

Crossbleed Start Indications



1 Crossbleed Start (X-BLD) Indication

Indicates crossbleed air is recommended for an inflight start.

Displayed (magenta):

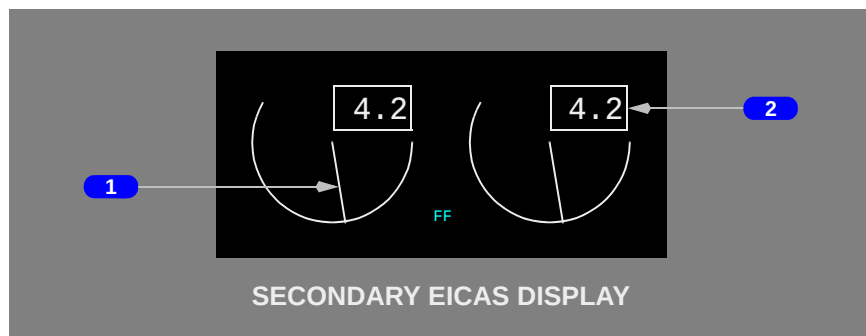
- the inflight start envelope is displayed, and
- airspeed is lower than that for a windmilling start

2 Fuel On Command Bug

Displayed (magenta):

- engine is shutdown on the ground or inflight when X-BLD is displayed
- minimum fuel on selection point during starter cranking

Fuel Flow Indications



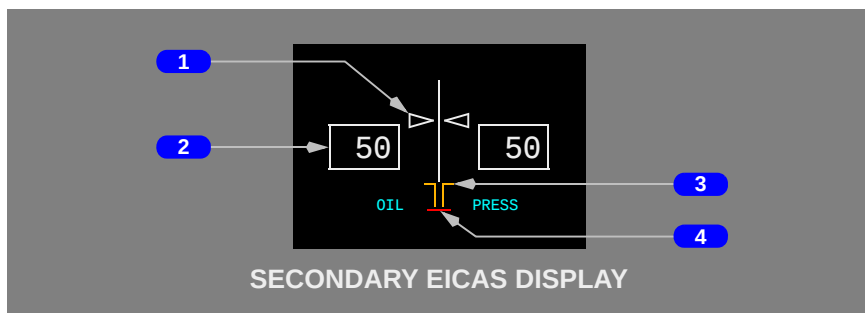
1 Fuel Flow Pointer

Displayed (white) – points at a value equal to that shown in the Fuel Flow

2 Fuel Flow (FF)

Displayed (white) – fuel flow to the engine (kilograms per hour x 1000)

Oil Pressure Indications



1 Oil Pressure Pointer

Engine oil pressure, displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached

2 Oil Pressure (OIL PRESS)

Engine oil pressure (psi), displayed:

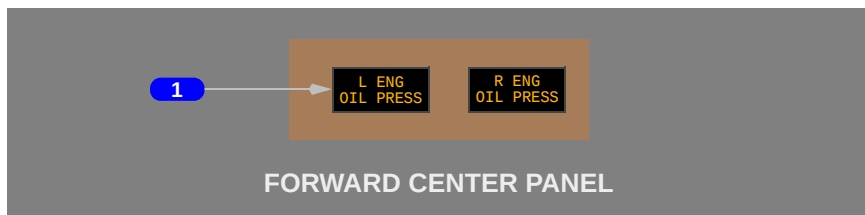
- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached

3 Oil Pressure Amber Band

Displayed (amber) – caution range for low oil pressure

4 Oil Pressure Red Line

Displayed (red) – low (minimum) oil pressure operating limit

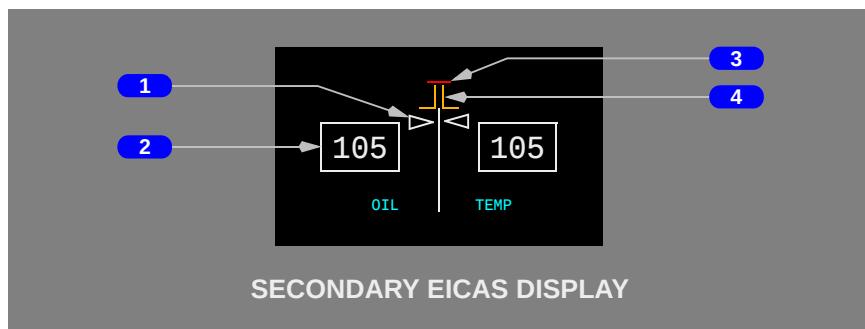


1 Engine Oil Pressure (L or R ENG OIL PRESS) Lights

Illuminated (amber):

- respective engine oil pressure is at or below minimum
- oil pressure switch malfunction

Oil Temperature Indications



1 Oil Temperature Pointer

Engine oil temperature, displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached

2 Oil Temperature

Engine oil temperature (degrees C), displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached

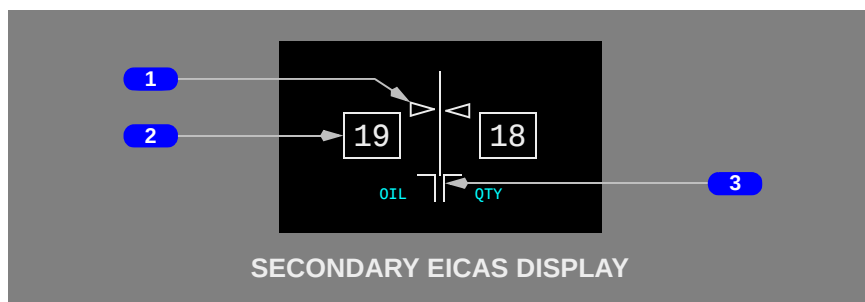
3 Upper Oil Temperature Red Line

Displayed (red) – maximum oil temperature operating limit

4 Oil Temperature Amber Band

Displayed (amber) – oil temperature caution range

Oil Quantity Indications



1 Oil Quantity Pointer

Displayed (white) – points at a value equal to that shown in the Oil Quantity

2 Oil Quantity

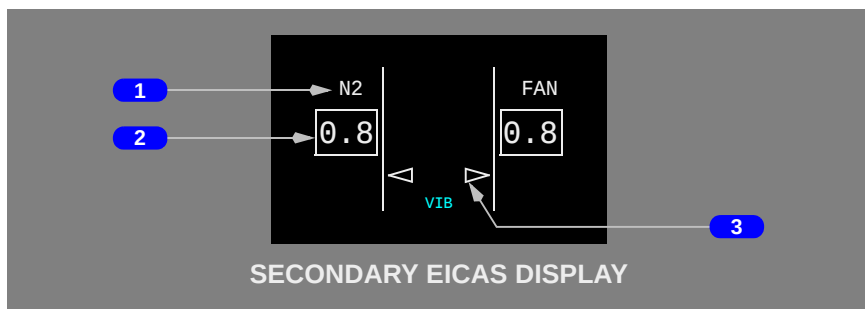
Usable oil quantity (liters), displayed:

- (white) – normal quantity

3 Low Oil Quantity Band

Displayed (white) – awareness range for low oil quantity

Engine Vibration Indications



1 Vibration Source

Identifies the vibration source being displayed.

Displayed (white) – vibration source with the highest vibration:

- FAN – low pressure compressor
- LPT – low pressure turbine
- N2 – high pressure compressor
- BB – broad band engine vibration

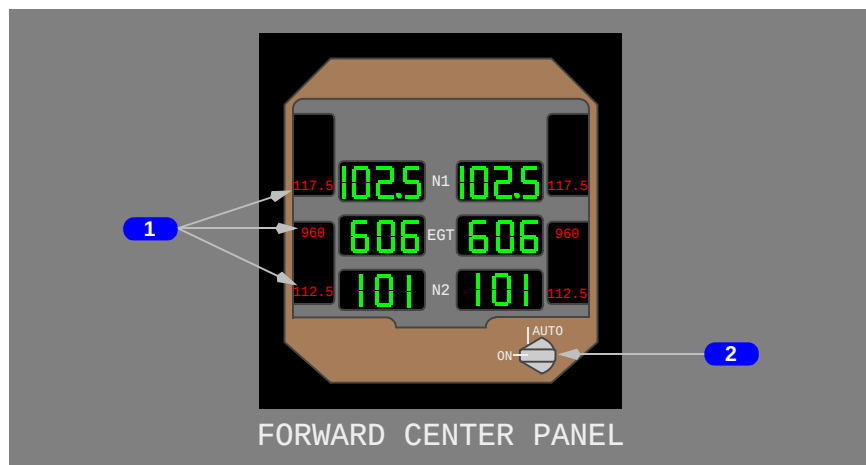
2 Engine Vibration

Displayed (white) – display of engine vibration in units

3 Engine Vibration Pointer

Displayed (white) – engine vibration

Standby Engine Indicator (SEI)



1 Maximum Engine Limits

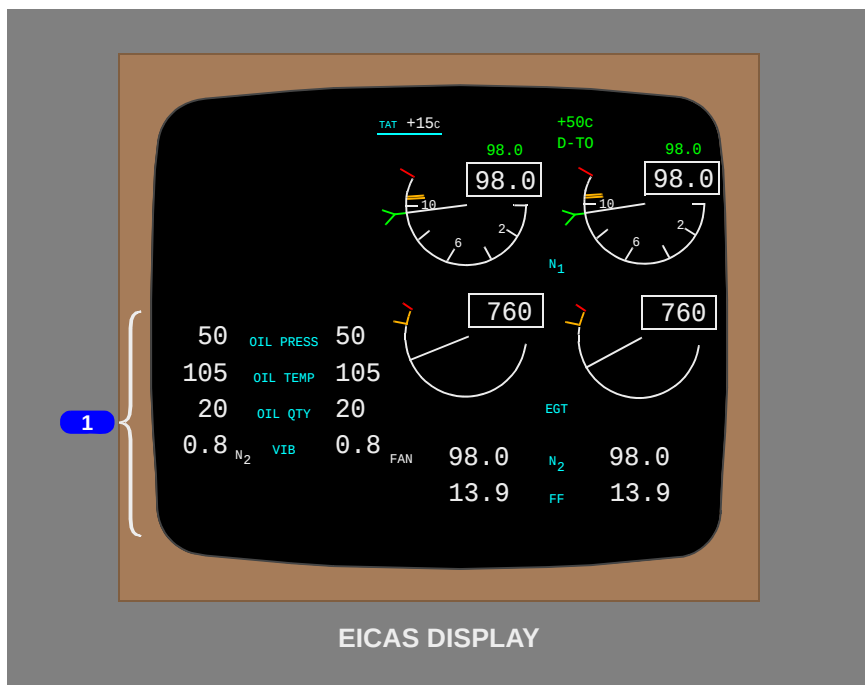
2 Standby Engine Indicator Selector

AUTO –

- display is blank with AC power on the airplane and EICAS operative
- standby engine indications in view when:
 - AC power is lost
 - either CRT failed and STATUS selected on the ground
 - EICAS failed

ON – standby engine indications in view

Compact Engine Indications



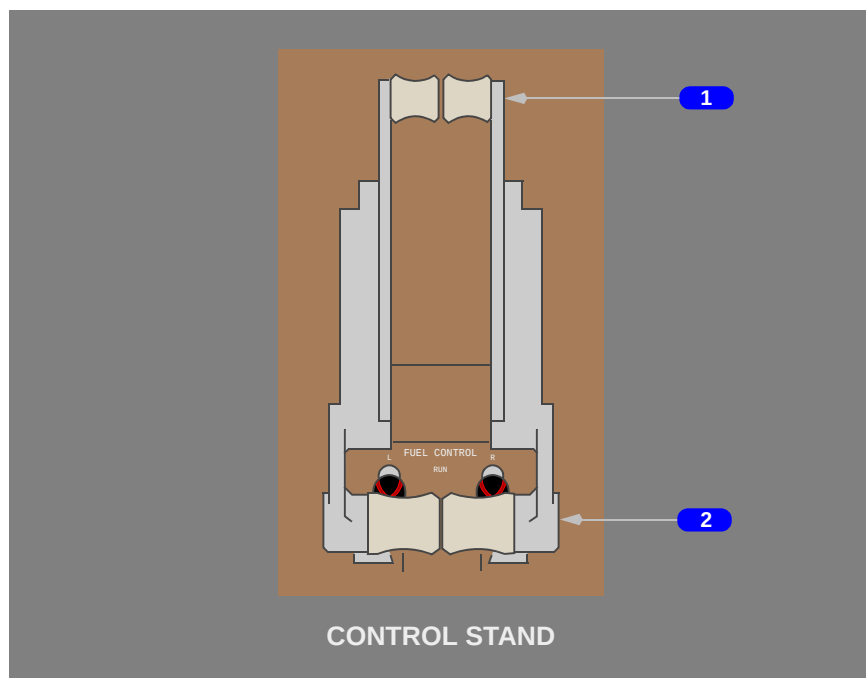
1 Compact Engine Indications

The following changes to EICAS and the normal secondary engine display occur:

- N2 changes from round dial display to digital display. The N2 digital display turns red if the limit is exceeded.
- FF, OIL PRESS and OIL TEMP are displayed as digital readouts only. The OIL PRESS and OIL TEMP 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.

Engine Controls

Thrust Levers



1 Reverse Thrust Levers

Controls engine reverse thrust

Reverse thrust can only be selected when the forward thrust levers are closed

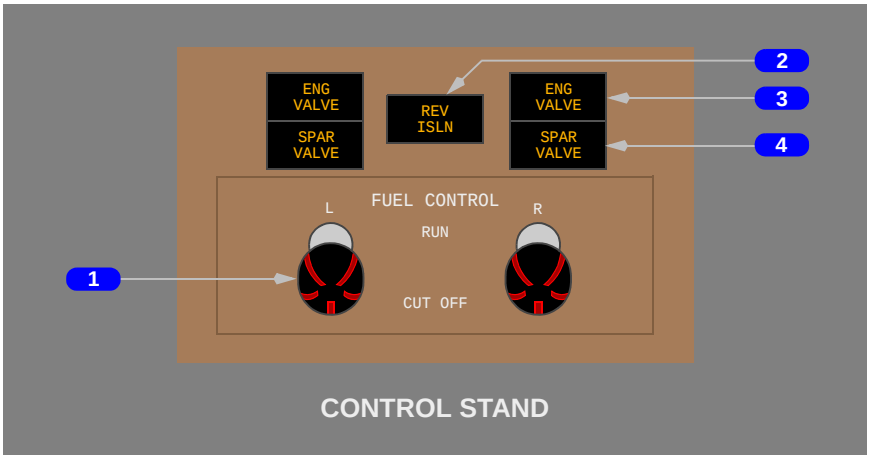
Actuates automatic speedbrakes (refer to Chapter 9, Flight Controls)

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



1 FUEL CONTROL Switches

RUN –

- normal position for flight
- opens engine and spar fuel valves
- activates selected ignitor(s)

CUT OFF –

- closes engine and spar fuel valves
- terminates ignition

2 Reverser Isolation Valve (REV ISLN) Light

Illuminated (amber) – a fault has been detected in the thrust reverser system

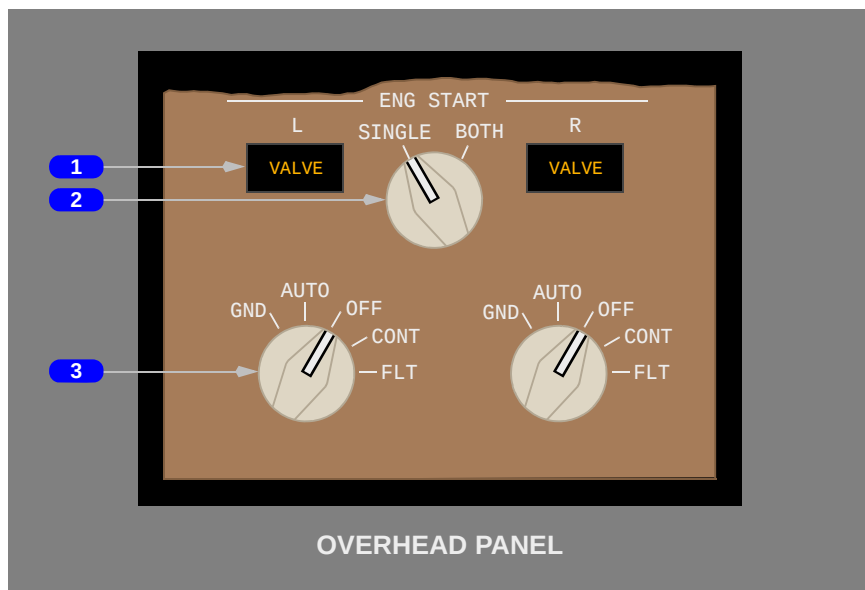
3 Engine Valve (ENG VALVE) Lights

Illuminated (amber) – engine fuel valve is not in commanded position

4 SPAR VALVE Lights

Illuminated (amber) – fuel spar valve is not in commanded position

Engine Control Panel



1 Engine Start Valve (VALVE) Lights

Illuminated (amber):

- valve is not in commanded position
- N2 RPM exceeds 50% and starter valve open

2 Ignition Selector

BOTH – both igniters in each engine operate when directed by Engine Start Selector

SINGLE – one igniter in each engine operates when directed by Engine Start Selector. The ignitor automatically alternates with each engine start.

Note: Auto relight is enabled regardless of engine start and ignition selector positions. Both igniters operate when N2 drops below idle speed.

3 Engine Start Selectors

GND (push-in and rotate) –

- opens start valve to supply starter air
- arms selected igniter(s)
- selector magnetically held in GND position until 50% N2 RPM

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AUTO –

- selector releases to AUTO at 50% N2 RPM
- closes start valve and terminates ignition
- selected igniter(s) operate continuously with L.E. slats extended or engine anti-ice on

OFF – no ignition
CONT –

- selected igniter(s) operate continuously
- no time limit

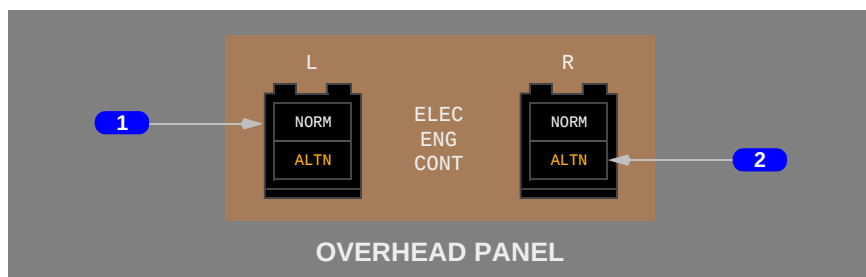
VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

(SB Adds VQ-BRA when a continuous ignition operable at approach idle is installed.)

- engine operates at a minimum of approach idle

FLT –

- both igniters operate continuously regardless of ignition selector position
- no time limit

Electronic Engine Control (EEC)

1 EEC (ELEC ENG CONT) Switches

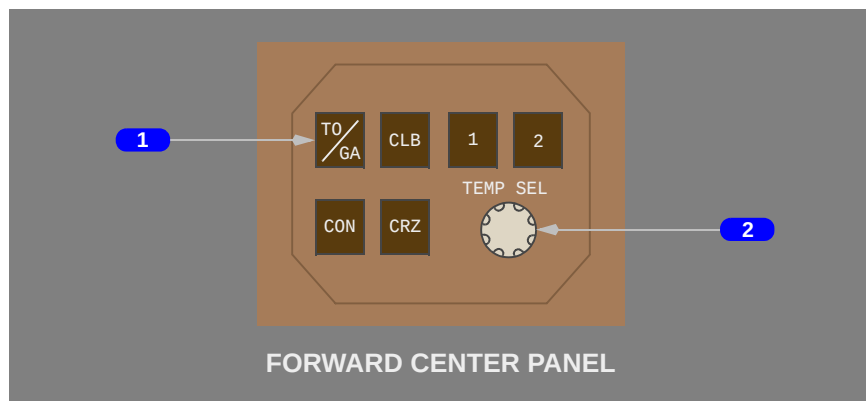
NORM – normal EEC mode is selected

ALTN (NORM not visible) – alternate EEC mode is selected

2 EEC Alternate Mode (ALTN) Lights

Illuminated (amber) – EEC is operating in alternate mode

Thrust Mode Select Panel (TMSP)



1 Thrust Reference Mode Select Switches

Push –

- manually selects desired thrust reference mode
- selected thrust reference mode and reference N1 are displayed

TO/GA –

- selects TO mode on the ground or GA mode inflight
- cancels preselected climb one or two
- cancels selected assumed temperature
- selecting 1 or 2 with TO or D-TO reference mode displayed:

VP-BDI, VQ-BMU, VQ-BOG

- selects TO 1 or TO 2
- preselects CLB 1 or CLB 2 on the ground if autothrottles not engaged
- subsequent push cancels any preselected 1 or 2
- cancels selected assumed temperature

CLB –

- selects CLB
- selects CLB 1 or CLB 2 if 1 or 2 is preselected

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- selecting 1 or 2 with CLB Reference mode displayed:
 - selects CLB 1 or CLB 2
- with CLB 1 or CLB 2 reference mode displayed:
 - subsequent push of active mode switch cancels 1 or 2
- with CLB 2 reference mode displayed:
 - switch 1 selects CLB 1

CON –

- selects CON mode
- selecting 1 or 2 with CON reference mode displayed:
 - preselects CLB 1 or CLB 2

CRZ –

- selects CRZ mode
- selecting 1 or 2 with CRZ reference mode displayed:
 - preselects CLB 1 or CLB 2

2 Assumed Temperature Selector (TEMP SEL)

VP-BDI, VQ-BMU, VQ-BOG

Functions only with TO, TO 1 or TO 2 mode displayed

VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA

Functions only with TO, TO 1* or TO 2* mode displayed

Sets assumed temperature

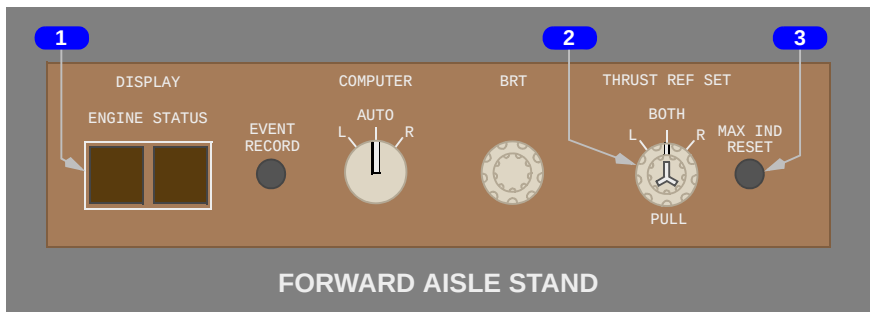
Rotate clockwise –

- assumed temperature appears on EICAS
- one click equals 1 degree centigrade

VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA

Note: * WHITE NUMBER - indicates reduced climb thrust is preselected.

EICAS Control Panel



1 ENGINE Display Switch

Push – displays the secondary engine parameters on the lower EICAS CRT

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

If secondary engine parameters are already displayed and no limits have been exceeded, the display reverts to fuel flow only

VP-BOQ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

If secondary engine parameters are already displayed and no limits have been exceeded, the display blanks

2 Manual Thrust Reference Set (THRUST REF SET) Controls

Outer Knob:

- BOTH – both N1 bugs may be set to the same value
- L or R – only the selected N1 bug may be set to the desired value. Bugs may be set at different values

Inner Knob:

- Push – reference N1 is set automatically
- Pull – reference N1 is set manually. MAN appears in N1 thrust reference mode display and N1 bug moves to 104%
- Rotate – in manual mode, sets N1 bug and reference N1 to desired value

3 Maximum Indication Reset (MAX IND RESET) Switch

Push – resets and blanks all maximum exceedance values N1, EGT and N2

Engines, APU

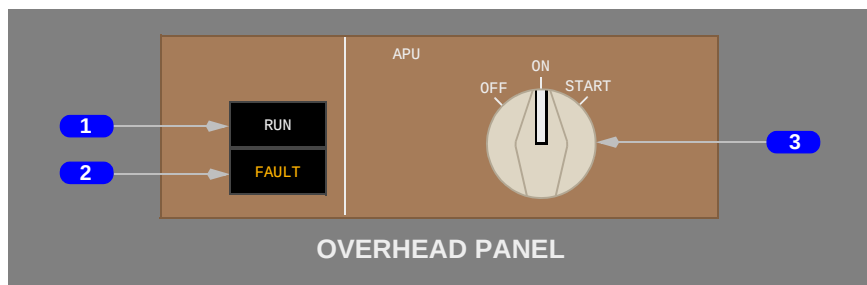
Controls and Indicators

Chapter 7

Section 15

Auxiliary Power Unit (APU)

APU Controls



1 APU RUN Light

Illuminated (white) - APU is at operating speed

2 APU FAULT Light

Illuminated (amber):

- the APU has automatically shut down
- the APU fuel valve disagrees with the commanded position

3 APU Selector

OFF –

- closes the APU bleed air valve, if open
- initiates APU cooling cycle
- closes the APU fuel valve and inlet door shutting down APU when cooling cycle is complete
- resets auto shutdown fault logic

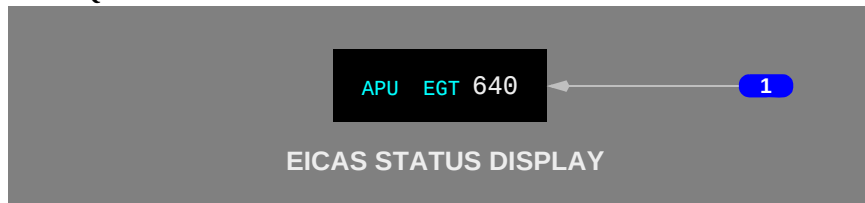
ON (APU operating position) –

- opens the APU fuel valve and inlet door
- activates AC or DC fuel pump
- powers the APU controller
- permits the APU bleed valve to open if the APU Bleed Switch is on when APU reaches operating speed

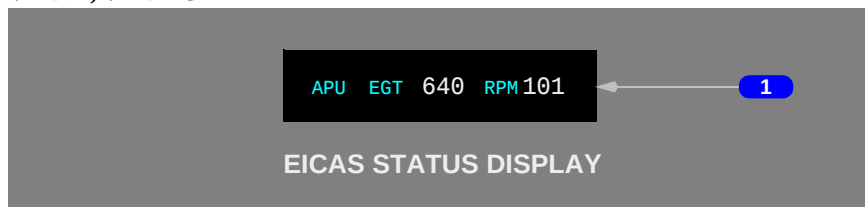
START (momentary position, spring-loaded to ON) – initiates automatic start sequence

APU Indications

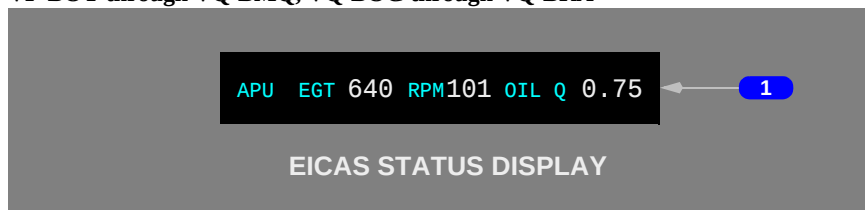
VP-BOQ



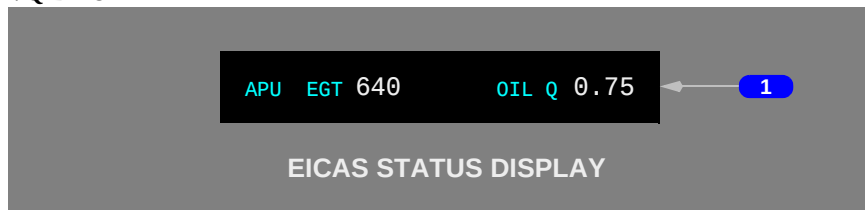
VP-BDI, VP-BMC



VP-BOY through VQ-BMQ, VQ-BOG through VQ-BRA



VQ-BMU



1 APU Status Display

EGT – APU exhaust gas temperature displayed in degrees centigrade

VP-BDI, VP-BMC, VP-BOY through VQ-BMQ, VQ-BOG through VQ-BRA

RPM – APU rotation speed in percent

VP-BOY through VQ-BRA

OIL Q – APU oil quantity displayed as FULL, 0.75, 0.50, 0.25 or ADD

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**Engines, APU****Chapter 7****Engine System Description (PW)****Section 21**

This Section Applies to VP-BMC, VP-BOY, VP-BOZ

Introduction**VP-BMC**

(SB Deletes VP-BOZ when Pratt and Whitney PW4060 engines removed.)

The airplane is powered by two Pratt and Whitney PW4060 engines. The engines are rated at 60,200 pounds of takeoff thrust each.

VP-BOY

(SB Adds VP-BOZ when Pratt and Whitney PW4062 engines installed.)

The airplane is powered by two Pratt and Whitney PW4062 engines. The engines are rated at 63,300 pounds of takeoff thrust each.

The engines are two-rotor axial flow turbofans of high compression and bypass ratio. The N1 rotor consists of the fan, a low pressure compressor and turbine section on a common shaft. The N2 rotor consists of a high pressure compressor and turbine section on a common shaft. The N1 and N2 rotors are mechanically independent. The N2 rotor drives the engine accessory gearbox.

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.

Each engine is controlled by an electronic engine controller (EEC). The EECs monitor autothrottle and flight crew inputs through the thrust levers to automatically control the engines.

Engine indications are displayed on the engine indication and crew alerting system (EICAS) display.

Engine Indications

Primary and secondary engine indications are provided. Engine indications are displayed on the EICAS display. In addition, annunciator lights and a liquid crystal standby engine indicator are provided to monitor engine operation.

Primary Engine Indications

EPR, N1, and EGT are the primary engine indications. The primary engine indications are always displayed on the upper EICAS display.

Secondary Engine Indications

N2, fuel flow, oil pressure, oil temperature, oil quantity, and engine vibration are secondary engine indications. Secondary engine indications are displayed on the lower EICAS display. The secondary engine indications can be displayed by pushing the Engine Display Switch (the ENGINE switch on the EICAS Control Panel). The secondary engine indications are automatically displayed when:

- the displays initially receive electrical power, or
- a secondary engine parameter is exceeded.

Normal Display Format

Primary engine indications and the N2 and fuel flow indications are digital readouts and round dial/moving pointer indications. The digital readouts display numerical values while the moving pointers indicate relative value.

Oil pressure, oil temperature, oil quantity and vibration indications are both digital readouts and vertical indication/moving pointers. All digital readouts are enclosed by boxes. The dial and vertical indications display the normal operating range, caution range, and operating limits.

Normal operating range is displayed on a dial or vertical indication in white.

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.

N1, EGT, N2, 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.

The EGT indication has a maximum continuous limit represented by an amber band. If EGT reaches the maximum continuous limit, the digital indication, box, pointer, and dial all change color to amber. The EGT indication is inhibited from changing to amber during takeoff or go-around for five minutes. The inhibit is extended to ten minutes for single-engine operation. The red line limits for these parameters are not inhibited. 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.

The maximum EPR limit is indicated by an amber line on 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

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 indication).

Primary and secondary engine indications are displayed on EICAS in compact format whenever a CRT fails.

Engine Secondary Data Cue

A series of blue 'v's are visible on the lower left corner of the upper EICAS CRT any time engine data is displayed on the lower EICAS CRT. If for some reason the engine data is not visible, the Status Display Switch may be used to allow the engine data to come up partially compacted on the upper EICAS CRT display.

Engine Pressure Ratio (EPR)

Engine Pressure Ratio is the primary thrust parameter. Annunciations associated with EPR are:

- Maximum EPR
- Thrust Reference Mode
- Reference/Target EPR indication
- Reference EPR
- Assumed Temperature
- Thrust Reverser Indication
- Command Thrust Level
- Commanded EPR Sector

The maximum EPR is the maximum certified thrust limit for all phases of flight and varies with existing ambient conditions. The maximum EPR is indicated by dual amber radials on the periphery of the EPR indicator. This value is acquired from the EEC or the TMC. With the EEC operating normally, the thrust levers can be moved to the forward stop and the engines will not exceed the displayed maximum EPR.

The command thrust level is a display of thrust lever position and appears as an extension of the EPR pointer when the engine is stabilized. A change in thrust lever position moves the command thrust level and displays the commanded thrust on the EPR indicator. This allows for precise thrust control.

The command sector is a display of the momentary difference between the command thrust level and actual EPR and appears as a white band on the EPR indicator. As the engine accelerates or decelerates to the command thrust level the command sector is erased. This allows for monitoring of engine acceleration and deceleration.

Thrust reverser indication (REV) is displayed above the EPR indicator when the reverser is activated. The annunciation is amber when the reverser is unlocked or in transit. When the reverser is fully deployed, the annunciation changes color to green and the forward thrust reference displays are inhibited.

Thrust Management Computer (TMC)

The thrust management computer calculates a reference EPR based on existing pressure altitude and ambient temperature data from the air data system for the following modes:

- TO – takeoff
- D-TO – assumed temperature takeoff
- CLB – climb
- CLB 1 – climb one
- CLB 2 – climb two
- CRZ – cruise
- CON – continuous
- GA – go-around

These modes can be selected with the thrust mode select panel (TMSP). The inner thrust reference set control on the EICAS control panel must be pushed in for the thrust reference modes to be displayed on EICAS. The selected thrust reference mode is displayed above the EPR indicators. The digital reference EPR is displayed adjacent to the mode display. When the EPR bug is green, it is positioned on the EPR scale at the same value as the digital reference EPR.

The thrust mode select switches provide the capability of selecting different thrust modes for each phase of flight. The TO/GA switch is used to select takeoff thrust on the ground and go-around thrust inflight.

The assumed temperature for a reduced thrust takeoff can be set by:

- using the assumed temperature selector on the TMSP
- entering the assumed temperature into the CDU TAKEOFF REF page

VP-BMC

- datalink

The 1 and 2 switches are used to select reduced climb thrust. Reduced climb thrust one or two can be preselected in conjunction with takeoff or assumed temperature takeoff thrust prior to takeoff. The CLB switch is used to select climb thrust inflight. If reduced climb thrust one or two was preselected, pushing the climb switch inflight selects CLB 1 or CLB 2.

The CON switch is used to select maximum continuous thrust inflight. The CRZ switch is used to select cruise thrust inflight. The assumed temperature selector or the CDU is used to set assumed temperatures when reduced takeoff thrust is desired.

To manually set Reference EPR values the thrust reference set control is pulled out, MAN appears as the thrust mode annunciation and the EPR bug slews to 1.55. Manual reference EPR values can then be set by rotating the inner control. The outer control of the thrust reference set control is used to select the desired EPR indicator(s) for manual EPR display. The autothrottles do not respond to manually set reference EPR values. When the inner control is pulled out, the autothrottles remain in the active TMC mode. The TMSP remains operable and the autothrottles respond to TMSP mode changes, but selected thrust reference mode displays are inhibited.

When the AFDS VNAV mode is engaged, the EPR bug may be magenta. When the EPR bug is magenta, it is positioned at a nominal target EPR by the FMC, which may not correlate with the digital reference EPR. In VNAV, the FMC controls Thrust mode selection automatically to meet thrust requirements for the active vertical mode of operation. The FMC does not have the capability to select reduced climb thrust values, these values must be selected manually with the 1 or 2 TMSP switches.

The thrust reference mode, reference EPR and EPR bug are not displayed when the reversers are fully deployed.

Assumed Temperature Takeoff

The thrust management computer calculates the reference EPR for assumed temperature reduced thrust takeoff. The assumed temperature can be entered manually on the CDU TAKEOFF REF page or selected with the assumed temperature selector on the TMSP. The assumed temperature is displayed above the thrust reference mode.

VP-BOZ

When the assumed temperature selector on the TMSP is initially rotated clockwise, a reference temperature is displayed on EICAS. This temperature also appears on the CDU TAKEOFF REF page as TEMP SEL.

VP-BMC, VP-BOY

When the assumed temperature selector on the TMSP is initially rotated clockwise, a reference temperature is displayed on EICAS. This temperature also appears on the CDU TAKEOFF REF page as THRUST.

VP-BMC

The assumed temperature can be supplied to the FMC and CDU via datalink.

Further clockwise rotation of the selector increases the assumed temperature by 1 degree centigrade per click. The reduced thrust annunciation of D-TO appears when the assumed temperature selected is above ambient. If the ambient temperature is greater than the initially displayed reference temperature, D-TO and reduced thrust occur when the assumed temperature selected exceeds ambient.

Counterclockwise rotation of the selector reduces the assumed temperature by one degree centigrade per click.

Assumed temperature takeoff thrust is limited to a 25% reduction of takeoff thrust or selected climb thrust, whichever is the greater thrust value. When the limit is reached, further adjustment to the assumed temperature by rotating the assumed temperature selector on the TMSP or changing the value entered in the CDU TAKEOFF REF page does not change the displayed assumed temperature or reference thrust value.

Reduced Climb Thrust

Two levels of reduced climb thrust are available with the 1 and 2 mode switches on the thrust mode select panel. Climb 1 is approximately 90% of climb thrust and climb 2 is approximately 80% of climb thrust. Climb one or two can be preselected in conjunction with the TO, D-TO, CON and CRZ thrust reference modes.

Above 10,000 feet, reduced climb thrust gradually changes to reach full climb thrust by 12,000 feet. The 1 or 2 annunciation disappears from the display by 12,500 feet.

Electronic Engine Control (EEC) – PW4000 Series Engine

The thrust system consists of a dual channel, full authority Electronic Engine Control unit without any hydromechanical backup. Each EEC is powered, when the engines are operating, by a dedicated permanent magnet alternator (PMA) independent of airplane electrical power. The EEC commands constant engine output for a given thrust lever position. EPR is the prime thrust setting parameter, N1 is alternate.

The EEC continuously computes the maximum thrust limit which is presented as an amber radial on the EPR display. Maximum rated thrust is available in any phase of flight by moving the thrust levers to the full forward positions.

Primary (EPR) Control Mode

Both engines normally operate in the primary mode to control thrust. In primary control mode operation, target EPR for current thrust lever position is computed as a ratio to the full throttle position. During rapid thrust lever movements, the difference between the engines actual EPR and the EEC commanded EPR is displayed as the command sector on the EICAS EPR display.

The EICAS advisory message L or R ENGINE CONTROL displays when faults are detected in the engine control systems. This message is designed to prevent dispatch with these faults.

The dual channel system provides redundancy of inputs to the engine fuel control.

Alternate (N1) Control Mode

If the EEC is unable to maintain EPR control, the EEC will automatically revert to the alternate control mode. The alternate control mode may be manually selected by using the flight deck EEC switches. When operating in alternate control mode, the ALTN light illuminates and the EICAS advisory message L or R ENG EEC MODE displays to indicate the EEC has reverted to the alternate mode.

In the alternate control mode, target N1 for current thrust lever position is computed as a ratio to the full throttle position. Due to changes in thrust produced at constant N1 setting during changes in ambient conditions, alternate control mode operations during climbs and descents require thrust lever adjustment to maintain constant thrust. Thrust is controlled in a manner similar to conventional fuel controls.

The alternate control mode has a dual channel system providing redundancy of inputs to the engine fuel controls. Automatic thrust limit protection is not available. In the alternate mode, the EICAS caution message L or R ENG LIM PROT displays to indicate the commanded N1 exceeds the maximum N1.

Overspeed Protection

In either control mode 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 L or R ENG RPM LIM displays to indicate N1 or N2 is at the red line limit.

The EEC does not provide EGT overtemperature protection.

If engine limit protection is not available, advancing the thrust levers full forward should be considered only during emergency situations when all other available actions have been taken and terrain contact is imminent.

Idle Selection

There are two engine idle speeds: minimum idle and approach idle. Minimum idle is a lower thrust than approach idle and selected for ground operation and all phases of flight except approach and landing. Approach idle is selected whenever this higher idle setting is required for proper system operation. The EEC selects these idle speeds automatically.

Rotating the engine start selectors to continuous manually selects approach idle. The EICAS advisory message L or R ENG LOW IDLE displays to indicate an engine failed to go to approach idle.

The EICAS advisory message IDLE DISAGREE displays to indicate the engines are at different idle settings. Either one engine has failed to go to approach idle when required or one engine has failed to return to minimum idle. Inflight, to ensure that approach idle is available if required, the thrust lever on the engine with the lower RPM should be advanced to match the engine with the higher RPM.

Engine Start and Ignition System

Air from the pneumatic duct is used to power the air driven starter, which is connected to the N2 rotor. The starter air source may be from a ground cart, APU or the other running engine.

The engine start selectors control the start valves. Ignition and fuel flow are controlled through the fuel control switches.

A maximum start limit line (red) is displayed on the EGT indication when the fuel control switch is moved to CUT OFF. 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.

Engine Start

Pushing in and rotating the engine start selector to the GND position, opens the start valve, engages the air driven starter to the N2 rotor and closes the engine bleed air valve if it is open. The VALVE light illuminates and the EICAS advisory message L or R ENG STARTER displays to indicate the start valve failed to open.

As N2 rotation accelerates to maximum motoring RPM, the fuel control switch is positioned to RUN.

Maximum motoring speed is reached when acceleration is less than approximately 1% in 5 seconds. Minimum N2 for selecting RUN is indicated by a magenta fuel on command bug. The fuel control switch opens the spar and engine fuel valves allowing the fuel to flow to the fuel control unit and activates the selected ignition. The ignition selector may be used to select BOTH, or either 1 or 2 ignitor(s). Normally, only one ignitor is used for ground start while both ignitors are used for inflight starts. At approximately 50% N2, the engine start selector automatically moves to the AUTO position. The starter automatically cuts out and the start valve closes stopping the flow of air to the starter. This allows the engine bleed valve to return to a position that agrees with the engine bleed air switch. If the start valve fails to close automatically, the corresponding valve light will illuminate and the EICAS caution message L or R STARTER CUTOUT will display. The engine start selector must be manually moved to the AUTO or OFF position to terminate starter operation.

Starter Operation

Continuous operation of the starter must be limited in accordance with the following starter duty cycles:

Normal Duty Cycle

Two consecutive aborted starts with EGT cooling periods. After second consecutive cooling period, let N2 drop to zero before re-engagement.

Re-engagement Speed

- 0% N2 – recommended
- 0–20% N2 – normal

Re-engagement is not recommended above 20% N2 except in case of fire. Re-engagement above 30% N2 may result in starter or gearbox damages.

In-Flight Start

Inflight start envelope information is displayed on the EICAS primary display when an engine is not running in flight, the respective engine fire switch is not pulled and both EICAS primary and secondary displays are selected. The inflight start envelope indicates the airspeed range necessary to ensure an inflight 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.

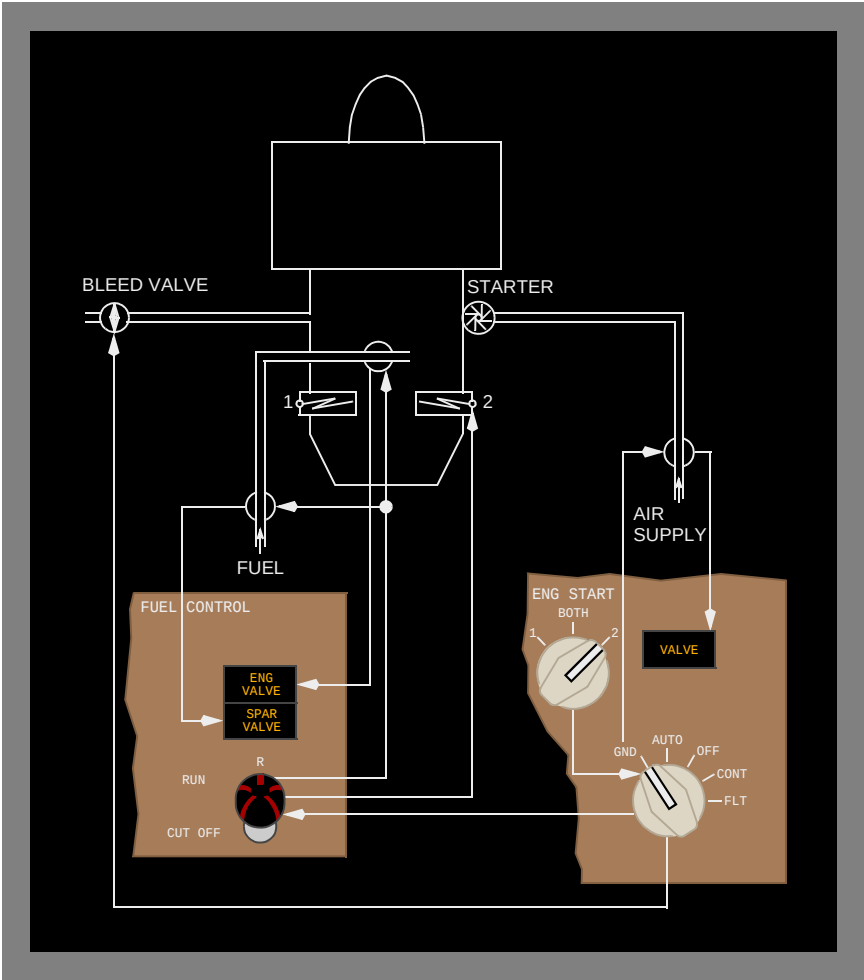
A crossbleed start indication (X-BLD) appears above the N2 indication and a fuel on command bug is displayed if airspeed is below that recommended for a windmilling start.

Engine Ignition

Each engine has two ignitors. Dual ignitors are always used for inflight starts.

Main AC power is the normal power source for ignition. Standby AC power provides a backup source.

Engine Start and Ignition System Schematic



Engine Fuel System

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 fuel flows through a fuel/oil heat exchanger where it is preheated. A fuel filter removes contaminants.

A second stage engine fuel pump adds more pressure before the fuel reaches the fuel control unit. The fuel is then controlled to meet the existing thrust requirements. The fuel then flows through the engine fuel valve and fuel flow meter before entering the engine.

Fuel Control Unit

The engine fuel control system incorporates a fuel control unit which operates in conjunction with the EEC. The fuel control system schedules fuel flow to meet engine thrust requirements as dictated by the thrust lever position and the specific engine operating conditions. The EEC controls the metered fuel and prevents engine limits from being exceeded.

Engine and Spar Valves

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 the RUN position. Both valves close when either the fuel control switch is in CUT OFF or the engine fire switch is OUT.

The ENG VALVE and SPAR VALVE lights illuminate momentarily as the valves open or close. If the valves do not agree with the fuel control switch or the respective fire switch position after allowing for the normal operating time, the lights remain illuminated and the EICAS advisory message L or R FUEL SPAR VAL or L or R ENG FUEL VAL displays.

Fuel Filter

The fuel is filtered by a filter with bypass capabilities. If the filter becomes clogged with contaminants, fuel will bypass the filter allowing contaminated fuel to enter the fuel control unit.

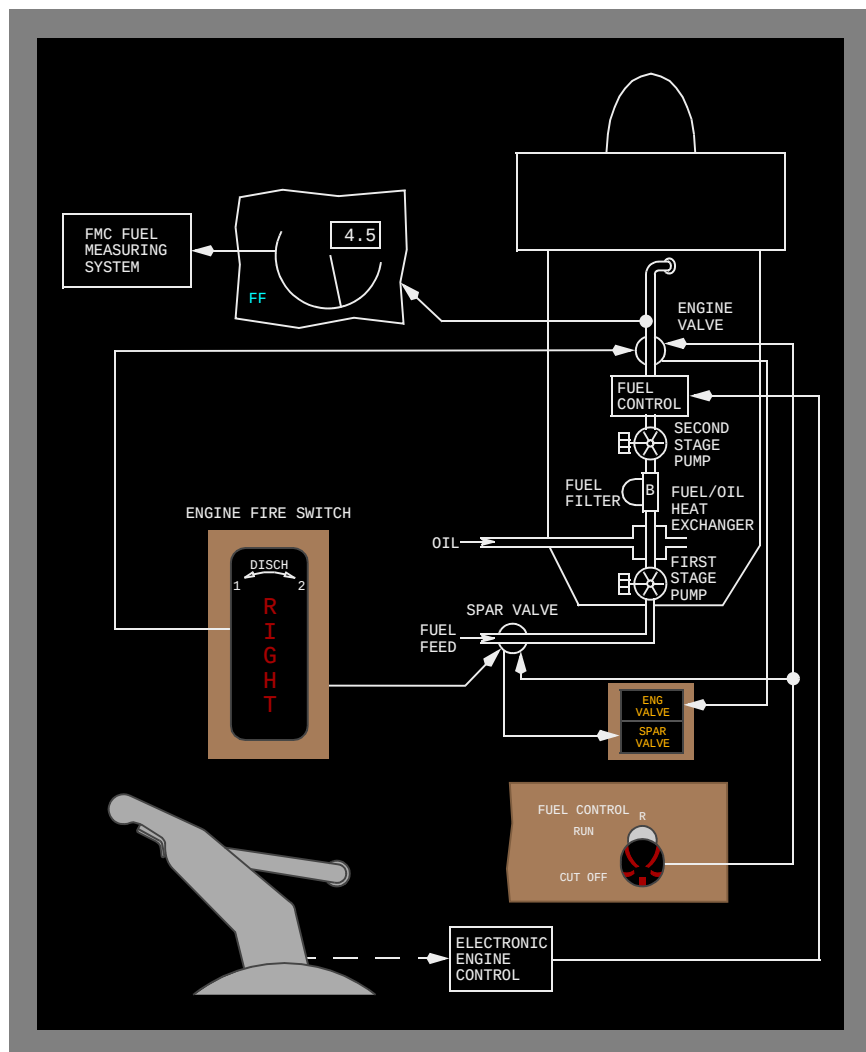
The EICAS advisory message L or R ENG FUEL FILT displays to indicate the affected engine filter is approaching a level sufficient to cause filter bypass.

Erratic engine operation and flameout may occur due to fuel contamination.

Fuel Flow Measurement

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



Engine Oil System – PW4000 Series Engine

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.

As an engine is started, a quantity of oil will transfer from the oil reservoir to the engine bearing compartments and gearbox. This results in a decrease of indicated oil quantity. During engine shutdown, the indicated oil quantity increases as the oil is returned to the reservoir. In addition, oil temperature will tend to vary with engine RPM such that, as RPM is increased, temperature increases. As RPM is decreased, temperature decreases.

Oil is pressurized by a main (engine-driven) oil pump. From the pump, the oil flows through the oil filter where contaminants are removed. Should the oil filter become saturated with contaminants, oil will automatically bypass the filter. The EICAS advisory message L or R OIL FILTER displays indicating the oil filter is bypassed. The oil flows through the oil coolers where fuel and air are used as the heat sink, and is then delivered to the engine main bearings, gears, and accessory drives. The oil is then returned to the reservoir.

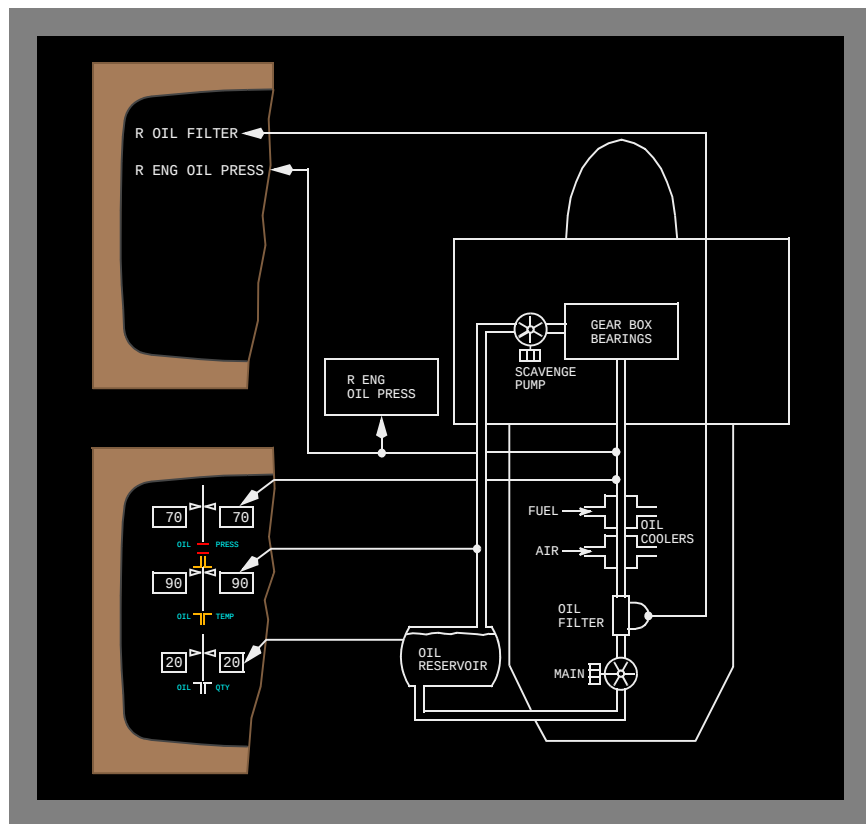
Oil pressure, temperature, and quantity are displayed on the secondary engine display.

Oil pressure is measured prior to entering the engine. The L or R ENG OIL PRESS light illuminates and the L or R ENG OIL PRESS EICAS advisory message displays to indicate the oil pressure is low. When the oil pressure is at or below the minimum limit, the EICAS indication changes to red.

Oil temperature is measured after leaving the scavenge pump, prior to entering the reservoir. When the oil temperature is in the caution range, the EICAS indication changes to amber.

There is no minimum oil quantity limit (no amber or red line limit). 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 – PW4000 Series Engine



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. An interlock stop limits thrust to idle reverse while the reverser is in transit.

The EECs control thrust limits during reverser operation.

When the reverse thrust levers are pulled aft to the interlock position:

- the autothrottle disengages
- the auto speedbrakes deploy

When the reverser system is activated:

- reverser isolation valve opens allowing the reverser translating sleeves to 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)

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. While the reverser is in transit, the REV annunciation changes color to amber. The thrust levers cannot be moved forward until the reverse thrust levers are fully down. When the reverser reaches the stowed position, the amber REV annunciation disappears.

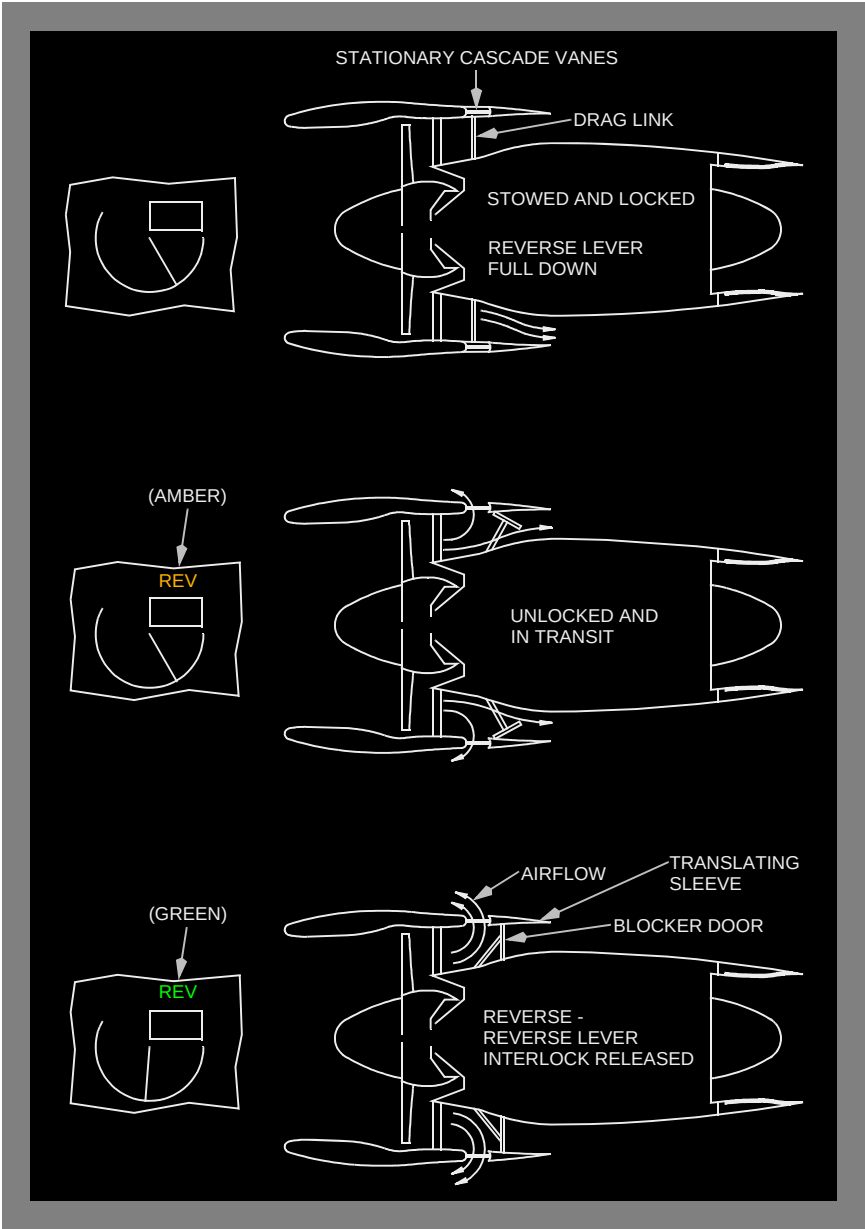
Each thrust reverser is automatically protected against unintentional reverse thrust. If an uncommanded thrust reverser movement is sensed, an autostow feature automatically applies hydraulic power to stow the reverser.

The EICAS advisory message L or R REV ISLN VAL is displayed and the REV ISLN light illuminates when a fault exists in the reverser system.

The light and message are inhibited in flight.

An electromechanical lock prevents uncommanded reverser deployment in the event of thrust reverser system failures.

Thrust Reverser Schematic



Airborne Vibration Monitoring System

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.

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.

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**Engines, APU****Chapter 7****Engine System Description (GE)****Section 22**

This Section Applies to VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

Introduction**VP-BRL through VQ-BRA**

The airplane is powered by two General Electric CF6-80C2B6F engines. The engines are rated at 60,200 pounds of takeoff thrust each.

VP-BDI, VP-BOQ

The airplane is powered by two General Electric CF6-80C2B7F engines. The engines are rated at 62,100 pounds of takeoff thrust each.

The engines are two-rotor axial flow turbofans of high compression and bypass ratio. The N1 rotor consists of the fan, a low pressure compressor and turbine section on a common shaft. The N2 rotor consists of a high pressure compressor and turbine section on a common shaft. The N1 and N2 rotors are mechanically independent. The N2 rotor drives the engine accessory gearbox.

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, Section 40, for a description of FMC thrust management functions.

Each engine is controlled by an electronic engine controller (EEC). The EECs monitor autothrottle and flight crew inputs through the thrust levers to automatically control the engines.

Engine indications are displayed on the engine indication and crew alerting system (EICAS) display.

Engine Indications

Primary and secondary engine indications are provided. Engine indications are displayed on the EICAS display. In addition, annunciator lights and a liquid crystal standby engine indicator are provided to monitor engine operation.

Primary Engine Indications

N1 and EGT are the primary engine indications. The primary engine indications are always displayed on the upper EICAS display.

Secondary Engine Indications

N2, fuel flow, oil pressure, oil temperature, oil quantity, and engine vibration are secondary engine indications. Secondary engine indications are displayed on the lower EICAS display. The secondary engine indications can be displayed by pushing the Engine Display Switch (the ENGINE switch on the EICAS Control Panel).

The secondary engine indications are automatically displayed when:

- the displays initially receive electrical power, or
- a secondary engine parameter is exceeded.

Normal Display Format

Primary engine indications and the N2 and Fuel Flow indications are digital readouts and round dial/moving pointer indications. The digital readouts display numerical values while the moving pointers indicate relative value.

Oil pressure, oil temperature, oil quantity and vibration indications are both digital readouts and vertical indication/moving pointers. 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.

The oil pressure and oil temperature vertical indications have caution ranges displayed by amber bands. If oil pressure or oil temperature reaches the caution range, the digital readout, digital readout box, and pointer all change color to amber.

N1, EGT, N2, 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.

The EGT indication has a maximum continuous limit represented by an amber band. If EGT reaches the maximum continuous limit, the digital indication, box, pointer, and dial all change color to amber.

VP-BDI, VP-BOQ, VP-BRL

The EGT indication is inhibited from changing to amber during takeoff or go-around for five minutes. The red line limits for these parameters are not inhibited.

VP-BWW through VQ-BRA

The EGT indication is inhibited from changing to amber during takeoff or go-around for five minutes. The inhibit is extended to ten minutes for single-engine operation. The red line limits for these parameters are not inhibited.

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.

The maximum N1 limit is indicated by an amber line on the N1 dial. The N1 indication does not change color when maximum N1 is reached. The reference/target N1 indication displays the FMS reference or target N1.

Compact Display Format

In compact format, primary and secondary engine indications are combined on the same display. The N1 and EGT 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 indication).

Primary and secondary engine indications are displayed on EICAS in compact format whenever a CRT fails.

Engine Secondary Data Cue

A series of blue 'v's are visible on the lower left corner of the upper EICAS CRT any time engine data is displayed on the lower EICAS CRT. If for some reason the engine data is not visible, the Status Display Switch may be used to allow the engine data to come up partially compacted on the upper EICAS CRT display.

N1 RPM

N1 RPM is the primary thrust parameter. Annunciations associated with N1 are:

- Maximum N1
- Thrust Reference Mode
- Reference/Target N1 Indication
- Reference N1
- Assumed Temperature
- Thrust Reverser Indication
- Command Thrust Level
- Command Sector

The maximum N1 is the maximum certified thrust limit for all phases of flight and varies with existing ambient conditions. The maximum N1 is indicated by dual amber radials on the periphery of the N1 indicator. This value is acquired from the EEC or the TMC. With the EEC operating normally, the thrust levers can be moved to the forward stop and the engines will not exceed the displayed maximum N1.

VP-BDI, VP-BOQ

During a maximum thrust takeoff, full takeoff thrust will not be available until approximately 65 KIAS. The TO thrust limit will be displayed throughout the takeoff, but the command thrust level will be approximately 1% to 2% below this limit at airspeeds below 65 KIAS.

The command thrust level is a display of thrust lever position and appears as an extension of the N1 pointer when the engine is stabilized. A change in thrust lever position moves the command thrust level and displays the commanded thrust on the N1 indicator. This allows for precise thrust control.

The command sector is a display of the momentary difference between the command thrust level and actual N1 and appears as a white band on the N1 indicator. As the engine accelerates or decelerates to the command thrust level the command sector is erased. This allows for monitoring of engine acceleration and deceleration.

Thrust reverser indication (REV) is displayed above the N1 indicator when the reverser is activated. The annunciation is amber when the reverser is unlocked or in transit. When the reverser is fully deployed, the annunciation changes color to green and the forward thrust reference displays are inhibited.

Thrust Management Computer (TMC)

The thrust management computer calculates a reference N1 based on existing pressure altitude and ambient temperature data from the air data system for the following modes:

- TO – takeoff

VP-BDI, VQ-BMU, VQ-BOG

- TO 1 – takeoff one

VP-BDI, VQ-BMU, VQ-BOG

- TO 2 – takeoff two
- D-TO – assumed temperature takeoff
- CLB – climb
- CLB 1 – climb one
- CLB 2 – climb two
- CRZ – cruise
- CON – continuous
- GA – go-around

These modes can be selected with the thrust mode select panel (TMSP). The inner thrust reference set control on the EICAS control panel must be pushed in for the thrust reference modes to be displayed on EICAS. The selected thrust reference mode is displayed above the N1 indicators. The digital reference N1 is displayed adjacent to the mode display. When the N1 bug is green, it is positioned on the N1 scale at the same value as the digital reference N1.

The thrust mode select switches provide the capability of selecting different thrust modes for each phase of flight. The TO/GA switch is used to select takeoff thrust on the ground and go-around thrust inflight.

VP-BDI, VQ-BMU, VQ-BOG

The 1 and 2 switches are used to select a reduced takeoff thrust rating or reduced climb thrust. When reduced takeoff thrust rating one or two is selected, this automatically preselects the associated reduced climb one or two. The CLB switch is used to select climb thrust inflight. If reduced climb thrust one or two was preselected, pushing the climb switch inflight selects CLB 1 or CLB 2.

The assumed temperature for a reduced thrust takeoff can be set by:

- using the assumed temperature selector on the TMSP
- entering the assumed temperature into the CDU TAKEOFF REF page

VQ-BOG

- datalink

VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT, VQ-BRA

The 1 and 2 switches are used to select reduced climb thrust. Reduced climb thrust one or two can be preselected in conjunction with takeoff or assumed temperature takeoff thrust prior to takeoff. The CLB switch is used to select climb thrust inflight. If reduced climb thrust one or two was preselected, pushing the climb switch inflight selects CLB 1 or CLB 2.

The CON switch is used to select maximum continuous thrust inflight. The CRZ switch is used to select cruise thrust inflight. The assumed temperature selector or the CDU is used to set assumed temperatures when reduced takeoff thrust is desired.

To manually set Reference N1 values the thrust reference set control is pulled out, MAN appears as the thrust mode annunciation and the N1 bug slews to 104%. Manual reference N1 values can then be set by rotating the inner control. The outer control of the thrust reference set control is used to select the desired N1 indicator(s) for manual N1 display. The autothrottles do not respond to manually set reference N1 values. When the inner control is pulled out, the autothrottles remain in the active TMC mode. The TMSP remains operable and the autothrottles respond to TMSP mode changes, but selected thrust reference mode displays are inhibited.

When the AFDS VNAV mode is engaged, the N1 bug may be magenta. When the N1 bug is magenta, it is positioned at a nominal target N1 by the FMC, which may not correlate with the digital reference N1. In VNAV, the FMC controls Thrust mode selection automatically to meet thrust requirements for the active vertical mode of operation. The FMC does not have the capability to select reduced climb thrust values, these values must be selected manually with the 1 or 2 TMSP switches.

The thrust reference mode, reference N1 and N1 bug are not displayed when the reversers are fully deployed.

Reduced Takeoff Thrust

VP-BDI, VQ-BMU, VQ-BOG

Two levels of reduced takeoff thrust are available with the 1 and 2 mode switches on the Thrust Mode Select Panel. These are lower thrust ratings than takeoff thrust. Takeoff 1 is approximately 90% of takeoff thrust and takeoff 2 is approximately 80% of takeoff thrust. Assumed temperature reduced thrust can be used in conjunction with these lower thrust ratings.

Assumed Temperature Takeoff

The thrust management computer calculates the reference N1 for assumed temperature reduced thrust takeoff. The assumed temperature can be entered manually on the CDU TAKEOFF REF page or selected with the assumed temperature selector on the TMSP. The assumed temperature is displayed above the thrust reference mode.

VQ-BRA

When the assumed temperature selector on the TMSP is initially rotated clockwise, a reference temperature is displayed on EICAS. This temperature also appears on the CDU TAKEOFF REF page as TEMP SEL.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

When the assumed temperature selector on the TMSP is initially rotated clockwise, a reference temperature is displayed on EICAS. This temperature also appears on the CDU TAKEOFF REF page as THRUST.

VQ-BOG

The assumed temperature can be supplied to the FMC and CDU via datalink.

Further clockwise rotation of the selector increases the assumed temperature by 1 degree centigrade per click. The reduced thrust annunciation of D-TO appears when the assumed temperature selected is above ambient. If the ambient temperature is greater than the initially displayed reference temperature, D-TO and reduced thrust occur when the assumed temperature selected exceeds ambient.

Counterclockwise rotation of the selector reduces the assumed temperature by one degree centigrade per click.

Assumed temperature takeoff thrust is limited to a 25% reduction of takeoff thrust or selected climb thrust, whichever is the greater thrust value. When the limit is reached, further adjustment to the assumed temperature by rotating the assumed temperature selector on the TMSP or changing the value entered in the CDU TAKEOFF REF page does not change the displayed assumed temperature or reference thrust value.

Reduced Climb Thrust

VP-BDI, VQ-BMU, VQ-BOG

Climb one or two is automatically preselected when takeoff one or takeoff two is selected.

Two levels of reduced climb thrust are available with the 1 and 2 mode switches on the thrust mode select panel. Climb 1 is approximately 90% of climb thrust and climb 2 is approximately 80% of climb thrust. Climb one or two can be preselected in conjunction with the TO, D-TO, CON and CRZ thrust reference modes.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

Above 10,000 feet, reduced climb thrust gradually changes to reach full climb thrust by 12,000 feet. The 1 or 2 annunciation disappears from the display by 12,500 feet.

VQ-BMU

Above 10,000 feet, reduced climb thrust gradually changes to reach full climb thrust by 30,000 feet. The 1 annunciation disappears from the display by 30,500 feet. The 2 annunciation will remain above 30,000 feet unless manually deselected by pressing the 2 switch on the TMSP. If not manually deselected, at cruise altitude the 2 will remain annunciated (white) until flaps are extended and the thrust reference mode changes to GA.

Electronic Engine Control (EEC)

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 normal and alternate modes, the EEC uses N1 RPM as the parameter for setting thrust.

EEC Normal Control Mode

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.

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.

The EICAS advisory message L or R ENG CONTROL and ENGINE CONTROLS displays when faults are detected in the engine control systems.

EEC Alternate Mode

The EEC uses alternate mode as a backup to normal mode. If EEC detects a fault and can no longer control the engine using the normal mode, it transfers control to alternate mode. The L or R ENG EEC MODE advisory message will appear and the ALTN light illuminate. Alternate mode can also be selected manually using the EEC Mode switch. If control for either EEC transfers from normal to alternate, the autothrottle disconnects. The autothrottle can be activated after all EECs are manually transferred to alternate mode.

Alternate mode does not provide thrust limiting at maximum N1. Maximum N1 is reached at a Thrust lever position less than full forward. The L or R ENG LIM PROT message will appear as the throttle is advanced into the overboost range in this mode. Thrust levers must be adjusted to maintain desired thrust as environmental conditions and bleed requirements change.

The L or R ENG CONTROL or the ENGINE CONTROLS advisory message means that engine control may be unreliable, and the L or R ENG RPM LIM will appear whenever N1 or N2 is at red line limit. Alternate mode provides equal or greater thrust than normal mode for the same Thrust lever position. Thrust does not change when EEC transfers control from normal mode to alternate mode. Thrust increases when alternate mode is selected manually. When thrust is greater than idle, the Thrust lever should be moved aft prior to manually selecting alternate mode so thrust does not exceed maximum N1.

If the EECs are in the alternate mode, advancing the Thrust levers full forward provides some overboost and should be considered only during emergency situations when all other actions have been taken and terrain contact is imminent.

Overspeed Protection

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 L or R ENG RPM LIM is displayed when N1 or N2 is at the red line limit.

The EEC does not provide EGT overtemperature protection.

If engine limit protection is not available, advancing the thrust levers full forward should be considered only during emergency situations when all other available actions have been taken and terrain contact is imminent.

Idle Selection

There are two engine idle speeds: minimum idle and approach idle. Minimum idle is a lower thrust than approach idle and selected for ground operation and all phases of flight except approach and landing. Approach idle is selected whenever this higher idle setting is required for proper system operation. The EEC selects these idle speeds automatically.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

(SB Adds VQ-BRA when a continuous ignition operable at approach idle is installed.)

Rotating the engine start selectors to continuous manually selects approach idle.

The EICAS advisory message L or R ENG LOW IDLE displays to indicate an engine failed to go to approach idle.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

(SB Adds VQ-BRA when a continuous ignition operable at approach idle is installed.)

The EICAS advisory message IDLE DISAGREE displays to indicate the engines are at different idle settings. Either one engine has failed to go to approach idle when required or one engine has failed to return to minimum idle. Inflight, to ensure that approach idle is available if required, the thrust lever on the engine with the lower RPM should be advanced to match the engine with the higher RPM.

(SB Deletes VQ-BRA when a continuous ignition operable at approach idle is installed.)

The EICAS advisory message IDLE DISAGREE displays to indicate the engines are at different idle settings. One engine has failed to return to minimum idle.

Engine Start and Ignition System

Air from the pneumatic duct is used to power the air driven starter, which is connected to the N2 rotor. The starter air source may be from a ground cart, APU or the other running engine.

The engine start selectors control the start valves. Ignition and fuel flow are controlled through the fuel control switches.

A maximum start limit line (red) is displayed on the EGT indication when the fuel control switch is moved to CUT OFF. 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.

Engine Start

Pushing in and rotating the engine start selector to the GND position, opens the start valve, engages the air driven starter to the N2 rotor and closes the engine bleed air valve if it is open. The VALVE light illuminates and the EICAS advisory message L or R ENG STARTER displays to indicate the start valve failed to open. As N2 rotation accelerates to maximum motoring RPM or 20% N2, the fuel control switch is positioned to RUN. Maximum motoring speed is reached when acceleration is less than approximately 1% in 5 seconds. Minimum N2 for selecting RUN is indicated by a magenta fuel on command bug. The fuel control switch opens the spar and engine fuel valves allowing the fuel to flow to the fuel control unit and activates the selected ignition.

The ignition selector may be used to select SINGLE or BOTH ignitor(s). With the ignition selector in SINGLE, each EEC channel alternates between the two ignitors on each engine.

Normally, only one ignitor is used for ground start while both ignitors are used for inflight starts. At approximately 50% N2, the engine start selector automatically moves to the AUTO position. The starter automatically cuts out and the start valve closes stopping the flow of air to the starter. This allows the engine bleed valve to return to a position that agrees with the engine bleed air switch. If the start valve fails to close automatically, the corresponding valve light will illuminate and the EICAS caution message L or R STARTER CUTOFF will display. The engine start selector must be manually moved to the AUTO or OFF position to terminate starter operation.

Starter Operation

Continuous operation of the starter must be limited in accordance with the following starter duty cycles:

Normal Duty Cycle

Five minutes on, followed by one-half minute off per minute on.

Re-engagement Speed

- 0% N2 – recommended
- 0–20% N2 – normal

Re-engagement is not recommended above 20% N2 except in case of fire.

Re-engagement above 30% N2 may result in starter or gearbox damages.

In-Flight Start

Inflight start envelope information is displayed on the EICAS primary display when an engine is not running in flight, the respective engine fire switch is not pulled and both EICAS primary and secondary displays are selected. The inflight start envelope indicates the airspeed range necessary to ensure an inflight 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.

A crossbleed start indication (X-BLD) appears above the N2 indication and a fuel on command bug is displayed if airspeed is below that recommended for a windmilling start.

Auto Relight

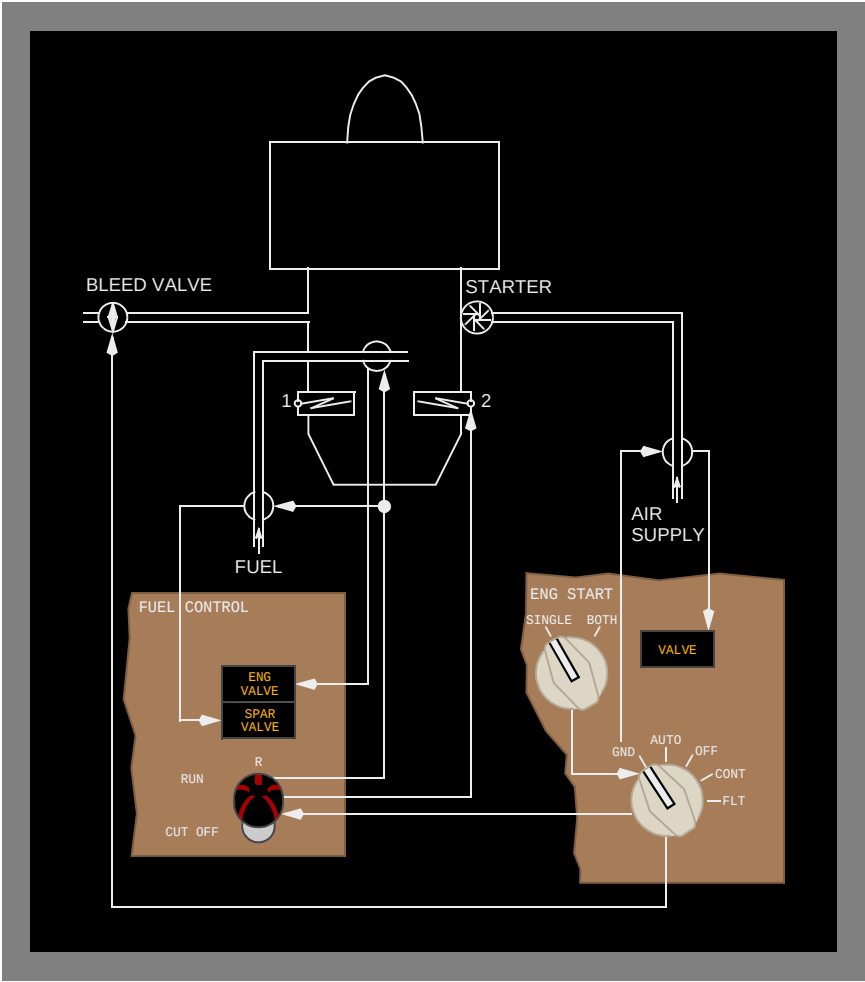
In the air or on the ground, an automatic relight feature is enabled if N2 drops below idle speed. If this occurs, the EEC will energize both ignition systems for the affected engine(s).

Engine Ignition

Each engine has two ignitors. Dual ignitors are always used for inflight starts.

Main AC power is the normal power source for ignition. Standby AC power provides a backup source.

Engine Start and Ignition System Schematic



Engine Fuel System

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. Final pressure is generated by a second stage fuel pump prior to entering a fuel/oil heat exchanger where it is preheated. A fuel filter removes contaminants. The fuel is then controlled to meet the existing thrust requirements. The fuel then flows through the engine fuel valve and fuel flow meter before entering the engine.

Fuel Metering Unit

The engine fuel control system incorporates a fuel metering unit which operates in conjunction with the EEC. The fuel control system schedules fuel flow to meet engine thrust requirements as dictated by the thrust lever position and the specific engine operating conditions. The EEC controls the metered fuel and prevents engine limits from being exceeded.

Engine and Spar Valves

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 the RUN position. Both valves close when either the fuel control switch is in CUT OFF or the engine fire switch is OUT.

The ENG VALVE and SPAR VALVE lights illuminate momentarily as the valves open or close. If the valves do not agree with the fuel control switch or the respective fire switch position after allowing for the normal operating time, the lights remain illuminated and the EICAS advisory message L or R FUEL SPAR VAL or L or R ENG FUEL VAL displays.

Fuel Filter

The fuel is filtered by a filter with bypass capabilities. If the filter becomes clogged with contaminants, fuel will bypass the filter allowing contaminated fuel to enter the fuel control unit.

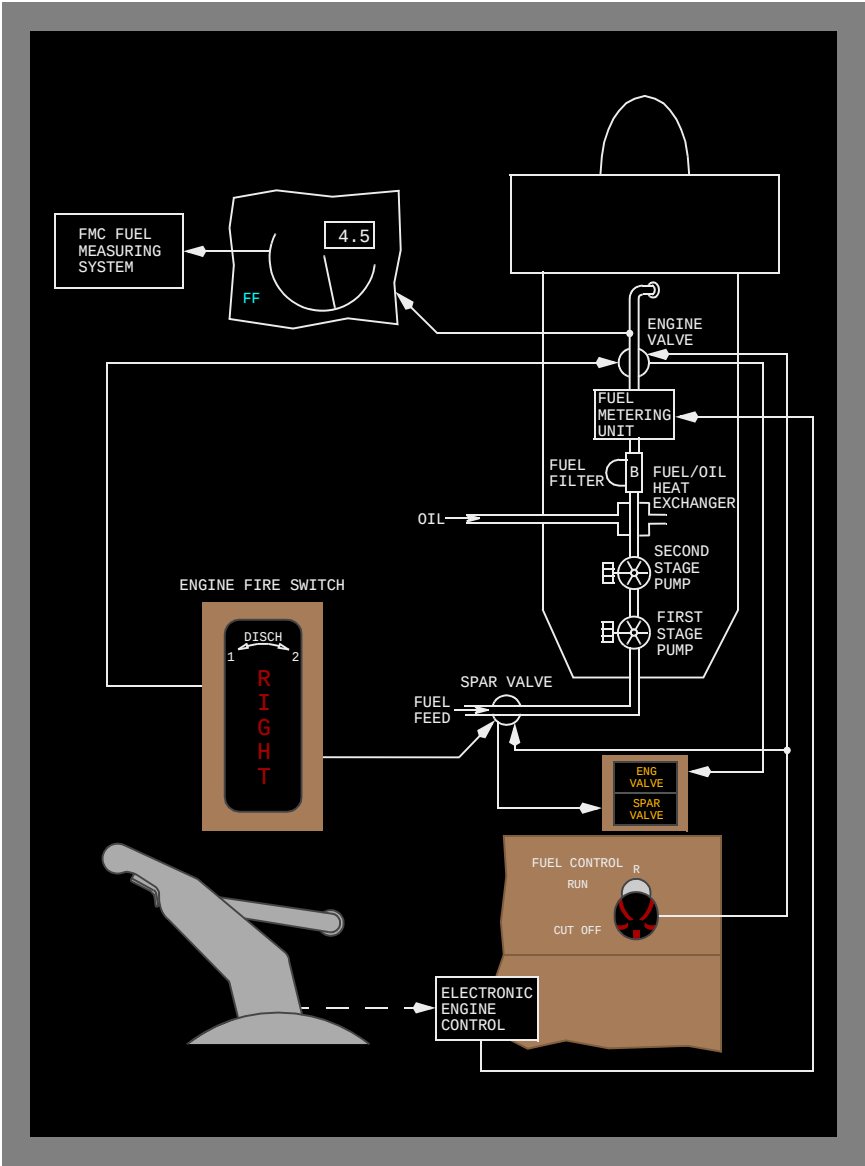
The EICAS advisory message L or R ENG FUEL FILT displays to indicate the affected engine filter is approaching a level sufficient to cause filter bypass.

Erratic engine operation and flameout may occur due to fuel contamination.

Fuel Flow Measurement

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



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.

Oil is pressurized by a main (engine-driven) oil pump. From the pump, the oil flows through the oil filter where contaminants are removed and then delivered to the engine main bearings, gears, and accessory drives. The oil is returned by means of a scavenge pump.

The oil enters the fuel/oil heat exchanger where fuel is used as the heat sink and then flows through a second filter before returning to the reservoir.

Should an oil filter become saturated with contaminants, oil will automatically bypass the filter. The EICAS advisory message L or R OIL FILTER displays indicating the oil filter is bypassed.

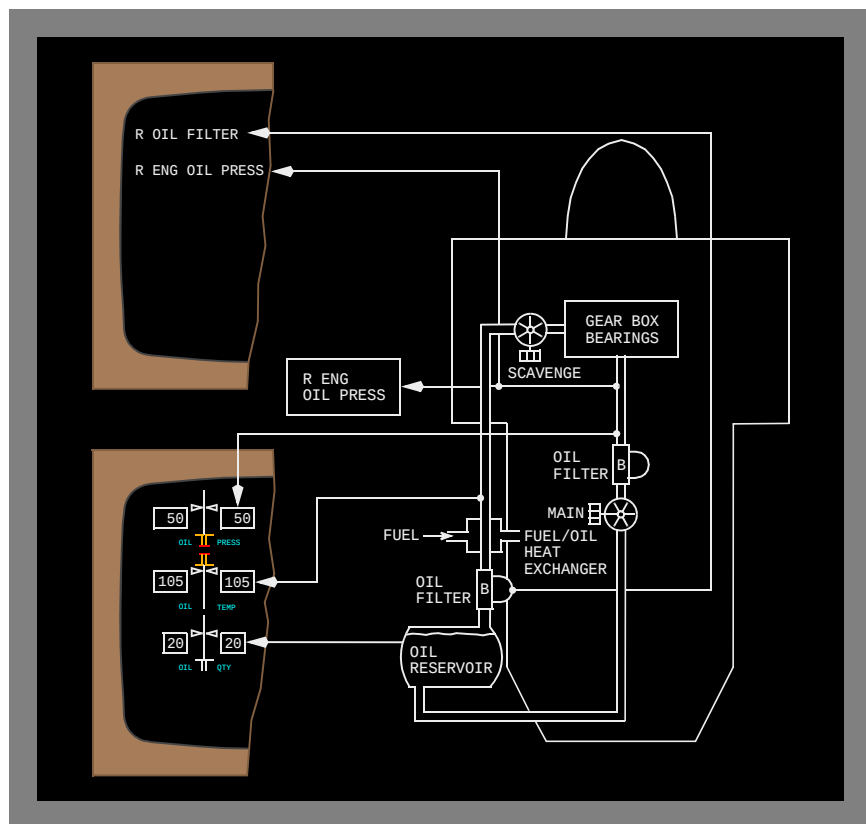
Oil pressure, temperature, and quantity are displayed on the secondary engine display.

Oil pressure is measured prior to entering the engine. The L or R ENG OIL PRESS light illuminates and the EICAS advisory message L or R ENG OIL PRESS displays to indicate the oil pressure is low. When the oil pressure is at or below the variable limits, the EICAS indication changes to amber.

Oil temperature is measured after leaving the scavenge pump, prior to entering the second filter.

There is no minimum oil quantity limit (no amber or red line limit). 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



Thrust Reverser System

Each engine has a pneumatically 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. An interlock stop limits thrust to idle reverse while the reverser is in transit.

The EECs control thrust limits during reverser operation.

When the reverse thrust levers are pulled aft to the interlock position:

- the autothrottle disengages
- the auto speedbrakes deploy

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When the reverser system is activated:

- reverser isolation valve opens allowing the reverser translating sleeves to pneumatically 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. While the reverser is in transit, the REV annunciation changes color to amber. The thrust levers cannot be moved forward until the reverse thrust levers are fully down. When the reverser reaches the stowed position, the amber REV annunciation disappears.

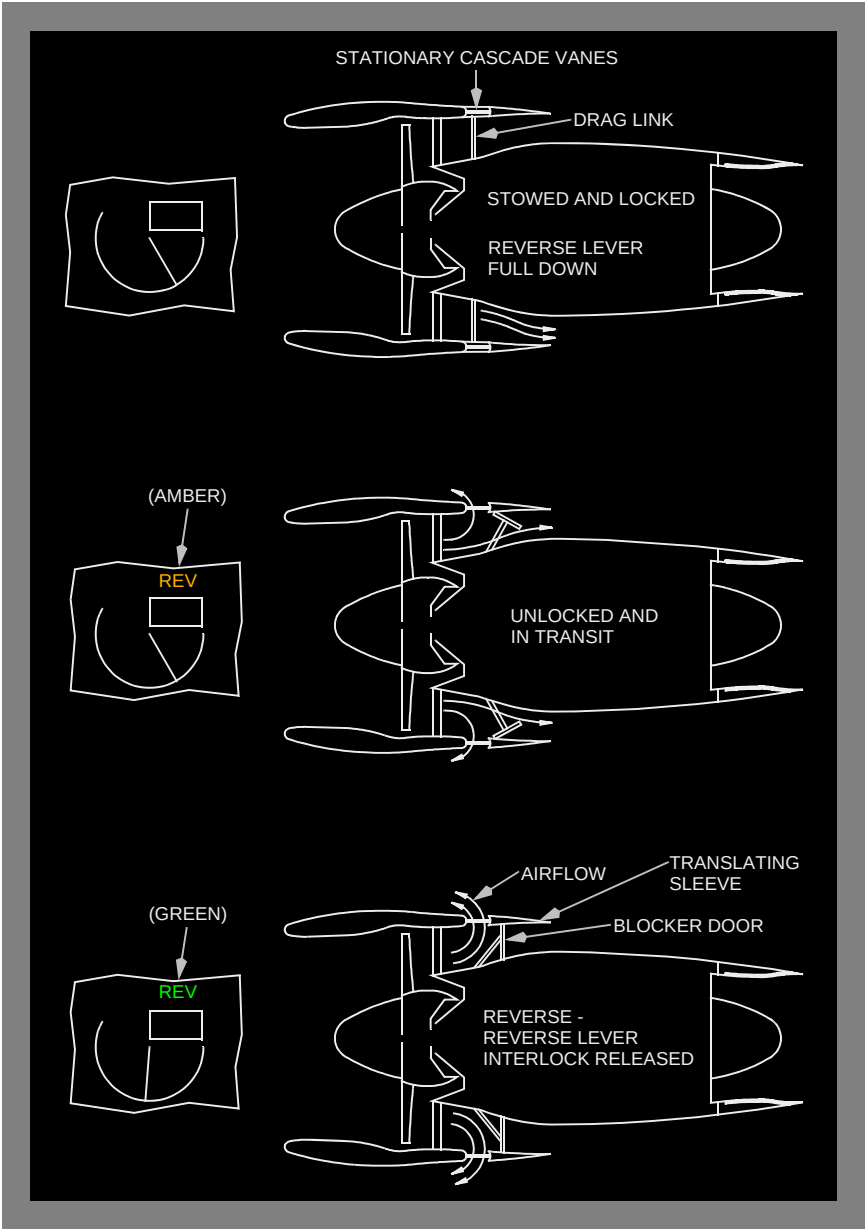
Each thrust reverser is automatically protected against unintentional reverse thrust. If an uncommanded thrust reverser movement is sensed, an autostow feature automatically applies pneumatic pressure to stow the reverser.

The EICAS advisory message L or R REV ISLN VAL is displayed and the REV ISLN light illuminates when a fault exists in the reverser system.

The light and message are inhibited in flight.

An electromechanical lock prevents uncommanded reverser deployment in the event of additional system failures.

Thrust Reverser Schematic



Airborne Vibration Monitoring System

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 (FAN, LPT or N2), broadband (BB) is displayed for the affected engine. Broadband vibration is the average vibration detected.

Thrust reduction at top of descent may cause momentary peak vibration increases. Minor throttle movements may improve, or remove, these momentary peak vibrations.

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.

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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 air inlet door is located between the horizontal and vertical stabilizers on the right side of the airplane.

While the primary purpose of the APU is to supply electrical power and bleed air on the ground before engine start, the APU can also be started inflight, and operated up to the airplane maximum certified altitude.

Electrical power has priority over bleed air. Electrical power is available throughout the airplane operating envelope. Inflight, APU bleed air is available up to approximately 17,000 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

APU start requires both the APU battery and the aircraft main battery.

Fuel for the APU is supplied from the left manifold. A dedicated DC fuel pump is energized when the APU Selector is placed in the ON position if no AC power is available. When AC power is available, the left forward AC fuel pump is signaled to operate regardless of its switch position, and the DC fuel pump is signaled off.

Rotating the APU selector to START begins the automatic start sequence. The APU fuel valve opens and at the same time the APU inlet door begins to open. A fuel pump also begins to operate.

When the inlet door is open, the electric starter engages. After the APU reaches the proper speed, ignition and fuel are provided, and the APU accelerates to its normal operating speed.

APU Run

When the APU RUN light illuminates, the APU may be used to supply electrical power and bleed air.

APU Shutdown

To protect the unit from thermal shock, the APU control system incorporates a time-delay feature permitting APU cooling before shutdown. If the APU is supplying pneumatic power, rotating the APU selector to OFF begins the shutdown cycle by closing the APU bleed air valve. If the APU bleed valve has been closed for a sufficient length of time when the selector is moved to OFF, the APU fuel valve and inlet door closes and the APU shuts down without delay.

If the selector is inadvertently moved to OFF, but the RUN light is still illuminated, momentarily moving the selector to START cancels the shutdown signal.

Protection System

On the ground, placing the Battery Switch OFF also results in an APU shutdown. This is not a recommended procedure however, because while the APU will go through a cooldown cycle, APU fire detection may not be available. In flight, Battery Switch position does not affect APU operation.

An amber FAULT light on the APU control panel illuminates whenever a fault is sensed. In addition, an EICAS advisory message APU FAULT is displayed, and the APU shuts down immediately. Fault detection circuitry is reset by positioning the APU Selector to OFF.

The FAULT light also comes on when the APU fuel valve is not in the commanded position. Therefore, during APU start and shutdown, the light illuminates momentarily. The EICAS advisory APU FUEL VAL appears if the valve fails to reach the commanded position.

With the APU Selector positioned to OFF, both the APU FAULT light and the associated APU FAULT EICAS message are inhibited. Only a failure of the APU fuel valve to close causes the APU FAULT light and the associated APU FUEL VAL message.

**Engines, APU
EICAS Messages (PW)****Chapter 7
Section 41****This Section Applies to VP-BMC, VP-BOY, VP-BOZ****Engines, APU EICAS Messages**

The following EICAS messages can be displayed.

APU

Message	Level	Light	Aural	Condition
APU FAULT	Advisory	FAULT		The APU has automatically shut down
APU FUEL VAL	Advisory	FAULT		The APU fuel valve position disagrees with the commanded position

**Engine
Control**

Message	Level	Light	Aural	Condition
L ENG CONTROL R ENG CONTROL	Advisory			Faults are detected in the engine control system
L ENG EEC MODE R ENG EEC MODE	Advisory	ALTN		The electronic engine control is not receiving adequate inputs and an alternate N1 control mode is being used by the EEC to control thrust
L ENG LIM PROT R ENG LIM PROT	Caution	ALTN	Beeper	The electronic engine control is operating in the ALTN control mode and the commanded N1 exceeds maximum N1
L ENG LOW IDLE R ENG LOW IDLE	Advisory			An engine has failed to go to approach idle

Message	Level	Light	Aural	Condition
L ENG RPM LIM R ENG RPM LIM	Advisory			N1 or N2 RPM is at the red line limit
L ENG SHUTDOWN R ENG SHUTDOWN	Caution			Engine was shutdown by the fuel control switch or fire switch
IDLE DISAGREE	Advisory			The engines are at different idle settings

Fuel

Message	Level	Light	Aural	Condition
L ENG FUEL FILT R ENG FUEL FILT	Advisory			An impending fuel filter bypass condition exists on the affected engine
L ENG FUEL VAL R ENG FUEL VAL	Advisory	ENG VALVE		The engine fuel valve position disagrees with commanded position
L FUEL SPAR VAL R FUEL SPAR VAL	Advisory	SPAR VALVE		The fuel spar valve position disagrees with commanded position

Oil

Message	Level	Light	Aural	Condition
L ENG OIL PRESS R ENG OIL PRESS	Advisory	L ENG OIL PRESS R ENG OIL PRESS		Engine oil pressure is low



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Message	Level	Light	Aural	Condition

VP-BMC

L OIL FILTER R OIL FILTER	Advisory			Affected engine oil filter contamination has been detected

Start

Message	Level	Light	Aural	Condition
L ENG STARTER R ENG STARTER	Advisory	VALVE		Engine starter valve is not in the commanded position
L STARTER CUTOUT R STARTER CUTOUT	Caution	VALVE	Beeper	The engine start valve is open when commanded closed

Thrust Reverser

Message	Level	Light	Aural	Condition
L REV ISLN VAL R REV ISLN VAL	Advisory	REV ISLN		Fault is detected in the affected engine reverser system

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**Engines, APU
EICAS Messages (GE)****Chapter 7
Section 42****This Section Applies to VP-BDI, VP-BOQ, VP-BRL through VQ-BRA****Engines, APU EICAS Messages**

The following EICAS messages can be displayed.

APU

Message	Level	Light	Aural	Condition
APU FAULT	Advisory	FAULT		The APU has automatically shut down
APU FUEL VAL	Advisory	FAULT		The APU fuel valve position disagrees with the commanded position

**Engine
Control**

Message	Level	Light	Aural	Condition

VP-BDI, VP-BOQ, VP-BWW through VQ-BRA

ENGINE CONTROLS	Advisory			Faults are detected in the engine control system

L ENG CONTROL R ENG CONTROL	Advisory			Faults are detected in the engine control system
L ENG EEC MODE R ENG EEC MODE	Advisory	ALTN		The electronic engine control is not receiving adequate inputs and an alternate N1 control mode is being used by the EEC to control thrust

Message	Level	Light	Aural	Condition
L ENG LIM PROT R ENG LIM PROT	Caution	ALTN	Beeper	The electronic engine control is operating in the ALTN control mode and the throttles are advanced into the overboost range
L ENG LOW IDLE R ENG LOW IDLE	Advisory			An engine has failed to go to approach idle
L ENG RPM LIM R ENG RPM LIM	Advisory			N1 or N2 RPM is at the red line limit
L ENG SHUTDOWN R ENG SHUTDOWN	Caution			Engine was shutdown by the fuel control switch or fire switch
IDLE DISAGREE	Advisory			The engines are at different idle settings

Fuel

Message	Level	Light	Aural	Condition
L ENG FUEL FILT R ENG FUEL FILT	Advisory			An impending fuel filter bypass condition exists on the affected engine
L ENG FUEL VAL R ENG FUEL VAL	Advisory	ENG VALVE		The engine fuel valve position disagrees with commanded position
L FUEL SPAR VAL R FUEL SPAR VAL	Advisory	SPAR VALVE		The fuel spar valve position disagrees with commanded position



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Oil

Message	Level	Light	Aural	Condition

VP-BDI, VP-BOQ, VP-BRL through VQ-BMU, VQ-BPT, VQ-BRA

L ENG OIL PRESS R ENG OIL PRESS	Caution	L ENG OIL PRESS R ENG OIL PRESS	Beeper	Engine oil pressure is low

VQ-BOG

L ENG OIL PRESS R ENG OIL PRESS	Advisory	L ENG OIL PRESS R ENG OIL PRESS		Engine oil pressure is low

L OIL FILTER R OIL FILTER	Advisory			Affected engine oil filter contamination has been detected

Start

Message	Level	Light	Aural	Condition
L ENG STARTER R ENG STARTER	Advisory	VALVE		Engine starter valve is not in the commanded position
L STARTER CUTOUT R STARTER CUTOUT	Caution	VALVE	Beeper	The engine start valve is open when commanded closed

Thrust Reverser

Message	Level	Light	Aural	Condition
L REV ISLN VAL R REV ISLN VAL	Advisory	REV ISLN		Fault is detected in the affected engine reverser system

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**Fire Protection**
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Fire Protection

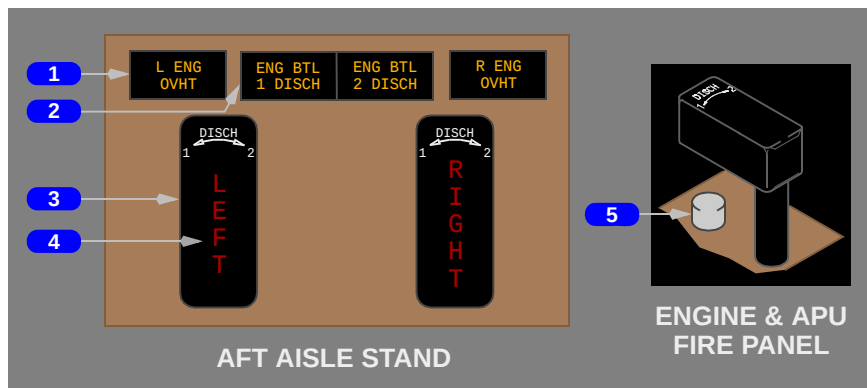
Controls and Indicators

Chapter 8

Section 10

Engine Fire Protection

Engine Fire Panel



1 Engine Overheat (L/R ENG OVHT) Lights

Illuminated (amber) – engine overheat is detected

2 Engine Bottle Discharged (ENG BTL DISCH) Lights

Illuminated (amber) – the extinguisher bottle is discharged or has low pressure

3 Engine Fire Switches

In – normal position, mechanically locked; unlocks automatically for fire warning

Out – closes the associated engine and spar fuel valves, and

- closes the associated engine bleed air valves
- trips the associated engine generator off
- shuts off hydraulic fluid to the associated engine-driven hydraulic pump
- arms both engine fire extinguisher bottles

Rotate to position 1 or 2 – discharges the selected fire extinguisher into the engine nacelle

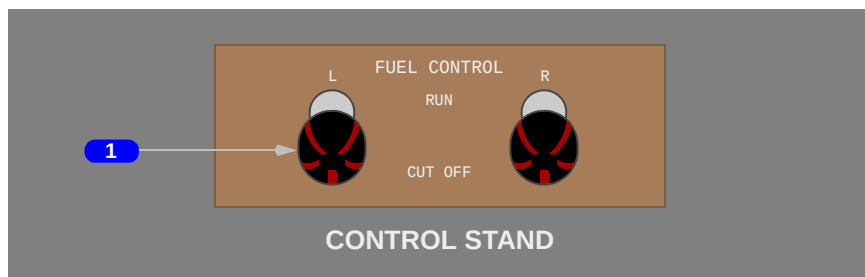
4 Engine Fire Warning Lights

Illuminated (red) – an engine fire is detected

5 Engine and APU Fire Override Switches

Push – unlocks the respective engine or APU fire switch

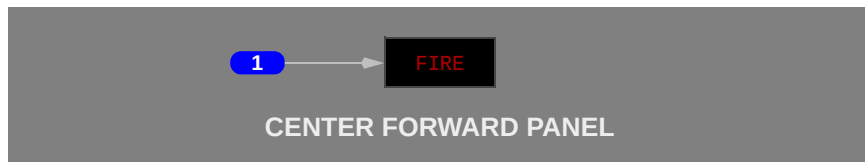
Fuel Control Switches



1 FUEL CONTROL Switch Fire Warning Lights

Illuminated (red) – an associated engine fire is detected

Fire Warning Light

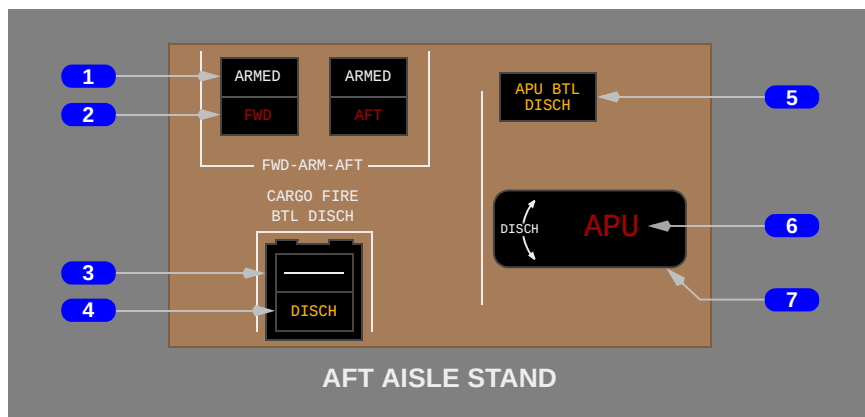


1 FIRE Warning Light

Illuminated (red) – an engine, APU, wheel well, or cargo fire is detected

Cargo and APU Fire Protection

Cargo and APU Fire Panel



1 CARGO FIRE ARM Switches and Lights

Push FWD ARMED – Light Illuminates

- arms all cargo fire extinguisher bottles
- turns off both recirculation fans

Push AFT ARMED – Light Illuminates

- arms all cargo fire extinguisher bottles
- turns off both the recirculation fans
- inhibits high flow operation of both packs

Off – normal position

2 CARGO FIRE Warning Lights (FWD or AFT)

Illuminated (red) – smoke is detected in associated cargo compartment

3 CARGO FIRE Bottle Discharge (BTL DISCH) Switch

Push – discharges the fire extinguisher bottles into the ARMED cargo compartment

4 CARGO FIRE Bottle Discharged (DISCH) Light

Illuminated (amber) – either extinguisher bottle has discharged or has low pressure

5 APU Fire Bottle Discharged (APU BTL DISCH) Light

Illuminated (amber) – the extinguisher bottle is discharged or has low pressure

6 APU Fire Warning Light

Illuminated (red) – an APU fire is detected

7 APU Fire Switch

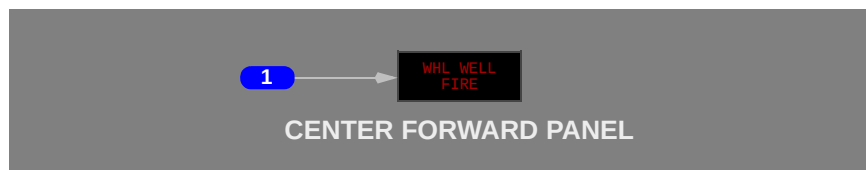
In – normal position, mechanically locked; unlocks automatically if fire warning occurs

Out – closes the APU fuel valve, and:

- trips the APU generator off
- closes the APU air supply valve
- shuts down the APU
- arms the APU fire extinguisher bottle

Rotate – either direction discharges the APU fire extinguisher into the APU compartment

Wheel Well Fire Light



1 Wheel (WHL) WELL FIRE Warning Light

Illuminated (red) – a fire is detected in one or both of the main gear wheel wells

Lavatory Smoke Light

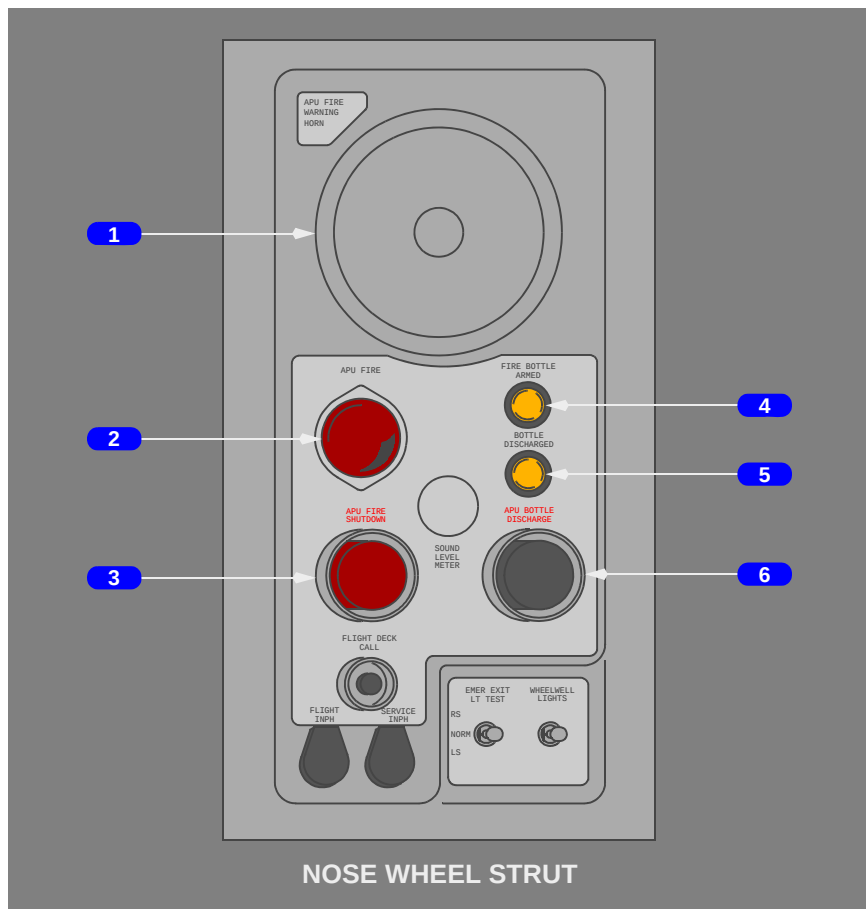
VP-BOQ



1 Lavatory Smoke (LAV SMOKE) Light

Illuminated (amber) – smoke detected in any lavatory

APU Ground Control Fire Protection Panel



1 APU Fire Warning Horn

Sounds intermittently during ground operation for an APU fire

2 APU FIRE Light

Illuminated (red) – an APU fire is detected

The APU automatically shuts down for a detected fire

VP-BWW through VQ-BMQ, VQ-BPT

The APU fire extinguisher bottle is automatically discharged for an APU fire when the airplane is on the ground

3 APU FIRE SHUTDOWN Switch

Push –

- closes the APU fuel valve and trips the APU generator off
- closes the APU air supply valve and shuts down the APU
- arms the APU fire extinguisher bottle

4 APU FIRE BOTTLE ARMED Light

Illuminated (amber) - the APU fire extinguisher is armed

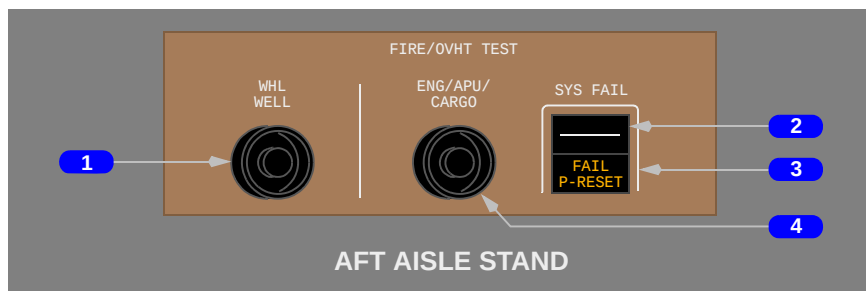
5 APU Fire BOTTLE DISCHARGED Light

Illuminated (amber) - the APU fire extinguisher bottle is discharged or has low pressure

6 APU BOTTLE DISCHARGE Switch

Push – discharges the APU fire extinguisher bottle into the APU compartment

Fire/Overheat Test Panel



1 Wheel (WHL) WELL Fire Test Switch

Push and hold – initiates a wheel well fire test

2 System Fail (FAIL P – RESET) Light

Illuminated (amber) – indicates the failure of the detectors in one of the following systems:

- engine fire
- engine overheat
- APU fire
- cargo fire

3 System Fail (SYS FAIL) Reset Switch (FAIL P – RESET)

Push – extinguishes the FAIL light and resets the monitor for other systems

4 ENG/APU/CARGO Test Switch

Push and hold – initiates an engine, APU, and cargo fire/overheat test

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Fire Protection System Description

Chapter 8 Section 20

Introduction

There are fire detection and extinguishing systems for the:

- engines
- APU
- forward and aft cargo compartments
- lavatories

The main gear wheel wells have a fire detection system, but no fire extinguishing system. The system will not detect hot brakes alone, without an associated fire.

Overheat detection systems are installed for both engines, struts, and pneumatic ducts in the wing and body areas.

Refer to Chapter 2, Air Systems, for a description of equipment smoke evacuation, equipment overheat detection and bleed air duct leak.

Engine Fire Protection

Engine fire protection consists of these systems:

- engine fire and overheat detection
- engine fire warning
- engine overheat caution
- engine fire extinguishing

Engine Fire and Overheat Detection

There are detector loops in each engine nacelle to provide both fire and overheat detection. The SYS FAIL light illuminates and the EICAS advisory message FIRE/OVHT SYS displays to indicate failure of the fire/overheat detection system. The SYS FAIL light and advisory message can be reset to allow monitoring of the remaining systems.

Engine Fire Warning

The indications of an engine fire warning are:

- the fire bell sounds
- the master WARNING lights illuminate
- the engine fire switch LEFT or RIGHT fire warning light illuminates
- the discrete FIRE warning light illuminates
- the engine FUEL CONTROL switch fire warning light illuminates
- the EICAS warning message L or R ENGINE FIRE displays
- the engine fire switch unlocks

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The fire warning lights remain illuminated as long as the fire signal exists. The fire bell may be silenced by any of the following actions:

- extinguishing the fire
- pushing either master warning/caution reset switch
- pulling the appropriate fire switch

Engine Overheat Caution

The indications of an engine overheat caution are:

- the caution beeper sounds
- the master CAUTION lights illuminate
- the L or R ENG OVHT light illuminates
- the EICAS caution message L or R ENG OVHT displays

The overheat lights remain illuminated as long as the overheat condition exists.

Engine Fire Extinguishing

There are two engine fire extinguisher bottles. Either or both bottles can be discharged into either engine.

When an engine fire switch is pulled out, the associated engine:

- fuel is shut off
- bleed valves are closed
- generator is tripped off
- hydraulic fluid is shut off to the engine-driven hydraulic pump
- fire extinguishing bottles are armed

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 second 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 ENG BTL 1 or 2 displays

Engine/APU Fire and Override Switches

The engine and APU fire switches are mechanically locked in the down position to avoid inadvertent activation. When a fire is detected, the respective switch is electrically unlocked and may then be pulled out. Manual unlocking of the switch is accomplished by pushing the fire override switch located beneath the fire switch.

APU Fire Protection

APU fire protection consists of these systems:

- APU fire detection
- APU fire warning
- APU fire extinguishing

APU Fire Detection

There are fire detector loops in the APU compartment. There is no APU overheat detection. The SYS FAIL light illuminates and the EICAS advisory message FIRE/OVHT SYS displays to indicate failure of the APU fire detection system. The SYS FAIL light and advisory message can be reset to allow monitoring of the remaining systems.

APU Fire Warning

The indications of an APU fire warning are:

- the fire bell sounds
- the master WARNING lights illuminate
- the APU fire warning light illuminates
- the discrete FIRE warning light illuminates
- the EICAS warning message APU FIRE displays
- the APU automatically shuts down
- the APU fire switch unlocks

In addition to the above APU fire warnings, if the airplane is on the ground the horn on the nose gear strut sounds and the fire warning light on the APU ground control panel illuminates.

The fire warning lights remain illuminated as long as the fire signal exists. The fire bell (and horn if APU fire on the ground) may be silenced by any of the following actions:

- extinguishing the fire
- pushing either master warning/caution reset switch
- pulling the APU fire switch
- pushing the APU fire shutdown switch if on the ground

APU Fire Extinguishing

There is one APU fire extinguisher bottle. When the APU fire switch is pulled out, the APU:

- fuel is shut off
- bleed air valve is closed

- generator is tripped off
- fire extinguishing bottle is armed

Rotating the switch in either direction discharges the extinguisher bottle into the APU compartment. When the bottle is discharged or has low pressure:

- the APU BTL DISCH light illuminates
- the EICAS advisory message APU BTL displays

VP-BWW through VQ-BMQ, VQ-BPT

An APU fire on the ground is automatically extinguished. The fire signal causes discharge of the APU extinguisher bottle a few seconds after automatic shutdown.

Main Gear Wheel Well Fire Protection

The main gear wheel well has fire detection and warning only. There is no fire extinguishing system. The nose gear wheel well does not have a fire detection system.

Main Gear Wheel Well Fire Detection

The main wheel well fire detection system consists of a single fire detection loop.

Main Gear Wheel Well Fire Warning

The indications for a main wheel well fire are:

- the fire bell sounds
- the master WARNING lights illuminate
- the WHL WELL FIRE warning light illuminates
- the discrete FIRE warning light illuminates
- the EICAS warning message WHEEL WELL FIRE displays

The fire warning lights remain illuminated as long as the fire signal exists. The fire bell may be silenced by any of the following actions:

- extinguishing the fire
 - pushing either master warning/caution reset switch
-

Cargo Compartment Fire Protection

Cargo compartment fire protection consists of these systems:

- cargo compartment smoke detection
- cargo compartment fire warning
- cargo compartment fire extinguishing

Cargo Compartment Smoke Detection

The forward and aft cargo compartments each have smoke detectors installed

The SYS FAIL light illuminates and the EICAS advisory message FIRE/OVHT SYS displays to indicate failure of the cargo compartment smoke detection system. The SYS FAIL light can be reset to allow monitoring of the remaining systems.

Cargo Compartment Fire Warning

The indications of a cargo compartment fire are:

- the fire bell sounds
- the master WARNING lights illuminate
- the FWD or AFT cargo fire warning light illuminates
- the discrete FIRE warning light illuminates
- the EICAS warning message FWD or AFT CARGO FIRE displays

The fire warning lights remain illuminated as long as the fire signal exists. The fire bell may be silenced by any of the following actions:

- extinguishing the fire and clearing the smoke
- pushing either master warning/caution reset switch
- pushing the illuminated cargo compartment ARMED switch

Cargo Compartment Fire Extinguishing

Fire extinguisher bottles are installed for cargo compartment fire extinguishing. Pushing the FWD or AFT cargo compartment ARMED switch arms the extinguishers for that compartment.

Pushing the cargo fire bottle discharge switch initiates discharge of the fire bottles. The first bottle discharges immediately into the selected compartment. The CARGO BTL 1 advisory message is displayed on EICAS within a few seconds after pressing the cargo fire bottle DISCH switch. The second fire bottle discharges at a later time or at a reduced flow rate into the selected compartment. The CARGO BTL 2 advisory messages is displayed on EICAS within a few seconds after the bottle starts to discharge. The DISCH light illuminates when either bottle discharges.

Lavatory Fire Protection

Lavatory fire protection consists of these systems:

- lavatory fire detection and annunciation
- automatic fire extinguishing in the lavatory waste container cabinet

Lavatory Smoke Detection and Annunciation

Each lavatory has a single smoke detector. When smoke is detected, aural annunciations sound in the lavatory and in the cabin. Depending on configuration, cabin lavatory smoke detection annunciation will consist of a horn, a chime, a flashing lavatory call light or flashing of the master call light at the associated flight attendant station.

VP-BOQ

Cockpit annunciation of smoke detected in any lavatory is the EICAS advisory message LAVATORY SMOKE and the LAV SMOKE light on the Miscellaneous Annunciator Panel.

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

There is no cockpit annunciation of smoke detected in a lavatory.

Lavatory Fire Extinguishing

Each lavatory has a fire extinguisher located in the waste container cabinet, with:

- automatic fire extinguisher operation
- no cockpit annunciations of lavatory fire extinguisher operations

Fire and Overheat Detection System Fault Test

Automatic testing of the engine fire and overheat detectors, APU fire detectors and cargo compartment smoke detectors occurs when electrical power is initially applied. The FIRE/OVHT test panel permits manual testing of the various fire and overheat sensors.

**Fire Protection**
System EICAS Messages**Chapter 8**
Section 30**Fire Protection EICAS Messages**

The following EICAS messages can be displayed.

Message	Level	Light	Aural	Condition
APU BTL	Advisory	APU BTL DISCH		APU fire extinguisher bottle pressure is low
APU FIRE	Warning	APU	Fire Bell	Fire is detected in the APU
CARGO BTL 1 CARGO BTL 2	Advisory	DISCH		Cargo fire extinguisher bottle 1 or bottle 2 pressure is low
AFT CARGO FIRE FWD CARGO FIRE	Warning	AFT FWD	Fire Bell	Smoke is detected in the affected cargo compartment
ENG BTL 1 ENG BTL 2	Advisory	ENG BTL 1 DISCH ENG BTL 2 DISCH		Engine fire extinguisher bottle 1 or bottle 2 pressure is low
L ENGINE FIRE R ENGINE FIRE	Warning	LEFT RIGHT	Fire Bell	Fire is detected in the engine
L ENG OVHT R ENG OVHT	Caution	L ENG OVHT R ENG OVHT	Beeper	An overheat is detected in the engine
FIRE/OVHT SYS	Advisory	FAIL P-RESET		Fire or overheat detection is inoperative for loops as shown on the status page



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Message	Level	Light	Aural	Condition

VP-BOQ

LAVATORY SMOKE	Advisory	LAV SMOKE		Smoke is detected in one or more lavatories

WHEEL WELL FIRE	Warning	WHL WELL FIRE	Fire Bell	Fire is detected in a main wheel well

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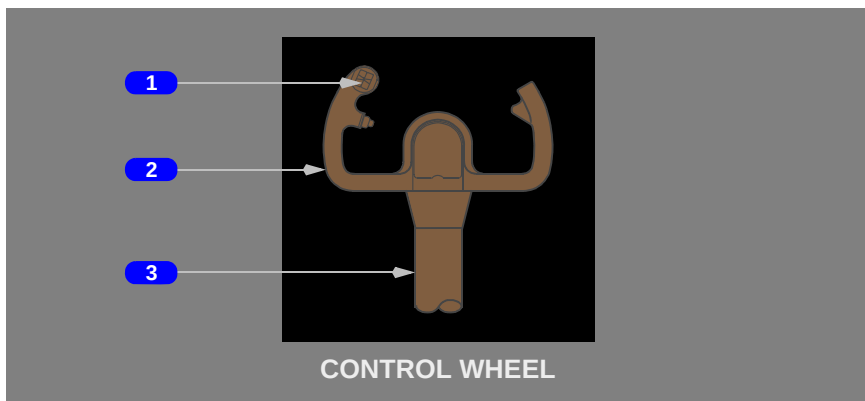
Flight Controls

Controls and Indicators

Chapter 9

Section 10

Pitch and Stabilizer Trim System Control Wheel and Column



1 Pitch Trim Switches

Spring-loaded to neutral.

Push (both switches) – electrically signals stabilizer movement.

2 Control Wheel

Rotate – deflects the ailerons and spoilers in the desired direction.

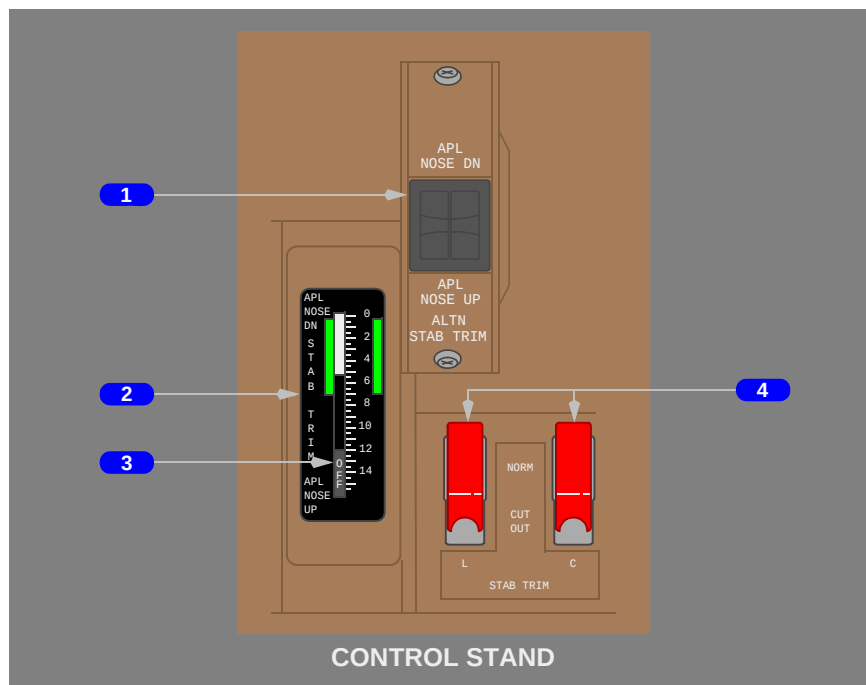
Moves and remains displaced with aileron trim.

3 Control Column

Push/Pull –

- deflects the elevator
- movement opposing stabilizer trim stops trimming

Stabilizer Trim System



1 Alternate Stabilizer Trim (ALTN STAB TRIM) Switches

Spring-loaded to neutral.

Push (both switches) –

- electrically signals stabilizer movement
- neutralizes conflicting trim commands

2 Stabilizer Trim (STAB TRIM) Indicator

- indicates stabilizer position in units of trim
- the green bands indicate the allowable takeoff trim range

3 Stabilizer Trim OFF Flag

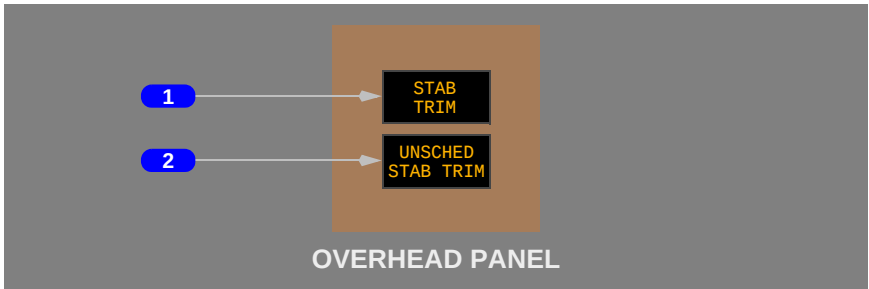
Trim indicator inoperative.

4 Stabilizer (STAB) Cutout Switches

NORM – hydraulic power is supplied to the related stabilizer trim control module.

CUTOUT – shuts off the respective left or center hydraulic system power to the related stabilizer trim control module.

Stabilizer Trim Lights



1 Stabilizer Trim (STAB TRIM) Light

Illuminated (amber) – stabilizer trim rate is one-half the normal control wheel stabilizer trim switch rate.

2 Unscheduled Stabilizer Trim (UNSCHED STAB TRIM) Light

Illuminated (amber) – uncommanded stabilizer motion detected.

Aileron and Rudder Trim Controls

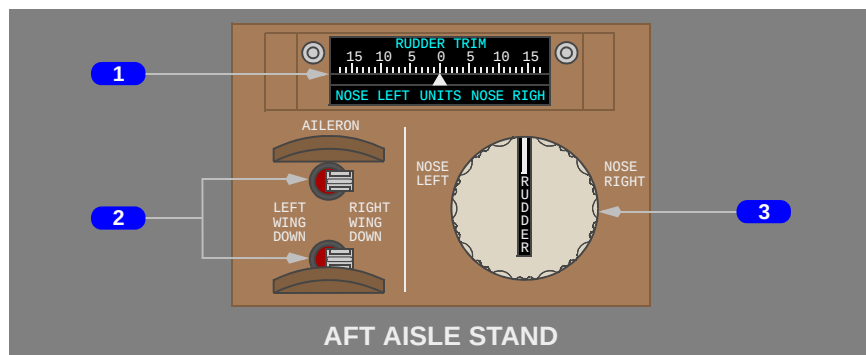
Aileron Trim Indicator



1 AILERON TRIM Indicator

Indicates units of aileron trim.

Aileron and Rudder Trim



1 RUDDER TRIM Indicator

Indicates units of rudder trim.

2 AILERON Trim Switches

Spring-loaded to neutral.

Push (both switches) – moves the control wheel, ailerons, and spoilers in the desired direction.

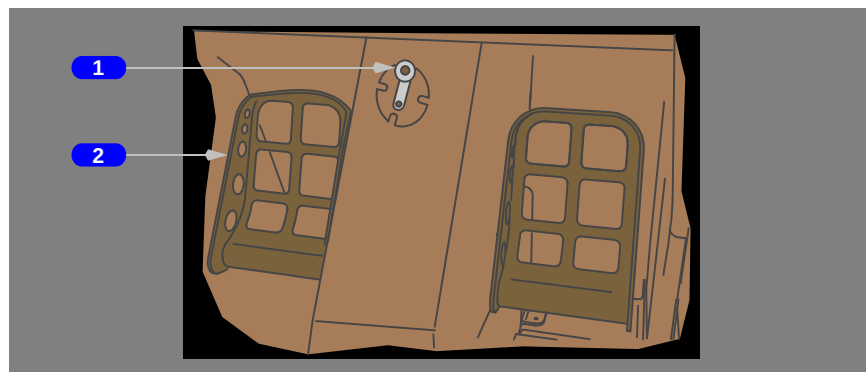
3 RUDDER Trim Control

Spring-loaded to neutral.

Rotate – moves the rudder pedals and rudder in the desired direction.

Rudder System

Rudder/Brake Pedals



1 Rudder Pedals Adjustment Crank

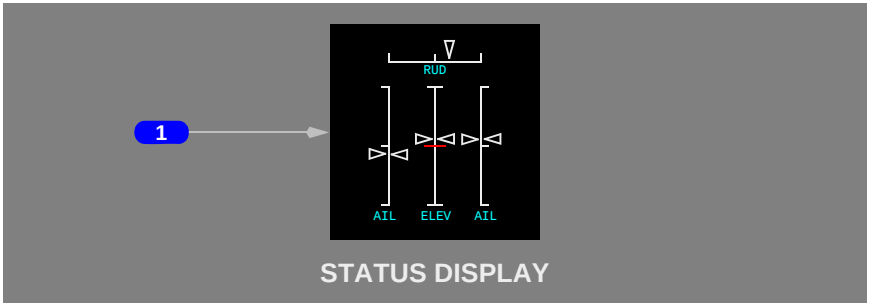
Pull and Rotate – adjusts rudder pedals forward or aft.

2 Rudder Pedals

Push – deflects the rudder in the desired direction.

Refer to Chapter 14, Landing Gear, for brakes and nosewheel steering description.

EICAS Status Display

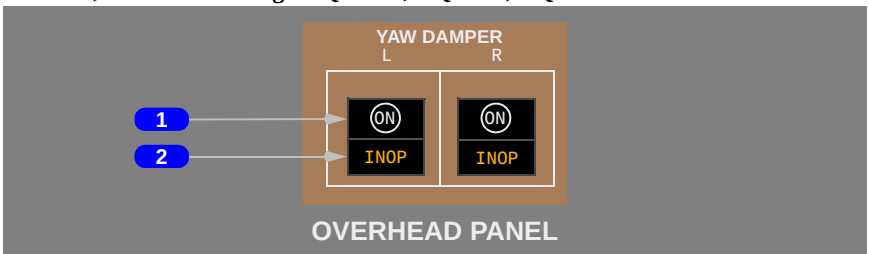


1 Rudder, Aileron, and Elevator (RUD, AIL, ELEV) Position

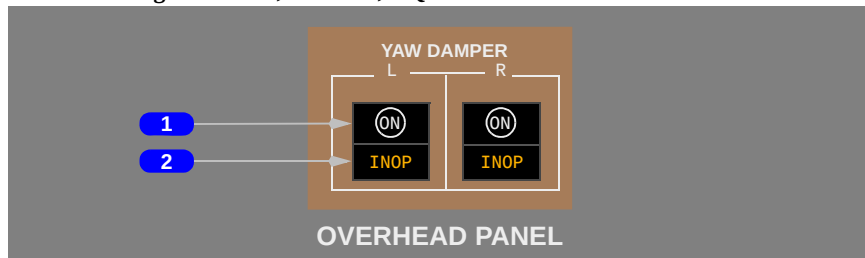
Indicates rudder, aileron, and elevator flight control surface deflection.

Yaw Damper Switches

VP-BOZ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA



VP-BDI through VP-BOY, VP-BRL, VQ-BOG



1 YAW DAMPER Switches

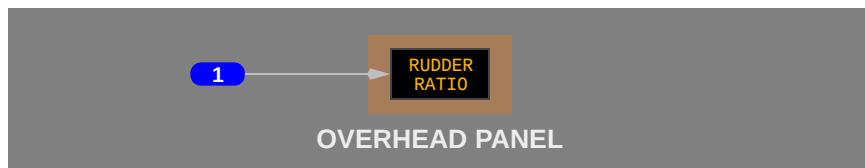
ON – yaw damper is commanded on.

Off (ON not visible) – the yaw damper is commanded off.

2 Yaw Damper Inoperative (INOP) Lights

Illuminated (amber) – the yaw damper is off or inoperative.

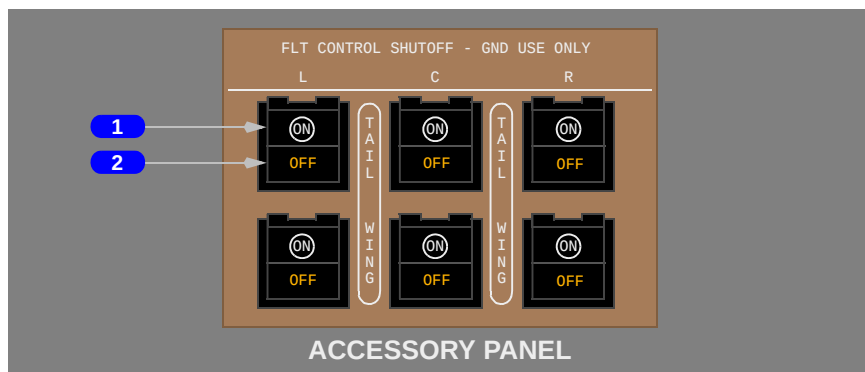
Rudder System Light



1 RUDDER RATIO Light

Illuminated (amber) – the rudder ratio system is failed.

Flight Control Shutoff Switches



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1 Flight (FLT) CONTROL SHUTOFF Switches

ON – the flight control valve is commanded open.

Off (ON not visible) – the flight control valve is commanded closed.

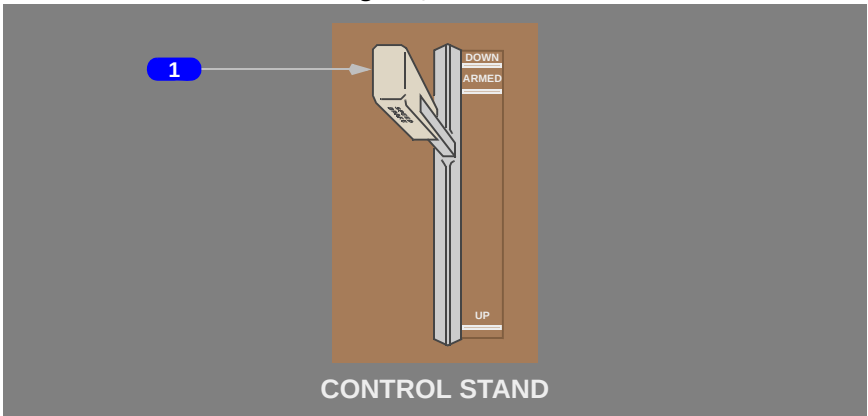
2 Flight Control Shutoff OFF Lights

Illuminated (amber) – the flight control valve is closed.

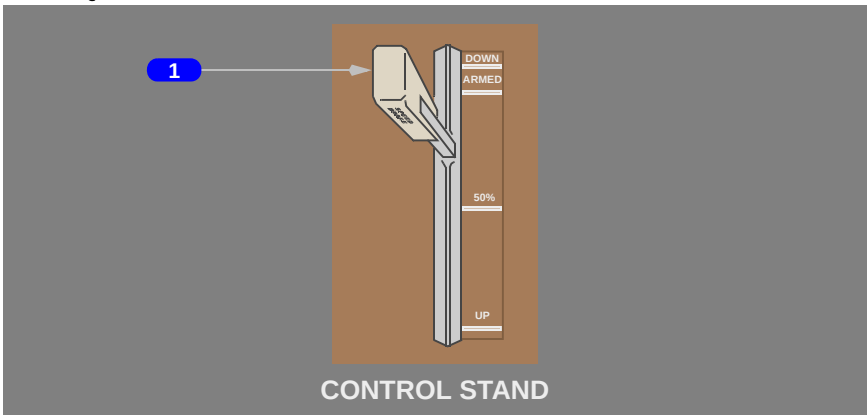
Speedbrakes

Speedbrake Lever

VP-BDI, VP-BMC, VP-BOY through VQ-BRA



VP-BOQ



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

VP-BOQ

50% – If the speedbrakes are deployed beyond the 50% position and the speedbrake load alleviation feature is activated:

- the speedbrake lever moves to this position
- all flight spoilers retract to one-half of their maximum position for inflight use

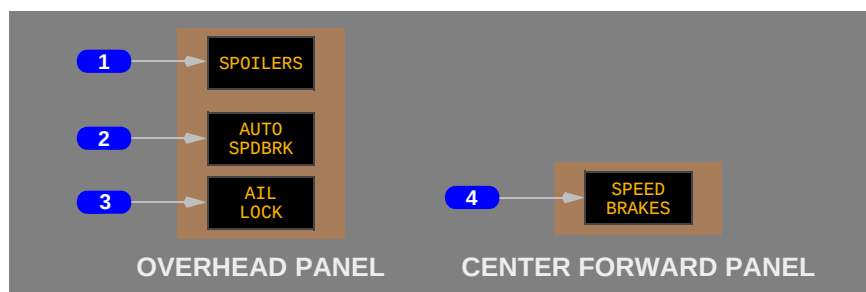
Note: Winglet modifications may include installation of the load alleviation system. If installed, the 50% speedbrake position is utilized to limit speedbrake extension under certain conditions.

UP – the required spoiler panels extend to their maximum in-flight or on-ground positions (intermediate positions can be selected).

On the ground:

- 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

Speedbrake and Aileron Lights



1 SPOILERS Light

Illuminated (amber) – one or more spoiler pairs are inoperative.

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

2 Auto Speedbrake (AUTO SPDBRK) Light

Illuminated (amber) – a fault is detected in the automatic speedbrake system.

VP-BOQ

2 Auto Speedbrake (AUTO SPDBRK) Light

Illuminated (amber) – a fault is detected in the automatic speedbrake system. Do not exceed 320 knots and do not arm the automatic speedbrakes for landing. Use manual speedbrake deployment as required. Increased force may be required to move the speedbrake lever into the UP position.

3 Aileron Lockout (AIL LOCK) Light

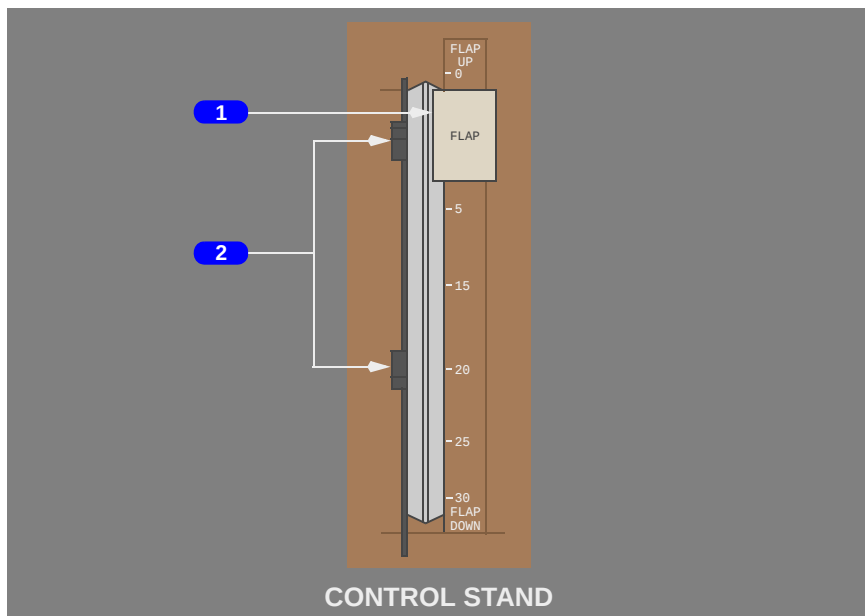
Illuminated (amber) – aileron lockout actuator disagrees with the commanded position.

4 SPEED BRAKES Light

Illuminated (amber) – the speedbrakes are extended when:

- radio altitude is 800 feet or below, or
- flaps are in a landing position

Flap System Flap Controls



1 FLAP Lever

Positions the slats and flaps hydraulically.

Up – the slats and flaps are retracted.

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1 –

- the slats extend to the midrange position
- the flaps remain retracted

5, 15, and 20 –

- the slats remain in the midrange position
- the flaps extend to the commanded position
- the inboard ailerons droop in conjunction with flap extension from 5 to 15 degrees
- the flap load relief system arms at flaps 20

25 –

- the slats extend to the fully extended position
- the flaps extend to 25

30 –

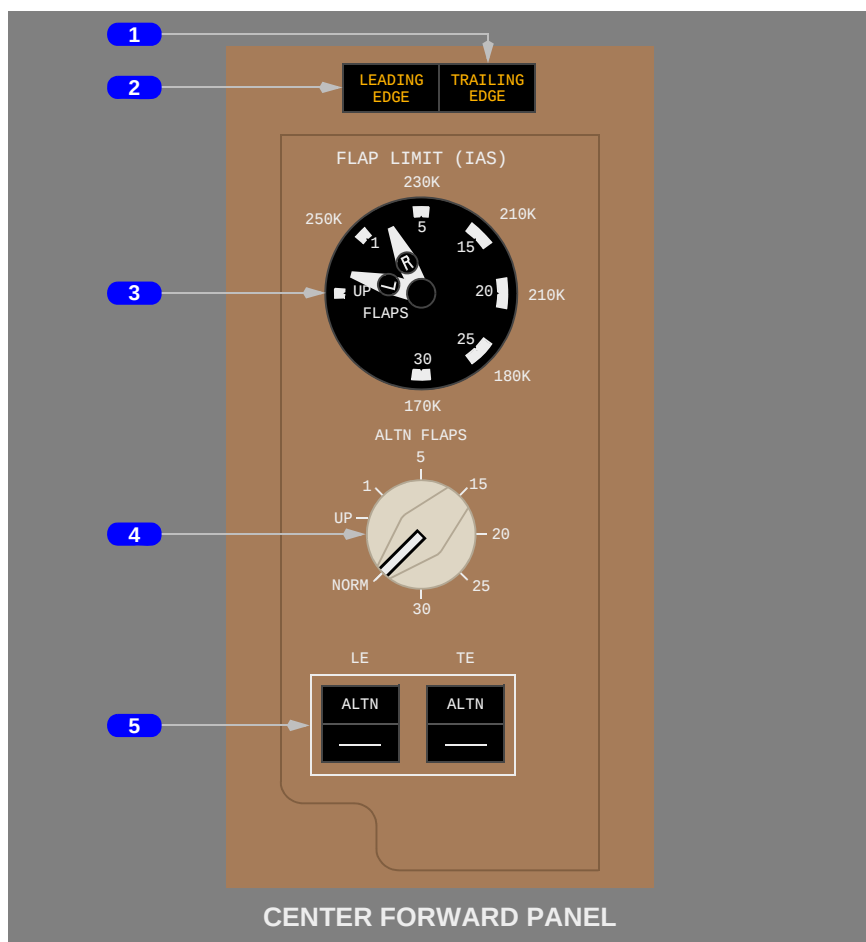
- the slats remain in the fully extended position
- the flaps extend to 30

2 Flap Gates

1 – prevents inadvertent retraction of the slats.

20 – prevents inadvertent retraction of the flaps past the go-around position.

Flap Position Indicator/Alternate Flaps Selector



1 TRAILING EDGE Light

Illuminated (amber) –

- a flap disagree exists
- a flap asymmetry exists
- the flap load relief system is not operating when required

2 LEADING EDGE Light

Illuminated (amber) –

- a slat disagree exists
- a slat asymmetry exists

3 Flap Position Indicator

Indicates flap position.

UP – the slats and flaps are retracted.

Between UP and 1 – the slats are between the retracted and midrange position.

1 to 30 – the flaps are in the indicated position.

4 Alternate (ALTN FLAPS) Flaps Selector

NORM – normal flap operation, alternate system not in use.

UP – the slats and flaps are retracted.

1 –

- the slats extend to the midrange position
- the flaps remain retracted

5 to 20 –

- the slats remain in the midrange position
- the flaps extend to the commanded position

Alternate flaps switches must be in ALTN for the slats and flaps to move.

5 Alternate (ALTN) Flaps Arm Switches

ALTN –

- arms the selected LE slat or TE flap alternate drive unit
- shuts off hydraulic power to the selected LE slat or TE flap drive system.

Off (ALTN not visible) – alternate flaps and slats command inactive.



Flight Controls

System Description

Chapter 9

Section 20

Introduction

The primary flight controls are elevators, ailerons, and rudders. The control column, control wheel, and rudder pedals control these flight control surfaces. The primary flight controls are powered by redundant hydraulic systems; there is no manual reversion.

Secondary flight controls include a moveable horizontal stabilizer, spoilers, and leading and trailing edge flaps. Spoilers operate differentially to assist ailerons for roll control and symmetrically as speedbrakes.

There are six guarded flight control shutoff switches that control hydraulic power to the ailerons, spoilers, elevators and rudder. The flight control shutoff OFF light illuminates and the EICAS advisory message L, C, or R WING HYD VAL or L, C, or R TAIL HYD VAL displays when a flight control valve is closed. If two or more OFF lights illuminate the EICAS advisory message FLT CONT VALS displays.

Pilot Controls

The pilot controls consist of:

- two control columns
- two control wheels
- two pairs of rudder pedals
- control wheel stabilizer trim switches
- the speedbrake lever
- the flap lever
- aileron trim switches
- rudder trim switch
- alternate stabilizer trim switches

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. When a restricted portion of the flight controls are bypassed, some control effectiveness may be lost.

The rudder pedals are rigidly connected between the two sides.

The speedbrake lever allows manual or automatic symmetric actuation of the spoilers.

Flight Control Surfaces

Pitch control is provided by:

- two elevators
- a movable horizontal stabilizer

Roll control is provided by:

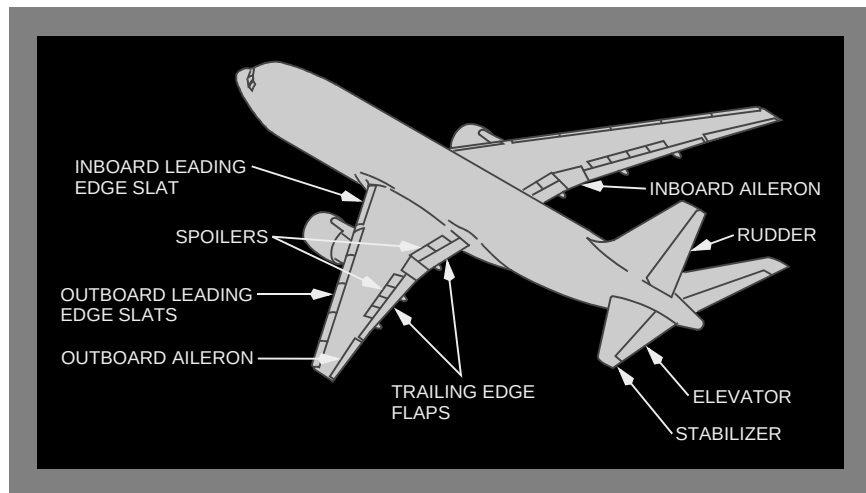
- four ailerons
- twelve spoilers

Yaw control is provided by a single rudder.

Flaps and slats provide high lift for takeoff, approach, and landing.

Symmetric spoilers are used as speedbrakes.

Flight Control Surface Locations



Pitch Control

The pitch control surfaces consist of two elevators and a stabilizer.

Elevator

Moving the control column signals hydraulic actuators to move the elevators.

Elevator positions are shown on the EICAS status display. Separate pointers indicate the left and right elevator deflection. A full-scale indication corresponds to the maximum elevator deflection.



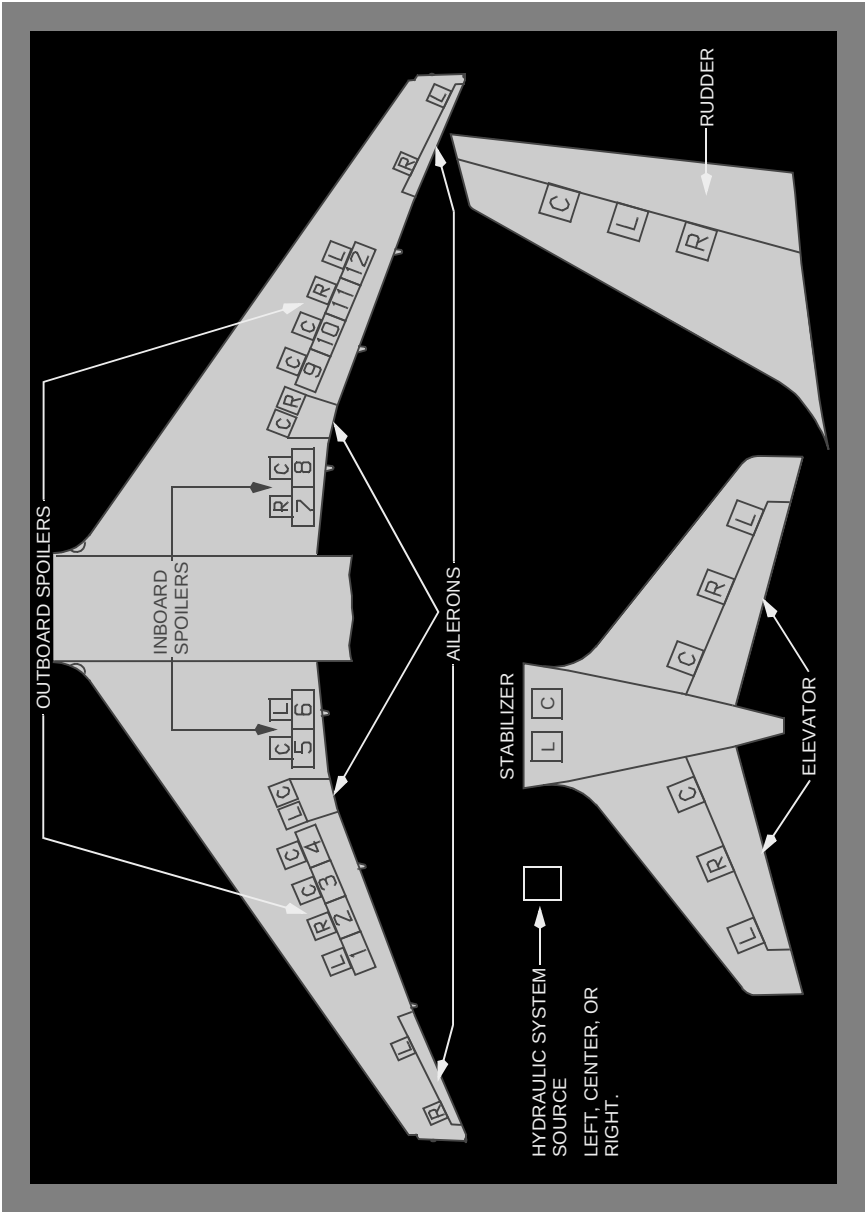
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If one control column should jam, applying significant forward or aft force to the other causes the two columns to override. Pitch control is then available using the free control column path.

Two elevator feel systems provide artificial feel forces to the pilots control columns. Mechanical springs provide feel following a loss of the left and center hydraulic systems.



Actuator Control Hydraulic Power Distribution



Stabilizer Trim Control

The stabilizer is powered by the left and center hydraulic systems. Stabilizer position commands 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 position is displayed on two stabilizer position indicators located on the control stand. Green bands indicate the normal trim settings for takeoff.

There are three modes of stabilizer trim control:

- electric
- alternate
- automatic

Electric Trim

Dual electric pitch trim switches located on the control wheel must be pushed simultaneously to command trim changes.

The alternate trim system must be used to set the stabilizer trim to less than 1.5 units with the flaps up.

Alternate Trim

Alternate trim control is provided by the alternate stabilizer trim switches on the control stand. Pushing both switches simultaneously commands trim changes and provides an increased range of stabilizer travel. The signals neutralize any other conflicting trim inputs.

Automatic Trim

The stabilizer is controlled automatically by the autopilot.

Automatic stabilizer trim uses only one trim control module and trims at one-half the electric or alternate trim rate.

Non-normal Operation

If a single autopilot is engaged, electric trimming causes the autopilot to disengage. If multiple autopilots are engaged, the electric trim switches are inhibited. Alternate trimming does not cause autopilot disengagement.

The UNSCHED STAB TRIM light illuminates and the EICAS caution message UNSCHD STAB TRIM displays when uncommanded stabilizer motion is detected.

The light and message also occur if alternate trim is used with an autopilot engaged.

The left and center stabilizer cutout switches control hydraulic power to the respective stabilizer trim control module. Placing both switches in the CUTOUT position removes all hydraulic power from the stabilizer.

The control column can be used to interrupt stabilizer trim commands. This feature allows the pilot to quickly stop uncommanded trim changes. The stabilizer trim commands are interrupted if the control column is displaced in the opposing direction.

The STAB TRIM light illuminates and the EICAS advisory message STAB TRIM displays when the electric stabilizer trim rate is one-half the normal control wheel stabilizer trim switch rate.

If the malfunction is unique to the electric trim control, full trim rate is available by using alternate trim.

Pitch Enhancement System (PES)

The Pitch Enhancement System (PES) consists of a hydraulic motor in the right system driving a pump which uses trapped left trim system fluid to operate the stabilizer. It will automatically activate if both the left and center hydraulic systems are lost in flight. Only electric trim is available at approximately 1/4 the normal rate. Alternate and automatic trim will be inoperative.

Roll Control

Two ailerons are located on each wing on either side of the outboard trailing edge flap. Aileron 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.

The control wheels are connected so that, if one control wheel jams, using significant force causes the control wheels to override. Roll control is then available using the free control wheel.

The inboard ailerons droop in conjunction with trailing edge flap extension.

Ailerons

Aileron positions are shown on the EICAS status display. A full-scale indication corresponds to maximum aileron deflection.

Dual aileron trim switches located on the aft aisle stand must be pushed simultaneously to command trim changes. Hydraulic power from one of the three hydraulic systems is necessary to accurately set aileron trim.

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The amount of aileron trim is indicated on a scale on the top of each control column.

Note: If the flight crew inadvertently activates aileron trim while an autopilot is engaged, the repositioning of the aileron neutral point is not apparent to the crew. When the autopilot is disengaged, the control wheels and ailerons move to the new (possibly undesired) neutral point and the airplane will roll proportional to the amount of trim input.

The aileron lockout control system permits full travel of the outboard ailerons at low speeds and locks out the outboard ailerons at high speeds. This provides the required roll authority at low airspeeds and prevents over controlling at high airspeeds.

The AIL LOCK light illuminates and the EICAS advisory message AILERON LOCKOUT displays to indicate aileron lockout actuator disagrees with the commanded position. At high airspeeds it may indicate that one or both of the outboard ailerons failed to lockout. When the message and light appear at low airspeeds it may indicate that one or both of the outboard ailerons failed to unlock.

Yaw Control

Yaw control is provided by a single rudder. Two yaw dampers operate through the rudder control system to improve directional stability.

Rudder

Rudder position is shown on the EICAS status display. On the ground, a full scale indication corresponds to the maximum rudder deflection.

The rudder trim control can be used to command trim changes. The rudder trim indicator shows the units of rudder trim that are commanded.

Rudder Ratio

The control commands from the rudder pedals and trim control are modified by a rudder ratio changer. As airspeed increases the ratio changer desensitizes these inputs from the pilot to reduce the rudder deflection.

The ratio changer receives air data computer airspeed inputs and provides control commands to an actuator powered by the left hydraulic system. The actuator then dampens the pilots inputs to the rudder.

The RUDDER RATIO light illuminates and the EICAS advisory message RUDDER RATIO displays to indicate the rudder ratio system is failed. Rudder structural protection is provided by automatic depressurization of the left hydraulic system actuator which limits rudder displacement at high airspeeds. However, abrupt rudder pedal input should be avoided at high airspeeds. At low airspeeds the two remaining rudder actuators provide sufficient control for full rudder displacement.

If the left hydraulic system is providing normal pressure to the ratio changer, a fault may result in limited displacement of the rudder at all airspeeds. This requires that crosswind and auto land limitations be observed.

Yaw Damping

The yaw damper systems improve turn coordination and dutchroll damping.

The yaw damper INOP light illuminates and the EICAS advisory message L or R YAW DAMPER displays, when a yaw damper is inoperative.

Spoilers

There are six spoiler panels located on the upper wing surface of each wing. 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.

Speedbrake Load Alleviation System

VP-BOQ

The speedbrake load alleviation system may be installed on aircraft with winglets. It can be identified by the addition of a 50% position on the speedbrake lever.

The speedbrake load alleviation system operates in flight when these conditions occur at the same time:

- Flaps are UP
- Gross weight is greater than 154,221 kgs
- Indicated airspeed is greater than 320 knots

If the speedbrake lever is beyond the 50% position, it will automatically move to the 50% position. If the speedbrake lever is DOWN, an attempt to move it past the 50% position will be restricted. In either case, the pilot may override the speedbrake lever restriction by applying additional force to the speedbrake lever.

When gross weight decreases to less than 153,768 kgs or airspeed is reduced to less than 315 knots, the load alleviation system deactivates and speedbrake lever movement is unrestricted.

Spoiler Speedbrake Operation

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

The speedbrakes 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.

VP-BOQ

The speedbrakes are controlled by the speedbrake lever located on the control stand. The speedbrake lever has four marked positions:

- DOWN
- ARMED
- 50%
- UP

On airplanes equipped with the speedbrake load alleviation system, the speedbrake lever can be placed in intermediate positions between ARMED and UP; however, the load alleviation system may limit lever placement to 50% or less.

In the ARMED position, when the landing gear is fully on the ground (not tilted) and the thrust levers are at idle, the speedbrake lever is driven aft to the UP position and the spoiler panels are fully extended.

On the ground, when either reverse thrust lever is moved to the reverse idle detent, the speedbrake lever is driven to the up position and the spoiler panels are fully extended. The speedbrake lever does not need to be in the ARMED position.

The SPEEDBRAKES light illuminates if speedbrakes are extended when radio altitude is 800 feet or below or the flaps are in landing position.

The EICAS caution message SPEEDBRAKES EXT displays and the master caution lights and beeper activate when the SPEEDBRAKES light illuminates.

The AUTO SPDBRK light illuminates and the EICAS advisory message AUTO SPEEDBRAKE displays to indicate a fault is detected in the automatic speedbrake system which may result in the loss of automatic speedbrake extension.

If the speedbrake lever is armed, the message and light indicate a fault which may result in an inadvertent speedbrake extension in flight. The speedbrake lever should be returned to the DOWN position. The speedbrakes can still be operated manually.

VP-BOQ

If the AUTO SPDBRK light illuminates on airplanes equipped with the load alleviation system, do not exceed 320 knots. Increased force may be required to move the speedbrake lever into the UP position during manual operation due to actuation of the load alleviation system.

The SPOILERS light illuminates and the EICAS advisory message SPOILERS displays to indicate that one or more spoiler pairs are inoperative.

Flaps and Slats

The trailing edge flaps and leading edge slats are high lift devices that increase wing lift and decrease stall speed during takeoff, approach, and landing.

Flap and slat positions are indicated by two pointers in the flap position indicator. There are L and R pointers for the left and right wing flaps and slats. The right pointer is normally hidden from view by the left pointer.

In the flaps 1 position, only the slats move. Flaps 5, 15, 20 are takeoff flap positions. Flaps 25 and 30 are landing flap positions. Flaps 20 is used for some non-normal landing conditions.

Flap and Slat Sequencing

When the flap lever is in the UP detent, all flaps and slats are commanded retracted and the flap position indicator points to UP. Moving the flap lever aft allows selection of flap detent positions 1, 5, 15, 20, 25, and 30.

Starting from flaps UP, selection of flaps 1 commands the slats to move to the midrange position. The flaps remain retracted. The position indicator pointers move mid-way between UP and 1 when the slats are in transit. The pointers move to the 1 indication when all slats are in the midrange position.

Selection of the flaps 5, 15, or 20 positions commands the flaps to move to the position selected. The inboard ailerons droop in conjunction with flap extension. The slats remain in the midrange position. The position indicator provides only trailing edge flap position indications for all flap settings greater than 1.

Selection of flaps 25 commands both the flaps and slats to move to landing positions.

Selection of flaps 30 commands the flaps to extend to the primary landing position.

During retraction flap and slat sequencing is reversed.

The flap gate at the flaps 20 detent prevents inadvertent retraction of the flaps past the go-around position. The flap gate at flaps 1 prevents inadvertent retraction of the slats.

Flap Load Relief

The flap load relief system protects the flaps from excessive airloads.

If the flap airspeed placard limit is exceeded with the flaps in the 25 or 30 position, the flaps automatically retract to position 20.

When airspeed is reduced, the flaps automatically re-extend.

Flap/Slat Non-Normal Operation

Alternate Flap Operation

The alternate mode allows direct manual operation of either the flaps and/or slats through electric motors. The alternate flaps switches:

- allow independent selection of either flaps or slats
- disable normal control
- arm the alternate mode
- engage the electric motors
- the flap lever no longer controls the selected flaps and/or slats

The alternate flaps selector extends and retracts the flaps and slats. Alternate mode flap and slat extension is limited procedurally to flaps 20. Flap load relief is not available in the alternate mode.

Trailing edge flap asymmetry protection is not available in the alternate mode.

Slat and flap operation time in the alternate mode is greatly increased.

Leading Edge Disagreement

The LEADING EDGE light illuminates and the EICAS caution message LE SLAT DISAGREE displays when the leading edge slat positions disagree with commanded position.

The disagree indicates that the slats are not driving toward their new commanded position.

A LE SLAT DISAGREE may also occur if the flap lever is not in a detent for an extended period of time. In this case, the light and message can be removed by moving the flap lever to the desired detent.

Leading Edge Asymmetry

The LEADING EDGE light illuminates and the EICAS caution message LE SLAT ASYM displays when the leading edge slats are not symmetrically extended. Hydraulic power to the slats is automatically shut off.

Trailing edge flaps extension is inhibited until the slats extend to position 1. Therefore, if a slat asymmetry occurs between the UP and 1 positions, the flap indicator may not move until flaps 5 or greater is selected.

Trailing Edge Disagreement

The TRAILING EDGE light illuminates and the EICAS caution message TE FLAP DISAGREE displays when the trailing edge flap positions disagree with commanded position.

The disagree indicates that the flaps are not driving toward their new commanded position.

A TE FLAP DISAGREE may also occur if the flap lever is not in a detent for an extended period of time. In this case, the light and message can be removed by moving the flap lever to the desired detent.

Trailing Edge Asymmetry

The TRAILING EDGE light illuminates and the EICAS caution message TE FLAP ASYM displays when the trailing edge flaps are not symmetrically extended. Hydraulic power to the flaps is automatically shut off.

Load Relief Inoperative

The TRAILING EDGE light illuminates and the EICAS advisory message FLAP LD RELIEF is displayed when the flap load relief system fails to operate when required.

Hydraulic Driven Generator

When the hydraulic driven generator is supplying electrical power, hydraulic flow to the slats and flaps is reduced, resulting in increased slat and flap operating time.

**Flight Controls**
EICAS Messages**Chapter 9**
Section 30**Flight Controls EICAS Messages**

The following EICAS messages can be displayed.

Message	Level	Light	Aural	Condition
AILERON LOCKOUT	Advisory	AIL LOCK		An aileron lockout actuator disagrees with the commanded position.
AUTO SPEEDBRAKE	Advisory	AUTO SPDBRK		A fault is detected in the automatic speedbrake system.
FLAP LD RELIEF	Advisory	TRAILING EDGE		The flap load relief system fails to operate when required.
FLT CONT VALS	Advisory	OFF		Two or more flight control valves are closed.
LE SLAT ASYM	Caution	LEADING EDGE	Beeper	The leading edge slats are not symmetrically extended.
LE SLAT DISAGREE	Caution	LEADING EDGE	Beeper	The leading edge slat positions disagree with the commanded position.
RUDDER RATIO	Advisory	RUDDER RATIO		The rudder ratio system is failed.
SPEEDBRAKE S EXT	Caution	SPEED BRAKES	Beeper	The speedbrakes are extended when the flaps are in a landing position, or when radio altitude is 800 feet or below.
SPOILERS	Advisory	SPOILERS		One or more spoiler pairs are inoperative.

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Message	Level	Light	Aural	Condition
STAB TRIM	Advisory	STAB TRIM		The stabilizer trim rate is one-half of the normal control wheel stabilizer trim switch rate.
C TAIL HYD VAL L TAIL HYD VAL R TAIL HYD VAL	Advisory	OFF		A tail flight control valve is closed.
TE FLAP ASYM	Caution	TRAILING EDGE	Beeper	The trailing edge flaps are not symmetrically extended.
TE FLAP DISAGREE	Caution	TRAILING EDGE	Beeper	The trailing edge flap positions disagree with the commanded position.
UNSCHD STAB TRIM	Caution	UNSCHED STAB TRIM	Beeper	Uncommanded stabilizer motion is detected.
C WING HYD VAL L WING HYD VAL R WING HYD VAL	Advisory	OFF		A wing flight control valve is closed.
L YAW DAMPER R YAW DAMPER	Advisory	INOP		The yaw damper is inoperative.

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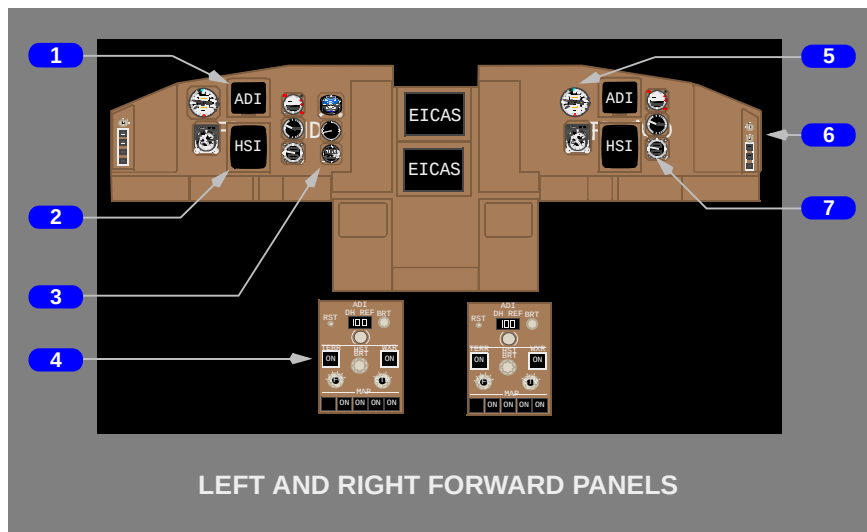
Flight Instruments, Displays

EFIS Controls and Indicators

Chapter 10

Section 10

Flight Instrument Display System - Overview



1 Attitude Director Indicator (ADI)

Displays flight management modes, airspeed, attitude, and radio altitude.

2 Horizontal Situation Indicator (HSI)

Displays map, approach, VOR or plan modes as selected on EFIS CPs.

3 Standby Flight Instruments

4 EFIS Control Panels

Displays controlled via their respective EFIS CP

5 Primary Airspeed Indicator (Conventional)

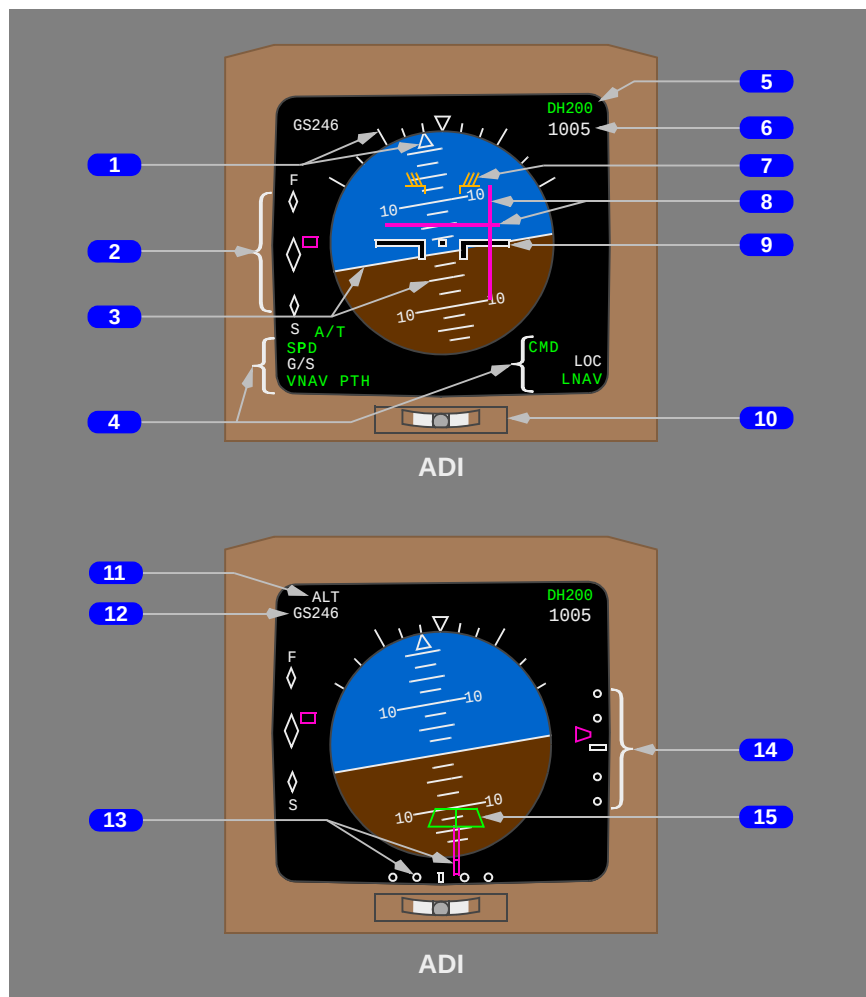
6 Source Selector Panel

Selects sources for respective flight instruments.

7 Primary Flight Instruments (Conventional)

Attitude Director Indicator (ADI) Display

VP-BOY, VP-BOZ



1 Bank Pointer and Scale

Indicates IRS bank in reference to the bank scale.

2 Fast/Slow Indicator**3 Horizon Line and Pitch Angle Scale**

Indicates the IRS horizon relative to the airplane symbol. Pitch scale is in 2.5 degree increments.

4 Flight Mode Annunciations

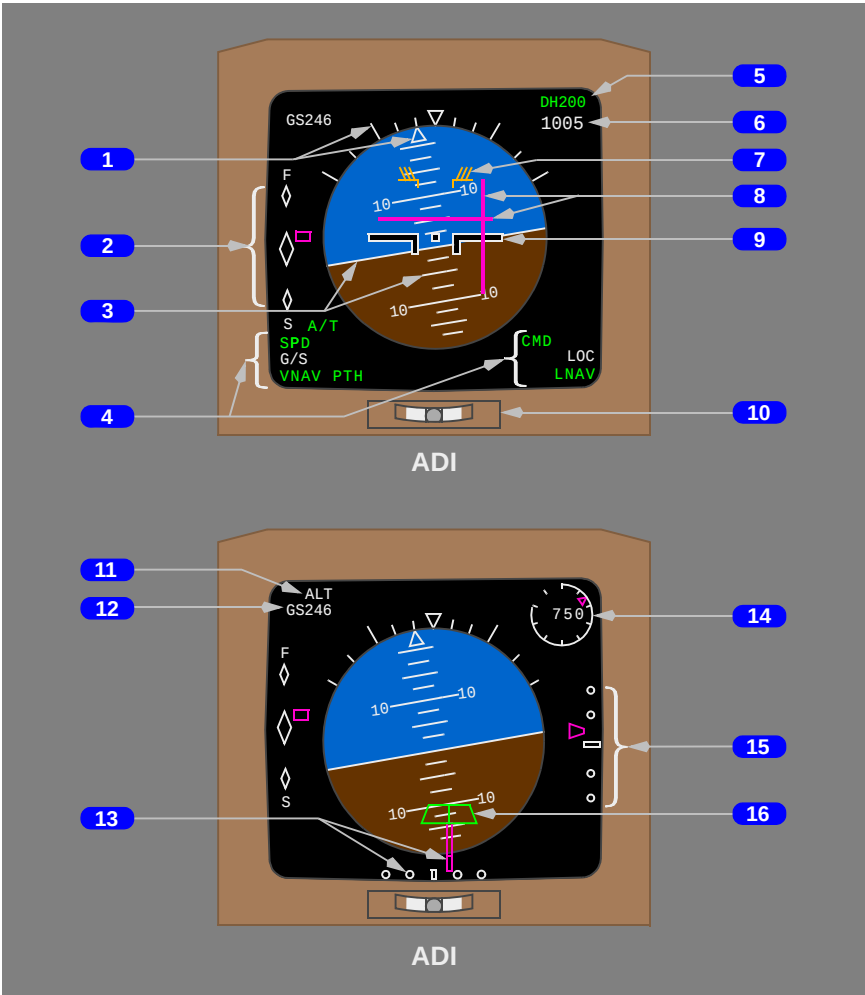
Displays Autopilot Flight Director System (AFDS) mode status. Refer to Automatic Flight, Chapter 4 for description.

5 Decision Height**6 Radio Altitude****7 Pitch Limit Indicator****8 Flight Director Command Bars****9 Airplane Symbol****10 Slip Indicator**

Indicates coordinated flight.

11 Height Alert**12 Ground Speed****13 Localizer Pointer and Deviation Scale****14 Glideslope Pointer and Deviation Scale****15 Rising Runway**

VQ-BMU



1 Bank Pointer and Scale

Indicates IRS bank in reference to the bank scale.

2 Fast/Slow Indicator**3 Horizon Line and Pitch Angle Scale**

Indicates the IRS horizon relative to the airplane symbol. Pitch scale is in 2.5 degree increments.

4 Flight Mode Annunciations

Displays Autopilot Flight Director System (AFDS) mode status. Refer to Automatic Flight, Chapter 4 for description.

5 Decision Height**6 Radio Altitude****7 Pitch Limit Indicator****8 Flight Director Command Bars****9 Airplane Symbol****10 Slip Indicator**

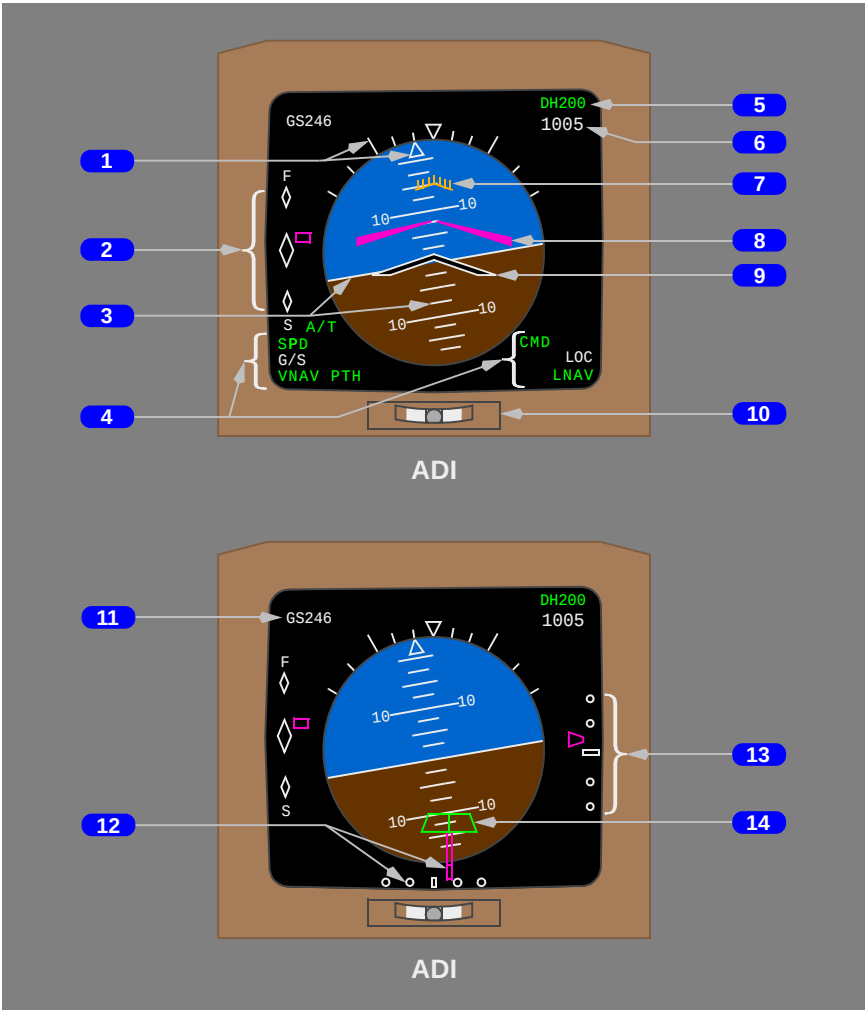
Indicates coordinated flight.

11 Height Alert**12 Ground Speed****13 Localizer Pointer and Deviation Scale****14 Radio Altitude Dial****15 Glideslope Pointer and Deviation Scale****16 Rising Runway**



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(SB Adds VP-BMC with ADI display as illustrated. Refer to ADI Symbology tables for technical changes.)



1 Bank Pointer and Scale

Indicates IRS bank in reference to the bank scale.

2 Fast/Slow Indicator**3 Horizon Line and Pitch Angle Scale**

Indicates the IRS horizon relative to the airplane symbol. Pitch scale is in 2.5 degree increments.

4 Flight Mode Annunciations

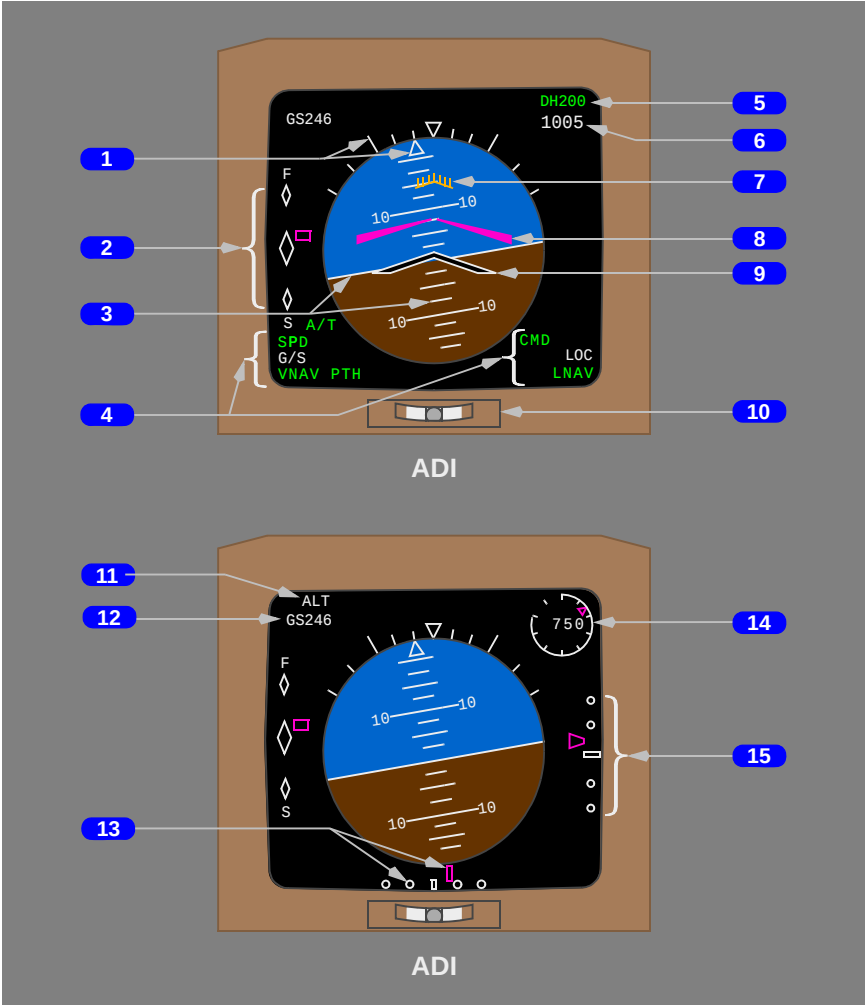
Displays Autopilot Flight Director System (AFDS) mode status. Refer to Automatic Flight, Chapter 4 for description.

5 Decision Height**6 Radio Altitude****7 Pitch Limit Indicator****8 Flight Director Command Bars****9 Airplane Symbol****10 Slip Indicator**

Indicates coordinated flight.

11 Ground Speed**12 Localizer Pointer and Deviation Scale****13 Glideslope Pointer and Deviation Scale****14 Rising Runway**

(SB Deletes VP-BMC with ADI display as illustrated. Refer to ADI Symbology tables for technical changes.)



1 Bank Pointer and Scale

Indicates IRS bank in reference to the bank scale.

2 Fast/Slow Indicator**3 Horizon Line and Pitch Angle Scale**

Indicates the IRS horizon relative to the airplane symbol. Pitch scale is in 2.5 degree increments.

4 Flight Mode Annunciations

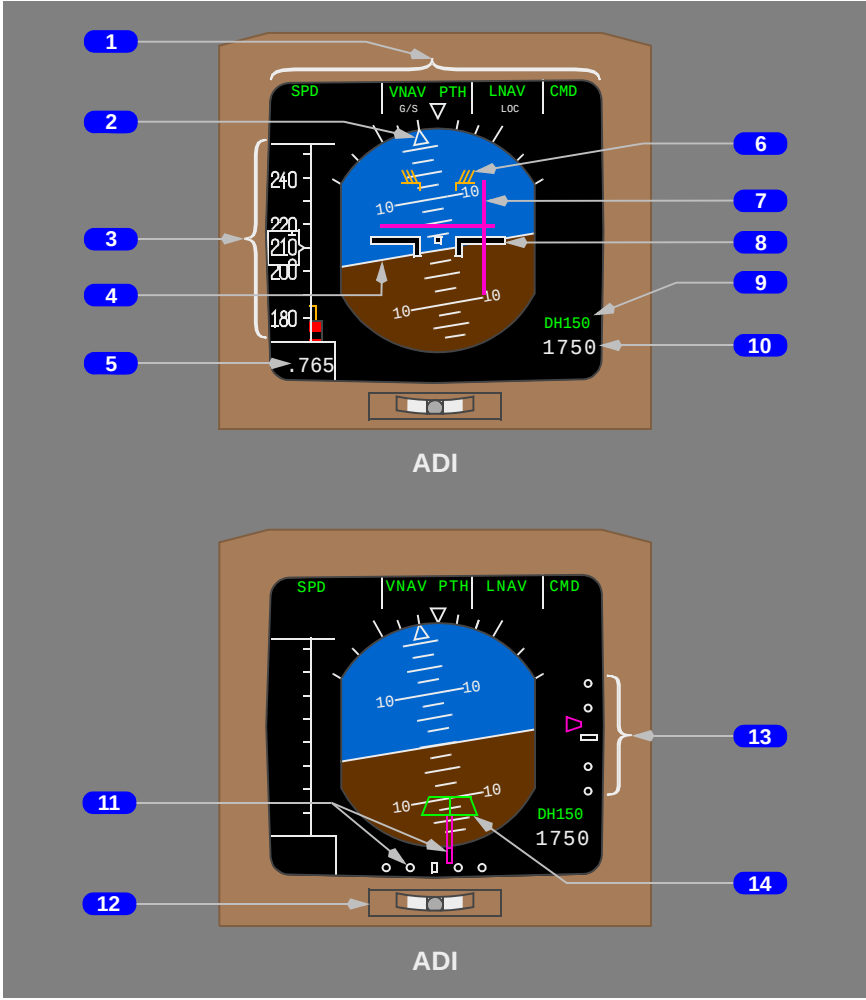
Displays Autopilot Flight Director System (AFDS) mode status. Refer to Automatic Flight, Chapter 4 for description.

5 Decision Height**6 Radio Altitude****7 Pitch Limit Indicator****8 Flight Director Command Bars****9 Airplane Symbol****10 Slip Indicator**

Indicates coordinated flight.

11 Height Alert**12 Ground Speed****13 Localizer Pointer and Deviation Scale****14 Radio Altitude Dial****15 Glideslope Pointer and Deviation Scale**

VP-BRL, VQ-BMQ, VQ-BPT
(SB Deletes VP-BWW, VP-BWX with ADI display as illustrated. Refer to ADI
symbology tables for technical changes.)



1 Flight Mode Annunciations

Displays Autopilot Flight Director System (AFDS) mode status. Refer to Automatic Flight, Chapter 4 for description.

2 Bank Pointer and Scale

Indicates IRS bank in reference to the bank scale.

3 Speed Tape Airspeed Indicator**4 Horizon Line and Pitch Angle Scale**

Indicates the IRS horizon relative to the airplane symbol. Pitch scale is in 2.5 degree increments.

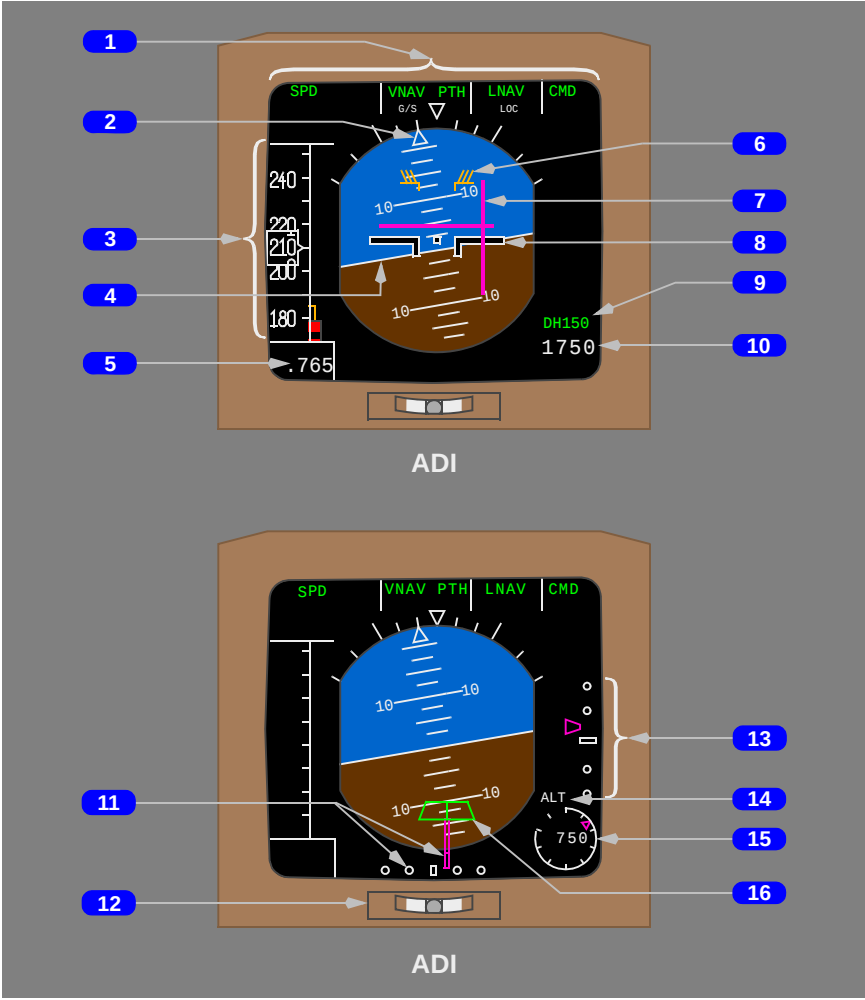
5 Mach Number**6 Pitch Limit Indicator****7 Flight Director Command Bars****8 Airplane Symbol****9 Decision Height****10 Radio Altitude****11 Localizer Pointer and Deviation Scale****12 Slip Indicator**

Indicates coordinated flight.

13 Glideslope Pointer and Deviation Scale**14 Rising Runway**

VP-BDI, VQ-BOG

(SB Adds VP-BWW, VP-BWX with ADI display as illustrated. Refer to ADI symbology tables for technical changes.)



1 Flight Mode Annunciations

Displays Autopilot Flight Director System (AFDS) mode status. Refer to Automatic Flight, Chapter 4 for description.

2 Bank Pointer and Scale

Indicates IRS bank in reference to the bank scale.

3 Speed Tape Airspeed Indicator**4 Horizon Line and Pitch Angle Scale**

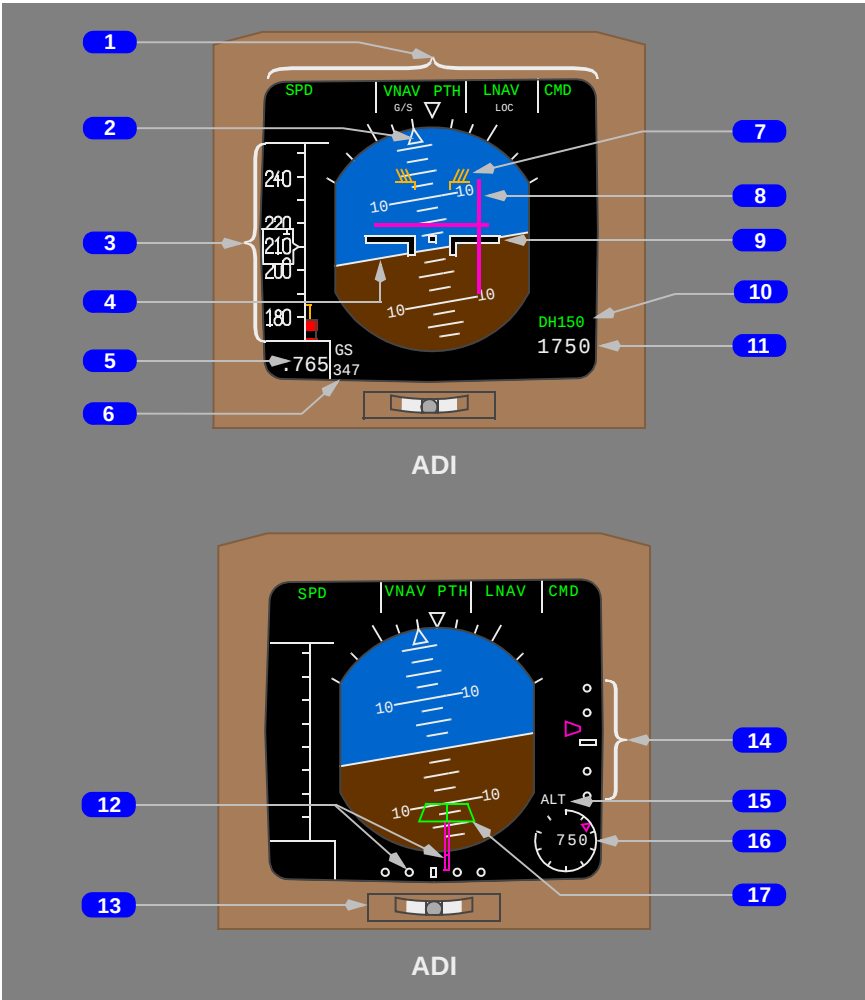
Indicates the IRS horizon relative to the airplane symbol. Pitch scale is in 2.5 degree increments.

5 Mach Number**6 Pitch Limit Indicator****7 Flight Director Command Bars****8 Airplane Symbol****9 Decision Height****10 Radio Altitude****11 Localizer Pointer and Deviation Scale****12 Slip Indicator**

Indicates coordinated flight.

13 Glideslope Pointer and Deviation Scale**14 Height Alert****15 Radio Altitude Dial****16 Rising Runway**

VP-BOQ, VQ-BRA



1 Flight Mode Annunciations

Displays Autopilot Flight Director System (AFDS) mode status. Refer to Automatic Flight, Chapter 4 for description.

2 Bank Pointer and Scale

Indicates IRS bank in reference to the bank scale.

3 Speed Tape Airspeed Indicator**4 Horizon Line and Pitch Angle Scale**

Indicates the IRS horizon relative to the airplane symbol. Pitch scale is in 2.5 degree increments.

5 Mach Number**6 Ground Speed****7 Pitch Limit Indicator****8 Flight Director Command Bars****9 Airplane Symbol****10 Decision Height****11 Radio Altitude****12 Localizer Pointer and Deviation Scale****13 Slip Indicator**

Indicates coordinated flight.

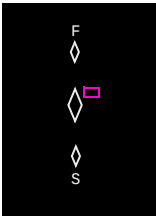
14 Glideslope Pointer and Deviation Scale**15 Height Alert****16 Radio Altitude Dial****17 Rising Runway**

ADI Symbolology

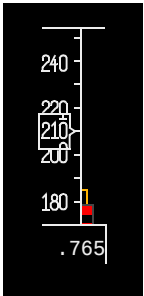
The following symbols can be displayed.

Symbol	Name	Remarks

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

	Fast/Slow airspeed indicator (white) and pointer (magenta)	Displays airspeed information. - indicates deviation from the airspeed selected by the FMC or the IAS/MACH selector, or limit speed - small diamonds indicate 10 knots fast (F), or slow (S).

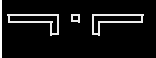
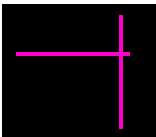
VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

	Speed tape airspeed indicator with rolling digits (white).	Displays airspeed information. Refer to "ADI Speed Tape" in this section for description.

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Symbol	Name	Remarks

VP-BDI, VP-BOQ through VQ-BRA

	Airplane symbol (black)	Indicates airplane attitude with reference to the IRS horizon.
	Flight director command bars (magenta)	Indicates flight director pitch and roll steering commands. VP-BDI, VP-BOQ through VQ-BMQ, VQ-BOG, VQ-BPT - displays when the respective F/D switch is ON and valid command steering is available - blanks when the respective F/D switch is OFF or when command steering becomes invalid. VQ-BMU, VQ-BRA - displays when the respective F/D switch is ON, valid command steering is available, and the selected flight director and autopilot in (CMD) are not the same - blanks when the respective FD switch is OFF, or when command steering becomes invalid, or when the selected flight director and autopilot in (CMD) are the same.

VP-BDI, VP-BOQ through VQ-BRA

	PLI - Pitch Limit Indicator (amber)	Indicates pitch limit (stick shaker activation point for the existing flight conditions). displays when flaps are extended.

Symbol	Name	Remarks

VP-BMC

	Airplane symbol (black)	Indicates airplane attitude with reference to the IRS horizon.
	Flight director command bars (magenta)	Indicates flight director pitch and roll steering commands. • displays when the respective F/D switch is ON and valid command steering is available • blanks when the respective F/D switch is OFF or when command steering becomes invalid.

VP-BMC

	PLI - Pitch Limit Indicator (amber)	Indicates pitch limit (stick shaker activation point for the existing flight conditions). • displays when flaps are extended.



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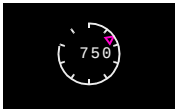
Symbol	Name	Remarks
	Decision height (green/amber)	Displays selected decision height. • blanks when negative decision height is selected VP-BOY through VP-BRL, VQ-BMQ, VQ-BPT (SB Adds VP-BMC with digital radio altitude. SB Deletes VP-BWW, VP-BWX with round dial radio altitude.) • display changes from green to amber, increases in size and “DH” flashes momentarily when airplane descends below decision height (decision height alerting) • decision height alert is reset automatically – if airplane climbs 75 feet or more above the selected decision height, or after the airplane lands • decision height alert is reset manually – if the RST switch is pushed. VP-BDI, VP-BOQ, VQ-BMU, VQ-BOG, VQ-BRA (SB Adds VP-BWW, VP-BWX with round dial radio altitude. SB Deletes VP-BMC with digital radio altitude.) • replaced by dial display below 1,000 feet AGL.

Symbol	Name	Remarks
1005	Radio altitude (white/amber)	Displays radio altitude. - blank above 2500 feet AGL VP-BOY through VP-BRL, VQ-BMQ, VQ-BPT (SB Adds VP-BMC with digital radio altitude. SB Deletes VP-BWW, VP-BWX with round dial radio altitude.) - changes color from white to amber when below selected decision height on descent - changes color from amber back to white when airplane climbs 75 feet or more above the selected decision height, or after the airplane lands - changes color from amber back to white when the RST switch is pushed. VP-BDI, VP-BOQ, VQ-BMU, VQ-BOG, VQ-BRA (SB Adds VP-BWW, VP-BWX with round dial radio altitude. SB Deletes VP-BMC with digital radio altitude.) - changes to dial display below 1,000 feet AGL.

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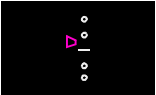
Symbol	Name	Remarks

VP-BDI, VP-BOQ, VQ-BMU, VQ-BOG, VQ-BRA
(SB Adds VP-BWW, VP-BWX with round dial radio altitude.
SB Deletes VP-BMC with round dial radio altitude inhibited.)

	Radio altitude dial (white) and pointer (magenta)	Displays when radio altitude is 1,000 feet AGL or below. - when dial displayed, pointer replaces digital decision height display - dial displays in 100 foot increments - during descent, segments of the dial erase, with remaining dial indicating radio altitude - display changes from white to amber and flashes momentarily when airplane descends below decision height (decision height alerting) - decision height alert is reset automatically – if airplane climbs 75 feet or more above the selected decision height, or after the airplane lands - decision height alert is reset manually – if the RST switch is pushed.

VP-BDI, VP-BOQ through VP-BOZ, VQ-BMU, VQ-BOG, VQ-BRA
(SB Adds VP-BWW, VP-BWX with height alerting.
SB Deletes VP-BMC with height alerting inhibited.)

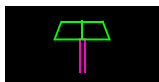
ALT	Height alerting (white)	Indicates airplane has descended through a specified altitude. - blanks if the RST switch is pushed. VP-BOY, VP-BOZ (SB Deletes VP-BMC with revised height alerting.) - displays during descent from 1,000 feet to 500 feet AGL VP-BDI, VP-BOQ, VQ-BMU, VQ-BOG, VQ-BRA (SB Adds VP-BWW, VP-BWX with height alerting at 2,500 feet.) - displays during descent from 2,500 feet to 500 feet AGL

Symbol	Name	Remarks
	Localizer deviation scale (white) and pointer (magenta)	The localizer pointer indicates position relative to the airplane. • scale indicates deviation • pointer not displayed when localizer is unusable • scale and pointer not displayed when an ILS frequency is not selected VP-BDI, VP-BOQ through VQ-BRA • scale and pointer can display an ILS Deviation Alert. VP-BMC, VP-BOY, VP-BOZ, VP-BWW through VQ-BRA • a two dot expanded localizer scale (not shown here) displays when LOC is engaged and deviation is slightly more than one half dot on the four dot scale. VP-BDI, VP-BOQ, VP-BRL • a two dot expanded localizer scale (not shown here) displays when LOC is engaged with an autopilot in CMD, and deviation is slightly more than one half dot on the four dot scale. • expanded scale is more sensitive, with one dot deviation equal to one half dot deviation on the four dot scale
	Glideslope deviation scale (white) and pointer (magenta)	The glideslope pointer indicates glideslope position relative to the airplane. • scale indicates deviation • pointer not displayed when glideslope unusable or when track and the front course on the ILS panel differ by more than 90° • scale and pointer not displayed when an ILS frequency is not selected VP-BDI, VP-BOQ through VQ-BRA • scale and pointer can display an ILS deviation alert.

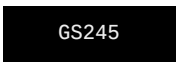
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Symbol	Name	Remarks

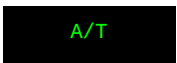
VP-BDI, VP-BOQ through VQ-BRA (SB Adds VP-BMC with rising runway.)

	Rising runway (green)	Displays when the localizer pointer is displayed and radio altitude is below 2500 feet. - rises towards airplane symbol when radio altitude is below 200 feet AGL VP-BDI, VP-BOQ through VQ-BRA - stem can display an ILS deviation alert.

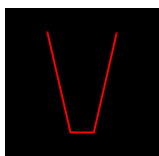
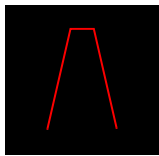
VP-BMC through VP-BOZ, VQ-BMU, VQ-BRA

	Groundspeed (white)	Indicates groundspeed in knots.

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

	Autothrottle (green)	These airplane(s) have A/T annunciated above the thrust mode.

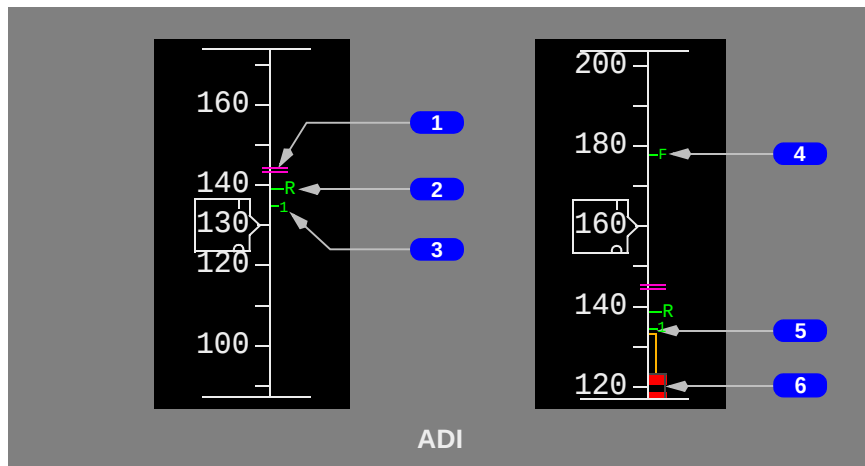
VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

	Vertical guidance (down advisory) (red)	Displayed whenever a TCAS RA is active. Indicates pitch altitude region to be avoided for traffic avoidance maneuver. Refer to Chapter 15, Warning Systems. Note: Both of the TCAS RA pitch commands (above and below) may be displayed at the same time. Note: The area inside the red lines indicates the pitch region to avoid in order to resolve the traffic conflict. The center of the airplane symbol must be outside the red RA pitch command area to ensure traffic avoidance.
	Vertical guidance (up advisory) (red)	

Symbol	Name	Remarks
	Windshear annunciation (Red)	Windshear warning active. Refer to Chapter 15, Warning Systems.

ADI Speed Tape

| VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA



1 FMC/MCP Command Airspeed Bug

Displays when the FMC/MCP command airspeed as selected by the FMC or the IAS/MACH selector is in the displayed range.

2 VR (Rotation Speed) Bug

Indicates rotation speed.

- displays after manual entry on the TAKEOFF REF page
- blanks 2 minutes after takeoff.

3 V1 (Decision Speed) Bug

Indicates Decision Speed

- displays after manual entry on the TAKEOFF REF page
- replaces digital V1 display when V1 speed is within the displayed range
- blanks 2 minutes after takeoff.

4 VF (Maneuvering Speed) Bug

- displays maneuvering speed for existing flap setting
- displays 10 seconds after takeoff

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- if VF is within 4 knots of VR, both VR and V1 bugs are blanked
- blanks above 20,000 feet.

5 Minimum Maneuvering Speed

Top of amber bar indicates minimum maneuvering speed. This airspeed provides:

- 1.3g maneuver capability to stick shaker below approximately 20,000 feet
- 1.3g maneuver capability to low speed buffet (or an alternative approved maneuver capability as preset by maintenance) above approximately 20,000 feet.

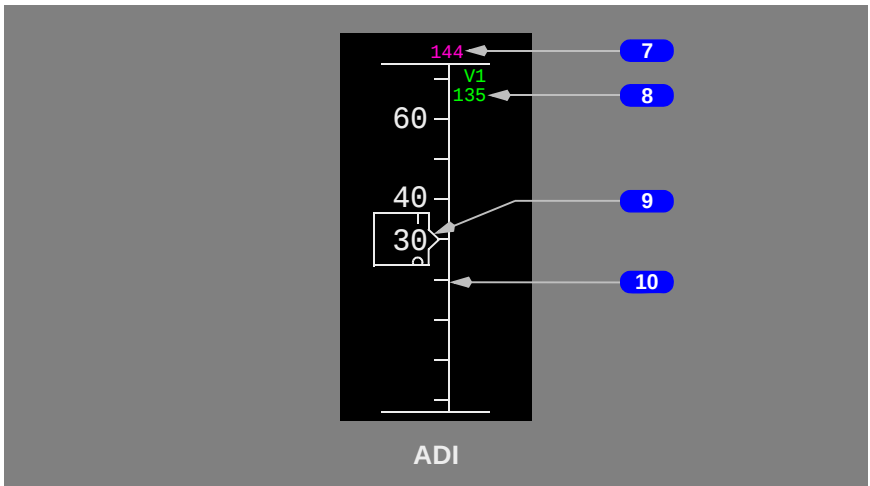
Displayed shortly after takeoff.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

6 Minimum Operating Speed

Indicates the minimum operating speed

- below 20,000 feet - airspeed where stick shaker activates
- above 20,000 feet - airspeed where stick shaker or low speed buffet occurs, whichever is higher.


7 FMC/MCP Command Airspeed

Displays in this location when the FMC/MCP command airspeed bug as selected by the FMC or IAS/MACH selector is above the displayed range.

8 V1 (Decision Speed)

Indicates decision speed.

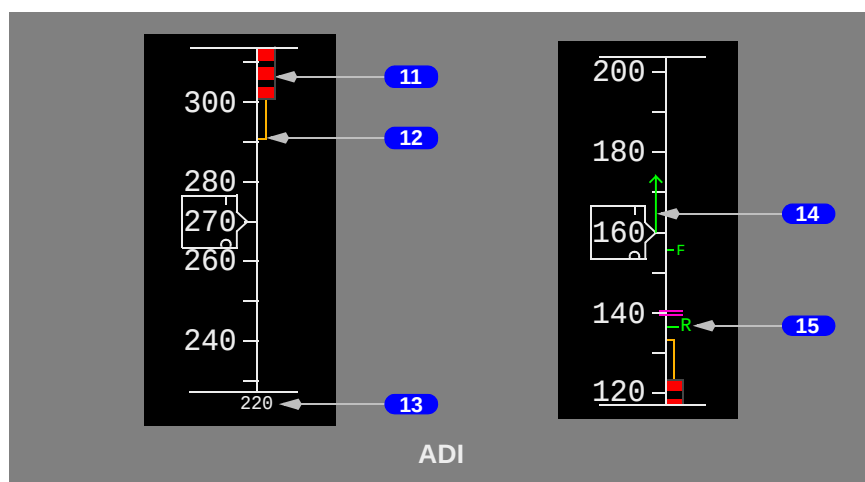
- displays after manual entry on the TAKEOFF REF page
- displays during initial takeoff roll when V1 is above the displayed range.

9 Airspeed Pointer and Digital Display

- indicates current airspeed when above 30 knots

10 Speed Tape Scale

Scrolls up or down in response to airspeed changes.



11 Maximum Speed

Indicates maximum permissible airspeed as limited by the lowest of the following:

- Vmo/Mmo
- landing gear placard speed
- flap placard speed.

12 Maximum Maneuvering Speed

Bottom of the amber bar indicates the maximum maneuvering speed. This airspeed provides 1.3g maneuver capability to high speed buffet (or an alternative approved maneuver capability set by maintenance). May be displayed when operating at high altitude at relatively high gross weights.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.



13 FMC/MCP Command Airspeed

Displayed in this location when the FMC/MCP command airspeed bug is selected by the FMC or IAS/MACH selector is below the displayed range.

14 Speed Trend Vector

Indicates predicted airspeed in 10 seconds based on current acceleration or deceleration.

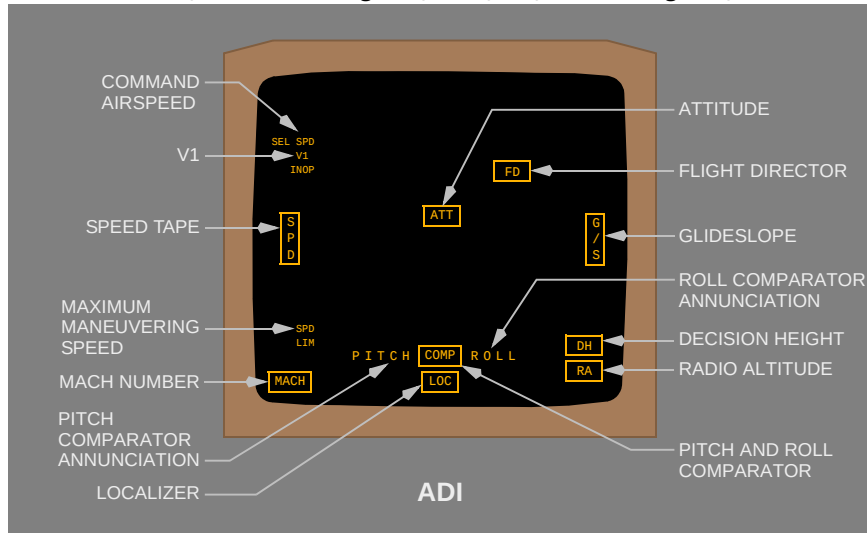
15 Landing Reference Bug

Displays the VREF speed as selected on the APPROACH REF page.

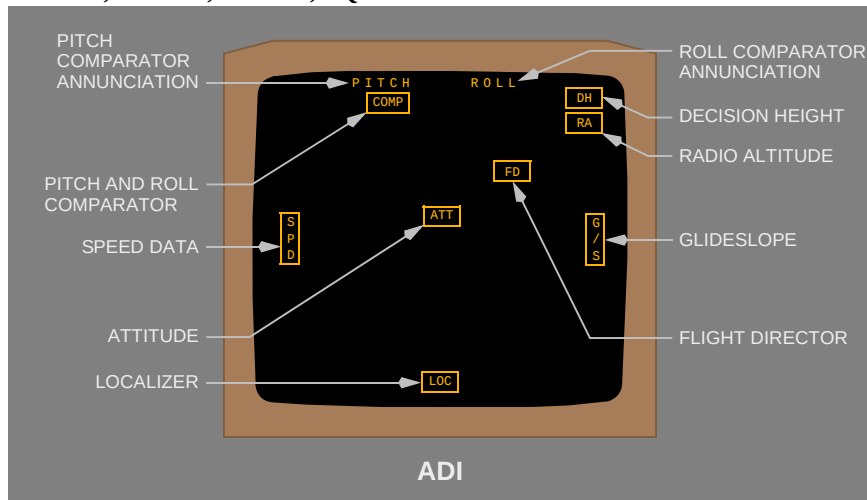
ADI Failure Flags and Annunciations

Note: ADI failure flags replace the appropriate display to indicate source system failure, or lack of computed information.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA



VP-BMC, VP-BOY, VP-BOZ, VQ-BMU





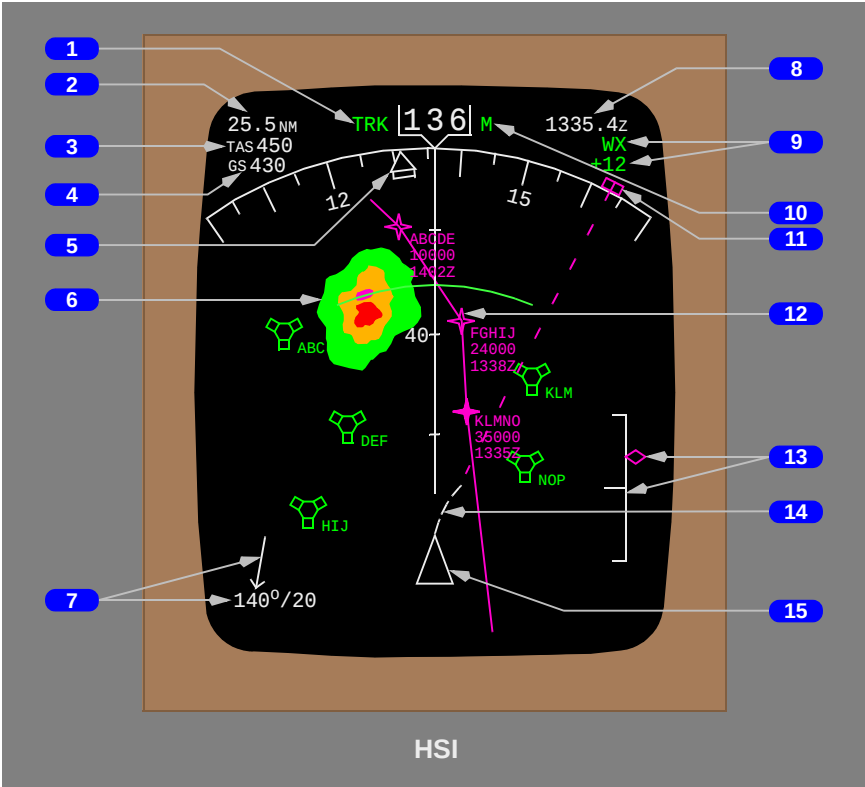
Intentionally
Blank



767 Flight Crew Operations Manual

- 1 Distance to the Active Waypoint**
- 2 Current Track**
- 3 Heading Pointer**
- 4 Weather Radar Returns**
- 5 Wind Direction and Speed**
- 6 Estimated Time of Arrival at the Active Waypoint**
- 7 Weather Radar Annunciations**
- 8 Magnetic/True Reference**
- 9 Selected Heading Bug**
- 10 Active LNAV Route**
- 11 Vertical Pointer and Deviation Scale**
- 12 Position Trend Vector**
- 13 Airplane Symbol**

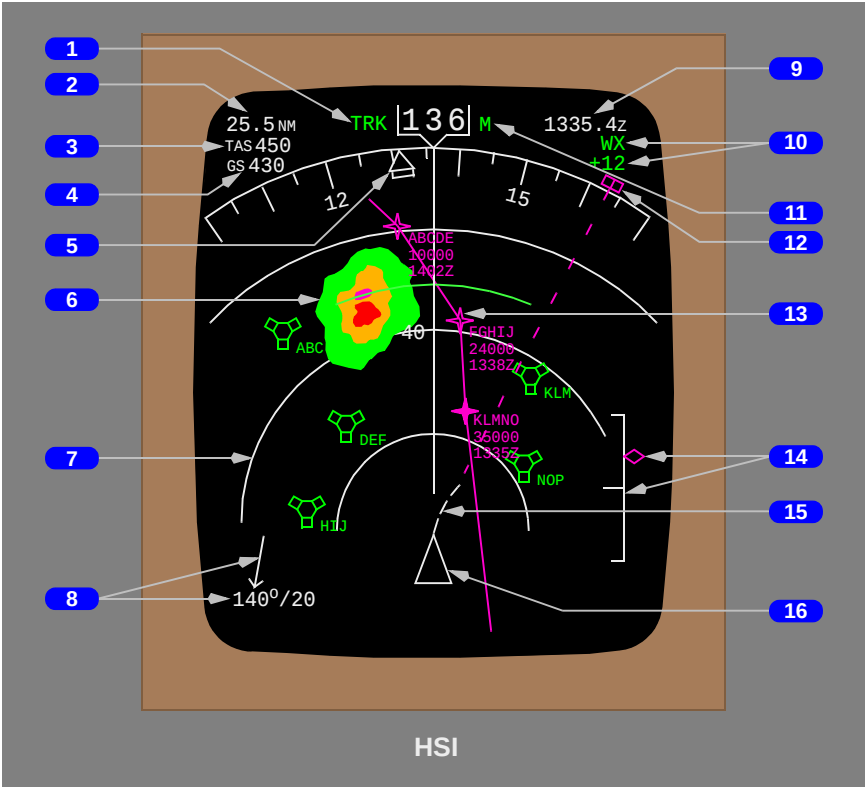
VQ-BMQ, VQ-BOG





- 1** Current Track
- 2** Distance to the Active Waypoint
- 3** True Airspeed
- 4** Groundspeed
- 5** Heading Pointer
- 6** Weather Radar Returns
- 7** Wind Direction and Speed
- 8** Estimated Time of Arrival at the Active Waypoint
- 9** Weather Radar Annunciations
- 10** Magnetic/True Reference
- 11** Selected Heading Bug
- 12** Active LNAV Route
- 13** Vertical Pointer and Deviation Scale
- 14** Position Trend Vector
- 15** Airplane Symbol

VP-BDI

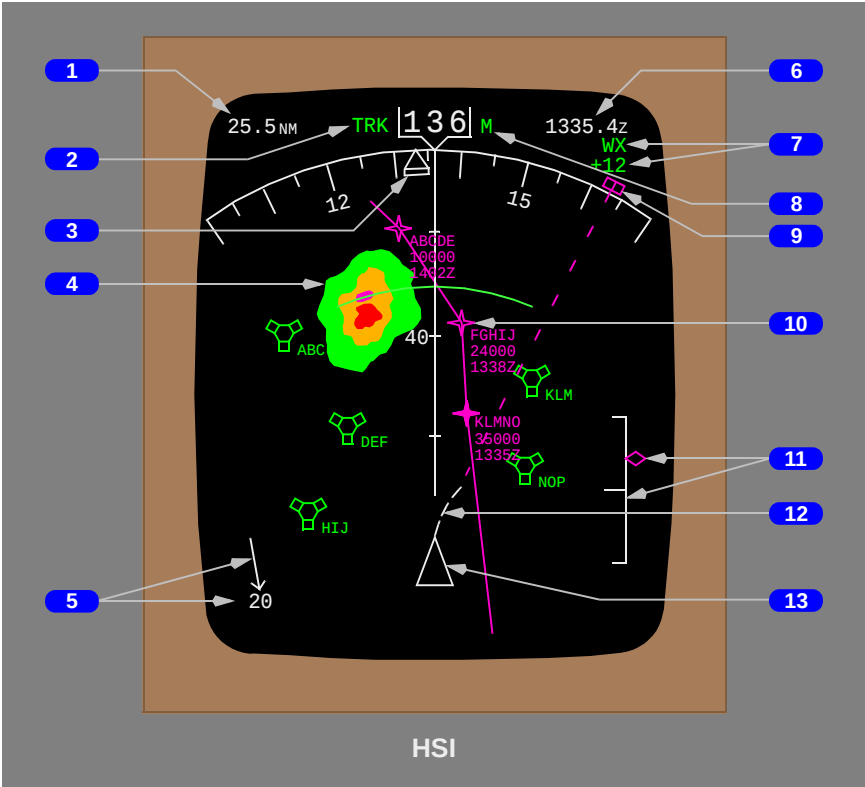




- 1** Current Track
- 2** Distance to the Active Waypoint
- 3** True Airspeed
- 4** Groundspeed
- 5** Heading Pointer
- 6** Weather Radar Returns
- 7** Range Arcs
- 8** Wind Direction and Speed
- 9** Estimated Time of Arrival at the Active Waypoint
- 10** Weather Radar Annunciations
- 11** Magnetic/True Reference
- 12** Selected Heading Bug
- 13** Active LNAV Route
- 14** Vertical Pointer and Deviation Scale
- 15** Position Trend Vector
- 16** Airplane Symbol



VP-BMC, VP-BOY, VP-BOZ

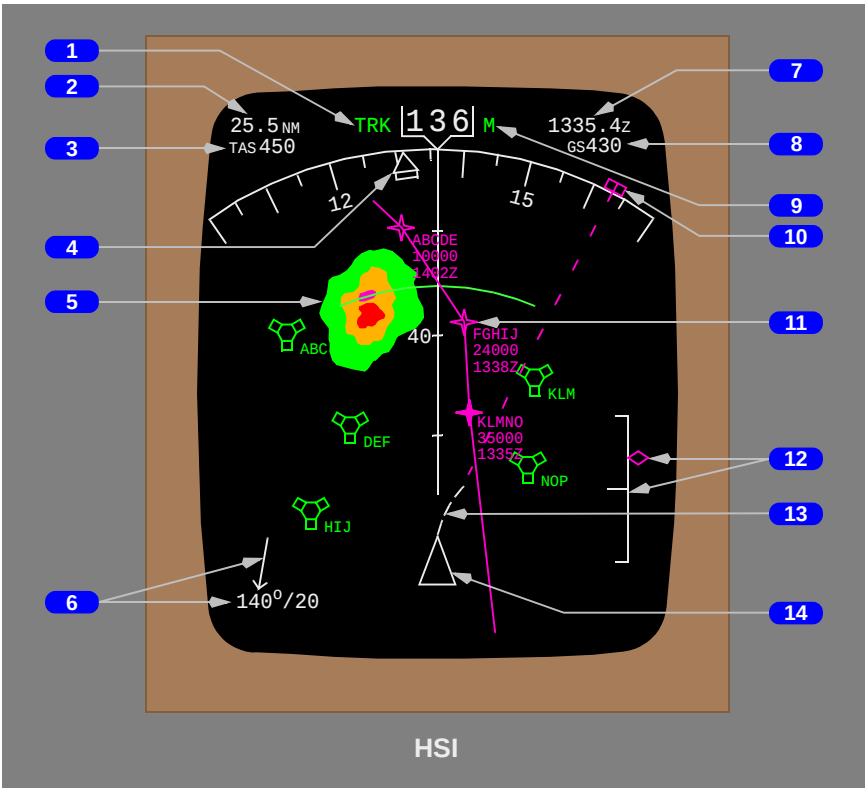




767 Flight Crew Operations Manual

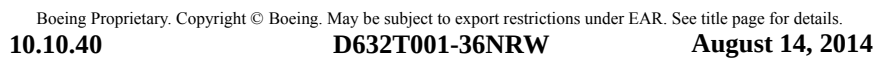
- 1 Distance to the Active Waypoint**
- 2 Current Track**
- 3 Heading Pointer**
- 4 Weather Radar Returns**
- 5 Wind Direction and Speed**
- 6 Estimated Time of Arrival at the Active Waypoint**
- 7 Weather Radar Annunciations**
- 8 Magnetic/True Reference**
- 9 Selected Heading Bug**
- 10 Active LNAV Route**
- 11 Vertical Pointer and Deviation Scale**
- 12 Position Trend Vector**
- 13 Airplane Symbol**

VP-BRL





- 1** Current Track
- 2** Distance to the Active Waypoint
- 3** True Airspeed
- 4** Heading Pointer
- 5** Weather Radar Returns
- 6** Wind Direction and Speed
- 7** Estimated Time of Arrival at the Active Waypoint
- 8** Groundspeed
- 9** Magnetic/True Reference
- 10** Selected Heading Bug
- 11** Active LNAV Route
- 12** Vertical Pointer and Deviation Scale
- 13** Position Trend Vector
- 14** Airplane Symbol



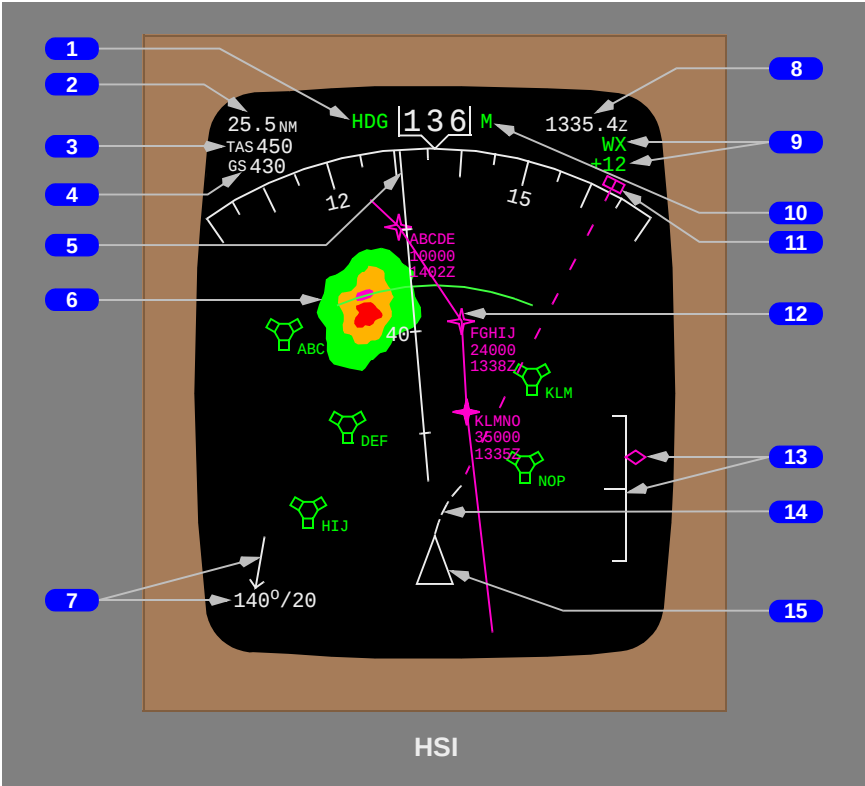


767 Flight Crew Operations Manual

- 1 Distance to the Active Waypoint**
- 2 Current Track**
- 3 Heading Pointer**
- 4 Weather Radar Returns**
- 5 Wind Direction and Speed**
- 6 Estimated Time of Arrival at the Active Waypoint**
- 7 Magnetic/True Reference**
- 8 Selected Heading Bug**
- 9 Active LNAV Route**
- 10 Vertical Pointer and Deviation Scale**
- 11 Position Trend Vector**
- 12 Airplane Symbol**



VQ-BPT
(SB Deletes VP-BWW, VP-BWX with HSI display as illustrated.)

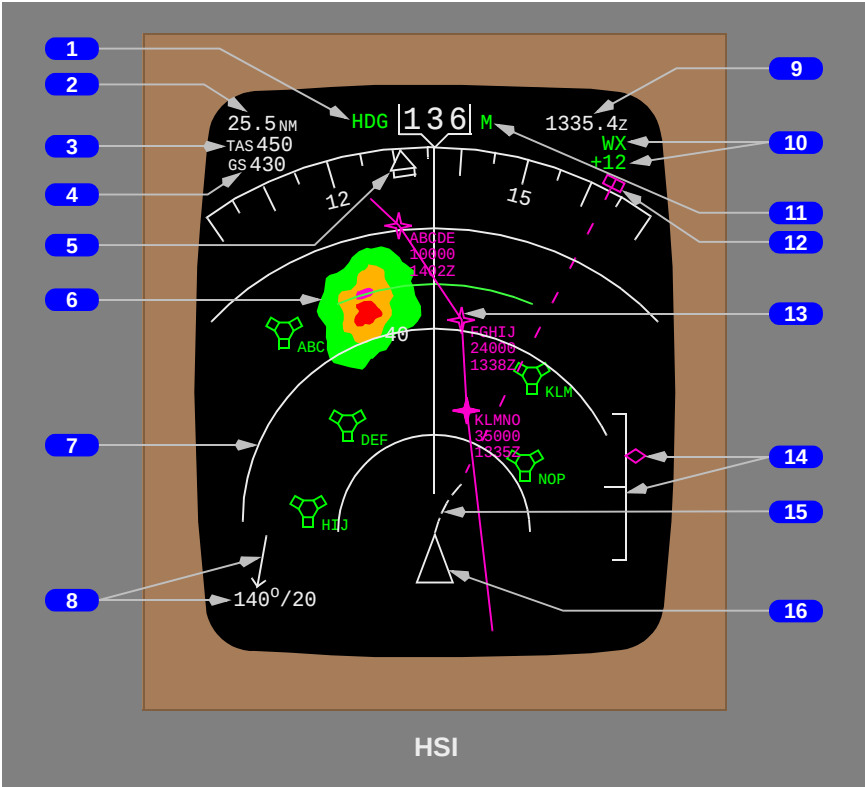




- 1** Current Heading
- 2** Distance to the Active Waypoint
- 3** True Airspeed
- 4** Groundspeed
- 5** Track Line
- 6** Weather Radar Returns
- 7** Wind Direction and Speed
- 8** Estimated Time of Arrival at the Active Waypoint
- 9** Weather Radar Annunciations
- 10** Magnetic/True Reference
- 11** Selected Heading Bug
- 12** Active LNAV Route
- 13** Vertical Pointer and Deviation Scale
- 14** Position Trend Vector
- 15** Airplane Symbol



(SB Adds VP-BWW, VP-BWX with HSI display as illustrated.)



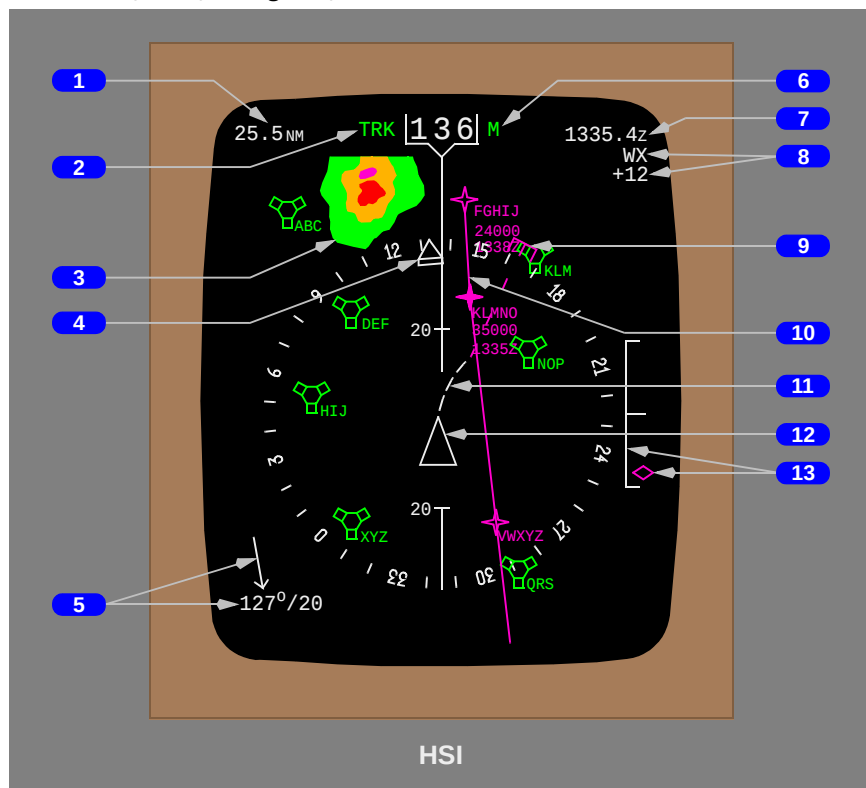


- 1** Current Heading
- 2** Distance to the Active Waypoint
- 3** True Airspeed
- 4** Groundspeed
- 5** Heading Pointer
- 6** Weather Radar Returns
- 7** Range Arcs
- 8** Wind Direction and Speed
- 9** Estimated Time of Arrival at the Active Waypoint
- 10** Weather Radar Annunciations
- 11** Magnetic/True Reference
- 12** Selected Heading Bug
- 13** Active LNAV Route
- 14** Vertical Pointer and Deviation Scale
- 15** Position Trend Vector
- 16** Airplane Symbol

CTR MAP Mode

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

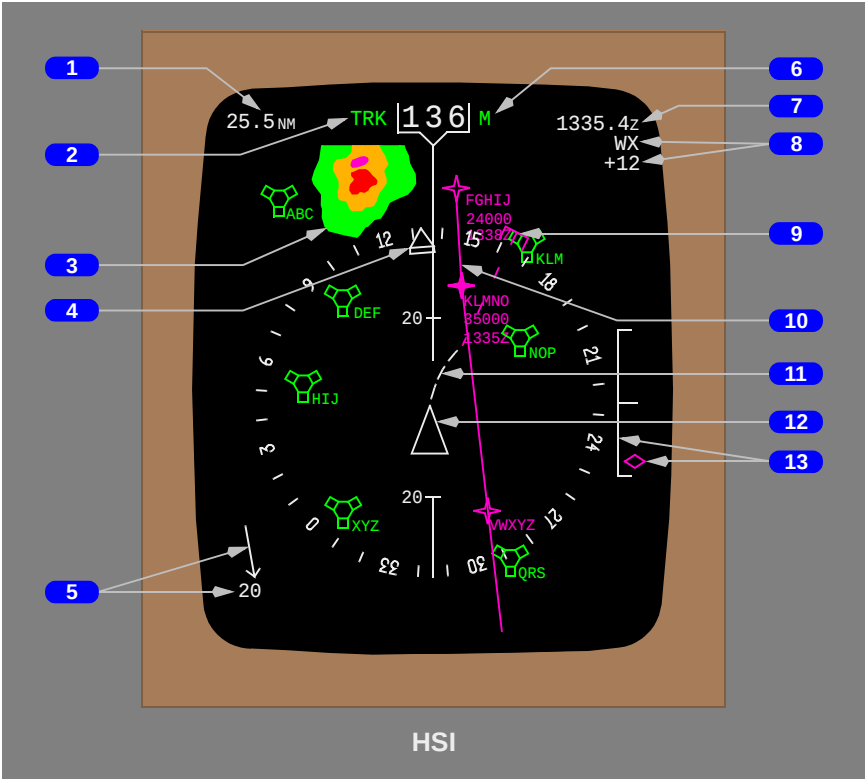
VP-BDI, VQ-BMQ through VQ-BOG





- 1 Distance to the Active Waypoint**
- 2 Current Track**
- 3 Weather Radar Returns**
- 4 Heading Pointer**
- 5 Wind Direction and Speed**
- 6 Magnetic/True Reference**
- 7 Estimated Time of Arrival at the Active Waypoint**
- 8 Weather Radar Annunciations**
- 9 Selected Heading Bug**
- 10 Active LNAV Route**
- 11 Position Trend Vector**
- 12 Airplane Symbol**
- 13 Vertical Pointer and Deviation Scale**

VP-BMC





- 1 Distance to the Active Waypoint**
- 2 Current Track**
- 3 Weather Radar Returns**
- 4 Heading Pointer**
- 5 Wind Direction and Speed**
- 6 Magnetic/True Reference**
- 7 Estimated Time of Arrival at the Active Waypoint**
- 8 Weather Radar Annunciations**
- 9 Selected Heading Bug**
- 10 Active LNAV Route**
- 11 Position Trend Vector**
- 12 Airplane Symbol**
- 13 Vertical Pointer and Deviation Scale**

VP-BWW, VP-BWX, VQ-BPT



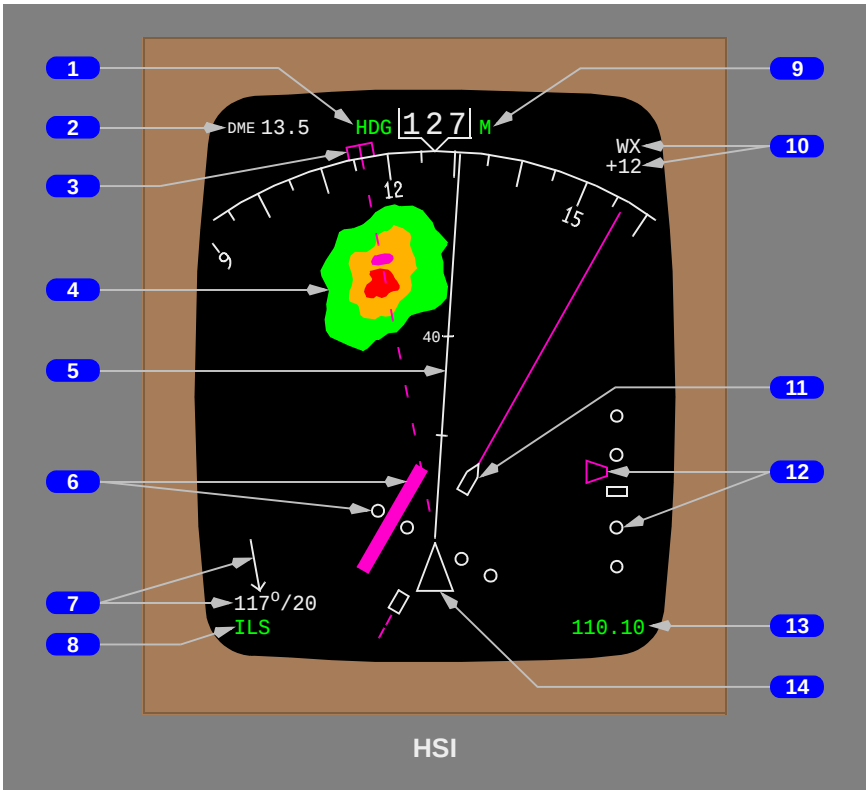


- 1** Current Heading
- 2** Distance to the Active Waypoint
- 3** True Airspeed
- 4** Groundspeed
- 5** Weather Radar Returns
- 6** Track Line
- 7** Wind Direction and Speed
- 8** Magnetic/True Reference
- 9** Estimated Time of Arrival at the Active Waypoint
- 10** Weather Radar Annunciations
- 11** Selected Heading Bug
- 12** Active LNAV Route
- 13** Position Trend Vector
- 14** Airplane Symbol
- 15** Vertical Pointer and Deviation Scale

VP-BOQ through VP-BRL, VQ-BRA
EXP ILS Mode

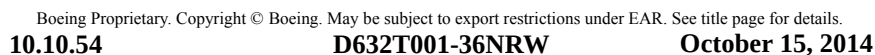
VP-BDI, VP-BMC, VP-BWW through VQ-BPT
APP Mode

VP-BOQ, VQ-BMU





- 1** Current Heading
- 2** Reference ILS DME
- 3** Selected Heading Bug
- 4** Weather Radar Returns
- 5** Track Line
- 6** Course Deviation Indicator and Deviation Scale
- 7** Wind Direction and Speed
- 8** Reference ILS Receiver
- 9** Magnetic/True Reference
- 10** Weather Radar Annunciations
- 11** Selected Course Pointer
- 12** Glideslope Pointer and Deviation Scale
- 13** Reference ILS Frequency
- 14** Airplane Symbol

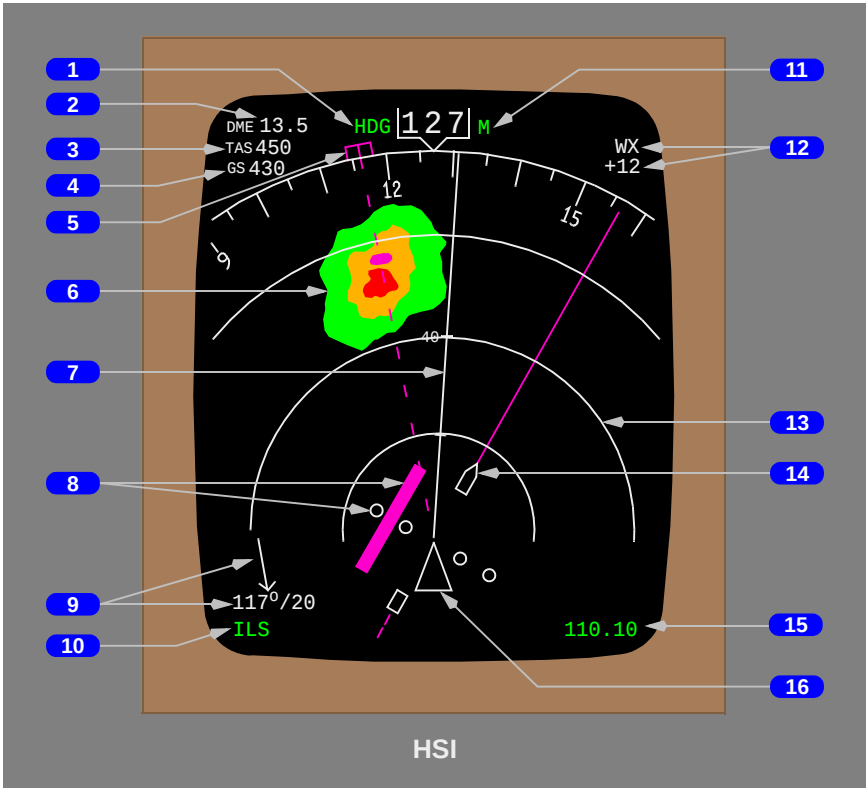




- 1** Current Heading
- 2** Reference ILS DME
- 3** True Airspeed
- 4** Groundspeed
- 5** Selected Heading Bug
- 6** Weather Radar Returns
- 7** Track Line
- 8** Course Deviation Indicator and Deviation Scale
- 9** Wind Direction and Speed
- 10** Reference ILS Receiver
- 11** Magnetic/True Reference
- 12** Weather Radar Annunciations
- 13** Selected Course Pointer
- 14** Glideslope Pointer and Deviation Scale
- 15** Reference ILS Frequency
- 16** Airplane Symbol



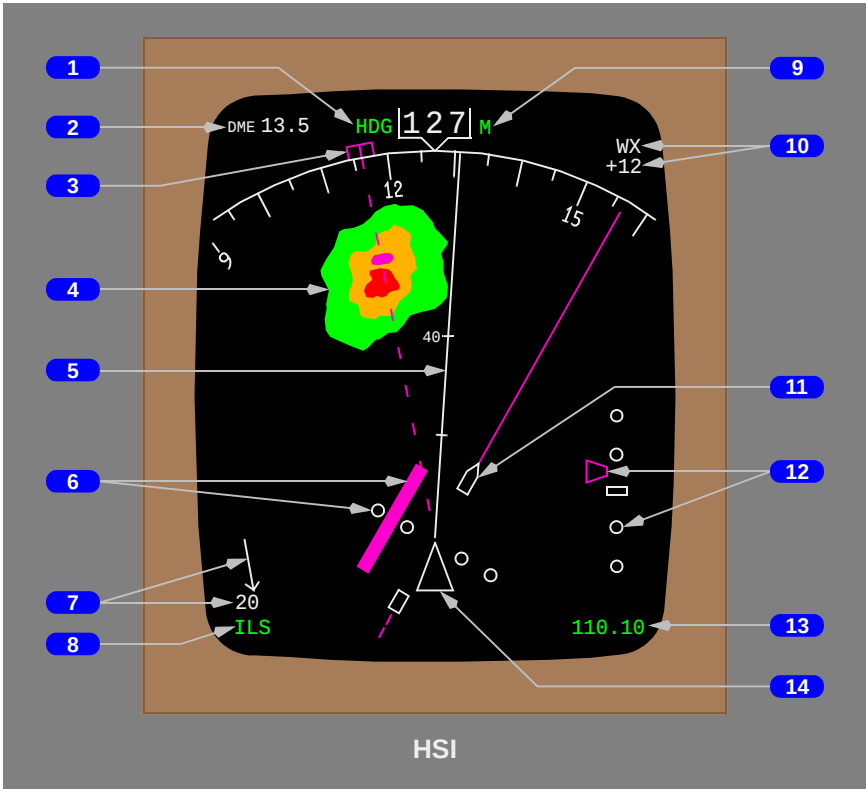
VP-BDI
(SB Adds VP-BWW, VP-BWX with HSI display as illustrated.)





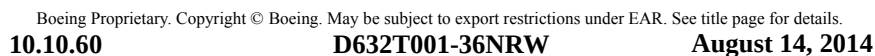
- 1** Current Heading
- 2** Reference VOR DME
- 3** True Airspeed
- 4** Groundspeed
- 5** Selected Heading Bug
- 6** Weather Radar Returns
- 7** Track Line
- 8** Course Deviation Indicator and Deviation Scale
- 9** Wind Direction and Speed
- 10** Reference ILS Receiver
- 11** Magnetic/True Reference
- 12** Weather Radar Annunciations
- 13** Range Arcs
- 14** Selected Course Pointer
- 15** Reference ILS Frequency
- 16** Airplane Symbol

VP-BMC, VP-BOY, VP-BOZ





- 1** Current Heading
- 2** Reference ILS DME
- 3** Selected Heading Bug
- 4** Weather Radar Returns
- 5** Track Line
- 6** Course Deviation Indicator and Deviation Scale
- 7** Wind Direction and Speed
- 8** Reference ILS Receiver
- 9** Magnetic/True Reference
- 10** Weather Radar Annunciations
- 11** Selected Course Pointer
- 12** Glideslope Pointer and Deviation Scale
- 13** Reference ILS Frequency
- 14** Airplane Symbol

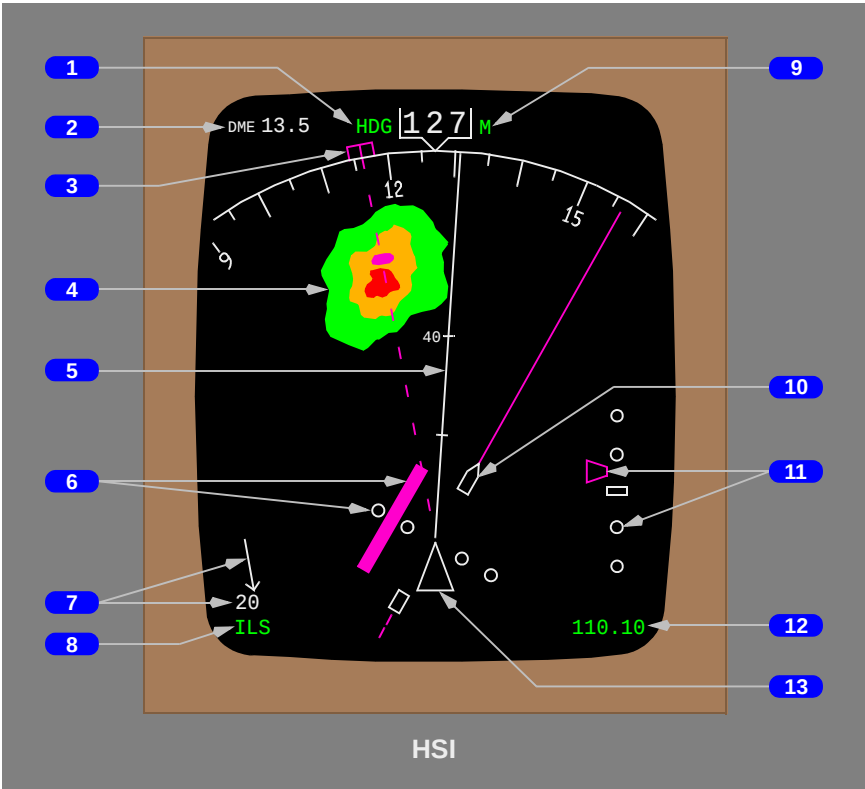




- 1** Current Heading
- 2** Reference ILS DME
- 3** True Airspeed
- 4** Selected Heading Bug
- 5** Weather Radar Returns
- 6** Track Line
- 7** Course Deviation Indicator and Deviation Scale
- 8** Wind Direction and Speed
- 9** Reference ILS Receiver
- 10** Magnetic/True Reference
- 11** Groundspeed
- 12** Selected Course Pointer
- 13** Glideslope Pointer and Deviation Scale
- 14** Reference ILS Frequency
- 15** Airplane Symbol



VQ-BRA



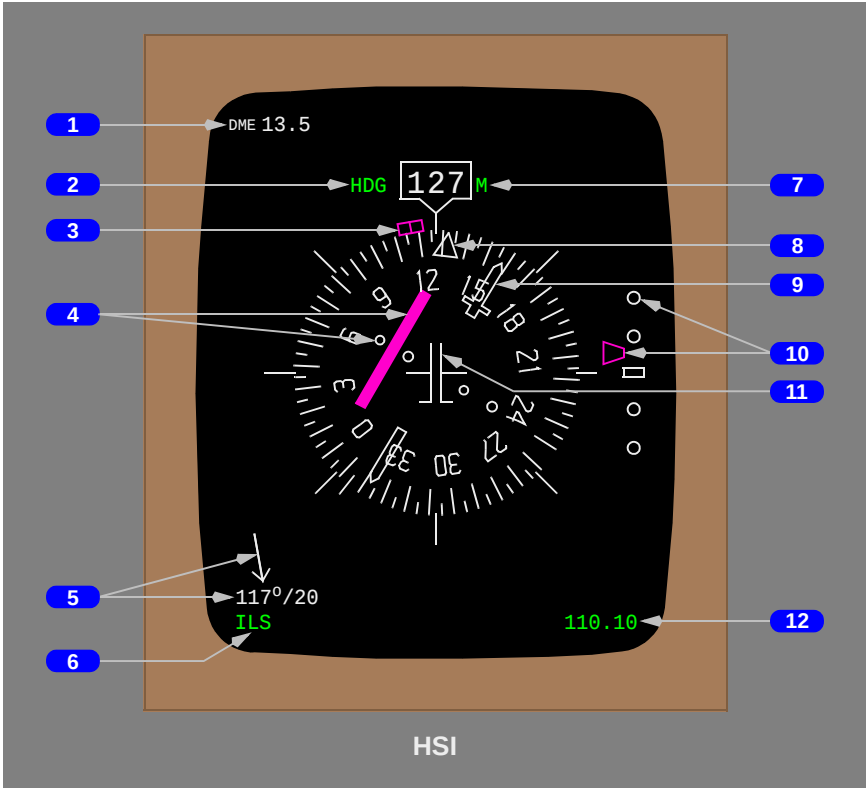


- 1** Current Heading
- 2** Reference ILS DME
- 3** Selected Heading Bug
- 4** Weather Radar Returns
- 5** Track Line
- 6** Course Deviation Indicator and Deviation Scale
- 7** Wind Direction and Speed
- 8** Reference ILS Receiver
- 9** Magnetic/True Reference
- 10** Selected Course Pointer
- 11** Glideslope Pointer and Deviation Scale
- 12** Reference ILS Frequency
- 13** Airplane Symbol

VP-BOQ through VP-BRL, VQ-BRA
FULL ILS Mode

VP-BDI, VP-BMC, VP-BWW through VQ-BPT
CTR APP Mode

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT



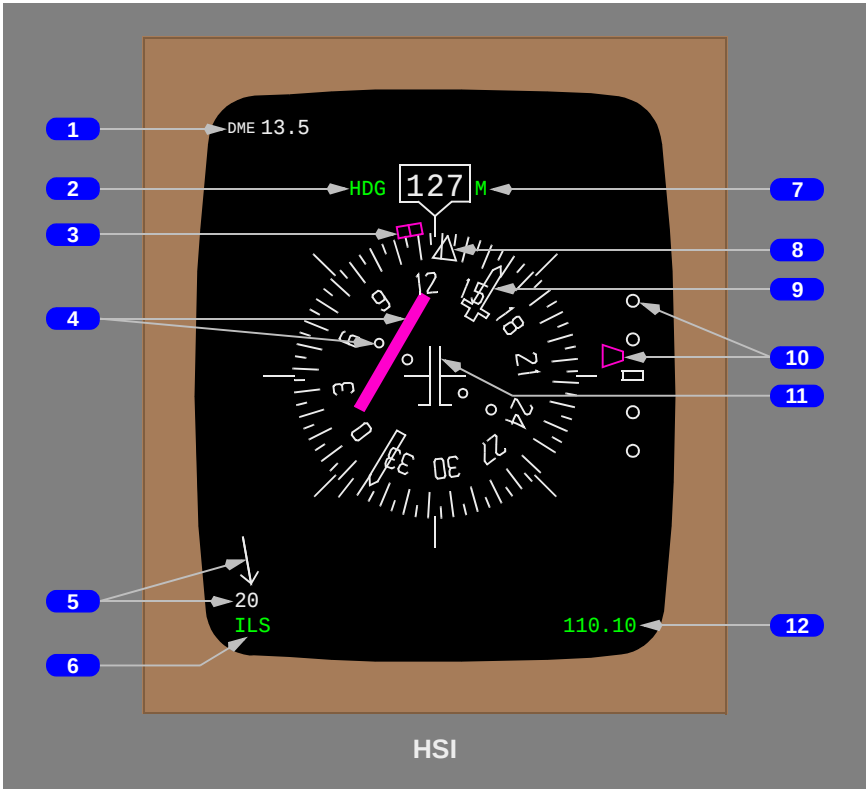


767 Flight Crew Operations Manual

- 1** Reference ILS DME
- 2** Current Heading
- 3** Selected Heading Bug
- 4** Course Deviation Indicator and Deviation Scale
- 5** Wind Direction and Speed
- 6** Reference ILS Receiver
- 7** Magnetic/True Reference
- 8** Drift Angle Pointer
- 9** Selected Course Pointer
- 10** Glideslope Pointer and Deviation Scale
- 11** Airplane Symbol
- 12** Reference ILS Frequency



VP-BMC, VP-BOY, VP-BOZ, VQ-BRA



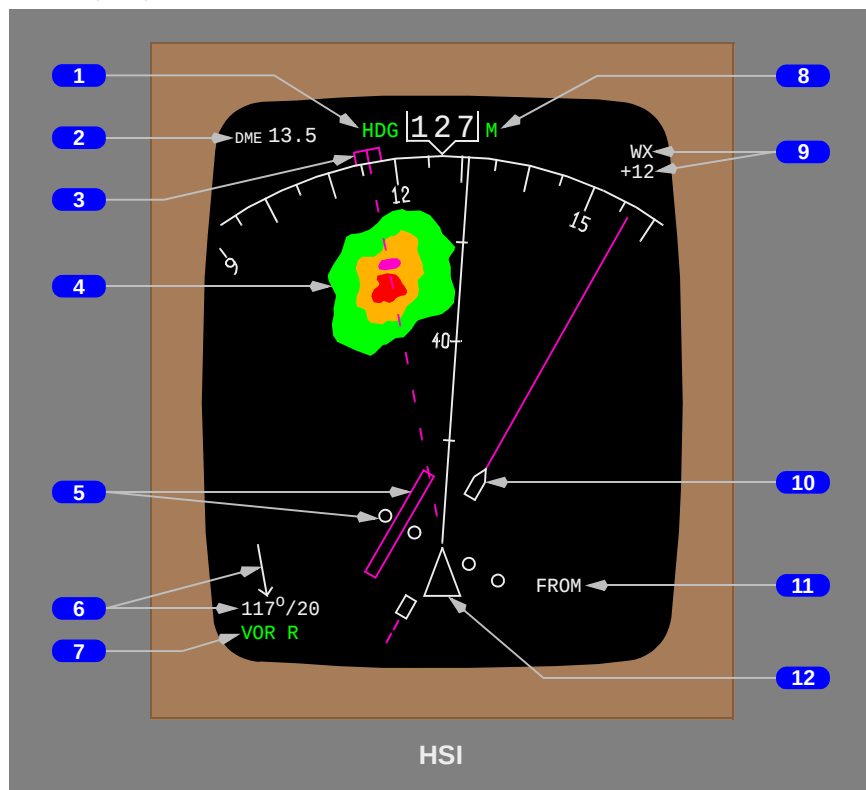


- 1** Reference ILS DME
- 2** Current Heading
- 3** Selected Heading Bug
- 4** Course Deviation Indicator and Deviation Scale
- 5** Wind Direction and Speed
- 6** Reference ILS Receiver
- 7** Magnetic/True Reference
- 8** Drift Angle Pointer
- 9** Selected Course Pointer
- 10** Glideslope Pointer and Deviation Scale
- 11** Airplane Symbol
- 12** Reference ILS Frequency

VP-BDI, VP-BMC, VP-BWW through VQ-BPT VOR Mode

VP-BOQ through VP-BRL, VQ-BRA EXP VOR Mode

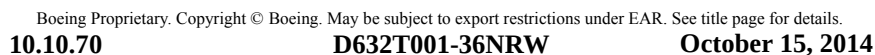
VP-BOQ, VQ-BMU





767 Flight Crew Operations Manual

- 1** Current Heading
- 2** Reference VOR DME
- 3** Selected Heading Bug
- 4** Weather Radar Returns
- 5** Course Deviation Indicator and Deviation Scale
- 6** Wind Direction and Speed
- 7** Reference VOR Receiver
- 8** Magnetic/True Reference
- 9** Weather Radar Annunciations
- 10** Selected Course Pointer
- 11** TO/FROM Indication
- 12** Airplane Symbol





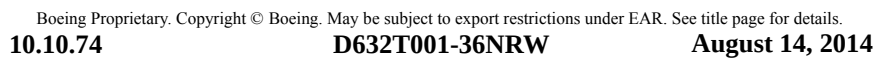
767 Flight Crew Operations Manual

- 1** Current Heading
- 2** Reference VOR DME
- 3** True Airspeed
- 4** Groundspeed
- 5** Selected Heading Bug
- 6** Weather Radar Returns
- 7** Track Line
- 8** Course Deviation Indicator and Deviation Scale
- 9** Wind Direction and Speed
- 10** Reference VOR Receiver
- 11** Magnetic/True Reference
- 12** Weather Radar Annunciations
- 13** Selected Course Pointer
- 14** TO/FROM Indication
- 15** Airplane Symbol





- 1** Current Heading
- 2** Reference VOR DME
- 3** True Airspeed
- 4** Groundspeed
- 5** Selected Heading Bug
- 6** Weather Radar Returns
- 7** Track Line
- 8** Course Deviation Indicator and Deviation Scale
- 9** Wind Direction and Speed
- 10** Reference VOR Receiver
- 11** Magnetic/True Reference
- 12** Weather Radar Annunciations
- 13** Range Arcs
- 14** Selected Course Pointer
- 15** TO/FROM Indication
- 16** Airplane Symbol

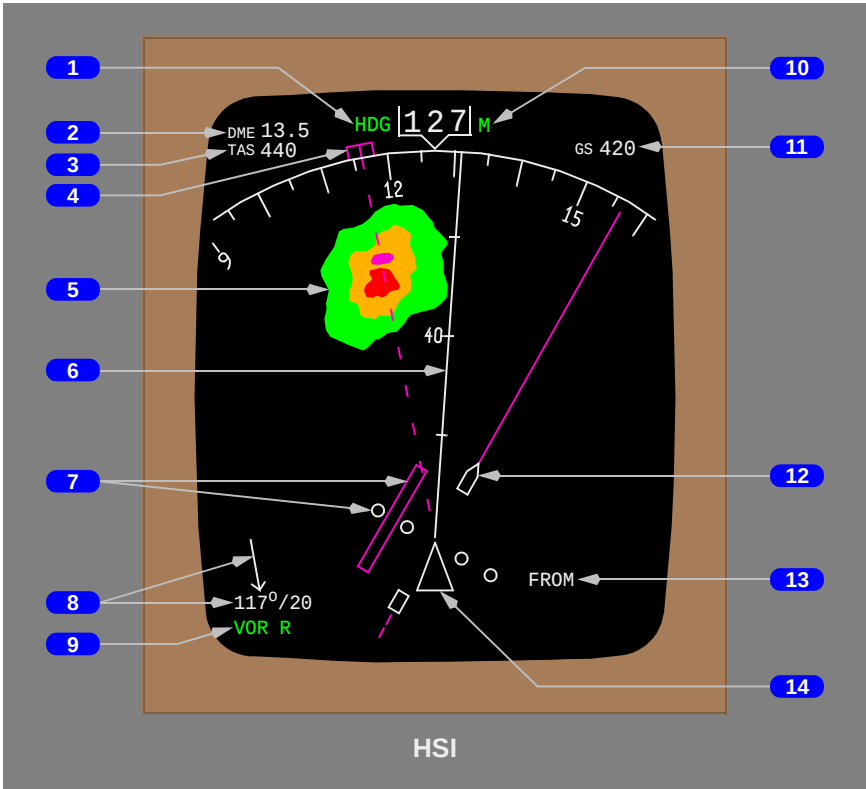




767 Flight Crew Operations Manual

- 1** Current Heading
- 2** Reference VOR DME
- 3** Selected Heading Bug
- 4** Weather Radar Returns
- 5** Course Deviation Indicator and Deviation Scale
- 6** Wind Direction and Speed
- 7** Reference VOR Receiver
- 8** Magnetic/True Reference
- 9** Weather Radar Annunciations
- 10** Selected Course Pointer
- 11** TO/FROM Indication
- 12** Airplane Symbol

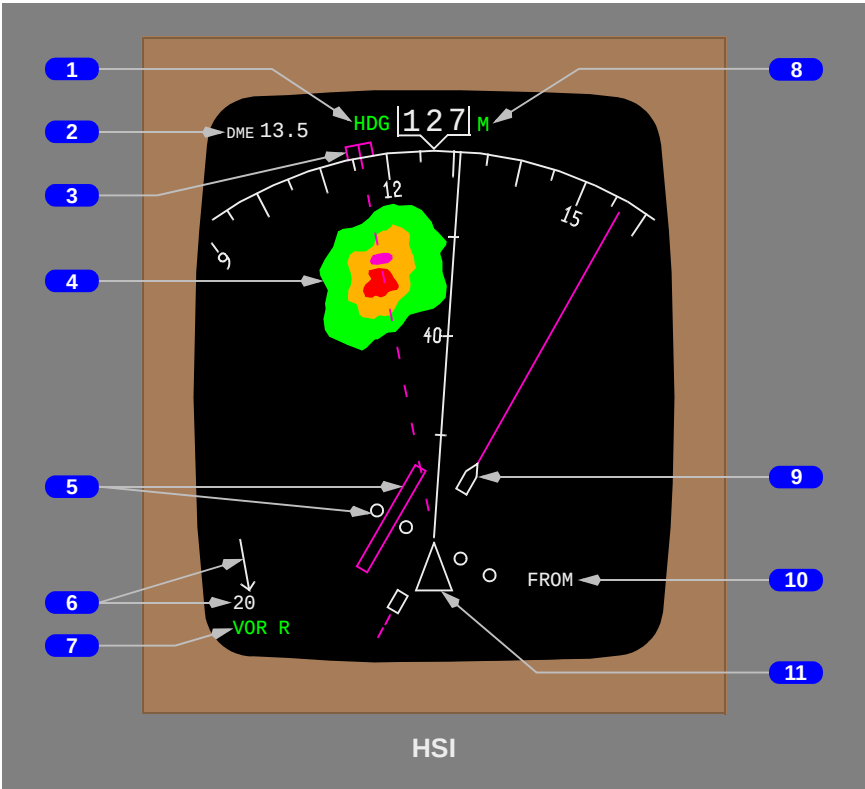
VP-BRL





- 1** Current Heading
- 2** Reference VOR DME
- 3** True Airspeed
- 4** Selected Heading Bug
- 5** Weather Radar Returns
- 6** Track Line
- 7** Course Deviation Indicator and Deviation Scale
- 8** Wind Direction and Speed
- 9** Reference VOR Receiver
- 10** Magnetic/True Reference
- 11** Groundspeed
- 12** Selected Course Pointer
- 13** TO/FROM Indication
- 14** Airplane Symbol

VQ-BRA



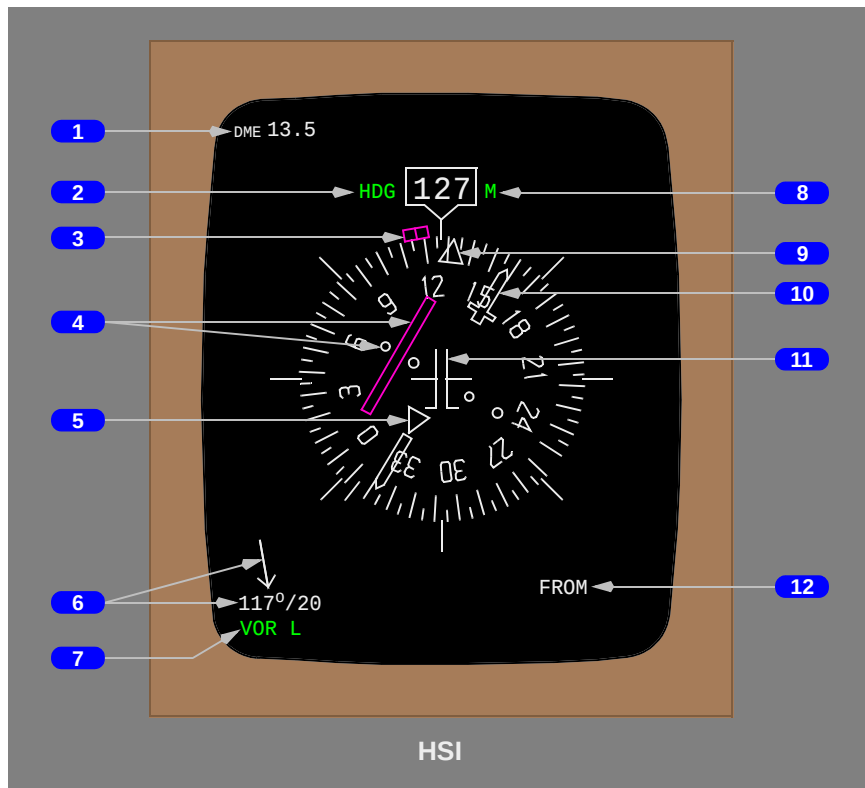


- 1** Current Heading
- 2** Reference VOR DME
- 3** Selected Heading Bug
- 4** Weather Radar Returns
- 5** Course Deviation Indicator and Deviation Scale
- 6** Wind Direction and Speed
- 7** Reference VOR Receiver
- 8** Magnetic/True Reference
- 9** Selected Course Pointer
- 10** TO/FROM Indication
- 11** Airplane Symbol

VP-BOQ through VP-BRL, VQ-BRA FULL VOR Mode

VP-BDI, VP-BMC, VP-BWW through VQ-BPT CTR VOR Mode

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT



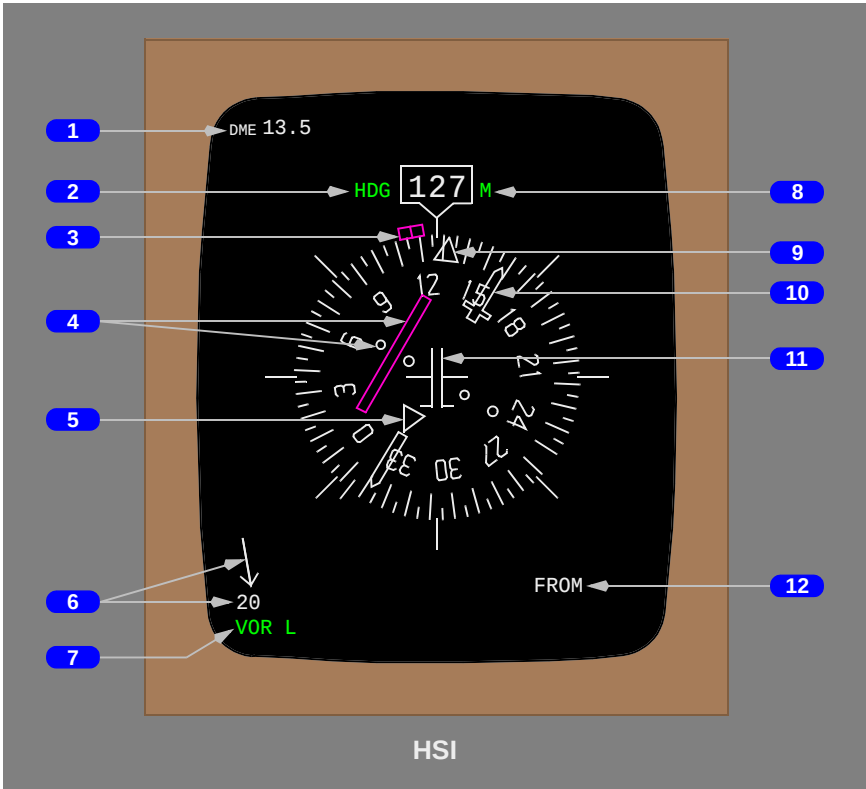


767 Flight Crew Operations Manual

- 1** Reference VOR DME
- 2** Current Heading
- 3** Selected Heading Bug
- 4** Course Deviation Indicator and Deviation Scale
- 5** To/From Pointer
- 6** Wind Direction and Speed
- 7** Reference VOR Receiver
- 8** Magnetic/True Reference
- 9** Drift Angle Pointer
- 10** Selected Course Pointer
- 11** Airplane Symbol
- 12** TO/FROM Indication



VP-BMC, VP-BOY, VP-BOZ, VQ-BRA





767 Flight Crew Operations Manual

- 1** Reference VOR DME
- 2** Current Heading
- 3** Selected Heading Bug
- 4** Course Deviation Indicator and Deviation Scale
- 5** To/From Pointer
- 6** Wind Direction and Speed
- 7** Reference VOR Receiver
- 8** Magnetic/True Reference
- 9** Drift Angle Pointer
- 10** Selected Course Pointer
- 11** Airplane Symbol
- 12** TO/FROM Indication

[illegible]

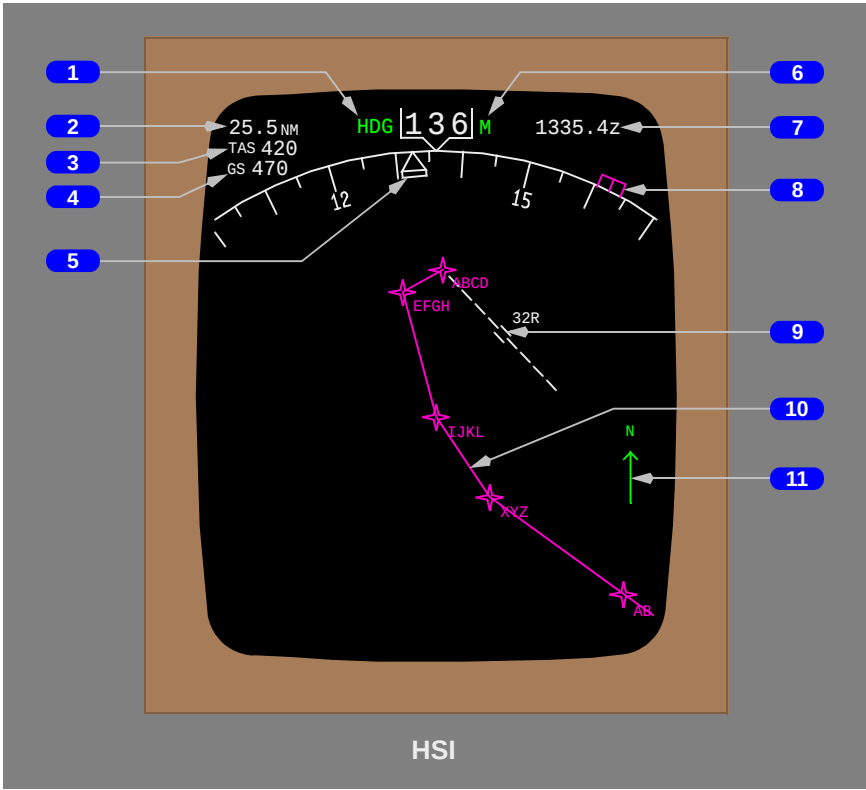


767 Flight Crew Operations Manual

- 1 Distance to the Active Waypoint**
- 2 Current Track**
- 3 Heading Pointer**
- 4 Magnetic/True Reference**
- 5 Estimated Time of Arrival at the Active Waypoint**
- 6 Selected Heading Bug**
- 7 Airport and Runway**
- 8 Active LNAV Route**
- 9 True North Pointer**



VP-BWW, VP-BWX, VQ-BPT





767 Flight Crew Operations Manual

- 1** Current Heading
- 2** Distance to the Active Waypoint
- 3** True Airspeed
- 4** Groundspeed
- 5** Drift Angle Pointer
- 6** Magnetic/True Reference
- 6** Estimated Time of Arrival at the Active Waypoint
- 8** Selected Heading Bug
- 9** Airport and Runway
- 10** Active LNAV Route
- 11** True North Pointer

HSI Symbology

The following symbols can be displayed, depending on EFIS control panel switch selections. Colors indicate the following:

- W (white) – present status, range scales
- G (green) – active or selected mode and/or dynamic conditions
- M (magenta) – command information, pointers, symbols, fly-to condition, weather radar turbulence
- C (cyan) – nonactive or background information
- A (amber) – cautions, faults, flags
- R (red) – warnings
- B (black) – blank area, off condition.

Heading, Track, and Wind

Symbol	Name	Applicable Mode(s)	Remarks

VP-BWW, VP-BWX, VQ-BPT

	HDG – Heading orientation (G), current heading and pointer (W), heading reference (G)	All	HDG – Displays heading as the display orientation, current heading, M or TRU as the heading reference, and points to the heading on the compass rose.

VP-BDI through VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA

	Track orientation (G), current track (W), and track reference (G)	MAP PLAN CTR MAP	Displays track as the display orientation, the current track, and M or TRU as the reference, and points to the heading on the compass rose.

767 Flight Crew Operations Manual

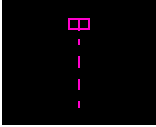
Symbol	Name	Applicable Mode(s)	Remarks

VP-BDI through VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA

	HDG – Heading orientation (G), current heading and pointer (W), heading reference (G)	EXP VOR FULL VOR EXP ILS FULL ILS VOR CTR VOR APP CTR APP	HDG – Displays heading as the display orientation, current heading, M or TRU as the heading reference, and points to the heading on the compass rose.

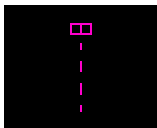
	Heading reference (G), box (W) in TRU, box (A) if TRU displayed in descents of 2,000 feet at more than 800 feet per minute.	All	Indicates heading/track is referenced to magnetic north or true north. On transition from TRU to M, a highlight box is displayed around M for 10 seconds. When TRU is the reference, the highlight box is displayed full time (W).

VP-BOQ through VP-BRL, VQ-BRA

	Selected heading bug (M) and reference line (M)	MAP EXP VOR EXP ILS Bug only FULL VOR FULL ILS PLAN	Displays the heading set in the MCP. A dashed line (M) extends from the bug to the airplane symbol in the MAP and expanded modes.

Symbol	Name	Applicable Mode(s)	Remarks

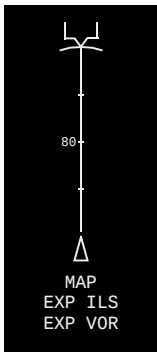
VP-BDI, VP-BMC, VP-BWW through VQ-BPT

	Selected heading bug (M) and reference line (M)	MAP, CTR MAP VOR, APP Bug only CTR VOR CTR APP PLAN	Displays the heading set in the MCP. A dashed line (M) extends from the bug to the airplane symbol in the MAP and expanded modes.

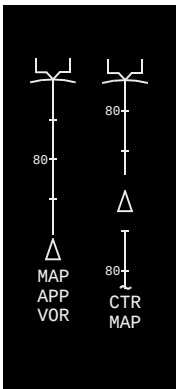
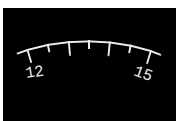
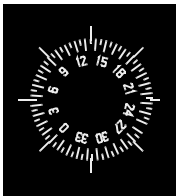
| VP-BDI through VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA

	Current heading pointer (W)	MAP PLAN	Points to current heading on the compass rose.

VP-BOQ through VP-BRL, VQ-BRA

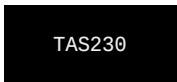
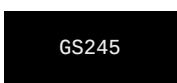
	Track line and range scale (W)	MAP EXP ILS EXP VOR	Displays present ground track based on airplane heading and wind. The displayed range numeric values are one-half the actual selected range. With heading-up orientation (EXP VOR/EXP ILS mode), the track line will be rotated left or right at an angle equal to the drift angle.

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Symbol	Name	Applicable Mode(s)	Remarks
VP-BDI, VP-BMC, VP-BWW through VQ-BPT			
	Track line and range scale (W)	MAP CTR MAP APP VOR	Displays present ground track based on airplane heading and wind. The displayed range numeric values are one-half and one-fourth (CTR MAP) the actual selected range. With heading-up orientation (VOR/APP mode), the track line will be rotated left or right at an angle equal to the drift angle.
	Expanded compass rose (W)	MAP PLAN EXP ILS EXP VOR VOR APP	Displays 70 degrees of compass rose.
	Full compass rose (W) Fixed reference marks (W)	FULL VOR FULL ILS CTR VOR CTR APP	The compass rose rotates through 360 degrees as a function of airplane heading. Fixed reference marks are evenly spaced at 45 degree intervals.
VP-BDI, VP-BMC, VP-BWW through VQ-BPT			
	Center Map full compass rose (W)	CTR MAP	The compass rose rotates through 360 degrees as a function of airplane heading.

Symbol	Name	Applicable Mode(s)	Remarks

VP-BDI, VP-BRL through VQ-BMQ, VQ-BOG, VQ-BPT

	True airspeed. (W)	All	Indicates true airspeed in knots.
	Ground speed. (W)	All	Indicates ground speed in knots.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

	Wind speed and direction. (W)	All except PLAN	Indicates wind speed and direction, with respect to display orientation and heading reference.

VP-BMC, VP-BOY, VP-BOZ, VQ-BRA

	Wind speed and direction. (W)	All except PLAN	Indicates wind speed and direction, with respect to display orientation and heading reference.

Radio Navigation

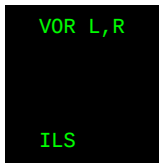
Symbol	Name	Applicable Mode(s)	Remarks
	Airplane symbol (W)	EXP VOR EXP ILS VOR APP	Current airplane position is at the apex of the triangle.
	Airplane symbol (W)	FULL VOR FULL ILS CTR VOR CTR APP	Current airplane position is at the center of the symbol.



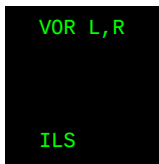
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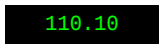
Symbol	Name	Applicable Mode(s)	Remarks

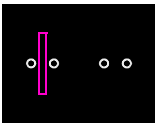
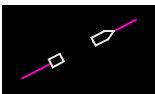
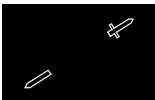
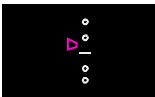
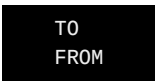
VP-BOQ through VP-BRL, VQ-BRA

	Reference VOR receiver (G)	EXP VOR FULL VOR	Indicates the source of the displayed navigation data.
	Reference ILS receiver (G)	EXP ILS FULL ILS	In the VOR or ILS mode the displayed data source is a function of the tuned frequency (VOR or LOC).

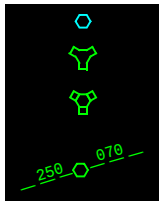
VP-BDI, VP-BMC, VP-BWW through VQ-BPT

	Reference VOR receiver (G)	VOR CTR VOR	Indicates the source of the displayed navigation data.
	Reference ILS receiver (G)	APP CTR APP	In the VOR or APP mode the displayed data source is a function of the tuned frequency (VOR or LOC).

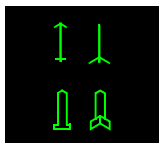
	Reference ILS frequency (G)	EXP ILS FULL ILS APP CTR APP	Displays frequency of manually tuned navaid.
	Reference VOR or ILS DME (W)	EXP VOR FULL VOR EXP ILS FULL ILS VOR CTR VOR APP CTR APP	Indicates DME distance to the reference navaid.

Symbol	Name	Applicable Mode(s)	Remarks
	Course deviation indicator (M) and deviation scale (W)	EXP VOR FULL VOR EXP ILS FULL ILS VOR CTR VOR APP CTR APP	Displays ILS or VOR course deviation.
	Selected course pointer (W) and line (M)	EXP VOR EXP ILS VOR APP	Displays selected course as set by the related VOR or ILS course selector.
	Selected course pointer (W)	FULL VOR FULL ILS CTR VOR CTR APP	Displays selected course as set by the related VOR or ILS course selector.
	Glideslope pointer (M) and deviation scale (W)	EXP ILS FULL ILS APP CTR APP	Displays glideslope position and deviation. Pointer not displayed when track and front course differ by more than 90°.
	To/from indication (W)	EXP VOR FULL VOR VOR CTR VOR	Displays VOR TO/FROM indication.
	To/from pointer (W)	FULL VOR CTR VOR	Displays VOR to/from direction.

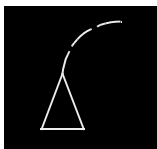
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Symbol	Name	Applicable Mode(s)	Remarks
	VOR (C, G), DME/TACAN (C, G), VORTAC (C, G) Manually tuned VOR radials (G)	MAP CTR MAP	When the EFIS control panel NAV AID switch is OFF, tuned navaids, excluding NDBs, are displayed (G). When the EFIS control panel NAV AID switch is selected ON, appropriate navaids are displayed. All navaids contained in the FMC data base and within the MAP area are displayed when the selected range is 10, 20 or 40 NM. Only high altitude navaids are displayed when the selected range is 80, 160, 320 NM. Navaids not being used are displayed in cyan. Tuned VHF navaids are displayed in green, regardless of switch selection. When a navaid is manually tuned, the selected course and reciprocal are displayed.

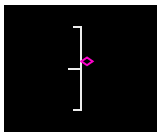
**VP-BOZ through VQ-BMU, VQ-BPT, VQ-BRA
(SB Adds VP-BMC with two ADF receivers installed.)**

	Left ADF pointer head and tail (G) Right ADF pointer head and tail (G)	All	Indicates bearing to (head) or from (tail) the tuned station.

Map

Symbol	Name	Applicable Mode(s)	Remarks
	Position trend vector (W) (dashed line) and airplane symbol (W).	MAP CTR MAP	Predicts position at the end of 30, 60, and 90 second intervals, based on bank angle and ground speed. Each segment represents 30 seconds. Selected range determines the number of segments displayed: • Range > 20 NM, 3 segments • Range = 20 NM, 2 segments • Range = 10 NM, 1 segment
	North Pointer (G)	PLAN	Indicates orientation of map background to true north.

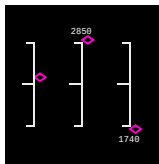
VP-BMC, VP-BOY, VP-BOZ, VQ-BRA

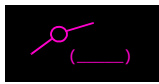
	Vertical pointer (M), and deviation scale (W)	MAP CTR MAP	Displays vertical deviation from selected VNAV PATH during descent only. Scale indicates +/- 400 feet deviation.

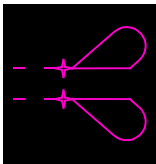
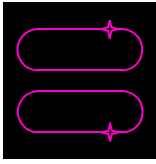
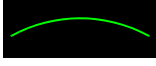
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Symbol	Name	Applicable Mode(s)	Remarks

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

	Vertical pointer (M), deviation scale (W), numeric display (W)	MAP CTR MAP	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 +/- 400 feet.

	Off route waypoint (C)	MAP PLAN CTR MAP	When the EFIS control panel WPT switch is selected on, waypoints not on the selected route are displayed, for ranges of 10, 20, or 40 NM. VP-BDI through VP-BOY, VP-BRL through VQ-BPT When a range greater than 40NM is selected, only those waypoints associated with NDBs that are within 80NM of the airplane are displayed.
	Conditional Waypoint: active (M), inactive (W)	MAP PLAN	Active – represents the waypoint the airplane is currently navigating to. Inactive – represents the waypoints on the active route. Data with parentheses for conditional waypoints indicates type of conditional waypoint (ALTITUDE etc.)

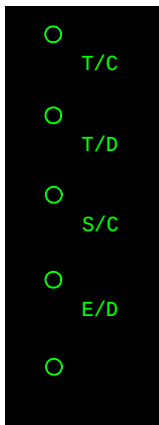
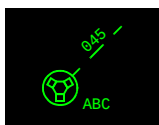
Symbol	Name	Applicable Mode(s)	Remarks
	Procedure turn: active (M), modified (W), inactive (C)	MAP PLAN CTR MAP	A fixed size procedure turn appears when it is part of the displayed FMC route. When the procedure turn waypoint is active and the HSI range is 40 nm or less, the procedure turn changes to the correct scale size. VP-BDI, VP-BOQ, VP-BRL through VQ-BPT (SB Adds VP-BMC with updated FMCs.) Also used for procedure hold course reversal.
	Holding pattern: active route (M), modified route (W), inactive route (C)	MAP PLAN CTR MAP	A fixed size holding pattern appears when it is part of the displayed FMC route. When the holding waypoint is active and the HSI range is 80 nm or less, the holding pattern changes to the correct scale size. VP-BDI, VP-BOQ, VP-BRL through VQ-BPT (SB Adds VP-BMC with updated FMCs.) Depicts entry path until entry is completed.
	Altitude range arc (G)	MAP CTR MAP	Based on present vertical speed and ground speed, indicates the approximate map position where the MCP altitude is reached.

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Symbol	Name	Applicable Mode(s)	Remarks

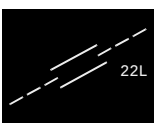
VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

	Energy management circles: clean (C), speedbrake (W)	MAP CTR MAP	Indicates clean and speedbrake energy management circles as defined on OFFPATH DES page.

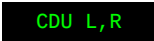
	Altitude profile point and identifier (G)	MAP PLAN CTR MAP	Indicates the approximate map position of the FMC-calculated T/C (top-of-climb), T/D (top-of-descent), S/C (step climb), and E/D (end of descent) points. Deceleration points have no identifier.
	Selected reference point and bearing information (G)	MAP PLAN CTR MAP	Displays the reference point selected on the CDU FIX page. Bearing from the fix is displayed with dashes (G).

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

	Selected reference point and distance information (G)	MAP PLAN CTR MAP	Displays the reference point selected on the CDU FIX page. Distance from the fix is displayed with dashes (G).

Symbol	Name	Applicable Mode(s)	Remarks
	Airport (C)	MAP PLAN CTRMAP	Displayed if the EFIS control panel ARPT switch is selected ON. Origin and destination airports are always displayed, regardless of switch selection.
	Airport and runway (W)		Displayed when selected as the origin or destination and selected range is 80, 160, or 320 NM.
	Airport and runway (W)		Displayed when selected as the origin or destination and selected range is 10, 20, or 40 NM. Dashed runway centerlines extend 14.2 NM.

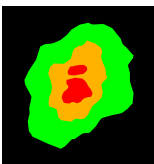
VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

	MAP source annunciation (G)	MAP	Displays HSI source if CDU is selected on respective NAV Source Select Switch.

Radar

Symbol	Name	Applicable Mode(s)	Remarks

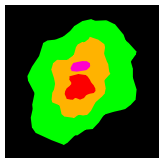
VP-BOQ

	Weather radar (WXR) returns (R, A, G)	MAP EXPVOR EXP ILS	The most intense areas are displayed in red, lesser intensity in amber, and lowest intensity green.

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Symbol	Name	Applicable Mode(s)	Remarks

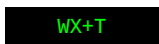
VP-BDI, VP-BMC, VP-BOY through VQ-BRA

	Weather radar (WXR) returns (R, A, G, M)	MAP EXP VOR EXP ILS CTR MAP VOR APP	The most intense areas are displayed in red, lesser intensity in amber, and lowest intensity green. Turbulence is displayed in magenta.

VP-BOQ

	WXR precipitation only mode (G)	MAP EXP VOR EXP ILS	Weather radar system is selected on the EFIS control panel. Weather radar mode, gain and tilt is controlled on the weather radar panel(s) (refer to Chapter 11, Flight Management, Navigation).

VP-BDI, VP-BMC, VP-BOY, VP-BOZ, VP-BWW through VQ-BPT

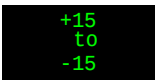
	WXR and turbulence mode (G)	MAP EXP VOR EXP ILS CTR MAP VOR APP	Weather radar system is selected on the EFIS control panel. Weather radar mode, gain and tilt is controlled on the weather radar panel(s) (refer to Chapter 11, Flight Management, Navigation).

Symbol	Name	Applicable Mode(s)	Remarks
	WXR receiver gain (G)	MAP EXPVOR EXP ILS CTR MAP VOR APP	Weather radar system is selected on the EFIS control panel. Weather radar mode, gain and tilt is controlled on the weather radar panel(s) (refer to Chapter 11, Flight Management, Navigation).

VP-BDI through VP-BOZ, VQ-BMQ through VQ-BPT

	Mode used with down-tilt when ground mapping (G)	MAP EXPVOR EXP ILS CTR MAP VOR APP	Weather radar system is selected on the EFIS control panel. Weather radar mode, gain and tilt is controlled on the weather radar panel(s) (refer to Chapter 11, Flight Management, Navigation).

VP-BDI through VP-BOZ, VQ-BMQ through VQ-BPT

	WXR antenna tilt (G)	MAP EXPVOR EXP ILS CTR MAP VOR APP	Weather radar system is selected on the EFIS control panel. Weather radar mode, gain and tilt is controlled on the weather radar panel(s) (refer to Chapter 11, Flight Management, Navigation).



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Symbol	Name	Applicable Mode(s)	Remarks

VP-BWW, VP-BWX

+15 (M or A) to -15 (M or A) *M=Manual A=Auto	WXR antenna tilt (G)	MAP CTR MAP VOR APP	Weather radar system is selected on the EFIS control panel. Weather radar mode, gain and tilt is controlled on the weather radar panel(s) (refer to Chapter 11, Flight Management, Navigation).
AUTOTILT FAIL	WXR detects loss of EGPWS input with AUTO TILT mode selected (A)		

VP-BDI through VP-BOZ, VP-BWW through VQ-BPT

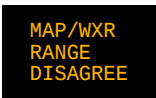
TEST	WXR test mode (C) (G)	MAP EXP VOR EXP ILS CTR MAP VOR APP	Weather radar mode, gain and tilt is controlled on the weather radar panel(s) (refer to Chapter 11, Flight Management, Navigation).

WXR WEAK	WXR calibration fault (A)	MAP EXP VOR EXP ILS CTR MAP VOR APP	When a degraded condition is present the EFIS will continue to display weather radar information. If any two or all degraded conditions occur simultaneously, the system will display only the highest priority condition as follows: • WEAK • ATT • STAB
WXR ATT	WXR attitude input fault (A)		
WXR STAB	WXR stabilization off (A)		

Symbol	Name	Applicable Mode(s)	Remarks

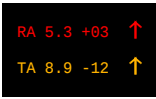
VP-BDI, VP-BMC, VP-BWW through VQ-BOG

	WXR display fault (A)	MAP CTR MAP VOR APP	HSI overheat or loss of digital unit cooling air when WXR is selected. Overheat annunciation has display priority over all other degraded conditions. Weather radar information removed after 30 seconds.

	WXR system failure (A)	MAP EXP VOR EXP ILS CTR MAP VOR APP	Weather radar system failure is annunciated under any of the following conditions: • receiver transmitter failure • antenna failure • control panel failure
	WXR range status annunciations (A)	MAP EXP VOR EXP ILS CTR MAP VOR APP	Weather output range disagrees with the range selected by the EFIS control panel.
	WXR range status annunciations (A)	MAP CTR MAP	Weather output range and map display output range disagree with selected EFIS control panel range.

TCAS

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

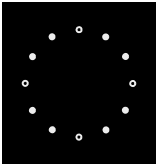
Symbol	Name	Applicable Mode(s)	Remarks
	TCAS resolution advisory (RA), relative altitude (R)	MAP EXPILS EXP VOR CTR MAP APP VOR	These symbols are displayed only when the EFIS control panel traffic (TFC) switch is selected on. Refer to Chapter 15, Warning Systems.
	TCAS traffic advisory (TA), relative altitude (A)		The arrow indicates traffic climbing or descending at a rate greater than or equal to 500 fpm. At rates less than 500 fpm, the arrow is not displayed.
	TCAS proximate traffic, relative altitude (W)		The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane.
	TCAS other traffic, relative altitude (W)		The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.
	TCAS no bearing message (RA-R, TA-A)	MAP EXPILS EXP VOR CTR MAP APP VOR	Message provides traffic type, range in NM, altitude and vertical direction.

Symbol	Name	Applicable Mode(s)	Remarks
TRAFFIC	TCAS traffic alert message (RA–R, TA–A)	All	Displayed whenever a TCAS RA or TA is active. EFIS control panel TFC switch does not have to be selected on.
OFFSCALE	TCAS off scale message (RA–R, TA–A)	MAP EXPILS EXP VOR CTR MAP APP VOR	Displayed whenever RA or TA traffic is outside the traffic area covered by the HSI range. Displayed only if the EFIS control panel TFC switch is selected on.
TFC	TCAS mode (G)	MAP EXPILS EXP VOR CTR MAP APP VOR	Indicates the HSI TCAS display is active; the EFIS control panel TFC switch is selected on.
TA ONLY	TCAS mode (G)	All	Indicates TCAS computer is not computing RAs. Displayed whether the EFIS control panel TFC switch is selected on or off.
TCAS TEST	TCAS mode (W)	All	Indicates TCAS is operating in the test mode. Displayed whether EFIS control panel TFC switch is selected on or off.

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Symbol	Name	Applicable Mode(s)	Remarks
	TCAS off message (W)	MAP EXP ILS EXP VOR MAP CTR MAP APP VOR	Displayed when the TCAS/ATC mode switch is not in TA ONLY or TA/RA. Not displayed if TCAS is failed.
	TCAS fail message (A)	MAP EXP ILS EXP VOR CTR MAP APP VOR	Indicates TCAS failure.

VQ-BOG
(SB Deletes VP-BMC with 3 NM range ring display.)

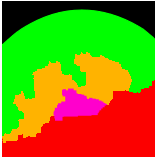
	3 NM Range Ring (W)	MAP CTR MAP APP VOR	Displayed when TFC is selected on the EFIS control panel and range is 80 NM or less. Ring is centered around the airplane symbol.

Look-Ahead Terrain

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

Symbol	Name	Applicable Mode(s)	Remarks

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

	Terrain display (R, A, G, M)	MAP CTR MAP VOR APP	Displays terrain data from the GPWS terrain data base. When the airplane is higher than 2,000 feet above the terrain, peaks contours are displayed in three densities (G). Highest peaks are displayed as solid, intermediate height terrain peaks are displayed as high density, and lowest terrain peaks are displayed as low density. When the airplane is lower than 2,000 feet above the terrain, the terrain displays as follows: 2,000 feet below to 500 feet (250 feet with gear down) below the airplane's current altitude (G), 500 feet (250 feet with gear down) below to 2000 feet above the airplane's current altitude (A), more than 2,000 feet above the airplane's current altitude (R), no terrain data available (M).

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Symbol	Name	Applicable Mode(s)	Remarks

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

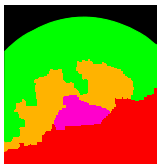
	Obstacle display (R, A, G)	MAP CTR MAP VOR APP	Displays obstacle data from the GPWS obstacle data base. Color displays using the same rules as terrain display.

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

	Highest and lowest terrain or obstacle altitudes (R, A, G)	MAP CTR MAP VOR APP	Terrain display enabled (manual or automatic display). Numbers displayed are altitudes, in hundreds of feet, of highest and lowest contours displayed on the HSI. Color corresponds to colors of highest and lowest terrain or obstacle displayed. Altitudes not displayed when terrain data unavailable.

Symbol	Name	Applicable Mode(s)	Remarks

VP-BMC, VQ-BMQ, VQ-BMU, VQ-BPT

	Terrain display (R, A, G, M)	MAP CTR MAP VOR APP	Displays terrain data from the GPWS terrain data base. The terrain displays as follows: 2,000 feet below to 500 feet (250 feet with gear down) below the airplane's current altitude (G), 500 feet (250 feet with gear down) below to 2000 feet above the airplane's current altitude (A), more than 2,000 feet above the airplane's current altitude (R), no terrain data available (M). Color and density vary based on terrain height vs. airplane altitude.

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

	Obstacle alert annunciation (R, A)	All	Look-ahead obstacle caution alert active (A), Look-ahead obstacle warning alert active (R).

VP-BDI, VP-BMC, VP-BWW through VQ-BOG

	Terrain alert annunciation (R, A)	All	Look-ahead terrain caution alert active (A), look-ahead terrain warning alert active (R).



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Symbol	Name	Applicable Mode(s)	Remarks

VP-BDI, VP-BMC, VP-BWW through VQ-BOG

	Terrain mode annunciation (C)	MAP CTR MAP VOR APP	Terrain display enabled (manual or automatic display).

VP-BDI, VP-BMC, VP-BWW through VQ-BOG

	Terrain status annunciations (A)	MAP CTR MAP VOR APP	Look-ahead terrain alerting and display have failed.
			Look-ahead terrain alerting and display unavailable due to position uncertainty.
			GPWS terrain override switch in OVRD position.
	Terrain test mode annunciation (C)		GPWS operating in self-test mode. This status annunciation is also available in plan mode.

VP-BDI, VP-BMC, VP-BWW through VQ-BOG

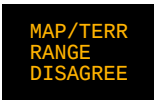
	TERR display fault (A)	MAP CTR MAP VOR APP	HSI overheat or loss of digital unit cooling air when TERR is selected. Overheat annunciation has display priority over all other degraded conditions. Look-ahead terrain information removed after 30 seconds.

Symbol	Name	Applicable Mode(s)	Remarks

VP-BDI, VP-BMC, VP-BWW through VQ-BOG

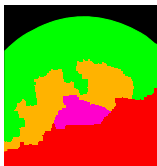
	Terrain range status annunciations (A)	MAP CTR MAP VOR APP	Terrain output range disagrees with selected EFIS control panel range.

VP-BDI, VP-BMC, VP-BWW through VQ-BOG

	Terrain range status annunciations (A)	MAP CTR MAP	Terrain output range and map display output range disagree with selected EFIS control panel range.

Look-Ahead Terrain

VP-BOQ

Symbol	Name	Applicable Mode(s)	Remarks
	Terrain display (R, A, G, M)	MAP EXP VOR EXP ILS	Displays terrain data from the GPWS terrain data base. When the airplane is higher than 2,000 feet above the terrain, peaks contours are displayed in three densities (G). Highest peaks are displayed as solid, intermediate height terrain peaks are displayed as high density, and lowest terrain peaks are displayed as low density. When the airplane is lower than 2,000 feet above the terrain, the terrain displays as follows: 2,000 feet below to 500 feet (250 feet with gear down) below the airplane's current altitude (G), 500 feet (250 feet with gear down) below to 2000 feet above the airplane's current altitude (A), more than 2,000 feet above the airplane's current altitude (R), no terrain data available (M).

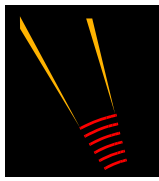


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Symbol	Name	Applicable Mode(s)	Remarks
	Obstacle display (R, A, G)	MAP EXP VOR EXP ILS	Displays obstacle data from the GPWS obstacle data base. Color displays using the same rules as terrain display.
	Highest and lowest terrain or obstacle altitudes (R, A, G)	All	Terrain display enabled (manual or automatic display). Numbers displayed are altitudes, in hundreds of feet, of highest and lowest contours displayed on the HSI. Color corresponds to colors of highest and lowest terrain or obstacle displayed. Altitudes not displayed when terrain data unavailable.

Predictive Windshear

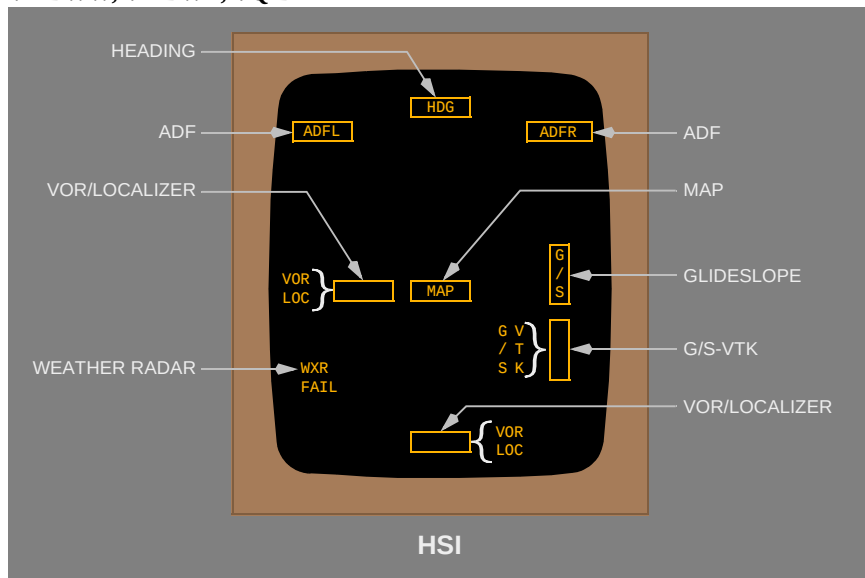
VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG

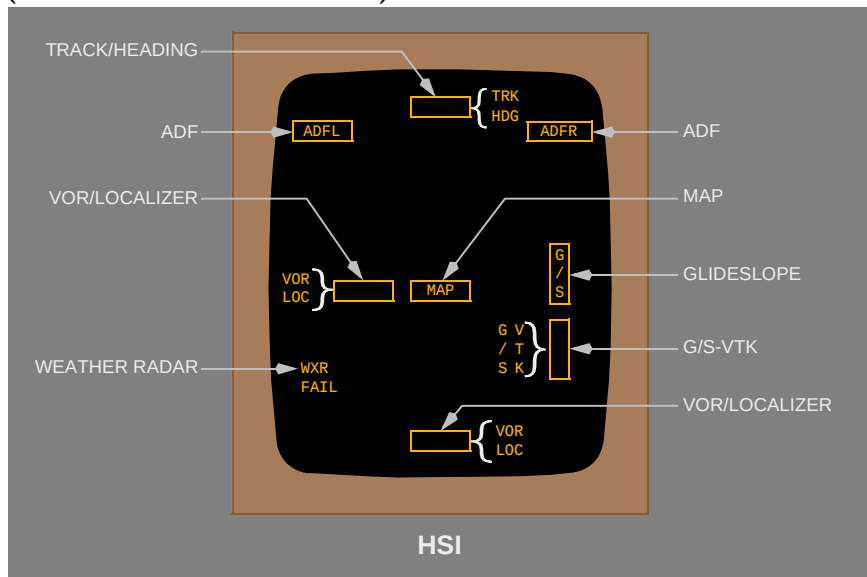
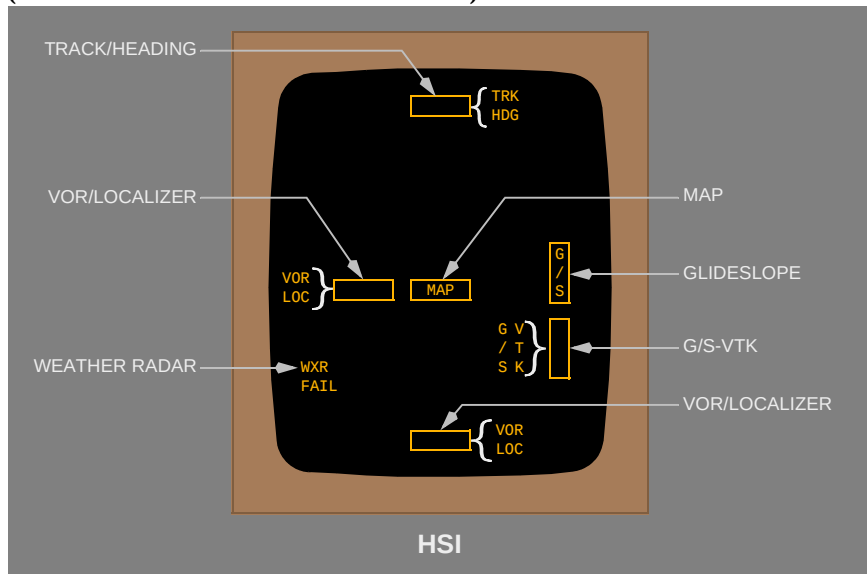
Symbol	Name	Applicable Mode(s)	Remarks
	Predictive windshear symbol (R, B, A)	MAP CTR MAP APP VOR	Displays windshear location and approximate geometric size (width and depth). Amber radials extend from predictive windshear symbol to help identify location of windshear event.
	Windshear annunciation (R, A)	All	Predictive windshear caution active (A). Predictive windshear warning active (R).

HSI Failure Flags and Annunciations

Note: HSI failure flags replace the appropriate display to indicate source system failure, or lack of computed information.

VP-BWW, VP-BWX, VQ-BPT



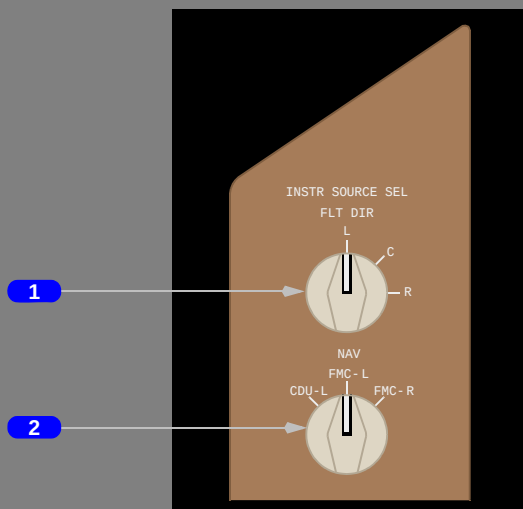
767 Flight Crew Operations Manual
**VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BRA
(SB Adds VP-BMC with dual ADFs.)**

**VP-BDI, VP-BOQ, VP-BOY, VQ-BOG
(SB Deletes VP-BMC without ADF receivers.)**


Instrument Switching

Various source selections are available for instrument displays. For other related instrument transfer switching, refer to Chapter 11, Flight Management, Navigation

Left Instrument Source Selector Panel (Upper)

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA



LEFT FORWARD PANEL

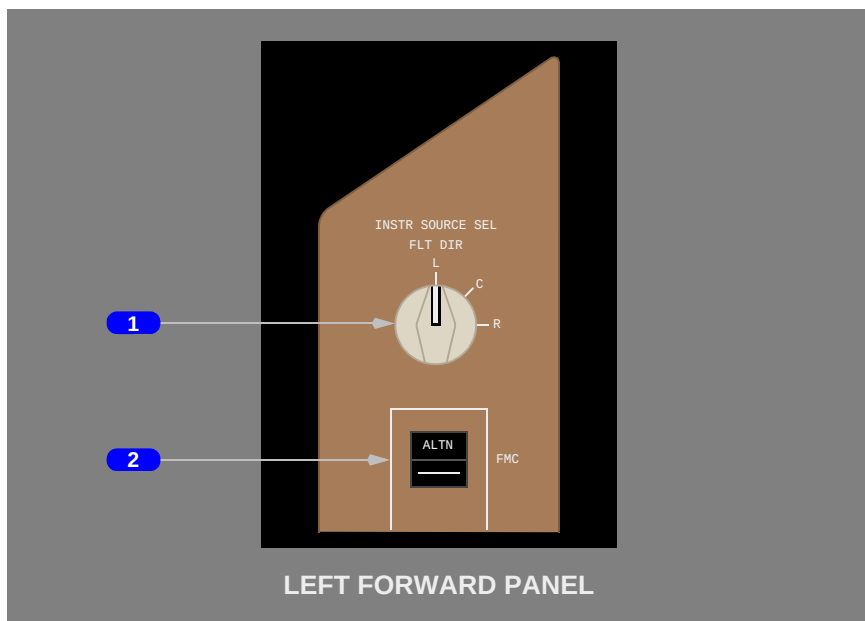
1 Flight Director (FLT DIR) Source Selector

Selects the flight control computer (left, center, or right) used as the source of commands for the captain's flight director display.

2 Navigation (NAV) Source Selector

Selects the source of FMC information used by the left and center EFIS symbol generators and the left and center flight control computers (FCCs).

- FMC L – normal position. Provides information to the left and center symbol generators, and to the left and center FCCs
- FMC R – alternate position. Provides information to the left and center symbol generators, and to the left and center FCCs
- CDU L – provides information to the left and center symbol generators. Used for operation of the Alternate Navigation System (refer to Chapter 11, Flight Management, Navigation)

VP-BRL

1 Flight Director (FLT DIR) Source Selector

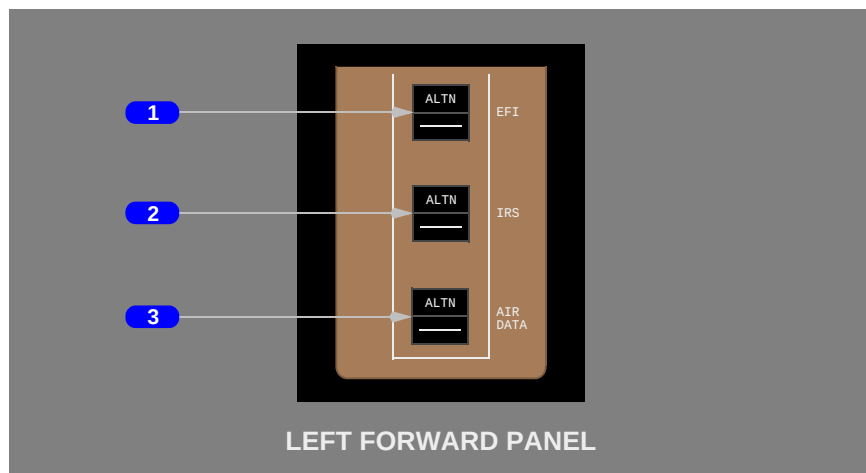
Selects the flight control computer (left, center, or right) used as the source of commands for the captain's flight director display.

2 FMC Switch

Selects the source of FMC information used by the left and center EFIS symbol generators and the left and center flight control computers (FCCs).

- Blank – normal position. The left FMC provides information to the left and center symbol generators, and to the left and center FCCs
- ALTN– alternate position. The right FMC provides information to the left and center symbol generators

Left Instrument Source Selector Panel (Lower)



1 Electronic Flight Instruments (EFI) Switch

Selects the EFIS symbol generator, ILS receiver, and radio altimeter used as the sources of information for the captain's ADI and HSI displays.

- Blank – normal position. The captain's displays use the left symbol generator, left ILS receiver, and left radio altimeter
- ALTN – alternate position. The captain's displays use the center symbol generator, center ILS receiver, and center radio altimeter

If both pilots select ALTN (both using center sources):

- both pilots' ADI and HSI displays are controlled by the left EFIS control panel
- the EICAS message INSTR SWITCH displays

2 Inertial Reference System (IRS) Switch

Selects the IRS used as the source of information for the left and center symbol generators, the captain's VSI, and the first officer's RDMI. Information provided by the IRS includes attitude, heading, and vertical speed

- Blank – normal position. The left IRS is the source for the left and center symbol generators, the captain's VSI, and the first officer's RDMI
- ALTN – alternate position. The center IRS is the source for the left and center symbol generators, the captain's VSI, and the first officer's RDMI

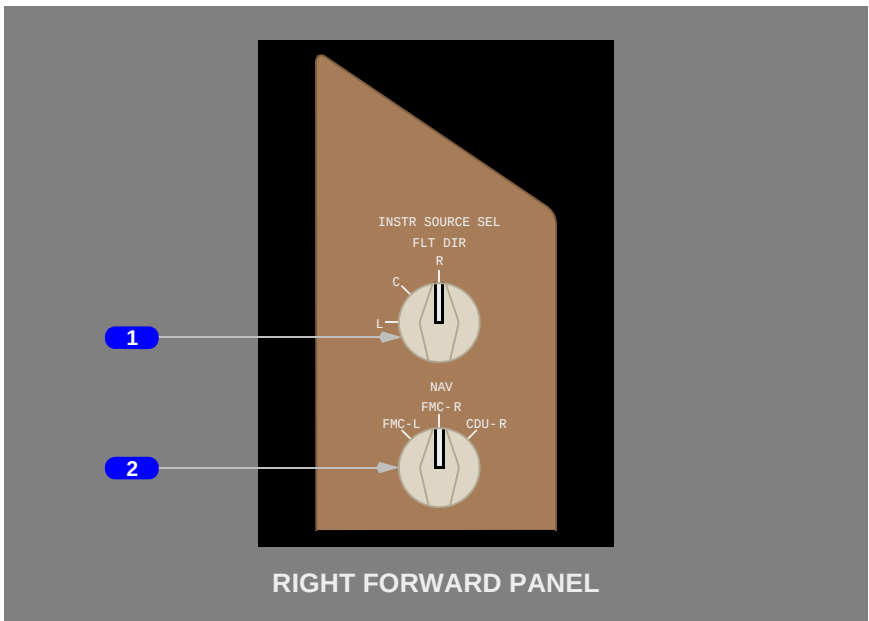
3 AIR DATA Switch

Selects the air data computer used as the source of information for the captain's Mach/airspeed indicator, primary altimeter, and vertical speed indicator (via the selected IRS).

- Blank – normal position. The left air data computer is the source for the captain's air data instruments
- ALTN – alternate position. The right air data computer is the source for the captain's air data instruments

Right Instrument Source Selector Panel (Upper)

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA



1 Flight Director (FLT DIR) Source Selector

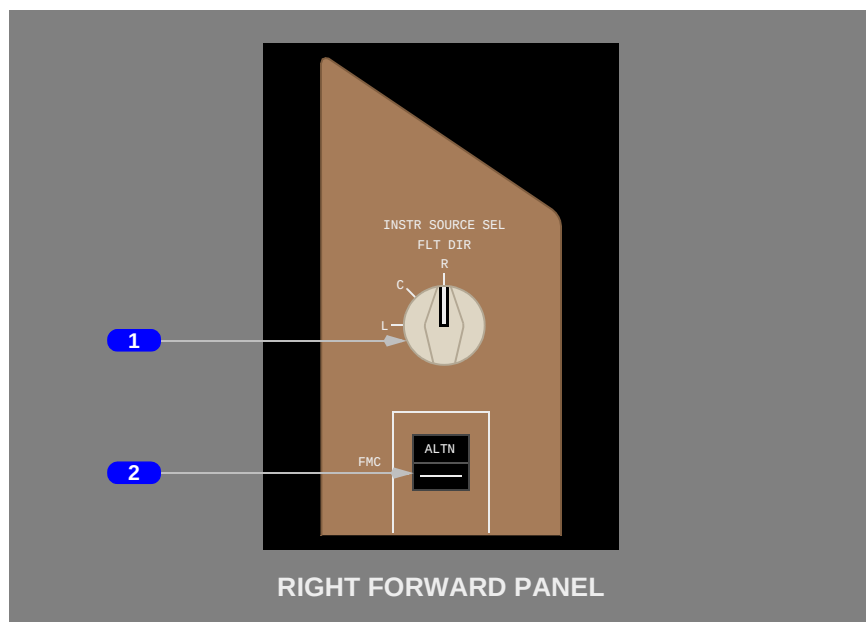
Selects the flight control computer (left, center, or right) used as the source of commands for the first officer's flight director display.

2 Navigation (NAV) Source Selector

Selects the source of FMC information used by the right EFIS symbol generator and the right flight control computer (FCC).

- FMC R – normal position. Provides information to the right symbol generator, and to the right FCC
- FMC L – alternate position. Provides information to the right symbol generator, and to the right FCC
- CDU R – provides information to the right symbol generator. Used for operation of the Alternate Navigation System (refer to Chapter 11, Flight Management, Navigation).

VP-BRL



1 Flight Director (FLT DIR) Source Selector

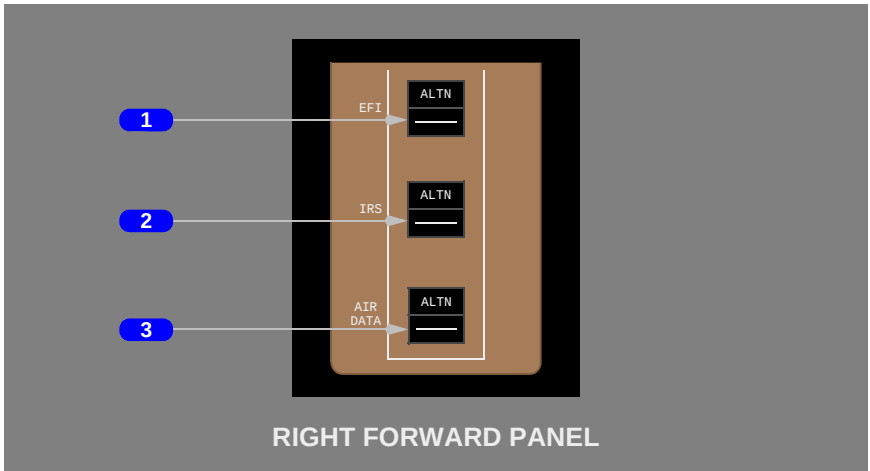
Selects the flight control computer (left, center, or right) used as the source of commands for the first officer's flight director display.

2 FMC Switch

Selects the source of FMC information used by the right EFIS symbol generator and the right flight control computer (FCC).

- Blank – normal position. The right FMC provides information to the right symbol generator, and to the right FCC
- ALTN – alternate position. The left FMC provides information to the right symbol generator

Right Instrument Source Selector Panel (Lower)



1 Electronic Flight Instruments (EFI) Switch

Selects the EFIS symbol generator, ILS receiver, and radio altimeter used as the sources of information for the first officer's ADI and HSI displays.

- Blank – normal position. The first officer's displays use the right symbol generator, right ILS receiver, and right radio altimeter
- ALTN – alternate position. The first officer's displays use the center symbol generator, center ILS receiver, and center radio altimeter

If both pilots select ALTN (both using center sources):

- both pilots' ADI and HSI displays are controlled by the left EFIS control panel
- the EICAS message INSTR SWITCH displays

2 Inertial Reference System (IRS) Switch

Selects the IRS used as the source of information for the right symbol generator, the first officer's VSI, and the captain's RDMI. Information provided by the IRS includes attitude, heading, and vertical speed.

- Blank – normal position. The right IRS is the source for the right symbol generator, the first officer's VSI, and the captain's RDMI
- ALTN – alternate position. The center IRS is the source for the right symbol generator, the first officer's VSI, and the captain's RDMI.

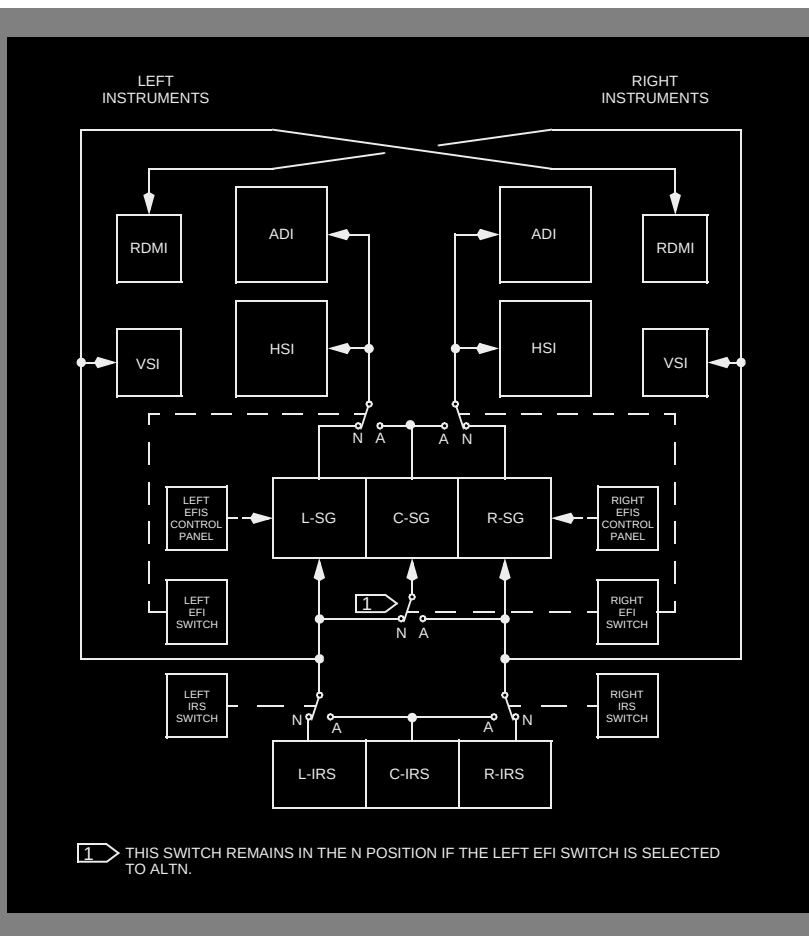
3 AIR DATA Switch

Selects the air data computer used as the source of information for the first officer's Mach/airspeed indicator, primary altimeter, and vertical speed indicator (via the selected IRS).

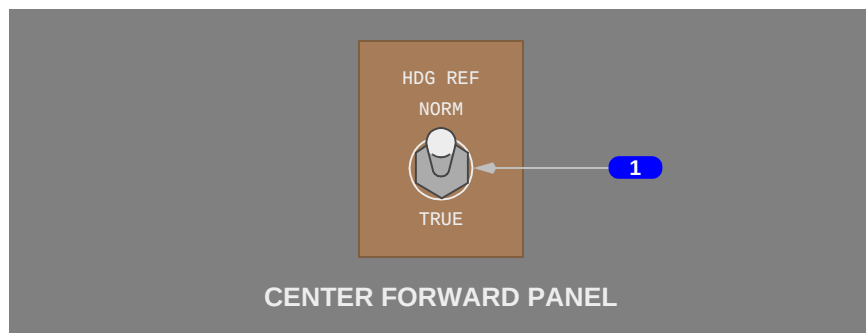
- Blank – normal position. The right air data computer is the source for the first officer's air data instruments
- ALTN – alternate position. The left air data computer is the source for the first officer's air data instruments.

EFI/IRS Interface Diagram

The following diagram shows the normal EFI/IRS interface. EFI switching determines the center symbol generator (C-SG) input and output. Normally, left system instrument sources supply the center symbol generator. When both pilots select ALTN with their EFI switches, the left system instrument sources supply data to the center symbol generator. However, the center symbol generator always uses the center ILS and center radio altimeter. Each EFIS control panel is connected to the symbol generator with the EFI switch. Each IRS switch permits pilot selection of the alternate data source for heading, attitude, and vertical speed.



Heading Reference Switch



1 Heading Reference (HDG REF) Switch

NORM –

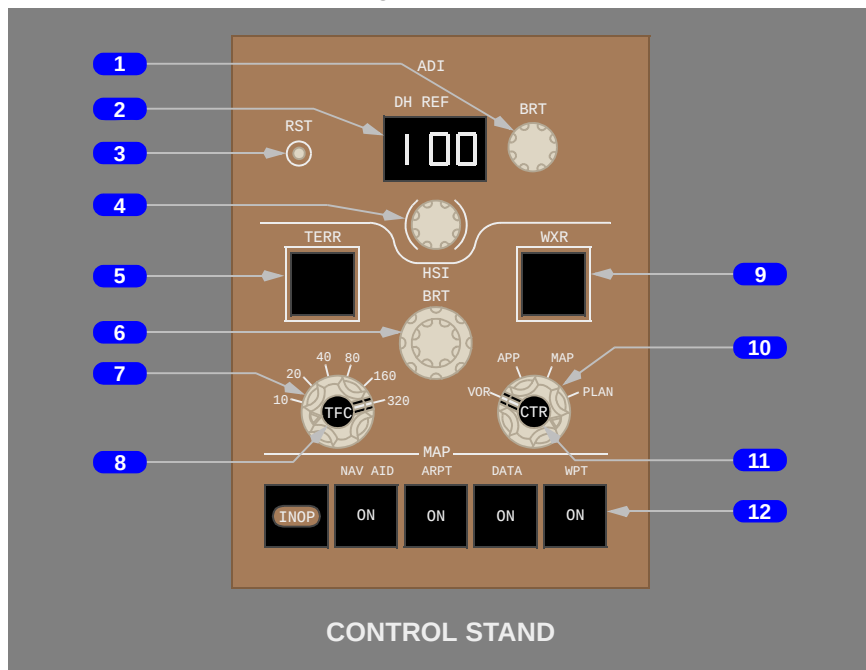
- references each compass card to magnetic north when operating outside polar regions
- references each HSI to true north and causes each RDMI heading flag to appear when operating within polar regions.

TRUE – references each compass card to true north regardless of latitude.

EFIS Control Panel

The left EFIS control panel controls the left ADI and HSI. The right EFIS control panel controls the right ADI and HSI.

VP-BDI, VP-BMC, VP-BWW through VQ-BPT



1 ADI Brightness (BRT) Control

Rotate – adjusts brightness of ADI display.

2 Decision Height Reference (DH REF) Window

- displays selected decision height
- displays on ADI (ADI blanks when a negative decision height is selected)

3 Decision Height Reset (RST) Switch

Push –

- resets DH alert on related ADI
- changes RA display from amber to white

VP-BDI, VQ-BMU, VQ-BOG

(SB Adds VP-BWW, VP-BWX with ADI height alert blanking.
SB Deletes VP-BMC with ADI height alert blanking.)

- blanks height alert on related ADI

4 Decision Height Selector

Rotate – selects decision height for DH alerting.

5 Terrain (TERR) Switch

Push –

- displays terrain data on the HSI in MAP, CTR MAP, VOR, and APP
- deselects the weather radar display regardless of the mode selector position

For a description of the ground proximity warning system, refer to Chapter 15, Warning Systems.

6 HSI Brightness (BRT) Control

Rotate –

- outer control – adjusts overall brightness of HSI display
- inner control – adjusts brightness of weather radar or terrain display

7 HSI Range Selector

Rotate –

- selects nautical mile range for MAP, CTR MAP, and PLAN displays
- when the WXR switch or TCAS TFC switch is ON, also selects the desired range for the VOR and APP mode displays

8 Traffic (TFC) Switch

Note: TCAS must be activated on the Transponder Panel (refer to Chapter 11, Flight Management, Navigation).

Push –

- displays or removes TCAS traffic information on HSI

9 Weather Radar (WXR) Switch

Push – displays weather radar information (refer to Chapter 11, Flight Management, Navigation).

10 HSI Mode Selector

VOR, CTR VOR –

- displays VOR navigation information
- selects manual VOR and DME tuning on the VOR/DME panel (automatic tuning inhibited)

APP, CTR APP –

- displays ILS navigation information
- selects manual VOR and DME tuning on the VOR/DME panel (automatic tuning inhibited)

MAP, CTR MAP –

- displays a dynamic map
- allows selection of manual or automatic VOR and DME tuning on the VOR/DME panel
- allows remote manual VOR and DME tuning on the PROGRESS page

PLAN –

- displays static FMC map in true–north–up orientation
- displays heading information in heading–up form
- allows selection of manual or automatic VOR and DME tuning on the VOR/DME panel
- allows remote manual VOR and DME tuning on the PROGRESS page
- activates the MAP CTR STEP prompt on the LEGS page for stepping through the displayed route

11 Center (CTR) Switch

Push –

- when the HSI Mode Selector is in the MAP, VOR, or APP positions, toggles between full and expanded rose displays
- does not affect display in PLAN mode

12 Map Switches

NAV AID –

- displays only high altitude VHF navigation aids when HSI range is 80nm or greater
- displays all VHF navigation aids when HSI range is 40nm or less

Airport (ARPT) –

Displays all airports in the display range.

DATA –

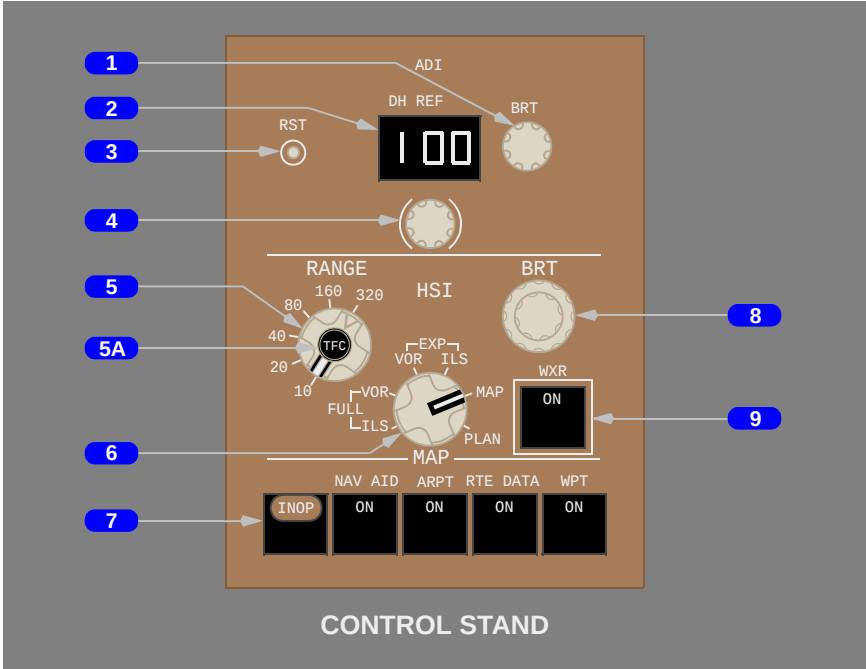
Displays estimated time of arrival and any altitude constraint for each waypoint in the displayed flight path.

Waypoint (WPT) –

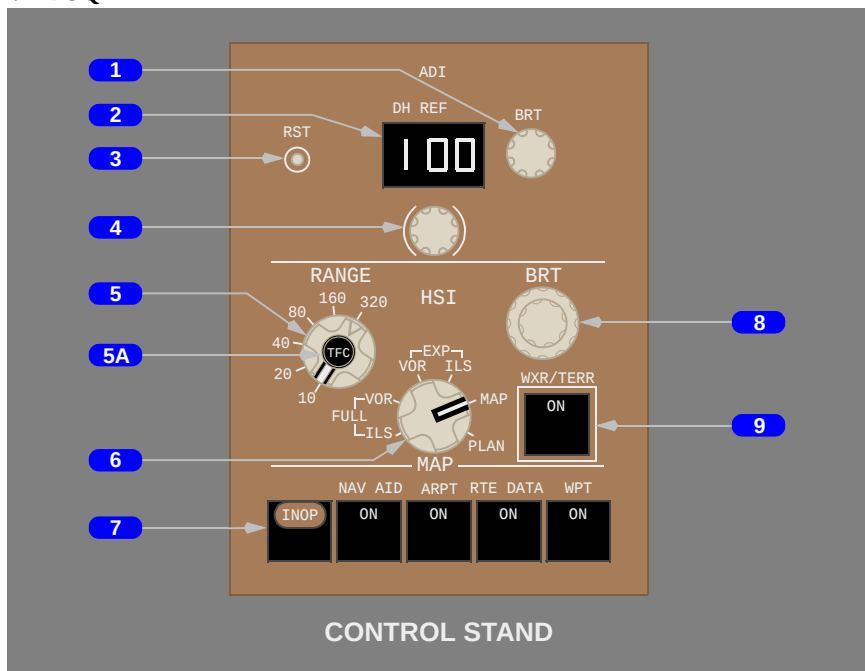
- displays all waypoints when HSI range is 40nm or less
- those waypoints associated with NDBs are displayed at any selected range as long as the NDBs are within 80nm of the airplane.

VP-BOQ through VP-BRL, VQ-BRA

VP-BOY through VP-BRL, VQ-BRA



VP-BOQ



1 ADI Brightness Control

Rotate – adjusts brightness of ADI display.

2 Decision Height Reference Window

- displays selected decision height
- also displayed on ADI (display on ADI blanks when a negative decision height is selected)

3 Decision Height Reset (RST) Switch

Push –

- resets DH alert on related ADI
- changes RA display from amber to white

VP-BOQ through VP-BOZ, VQ-BRA

- blanks height alert on related ADI

4 Decision Height Selector

Rotate – selects decision height for DH alerting.

5 HSI Range Selector

Rotate –

- selects nautical mile range for MAP and PLAN displays
- when the WXR switch or TFC switch is ON, also selects the desired range for the EXP VOR and EXP ILS mode displays

5A Traffic (TFC) Switch

Push –

- displays TCAS traffic information on HSI
- second push removes traffic display

VP-BOQ, VP-BRL, VQ-BRA

Note: TCAS must be activated on the transponder panel (refer to Chapter 11, Flight Management, Navigation for transponder operation and Chapter 15, Warning Systems for TCAS).

VP-BOY, VP-BOZ

Note: Inoperative. TCAS target information displayed on the VSI. TCAS must be activated on the transponder panel (refer to Chapter 11, Flight Management, Navigation for transponder operation and Chapter 15, Warning Systems for TCAS).

6 HSI Mode Selector

EXP/FULL VOR –

- displays VOR navigation information
- selects manual VOR and DME tuning on the VOR/DME panel (automatic tuning inhibited)

EXP/FULL ILS –

- displays ILS navigation information
- selects manual VOR and DME tuning on the VOR/DME panel (automatic tuning inhibited)

MAP –

- displays a dynamic map
- allows selection of manual or automatic VOR and DME tuning on the VOR/DME panel
- allows remote manual VOR and DME tuning on the PROGRESS page

PLAN –

- displays static FMC map in true–north–up orientation
- displays heading information in heading–up form
- allows selection of manual or automatic VOR and DME tuning on the VOR/DME panel

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- allows remote manual VOR and DME tuning on the PROGRESS page
- activates the MAP CTR STEP prompt on the LEGS page for stepping through the displayed route

7 Map Switches

NAV AID –

- displays only high altitude VHF navigation aids when HSI range is 80nm or greater
- displays all VHF navigation aids when HSI range is 40nm or less

Airport (ARPT) –

Displays all airports in the display range.

RTE DATA –

Displays estimated time of arrival and any altitude constraint for each waypoint in the displayed flight path.

Waypoint (WPT) –

- displays all waypoints when HSI range is 40nm or less

VP-BOQ, VP-BOY, VP-BRL

- those waypoints associated with NDBs are displayed at any selected range as long as the NDBs are within 80nm of the airplane.

8 HSI Brightness Controls

Rotate –

- outer control – adjusts overall brightness of HSI display
- inner control – adjusts brightness of weather radar

VP-BOY through VP-BRL, VQ-BRA

9 Weather Radar (WXR) Switch

Push –

- displays weather radar information on the HSI (refer to Chapter 11, Flight Management, Navigation)
- second push disables weather radar display

VP-BOQ

9 Weather Radar and Terrain (WXR/TERR) Display Enable Switch

Push –

- enables weather radar information on the HSI (refer to Chapter 11, Flight Management, Navigation)
- enables terrain data on the HSI in MAP, EXP ILS, and EXP VOR (refer to Chapter 15, Warning Systems)
- separate switches on the left and right center forward panels select which option is displayed on the HSI (refer to Chapter 15, Warning Systems)
- second push disables weather radar and terrain display



Flight Instruments, Displays

EFIS System Description

Chapter 10

Section 20

Introduction

The electronic flight instrument system (EFIS) consists of three (L, C, R) symbol generators (SGs), two control panels (CPs), two attitude director indicators (ADIs), two horizontal situation indicators (HSIs), and ambient light sensing units. The EFIS uses information provided by a variety of aircraft systems to generate the appropriate visual presentations on the HSI and ADI.

Data relating primarily to navigation is provided by aircraft systems such as the navigation radios, flight management computer (FMC), and the inertial reference systems. Data relating primarily to automatic flight is provided by the flight control computers (FCCs), the autothrottle (A/T), and the FMC. Data which is used to display current aircraft state information is provided by the two air data computers (ADCs) and the three inertial reference systems (IRSs).

Automatic adjustment of the display intensity for each display unit is provided by the ambient light sensing units. Flight crew control of the EFIS displays is accomplished by positioning the various controls on the respective EFIS control panels to the desired settings. For information on EFIS/IRS interface, and instrument switching see Section 10, of this chapter.

EFIS Symbol Generators

Three symbol generators form the heart of the EFIS. The SGs receive inputs from various aircraft systems, then generate the proper visual displays for the related ADI and HSI. Each pilot's ADI and HSI displays are provided from the SG selected with their respective EFI switch. The left SG normally provides the captain's displays, and the right SG normally provides the first officer's displays. The center SG is available as an alternate source for either or both pilots.

EFIS Control Panels

The EFIS control panels control display options, modes, ranges and brightness for the respective ADIs and HSIs.

Attitude Director Indicator

The ADI presents conventional displays for attitude (pitch and roll), flight director commands, localizer deviation and glideslope deviation. In addition, the ADI displays information relating to autoflight system mode annunciations, airplane speed, pitch limit, radio altitude, and decision height. The captain's attitude information is provided by the left IRS and the first officer's information is provided by the right IRS. The center IRS provides that data as an alternate source.

Attitude Display

Airplane attitude data is provided by the IRSs. The IRSs' pitch and roll attitude information is valid throughout 360 degrees of rotation in each axis.

Mode Annunciations

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

Mode annunciations for the A/T and the AFDS are displayed at the bottom of the ADI displays. For a detailed description of the various autoflight mode annunciations and their meanings, refer to Chapter 4, Automatic Flight.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

Mode annunciations for the A/T and the AFDS are displayed at the top of the ADI displays. For a detailed description of the various autoflight mode annunciations and their meanings, refer to Chapter 4, Automatic Flight.

Flight Director Commands

Flight director guidance commands from the selected FCC are displayed via the flight director symbol on the ADI.

VP-BMC

A flight director failure in either axis causes the command bar to disappear and the FD flag appears.

VP-BDI, VP-BOQ through VQ-BRA

A flight director failure in either axis causes the respective command bar to disappear. If both axes become unreliable, both command bars disappear and the FD flag appears.

Glideslope and Localizer Deviation Displays

Conventional ILS information is provided from the ILS receiver selected with each pilot's EFI switch. All three ILS receivers are commonly tuned on the ILS panel.

ILS Deviation Warning

VP-BDI, VP-BOQ through VQ-BRA

ILS localizer and glideslope deviations are monitored when below 500 feet radio altitude with the mode control panel APP switch selected ON. An alert is displayed if a significant deviation from localizer or glideslope occurs: the respective deviation scale changes color from white to amber and the associated pointer flashes. The alert stops when deviation returns to within normal limits. The glideslope alert is inhibited when below 100 feet radio altitude.

If a localizer alert is active, the stem of the rising runway symbol also flashes.

Rising Runway Symbol

VP-BDI, VP-BOQ through VQ-BRA
(SB Adds VP-BMC with rising runway symbol.)

The rising runway symbol is an integral part of the LOC deviation display and is positioned at the top of the LOC deviation pointer. The rising runway symbol is displayed in addition to the radio altitude display and gives an additional cue to the flight crew of the aircraft's close proximity to the ground as the airplane descends below 200 feet radio altitude. Full scale, vertical movement of the rising runway represents the last 200 feet of radio altitude. Zero feet radio altitude is indicated as the top of the runway symbol rises to the base of the airplane symbol.

Attitude Comparator

The EICAS caution message ATT DISAGREE displays when a difference of more than 3 degrees between the captain's and first officer's pitch or roll displays is detected. An amber PITCH or ROLL alerting annunciation is displayed on both ADIs for the parameter that is out of tolerance. Attitude comparison monitoring is inhibited when both pilots are using the center symbol generator by selecting ALTN on the EFI switches.

Height Alert

VP-BDI, VP-BOQ through VP-BOZ, VQ-BMU, VQ-BOG, VQ-BRA
(SB Adds VP-BWW, VP-BWX with height alerting.)

SB Deletes VP-BMC with height alerting.)

VP-BOY, VP-BOZ
(SB Deletes VP-BMC with 1000 foot radio height alerting.)

The radio height alert ALT is triggered when the airplane descends below 1,000 feet AGL. The alert is turned off when the airplane continues to descend below 500 feet AGL or climbs above 1,000 feet AGL, or after pressing the decision height reset switch on the EFIS control panel.

VP-BDI, VP-BOQ, VQ-BMU, VQ-BOG, VQ-BRA
(SB Adds VP-BWW, VP-BWX with radio height alerting at 2500 feet.)

The radio height alert ALT is triggered when the airplane descends below 2,500 feet AGL. The alert is turned off when the airplane continues to descend below 500 feet AGL or climbs above 2,500 feet AGL, or after pressing the decision height reset switch on the EFIS control panel.

Radio Altitude and Decision Height

When radio altitude is less than 2,500 feet AGL, a digital display is depicted on the ADI. At all other times, the digital radio altitude display is blanked.

When a positive decision height has been selected on the related EFIS control panel, the letters DH and the decision height are displayed just above the digital radio altitude display of the associated ADI.

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VP-BDI, VP-BOQ, VQ-BMU, VQ-BOG, VQ-BRA

(SB Adds VP-BWW, VP-BWX with radio altitude round dial decision height display. SB Deletes VP-BMC with radio altitude round dial decision height display.)

When the airplane is below 1000 feet AGL, a radio altitude dial is added to the radio altitude display, and the digital decision height display is replaced by a magenta pointer located on the radio altitude dial. As the airplane descends, segments of the ring erase and radio altitude is indicated by the remaining ring as well as by the digital value. When descending through the selected decision height, a decision height alert occurs. The radio altitude dial, digital display, and the decision height pointer change color to amber, flash momentarily, then remain steady amber as the airplane continues to descend.

VP-BOY through VP-BRL, VQ-BMQ, VQ-BPT

(SB Adds VP-BMC with digital radio altitude and decision height display. SB Deletes VP-BWW, VP-BWX with digital radio altitude and decision height display.)

When descending through the selected decision height, a decision height alert occurs. The display changes from white to amber, increases in size and DH flashes momentarily

The decision height alert is reset if any one of the following occurs:

- the DH reset switch on the EFIS control panel is pressed
- the radio altitude increases to decision height +75 feet
- the radio altitude is equal to zero feet (i.e. during touchdown).

Pitch Limit Indicator

The position of the pitch limit indicator is a function of the stall warning computer. It is programmed so that stick shaker activation will coincide with a pitch attitude equal to the pitch limit indication.

Ground Speed Display

VP-BMC through VP-BOZ, VQ-BMU, VQ-BRA

A digital presentation of the current ground speed is displayed. The ground speed data is received from the FMC or the IRS, with the FMC being the primary source.

Airspeed Display

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

The fast/slow airspeed indicator is positioned by the thrust management computer. For additional details see Chapter 4, Automatic Flight.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

Airspeed is displayed on a tape on the ADI. The current Mach number is digitally displayed below the airspeed tape when the current Mach number is greater than 0.40.

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The selected airspeed, takeoff and landing reference speeds, and flap maneuvering speeds are shown on the airspeed tape. Maximum and minimum airspeeds are also displayed on the airspeed tape.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

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.

Horizontal Situation Indicator (HSI)

The HSI presents an electronically generated color display of navigational data. Each HSI is capable of displaying the airplane's progress on a dynamic map display.

Display Orientation

During normal operation, heading reference data is supplied to each HSI from the respective IRS.

The 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 operating within polar regions.

Track

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

Airplane track data is supplied by the FMC during normal operation and by the CDU when in alternate navigation.

VP-BRL

Airplane track data is supplied by the FMC during normal operation

MAP Mode

The MAP mode is recommended for most phases of flight.

VP-BDI through VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA

Presented track up, this mode shows airplane position relative to the route of flight against a moving map background.

VP-BWW, VP-BWX, VQ-BPT

Presented heading up, this mode shows airplane position relative to the route of flight against a moving map background.

Displayed information can include:

- track
- heading
- wind
- routes
- position trend vector
- altitude range arc
- estimated time of arrival
- selected navigation data points programmed in the FMC

VOR Mode

The VOR mode is presented heading up. The VOR mode displays track, heading, and wind speed and direction with VOR navigation information.

ILS Mode

VP-BOQ through VP-BRL, VQ-BRA

The ILS mode is presented heading up. The ILS mode displays track, heading, and wind speed and direction with ILS approach information.

APP Mode

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

The APP mode is presented heading up. The APP mode displays track, heading, and wind speed and direction with ILS approach information.

PLAN Mode

The PLAN mode is presented true north up. The active route may be viewed using The STEP prompt on the LEGS pages.

Weather Radar Display

Display of weather radar returns on the HSI is enabled or disabled by the WXR switch on the respective EFIS control panel. The weather radar system is described in Chapter 11, Flight Management, Navigation.

Terrain Display

VP-BDI through VP-BOQ, VP-BWW through VQ-BPT

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

The HSI can display look ahead terrain alerting. For detailed information, refer to Chapter 15, Warning Systems.

VP-BOQ

The HSI can display look ahead terrain alerting. For detailed information, refer to Chapter 15, Warning Systems.

Traffic

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

Traffic information from the TCAS can be displayed on the HSI. TCAS is described in Chapter 15, Warning Systems.

Predictive Windshear

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG

The HSI can display predictive windshear warnings. For detailed information, refer to Chapter 15, Warning Systems.

EFIS Failure Flags and Annunciations

In addition to the normal EFIS displays, various failure annunciations, flags, or indications may be displayed on the ADI or HSI.

The location of the different failure flags and annunciations is depicted in the ADI and HSI Failure Flags and Annunciations figures included in the EFIS Controls and Indicators, section 10 of this chapter.

Not all EFIS displays will be replaced by a failure flag or annunciation if the signal from the sending unit has failed. In these instances, failure is indicated by removal of the data or the affected portions of the display.

During preflight, heading/track data is unavailable until the associated IRS has completed alignment and entered the navigation mode. Heading flags do not appear in this case.

VP-BDI through VP-BOZ, VP-BWW through VQ-BPT

If an FMC FAIL message is observed on a CDU, a MAP flag will appear on the associated HSI when viewing the MAP mode. Selecting the opposite FMC with the NAV selector will restore the map display. If both FMCs fail, selecting CDU on the NAV selector will allow the CDU to provide limited map data to the HSI. For more detailed information on the alternate navigation system, refer to Chapter 11, Flight Management, Navigation.

VQ-BRA

If an FMC FAIL message is observed on a CDU, a MAP flag will appear on the associated HSI when viewing the MAP mode. Selecting the opposite FMC with the NAV selector will restore the map display. However, the range selector for the opposite side pilot now controls the displayed range for both HSIs. If the failed side pilot selects a range that is not the same as the opposite side pilot, map information will again be lost and a MAP RANGE DISAGREE message will be displayed. If both FMCs fail, selecting CDU on the NAV selector will allow the CDU to provide limited map data to the HSI. For more detailed information on the alternate navigation system, refer to Chapter 11, Flight Management, Navigation.

VP-BRL

If an FMC FAIL message is observed on a CDU, a MAP flag will appear on the associated HSI when viewing the MAP mode. Selecting ALTN with the FMC switch will restore the map display.

Various fault messages can also be displayed. For example, a WXR/MAP RANGE DISAGREE message is displayed when the ranges for the FMC and weather radar disagree with the range selected on the HSI control panel.

An EXCESS DATA message is displayed if the quantity of information to the display exceeds the HSI's capability to provide a normal display. If in the MAP mode, deselecting the Map switches may correct the condition and remove the message.

Light Sensing and Brightness Control

Ambient light sensors automatically adjust the brightness of the EFIS displays. Once the desired brightness is set, using the EFIS brightness controls, little or no adjustment is needed throughout a wide range of ambient light conditions both outside and inside the flight deck.

Chapter 10

Conventional Instruments Controls and Indicators Section 30

Mach/Airspeed Indicator (Electric)

**VP-BDI through VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA
(SB Adds VP-BWW, VP-BWX with electric mach/airspeed indicators.)**



1 Vmo Pointer

Indicates the maximum operating airspeed in knots.

2 Vmo Flag

Flag in view – indicates the Vmo pointer is inoperative.

3 Airspeed Pointer

Indicates airspeed in knots.

4 Command Airspeed Bug

Indicates airspeed as manually selected with the IAS/MACH selector.

- positioned by FMC when IAS/MACH window is blank
- removed from view when inoperative.

5 Mach Indicator and Flag

Displays Mach number.

Display range:

- .400 to .999 Mach
- masked below .400 Mach
- flag in view – air data system is inoperative.

6 Command Airspeed Inoperative Flag

Flag in view – command airspeed bug is inoperative.

7 Reference Airspeed Bugs

Set at reference airspeeds.

8 Airspeed Indicator and Flag

- displays airspeed when above 30 knots
- flag in view – air data system is inoperative.

Primary Altimeter (Electric)

VP-BDI, VP-BMC, VP-BOY through VQ-BRA



1 Altitude Indicator

Indicates altitude in increments of twenty feet.

OFF flag in view– the altimeter is inoperative

NEG flag in view – displays in the two left-hand windows when altitude below zero feet is displayed.

2 Altitude Pointer

Makes one revolution each one thousand feet.

3 Barometric Setting Control

Rotate – adjusts barometric settings.

4 Altimeter Altitude (ALT) Light

Illuminated (white) –

VP-BMC, VP-BOY through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

- between 300 and 900 feet of the altitude selected with the altitude selector

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

- between 200 and 500 feet of the altitude selected with the altitude selector

5 Barometric Setting Window

Displays barometric correction (in millibars and inches of mercury) as set by the barometric setting control.

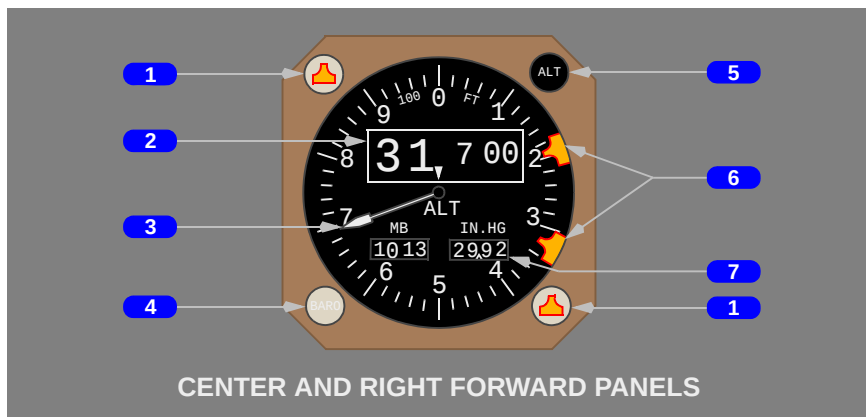
6 Reference Altitude Marker

Manually positioned to the desired reference altitude using the reference altitude marker control.

7 Reference Altitude Marker Control

Used to manually set the reference altitude marker.

VP-BOQ



1 Reference Altitude Marker Control

Used to manually set the reference altitude marker.

2 Altitude Indicator

Indicates altitude in increments of twenty feet.

OFF flag in view– the altimeter is inoperative

NEG flag in view – displays in the two left-hand windows when altitude below zero feet is displayed.

3 Altitude Pointer

Makes one revolution each one thousand feet.

4 Barometric Setting Control

Rotate – adjusts barometric settings.

5 Altimeter Altitude (ALT) Light

Illuminated (white) –

- between 300 and 900 feet of the altitude selected with the altitude selector

6 Reference Altitude Markers

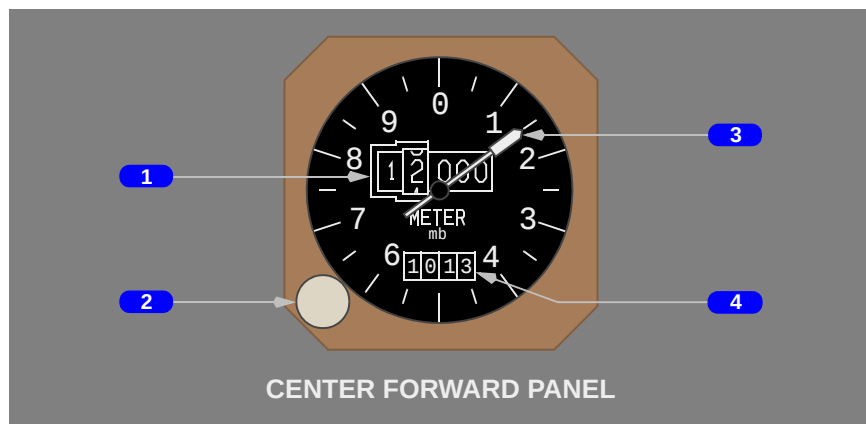
Manually positioned to the desired reference altitude using the reference altitude marker controls.

7 Barometric Setting Window

Displays barometric correction (in millibars and inches of mercury) as set by the barometric setting control.

Metric Altimeter

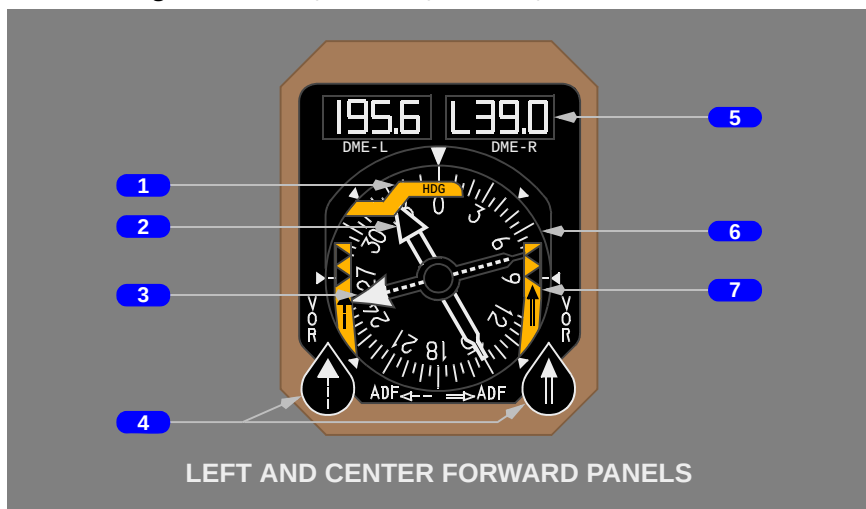
VP-BWW through VQ-BMQ, VQ-BPT



- 1 Digital Counter**
- 2 Barometric Setting Control**
- 3 Altitude Pointer**
- 4 Barometric Setting Window**

Radio Distance Magnetic Indicator

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA



1 Heading (HDG) Flag

Flag in view –

- selected IRS heading source has failed, or no computed data is available
- instrument failure.

2 Wide Bearing Pointer

- indicates right ADF/VOR magnetic bearing to selected station
- maintains last known bearing on loss of right ADF/VOR signal.

3 Narrow Bearing Pointer

- indicates left ADF/VOR magnetic bearing to selected station
- maintains last known bearing on loss of left ADF/VOR signal.

4 VOR/ADF Selector (Left/Right)

Rotate – selects related VOR or ADF for the bearing pointer.

VP-BOQ through VP-BRL, VQ-BRA

5 Left/Right DME (DME –L/R) Indicators

Displays distance to the VOR–tuned station (VORTAC or VOR/DME) in nautical miles, except when ILS is selected on the associated (L or R) EFIS control panel.

- displays distance to the ILS–tuned station when ILS is selected on the associated (L or R) EFIS control panel (L is displayed when valid ILS/DME is available)
- displays dashes when no computed data is available

VP-BOZ, VP-BRL, VQ-BRA

- displays blank when DME distance is unreliable

VP-BOQ, VP-BOY

- displays blank when DME distance is unreliable, or when there are no DME nav aids within range for autotuning

| VP-BDI, VP-BMC, VQ-BMU, VQ-BOG

5 Left/Right DME (DME –L/R) Indicators

Displays distance to the VOR–tuned station (VORTAC or VOR/DME) in nautical miles, except when APP is selected on the associated (L or R) EFIS control panel.

- displays distance to the ILS–tuned station when APP is selected on the associated (L or R) EFIS control panel (L is displayed when valid ILS/DME is available)
- displays dashes when no computed data is available
- displays blank when DME distance is unreliable, or when there are no DME nav aids within range for autotuning

6 Compass Card

Indicates airplane heading under lubber line.

- Captain's heading information as selected by the first officer's IRS switch
- First officer's heading information as selected by the captain's IRS switch

7 Bearing Pointer Failure Flag (Left/Right)

Selected VOR/ADF receiver has failed, or no computed data is available.

- may be in view with heading flag
- instrument failure.

VP-BWW through VQ-BMQ, VQ-BPT



1 Heading (HDG) Flag

Flag in view –

- selected IRS heading source has failed, or no computed data is available
- instrument failure.

2 Wide Bearing Pointer

- indicates right VOR magnetic bearing to selected station
- maintains last known bearing on loss of right VOR signal.

3 Narrow Bearing Pointer

- indicates left VOR magnetic bearing to selected station
- maintains last known bearing on loss of left VOR signal.

4 Left/Right DME (DME –L/R) Indicators

Displays distance to the VOR–tuned station (VORTAC or VOR/DME) in nautical miles, except when APP is selected on the associated (L or R) EFIS control panel.

- displays distance to the ILS–tuned station when APP is selected on the associated (L or R) EFIS control panel (L is displayed when valid ILS/DME is available)
- displays dashes when no computed data is available
- displays blank when DME distance is unreliable, or when there are no DME nav aids within range for autotuning

5 Compass Card

Indicates airplane heading under lubber line.

- Captain's heading information as selected by the first officer's IRS switch
- First officer's heading information as selected by the captain's IRS switch

6 Bearing Pointer Failure Flag (Left/Right)

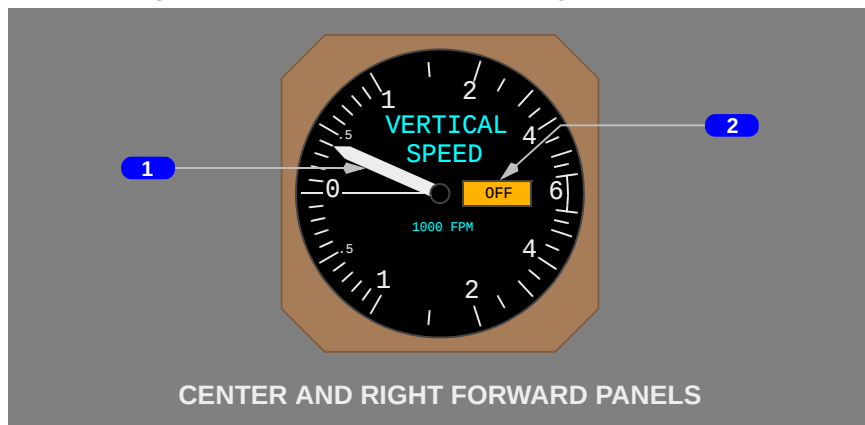
Selected VOR receiver has failed, or no computed data is available.

- may be in view with heading flag
- instrument failure.

Vertical Speed Indicator

VP-BDI through VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA

VP-BDI through VP-BOQ, VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA



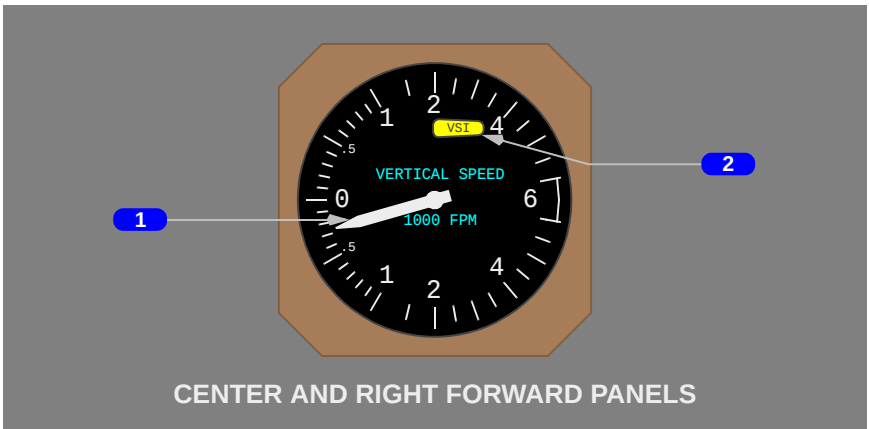
1 Vertical Speed Pointer

Indicates rate of climb or descent from 0 to 6,000 feet per minute.

2 OFF Flag

Flag in view – VSI is inoperative.

VP-BOY, VP-BOZ



1 Vertical Speed Pointer

- Indicates rate of climb or descent from 0 to 6,000 feet per minute
- Indicates zero when vertical speed is unreliable

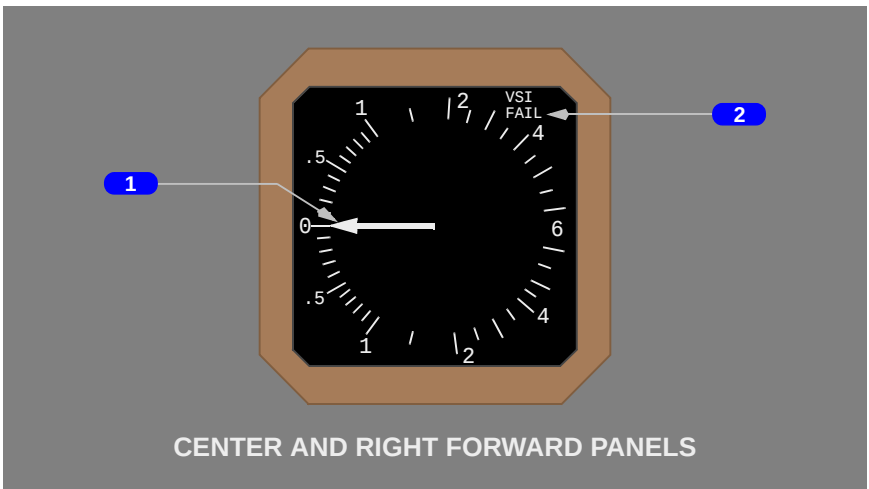
2 VSI Flag

Flag in view – VSI is inoperative.

Note: The VSI displays vertical guidance bars when TA/RA is selected with the transponder mode selector. (Refer to Chapter 15, Warning Systems)

Vertical Speed Indicator with TCAS Display

VP-BWW, VP-BWX, VQ-BPT



1 Vertical Speed Pointer

- Indicates rate of climb or descent from 0 to 6,000 feet per minute
- Blanks when vertical speed is unreliable

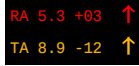
2 VSI Status Annunciation

- VSI FAIL (white) – VSI function is inoperative

Note: The VSI displays TCAS symbology when TA or TA/RA is selected with the transponder mode selector. (Refer to Chapter 15, Warning Systems)

Vertical Speed Indicator TCAS Symbology

VP-BWW, VP-BWX, VQ-BPT

Symbol	Name	Applicable Mode(s)	Remarks
	TCAS resolution advisory (RA), relative altitude (R)	TA/RA	These symbols are displayed when TA or TA/RA is selected with the transponder mode selector. Refer to Chapter 15, Warning Systems.
	TCAS traffic advisory (TA), relative altitude (A)	TA TA/RA	The arrow indicates traffic climbing or descending at a rate greater than or equal to 500 fpm. At rates less than 500 fpm, the arrow is not displayed.
	TCAS proximate traffic, relative altitude (W)	TA TA/RA	The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane.
	TCAS other traffic, relative altitude (W)	TA TA/RA	The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.
	TCAS no bearing message (RA-R, TA-A)	TA TA/RA	Message provides traffic type, range in NM, altitude and vertical direction.

Clock

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA



VP-BRL



1 Chronograph (CHR) Switch

Push – initiates start, stop and reset functions of the CHR display and second hand
Subsequent pushes –

- overrides any existing ET display
- controls chronograph second hand.

1A DATE Switch

Push – displays day and month, alternating with year.

Subsequent push – returns display to time.

2 Time/Date Window

Displays time (hours, minutes – 24 hour format) when time is selected with the date switch.

Alternately displays day–month and year when date is selected with the date switch.

3 Chronograph Second Hand

Indicates seconds.

4 Elapsed Time (ET) Selector

Controls the elapsed time function.

RUN – starts the elapsed time display.

HLD – stops the elapsed time display.

RESET – (spring–loaded to HLD) returns ET display to zero.

5 Elapsed Time/Chronograph (ET/CHR) Window

Displays elapsed time in hours and minutes, or chronograph minutes.

- when selected, the chronograph display replaces the elapsed time display
- elapsed time continues to run in the background and displays after the chronograph is reset.

6 SET Selector

Sets the time and date when the date switch is set to manual

RUN – starts the time indicator.

HLDY (hold, year) –

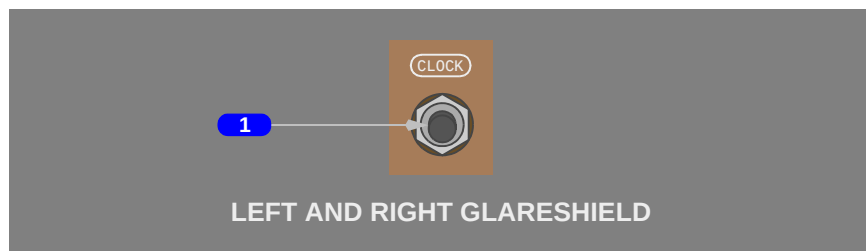
- stops the time indicator and sets the seconds to zero when time is selected with the date switch
- advances years when date is selected with the date switch.

MSM (minute slew, month) –

- advances minutes when time is selected with the date switch
- advances months when date is selected with the date switch.

HSD (hour slew, day) –

- advances hours when time is selected with the date switch
- advances days when date is selected with the date switch



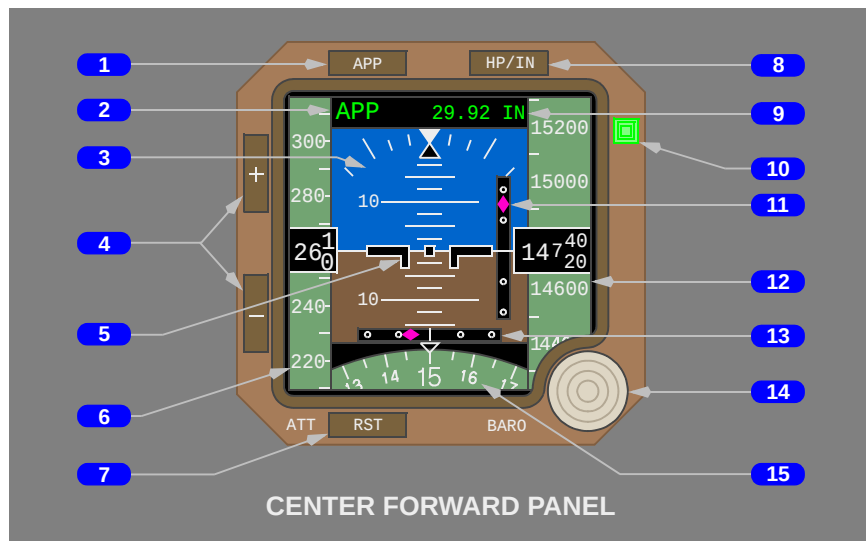
1 CLOCK Switch

Operates the same as the chronograph switch.

Standby Flight Instruments

Integrated Standby Flight Display (ISFD)

(SB Adds VP-BOQ with integrated standby flight display.)



1 Approach Mode (APP) Switch

Push –

- when blank, selects APP
- when APP displayed, selects BCRS
- when BCRS displayed, blanks

2 Approach Mode Annunciation

Displays approach mode:

- Blank – no approach deviation data displayed
- APP – ILS localizer and glideslope deviation data displayed
- BCRS – 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 intensity
- - decreases display intensity

5 Airplane Symbol

Indicates airplane attitude with reference to the horizon.

6 Airspeed Indications

Indicates current airspeed when above 30 knots.

7 Attitude Reset (RST) Switch

Push and hold at least two seconds

- aligns horizon with the airplane symbol
- reset takes approximately ten seconds
- starts new initialization sequence if previous attempt failed (ground only)

8 Hectopascal/Inch (HP/IN) Switch

Push – changes the units of the barometric pressure setting.

9 Barometric Setting

Indicates the barometric setting selected with the barometric selector.

STD is displayed when selected with the barometric selector.

10 Ambient Light Sensor

Automatically adjusts display intensity for ambient lighting condition.

11 Glideslope Pointer and Deviation Scale

The glideslope pointer indicates glideslope position relative to the airplane.

- the pointer is in view when the glideslope signal is received
- the scale is in view when the APP mode is selected
- the pointer and scale are removed when the BCRS mode is selected

12 Current Altitude

13 Localizer Pointer and Deviation Scale

The localizer pointer indicates localizer position relative to the airplane.

- the pointer is in view when the localizer signal is received
- the scale is in view when either the APP or BCRS mode is selected

14 Barometric (BARO) Selector

Rotate – changes barometric setting

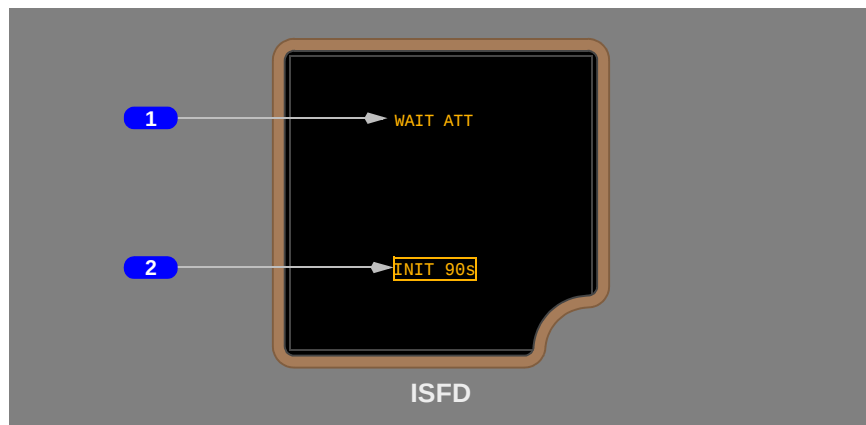
Push –

- selects standard barometric setting (29.92 inches Hg/1013 HPA)
- if STD is displayed, selects the preselected barometric setting

15 Magnetic Heading Scale

Displays airplane magnetic heading in a 45° compass rose format.

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

(SB Deletes VP-BOQ Removed older version of the ISFD.)

INIT 90s (amber) – 90 second initialization in progress.

INIT 90s – 90 second initialization countdown.

- 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.

The OUT OF ORDER annunciation replaces the display when a total ISFD system failure occurs.

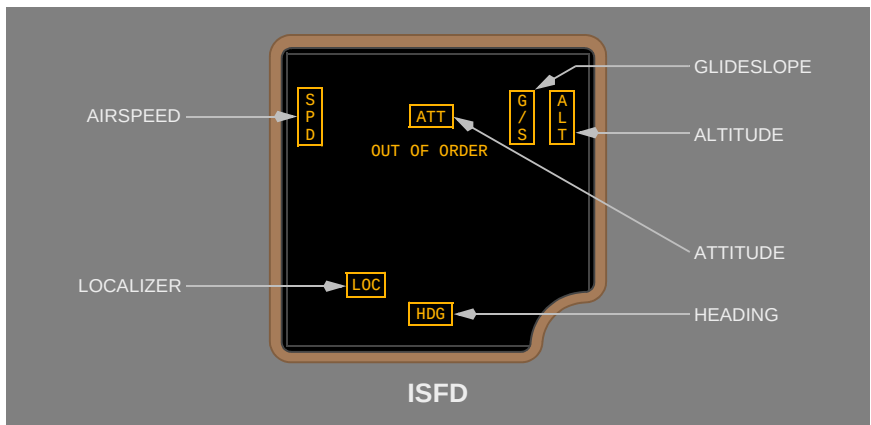


Diagram of the Center Forward Panel with numbered callouts:

- 1: Gyrocompass indicator (GYRO)
- 2: Heading scale (20, 20)
- 3: Heading scale (20, 20)
- 4: Heading scale (20, 20)
- 5: ILS OFF, ILS, B/CRS indicator
- 6: LOC indicator
- 7: Heading scale (20, 20)
- 8: Heading scale (20, 20)
- 9: Heading scale (20, 20)
- 10: Heading scale (20, 20)

CENTER FORWARD PANEL

6 Localizer (LOC) Flag

Flag in view – center localizer receiver has failed.

7 Glideslope Pointer and Deviation Scale

The glideslope pointer indicates glideslope position relative to the airplane.

- scale indicates deviation
- pointer is not displayed when ILS selector is OFF or no computed data exists.

8 Glideslope (G/S) Flag

Flag in view – center glideslope receiver has failed.

9 Localizer Pointer and Deviation Scale

The localizer pointer indicates position relative to the airplane.

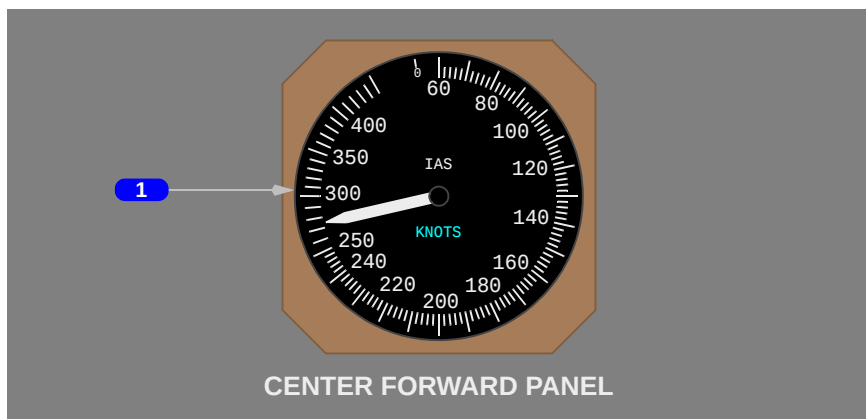
- scale indicates localizer deviation
- expanded localizer scale not available
- pointer not displayed when ILS selector is OFF or no computed data exists.

10 Caging Control

Pull – aligns horizon with the airplane symbol.

Standby Airspeed Indicator (Pneumatic)

VP-BDI, VP-BMC, VP-BOY through VQ-BRA
(SB Deletes VP-BOQ with standby airspeed indicators.)

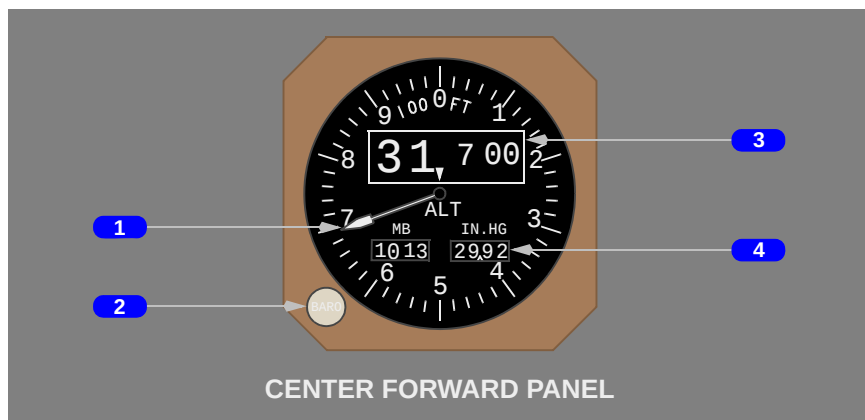


1 Standby Airspeed Indicator

Provides alternate airspeed information.

Standby Altimeter (Pneumatic)

VP-BDI, VP-BMC, VP-BOY through VQ-BRA
(SB Deletes VP-BOQ with standby altimeter.)



1 Altitude Pointer

Makes one revolution each one thousand feet.

2 Barometric Setting Control

Rotate – adjusts barometric settings.

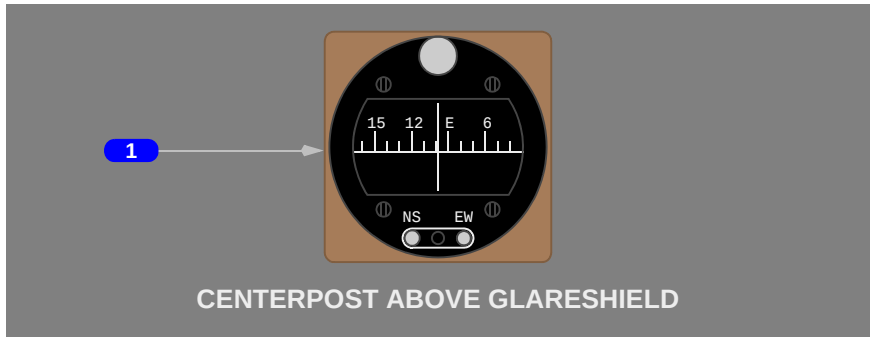
3 Altitude Indicator

Indicates altitude in increments of twenty feet.

4 Barometric Setting Window

Displays barometric correction (in millibars and inches of mercury) as set by the barometric setting control.

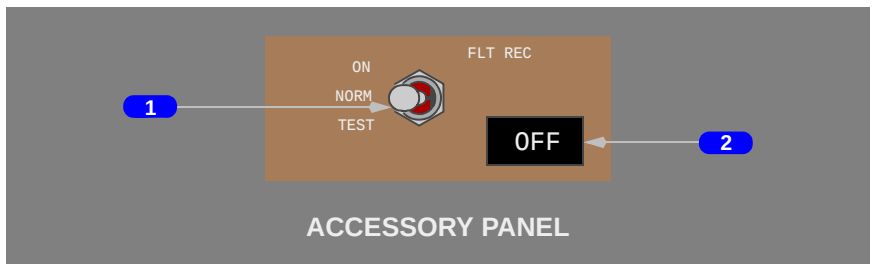
Standby Magnetic Compass



1 Standby Magnetic Compass

Displays magnetic heading.

Flight Recorder



1 Flight Recorder (FLT REC) Switch

ON – applies power to the flight recorder.

NORM –

- in flight – the recorder operates anytime electrical power is available
- on the ground – either engine must also be operating.

TEST – (Spring – loaded to NORM) initiates a flight recorder test.

2 Flight Recorder OFF Light

Illuminated (white) – indicates the recorder is not operating or the test is invalid.

Intentionally
Blank

**Flight Instruments, Displays****Chapter 10****Conventional Instruments System Description****Section 40****Introduction**

The conventional instruments provide information in addition to the EFIS displays to aid pilots in controlling the airplane throughout its flight regime. This section includes a discussion of the primary instruments, standby instruments, and the pitot static system.

Primary Flight Instruments**Mach/Airspeed Indicator**

VP-BDI through VP-BRL, VQ-BMQ through VQ-BOG, VQ-BRA
(SB Adds VP-BWW, VP-BWX with mach/airspeed indicator.)

Two electric mach/airspeed indicators display airspeed, mach, and Vmo from the selected air data source. The Vmo pointer indicates the maximum operating airspeed in knots or the equivalent to the maximum operating mach number. The command airspeed bug on each indicator can be automatically positioned from the FMC, or manually from the MCP IAS/MACH Selector.

Primary Altimeter

Two electric altimeters indicate current altitude in feet. An altimeter altitude light is provided. Altitude alerting is described in Chapter 15, Warning Systems.

Radio Distance Magnetic Indicator (RDMI)

Two radio distance magnetic indicators are installed. Each displays magnetic heading or true heading, VOR or ADF bearing, and (VOR/ILS/DME, VORTAC) distance. The RDMI receives primary heading signals from the opposite side IRS and alternate heading signals from the C-IRS. The RDMI is inoperative until the associated IRS has completed alignment and entered the navigation mode.

With the heading reference switch in NORM, magnetic heading is displayed if the airplane is outside polar regions. In polar regions, a heading flag shows. When the switch is in TRUE, true heading is displayed regardless of latitude. For more information on polar regions refer to Chapter 11, Flight Management, Navigation.

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

When the RDMI is referenced to true north, positioning an ADF/VOR selector to VOR causes the associated pointer failure flag to appear.

Vertical Speed Indicator

Two electrically-driven vertical speed indicators (VSI) are installed. The captain's VSI is connected to the left IRS and ADC, and the first officer's VSI is connected to the right IRS and ADC. The center IRS provides backup vertical speed data for either crew member when ALTN is selected with the respective IRS switch. The opposite ADC provides backup vertical speed data for either crewmember when ALTN is selected with the respective AIR DATA switch.

The VSI is inoperative until the associated IRS has completed alignment and entered the navigation mode.

Standby Flight Instruments

VP-BDI, VP-BMC, VP-BOY through VQ-BRA
(SB Deletes VP-BOQ replacing the Standby Flight Instruments with the Integrated Standby Flight Display (ISFD).)

Standby Attitude Director Indicator (Standby ADI)

A self-contained standby attitude director indicator incorporating an ILS display is installed. In the event that all generator power is lost, the standby ADI will be supplied with electrical power from the standby DC bus. ILS information is provided from the C-ILS receiver.

Standby Airspeed Indicator (Pneumatic)

The standby airspeed indicator provides current airspeed in knots. It is connected directly to the L AUX PITOT and the alternate static ports. (See pitot-static system schematic.)

Standby Altimeter (Pneumatic)

A single indicator is installed for standby reference. Input for the indicator is from the alternate static ports. (See pitot-static system schematic.)

Integrated Standby Flight Display (ISFD)

(SB Adds VP-BOQ with ISFD.)

The ISFD displays attitude, airspeed, altitude, ILS, and magnetic heading information. It is connected directly to the L AUX PITOT and the alternate static sources. (See pitot-static system schematic.) 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 left IRS only. Heading information is not available in polar regions.

Note: The standby magnetic compass must be used to validate heading information.

The standby DC bus powers the ISFD. Selecting the battery switch ON and the standby power selector to AUTO activates the ISFD. After 10 seconds, an initialization sequence begins that requires 90 seconds to complete. ATT and INIT 90s messages are displayed during initialization. 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. Operation of the attitude reset switch is required in response to the ATT:RST message. This will reset the horizon line with the airplane symbol.

On the ground, operation of the attitude reset switch must be performed with the airplane stationary. In flight, operation of the attitude reset switch must be performed with the airplane in wings level, non-accelerated flight. During the process, the ATT 10s message displays. Failure to maintain straight and level flight for 10 seconds may result in an ATT:RST message. If the reset attempt is unsuccessful, the ATT:RST message remains displayed and attitude will not be displayed.

Standby Magnetic Compass

A standard magnetic standby compass is provided. A card located near the compass provides heading correction factors.

Clock

Two electronic clocks are installed, with two digital displays on each clock. Either coordinated universal time (UTC) or local time may be set on the upper time display. The lower ET/CHR display is used for either elapsed time or the chronograph. Separate controls are provided for each display.

In addition to UTC and local time, the date may be set on the upper time display.

Flight Recorder

The flight recorder provides a permanent record of selected operational systems in a sealed, fire-resistant container. The recorder automatically turns on when either engine is operating or the airplane is in flight.

Air Data System

The air data system consists of the pitot-static system, one temperature probe (TAT), two angle of attack probes, two air data computers (ADCs), and electric flight instruments.

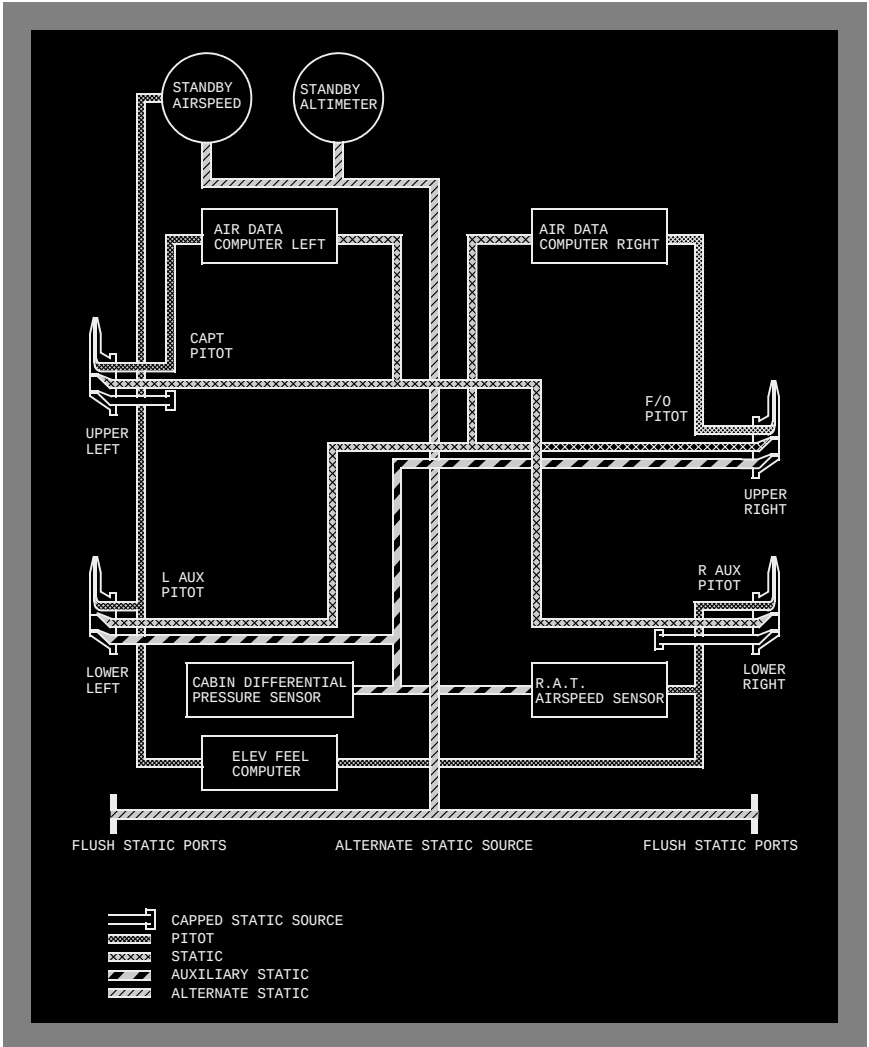
The system provides pitot and/or static pressure information to various flight instruments and airplane systems. Standby airspeed and altimeter indicators are also provided. The ADCs use air data information to provide input signals to certain flight instruments (electric mach/airspeed indicator, electric altimeter) and other using systems (AFDS, FMC, etc.). The left instruments use the left ADC and the right instruments use the right ADC. The opposite ADC is available as an alternate air data source.

Warning flags indicate instrument failure or unreliable data. When a malfunction occurs in instruments with failure monitors, warning flags appear.

The EICAS caution messages ALT DISAGREE or IAS DISAGREE display when there is a significant difference between the left and right air data information. These messages are inhibited at low altitude or when both pilots have the same air data source selected.

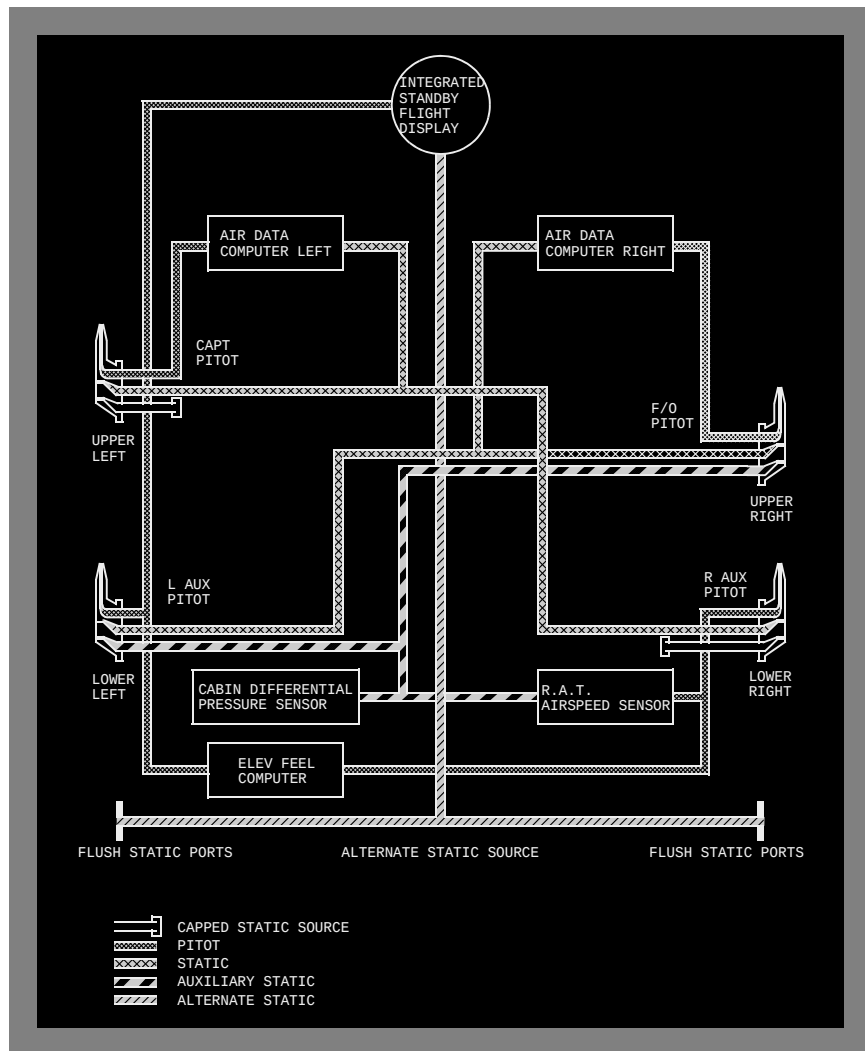
Pitot-Static System Schematic

VP-BDI, VP-BMC, VP-BOY through VQ-BRA
(SB Deletes VP-BOQ with Standby Flight Instruments.)



Pitot-Static System Schematic

(SB Adds VP-BOQ with Integrated Standby Flight Display.)



Total Air Temperature (TAT)

TAT appears on the primary EICAS display above the engine indications and is supplied by a thrust management or air data computer. The TAT indication is comprised of outside air temperature (OAT) plus ram rise. TAT Indication on the ground will approximate OAT.



True Airspeed/Static Air Temperature (TAS/SAT)

True airspeed (TAS) and static air temperature (SAT) are displayed on the PROGRESS page.

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Flight Instruments, Displays

EICAS Messages

Chapter 10

Section 50

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	Light	Aural	Condition
ALT DISAGREE	Caution		Beeper	Captain's and first officer's altitude indications disagree.
ATT DISAGREE	Caution		Beeper	Captain's and first officer's attitude indications disagree.
IAS DISAGREE	Caution		Beeper	Captain's and first officer's airspeed indications disagree.
INSTR SWITCH	Caution		Beeper	Both EFI switches are in the ALTN position.

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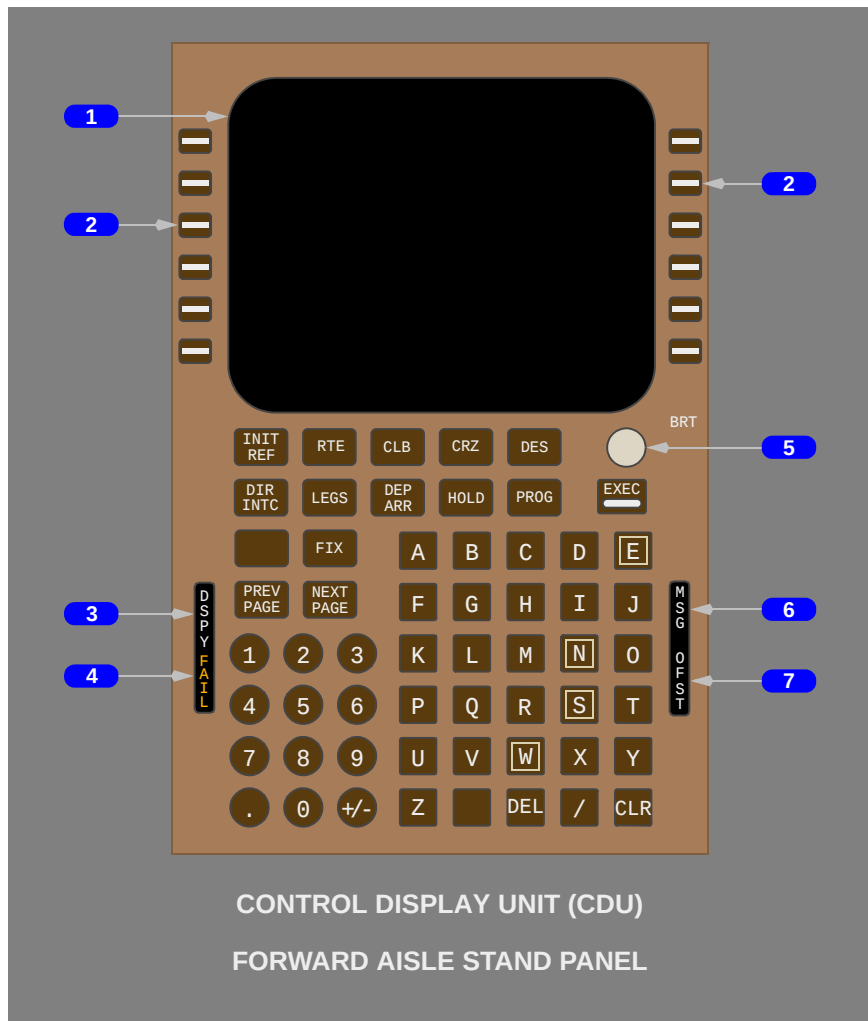


Flight Management, Navigation Controls and Indicators

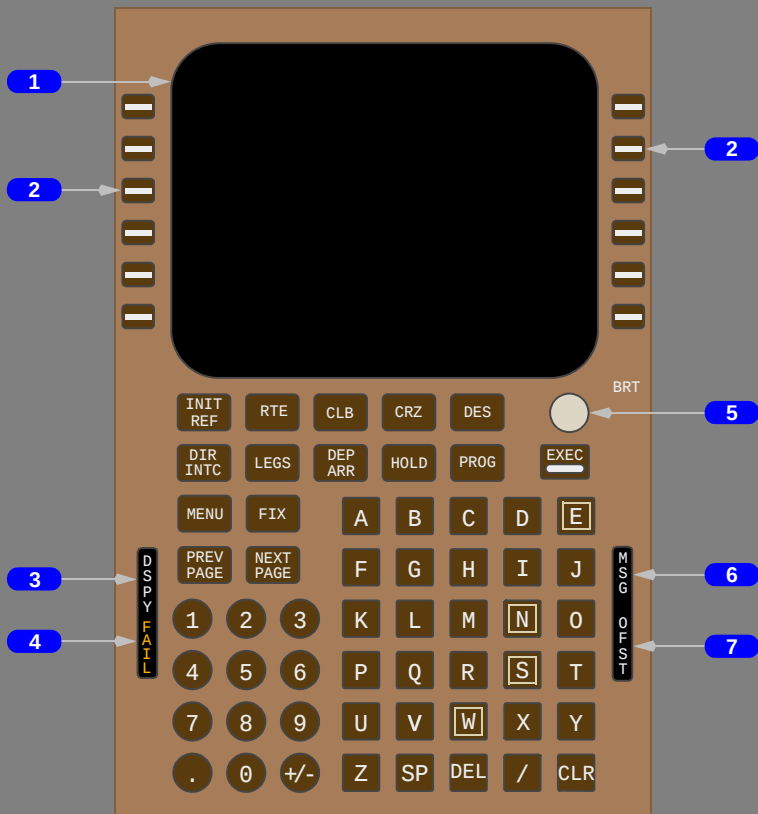
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Flight Management System Control Display Unit (CDU)

VP-BRL



VP-BOQ, VP-BOZ, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

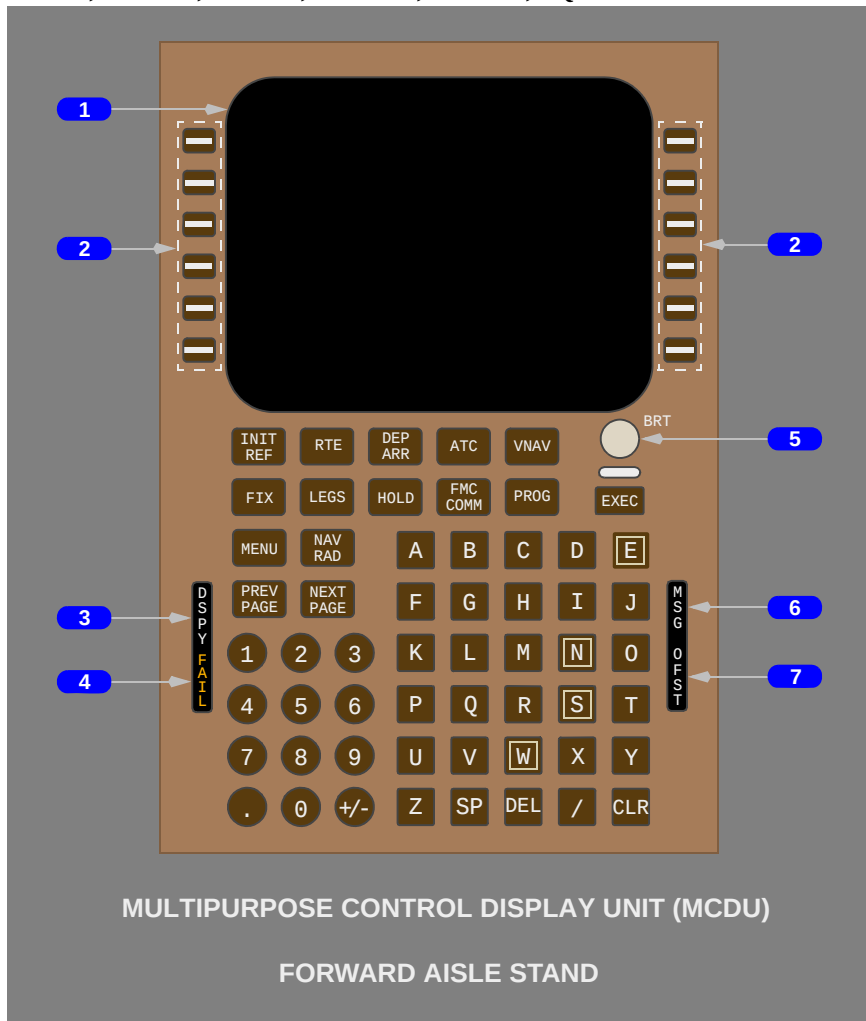


HYBRID MULTIPURPOSE CONTROL DISPLAY UNIT (HMCPU)

FORWARD AISLE STAND PANEL

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VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG



1 Control Display Unit (CDU) Display

Displays CDU data pages.

2 Line Select Keys

Push –

- moves data from scratchpad to selected line
- moves data from selected line to scratchpad

- selects page, procedure, or performance mode as applicable
- deletes data from selected line when DELETE is shown in scratchpad.

3 Display (DSPY) Light

Illuminated (white) –

- when RTE page 3 or greater, RTE LEGS page 2 or greater, RTE DATA page 2 or greater is shown
- when airplane is not in holding pattern shown on HOLD page
- when modification is in progress, and any RTE, RTE LEGS, RTE DATA, HOLD, CLB, CRZ, or DES page is shown.

4 FAIL Light

Illuminated (amber) – fault detected in related FMC.

5 Brightness Control

Rotate – controls display brightness.

6 Message (MSG) Light

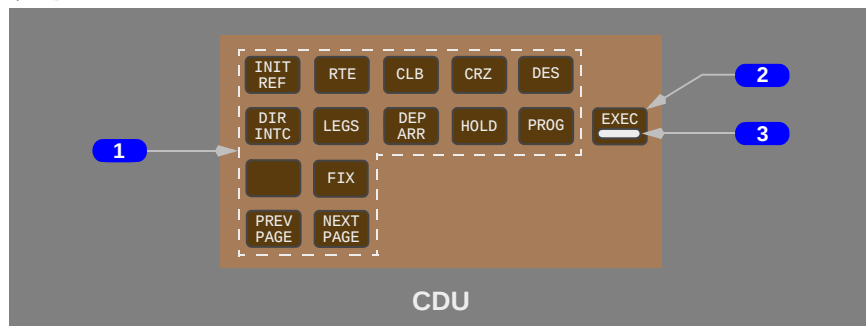
Illuminated (white) – scratchpad message is shown.

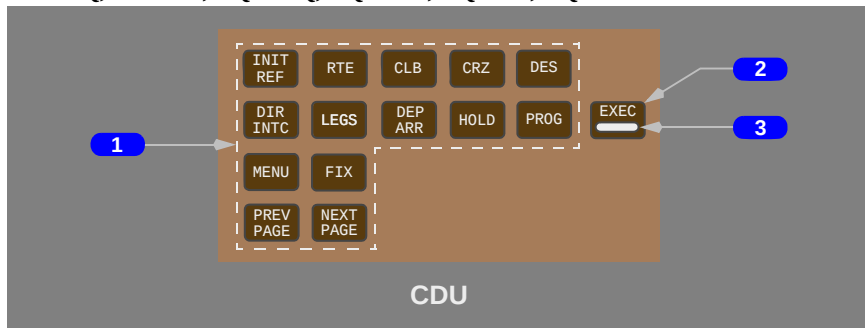
7 Offset (OFST) Light

Illuminated (white) – LNAV gives guidance for lateral route offset.

Function and Execute Keys

VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA
VP-BRL



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VP-BOQ, VP-BOZ, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

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
- CLB – displays page to view or change vertical navigation profile in climb
- CRZ – displays page to view or change vertical navigation profile in cruise
- DES – displays page to view or change vertical navigation profile in descent
- DIR INTC – displays page to change the active waypoint and select a direct or intercept course to that waypoint
- LEGS –
 - displays page to evaluate or modify lateral and vertical route data
 - displays page to control the center point of the PLAN mode display
- DEP ARR – displays page to input or change departure and arrival procedures
- HOLD – displays page to create holding patterns and show holding pattern data
- PROG – displays page to view dynamic flight and navigation data, including waypoint and destination ETAs, fuel remaining, and arrival estimates

VP-BOQ, VP-BOZ, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

- MENU – displays page to choose subsystems controlled by CDU
- FIX – displays page to create reference points on the map display
- PREV PAGE – displays previous page of related pages (for example, LEGS pages)
- NEXT PAGE – displays next page of related pages.

2 Execute (EXEC) Key

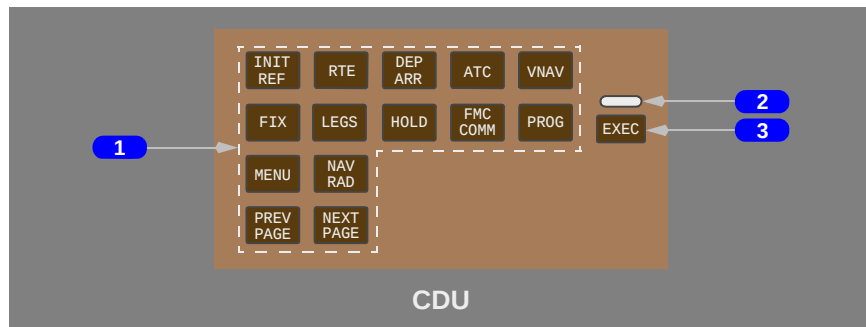
Push –

- makes data modification(s) active
- extinguishes execute light.

3 Execute Light

Illuminated (white) – active data is modified but not executed.

VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG



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

VP-BWW, VP-BWX, VQ-BOG

- ATC – displays ATC datalink pages

VP-BDI, VP-BMC, VP-BOY

- ATC – displays ATC datalink pages (function inoperative)
- VNAV – displays page to view or change vertical navigation path data
- FIX – displays page to create reference points on the map display
- LEGS –
 - displays page to evaluate or modify lateral and vertical route data
 - displays page to control the center point on the PLAN mode display
- HOLD – displays page to create holding patterns and show holding pattern data

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

- FMC COMM – displays FMC data link status page

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VP-BOY

- FMC COMM – displays FMC data link status page (function inoperative)
- PROG – displays page to view dynamic flight and navigation data, including waypoint and destination ETAs, fuel remaining, and arrival estimates
- MENU – displays page to choose subsystems controlled by CDU
- NAV RAD – displays page to monitor or control VOR tuning
- PREV PAGE – displays previous page of related pages (for example, LEGS pages)
- NEXT PAGE – displays next page of related pages.

2 Execute Light

Illuminated (white) – active data is modified but not executed.

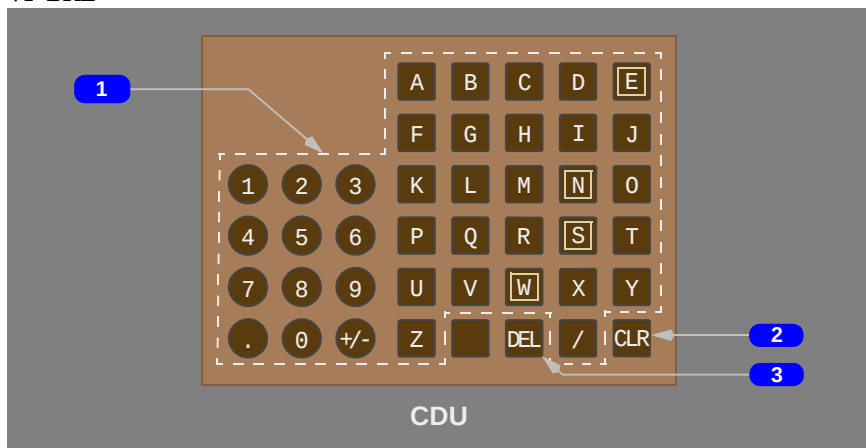
3 Execute (EXEC) Key

Push –

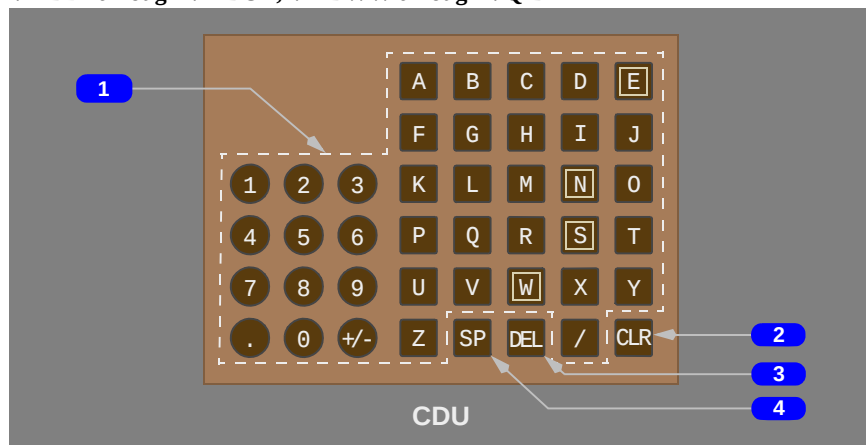
- makes data modification(s) active
- extinguishes execute light.

Alpha/Numeric and Miscellaneous Keys

VP-BRL



VP-BDI through VP-BOZ, VP-BWW through VQ-BRA



1 Alpha/Numeric Keys

Push –

- puts selected character in scratchpad
- Slash (/) key – puts "/" in scratchpad
- Plus Minus (+/-) key – first push puts "-" in scratchpad. Subsequent pushes alternate between "+" and "-".

2 Clear (CLR) Key

Push –

- if scratchpad message is present – clears scratchpad message.
- if scratchpad entry in progress – clears last scratchpad character

Push and hold – clears all scratchpad data.

3 Delete (DEL) Key

Push – enters "DELETE" in scratchpad.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

4 Space (SP) Key

Push – puts space in scratchpad.

VP-BDI through VP-BOY, VP-BWW through VQ-BPT

Note: The SP key is normally used when keying in messages for datalink communications. If the SP key is inadvertently pressed while keying in data for FMC use, it will result in an INVALID ENTRY scratchpad message when attempting to select the data to the appropriate line. Should this occur, clear the scratchpad and begin again.

CDU Page Components



1 Page Title

Subject or name of data shown on page.

ACT (active) or MOD (modified) displays whether page contains active or modified data.

2 Line Title

Title of data on line below.

3 Line

Displays –

- prompts
- selectors
- data.

4 Prompts

Show pages, select modes, and control displays. Caret, "<" or ">", is displayed before or after the prompt adjacent to the related line select key.

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 Boxes

Data input is mandatory.

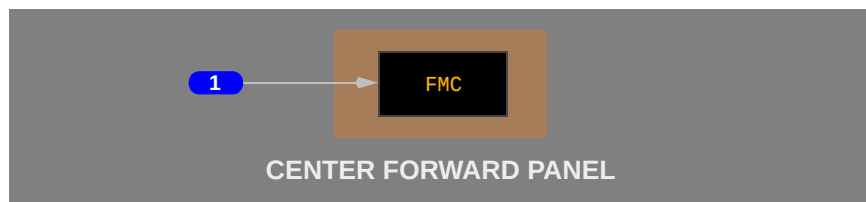
7 Dashes

Data input is optional. The data is not mandatory.

8 Scratchpad

Displays messages, alphanumeric entries or line selected data.

FMC Annunciator Light



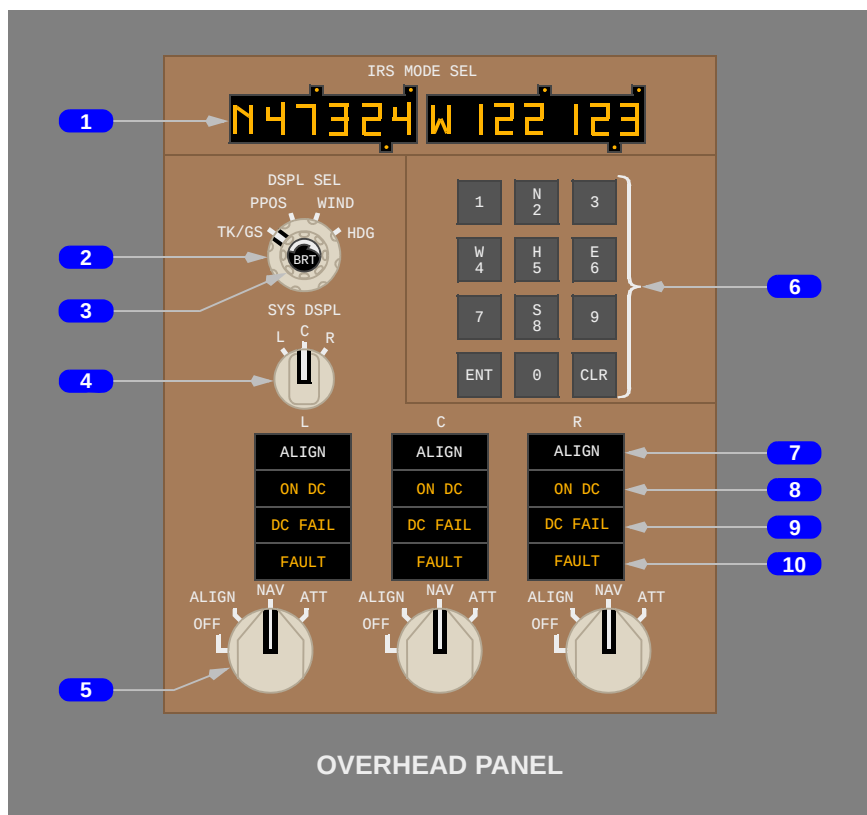
1 FMC Annunciator Light

Illuminated (amber) –

- CDU is displaying an operationally significant message in the scratchpad
- pushing CDU CLR key extinguishes the light and clears the scratchpad message

Inertial System

Inertial Reference System



1 IRS DISPLAY

Displays track, groundspeed, present position, wind or heading as controlled by display selectors or keyboard.

2 IRS Display Selector

Selects data for display when keyboard not in control.

- TK/GS – displays present true track and groundspeed
- PPOS – displays present position
- WIND – displays present true wind when inflight
- HDG – displays present true heading.

3 Brightness Control

Rotate – controls intensity of display.

4 IRS System Display Selector

Selects system to display data when keyboard not in control.

5 IRS Mode Selectors

Rotate – controls mode of related IRS.

Must be pulled out to move from NAV position.

OFF –

- alignment is lost
- ALIGN light illuminates for 30 seconds as system goes through a shutdown sequence
- realignment requires about 10 minutes while the airplane is parked and entry of present position (latitude and longitude).

ALIGN –

- initiates alignment when parked
- initiates a quick alignment if selected when the system is in the navigation mode.

NAV –

- normal operational mode
- permits system to enter NAV mode after completing alignment
- initiates a 10 minute alignment if selected from OFF.

ATT –

- provides only attitude and heading information
- position and ground speed information lost until system realigned on ground
- when selected airborne, ALIGN light illuminates for 30 seconds while system senses local level (requires level flight)
- magnetic heading input required to initialize heading output
- the selector must be cycled through OFF to re-enter ALIGN or NAV mode.

6 IRS Keyboard

Push an alpha key to begin entry.

- pushing the N, S, E or W keys changes the IRS display to keyboard control and arms the keyboard for latitude or longitude entry
- pushing H changes the display to keyboard control and arms the keyboard for heading entry.

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Enter (ENT) Key – push

- enters data from display into all three IRS systems
- restores display to the display selector setting

Clear (CLR) Key – push

- clears data keyed into display
- restores display to the display selector setting.

7 ALIGN Lights

Illuminated (white) –

- steady – the related IRS is operating in the ALIGN mode, the initial ATT mode, or the shutdown cycle
- flashing – alignment cannot be completed due to IRS detection of:
 - significant difference between previous and entered positions or an unreasonable present position entry
 - no present position entry.

Extinguished –

- IRS not in ALIGN mode
- with mode selector in NAV, alignment is complete, and all IRS information is available
- with mode selector in ATT, attitude information is available. Heading information is available following entry of initial magnetic heading.

8 ON DC Lights

Illuminated (amber) –

- normal AC power for the related IRS has failed and the IRS is operating on DC backup power from the hot battery bus (AC power not normal)
- if on the ground, the ground–call horn in the nose wheel well sounds, providing an alert that a battery drain condition exists
- EICAS advisory message L, C or R IRS ON DC is displayed
- momentary illumination is normal during alignment self–test.

9 DC FAIL Lights

Illuminated (amber) –

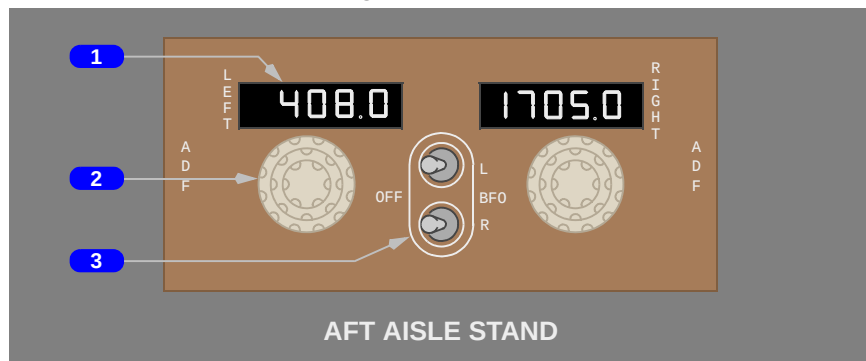
- DC backup power for the related IRS has failed
- if the other lights are extinguished, the IRS is operating normally on AC power.
- EICAS advisory message L, C or R IRS DC FAIL is displayed

10 FAULT Lights

Illuminated (amber) – a system fault affecting the related IRS ATT and/or NAV modes has been detected. The EICAS advisory message L, C or R IRS FAULT is also displayed.

Radio Navigation Systems Automatic Direction Finding (ADF) Control

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA



1 Frequency Indicators

Display the frequency selected with the related frequency selector.

2 Frequency Selectors

Rotate –

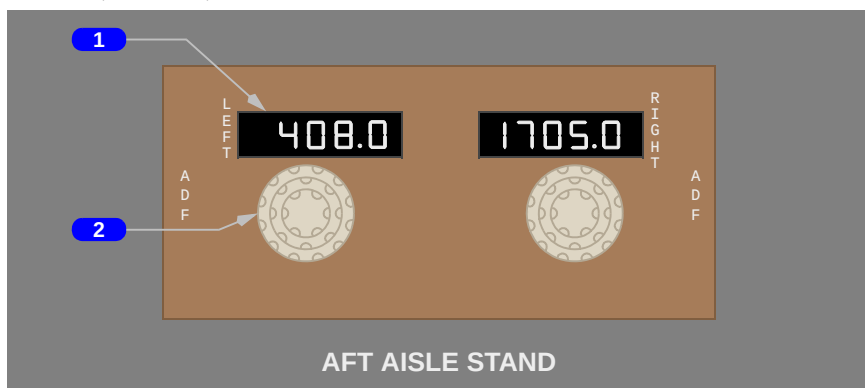
- outer knob sets the hundreds number
- middle knob sets the tens number
- inner knob sets the tenths and ones number.

3 BFO Switches

BFO – activates tone generator (beat frequency oscillator) for receiving identifier from unmodulated (A1) stations.

OFF – deactivates tone generator.

VP-BMC, VP-BOY, VP-BOZ



1 Frequency Indicators

Display the frequency selected with the related frequency selector.

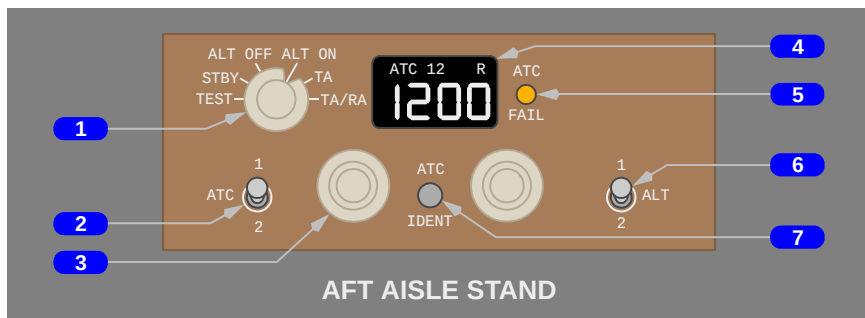
2 Frequency Selectors

Rotate –

- outer knob sets the hundreds number
- middle knob sets the tens number
- inner knob sets the tenths and ones number.

Transponder Panel

VP-BOY, VP-BOZ



1 Transponder Mode Selector

TEST – activates test.

STBY – deactivates transponder.

ALT OFF – activates transponder without altitude reporting if airplane is in-flight.

ALT ON – activates transponder with altitude reporting if airplane is in-flight.

TA (traffic advisory) – activates TCAS Traffic Advisory (TA) mode and altitude reporting. (refer to Chapter 15, Warning Systems)

TA/RA – activates TCAS TA and Resolution Advisory (RA) modes. (refer to Chapter 15, Warning Systems)

2 Transponder Switch

1 – selects number 1 transponder for operation.

2 – selects number 2 transponder for operation.

4 Transponder Code Selectors

Sets transponder code in transponder code window and both transponders. Left selector sets the first two digits, the right selector sets the second two digits.

4 Transponder Code Window

Displays transponder code. The heading displays which transponder is selected (ATC 1 or 2) and when a reply is being sent (R).

5 ATC FAIL Light

Illuminated (amber) – selected transponder has failed.

6 Altitude (ALT) Source Select Switch

Selects the altitude source for the transponder.

1 – left ADC

2 – right ADC

7 Identification (IDENT) Switch

Push – transmits an identification signal.

VP-BMC, VQ-BRA



1 Transponder Mode Selector

TEST – activates test.

STBY – deactivates transponder.

ALT RPTG OFF – activates transponder without altitude reporting if airplane is in-flight.

XPDR – activates transponder with altitude reporting if airplane is in-flight.

TA ONLY – activates TCAS Traffic Advisory (TA) mode and altitude reporting. (refer to Chapter 15, Warning Systems)

TA/RA – activates TCAS TA and Resolution Advisory (RA) modes. (refer to Chapter 15, Warning Systems)

2 Transponder Code Selector

Sets transponder code in transponder code window and both transponders.

3 Transponder Code Window

Displays transponder code.

4 ATC FAIL Light

Illuminated (amber) – selected transponder has failed.

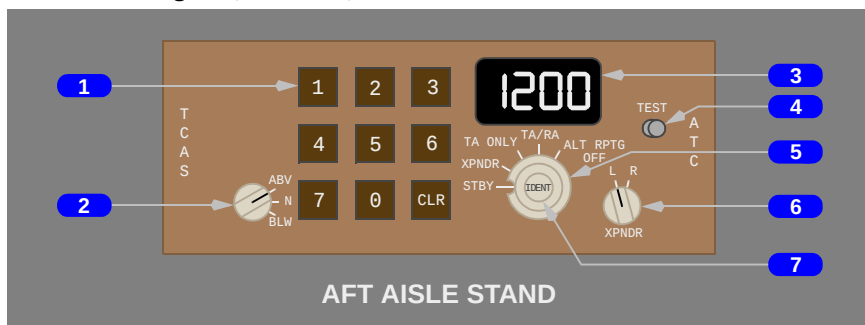
5 Transponder (XPDR) Selector

L or R – selects transponder for operation.

6 Identification (IDENT) Switch

Push – transmits an identification signal.

VP-BWW through VQ-BMU, VQ-BPT



1 Transponder Code Selectors

Push – sets transponder code in transponder code window and both transponders.

2 Above (ABV) /Normal/Below (BLW) Switch

Controls TCAS displays. (refer to Chapter 15, Warning Systems)

3 Transponder Code Window

Displays transponder code and operating transponder (L or R).

4 Test Switch

Push – activates test.

5 Transponder Mode Selector

STBY – deactivates transponder.

XPNDR – activates transponder with altitude reporting if airplane is in-flight.

TA ONLY – activates TCAS Traffic Advisory (TA) mode. (refer to Chapter 15, Warning Systems)

TA/RA – activates TCAS TA and Resolution Advisory (RA) modes. (refer to Chapter 15, Warning Systems)

ALT RPTG OFF – activates transponder without altitude reporting if airplane is in-flight.

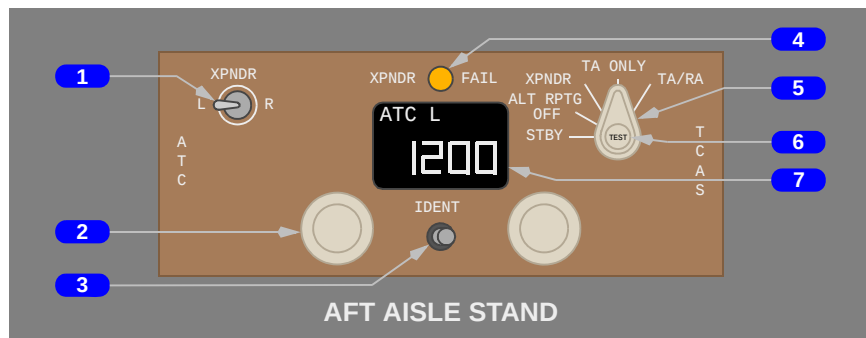
6 Transponder (XPNDR) Switch

L or R – selects transponder for operation.

7 Identification (IDENT) Switch

Push – transmits an identification signal.

VP-BDI, VP-BRL, VQ-BOG



1 Transponder (XPNDR) Selector

L or R – selects transponder for operation.

2 Transponder Code Selectors

Sets transponder code in transponder code window and both transponders. Left selector sets the first two digits, the right selector sets the second two digits.

3 Identification (IDENT) Switch

Push – transmits an identification signal.

4 Transponder (XPNDR) FAIL Light

Illuminated (amber) – selected transponder has failed.

5 Transponder Mode Selector

STBY – deactivates transponder.

ALT RPTG OFF – activates transponder with altitude reporting off if airplane is in-flight.

XPNDR – activates transponder with altitude reporting if airplane is in-flight.

TA ONLY – activates TCAS Traffic Advisory (TA) mode. (refer to Chapter 15, Warning Systems)

TA/RA – activates TCAS TA and Resolution Advisory (RA) modes. (refer to Chapter 15, Warning Systems)

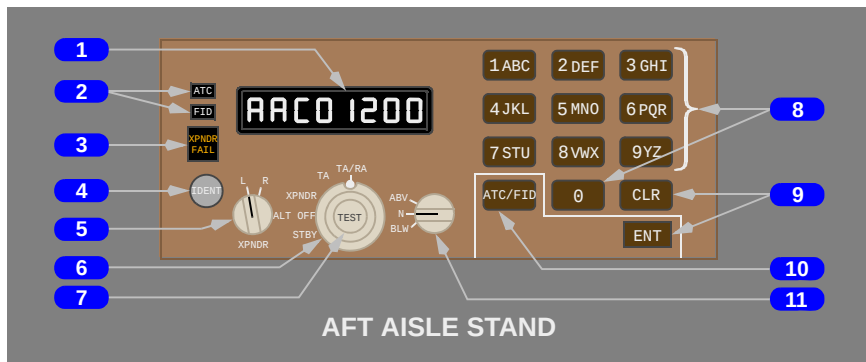
6 Test Switch

Push – initiates transponder test.

7 Transponder Code Window

Displays transponder code. The heading shows which transponder is selected (ATC L or R).

VP-BOQ



1 Flight ID/Transponder Code Window

- Displays flight ID code when FID mode selected.
- Displays transponder code when ATC mode selected.

2 Transponder (ATC) /Flight ID (FID) Annunciator Lights (white)

ATC – annunciates when ATC mode selected.

FID – annunciates when flight ID mode selected.

3 Transponder Fail (XPNDR FAIL) Light (amber)

Illuminated – selected transponder has failed.

4 Identification (IDENT) Switch

Push – transmits identification signal.

5 Transponder Selector

L or R – selects transponder for operation.

6 Transponder Mode Selector

STBY – deactivates transponder. TCAS II is also disabled and TCAS OFF is annunciated on the TCAS II display.

ALT OFF – activates transponder with altitude reporting off when airplane is in-flight.

XPNDR – activates transponder function with altitude reporting on when airplane is in-flight. TCAS II is disabled and TCAS OFF is annunciated on the TCAS II display.

TA – activates TCAS II Traffic Advisory (TA) mode, no Resolution Advisories are issued. (refer to Chapter 15, Warning Systems)

TA/RA – activates TCAS II to provide Traffic Advisories and Resolution Advisories. (refer to Chapter 15, Warning Systems)

7 Test Switch

Push – activates test.

8 Transponder and Flight ID Code Selectors

- Sets flight ID surveillance code in flight ID/transponder code window when panel is selected to flight ID mode.
- Sets transponder code in flight ID/transponder code window when panel is selected to transponder mode.

9 Clear (CLR)/Enter (ENT) Switch

CLR – clears code in flight ID/transponder code window.

ENT – enters into the transponder the code displayed in the flight ID/transponder code window.

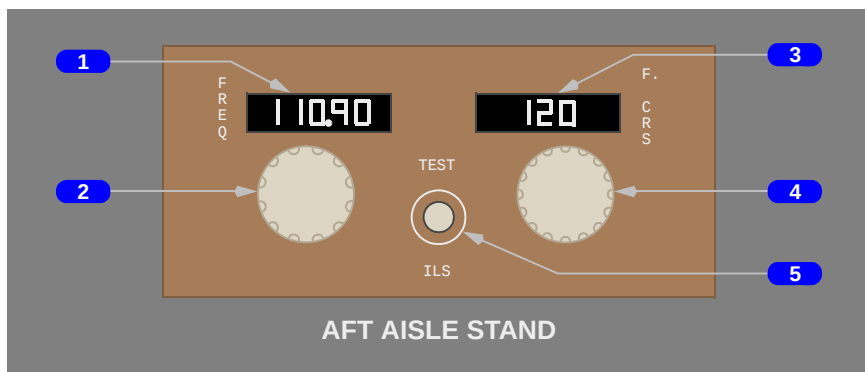
10 Transponder/Flight ID (ATC/FID) Mode Selector

- Alternately selects transponder mode or flight ID mode with successive pushes of the switch.
- Illuminates associated white mode annunciator light for mode selected.

11 Above (ABV)/Normal (N) /Below (BLW) Switch

Controls TCAS display. (refer to Chapter 15, Warning Systems)

ILS Control Panel



1 ILS Frequency (FREQ) Indicator

Displays frequency tuned in all three ILS receivers or dashes (----) if the selector is in the standby position. The display is generated by the center ILS receiver.

2 ILS Frequency Selector

Rotate – tunes all ILS receivers.

- tuned frequency displayed in frequency indicator
- received data is displayed on the ADI
- if an ILS mode is selected on the HSI, ILS data is displayed on the related HSI and the associated DME is tuned to the ILS frequency
- VOR frequencies cannot be tuned

- frequency change is inhibited when all three autopilots are armed and either Localizer or Glideslope is captured
- dashes are displayed when turned to the standby position. ILS display symbology is removed from the ADI when dashes are displayed

3 ILS Front Course (F. CRS) Indicator

Displays the selected front course.

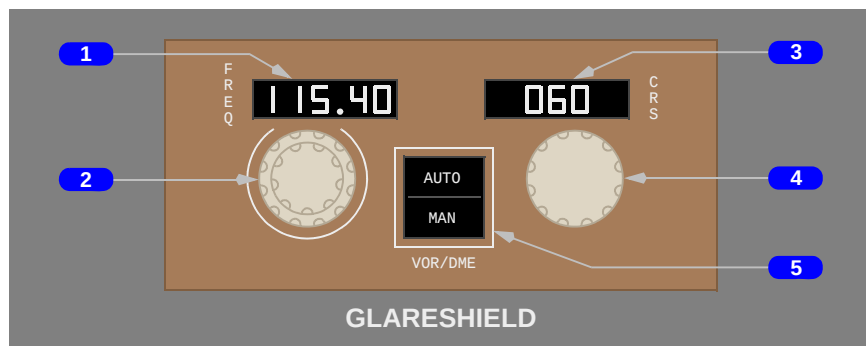
4 ILS Front Course Selector

Rotate – selects the ILS front course.

5 ILS Test Switch

Push – sends a test signal to all ILS receivers except during multiple autopilot approaches after either the localizer or glideslope is captured.

VOR Control Panel



1 VOR Frequency (FREQ) Indicator

Indicates the frequency selected by the frequency selector.

2 VOR Frequency Selector

Rotate –

- when MAN light illuminated, tunes related VOR and also tunes DME if HSI mode selector is not in an ILS position
- ILS frequencies cannot be tuned.

3 VOR Course (CRS) Indicator

Displays course set by VOR course selector.

4 VOR Course Selector

ROTATE – sets course in VOR course indicator and EFIS.

Boeing Proprietary. Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details.

767 Flight Crew Operations Manual**5 VOR/DME Switch**

Push –

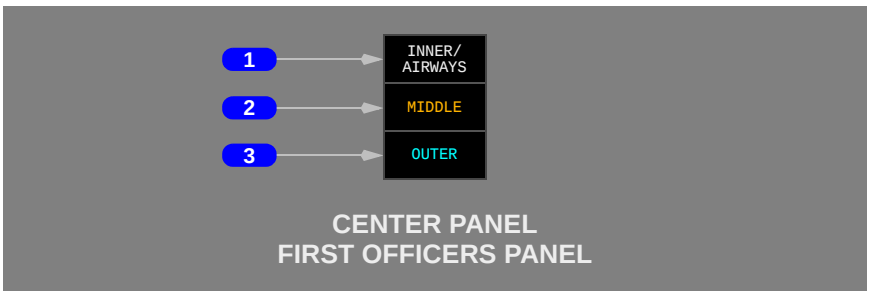
- alternates VOR and DME tuning between the FMC (AUTO) automatic and VOR frequency selector (MAN) manual when the HSI mode selector is in a MAP or PLAN mode.
- only MAN available when the HSI is not in a MAP or PLAN mode.

AUTO Light illuminated (white) –

- FMC is tuning related VOR and DME
- HSI selector must be in a MAP or PLAN mode.

MAN Light illuminated (white) –

- VOR frequency selector is tuning VOR
- if the HSI mode selector is not in an ILS mode, the VOR frequency selector tunes the DME
- if the HSI mode selector is in an ILS mode, the ILS frequency selector tunes the DME.

Marker Beacon Lights**1 INNER/AIRWAYS**

Illuminates (white) – over an inner or airways marker beacon.

2 MIDDLE

Illuminates (amber) – over a middle marker beacon.

3 OUTER

Illuminates (blue) – over an outer marker beacon.

Weather Radar

Weather Radar Control Panel

VP-BOY, VP-BOZ, VQ-BMU



1 System (SYS) Switch

L – selects left weather radar system.

R – selects right weather radar system.

2 GAIN Control

AUTO – normal operation, detent position provides automatic gain control calibrated for optimum return.

Rotate – provides manual control of radar gain. Gain increases as control is rotated clockwise toward MAX.

3 Mode Selector

TEST – activates system test.

WX – displays weather radar returns at selected gain level.

WX/TURB – displays weather radar returns plus turbulence. Turbulence is only displayed within 40 NM of the airplane.

MAP – displays ground returns.

4 TILT Control

Rotate clockwise – radar antenna tilts up to selected degrees from horizon.

Rotate counterclockwise – radar antenna tilts down to selected degrees from horizon.

VP-BWW, VP-BWX

1 System (WXR SYS) Switch

L – selects left weather radar receiver/transmitter (R/T) for operation.

R – selects right weather radar receiver/transmitter (R/T) for operation.

2 Mode Selector

TEST – displays test pattern on HSI if WXR switch on EFIS control panel selected to ON; and initiates a test and fault isolation of the selected R/T.

WX – displays weather radar returns at selected gain level.

WX/TURB – displays weather returns and turbulence. Turbulence display only available with display ranges of 40 nm 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.

3 GAIN Control

AUTO – detent position provides automatic gain control calibrated for optimum weather returns.

Rotate – provides manual control of radar gain. Gain increases as control is rotated clockwise toward MAX.

4 TILT Mode Switch

MAN – antenna tilt can only be adjusted with the TILT control; disables antenna autotilt function.

AUTO – enables antenna autotilt function; optimizes antenna tilt to avoid over or under-scanning weather.

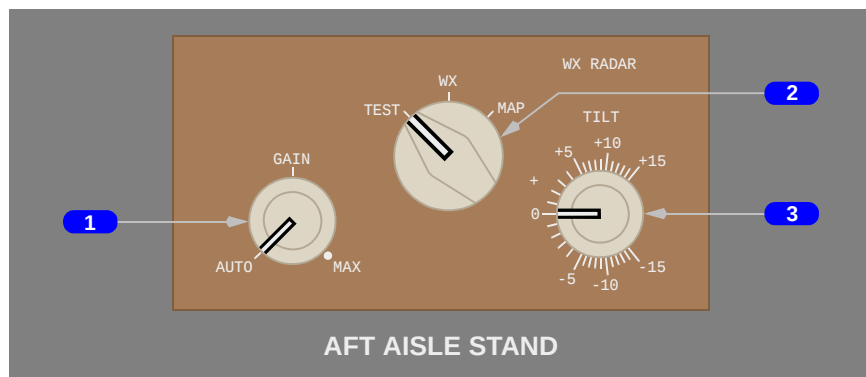
Boeing Proprietary. Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details.

5 TILT Control (active only when TILT mode switch selected to MAN)

Rotate clockwise – radar antenna tilts up to selected degrees from horizon.

Rotate counterclockwise – radar antenna tilts down to selected degrees from horizon.

VP-BOQ



1 GAIN Control

AUTO – normal operation, detent position provides automatic gain control calibrated for optimum return.

Rotate – provides manual control of radar gain. Gain increases as control is rotated clockwise toward MAX.

2 Mode Selector

TEST – activates system test.

WX – displays weather radar returns at selected gain level.

MAP – displays ground returns.

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.

VQ-BRA

1 GAIN Control

CAL – normal operation, detent position provides automatic gain control calibrated for optimum return.

Rotate – provides manual control of radar gain. Gain increases as control is rotated clockwise toward MAX.

2 MODE Switches

TEST – activates system test.

WX – displays weather radar returns at selected gain level.

WX+T – displays weather radar returns plus turbulence. Turbulence is only shown on display ranges of 40 miles or less.

MAP – displays ground returns.

IDNT – suppresses ground returns. Normal operation is with this switch off because weather returns can also be suppressed.

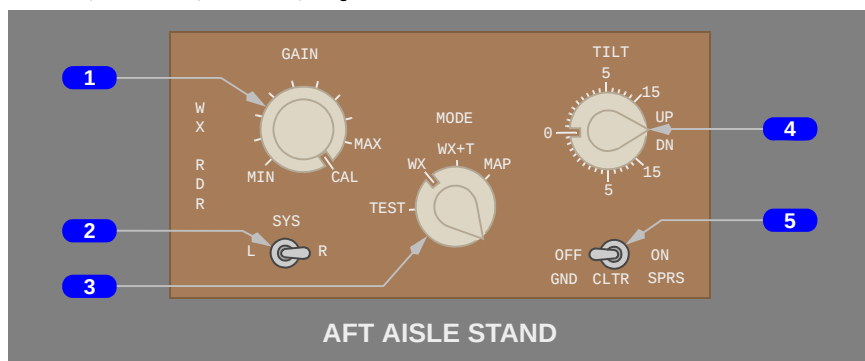
STAB – activates antenna stabilization.

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.

VP-BDI, VP-BMC, VP-BRL, VQ-BOG



1 GAIN Control

Rotate – provides manual control of radar gain. Sets receiver sensitivity from minimum (MIN) to maximum (MAX).

CAL (calibrated)– maintains receiver sensitivity at a preset level for optimum return.

2 System (SYS) Switch

L – selects the left weather radar system for operation.

R – selects the right weather radar system for operation.

3 Mode Selector

TEST – activates system test.

WX – displays weather radar returns at selected gain level.

WX+T – displays weather radar returns plus turbulence. Turbulence is only shown on display ranges of 40 miles or less.

MAP – displays ground returns.

4 TILT Control

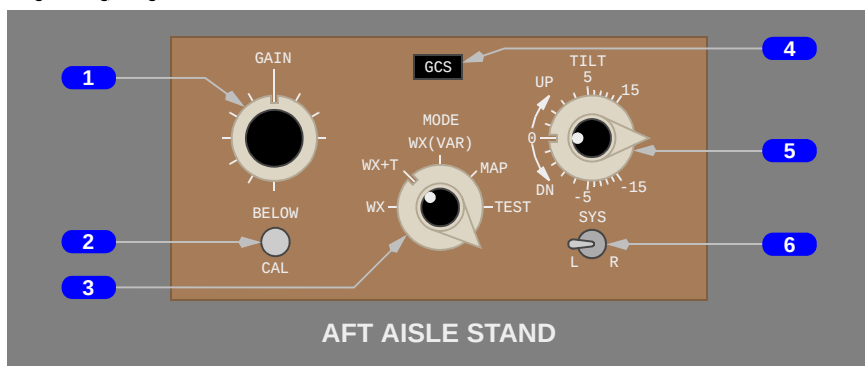
Rotate clockwise – radar antenna tilts up to selected degrees from horizon.

Rotate counterclockwise – radar antenna tilts down to selected degrees from horizon.

5 Ground Clutter Suppression (GND CLTR SPRS) Switch

OFF – provides normal radar returns.

ON – activates ground clutter suppression mode. Normal operation is with this switch OFF because weather returns can also be suppressed.

VQ-BMQ, VQ-BPT

1 GAIN Control

Rotate – provides manual control of radar gain. Gain increases as control is rotated clockwise.

2 BELOW CAL Light

Illuminates when gain control is set below the calibrated value.

3 MODE Selector

WX – displays weather radar returns at calibrated gain level.

WX+T – displays weather radar returns and turbulence returns at calibrated gain level. Turbulence is only shown on display ranges of 40 miles or less.

WX(VAR) – displays weather radar returns with manual gain control.

MAP – displays ground returns.

TEST – activates system test.

4 Ground Clutter Suppression (GCS) Switch

ON – activates ground clutter suppression mode. Normal operation is with this switch OFF because weather returns can also be suppressed.

OFF – provides normal radar returns.

5 TILT Control

Rotate clockwise – radar antenna tilts up to selected degrees from horizon.

Rotate counterclockwise – radar antenna tilts down to selected degrees from horizon.

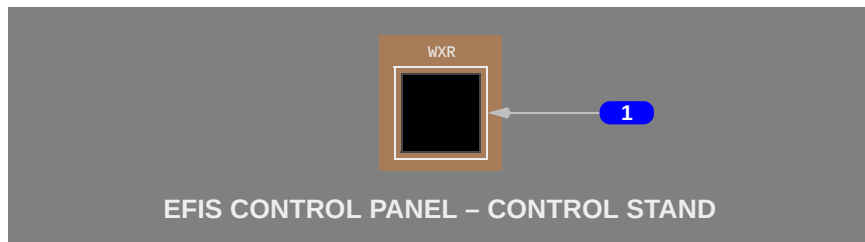
6 System (SYS) Switch

L – selects the left weather radar system for operation.

R – selects the right weather radar system for operation.

Weather Radar Switch

VP-BDI, VP-BMC, VP-BOY through VQ-BRA



1 Weather Radar (WXR) Switch

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

Push – alternately selects the HSI radar display on and off. The radar transmitter is activated when the radar is displayed on either HSI.

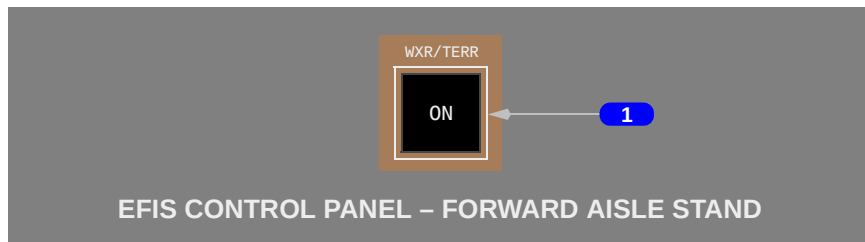
VP-BOY through VP-BRL, VQ-BRA

Push – alternately selects the HSI radar display on and off. The radar transmitter is activated when ON is displayed in the switchlight.

Weather Radar Switches

VP-BOQ

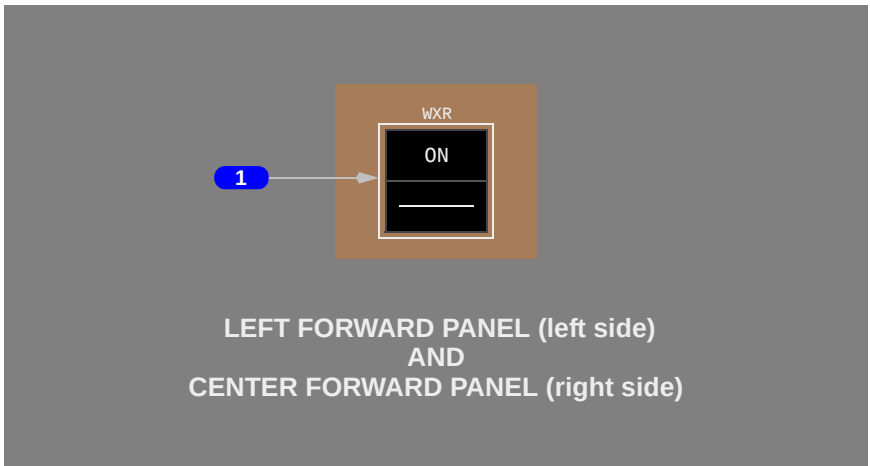
Weather Radar/Terrain (WXR/TERR) Switch



1 WXR/TERR Switch

Push – alternately arms and disarms the associated WXR and TERR display switches located on the left forward panel and center forward panel (refer to Chapter 15 for description of TERR switch).

Weather Radar Display Switch



1 Weather Radar (WXR) Display Switch

Push –

- alternately selects radar display on and off for the associated HSI
- illuminates the ON switch light
- deselects terrain display if corresponding TERR switch was selected ON
- activates the radar transmitter if not already activated by the other WXR switch
- displays weather returns on the associated HSI if detectable weather present.

Note: The WXR/TERR switch on the EFIS control panel must be selected to ON and an HSI mode that can display weather/terrain data (MAP, EXP VOR or EXP ILS) must be selected before the ON annunciator light will illuminate in the WXR switch when it's selected on.

Intentionally
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Flight Management, Navigation

Navigation Systems Description

Chapter 11

Section 20

Introduction

VP-BOQ, VP-BOZ, VP-BRL, VQ-BRA

Navigation systems include the inertial reference system (IRS), 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.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

Navigation systems include the global positioning system (GPS), inertial reference system (IRS), 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.

The FMC will provide navigation guidance and map display between 87° North and 87° South latitudes.

Navigation Systems Flight Instrument Displays

Refer to Chapter 10, Flight Instruments, Displays for flight instrument display system operations and typical instrument displays.

Inertial Reference System

The inertial reference system (IRS) calculates airplane position, acceleration, track, vertical speed, ground speed, true and magnetic heading, wind speed and direction. It also supplies attitude data for the displays, flight management system, flight controls, engine controls, and other systems.

The IRS consists of three Inertial Reference Units (IRUs) and the IRS mode selector panel.

Inertial Reference System Operation

The Inertial Reference System is controlled by the IRS Mode Control Panel on the overhead panel. When operating in the navigation mode, the IRS provides attitude, acceleration, ground speed, track, true and magnetic heading, present latitude and longitude, and wind speed and direction to other systems.

VP-BDI, VP-BMC, VP-BOY, VP-BOZ, VP-BWW through VQ-BMQ, VQ-BPT
Magnetic heading and track are not available in polar regions. Magnetic reference is provided between N82° and S82° latitude except for areas near the magnetic poles. The north magnetic polar region is bounded by W80° and W130° where magnetic reference is provided to N70°. The southern magnetic polar region is bounded by E120° and E160° where magnetic reference is provided to S60°.

VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Magnetic heading and track are not available in polar regions. Magnetic reference is provided between N73° and S60° latitude. Above these latitudes only true headings are available.

IRS Alignment

An IRS must be aligned before it can enter the NAV mode. Rotating the IRS mode selector from OFF to NAV begins the IRS alignment. The IRS performs a short power test, during which the ON DC light illuminates. When the ON DC light extinguishes, the ALIGN light illuminates. Alignment requires approximately ten minutes.

Present position (latitude and longitude) must be entered on the CDU position initialization page to complete the alignment. If the present position cannot be entered through the CDU, it may be entered through the IRS mode selector keyboard.

If the latitude/longitude position is not near the origin airport, the CDU scratchpad message VERIFY POSITION is displayed. If the entered latitude/longitude position does not pass the IRS internal comparison tests, the scratchpad message ENTER IRS POSITION is displayed.

Alignment can be accomplished only when the airplane is parked. Alignment stops if an IRU detects motion during alignment. When the motion stops, some units automatically restart the alignment. Other units flash the ALIGN Light until the alignment is restarted. Manual restarts are accomplished by moving the IRS Mode Selector to OFF, then back to NAV after the ALIGN Light stops flashing.

The IRS is aligned when all IRUs enter the navigation mode. The latitude and longitude display on the SET IRS POS line of the CDU POS INIT page then blanks. Alignment is lost if the selector is moved out of the NAV position.

High Latitude Alignment

High latitude (between 70°~ 12.0' and 78°~ 15.0') alignments requires an extended alignment time. This extended alignment is accomplished by rotating the Mode Selector from OFF to the ALIGN position and allowing the IRS to align for a minimum of 17 minutes. Present position is entered while in the align mode. After the extended alignment, navigation mode is entered by rotating the mode selector to the NAV position.

Fast Realignment

Following operation in the navigation mode and with the airplane parked, performing a fast realignment removes accumulated track, ground speed, and attitude errors, levels the system, and updates present position. This is accomplished by positioning selectors to ALIGN, entering present position, and repositioning selectors to NAV. Fast realignment completes in approximately 30 seconds.

Fast realignment can be accomplished without entering present position; however, greater navigational accuracy is attained by entering present position.

A full alignment, accomplished by rotating the IRS mode selector to OFF and back to NAV, must be accomplished when the time from the last full alignment exceeds 18 hours.

IRS Attitude

If alignment is lost in flight, the navigation mode is inoperative for the remainder of the flight. Attitude information can be obtained by moving the selector to the attitude (ATT) position. The IRU enters the Align mode for 30 seconds during which the airplane should stay in straight and level flight. This re-levels the system and provides an attitude reference. Some attitude errors may occur during acceleration. After acceleration, errors are slowly removed.

Heading information can be provided in the ATT Mode if a heading entry is made on the CDU POS INIT page or IRS mode selector panel. Magnetic heading must be updated periodically.

IRS Power

Normally the IRSs operate on AC power from the left and right electrical systems. The main airplane battery is used as an alternate power source. The ON DC light illuminates and the EICAS message IRS ON DC is displayed when AC power is lost and DC power is being used. The DC FAIL light illuminates and the EICAS message IRS DC FAIL is displayed when DC power is lost and AC power is being used. Both lights extinguish if both AC and DC power are on or off.

If all AC power sources are lost the IRSs are powered by the Standby power system.

Standby power to the right IRS is limited to 5 minutes to save battery power.

Radio Navigation Systems

Automatic Direction Finding (ADF)

A dual ADF system is installed with the control panel located on the aft electronics panel.

VP-BOZ, VP-BRL, VQ-BMU, VQ-BRA

(SB Adds VP-BMC . SB adds ADF pointers to the HSI. Information valid for "SB Adds..." airplanes only after SB incorporated.)

The ADF bearing signals are displayed on pointers and flags on the HSIs and can also be displayed on the RDMLs.

VP-BWW through VQ-BMQ, VQ-BPT

The ADF bearing signals are displayed on pointers and flags on the HSIs.

VP-BDI, VP-BOQ, VP-BOY, VQ-BOG

(SB Deletes VP-BMC when incorporated.)

The ADF bearing signals can be displayed on the pointers and flags on the RDMLs.

Distance Measuring Equipment (DME)

Two DME systems are installed and each can be automatically tuned by the FMC or manually tuned by the VOR or ILS control panel.

DME Tuning

When the HSI Mode Selector is in the VOR or ILS position, the related panel tunes the DME. When the HSI selector is in the MAP or PLAN position automatic FMC tuning or manual VOR panel tuning can be selected with the MAN/AUTO switch on the VOR panel.

VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

The DME can also be remotely tuned by entering a VOR frequency on the progress page on the CDU.

VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG

The DME can also be remotely tuned by entering a VOR frequency on the NAV RADIO page on the CDU.

The FMC uses two DMEs for position updates. If only one DME is available the FMC can use that DME and the associated VOR for a VOR/DME update.

The FMC cannot tune specific DMEs if the nav aids are inhibited on the REF NAV DATA page.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

When either or both VORs are being auto tuned by the FMCs, the DME receivers are scanned through several frequencies. This provides the FMC with continuous DME-DME updating even when one VOR is being manually tuned or when both VORs are remotely tuned. If both VORs are manually tuned the scanning DME function is disabled.

DME Displays

DME distance is displayed on the RDML. When the DME is tuned by the ILS receiver the distance display is preceded by an L. DME distance is also displayed on the HSI when a VOR or ILS display is selected.

767 Flight Crew Operations Manual**VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA**

The progress page and the POS REF page 2 displays the identifiers of the DME stations used for FMC position updates.

VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG

The POS REF page 2/4 and the NAV RADIO page display the identifiers of the DME stations used for FMC position updates.

VOR

There are two VOR receivers and two control panels installed.

VOR Tuning

In normal operation the FMC tunes both VORs and the associated DMEs for radio position updates. The HSI must be in the MAP or PLAN mode to allow FMC tuning of the VOR.

Specific VOR navaids can be inhibited on the REF NAV DATA page to prevent the FMC from using those navaids for position updating.

The crew can tune the VORs manually using the control panels, or remotely using the CDU. If the HSI is not in a MAP or PLAN mode, the associated VOR must be manually tuned using the control panel.

If the HSI is in the MAP or PLAN mode, the AUTO/MAN switch on the control panel must be selected to MAN to manually tune the VOR.

VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

If the switch is in AUTO, the VOR can be remotely tuned on the CDU progress page.

VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG

If the switch is in AUTO, the VOR can be remotely tuned on the CDU NAV RADIO page.

VOR Displays

Left and right VOR bearings can be displayed on the RDMIs. When VOR is selected on the HSI, the selected course and course deviation are displayed.

The tuned frequencies and selected courses are displayed on the VOR control panels on the glareshield.

If the HSI is in a MAP mode, symbols indicate the position of tuned VORs on the map display. If a VOR is manually tuned, the selected course is displayed on the HSI map as a dashed green line.

VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG

The identifier and frequency of the navaid tuned on the left and right VOR are displayed on the NAV RADIO page. The current radial of the tuned navaids are also displayed digitally on the NAV RADIO page.

VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

The identifier and frequency of the navaids tuned on the left and right VOR are displayed on the progress page.

POS REF page 2 displays the identifier of the navaids being used for position updates.

Marker Beacon

Each pilot has a set of marker beacon lights that show outer, middle and inner/airways beacon passage. Both sets are operated by the marker beacon receiver that is part of the left VOR receiver.

Multi-Mode Receiver

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

Three Multi-Mode Receivers (MMRs) are installed. Each MMR includes an ILS and GPS receiver. The GPS receiver in the center MMR is not used.

Instrument Landing System (ILS)

Three ILS receivers are installed. They are controlled by a single control panel on the aft electronics panel. Frequency changes are inhibited after localizer or glideslope capture if three autopilots are armed for approach. The selected runway front course is locked to prevent changes when the localizer is captured.

ILS Displays

Localizer and glideslope deviation are shown on the ADIs and Standby Attitude Indicator. When the ILS display is selected on the HSI, localizer and glideslope deviation plus the selected course and frequency are displayed. Front or back course deviation is determined from airplane heading.

Global Positioning System (GPS)

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

VP-BMC, VP-BOY, VQ-BMQ through VQ-BPT

(SB Deletes VP-BDI when incorporated.)

The left and right GPS receivers are independent and supply very accurate position data to the FMCs. The GPS receivers are contained in the left and right Multi-Mode Receivers (MMRs). All GPS tuning is automatic.

VP-BWW, VP-BWX

(SB Adds VP-BDI when ADS-B capability is installed.)

The left and right GPS receivers are independent and supply very accurate position data to the FMCs, transponders, and other installed systems. The GPS receivers are contained in the left and right Multi-Mode Receivers (MMRs). All GPS tuning is automatic.



GPS Displays

Position Reference, page 3 of 4 (POS REF 3/4) displays the left and right GPS position.

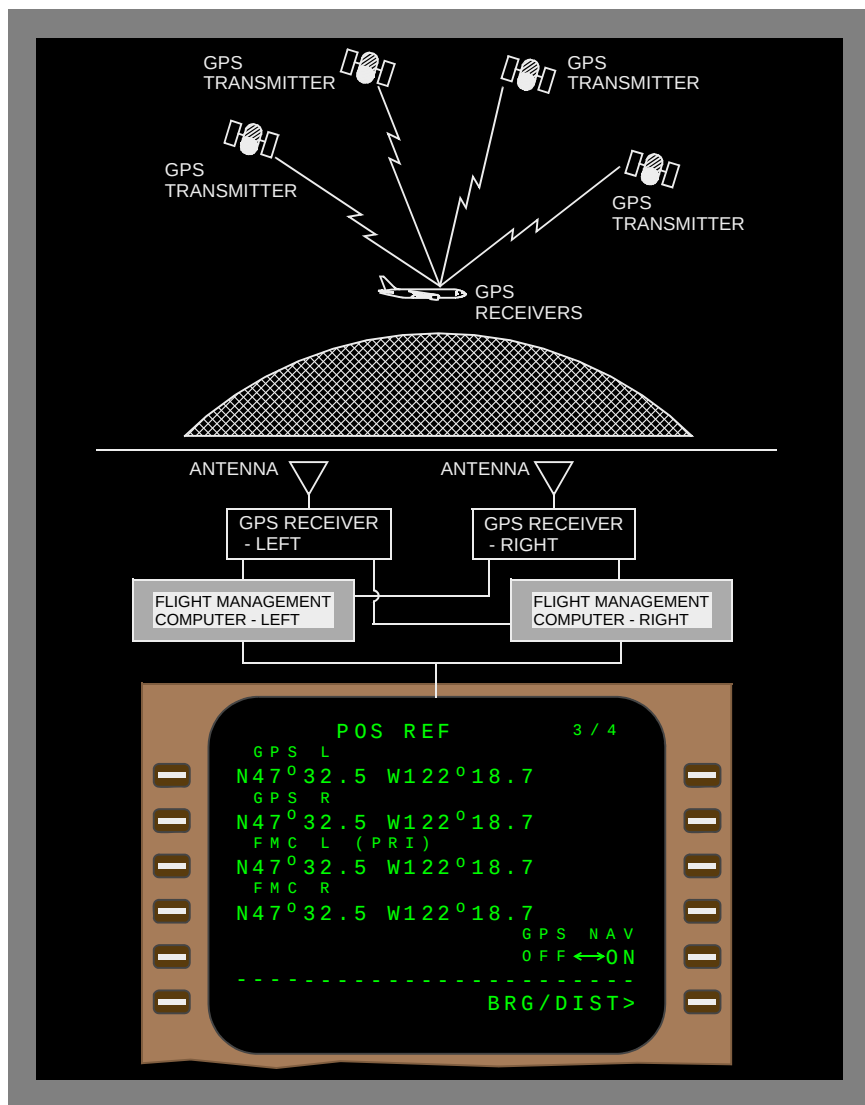
GPS Data

The FMC uses GPS data for position information as long as the GPS is enabled and the GPS data is valid. If GPS data is not available or is unreliable the FMC will use Radio or IRS position data. The GPS NAV prompt on POS REF page 3/4 can be used to inhibit GPS navigation data.

The L GPS and R GPS EICAS messages alert the crew when the respective GPS system has failed. The GPS message is displayed when both GPS systems have failed.

GPS position updates are allowed for all United States National Airspace approach operations. Outside of this region, GPS position updates are allowed during approaches only if the FMC database and approach charts are referenced to the WGS 84 reference datum. GPS updates should be inhibited for all other approach operations unless other appropriate procedures are used.

GPS System Schematic



Transponder

There are two ATC transponders installed. They are controlled by a single control panel and provide normal transponder functions and altitude reporting. The control panel is used to set the ATC code, operating mode, and to select which transponder is active.

VP-BDI, VP-BMC, VP-BRL through VQ-BRA

The transponder is capable of providing traffic alert and collision avoidance system (TCAS) indications. Select TA ONLY or TA/RA to enable traffic displays. Refer to Chapter 15, Warning systems, for a description of TCAS.

VP-BOQ through VP-BOZ

The transponder is capable of providing traffic alert and collision avoidance system (TCAS) indications. Select TA or TA/RA to enable traffic displays. Refer to Chapter 15, Warning systems, for a description of TCAS.

VP-BMC, VP-BOY, VP-BOZ, VQ-BRA

Failure of a transponder is indicated by the illumination of the amber ATC FAIL light on the control panel and the ATC FAULT advisory message on EICAS.

VP-BDI, VP-BOQ, VP-BRL, VQ-BOG

Failure of a transponder is indicated by the illumination of the amber XPNDR FAIL light on the control panel and the ATC FAULT advisory message on EICAS.

VP-BWW through VQ-BMU, VQ-BPT

Failure of a transponder is indicated by ATC FAULT advisory message on EICAS.

Mode S**VP-BOQ, VP-BWW through VQ-BMQ, VQ-BRA**
(SB Adds VP-BDI when Mode S transponders are installed.)

Mode S capable transponders can also transmit a unique Flight ID and additional flight parameters such as magnetic heading, indicated airspeed, groundspeed, etc., depending on specific system implementation.

Some airports can monitor airplane position on the ground when the transponder is active (mode selector not in STANDBY or OFF). TCAS modes should not be used on the ground for ground tracking.

Automatic Dependent Surveillance-Broadcast (ADS-B)**VP-BWW, VP-BWX**
(SB Adds VP-BDI when ES/ADS-B capable transponders are installed.)

Mode S transponders equipped with the Extended Squitter feature enable air traffic controllers in some areas of the world to use ADS-B technology for airplane tracking. ADS-B transponders periodically broadcast messages containing airplane information such as position and velocity data without the requirement for ground-based interrogation.

The left transponder receives position data for ADS-B broadcast messages directly from the left GPS receiver. If left GPS data is not available, then left IRS position data is used. The right transponder receives position data directly from the right GPS receiver. If right GPS data is not available, then right IRS position data is used.

IRS position accuracy is considered inadequate for operations in airspace where ADS-B is required. If a L GPS EICAS message is displayed, the right transponder must be selected to continue broadcasting ADS-B messages containing GPS position data. Likewise, if a R GPS EICAS message is displayed, the left transponder must be selected to continue ADS-B operations.

Weather Radar

VP-BOQ, VQ-BOG, VQ-BRA

The weather radar system consists of a receiver-transmitter, an antenna, and a control panel.

VP-BDI, VP-BMC, VP-BOY through VQ-BPT

The weather radar system consists of two receiver-transmitters, an antenna, and a control panel. The control panel provides manual selection of which receiver-transmitter is used.

Radar returns are displayed on the HSI.

The weather radar switch (WXR) on the EFIS control panel selects the weather radar display. The radar display range is set by the range selected on the EFIS control panel.

The radar system transmits when either WXR switch is selected on.

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

Turbulence can be sensed by the weather radar only when there is sufficient precipitation. Turbulence is displayed in magenta. Clear air turbulence can not be sensed by radar.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG

The predictive windshear alerting system uses the weather radar to sense windshear. To provide windshear alerting the weather radar transmitter is activated on the ground when takeoff power is set and in flight when the airplane is below 2300 feet radio altitude. Weather radar returns are not displayed unless the WXR switch is ON, or a predictive windshear alert occurs. Weather radar returns can only be displayed in VOR, APP, MAP and CTR MAP modes.

VP-BWW, VP-BWX

For detecting weather or turbulence it is recommended the WXR antenna tilt mode be selected to AUTO. With antenna tilt in AUTO, terrain information from the EGPWS is used to determine the optimum antenna tilt angle for the existing terrain conditions, preventing over scan or under scan of the weather. This results in optimum weather/turbulence returns while keeping ground clutter to a minimum. Automatic antenna tilt only functions in WX and WX/TURB modes.



Flight Management, Navigation

Flight Management System Description

Chapter 11

Section 30

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, 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 for position updating. 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 heart of the flight management system is the flight management computer. 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 navigation database to calculate airplane present position and generate the 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 HSIs. The EFIS control panels are used to select the data to be displayed on the HSIs.

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.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

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 as a supplement to primary navigation means when conducting other types of nonprecision approaches.

VP-BOQ, VP-BOZ, VP-BRL, VQ-BRA

The FMC is certified for area navigation when used with navigation radio updating. The FMC and CDU are used for enroute and terminal area navigation, RNAV approaches, and as a supplement to primary navigation means when conducting other types of nonprecision approaches.

Control Display Units (CDUs)

Two CDUs are used to control the FMS.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

The CDUs can provide alternate navigation capability if there is a dual FMC failure (refer to the Alternate Navigation section of this chapter). The CDUs can also provide control of other systems which are accessed through the MENU page.



Flight Management, Navigation

Flight Management System Operation

Chapter 11

Section 31

Introduction

Many FMS functions change depending on the current phase of flight. When first powered, the FMS is in the preflight phase. As a phase is completed, the FMS changes to the next phase in this order:

- preflight
- takeoff
- climb
- cruise
- descent
- approach
- flight complete

Preflight

During preflight, flight plan and load sheet data are manually entered into the CDU. The flight plan defines the route of flight from the origin to the destination and initializes LNAV. Flight plan and load sheet data are provided to the FMC to enable performance calculations and initialize VNAV.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

Some of the preflight data can also be entered by datalink.

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
- SID
- STAR
- wind

Each required or optional data item is entered on specific preflight pages.

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 necessary CDU preflight pages. Preflight pages can be manually selected in any order.

After the necessary data on each preflight page is entered and checked, the lower right line select key selects the next preflight page. When ACTIVATE is selected on the ROUTE page, the execute (EXEC) light illuminates. Push the EXEC key to make the route active.

Use the departure/arrival (DEP/ARR) page to select a standard instrument departure (SID). Selection of the SID may cause a route discontinuity in the flight plan. The modification can be connected to the existing route and executed. This is accomplished on the ROUTE or LEGS page.

When all required preflight entries are complete, PRE–FLT COMPLETE is displayed on the TAKEOFF REF page.

Takeoff

The takeoff phase starts with engagement of takeoff thrust and extends to the thrust reduction altitude where climb thrust is normally selected.

Climb

The climb phase starts at the thrust reduction altitude and extends to the top of climb (T/C) point. The T/C is the position where the airplane reaches the cruise altitude entered on the PERF INIT page.

Cruise

The cruise phase starts at the T/C point and extends to the top of descent (T/D) point. Cruise can include step climbs and en route descents.

Descent

The descent phase starts at the T/D point or when the VNAV descent page becomes active. The descent phase extends to the start of the approach phase.

Approach

The approach phase starts when intercepting the first leg of a published approach selected from the ARRIVALS page.

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, system operation must be monitored for unwanted pitch, roll, or thrust commands. If unwanted operation is noticed, roll and pitch modes other than LNAV and VNAV must be selected.

The system must be carefully monitored for errors following:

- activation of a new data base
- power interruption
- IRS 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.

When a waypoint is in the route more than once, certain route modifications (such as DIRECT TO and HOLD) use the first occurrence of the waypoint even if the second occurrence is selected.

Some SIDs or STARS contain a heading vectors leg. VECTORS waypoints display on the map display as a magenta line without an end point leading away from the airplane symbol. If LNAV is engaged, the DIRECT TO or INTERCEPT COURSE TO procedure 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. Otherwise, the route segment must be entered as a DIRECT leg.

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 being used to calculate LNAV or VNAV guidance commands.

Activate – the procedure to change an inactive route to the active route for navigation. It is a two step procedure.

- select the ACTIVATE prompt
- push the execute (EXEC) key.

Altitude constraint – a crossing restriction at a waypoint.

Delete – using the delete (DEL) key to remove FMC data and revert 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 low cost index may be used when fuel costs are high compared to operating costs.

A minimum time speed schedule may be obtained by entering a cost index of 9999. This speed schedule calls for maximum flight envelope speeds.

Enter – insert data in the CDU scratchpad and line select the data to the applicable location. New characters can be typed or existing data can be line selected to the scratchpad for entry.

Erase – remove entered data, which has resulted in a modification, by selecting the ERASE prompt.

Execute – push the EXEC key when the light is illuminated 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 – to change 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 EXEC key illuminates.

Prompt – CDU symbol that aids the flight crew in accomplishing a task. Prompts can be boxes, dashes, or symbols (< or >) to remind the flight crew to enter or select data.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Reset – a self protection function which causes an FMC to shutdown and restart when an error is detected. Current flight and performance data is automatically re-loaded from the other FMC during the reset.

VP-BOZ, VQ-BRA

Resynchronization – the automatic process of one FMC loading data in the other when a significant difference between the two FMCs is detected.

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 from the database.

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 1000 feet".

Navigation Position

The FMC determines present position from these navigation systems:

- IRS
- navigation radios
- **VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT**
- GPS

The FMC uses its calculated present position to generate lateral steering commands along the active leg to the active waypoint. The FMC requires position data from the IRS. All other position sources are validated against the IRS position and are used to refine the FMC position.

FMC Position Determination

The FMC position is based on the IRS position adjusted with updates from available navigation signals.

FMC Position Update

VP-BOQ, VP-BOZ, VP-BRL, VQ-BRA

On the ground, the FMC position is based on the IRS position.

The FMC updates position to the takeoff runway threshold when the autothrottle is engaged for takeoff. The runway data on the TAKEOFF REF page specifies the takeoff position. When an intersection takeoff is made, the intersection displacement distance from the runway threshold must be entered on the TAKEOFF REF page.

In flight, the FMC position is continually updated from the navigation radios. Updating priority is based on the availability of valid data from the supporting systems but the FMC requires at least one IRS operating in NAV.

The FMC automatically tunes the VOR, DME, and ILS radios for position updates.

FMC position updates from navigation sensor positions follow this priority:

- one LOC (tuned for approach)
- two DME stations
- one VOR with a collocated DME
- IRS.

The selected station identifiers and radio update mode can be seen on the PROGRESS page. The possible modes are, DME – DME, VOR – DME or LOC.

This information is also displayed on POS REF page 2.

FMC Position Update

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

FMC position may be manually updated to any of the navigation system positions. This update is accomplished on POS REF page 2/4.

On the ground, the FMC calculates present position based on IRS and the GPS data.

If GPS NAV is OFF, the FMC updates position to the takeoff runway threshold when the autothrottle is engaged for takeoff. The runway data is on the TAKEOFF REF page. When an intersection takeoff is made, the intersection displacement distance from the runway threshold must be entered on the TAKEOFF REF page. If GPS NAV is ON, this update is inhibited. GPS navigation can be selected on or off on POS REF page 3/4.

In flight, the FMC position is continually updated from the GPS, navigation radios, and IRS. Updating priority is based on the availability of valid data from the supporting systems.

The FMC automatically tunes the VOR, DME, and ILS radios for position updates.

FMC position updates from navigation sensor positions follow this priority:

- one LOC and GPS (tuned for approach)
- one LOC and collocated DME (tuned for approach)
- one LOC and VOR with a collocated DME (tuned for approach)
- LOC (tuned for approach)
- GPS
- two DME stations
- one VOR with a collocated DME
- IRS.

The selected station identifiers of the radio navigation aids are displayed on POS REF page 2/4.



Primary FMC Position Update Source	POS REF page 2/4
GPS	GPS
LOC, GPS valid*	LOC–GPS
LOC, DME DME valid; GPS invalid*	LOC–RADIO
LOC, VOR DME valid; GPS invalid*	LOC–RADIO
LOC valid; GPS, DME, VOR invalid*	LOC
DME DME valid; GPS invalid	RADIO
VOR DME valid; GPS invalid	RADIO
GPS, VOR, DME invalid	IRS
IRS invalid (no navigation capability)	blank
* The FMC changes to LOC updating when: • the tuned localizer is associated with the destination runway • valid localizer signal is being received • the airplane is within the criteria to ensure accurate LOC updating.	

FMC Polar Operations

The FMC automatically starts polar operations when the calculated airplane position enters a polar region. The FMC switches all flight display inputs to reference true north while in these regions.

Automatic switching to a true north reference is annunciated by a flashing white box around the word TRU on the HSI. A TRUE heading reference can be selected with the heading reference switch when outside the polar region. The HSI displays a green box around the word MAG to annunciate the change back to magnetic reference. If the heading reference is TRU in the descent phase, the HSI displays an amber box around the word TRU.

The navigation and display system does not support operations at latitudes greater than 87° North or South.

FMC Polar Regions

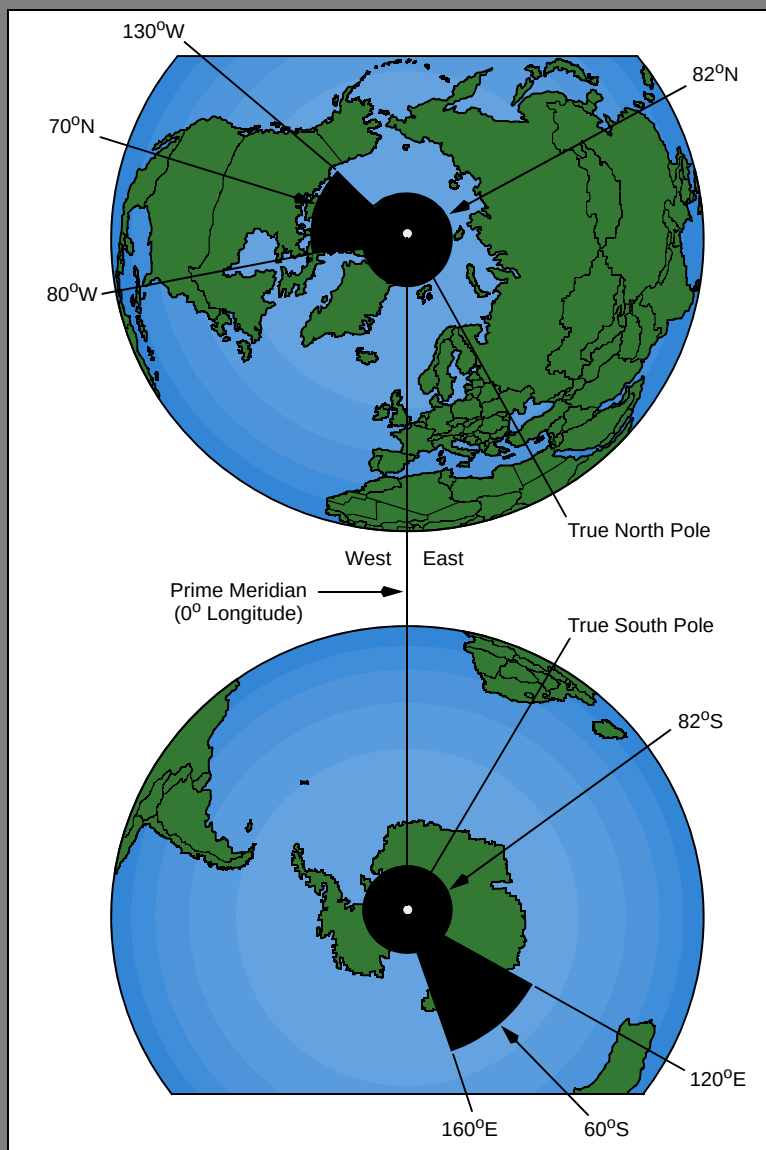
VP-BOQ, VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Polar regions are all areas above 73° North or below 60° South. Magnetic headings are not available in these areas.

VP-BDI, VP-BMC, VP-BOY, VP-BOZ, VP-BWW through VQ-BMQ, VQ-BPT

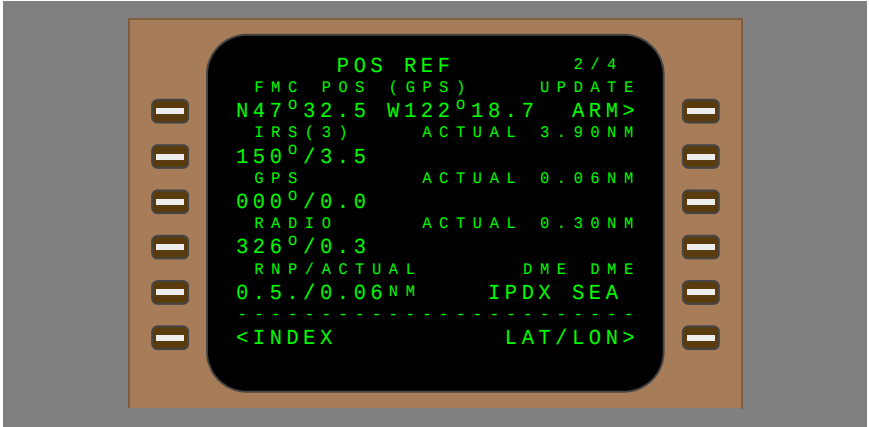
Polar regions are shown in the graphic(s) below. Magnetic headings are not available in these areas.

VP-BDI, VP-BMC, VP-BOY, VP-BOZ, VP-BWW through VQ-BMQ, VQ-BPT



Navigation Performance

VP-BDI, VP-BMC, VP-BOY, VP-BRL through VQ-BPT



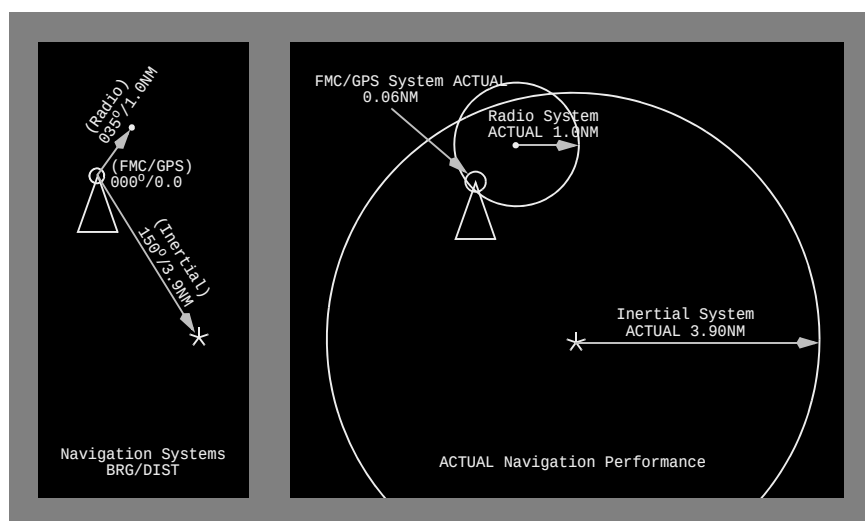
The FMC uses data from the navigation systems to accurately calculate the position of the airplane. The current FMC position is displayed on line 1 of POS REF page 2. The primary source of update is shown in parentheses above the FMC position. The positions of each of the navigation systems are shown in lines 2 through 4. The flight crew can change the display format from latitude/longitude to bearing/distance format. The bearing/distance is from the FMC position to the individual navigation system position.

Actual Navigation Performance

Actual navigation performance (ANP) is the FMC current computed position accuracy. It is shown on POS REF page 2 (line 5L) titled ACTUAL. ACTUAL navigation performance is expressed in nautical miles. It represents the radius of a circle centered at the FMC position which defines the limit of the potential error in that position. The smaller the ANP the more accurate the FMC position.

ACTUAL navigation performance is also computed for each of the navigation systems and those values are displayed on POS REF page 2 adjacent to the system name. The systems' ACTUAL navigation performance is equivalent to the one calculated for the FMC.

After a manual position update, the ACTUAL navigation performance of the FMC changes to the ACTUAL navigation performance of the selected navigation system. In the example above, a manual position update to the INERTIAL system would change the FMC ACTUAL navigation performance to 3.9 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. Inertial and DME/DME updates can not be inhibited.



Required Navigation Performance

Required navigation performance (RNP) values have been created and published for certain areas of operation and procedures. The RNP, expressed in nautical miles, defines the accuracy of the navigation equipment required to fly the route or procedure for which it is published. ACTUAL navigation performance should not exceed RNP. The FMC triggers the EICAS advisory or caution level message UNABLE RNP to alert the flight crew if ANP exceeds RNP. The FMC supplies a default RNP value for takeoff, enroute, oceanic/remote, terminal, and approach phases of flight. RNP is displayed on POS REF page 2. The flight crew may enter an RNP value, if required.

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.

Waypoints

Waypoint (navigation fix) identifiers are displayed on the CDU and on the map display.

The CDU message NOT IN DATABASE is displayed if a manually entered waypoint identifier is not in the data base. The waypoint can still be entered as a latitude/longitude, place-bearing/distance or a 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 (non-directional beacon) – 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 Waypoint Names

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



Waypoint 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

When there are multiple unnamed waypoints along a DME arc with a radius greater than 26 miles, the station identifier is reduced to two characters, followed by the radius, and then a sequence character. Examples:

- CPR134°/29 = CP29A
- CPR190°/29 = CP29B

DME step down fixes are identified by the distance and a "D".
Examples: 138D, 106D, 56D, 3D.

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

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
• F () – final approach fix	• ()B – backcourse ILS
• P () – missed approach point	• ()D – VOR/DME
• I () – initial approach fix	• ()V – VOR only
• D () – minimum descent altitude	• ()S – VOR with DME points
• T () – touch down point	• ()N – NDB
• R () – runway centerline intercept.	• ()Q – NDB with DME points
• ()I – ILS	• ()M – MLS
	• ()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.

Duplicate Waypoints

Application of the abbreviation rules may create identical identifiers for different waypoints. When a duplicate waypoint identifier is entered, the page changes to the SELECT DESIRED WPT page. The page lists the latitude, longitude, and the type of facility or waypoint of all the waypoints with the same identifier. Select the latitude/longitude of the correct waypoint to enter the correct waypoint on the original page.

Conditional Waypoints

Conditional waypoints are automatically entered into a route as a result of selecting a procedure on a DEPARTURES or ARRIVALS page. They are not geographically fixed. They are defined by satisfying a condition such as passing an altitude or flying a heading to a radial. Some conditional waypoints are displayed on the map display. The conditions that may define conditional waypoints are:

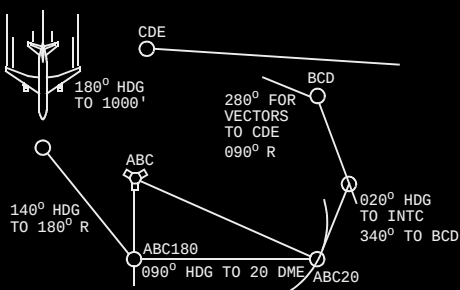
- climb/descent through an altitude
- flying a heading to a radial or DME distance
- intercepting a course
- heading vectors to a course or fix.

Altitude and course intercept conditional waypoints display on the CDU inside (parenthesis) marks. The diagram below shows conditional waypoints.

EXAMPLE:

RTE 1 LEGS
180° HDG
(1000)
140° HDG
ABC180
090° HDG
ABC20
020° HDG
(INTC)
340°
BCD
280°
VECTORS
270°
CDE

MEANING:



NOTE: ALL WAYPOINTS EXCEPT BCD AND CDE ARE EXAMPLES OF CONDITIONAL WAYPOINTS.

Manually Entered Latitude/Longitude Waypoints

Pilot defined waypoints entered as a latitude and longitude are shown in a seven-character format. Latitude and longitude waypoints are entered with no space or slash between the latitude and longitude entries. Leading zeroes must be entered. All digits and decimal points (to 1/10 minute) must be entered unless the latitude or longitude are full degrees. Examples:

- N47° W008° is entered as N47W008 and is displayed as N47W008
- N47° 15.4' W008° 3.4' is entered as N4715.4W00803.4 and is displayed 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:

- SEA330/10 becomes SEA01
- SEA330/OLM020 becomes SEA02.

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 TO 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:

- 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.

EO SID

An engine out SID is a procedure developed by an airline for a particular runway to provide unique routing if an engine fails on takeoff. If the database contains an EO SID for the takeoff runway and an engine fails while the flaps are extended, the active route is automatically modified to the engine out route. The modification may be either executed or erased.

Map Displays

The route is displayed on the HSI when a MAP or PLAN mode is selected.

The display color and format represent the following status:

- an inactive route is displayed as a cyan dashed line
- an activated, but not yet executed route, is displayed as a white dashed line
- the active route is displayed in magenta
- modifications to an active route are shown as dashed white lines
- modified waypoints are displayed in white
- executed route offsets are displayed as a dashed magenta line
- prior to execution, entered route offsets are displayed as a dashed white line.

The MAP displays the FMC position at the apex of the airplane symbol. All MAP data is displayed relative to this apex.

When adequate position updating is not available, the map may display a shift error. This error results in the displayed position of the airplane, route, waypoints and navigation aids being shifted from their actual position. An undetected, across track map shift may result in the airplane flying a ground track that is offset from the desired track. An undetected, along track map shift may result in the flight crew initiating altitude changes earlier or later than desired. In either case, an undetected map shift may compromise terrain or traffic separation.

Map shift errors can be detected by comparing the position of the airplane on the map with data from the ILS, VOR, DME, and ADF systems.

Vertical Navigation (VNAV)

VNAV provides vertical profile guidance through the climb, cruise, and descent phases of flight.

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 are displayed in small font.

Waypoints can have altitude or airspeed/altitude constraints. Speed constraint entries require an altitude constraint at the same waypoint. All speed constraints are considered by the FMC as at or below constraints.

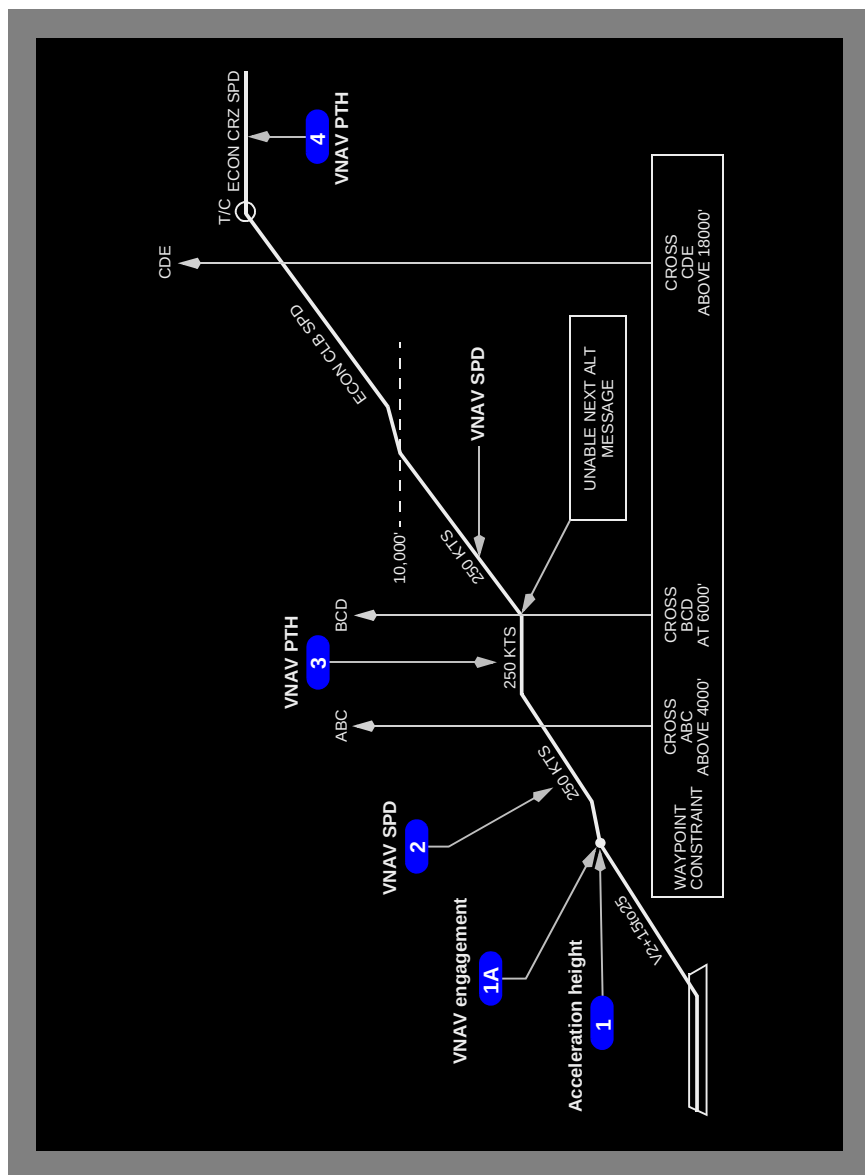


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At or above altitude constraints are entered with a suffix letter A (example: 220A).
At or below altitude constraints are entered with a suffix letter B (example: 240B).
Mandatory altitude constraints are entered without any suffix letter (example: 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 Acceleration Height

Height at which acceleration is initiated for flap retraction, normally 1000 feet. Takeoff (TO) pitch mode is used for takeoff and initial climb up to this point.

1A VNAV Engagement

VNAV is normally engaged at acceleration height. Pitch guidance then commands:

- an airspeed increase to 250 knots, or
- the speed transition associated with the origin airport, or
- the takeoff target airspeed (between $V_2 + 15$ and $V_2 + 25$ knots) if the acceleration altitude entered on TAKEOFF REF page 2/2 has not been reached.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Initial reduction of flaps after VNAV is engaged also initiates pitch guidance to accelerate to 250 knots.

When VNAV is engaged (above 400 feet) the thrust reference changes to climb.

2 VNAV Climb

The 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 that are part of the SID entered into the active route. Autothrottle uses selected climb thrust limit.

3 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.

VP-BOQ, VP-BRL through VP-BWX, VQ-BOG

(SB Adds VP-BDI . SB adds speed/altitude constrained waypoint functionality for airplanes with Pegasus 2009 FMC software. Information valid for "SB Adds..." airplanes after SB incorporation.)

When executing a SID with a speed and altitude constrained waypoint, VNAV will maintain the speed constraint during the climb until the respective waypoint is sequenced, regardless of the associated altitude constraint.

If the FMC predicts the airplane will not reach an altitude constraint, the message UNABLE NEXT ALTITUDE is displayed on the CDU. 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.

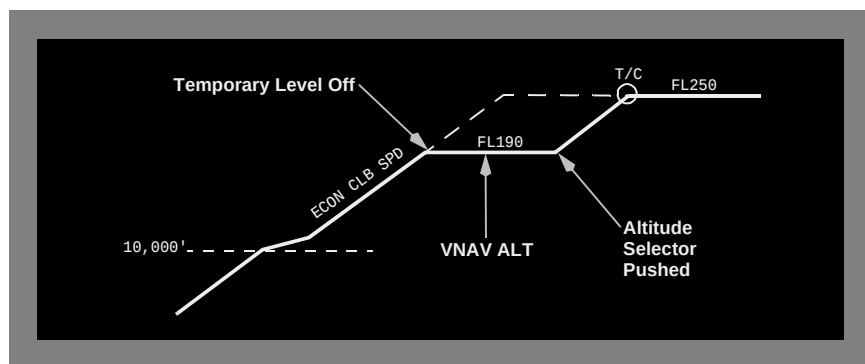
4 Top Of Climb (T/C)

The point where the climb phase meets the cruise altitude is called the top of climb. Approaching this point, the FMC changes from the climb phase to the cruise phase. The T/C is displayed any time the FMC calculates a change from a climb phase to a cruise phase, such as a step climb.

The T/C point is displayed on the map as a green open circle with the label T/C.

MCP Altitude Intervention

VQ-BPT



Whenever the airplane levels off at an MCP altitude which is not in the FMC climb profile, 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

At cruise altitude, the FMC commands economy cruise speed or the pilot entered speed until reaching the top-of-descent (T/D) point. Alternate cruise speed options are:

- long range (LRC)
- engine out (ENG OUT), or
- flight crew entered speed.

If the cost index is set to zero the FMC commands maximum range cruise speed. Cost index modifications are allowed until within ten miles of the top of descent.

Cruise Climb

VP-BDI through VQ-BOG, VQ-BRA

When VNAV is engaged, resetting the MCP to an altitude higher than the current cruise altitude causes that altitude to be displayed in the scratchpad of the CDU. The altitude can then be entered on the CRZ ALT line on the cruise page. When the modification is executed the airplane will climb to the new cruise altitude. The CRZ page displays ACT ECON CRZ CLB.

VQ-BPT

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 predictions assume the airplane climbs at each predicted step climb point as airplane weight decreases.

FMC predicted 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 altitude on the CRZ or RTE LEGS page overrides the FMC step climb predictions. Entry of a planned step altitude on the RTE LEGS page overrides a "Step To" entry made on the CRZ page.

Predicted step altitudes display on the RTE LEGS page. The distance and ETA to the next step point (predicted or flight crew entered) display on the CRZ and progress pages. They also display on the map display with a green circle and S/C label.

Cruise Descent

VP-BDI through VQ-BOG, VQ-BRA

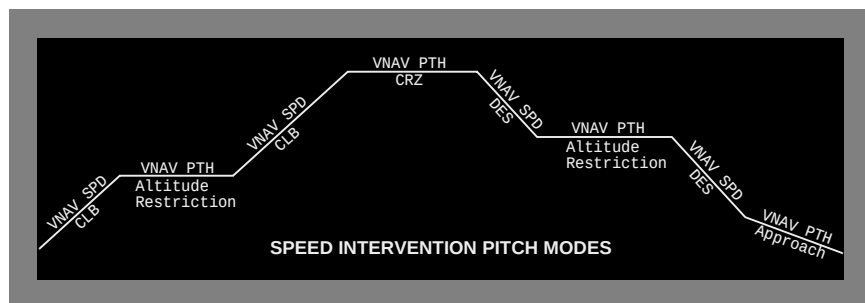
Resetting the MCP to an altitude below the current cruise altitude causes the new altitude to be copied to the scratchpad if the altitude change is 4000 feet or less. The new cruise altitude can be entered on the cruise page. When the modification is executed the CRZ page displays ACT ECON CRZ DES. If 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 and the airplane will maintain cruise speed during the descent. Transition or speed restrictions must be maintained by flight crew action.

VQ-BPT

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.

Mode Control Panel Speed Intervention

With VNAV engaged, 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 VNAV mode for each phase of flight during speed intervention.

Note: The FMC does not use the speed set on the MCP for fuel or ETA predictions so FMC predictions are not accurate if speed intervention is used for an extended period.

In VNAV PTH mode, thrust controls speed; in VNAV SPD mode, pitch controls speed.

If speed intervention is selected during a VNAV PTH descent, VNAV PTH pitch mode changes to VNAV SPD and the airplane may depart the FMC calculated descent path. In all other phases of flight, the AFDS captured pitch mode remains unchanged when speed intervention is selected.

In approach phase (see Approach topic this chapter/section), during speed intervention, pitch mode remains in VNAV PTH and the vertical path is maintained regardless of IAS MACH selector changes.

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. It displays on the HSI as a green circle with the label T/D. 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 VMO/MMO minus 16 knots or a pilot entered speed greater than 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.

VQ-BPT

If the airplane passes the T/D point and the window altitude has not been set lower, or if the airplane levels at an MCP altitude not in the FMC descent profile, VNAV ALT annunciates. The MCP altitude must be reset and altitude selector pushed to initiate/continue the descent.

VP-BDI through VQ-BOG, VQ-BRA

If the airplane passes the T/D point and the altitude window has not been set lower, or if the airplane levels at an MCP altitude not in the FMC descent profile, ALT HOLD annunciates. The MCP must be reset and VNAV re-engaged to initiate/continue the descent.

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 VMO/MMO minus 16 knots, the scratchpad message DRAG REQUIRED displays. The airplane may accelerate up to 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 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

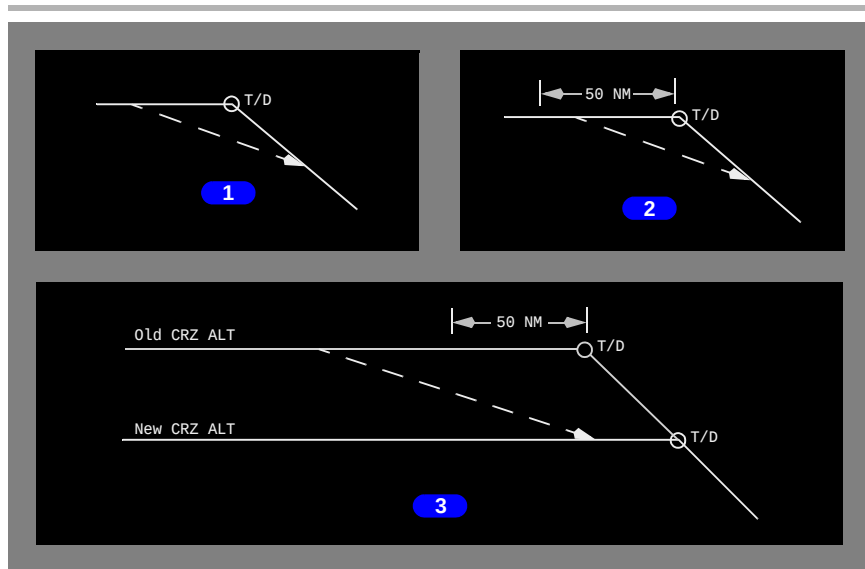
When a descent is started before the T/D, VNAV commands a descent at a reduced descent rate until the idle descent path is intercepted.

VP-BDI through VQ-BOG, VQ-BRA

Start an early descent by resetting the MCP altitude, then selecting the DES NOW prompt on the DES page. 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.

VQ-BPT

Start an early descent by 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.

Note: When more than 50 NM from the top of descent point, perform a cruise descent rather than a descend now for descent to intermediate altitudes. During cruise descent the FMC computes a new top of descent for the new cruise altitude and accurate destination fuel predictions. Fuel predictions using DES NOW more than 50 NM from the top of descent point can cause a fuel computation error.

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.

Approach

For VFR and nonprecision approaches, VNAV will fly the computed descent path to the E/D point altitude if the MCP altitude is set at or below the E/D point altitude. However, it is the responsibility of the flight crew not to descend below the MDA of the approach being flown until adequate visual contact is achieved.

"On Approach" Mode

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

The FMC transitions to "on approach" mode for any of the following conditions:

- an approach procedure selected into the active route from the destination airport ARRIVALS page becomes the active procedure on the RTE 1 or RTE 2 page.
- distance to the destination airport is less than 12 nm and the active leg is not part of a procedure
- the MAP (or last waypoint on the approach procedure) is the active waypoint and the distance to that waypoint is less than 25 nm

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

(SB Adds VP-BMC . SB updates FMCs to Pegasus 2003, 2004, 2005 or 2009 FMC software. Line item applicable to "SB Adds..." airplanes only after SB incorporated.)

- VNAV engaged in DES mode and flaps extended.

VP-BOZ, VQ-BRA

The FMC transitions to "on approach" mode for any of the following conditions:

- an approach procedure selected into the active route from the destination airport ARRIVALS page becomes the active procedure on the RTE 1 or RTE 2 page.
- the RWxx threshold waypoint is the active waypoint and the distance to that waypoint is less than 25 nm.

Transition to the "on approach" FMC mode may be delayed if the flight crew manually inserts, bypasses, or deletes an approach waypoint on the LEGS page.

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.

The FMC transitions out of approach under the following conditions:

- the airplane lands
- selecting GA
- the airplane flies beyond the missed approach waypoint.

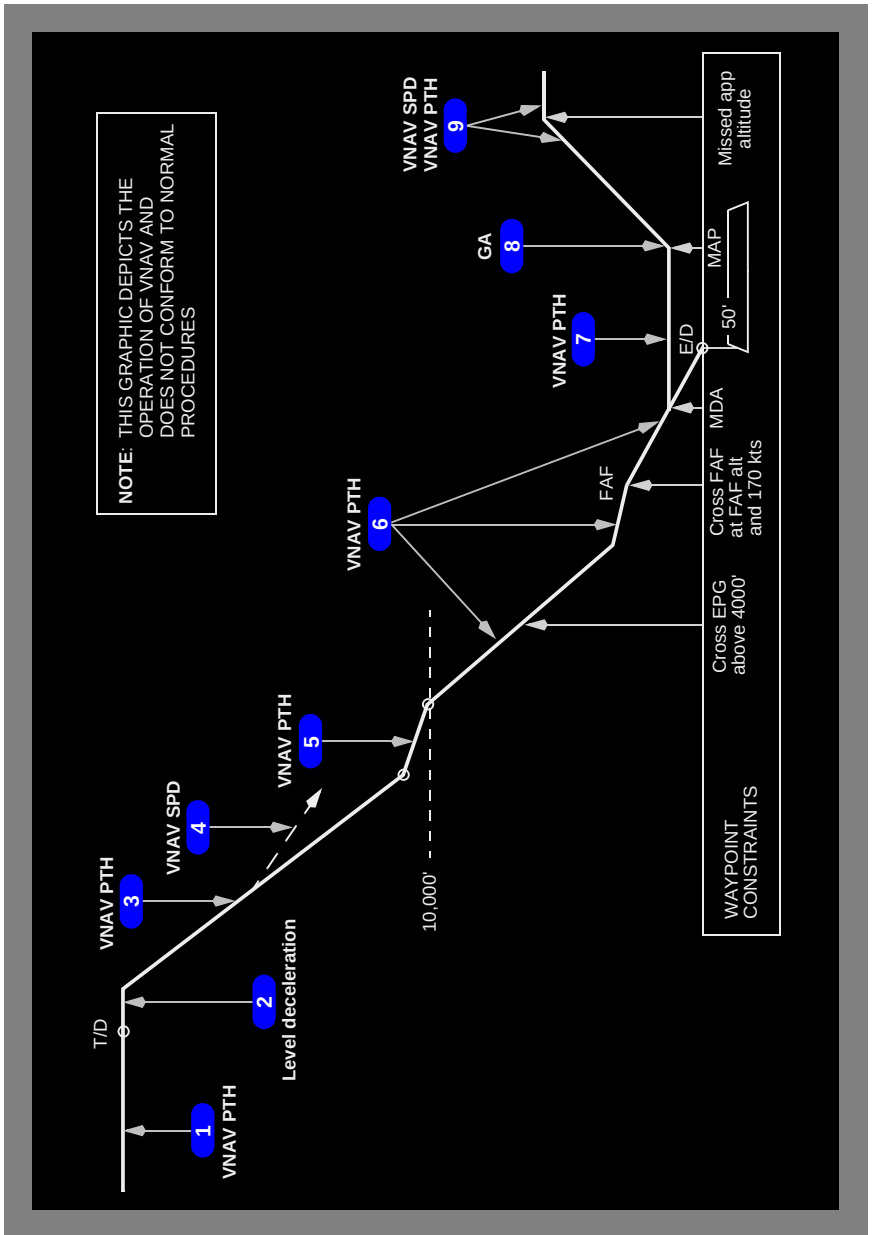
A side step to another approach can be accomplished by selection of a new approach on the ARRIVALS page. An along-course intercept to the next logical approach waypoint in the new approach can be selected on the "INTC CRS TO" line on the LEGS page or by selecting the "XXXXXX INTC>" prompt on the ARRIVALS page.

Missed Approach

A missed approach is accomplished by selection of either GA switch. The following features are available:

- VNAV (and LNAV) can only be activated when the airplane climbs above 400 feet radio altitude
- all descent altitude constraints below the current airplane altitude are deleted; the waypoints are retained in the active flight plan
- the higher of the altitude in the MCP altitude window or the highest altitude in the missed approach procedure becomes the new cruise altitude
- the FMC transitions from active descent to active climb
- AFDS guidance to fly the published missed approach procedure to the new cruise altitude is active when VNAV (and LNAV) are selected
- when cruise phase is active, the speed target is the most restrictive of 250 knots (below speed transition altitude), best hold speed, or ECON cruise (above speed transition altitude).

Cruise and Descent Profile (Nonprecision Approach)



1 Cruise

Before the top of descent, FMC is in cruise mode and uses VNAV PTH and ECON cruise speed.

2 Level descent phase

After top of descent, FMC is in descent mode, VNAV decreases airspeed to ECON descent speed, maintains altitude in VNAV PTH.

3 Descent

Upon reaching descent speed, VNAV descends in VNAV PTH at ECON descent speed.

4 Speed Limit Protection

If a tailwind which was not entered on the descent forecast page causes the airplane to accelerate, the DRAG REQUIRED scratchpad message will be displayed. If the speedbrakes are not deployed, the pitch mode will change to VNAV SPD and depart the path before the speed reaches the limit.

5 Speed Restriction Deceleration

Before the speed restriction altitude, VNAV decelerates to commanded speed using VNAV PTH.

6 Descent and Approach

When at restricted speed, VNAV descends and starts approach in VNAV PTH at commanded speed.

7 Minimum Descent Altitude

When the MDA is reached with VNAV engaged the airplane will maintain the MDA altitude in VNAV PTH.

VP-BOZ, VQ-BRA

If the missed approach point is crossed without selecting GA, VNAV will start a VNAV SPD climb to the missed approach altitude.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

If the missed approach point is crossed without selecting GA, VNAV will continue to the end of descent point altitude until GA is selected.

8 Go-Around (GA)

The missed approach go-around is commenced by pushing a Go-Around switch.

Pushing a Go-Around switch

- starts a missed approach
- sets go-around thrust

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

- and deletes altitude constraints between the airplane and the missed approach waypoint.

9 Missed Approach Level Off

If VNAV is selected during missed approach, VNAV engages in VNAV SPD. At the missed approach altitude the pitch mode changes to VNAV PTH.

VNAV Engine Out Operation

The FMC provides single engine performance guidance which is accessed with the ENG OUT prompt on the VNAV pages (CLB, CRZ or DES). After the engine out page is selected the execute key must be pushed to activate the single engine guidance.

The autothrottle system does not have a single engine capability and the autothrottle should be disconnected after an engine failure. VNAV thrust settings and thrust reference modes must be manually set when operating single engine.

Climb (Engine Out Above Engine Out Max Alt)

When the airplane is above the engine out maximum altitude, selection of the ENG OUT> prompt on the CLB page creates a modification and displays the applicable engine out driftdown (D/D) performance data to enable the airplane to descend to the engine out maximum altitude. Execution of the modification activates the engine out driftdown function.

Cruise (Engine Out Above Engine Out Max Alt)

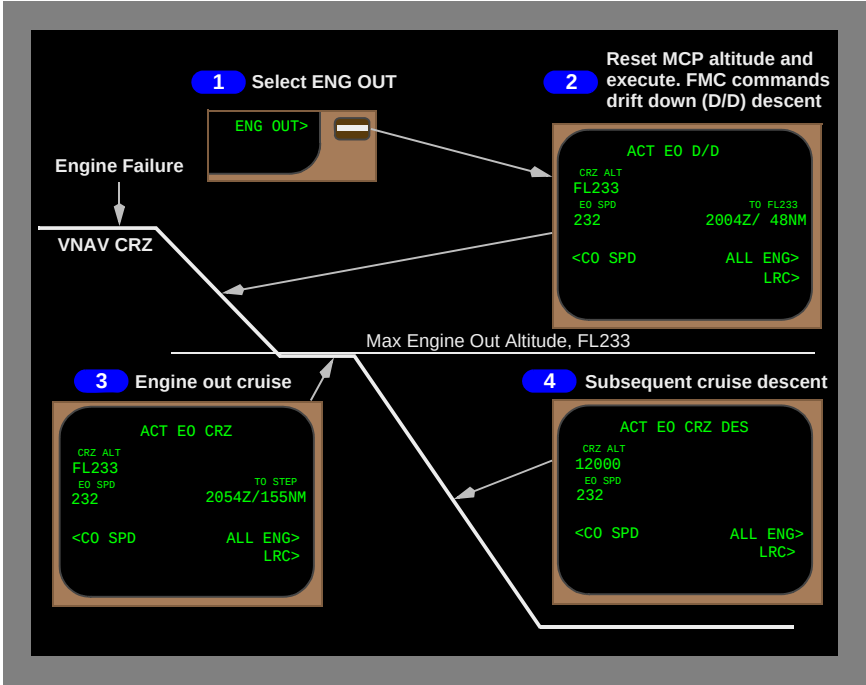
Selection of ENG OUT> may also be selected on the CRZ page. If the current altitude is above the engine out maximum altitude, the FMC will command a cruise drift down.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

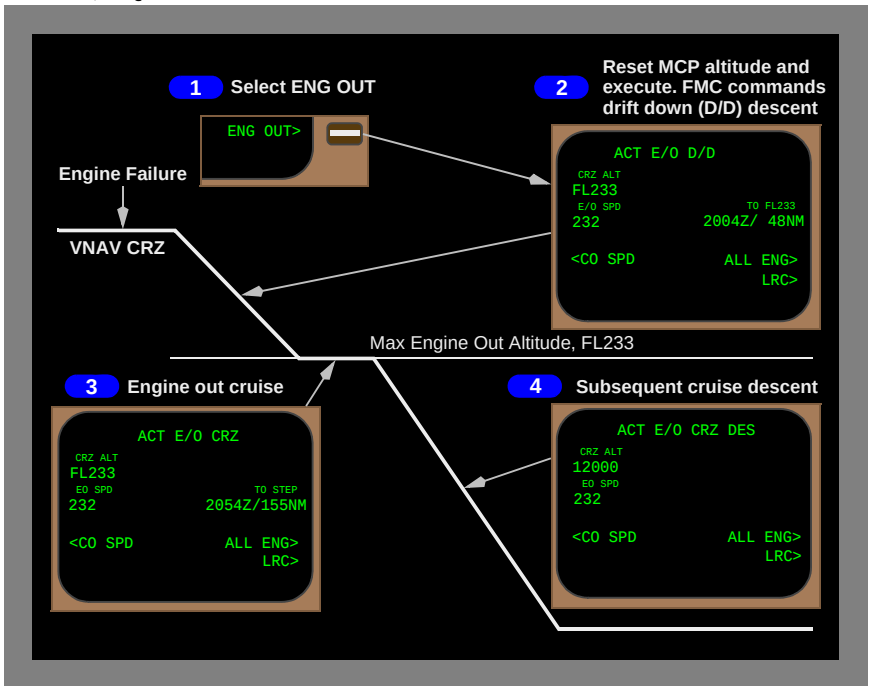
Selection of ENG OUT> may also be accomplished on the XXXX ALTN page in conjunction with a diversion modification.



VP-BDI through VP-BOY, VP-BRL through VQ-BPT



VP-BOZ, VQ-BRA



1 Engine Out Modification

Select the ENG OUT> prompt on the VNAV CRZ page. Disconnect the autothrottle and set maximum continuous thrust on the operating engine.

Result: The FMC creates a modification and displays the applicable engine out driftdown (D/D) performance data to enable the airplane to descend to the engine out maximum altitude.

2 Drift Down Execution

Set the MCP altitude at or below EO MAX altitude and execute the FMC modification. This assumes clearance is approved to descend slowly to a non-standard altitude; for example, FL233.

Result: VNAV commands a driftdown at EO SPD, and the EO MAX altitude becomes the cruise altitude at 1L. The descent rate is controlled to a minimum of 300 feet per minute (fpm). Time and distance for the D/D to EO MAX altitude are displayed at 2R.

The initial drift down speed defaults to E/O (minimum drag) speed. Prompts for LRC (long range cruise) and CO SPD (company speed) are displayed or a manual speed entry may be made.

3 Engine Out Cruise

When VNAV captures the engine out maximum altitude, the page changes to the engine out cruise page and the pitch annunciation is VNAV PTH. Predictions for engine out step climb are displayed at 2R.

The VNAV single engine speed can be adjusted to LRC speed, company speed, or a speed entered by the crew. Any change in the single engine speed will change the maximum altitude.

4 Subsequent Cruise Descent

VP-BDI through VQ-BOG, VQ-BRA

With the FMC in engine out mode more than 50 nm from T/D, set a lower MCP altitude, select the entered altitude from the CDU scratchpad to the CRZ ALT line on the CRZ page and execute.

VQ-BPT

With the FMC in engine out mode more than 50 nm from T/D, set a lower MCP altitude and push the altitude selector.

Result: VNAV cruise descent at approximately 1,250 fpm at the current speed. When the engine out cruise descent intersects the planned descent profile, descent mode becomes active.

Required Time of Arrival (RTA)

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

When an RTA is entered for a waypoint on the active route, VNAV controls cruise speed to arrive at the waypoint within ± 30 seconds of the specified time. If the RTA is not achievable, the FMC displays the scratchpad message UNABLE RTA.

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.

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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 830
- 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
- 836 feet is entered as 00836; displays as 840
- 1,500 feet is entered as 01500; displays as 1500
- 8,500 feet is entered as 08500; displays as FL085
- 9,996 feet is entered as 09996; 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). CAS is 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.

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Flight Management, Navigation

Flight Management Computer

Chapter 11

Section 32

FMC Databases

The FMC contains the following databases:

- performance database
- navigation database
- **VP-BDI through VP-BOY, VP-BRL through VQ-BPT**
- airline modifiable information (AMI).

The performance database supplies all the necessary performance data to the flight crew. It supplies the FMC with the necessary data to calculate pitch and thrust commands. All necessary data can be shown on the CDU. The database includes:

- airplane drag and engine characteristics
- maximum and optimum altitudes
- maximum and minimum speeds.

The navigation database includes data usually found on navigation charts. The database contains:

- the location of VHF navigation aids
- airways
- 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 flight crew selects which set of navigation data is active for navigation calculations. The contents of the navigation database are periodically updated and are transferred to the FMC before the expiration date of the active data.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

The Airline Modifiable Information (AMI) file contains airline specified data. If the FMC senses a conflict in an AMI value after a new AMI data load, the scratchpad shows the message CHECK AIRLINE POLICY.

Thrust Management

The autothrottle is controlled by the thrust management computer. When VNAV is engaged, the FMC controls the autothrottle by setting the command speeds and thrust reference modes on the thrust management computer.

When VNAV is not engaged, the thrust management is controlled by the flight crew through selections made on the TMSP and AFDS.

Fuel Monitoring

The FMC receives fuel quantity data from the fuel quantity system or from manual entries. Fuel quantity values are shown on the PERF INIT page as calculated (CALC), MANUAL, or SENSED. They are shown 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 the same as the fuel quantity indicating system totalizer 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.

The FMC will accept manual entry of the fuel quantity. The line title changes to MANUAL and the manual value is then updated by fuel flow rate. When the fuel quantity calculations are based on a manual entry the FUEL QUANTITY DISAGREE message is inhibited. Deleting the manual entry resets the fuel quantity to the totalizer value and the title returns to CALCULATED.

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 is shown as TOTALIZER on PROGRESS page 2. The fuel used by each engine is calculated with its related fuel flow signal.

FUEL USED is also shown on PROGRESS page 2. It is calculated by the FMC from the fuel flow rate beginning at engine start.

Fuel used is reset to zero on the ground after engine shutdown when electrical power is removed or when the FMC receives a positive fuel flow at the next engine start.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

The scratchpad shows the message FUEL DISAGREE–PROG 2 (or FUEL DISAGREE–PROG 2/2) if the FMC calculates a large difference between the total fuel value determined by the fuel quantity indicating system and the total fuel value calculated by the FMC. When the fuel disagree message appears, PROGRESS page 2 is used to select one of those two values for use by the FMC for its fuel calculations for the remainder of the flight.

VP-BRL

The scratchpad shows the message FUEL QTY ERROR–PROG 2/2 if the FMC calculates a large difference between the total fuel value determined by the fuel quantity indicating system and the total fuel value calculated by the FMC. When the fuel quantity error message appears, PROGRESS page 2 is used to select one of those two values for use by the FMC for its fuel calculations for the remainder of the flight.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

Note: The FUEL DISAGREE message is inhibited if the fuel quantity on the PERF INIT page is entered manually. Deleting a manual entry sets the fuel quantity back to the totalizer value, changes the line title back to CALC and enables the FUEL DISAGREE message.

VP-BRL

Note: The FUEL QTY ERROR message is inhibited if the fuel quantity on the PERF INIT page is entered manually. Deleting a manual entry sets the fuel quantity back to the totalizer value, changes the line title back to CALC and enables the FUEL QTY ERROR message.

The FMC continually estimates the fuel at the destination airport if the active route is flown. The CDU message INSUFFICIENT FUEL is shown if the estimate is less than the fuel reserve value entered on the PERF INIT page.

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 active route in the FMC is flown.

Loss of FMC Electrical Power

The FMC must have continuous electrical power to operate. When the electrical power is interrupted and returns, the FMC automatically restarts.

After the restart, the performance data must be re–entered on the PERF INIT page. The route previously in use is available but must be reactivated.

The flight crew must modify the active waypoint to engage LNAV. Select the applicable active waypoint and proceed direct or intercept a course to the waypoint.

FMC Failure

Single FMC Failure

The scratchpad shows the message SINGLE FMC OPERATION after loss of a single FMC. The EICAS shows the advisory message L (or R) FMC FAIL and the MAP page is displayed on the side with the failed FMC.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

The crew member on the side with the failed FMC selects the opposite FMC with the NAV selector to regain CDU access to the operating FMC and map displays. LNAV and VNAV, if engaged, stay engaged and all flight plan and performance data is kept.

VP-BRL

The crew member on the side with the failed FMC selects the opposite FMC with the FMC switch on the instrument selector panel to regain CDU access to the operating FMC and HSI map displays. If the left FMC fails, use the right autopilot to enable LNAV and VNAV operation. If the right FMC fails, use the left or center autopilot. All flight plan and performance data is kept.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

Note: If the MENU page and the scratchpad message TIMEOUT RESELECT is shown, the FMC is no longer connected to the CDU. Use the <FMC prompt on the MENU page to connect the CDU to the FMC.

Dual FMC Failure

In the unlikely event that both FMCs fail, the EICAS advisory messages L FMC FAIL and R FMC FAIL are displayed. LNAV and VNAV are not available.

VP-BRL

The HSI map is also unavailable with a dual FMC failure.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

Selecting CDU-L or CDU-R with the NAV selector on the instrument select panel provides route data to the MAP display. Alternate navigation using the CDUs is discussed in Section 50 of this chapter.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

Note: The MENU page is shown and the <FMC prompt is not shown in line 1. Push the LEGS function key to show the IRS LEGS page or the PROG key to show the IRS PROGRESS page.

FMC Resets

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

A software reset may occur in dual or single FMC operation. When a software reset occurs, the active route becomes inactive, the performance data is erased, and LNAV and VNAV modes (if engaged) fail. There is not an EICAS message or an FMC scratchpad message to alert the crew of a reset condition. To regain FMC operation, activate and execute the flight plan, reenter the necessary performance data, and reengage LNAV and VNAV.



This Section Applies to VP-BWW, VP-BWX, VQ-BOG

Air Traffic Control Data Link

Air Traffic Control data link functions are accomplished on the CDU. 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 prompts on the ATC CDU pages. Execution of an ATC loaded modification is accomplished using normal FMC modification procedures.

Refer to chapter 5, Communications, section 45, ATC Communications, for a description of ATC data link.

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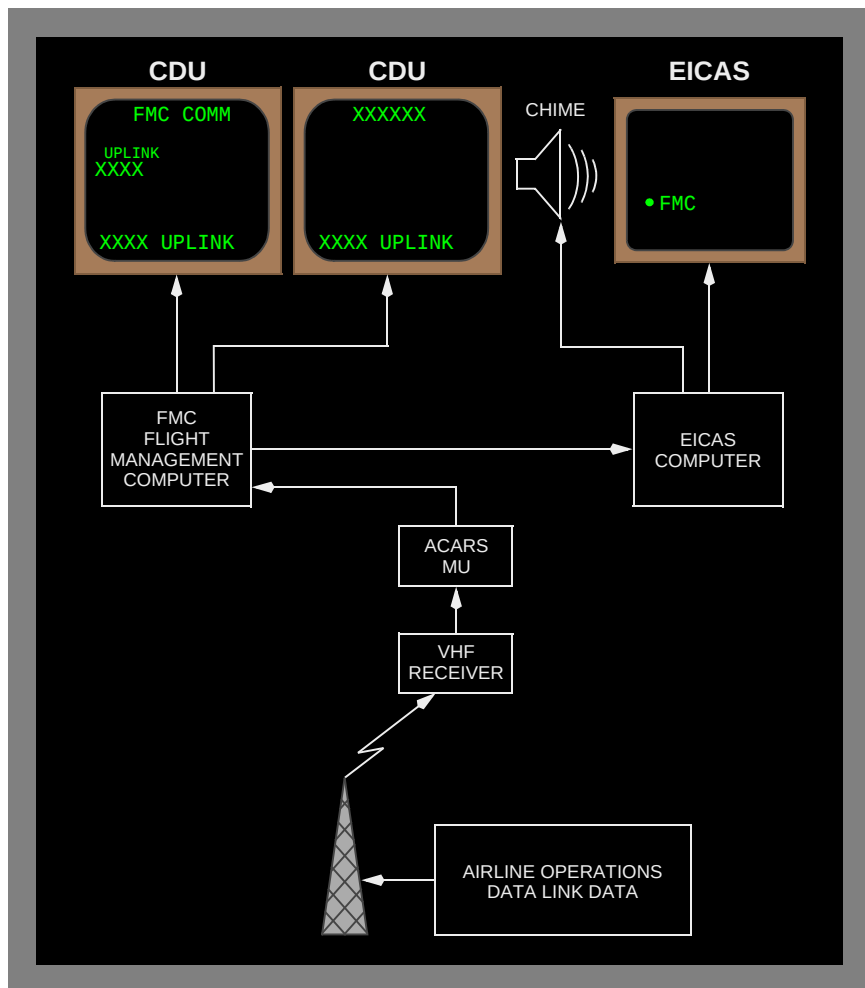
**Flight Management, Navigation
Company Data Link**

**Chapter 11
Section 34**

This Section Applies to VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT |

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. 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 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.

CDU Data Link Status Displays

Data link operation is verified when the correct prompt is displayed. In the example below, the REQUEST SEND prompt indicates the data link status is READY.



When the data link system status is not READY, the line titles change to DATA LINK and the line displays the system status, NO COMM, VOICE or FAIL.

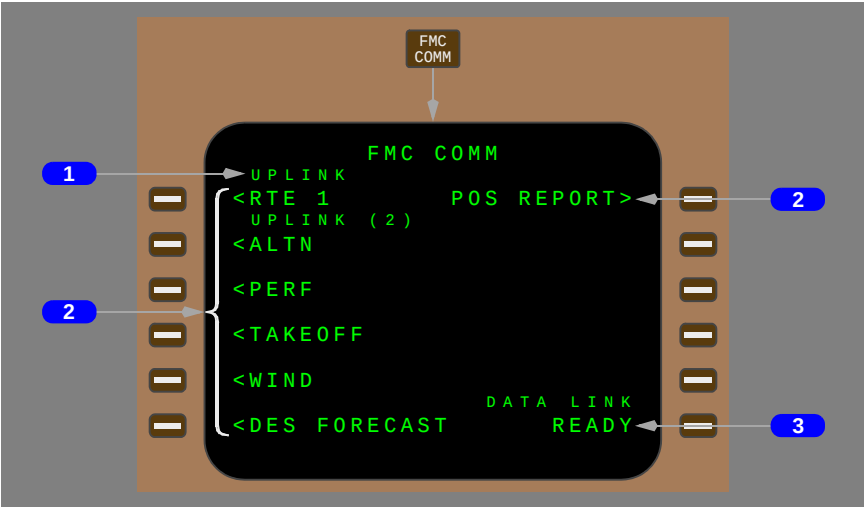




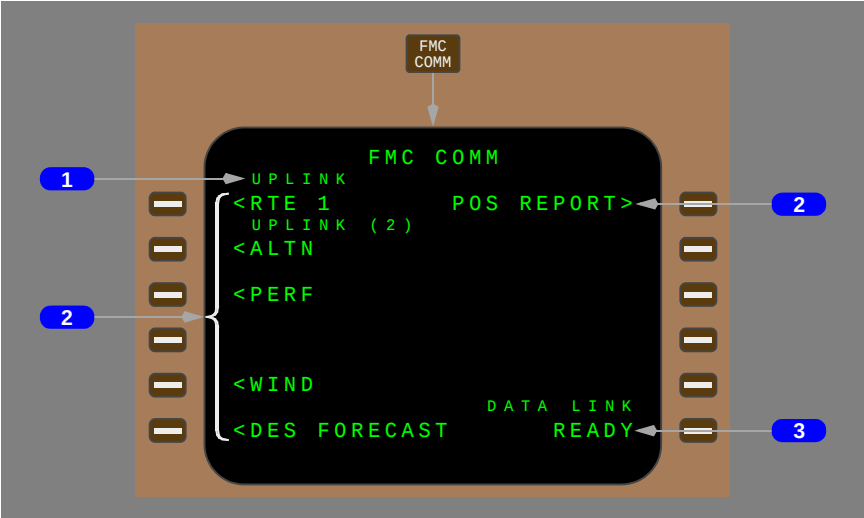
FMC Communications Page

General data link status is shown on the FMC COMM page. Page select prompts are shown for each FMC page with access to data link data.

VP-BMC, VQ-BOG



VP-BDI, VP-BWW, VP-BWX, VQ-BPT



1 Uplink Status

The page line heading shows UPLINK when an uplink message is pending and all preprocessing is complete. Preprocessing of uplinks makes sure all of the prerequisite data is available before the uplink message can be selected. Examples of preprocessing include:

VP-BMC, VQ-BOG

- RTE ALTN, ALTN LIST, PERF, TAKEOFF, and WIND uplinks are held until route activation or modifications are complete.

VP-BDI, VP-BWW, VP-BWX, VQ-BPT

- RTE ALTN, ALTN LIST, PERF, 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.

VP-BMC, VQ-BOG

- 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) is shown to the right of UPLINK in the line heading.

The EICAS message •FMC is shown whenever any UPLINK message is pending.

2 Page Select Prompts

Selection of any of these prompts shows the related page:

- RTE X
- ALTN
- PERF

VP-BMC, VQ-BOG

- TAKEOFF
- WIND
- DES FORECAST
- POS REPORT.

3 DATA LINK

Shows the data link system status.

System status can be:

- READY
- NO COMM
- VOICE
- FAIL.

Data Link Messages

Downlinks are data link message 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

I **VP-BMC, VQ-BOG**

Select a REQUEST SEND prompt to start a downlink request for data. REQUEST SEND 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 SEND prompt on the RTE page and a position report may be downlinked by selection of the COMPANY SEND prompt on the POS REPORT page.

VP-BDI, VP-BWW, VP-BWX, VQ-BPT

Select a REQUEST SEND prompt to start a downlink request for data. REQUEST SEND prompts are on PERF INIT, DESCENT FORECAST, RTE, ALTN, ALTN LIST or RTE DATA pages. Downlink reports of the active route may be accomplished by selecting of the REPORT SEND prompt on the RTE page and a position report may be downlinked by selection of the COMPANY SEND prompt on the POS REPORT page.

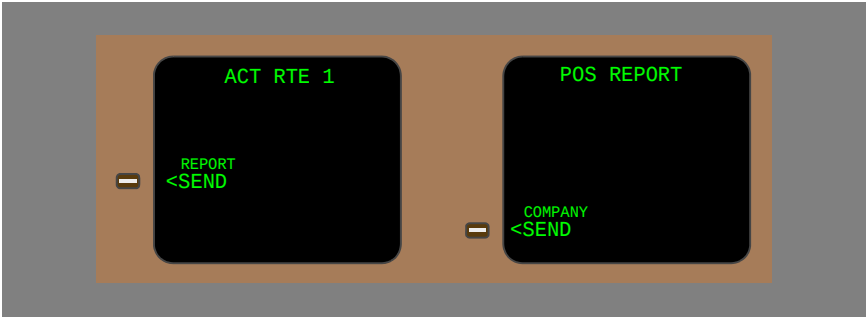
When the communications function is unable to downlink FMC messages, the words DATALINK FAIL, NO COMM, or VOICE are shown on the CDU pages in place of the REQUEST SEND and REPORT SEND prompts. The data link status is also shown on the FMC COMM page. The status messages are:

- FAIL –
 - the data communications management function is inoperative, or
 - the data radios have failed.
- NO COMM –
 - the radios are operational but not available
- VOICE – all available radios are operating in the VOICE mode.

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Reports

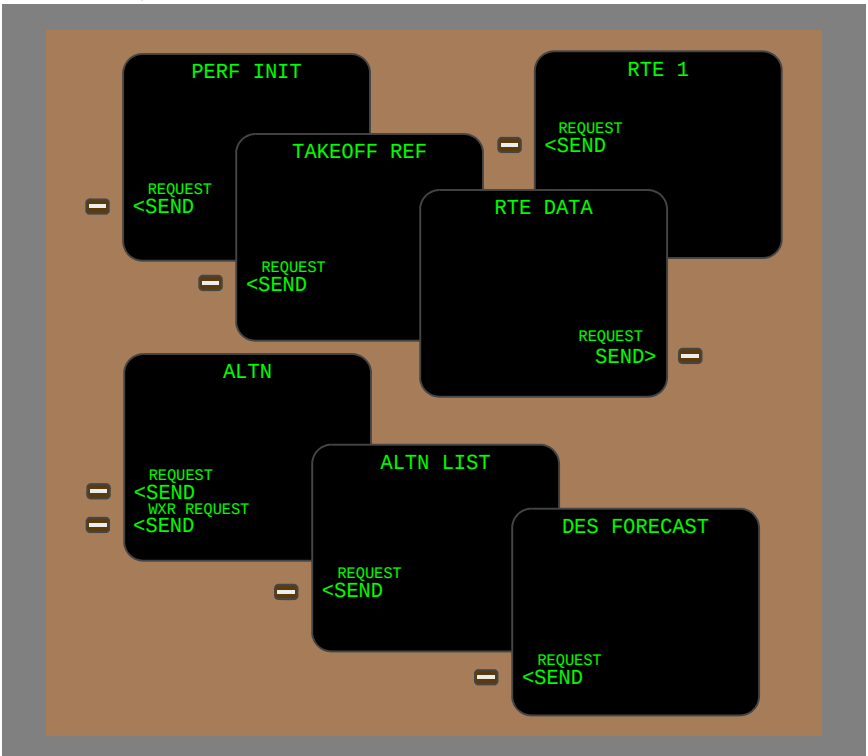
Selecting the REPORT SEND or COMPANY SEND prompt downlinks a unique report. The pages below contain report prompts.



Requests

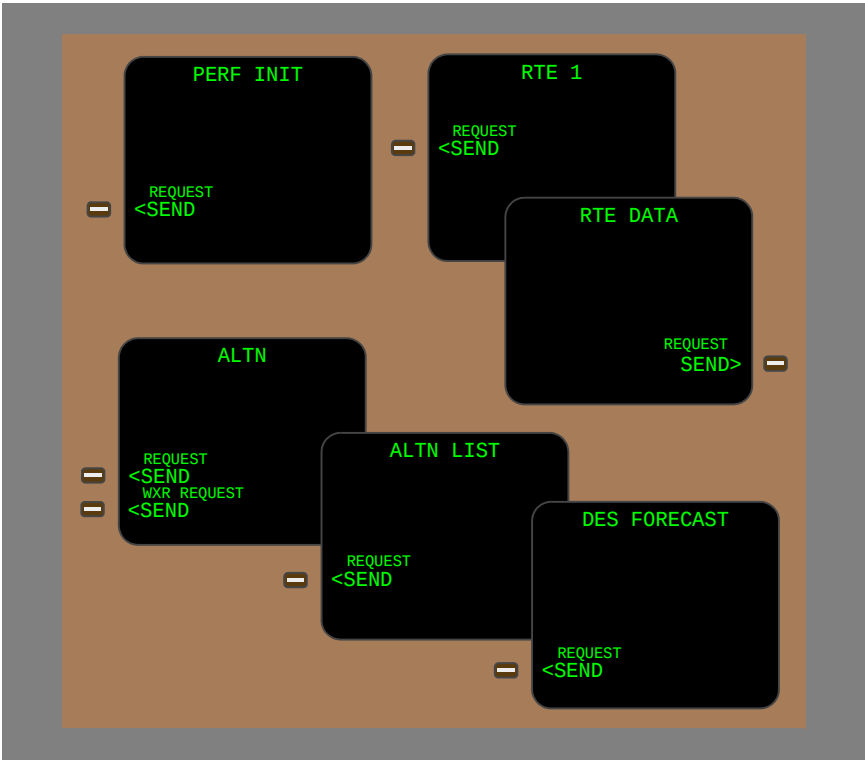
A REQUEST SEND prompt downlinks a unique request applicable to the displayed page. The pages below contain REQUEST SEND prompts as shown.

VP-BMC, VQ-BOG



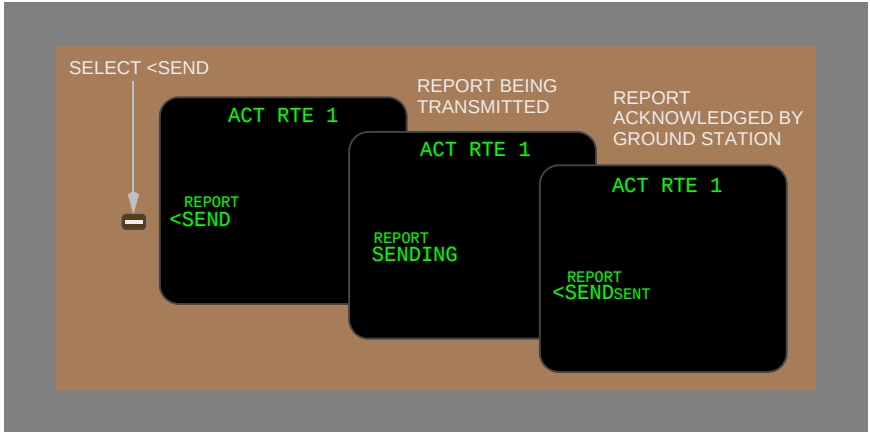


VP-BDI, VP-BWW, VP-BWX, VQ-BPT



Downlink Status

When a SEND prompt is selected the line changes to show the status of the downlink message. Below is a typical sequence of the status display in response to sending a report. The same sequence appears when sending a request.



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 loaded 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.

VP-BMC, VQ-BOG

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 chime. The uplink is identified by a CDU scratchpad message and by the presence of an UPLINK label over the applicable COMM page prompt.

VP-BDI, VP-BWW, VP-BWX, VQ-BPT

Data can be uplinked from the airline dispatcher directly to the PERF INIT, DESCENT FORECAST, RTE, ALTN, ALTN LIST, and WIND pages. The uplinks are annunciated to the crew by the •FMC EICAS communications alert and a chime. The uplink is identified by a CDU scratchpad message and by the presence of an UPLINK label over the applicable COMM page prompt.

VP-BMC, VQ-BOG

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.

FMC Data Link Uplinks (Accept/Reject)

VP-BMC, VQ-BOG

ACCEPT and REJECT prompts are shown on the PERF INIT, TAKEOFF 1/2, and ALTN pages after receipt of uplink data.

Uplink data is shown initially in small font for preview.

Select ACCEPT prompt:

- shows uplinked data in large font
- replaces previous data with uplinked data
- page changes to pre-uplink format
- clears scratchpad message
- transmits a downlink accept message (if enabled).

Select REJECT prompt:

- replaces uplinked data with previous data
- page changes to pre-uplink format
- clears scratchpad message
- transmits a downlink reject message (if enabled).



FMC Data Link Uplinks (Accept/Reject)

VP-BDI, VP-BWW, VP-BWX, VQ-BPT

ACCEPT and REJECT are shown on the PERF INIT, and ALTN pages after receipt of uplink data.

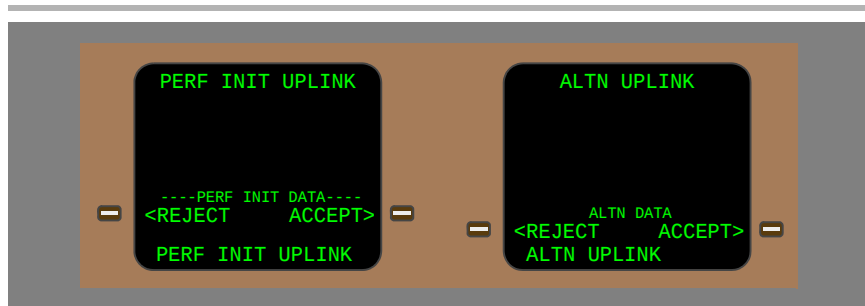
Uplink data is shown initially in small font for preview.

Select ACCEPT prompt:

- shows uplinked data in large font
- replaces previous data with uplinked data
- page changes to pre-uplink format
- clears scratchpad message
- transmits a downlink accept message (if enabled).

Select REJECT prompt:

- replaces uplinked data with previous data
- page changes to pre-uplink format
- clears scratchpad message
- transmits a downlink reject message (if enabled).



FMC Data Link Uplinks (Load/Purge)

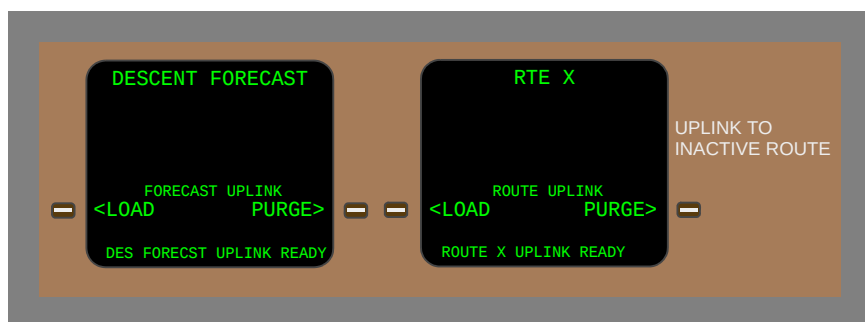
LOAD and PURGE are shown on the DESCENT FORECAST page after receipt of uplink data. LOAD and PURGE are shown on the RTE 1 or RTE 2 page when there is an uplink to the inactive route.

Select LOAD prompt:

- loads uplinked data into FMC for viewing
- clears scratchpad message
- replaces previous data with uplinked data
- page changes to pre-uplink format
- transmits a downlink accept message (if enabled).

Select PURGE prompt:

- replaces uplinked data with previous data
- page changes to pre-uplink format
- clears scratchpad message
- transmits a downlink reject message (if enabled).



FMC Data Link Uplinks (Load/Exec-Erase)

LOAD shows 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 is shown.

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Select LOAD prompt:

- loads uplinked data into FMC
- loaded data can be viewed
- clears scratchpad message
- replaces existing data with modified uplinked data
- page title changes 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:

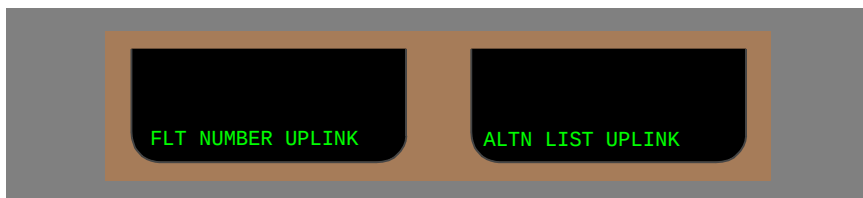
- remove modified data
- return page display to pre-uplink format
- transmit a downlink reject message (if enabled).



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 up to 20 alternates automatically loads into the ALTN LIST page without flight crew action.

The scratchpad messages FLIGHT NUMBER UPLINK or ALTN LIST UPLINK stay in the scratchpad display queue until the applicable CDU page is selected.





Flight Management, Navigation

FMC Preflight

Chapter 11

Section 40

Introduction

FMC preflight is required before flight.

Completion of the FMC preflight requires data entry in all minimum required data locations. Additional entry of optional preflight data optimizes FMC accuracy.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

Data link can be used to 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.

VP-BMC, VQ-BOG

Data link can also be used to load takeoff data onto the TAKEOFF REF pages.

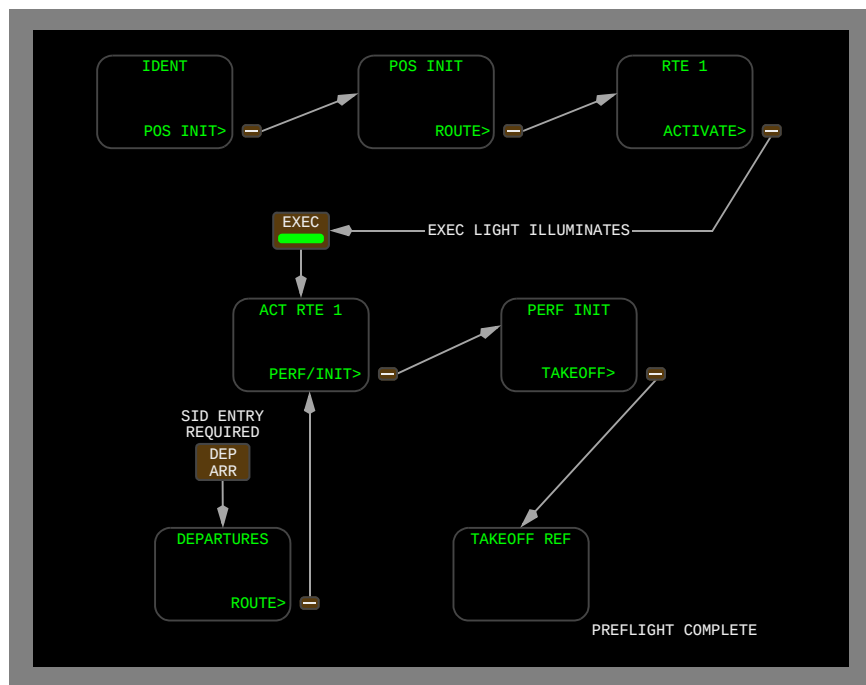
Preflight Page Sequence

The usual FMC power-up page is the identification page. Preflight flow continues in this sequence:

- identification (IDENT) page
- position initialization (POS INIT) page
- ROUTE page
- DEPARTURES page (no automatic prompt)
- performance initialization (PERF INIT) 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 including the airplane weight and cruise altitude is required.

Takeoff data requires a flap setting.

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.



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Route discontinuities are removed and the route is modified on the ROUTE and RTE LEGS pages. Speed/altitude restrictions are entered and removed on the RTE LEGS page. The RTE LEGS page is described in the FMC Cruise section of this chapter.

Waypoint, navaid, 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.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Alternate airports are added on the ALTN page. The ALTN page is described in the FMC Descent/Approach section of this chapter.

VNAV performance is improved if forecast winds and temperatures are entered during the preflight.

Wind and temperature information for specific waypoints is entered on the WIND page. The WIND page is described in the FMC Cruise section of this chapter.

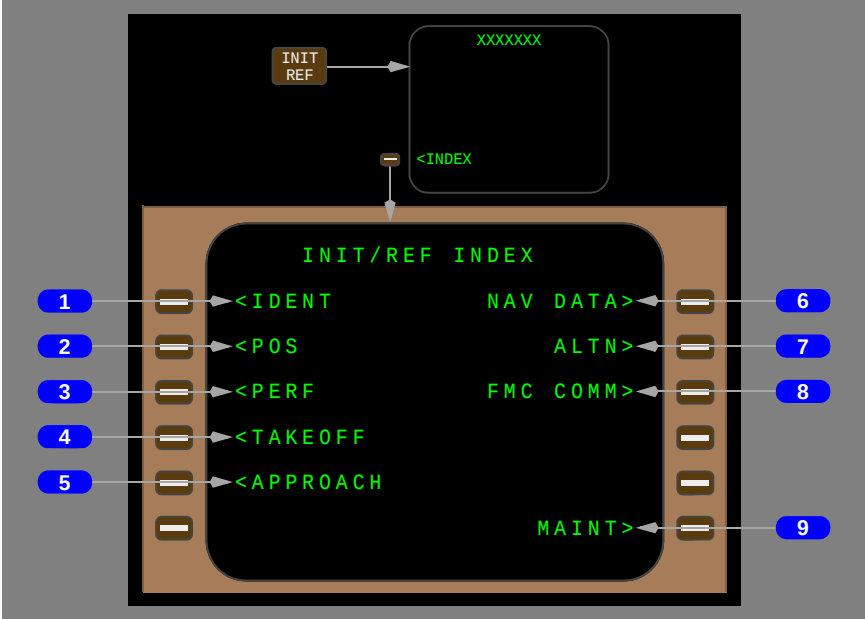
Preflight Pages

The preflight pages are presented in the sequence used during a typical preflight.

Initialization/Reference Index Page

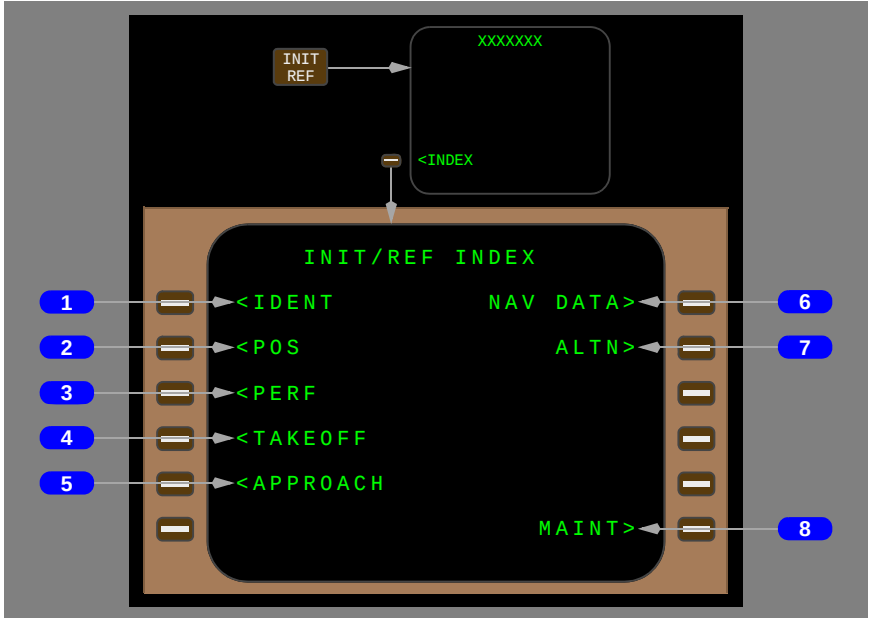
The initialization/reference index page allows manual selection of FMC pages. It gives access to pages used during preflight and not usually used in flight.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

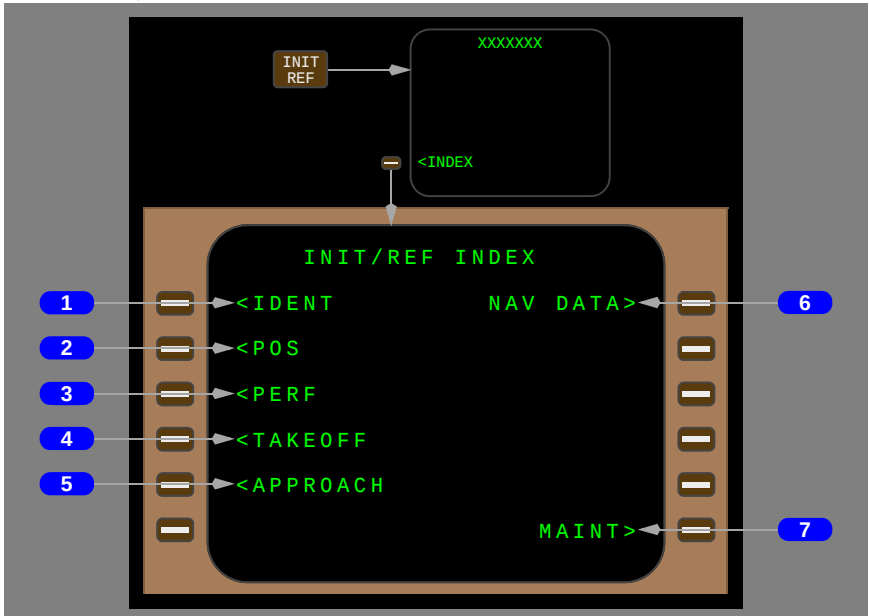


767 Flight Crew Operations Manual

VP-BOQ, VP-BOY, VP-BRL, VQ-BMQ, VQ-BMU



VP-BOZ, VQ-BRA



1 Identification (IDENT)

The IDENT page is the first page in the preflight sequence.

2 Position (POS)

The POS INIT page is used for input of reference position for inertial alignment.

3 Performance (PERF)

The PERF INIT page is used for initialization of data required for VNAV operations and performance predictions.

4 TAKEOFF

The TAKEOFF REF page is used to enter takeoff reference data and V speeds.

VP-BMC, VP-BOY, VP-BOZ, VQ-BMU

5 APPROACH

The APPROACH REF page is used to determine the approach VREF speed for the planned landing flap configuration.

| VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

5 APPROACH

The APPROACH REF page is used to set the approach VREF speed bug on the ADI speed tape for the planned landing flap configuration.

6 Navigation (NAV) DATA

The REF NAV DATA page is used for data on waypoints, nav aids, airports, and runways. NAV DATA pages are accessible only from this page.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

7 Alternate (ALTN)

The ALTN page is used for alternate airport planning and diversions.

VP-BOZ, VQ-BRA

7 Maintenance (MAINT)

For maintenance use only; displays maintenance pages.

| VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

8 FMC Communication (COMM)

The FMC COMM page is used to access other pages from which FMC datalink messages can be accessed or sent.

VP-BOQ, VP-BOY, VP-BRL, VQ-BMQ, VQ-BMU

8 Maintenance (MAINT)

For maintenance use only; displays maintenance pages.



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VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

9 Maintenance (MAINT)

For maintenance use only; displays maintenance pages.



Identification Page

Most of the data on this page is for flight crew verification. The active navigation database can be selected.

The flight crew verifies FMC data, selects the current navigation database, and checks drag and fuel flow factors on the identification page.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

VP-BMC, VP-BOY



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VP-BDI, VP-BOQ, VP-BRL through VQ-BPT


1 MODEL

Displays the airplane model from the FMC performance database.

2 Navigation (NAV) DATA

Displays the navigation database identifier.

3 Operating (OP) PROGRAM

Displays the operating program identifier.

4 Operational Program Configuration (OPC) PART NUMBER

Displays the Operational Program Configuration part number.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 ENGINES

Displays the engine model from the FMC performance database.

7 ACTIVE

Displays range of effective dates for the active navigation database.

The active navigation database can be replaced with the inactive database while on the ground. Changing the navigation database removes all previously entered route data.

8 Inactive Date Range

Displays range of effective dates for the inactive navigation database. May be line selected to the scratchpad and inserted to the ACTIVE line while on the ground.

9 Company (CO) DATA

Displays the last eight characters of the Airline Modifiable Information (AMI) part number.

10 DRAG/Fuel Flow (FF) Factors

Displays the airplane drag and fuel flow correction factors.

For maintenance use only.

11 Position Initialization (POS INIT)

Push – displays the POS INIT page.

VP-BOZ, VQ-BRA

VP-BOZ



VQ-BRA


1 MODEL

Displays the airplane model from the FMC performance database.

2 Navigation (NAV) DATA

Displays the navigation database identifier.

3 Operating (OP) PROGRAM

Displays the operating program identifier.

4 DRAG/Fuel Flow (FF) Factors

Displays the airplane drag and fuel flow correction factors.

For maintenance use only.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 ENGINES

Displays the engine model from the FMC performance database.

7 ACTIVE

Displays range of effective dates for the active navigation database.

The active navigation database can be replaced with the inactive database while on the ground. Changing the navigation database removes all previously entered route data.

8 Inactive Date Range

Displays range of effective dates for the inactive navigation database. May be line selected to the scratchpad and inserted to the ACTIVE line while on the ground.

9 VERSION

Displays the version identification for the current configuration.

10 Company (CO) DATA

Displays the identification of the airline policy file.

11 Position Initialization (POS INIT)

Push – displays the POS INIT page.

Position Initialization Page

The position initialization page allows entry of airplane present position for IRS alignment. This page is also used to enter the heading when an IRS is in the ATT mode.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

The diagram illustrates the Position Initialization Page, which consists of two main display areas. The top area is a control panel with several buttons and a small display. The bottom area is a large display showing the current position and heading information.

Top Control Panel:

- INIT REF:** A button labeled "INIT REF" with a note "Inertial position not entered".
- IDENT:** A box labeled "IDENT" with a "POS INIT>" button below it.
- INIT/REF INDEX:** A box labeled "INIT/REF INDEX" with a "<POS" button below it.

Bottom Display Area:

The bottom display area shows the current position and heading information. It is divided into two sections: "POS INIT" and "GPS POS".

POS INIT Section:

- 1 / 4:** A small display showing "1 / 4".
- LAST POS:** A label for the last position.
- N47°32.5 W122°18.7:** The current latitude and longitude coordinates.
- REF AIRPORT:** A label for the reference airport.
- GATE:** A label for the gate number.
- UTC (GPS):** A label for the time zone.
- 1530Z:** The current time in UTC.
- SET IRS POS:** A label for the IRS position.
- <INDEX:** A button to return to the index screen.
- ROUTE>:** A button to enter the route.

GPS POS Section:

- GPS POS:** A label for the GPS position.
- 1530Z:** The current time in UTC.
- N47°32.5 W122°18.7:** The current latitude and longitude coordinates.
- SET HDG:** A label for the heading.
- <INDEX:** A button to return to the index screen.
- ROUTE>:** A button to enter the route.

Numbered Callouts:

- 1:** REF AIRPORT button
- 2:** GATE button
- 3:** UTC (GPS) button
- 4:** <INDEX button
- 5:** LAST POS button
- 6:** GPS POS button
- 7:** SET IRS POS button
- 8:** ROUTE> button
- 9:** SET HDG button

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 when airborne.

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 is entered.

Entry blanks when airborne.

3 Universal Time Coordinated (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 can be 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 IRS Position (SET IRS POS)

The set inertial position entry is required to initialize the IRS. Select the most accurate latitude/longitude from LAST POS, REF AIRPORT, GATE, GPS POS, or a manual entry to initialize the IRS.

If an entry is not made before the IRS completes the initial alignment, the scratchpad message ENTER IRS POSITION is displayed.

If the manually entered position fails the IRS internal check, the scratchpad message ENTER IRS POSITION is displayed.

The manually 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 IRS POS/ORIGIN DISAGREE is displayed.

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Boxes display within one minute of IRS power-up.

Blanks when the IRS changes from the alignment to the navigation mode.

8 ROUTE

Push – displays the ROUTE page.

9 Set Heading (SET HDG)

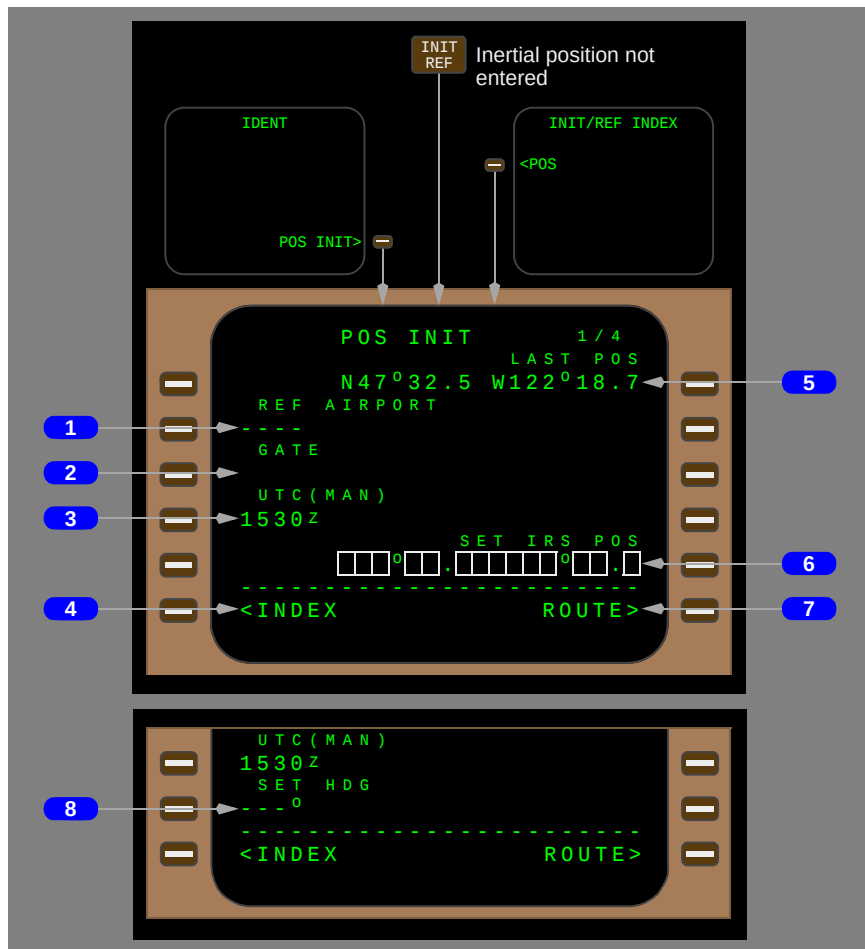
Dashes display when an IRS selector is placed in the ATT position.

Enter magnetic heading to initialize the IRS in the ATT mode to provide headings.

Heading should be updated regularly if extended operation in ATT is necessary.

Valid entry is 0 to 360 (0 or 360 displays as 0°).

VP-BOQ, VP-BRL



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 when airborne.

2 GATE

The gate entry allows further refinement of the latitude/longitude position.

Optional entry after reference airport entered.

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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 is entered.

Entry blanks when airborne.

3 Universal Time Coordinated (UTC)

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 Set IRS Position (SET IRS POS)

The set inertial position entry is required to initialize the IRS. Select the most accurate latitude/longitude from LAST POS, REF AIRPORT, GATE, or a manual entry to initialize the IRS.

If an entry is not made before the IRS completes the initial alignment, the scratchpad message ENTER IRS POSITION is displayed.

If the manually entered position fails the IRS internal check, the scratchpad message ENTER IRS POSITION is displayed.

The manually 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 IRS POS/ORIGIN DISAGREE is displayed.

Boxes display within one minute of IRS power-up.

Blanks when the IRS changes from the alignment to the navigation mode.

7 ROUTE

Push – displays the ROUTE page.

8 Set Heading (SET HDG)

Dashes display when an IRS selector is placed in the ATT position.

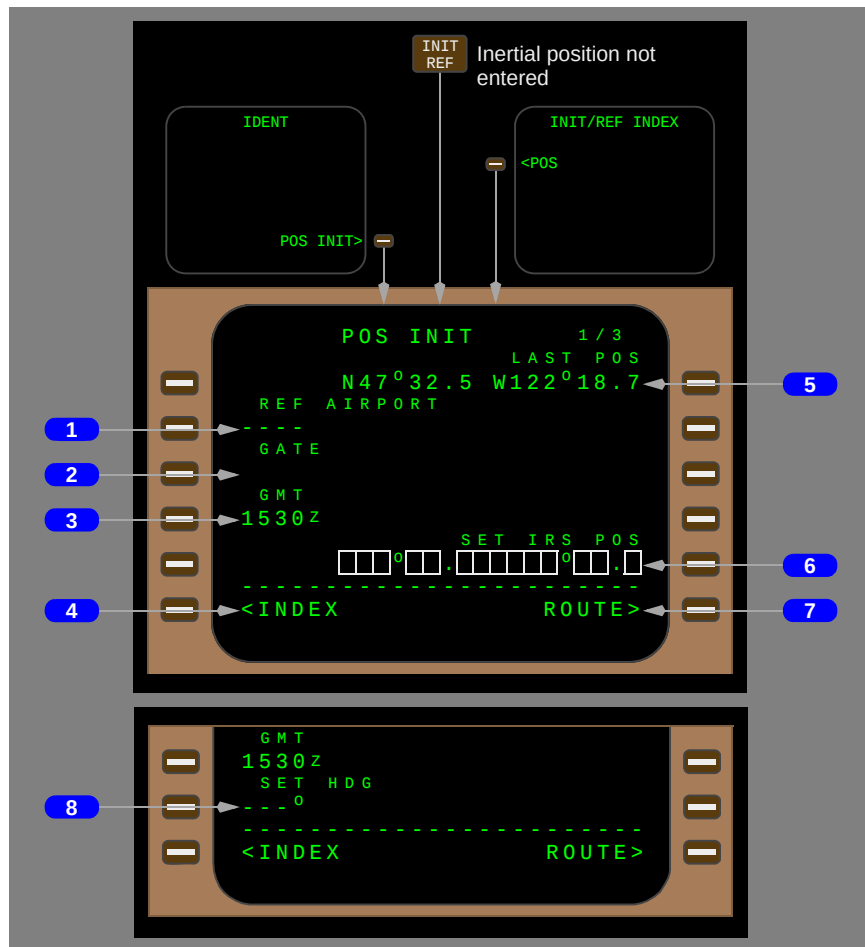
Enter magnetic heading to initialize the IRS in the ATT mode to provide headings.

Heading should be updated regularly if extended operation in ATT is necessary.

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Valid entry is 0 to 360 (0 or 360 displays as 0°).

VP-BOZ, VQ-BRA



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 when airborne.

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 is entered.

Entry blanks when airborne.

3 Greenwich Mean Time (GMT)

Displays time from captain's clock when operative; otherwise, displays time from first officer's clock.

The hours can be changed by entering desired value. The minutes can only be changed by resetting the 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 Set IRS Position (SET IRS POS)

The set inertial position entry is required to initialize the IRS. Select the most accurate latitude/longitude from LAST POS, REF AIRPORT, GATE, or a manual entry to initialize the IRS.

If an entry is not made before the IRS completes the initial alignment, the scratchpad message ENTER IRS POSITION is displayed.

If the manually entered position fails the IRS internal check, the scratchpad message ENTER IRS POSITION is displayed.

Boxes display within one minute of IRS power-up.

Blanks when the IRS changes from the align to the navigation mode.

7 ROUTE

Push – displays the ROUTE page.

8 SET Heading (HDG)

Dashes display when an IRS selector is placed in the ATT position.

Enter magnetic heading to initialize the IRS in the ATT mode to provide headings.

Heading should be updated regularly if extended operation in ATT is necessary.

Valid entry is 0 to 360 (0 or 360 displays as 360°).

Position Reference Pages

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

The position reference pages are not part of a normal preflight. They are presented here in a logical sequence because they are accessed from the position initialization page.

Position Reference Page 2/4

VP-BOQ, VP-BRL

Position reference page 2 displays positions calculated by the FMC, IRS, and radio navigation receivers. The FMC position can be updated to IRS or radio position on this page.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

Position reference page 2 displays positions calculated by the FMC, IRS, GPS, and radio navigation receivers. The FMC position can be updated to IRS, GPS, or radio position on this page.

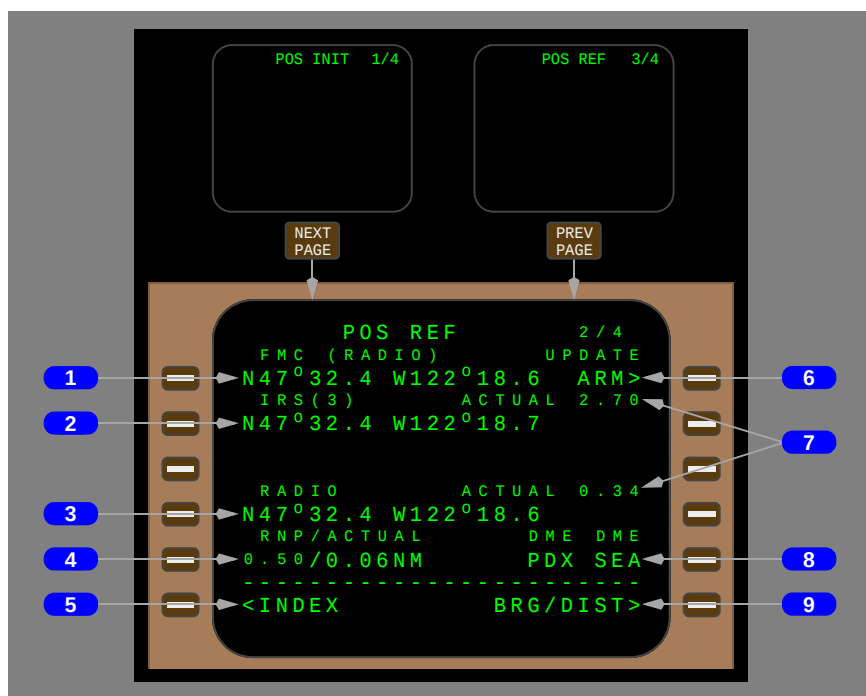
VP-BOQ, VP-BRL

Positions are displayed as the latitude/longitude calculated by the individual systems. When BRG/DIST is selected the IRS and radio positions are shown as bearing and distance from the FMC position.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

Positions are displayed as the latitude/longitude calculated by the individual systems. When BRG/DIST is selected the IRS, GPS, and radio positions are shown as bearing and distance from the FMC position.

VP-BRL



1 FMC

The source used by the active FMC for position data is displayed next to the FMC line title. In the example, the FMC uses RADIO for position data.

Displays the FMC calculated latitude/longitude.

Identifies the source for calculating the FMC position:

- IRS – position calculated from inertial position data only
- RADIO – position calculated from navigation radio and inertial position data
- LOC–RADIO – position is calculated from localizer, navigation radio and inertial data
- LOC – position is calculated from localizer and inertial data.

2 IRS

Displays latitude/longitude position or the bearing and distance from the FMC position determined by the IRS. If the displayed position is derived from all three IRSs, (3) is displayed. If the position is from a single IRS then (L), (C), or (R) is displayed to indicate which IRS position is displayed.

3 RADIO

After airborne, displays latitude/longitude position or the bearing and distance from the FMC position determined by navigation radios.

4 Required Navigation Performance and Actual Navigation Performance (RNP /ACTUAL)

Displays the RNP and actual navigational performance (ACTUAL) of the FMC.

Default RNP is in small font.

Valid RNP entries are in the range 0.01 to 99.9. ACTUAL entry not allowed.

When ACTUAL exceeds RNP, EICAS displays UNABLE RNP message.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 UPDATE ARM

Push –

- arms FMC position update function
- changes prompt to ARMED
- adds NOW prompts to right side of INERTIAL and RADIO lines.

Push a NOW prompt key to momentarily update FMC position to the selected source. If another source with a smaller ANP exists, the FMC position will correct back to the most accurate position available.

7 ACTUAL

Displays actual navigation performance (ANP) of the IRS and navigation radios.

8 Radio Update Station(s)/Mode

Displays radio station identifiers.

Position update mode is indicated in the line title:

- DME DME
- VOR DME

Line and title are blank when no radio position is computed.

9 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 display is relative to the FMC position.

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VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT



1 FMC

The source used by the active FMC for position data is displayed 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 and inertial position data
- IRS – position calculated from inertial position data only
- RADIO – position calculated from navigation radio and inertial position data
- LOC–GPS – position is calculated from localizer, GPS and inertial data
- LOC–RADIO – position is calculated from localizer, navigation radio and inertial data
- LOC – position is calculated from localizer and inertial data.

2 IRS

Displays latitude/longitude position or the bearing and distance from the FMC position determined by the IRS. If the displayed position is derived from all three IRSs, (3) is displayed. If the position is from a single IRS then (L), (C), or (R) is displayed to indicate which IRS position is displayed.

3 GPS

Displays latitude/longitude position or the bearing and distance from the FMC position determined by the GPS.

4 RADIO

After airborne, displays latitude/longitude position or the bearing and distance from the FMC position determined by navigation radios.

5 Required Navigation Performance and Actual Navigation Performance (RNP /ACTUAL)

Displays the RNP and actual navigational performance (ACTUAL) of the FMC. Default RNP is in small font.

Valid RNP entries are in the range 0.01 to 99.9. ACTUAL entry not allowed.

When ACTUAL exceeds RNP, EICAS displays UNABLE RNP message.

Note: The FMC stops GPS updating if GPS data accuracy degrades due to satellite availability or unfavorable geometry. Subsequently, the FMC receives updates from another system.

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 momentarily update FMC position to the selected source. If another source with a smaller ANP exists, the FMC position will correct back to the most accurate position available.

8 ACTUAL

Displays actual navigation performance (ANP) of the IRS, GPS and navigation radios.

9 Radio Update Station(s)/Mode

Displays radio station identifiers.

Position update mode is indicated in the line title:

- DME DME
- VOR DME

Line and title are blank when no radio position is computed.

10 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 display is relative to the FMC position.

VP-BOQ



1 FMC

The source used by the active FMC for position data is displayed next to the FMC line title. In the example, the FMC uses RADIO for position data.

Displays the FMC calculated latitude/longitude.

Identifies the source for calculating the FMC position:

- IRS – position calculated from inertial position data only
- RADIO – position calculated from navigation radio and inertial position data
- LOC–RADIO – position is calculated from localizer, navigation radio and inertial data
- LOC – position is calculated from localizer and inertial data.

2 IRS

Displays latitude/longitude position or the bearing and distance from the FMC position determined by the IRS. If the displayed position is derived from all three IRSs, (3) is displayed. If the position is from a single IRS then (L), (C), or (R) is displayed to indicate which IRS position is displayed.

3 RADIO

After airborne, displays latitude/longitude position or the bearing and distance from the FMC position determined by navigation radios.

4 INDEX

Push – displays the INIT/REF INDEX page.

5 UPDATE ARM

Push –

- arms FMC position update function
- changes prompt to ARMED
- adds NOW prompts to right side of INERTIAL and RADIO lines.

Push a NOW prompt key to momentarily update FMC position to the selected source.

6 Radio Update Station(s)/Mode

Displays radio station identifiers.

Position update mode is indicated in the line title:

- DME DME
- VOR DME

Line and title are blank when no radio position is computed.

7 Bearing/Distance (BRG/DIST) or Latitude/Longitude (LAT/LON)

Push – alternates position data format between bearing/distance or latitude/longitude.

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The page illustration is shown in the latitude/longitude display format. Latitude/longitude format displays are actual position. Bearing/distance display is relative to the FMC position.

Position Reference Page 3/4

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

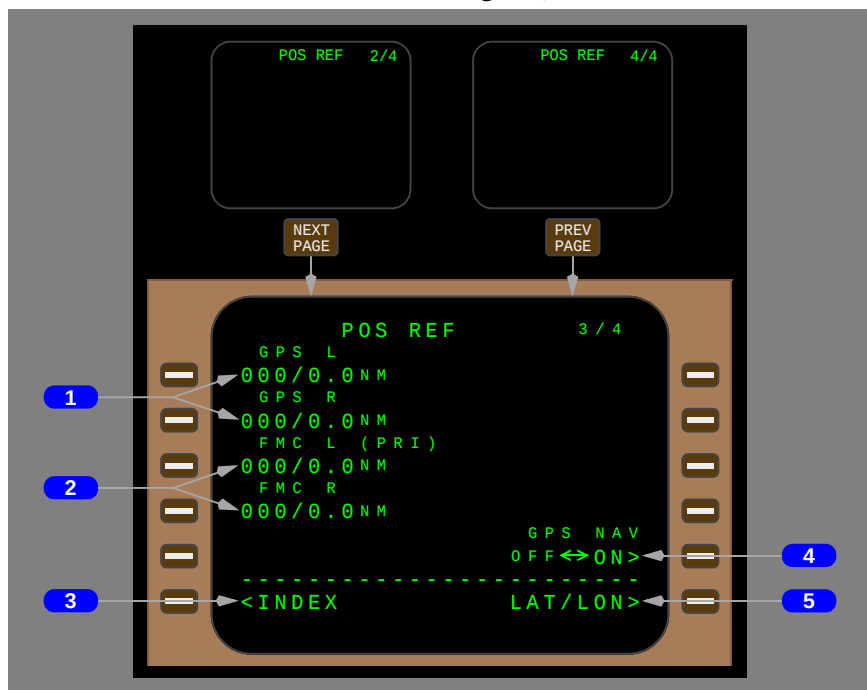
On position reference page 3, the flight crew can observe the calculated positions from the left and right GPS receivers and the left and right FMC calculations. This page also allows the flight crew to enable or disable GPS position updates.

VP-BOQ, VP-BRL

On position reference page 3, the flight crew can observe the calculated positions from the left and right FMC calculations.

This page can display the bearing/distance or latitude/longitude format. The bearing/distance format displays the positions relative to the active FMC position on the POS REF 2/4 page.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT



1 GPS L and GPS R

Displays the left and right GPS positions.

2 FMC L and FMC R

Displays the left and right FMC calculated position.

Primary (PRI) is displayed in line title of the FMC that is the navigation master.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 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 letters; ON displays in small letters.

ON – GPS position data is available to the FMC. ON displays in large letters; OFF displays in small letters.

Note: When the engines are shut down after flight GPS NAV is set to ON.

5 Latitude/Longitude (LAT/LON) or Bearing/Distance (BRG/DIST)

Push – alternately changes the display of position data on POS REF 2/4, 3/4, and 4/4 to latitude/longitude format or bearing/distance format.

The page illustration is shown in the bearing/distance display mode.

767 Flight Crew Operations Manual
VP-BOQ, VP-BRL

1 FMC L and FMC R

Displays the left and right FMC calculated position.

Primary (PRI) is displayed in the line title of the FMC that is the navigation master.

2 INDEX

Push – displays the INIT/REF INDEX page.

3 Latitude/Longitude (LAT/LON) or Bearing/Distance (BRG/DIST)

Push – alternately changes the display of position data on POS REF 2/4, 3/4, and 4/4 to latitude/longitude format or bearing/distance format.

The page illustration is shown in the bearing/distance display mode.

Position Reference Page 4/4

On position reference page 4, the calculated positions and ground speeds from the left, center and right IRS are displayed. Positions can be displayed in the bearing/distance or latitude/longitude format.



1 IRS L, C, and R

Displays the position of the Left, Center, and Right IRS. Positions can be displayed in latitude longitude or as bearing and distances from the FMC position.

2 INDEX

Push – displays the INIT/REF INDEX page.

3 Ground Speed (GS)

Displays the ground speed calculated by each IRS. The displayed values are frozen when the engines are shut down after flight until power is removed.

4 Latitude/Longitude (LAT/LON) or Bearing/Distance (BRG/DIST)

Push – alternately changes the displayed position between latitude/longitude format and bearing/distance format. When the display is in the bearing/distance format the prompt shows LAT/LON>.

Position Reference Pages

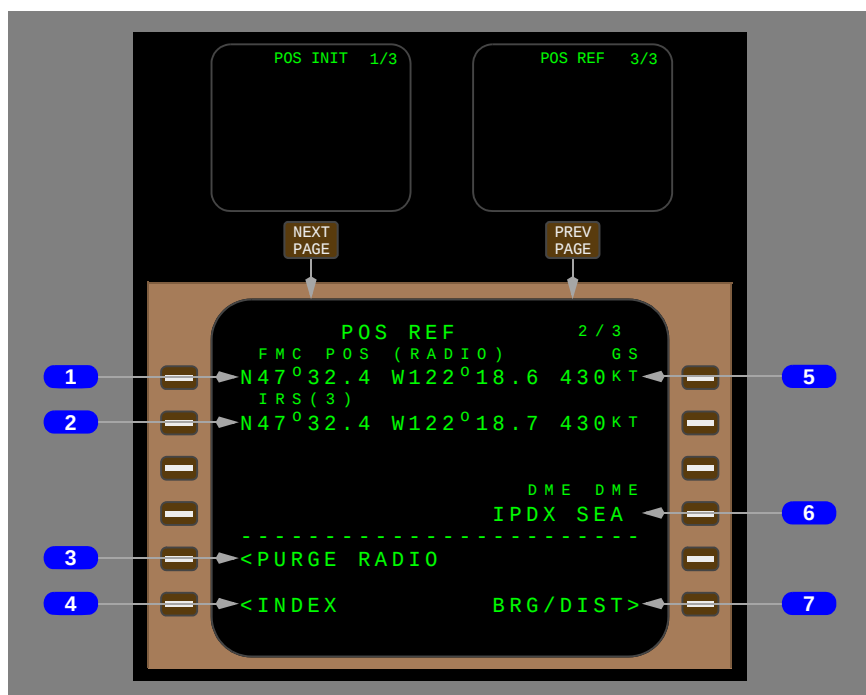
VP-BOZ, VQ-BRA

The position reference pages are not part of a normal preflight. They are presented here in a logical sequence because they are accessed from the position initialization page.

Position Reference Page 2/3

Position reference page 2 displays positions calculated by the FMC and IRS.

Positions are displayed as the latitude/longitude calculated by the individual systems. When BRG/DIST is selected the IRS position is shown as bearing and distance from the FMC position.



1 FMC Position (POS)

The source used by the active FMC for position data is displayed next to the FMC line title. In the example, the FMC uses navigation radios for position data.

Displays the FMC calculated latitude/longitude.

2 IRS

Displays latitude/longitude position or the bearing and distance from the FMC position determined by the IRS. If the displayed position is derived from all three IRSs, (3) is displayed. If the position is from a single IRS then (L), (C), or (R) is displayed to indicate which IRS position is displayed.

3 PURGE RADIO

Displays PURGE RADIO when the FMC position is determined with navigation radio updating.

Push – when PURGE RADIO is displayed:

- removes radio updates from FMC position
- displays the IRS position on the FMC line
- changes the prompt to CONFIRM

Push – when CONFIRM is displayed:

- sets the FMC position to the IRS position displayed
- allows radio updates to resume
- increases the error term used to determine the validity of nav aids to a value based on the time since the IRSs were aligned. This allows the FMC to accept radio updates from nav aids that were being rejected.

4 INDEX

Push – displays the INIT/REF INDEX page.

5 Ground Speed (GS)

Displays the current ground speed from the FMC and IRS.

6 Radio Update Station(s)/Mode

Displays the current mode of radio updating in the heading

- DME DME
- VOR DME
- LOC
- NAV STA – no radio updating.

Displays the identifiers of the nav aids being used for radio updating.

7 Bearing/Distance (BRG/DIST) or Latitude/Longitude (LAT/LON)

Push – alternates position data format between bearing/distance or latitude/longitude. Also changes the display on POS REF page 3/3.

The page illustration is shown in the latitude/longitude display format.

Latitude/longitude format displays are actual position. Bearing/distance display is relative to the FMC position.

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Position Reference Page 3/3

On position reference page 3, the calculated positions and ground speeds from the left, center and right IRS are displayed. Positions can be displayed in the bearing/distance or latitude/longitude format.



1 IRS L, C, and R

Displays the position of the Left, Center, and Right IRS. Positions can be displayed in latitude longitude or as bearing and distances from the FMC position.

2 INDEX

Push – displays the INIT/REF INDEX page.

3 Ground Speed (GS)

Displays the ground speed calculated by each IRS. The displayed values are frozen when the engines are shut down after flight until power is removed.

4 Latitude/Longitude (LAT/LON) or Bearing/Distance (BRG/DIST)

Push – alternately changes the displayed position between latitude/longitude format and bearing/distance format. Also changes the display on POS REF page 2/3. When the display is in the bearing/distance format the prompt shows LAT/LON>.

Route Page

Two routes (RTE 1 and RTE 2) can be stored and displayed in air traffic control format. The first route page displays origin and destination data. Subsequent route pages display route segments between waypoints or fixes. Having two routes allows management of alternate or future routes while leaving the active route unmodified. RTE 2 has an identical page structure as RTE 1.

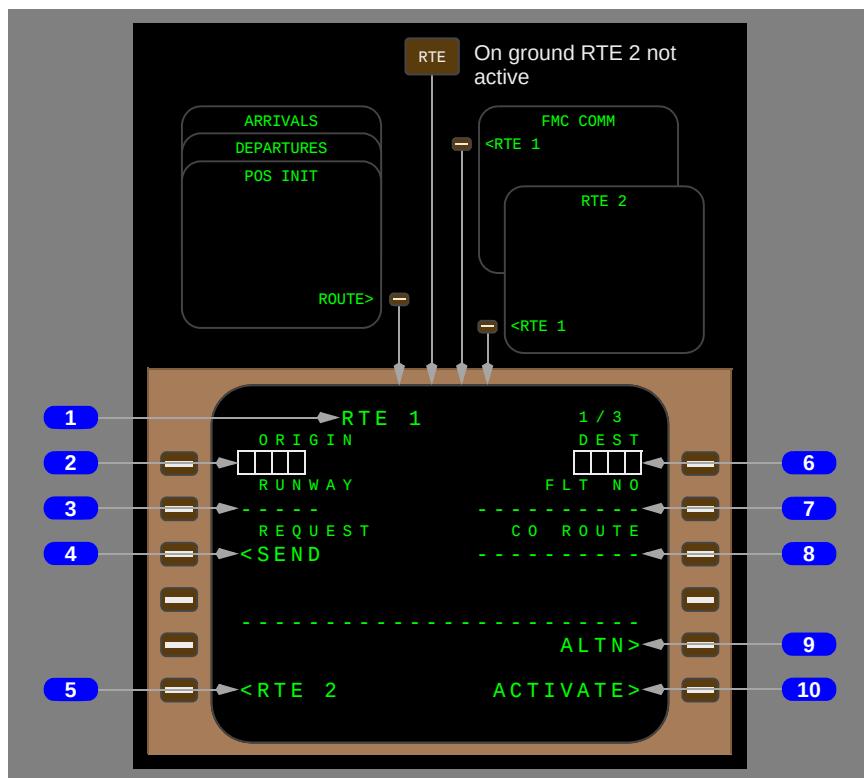
VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

Routes can be entered by the flight crew or uplinked through data link.

Route Page 1/X

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT



1 Page Title

Preceded by ACT when the route is active, and by MOD 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
- made automatically when a company route is entered
- enables direct selection of departure and arrival procedures
- required for route activation
- inhibited in-flight for active route.

Entry on the ground deletes existing route.

3 RUNWAY

Enter the applicable runway for the origin airport. Runway must be in the navigation database.

Entry:

- is optional
- causes MOD to display in the title if route is active
- can be selected on the DEPARTURES page
- can be included in company route.

The runway is deleted after the first waypoint is crossed.

4 REQUEST SEND

Push – transmits a data link request for a flight plan route uplink.

Flight crew can optionally fill in origin, destination, runway, flight number, company route name, or route definition to be included in the request.

5 Route (RTE) 2

Push – displays the RTE 2 page 1/X.

Allows access to an inactive route for entry, modification or activation.

Inactive route modifications:

- do not alter the active route
- do not change the inactive RTE page title.

Prompt changes to RTE 1 when RTE 2 is displayed.

6 Destination (DEST)

Entry:

- must be a valid ICAO identifier in the navigation database
- is made automatically when a company route is entered
- enables direct selection of destination arrival procedures
- is required for route activation
- displays MOD in page title if entered in an active route.

7 Flight Number (FLT NO)

Enter the company flight number.

Entry:

- optional for activation of the route
- limited to 10 characters
- may be entered by the flight crew or uplinked
- included in the PROGRESS page title

VP-BWW, VP-BWX, VQ-BOG

- propagated to RTE 2 and the ATC LOGON pages

VP-BDI, VP-BMC, VQ-BPT

- propagated to RTE 2 page
- deleted at flight completion.

VP-BWW, VP-BWX, VQ-BOG

Flight number can also be entered on the ATC LOGON page.

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.

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 is displayed.

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 and illuminate the EXECUTE light. When the EXECUTE key is pushed, the route becomes the active, ACT is displayed in the title, and the ACTIVATE prompt is replaced with the next required preflight page prompt.

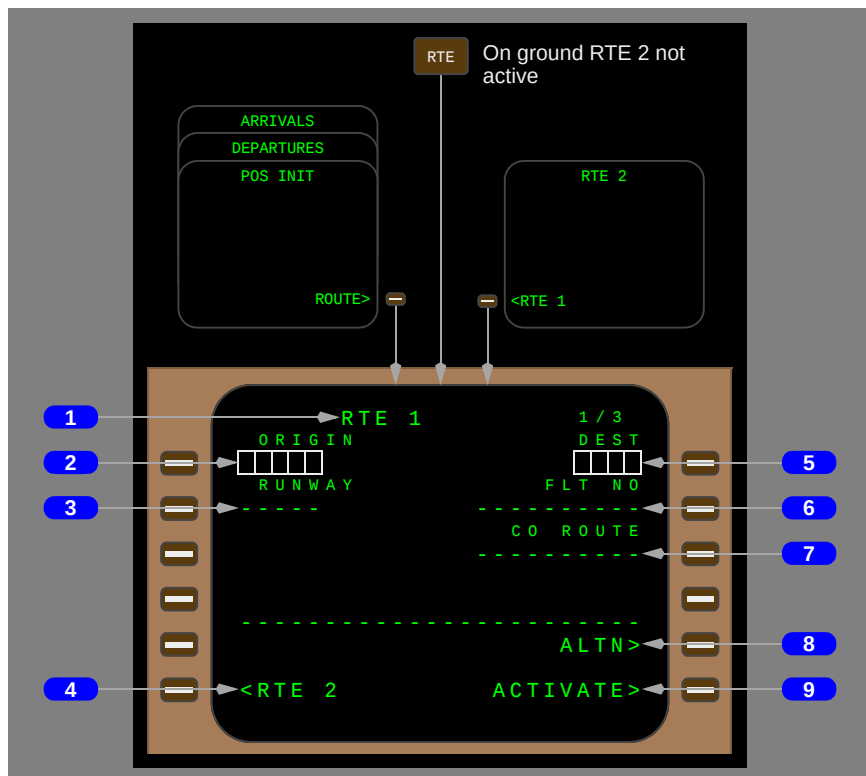
Activation of a route is required for completion of the preflight.

ACTIVATE is always displayed on the 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.

VP-BOQ, VP-BOY, VP-BRL, VQ-BMQ, VQ-BMU



1 Page Title

Preceded by ACT when the route is active, and by MOD 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
- made automatically when a company route is entered
- enables direct selection of departure and arrival procedures
- required for route activation
- inhibited in-flight for active route.

Entry on the ground deletes existing route.

3 RUNWAY

Enter the applicable runway for the origin airport. Runway must be in the navigation database.

Entry:

- is optional
- causes MOD to display in the title if route is active
- can be selected on the DEPARTURES page
- can be included in company route.

The runway is deleted after the first waypoint is crossed.

4 Route (RTE) 2

Push – displays the RTE 2 page 1/x.

Allows access to an inactive route for entry, modification or activation.

Inactive route modifications:

- do not alter the active route
- do not change the inactive RTE page title.

Prompt changes to RTE 1 when RTE 2 is displayed.

5 Destination (DEST)

Entry:

- must be a valid ICAO identifier in the navigation database
- made automatically when a company route is entered
- enables direct selection of destination arrival procedures
- required for route activation
- displays MOD in page title if entered in an active route.

6 Flight Number (FLT NO)

Enter the company flight number.

Entry:

- optional for activation of the route
- limited to 10 characters
- may be entered by the flight crew or uplinked
- included in the PROGRESS page title
- propagated to RTE 2 page
- deleted at flight completion.

7 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.

Valid entry is any flight crew entered or uplinked company route name. If the name is not contained in the navigation database, the entry is allowed and the scratchpad message NOT IN DATABASE is displayed.

Entry of a new company route replaces the previous route.

In-flight entry is inhibited for the active route.

8 Alternate (ALTN)

Push – displays the ALTN page.

9 ACTIVATE

Push the ACTIVATE key to arm the route and illuminate the execute light. When the EXEC key is pushed, the route becomes active, ACT is displayed in the title, and the ACTIVATE prompt is replaced with the next required preflight page prompt.

Activation of a route is required for completion of the preflight.

ACTIVATE is always displayed on the 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

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Additional prompts are displayed on the route page once it becomes active.

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VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT



1 REPORT SEND

Push – transmits the active route to the company via data link downlink.

2 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.

VP-BOQ, VP-BOY, VP-BRL, VQ-BMQ, VQ-BMU



1 Route Copy (RTE COPY)

Push – copies the entire active route (RTE x) into the inactive route (RTE y).

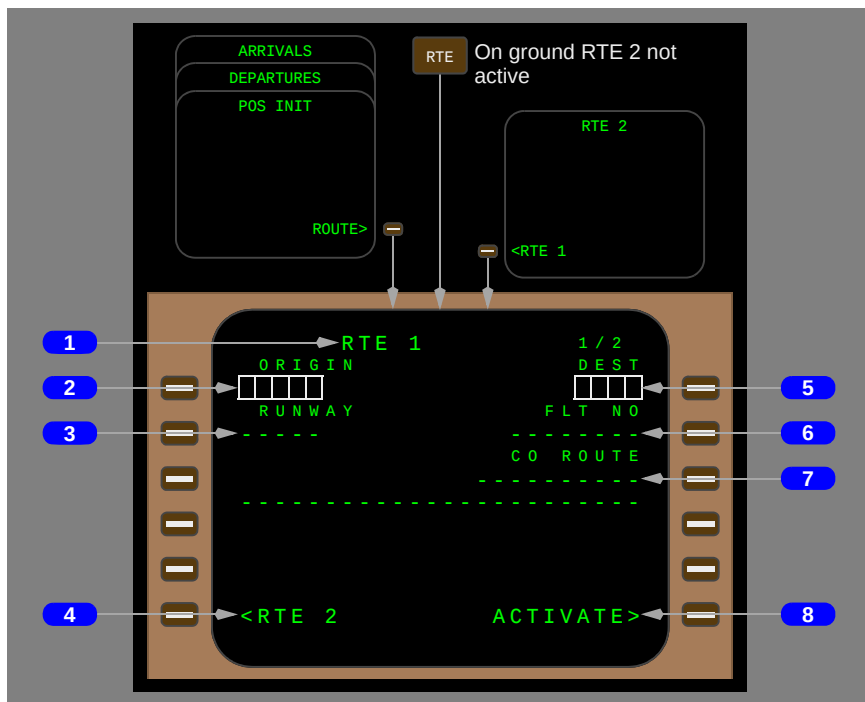
Displayed only on the active route page.

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Displays COMPLETE after the route is copied.

Route Page 1/X

VP-BOZ, VQ-BRA


1 Page Title

Preceded by ACT when the route is active, and by MOD 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
- made automatically when a company route is entered
- enables direct selection of departure and arrival procedures
- required for route activation
- inhibited in-flight for active route.

Entry on the ground deletes existing route.

3 RUNWAY

Enter the applicable runway for the origin airport. Runway must be in the navigation database.

Entry:

- is optional
- causes MOD to display in the title if route is active
- can be selected on the DEPARTURES page
- can be included in company route.

The runway is deleted after the first waypoint is crossed.

4 Route (RTE) 2

Push – displays the RTE 2 page 1/x.

Allows access to an inactive route for entry, modification or activation.

Inactive route modifications:

- do not alter the active route
- do not change the inactive RTE page title.

Prompt changes to RTE 1 when RTE 2 is displayed.

5 Destination (DEST)

Entry:

- must be a valid ICAO identifier in the navigation database
- made automatically when a company route is entered
- required for route activation
- displays MOD in page title if entered in an active route.

6 Flight Number (FLT NO)

Enter the company flight number.

Entry:

- optional for activation of the route
- limited to 10 characters
- may be entered by the flight crew or uplinked
- included in the PROGRESS page title
- propagated to RTE 2
- deleted at flight completion.

7 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.

Valid entry is any flight crew entered or uplinked company route name. If the name is not contained in the navigation database, the entry is allowed and the scratchpad message NOT IN DATABASE is displayed.

Entry of a new company route replaces the previous route.

In-flight entry is inhibited for the active route.

8 ACTIVATE

Push the ACTIVATE key to arm the route and illuminate the execute light. When the EXEC key is pushed, the route becomes active, ACT is displayed in the title, and the ACTIVATE prompt is replaced with the next required preflight page prompt.

Activation of a route is required for completion of the preflight.

ACTIVATE is always displayed on the 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.

Route Page After Ground Station Uplink**VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT**

When a valid route uplink is received, the message ROUTE X UPLINK READY is displayed in the scratchpad.

The EICAS communications message FMC is displayed and a chime sounds.



1 ROUTE UPLINK

Displays ROUTE UPLINK when flight plan uplink received.

2 LOAD

Displays LOAD when an uplinked route received.

Push –

- loads uplinked flight plan
- in flight, when uplinked flight plan applies to active route, EXECUTE light illuminates and ERASE displays at 6L
- when route inactive, blanks PURGE at 4R
- displays scratchpad message ROUTE 1 UPLINK LOADING.

3 PURGE

Displays PURGE when an uplink that applies to an inactive route has been received.

Push – rejects uplinked flight plan data.

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 result in the scratchpad message INVALID ENTRY.

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.

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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.

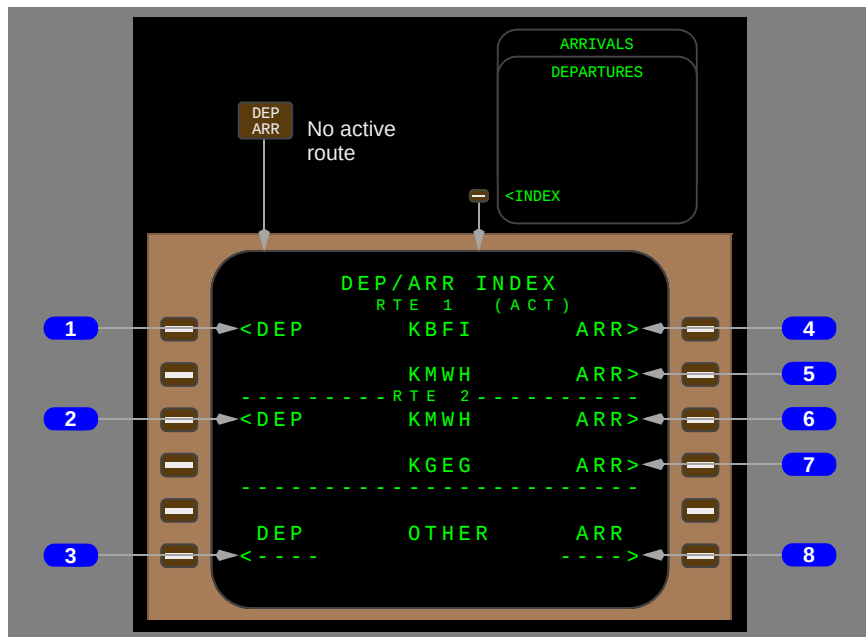
Dashes display on the first TO waypoint after the end of the route.

Preflight Pages – Part 2

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 allow display of departure data about airports that are not the origin or destination for route 1 or 2. 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

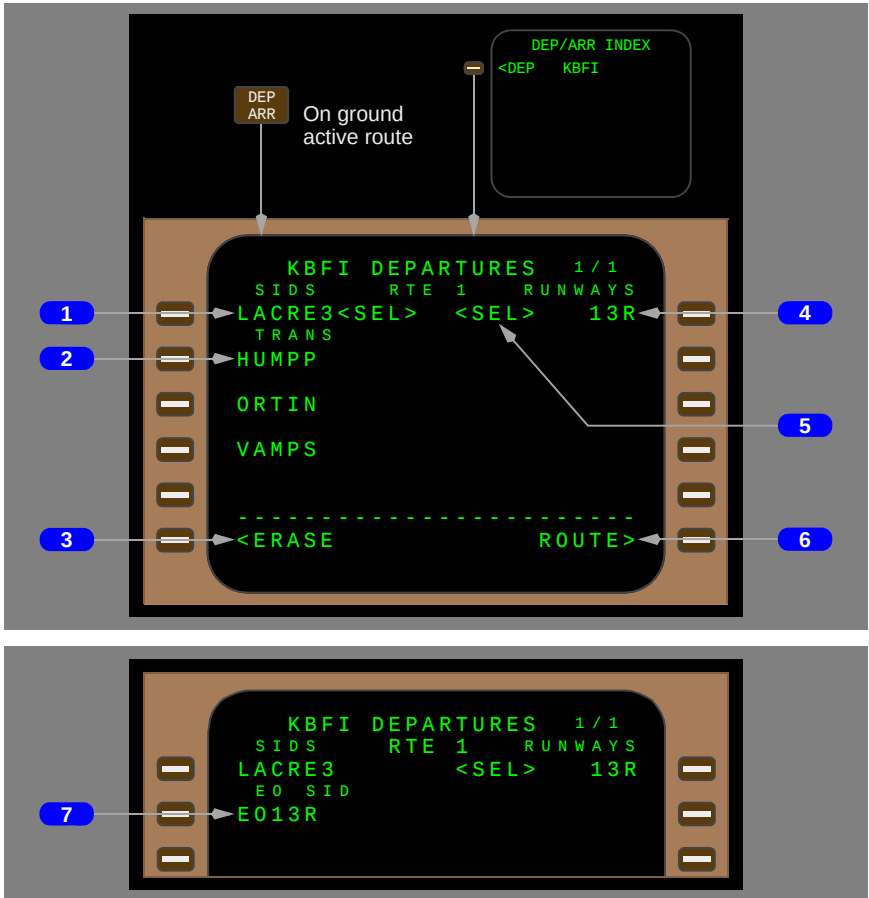
Displays the arrival page for the airport entered in this line through the scratchpad.

ARR prompt for OTHER allows display of arrival data about airports that are not the origin or destination for route 1 or 2. 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.

The departures page for the inactive route displays when the DEP ARR function key is pushed with 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 are no longer displayed and the transitions for the selected SID are displayed
- runways for selected SID remain and others are no longer displayed.

2 Transitions (TRANS)

Displays transitions compatible with the selected SID.

Push –

- selects transition for entry in the route
- other transitions no longer display.

3 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.

4 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.

5 <SEL>, <ACT>

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.

6 ROUTE

Push – displays the related RTE page.

7 Engine Out Standard Instrument Departure (EO SID)

EO SIDs are airline designed procedures for specific runways. When a runway is selected the EO SID is listed after the other SIDs associated with that runway. If no EO SID exists for the selected runway, NONE is displayed.

PUSH – on the ground, selects the EO SID as a route modification for review. The modification should be erased after the review is complete.

If an engine failure occurs after takeoff before the flaps are retracted, the EO SID will be automatically loaded as a route modification to be executed or erased.

Navigation Radio Page

VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG

VOR navigation radios are normally autotuned by the FMC. The NAV RADIO page displays the tuned VOR frequencies, identifiers, tuning status and current radial for both VOR receivers. The VORs can be remotely tuned from this page.



1 VOR Frequency and Tune Status

Displays the frequency and identifier of the tuned navaids and allows input of frequencies or identifiers to remote tune the VORs. Dashes are displayed if the VOR is not tuned.

The tuning status is displayed adjacent to left and right VOR frequencies. Entry of a frequency or identifier remotely tunes a VOR. The FMC autotunes VORs and their related DMEs for procedure flying and radio positions. The tuning status displays are:

- A (autotuning) – FMC selects a navaid for best position orientation
- P (procedure autotuning) – FMC selects navaids for approach or departure procedure guidance
- R (remote tuning) – VOR frequency or identifier has been entered by the flight crew on the NAV RADIO page
- M (manual) – VOR is manual-tuned using the VOR control panels on the glareshield. Manual-tuning takes priority over FMC autotuning.

Valid entries:

- VOR, non-ILS DME, or ILS DME identifier
- VOR frequency (XXX.X or XXX.XX).

2 RADIAL

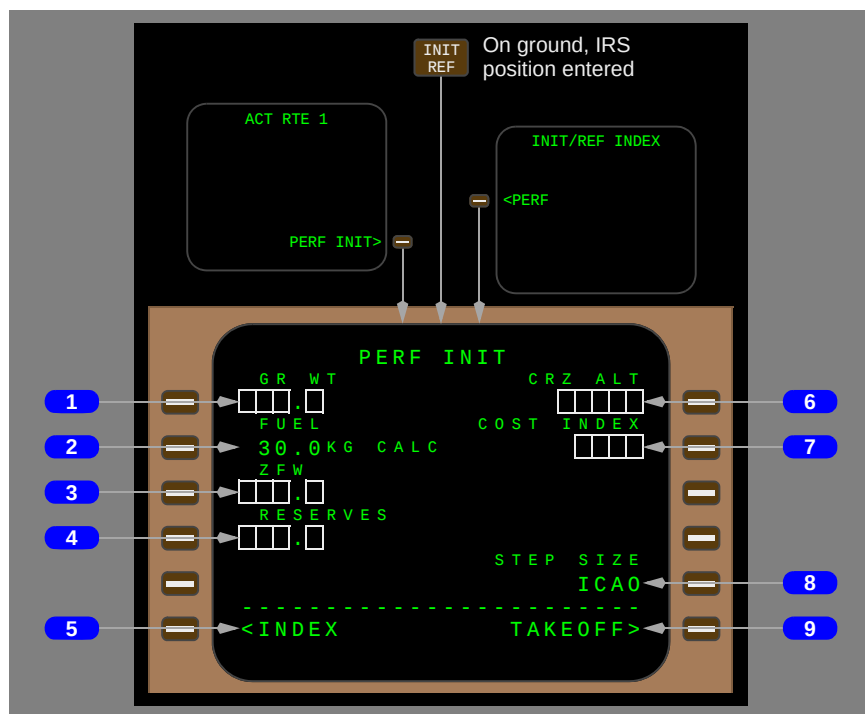
Displays the current radial from the left and right VOR stations to the airplane.

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 operation.

Performance Initialization Page

VP-BOZ, VQ-BRA



The diagram illustrates the Performance Initialization (PERF INIT) page on a Boeing 767 FMC. The page is divided into several sections with input fields and labels:

- INIT REF**: A label indicating the current reference position. A note states: "On ground, IRS position entered".
- ACT RTE 1**: A box containing the text "PERF INIT>".
- INIT/REF INDEX**: A box containing the text "<PERF".
- PERF INIT**: The main title of the page.
- GR WT**: Gross Weight input field (1 digit, 1 decimal place).
- FUEL**: Fuel input field (3 digits, 1 decimal place).
- 30.0 KG CALC**: A label indicating the calculated gross weight.
- ZFW**: Zero Fuel Weight input field (3 digits, 1 decimal place).
- RESERVES**: Reserves input field (3 digits, 1 decimal place).
- CRZ ALT**: Cruise Altitude input field (4 digits).
- COST INDEX**: Cost Index input field (3 digits).
- STEP SIZE**: Step Size input field (2 digits).
- ICAO**: ICAO input field (4 digits).
- <INDEX**: A label indicating the current index.
- TAKEOFF>**: A label indicating the takeoff performance.

Numbered callouts (1-9) point to specific input fields:

- 1: GR WT input field
- 2: FUEL input field
- 3: ZFW input field
- 4: RESERVES input field
- 5: <INDEX input field
- 6: CRZ ALT input field
- 7: COST INDEX input field
- 8: STEP SIZE input field
- 9: ICAO input field

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 entry is thousands of kilograms with a decimal (hundreds) optional.

Entering the zero fuel weight first displays calculated gross weight.

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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.
- CALC (calculated) – fuel quantity is from FMC calculations. Manual entry is possible
- MANUAL – fuel quantity has been manually entered. Manual entries blank totalizer on PROGRESS page 2/3.

Valid entry is thousands of kilograms with a decimal (hundreds) optional.

Only manual entries can be deleted. The display returns to the sensed (totalizer) value when a manual entry is deleted.

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 thousands of kilograms with a decimal (hundreds) optional.

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.

4 RESERVES

Valid entry is thousands of kilograms with a decimal (hundreds) optional.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 Cruise Altitude (CRZ ALT)

Cruise altitude can be entered by the flight crew or from a company route.

Entered value is displayed on the CLB and CRZ pages.

7 COST INDEX

Cost index is used to calculate ECON climb, cruise, and descent speeds. Larger values increase the ECON cruise speed. Entering zero results in maximum range airspeed and minimum trip fuel.

Valid entries are 0 to 9999.

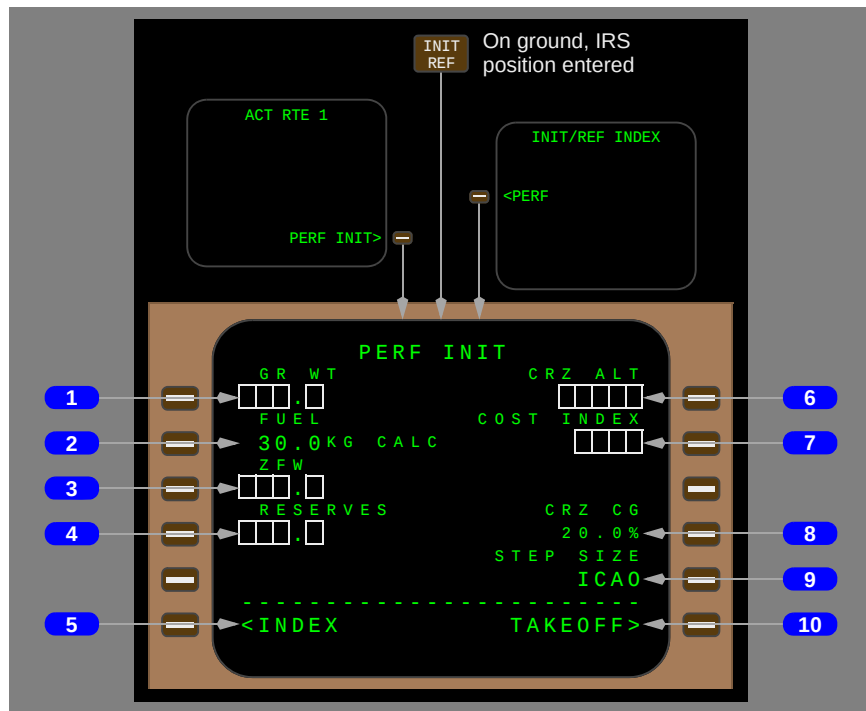
For a non-zero entry, performance predictions are based on step climbs at optimum points. For a zero entry, performance predictions are based on a constant CRZ ALT.

9 TAKEOFF

Performance Initialization Page

VP-BDI through VP-BOY, VP-BRL through VO-BPT

VP-BOQ, VP-BOY, VP-BRL, VQ-BMQ, VQ-BMU



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 entry is thousands of kilograms with a decimal (hundreds) optional.

Entering the 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.
- CALC (calculated) – fuel quantity is from FMC calculations. Manual entry is possible
- MANUAL – fuel quantity has been manually entered. Manual entries blank totalizer on PROGRESS page 2/3.

Valid entry is thousands of kilograms with a decimal (hundreds) optional.

Only manual entries can be deleted. The display returns to the sensed (totalizer) value when a manual entry is deleted.

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 thousands of kilograms with a decimal (hundreds) optional.

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 may 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 thousands of kilograms with a decimal (hundreds) optional.

Can be manually entered or uplinked. When a performance uplink is pending, uplinked values (small font) display beside the entered values (large font).

5 INDEX

Push – displays the INIT/REF INDEX page.

6 Cruise Altitude (CRZ ALT)

Cruise altitude can be entered by the flight crew or from a company route or uplink.

Entered value is displayed on the CLB and CRZ pages.

7 COST INDEX

Cost index is used to calculate ECON climb, cruise, and descent speeds. Larger values increase the ECON cruise speed. 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.

8 Cruise Center of Gravity (CRZ CG)

Used by FMC to compute maximum altitude and maneuver margin to buffet.

Displays default center of gravity.

Can be manually entered or uplinked.

Default value displays in small font.

A flight crew entered or unlinked value displays in large font.

9 STEP SIZE

Displays the climb altitude increment used for planning the optimum climb profile.

Default value is ICAO which provides a 2000 foot step below FL290 and a 4000 foot step above FL290.

Valid manual entries are 0 to 9000 in 1000 foot increments.

In-flight entries are inhibited. In-flight step size changes are made on the CRZ page.

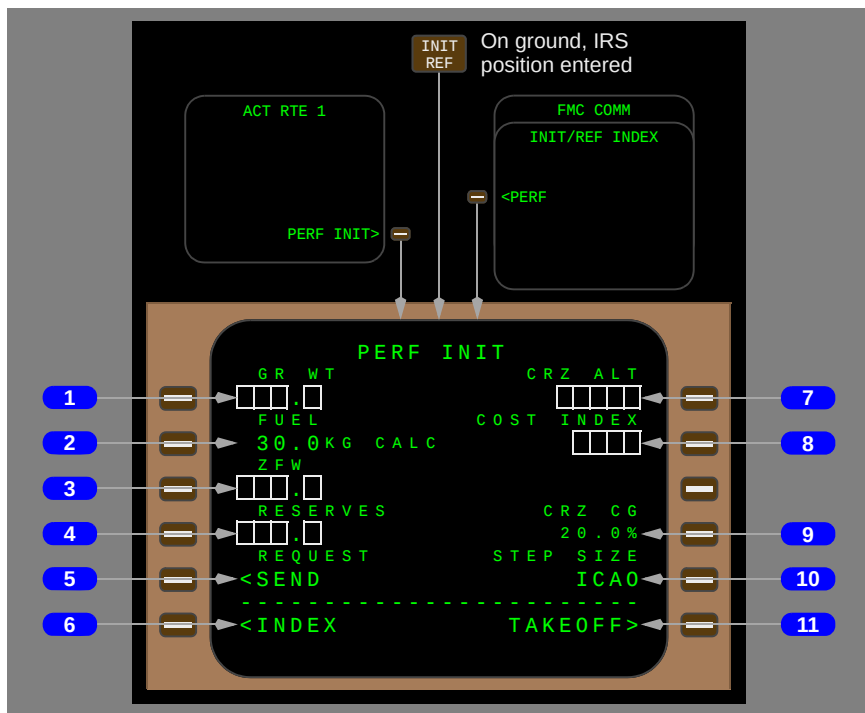
For a non-zero entry, performance predictions are based on step climbs at optimum points. For a zero entry, performance predictions are based on a constant CRZ ALT.

10 TAKEOFF

Push – displays the TAKEOFF REF page.

767 Flight Crew Operations Manual

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT



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 entry is thousands of kilograms with a decimal (hundreds) optional.

Entering the 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.
- CALC (calculated) – fuel quantity is from FMC calculations. Manual entry is possible
- MANUAL – fuel quantity has been manually entered. Manual entries blank totalizer on PROGRESS page 2/3.

Valid entry is thousands of kilograms with a decimal (hundreds) optional.

Only manual entries can be deleted. The display returns to the sensed (totalizer) value when a manual entry is deleted.

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 thousands of kilograms with a decimal (hundreds) optional.

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 may 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 thousands of kilograms with a decimal (hundreds) optional.

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 (REQUEST SEND)

Push – transmits a data link request for performance data uplink.

Flight crew can fill in ZFW, CG, cruise altitude, reserves or cost index 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.

Entered value is displayed on the CLB and CRZ pages.

8 COST INDEX

Cost index is used to calculate ECON climb, cruise, and descent speeds. Larger values increase the ECON cruise speed. 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.

9 Cruise Center of Gravity (CRZ CG)

Used by FMC to compute maximum altitude and maneuver margin to buffet.

Displays default center of gravity.

Can be manually entered or uplinked.

Default value displays in small font.

A flight crew entered or unlinked value displays in large font.

10 STEP SIZE

Displays the climb altitude increment used for planning the optimum climb profile.

Default value is ICAO which provides a 2000 foot step below FL290 and a 4000 foot step above FL290.

Valid manual entries are 0 to 9000 in 1000 foot increments.

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.

11 TAKEOFF

Push – displays the TAKEOFF REF page.

Takeoff Reference Page

The takeoff reference page allows the input of the final performance data required for takeoff. Entries on the takeoff reference page complete the normal FMC preflight. If any required preflight data has been omitted, a prompt is displayed to access the page where data is missing.

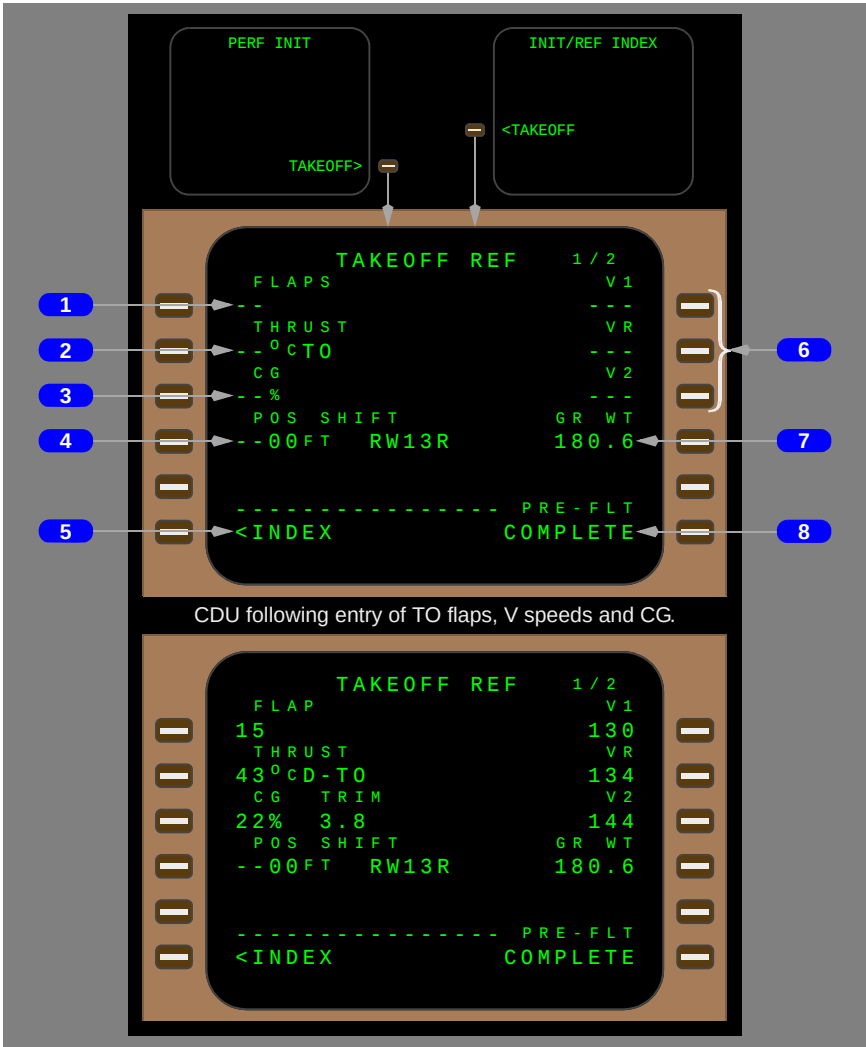
VP-BMC, VQ-BOG

Takeoff reference page entries can be made manually or uplinked.

Takeoff Reference Page

VP-BOZ, VQ-BRA

VQ-BRA



1 FLAPS

Enter a valid takeoff flap setting.

Entry of a value after takeoff "V" speeds are entered deletes the "V" speeds.

2 THRUST

Initially displays dashes and the thrust reference mode from the TMC.

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767 Flight Crew Operations Manual

If an assumed temperature value is entered on the thrust management select panel, the entered temperature is displayed here.

Allows entry of an assumed temperature which is used by the TMC. Entries can be made in degrees Celsius or Fahrenheit. Fahrenheit entries must be suffixed with an F. The entered value is displayed on EICAS.

Entry of a value after takeoff "V" speeds are entered deletes the "V" speeds.

3 Center of Gravity (CG), TRIM

Valid entry is CG within the valid range.

After the CG is entered, the FMC calculates and displays the stabilizer takeoff trim setting.

4 Position Shift (POS SHIFT)

Displays the departure runway from the active RTE page and allows entry of a distance between departure runway threshold and where the autothrottle will be engaged for takeoff.

The FMC updates its position to the departure runway threshold when the autothrottle is engaged for takeoff. If a position shift distance is entered, upon autothrottle engagement the FMC updates its position to that entered distance from the departure runway threshold.

If an intersection takeoff is planned, the intersection identifier or a positive value should be entered.

If a displaced threshold takeoff is planned a negative value should be entered.

The lack of a positive or negative value preceding the entry will assume it is a positive value.

Valid position shift entries are from 99 to – 99 in hundreds of feet.

Entry of a value after takeoff "V" speeds are selected deletes the "V" speeds.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 V Speeds

Dashes are displayed before speeds are entered and when speeds have been deleted.

Flight crew entered speeds are displayed in large font. V1 and VR are displayed on the ADI speed tape.

If performance data is changed or a new thrust rating is set on the TMSP after the takeoff speeds are entered the takeoff speeds are deleted and dashes are displayed. The scratchpad message TAKEOFF SPEEDS DELETED is also displayed, except when the takeoff speeds are deleted as a result of data entry or data changes on this page.

7 Gross Weight (GR WT)

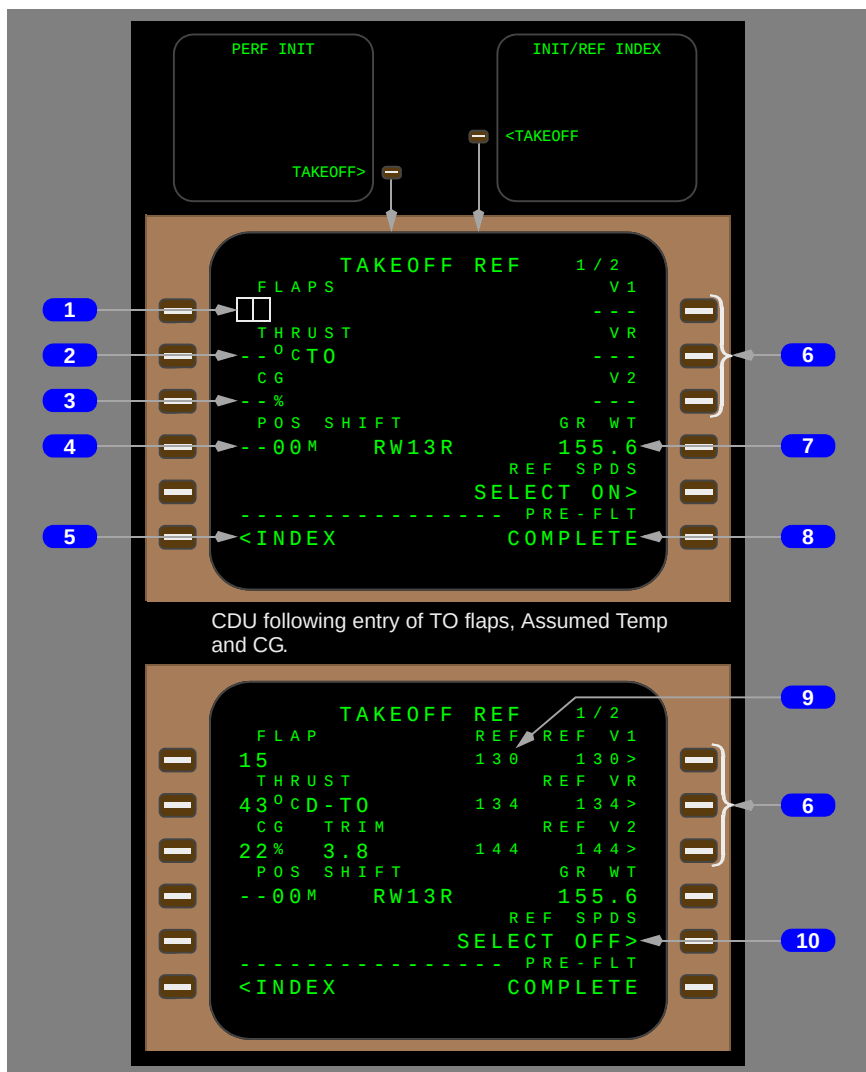
Displays the airplane gross weight value from the PERF INIT page.

8 Pre-Flight (PRE-FLT) Status

Displays COMPLETE if all required pre-flight entries have been made.

Displays a prompt to access a pre-flight page where further entries are required if pre-flight is not complete.

VP-BOZ



1 Flaps

Enter a valid takeoff flap setting.

Entry after takeoff "V" speeds are entered deletes the "V" speeds.

2 THRUST

Initially displays dashes and the thrust reference mode from the TMC.

If an assumed temperature value is entered on the thrust management select panel, the entered temperature is displayed here.

Allows entry of an assumed temperature which is used by the TMC. Entries can be made in degrees Celsius or Fahrenheit. Fahrenheit entries must be suffixed with an F. The entered value is displayed on EICAS.

Entry of a value after takeoff "V" speeds are entered deletes the "V" speeds.

3 Center of Gravity (CG), TRIM

Valid entry is CG within the valid range.

After the CG is entered, the FMC calculates and displays the stabilizer takeoff trim setting.

4 Runway/Position (RWY/POS)

Displays the departure runway from the active RTE page and allows entry of a distance between departure runway threshold and where the autothrottle will be engaged for takeoff.

The FMC updates its position to the departure runway threshold when the autothrottle is engaged for takeoff. If a position shift distance is entered, upon autothrottle engagement the FMC updates its position to that entered distance from the departure runway threshold.

If an intersection takeoff is planned, the intersection identifier or a positive value should be entered. If a displaced threshold takeoff is planned a negative value should be entered.

Valid position shift entries are from 30 to – 30 in hundreds of meters.

Entry of a value after takeoff "V" speeds are entered deletes the speeds.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 V Speeds (V1, VR, V2)

Dashes are displayed if required information has not been entered.

When the flap setting and gross weight have been entered, FMC calculated V speeds are displayed along with a caret in small font, and REF is displayed in the line titles.

Pushing an adjacent line select key:

- accepts the associated speed for the using systems
- deletes REF from the associated line title
- changes the displayed value to large font



767 Flight Crew Operations Manual

Flight crew entered speeds are also displayed in large font and override any speed values already displayed on the V speed lines. Deleting a large font speed results in redisplay of the small font FMC calculated speed.

FMC calculated speeds provide VMCA and VMCG protection. When a displayed speed is based on a minimum value, MIN is displayed in the line title (e.g. MINV1) and the minimum V speed value is displayed on the associated line.

If performance data is changed or a new thrust rating is set on the TMSP after the takeoff speeds are accepted/entered, the speeds are replaced with dashes or revised FMC calculated speeds and the takeoff speeds must be accepted/entered again.

7 Gross Weight

Displays the airplane gross weight value from the PERF INIT page.

8 Pre-Flight (PRE-FLT) Status

Displays COMPLETE if all required pre-flight entries have been made.

Displays a prompt to access a pre-flight page where further entries are required if pre-flight is not complete.

9 Reference Speeds

Displays FMC calculated V1, VR, and V2 when selected on and required data is entered.

10 Reference Speed Select

PUSH – when prompt reads SELECT ON, causes the FMC calculated reference speeds to be displayed on the CDU and changes the prompt to SELECT OFF. Subsequent push removes the reference speeds from the CDU.

Takeoff Reference Page 2



1 WIND

Valid entry is the takeoff wind.

Entry of a value after takeoff speeds are entered removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

2 Runway (RWY) WIND

Displays the takeoff runway wind components in knots once the wind is entered and a runway is entered on TAKEOFF REF page 1. The headwind is displayed with an H or T and the crosswind is displayed with an L or R.

3 SLOPE

Valid entry is U.0 to U2.0 or D.1 to D2.0. The U is optional for upslopes.

Entry of a value after takeoff speeds are entered removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.



4 Acceleration Height (ACCEL HT)

Displays the height that VNAV will begin an acceleration for flap retraction after takeoff. Default value from the navigation database is displayed in small font. Valid entry is 400 to 9999 feet. Pilot entered values are displayed in large font.

5 Reference Outside Air Temperature (REF OAT)

Allows entry of an outside air temperature. Entered value is used in V speed calculations and is included in the takeoff data request downlink.

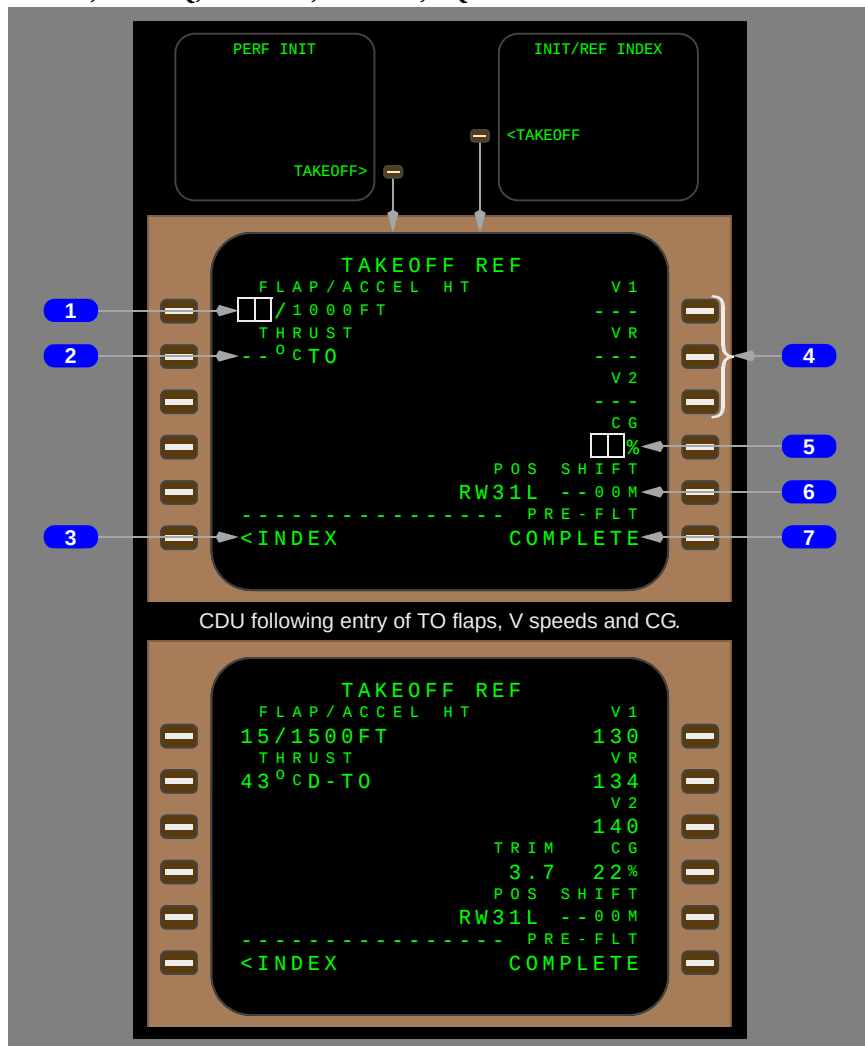
Entry can be made in degrees Celsius or Fahrenheit. Fahrenheit entries must be include an F.

Takeoff Reference Page

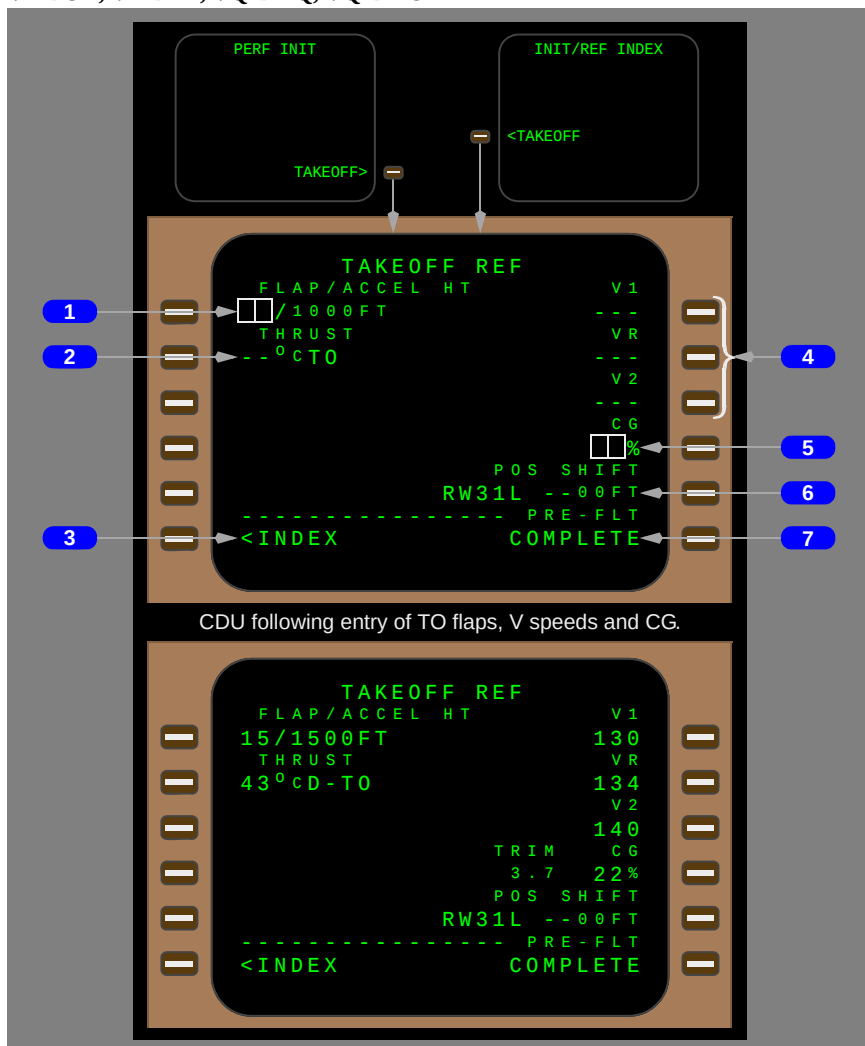
VP-BDI through VP-BOY, VP-BRL through VQ-BPT

VP-BDI, VP-BOQ, VP-BOY, VP-BRL through VQ-BMU, VQ-BPT

VP-BDI, VP-BOQ, VP-BWW, VP-BWX, VQ-BPT



VP-BOY, VP-BRL, VQ-BMQ, VQ-BMU



1 Flap/Acceleration Height (FLAP/ACCEL HT)

Enter a valid takeoff flap setting: 5, 15, or 20.

Entry of a value after takeoff speeds are entered removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

ACCEL HT displays the acceleration height in feet above the origin airport.

VNAV commands acceleration at this altitude or at first flap retraction.

Default value is from the AMI.

Valid flight crew entries are from 400 to 9999 feet above the origin airport elevation.

2 THRUST

Initially displays dashes and the thrust reference mode.

If an assumed temperature value is entered on the thrust management select panel, the entered temperature is displayed here.

Allows entry of an assumed temperature which is used by the TMC. Entries can be made in degrees Celsius or Fahrenheit. Fahrenheit entries must be suffixed with an F. The entered value is displayed on EICAS.

Entry of a value after takeoff speeds are entered removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 V Speeds

Dashes are displayed before speeds are entered and when speeds have been deleted.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BPT

Flight crew entered speeds are displayed in large font. "V1" and "VR" are displayed on the ADI speed tape.

If performance data is changed or a new thrust rating is set on the TMSP after takeoff speeds are entered, the takeoff speeds are deleted, dashes are displayed, and the scratchpad message TAKEOFF SPEEDS DELETED is displayed.

5 TRIM, Center of Gravity (CG)

Valid entry is CG within the valid range.

After the CG is entered, the FMC calculates and displays the stabilizer takeoff trim setting to the left of the CG entry.

6 Position Shift (POS SHIFT)

Displays the departure runway from the active RTE page and allows entry of a distance between departure runway threshold and where the autothrottle will be engaged for takeoff.

The FMC updates its position to the departure runway threshold when the autothrottle is engaged for takeoff. If a position shift distance is entered, upon autothrottle engagement the FMC updates its position to that entered distance from the departure runway threshold.

767 Flight Crew Operations Manual

If an intersection takeoff is planned, the intersection identifier or a positive value should be entered. If a displaced threshold takeoff is planned a negative value should be entered.

VP-BDI, VP-BOQ, VP-BWW, VP-BWX, VQ-BPT

Valid position shift entries are from 30 to – 30 in hundreds of meters.

VP-BOY, VP-BRL, VQ-BMQ, VQ-BMU

Valid position shift entries are from 99 to – 99 in hundreds of feet.

Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

VP-BDI, VP-BOY, VP-BWW through VQ-BMU, VQ-BPT

POS SHIFT update is inhibited when GPS is primary FMC navigation source (i.e. GPS NAV is ON).

7 Pre-Flight (PRE-FLT) Status

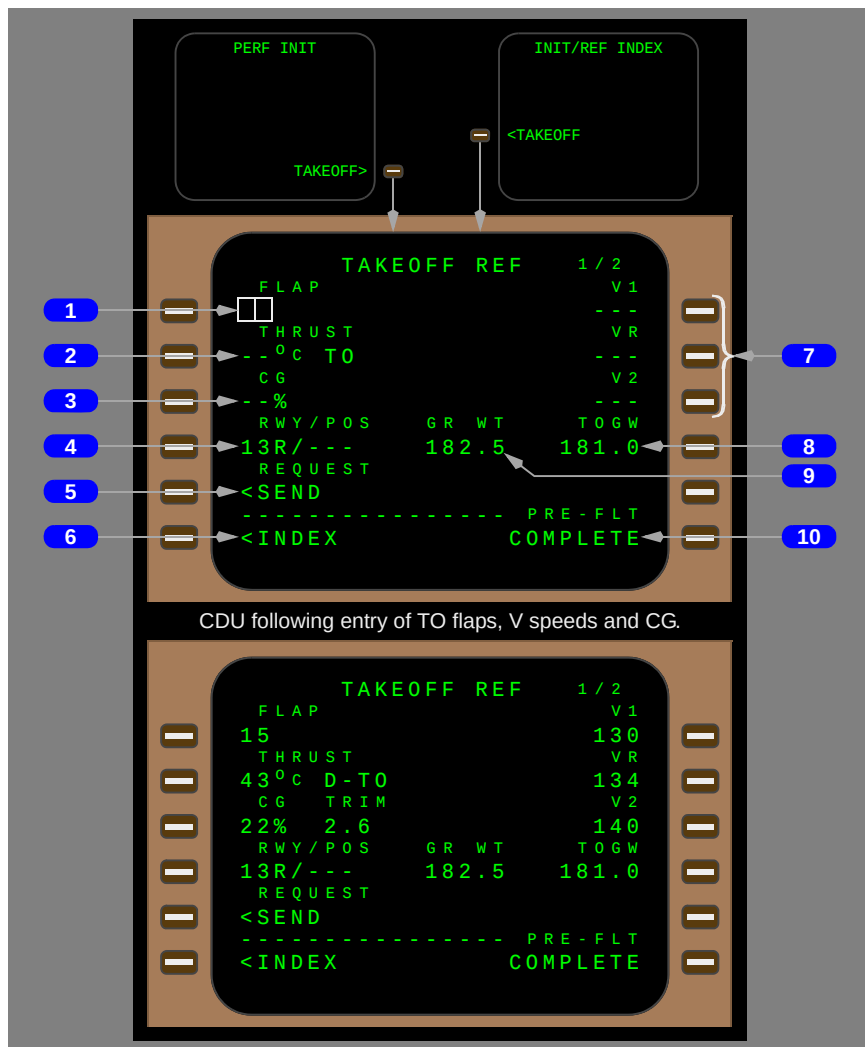
Displays COMPLETE if all required pre-flight entries have been made.

Displays a prompt to access a pre-flight page where further entries are required if pre-flight is not complete.

VP-BMC, VQ-BOG

Note: Data entered on this page does not change the same data entered on previous preflight pages (i.e. entry of a runway in the RWY/POS line does not change the runway entered on the RTE page). Values entered by the flight crew on this page and downlinked is a request for takeoff data for the entered values.

VP-BMC, VQ-BOG



1 Flap

Enter a valid takeoff flap setting: 5, 15, or 20.

Entry of a value after takeoff speeds are entered removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

2 THRUST

Initially displays dashes and the thrust reference mode.

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If an assumed temperature value is entered on the thrust management select panel, the entered temperature is displayed here.

When dashes are displayed, allows entry of an assumed temperature which is used by the TMC. Entries can be made in degrees Celsius or Fahrenheit. Fahrenheit entries must be suffixed with an F. The entered value is displayed on EICAS.

Entry of a value after takeoff speeds are entered removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

3 Center of Gravity (CG), TRIM

Valid entry is CG within the valid range.

After the CG is entered, the FMC calculates and displays the stabilizer trim setting for takeoff.

4 Runway/Position Shift (RWY/POS)

Displays the departure runway from the active RTE page and allows entry of an offset distance between departure runway threshold and where the autothrottle will be engaged for takeoff.

If GPS navigation is not enabled (GPS NAV selected OFF), the FMC updates its position to the departure runway threshold when the autothrottle is engaged for takeoff. If a position shift distance is entered, upon autothrottle engagement the FMC updates its position to that entered distance from the departure runway threshold.

If an intersection takeoff is planned, the intersection identifier or a positive value should be entered. If a displaced threshold takeoff is planned a negative value should be entered.

VQ-BOG

Valid position shift entries are from 3000 to – 3000 in meters. The last two digits must be zeros.

VP-BMC

Valid position shift entries are from 9900 to – 9900 in feet. The last two digits must be zeros.

Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

5 Takeoff Data Request (REQUEST SEND)

Push – transmits a data link request for takeoff data uplink.

Flight crew entered data is included with the request.

6 INDEX

Push – displays the INIT/REF INDEX page.

7 V Speeds

Dashes are displayed before speeds are entered and when speeds have been deleted.

VQ-BOG

Flight crew entered speeds are displayed in large font. "V1" and "VR" are displayed on the ADI speed tape.

If performance data is changed or a new thrust rating is set on the TMSP after takeoff speeds are entered, the takeoff speeds are deleted, dashes are displayed, and the scratchpad message TAKEOFF SPEEDS DELETED is displayed.

8 Takeoff Gross Weight

Entry is included with the takeoff datalink request.

9 Gross Weight

Displays the airplane gross weight value from the PERF INIT page.

10 Pre-Flight (PRE–FLT) Status

Displays COMPLETE if all required pre–flight entries have been made.

Displays a prompt to access a pre–flight page where further entries are required if pre–flight is not complete.

Takeoff Reference Page 2

VP-BMC, VQ-BOG



1 WIND

Valid entry is the takeoff wind.

Entry of a value after takeoff speeds are entered removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

2 Runway (RWY) WIND

Displays the takeoff runway wind components in knots once the wind is entered and a runway is entered on TAKEOFF REF page 1. The headwind is displayed with an H or T and the crosswind is displayed with an L or R.

3 Acceleration Height (ACCEL HT)

Displays the height that VNAV will begin an acceleration for flap retraction after takeoff. Default value from the navigation database is displayed in small font. Valid entry is 400 to 9999 feet. Pilot entered values are displayed in large font.

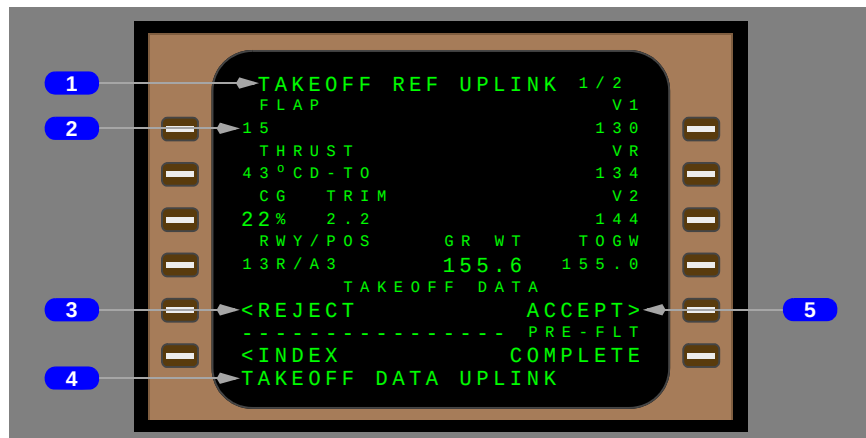
4 Reference Outside Air Temperature (REF OAT)

Allows entry of an outside air temperature. Entered value is used in V speed calculations and is included in the takeoff data request downlink.

Entry can be made in degrees Celsius or Fahrenheit. Fahrenheit entries must be include an F.

Takeoff Reference Uplink

VP-BMC, VQ-BOG



1 TAKEOFF REF UPLINK

The page title changes to indicate UPLINK data is displayed.

2 Uplinked Data

Uplinked data is displayed in small font until it is accepted.

3 REJECT

PUSH – deletes uplinked data and returns pre-uplink data to display.

4 Scratchpad Message

The TAKEOFF DATA UPLINK message appears in the scratchpad when the uplink is received. The message is cleared when ACCEPT or REJECT is selected.

5 ACCEPT

Push – loads uplinked data and changes the small font displays to large font.



1 Alternate Takeoff Data (ALTN THR/FLAP)

Provides access to alternate takeoff data which is included in the takeoff uplink. Shows the thrust and flap setting used to calculate the alternate data.

PUSH – selects the alternate takeoff data and replaces all pending (small font) data on page 1 and 2 with the alternate data. The line title changes to STD THR/FLAP and the data line shows the thrust and flap setting used to calculate the standard takeoff uplink data.

2 Standard Limit Takeoff Gross Weight (STD LIM TOGW)

Displays the limit takeoff gross weight used to calculate the standard uplink takeoff data. If alternate data is selected the line title displays ALT LIM TOGW.

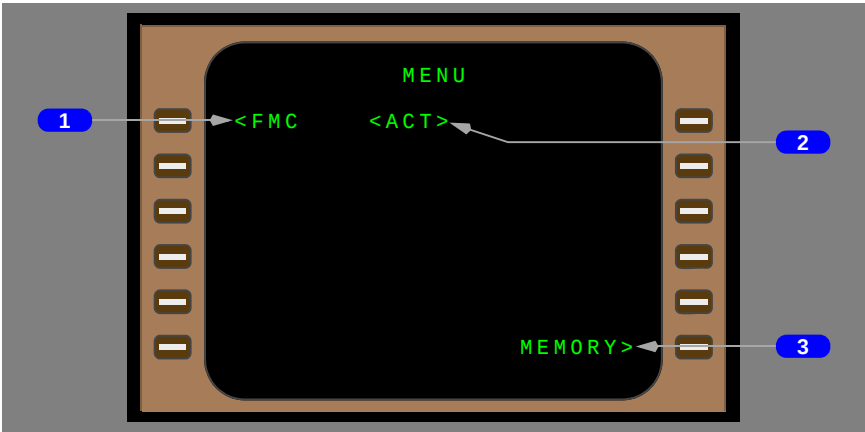
Menu Page

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

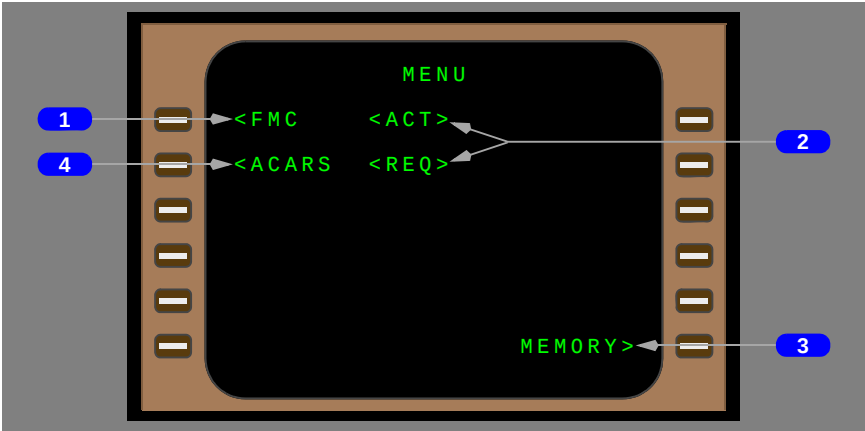
The MENU page allows access to other airplane systems which are controlled with the CDU.



VP-BMC, VP-BOY

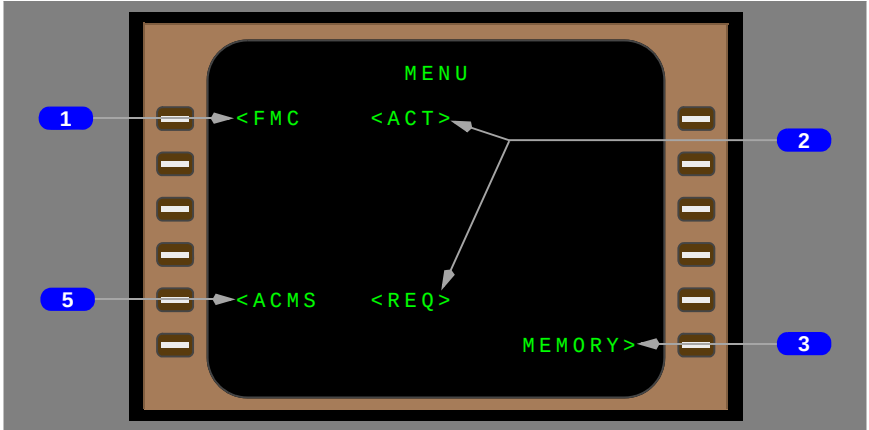


VP-BDL, VQ-BOG

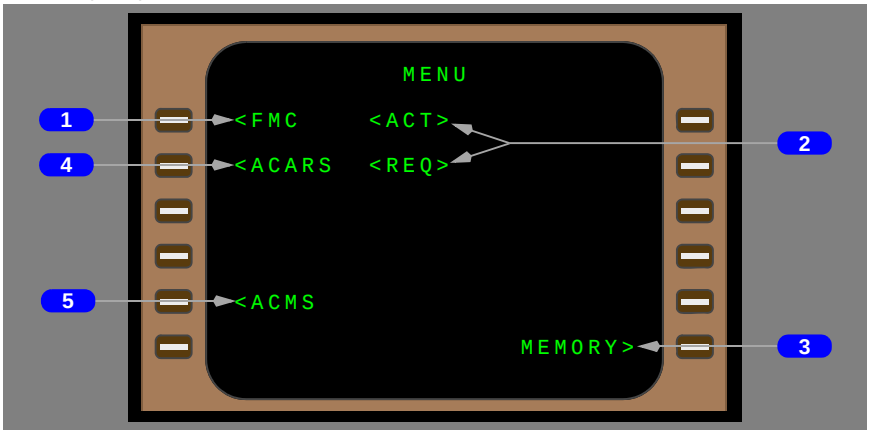


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VP-BOZ, VP-BWW through VQ-BMQ, VQ-BPT, VQ-BRA



VP-BOQ, VQ-BMU


1 FMC

Push – connects FMC to CDU

2 CDU Status

- <ACT> – indicates system currently controlling CDU
- <REQ> – indicates inactive CDU function requiring pilot action
- blank – indicates function is not selected or requiring action.

3 MEMORY (not displayed while airborne)

Push – displays maintenance memory page, providing access to computer memory for maintenance while the airplane is on the ground

VP-BDI, VP-BOQ, VQ-BMU, VQ-BOG

4 ACARS (Aircraft Communication Addressing and Reporting System)

Push –

- activates CDU control of ACARS
- displays ACARS page.

See Chapter 5, Communications.

VP-BOQ, VP-BOZ, VP-BWW through VQ-BMU, VQ-BPT, VQ-BRA

5 ACMS (Airplane Condition Monitoring System)

Push –

- activates CDU control of ACMS
- displays ACMS page.

See Chapter 10, Flight Instruments, Displays.



Flight Management, Navigation

FMC Takeoff and Climb

Chapter 11

Section 41

Introduction

The takeoff phase of flight starts with the selection of takeoff thrust at the start of the takeoff roll.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

If GPS navigation is not available the FMC position is updated to the takeoff runway position when the autothrottle is engaged for takeoff.

VP-BOQ, VP-BOZ, VP-BRL, VQ-BRA

The FMC position is updated to the takeoff runway position when the autothrottle is engaged for takeoff.

The takeoff mode of the autoflight system provides flight director guidance until LNAV and VNAV are engaged after takeoff. 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 climb thrust and VNAV are engaged. The climb phase continues to the top of climb point, where the cruise phase starts.

Takeoff Phase

When changes are made to the departure runway and SID, the DEPARTURES and TAKEOFF REF pages must be modified to agree. The modified data is entered the same as during preflight.

During takeoff, the autothrottle commands the selected thrust and the autoflight system provides pitch and roll commands through the flight director.

When armed before takeoff, LNAV engages at 50 feet radio altitude. When engaged, FMC roll commands fly the active route leg.

Climb Phase

When climb thrust and VNAV are engaged the FMC provides pitch commands to maintain the climb speed until the acceleration height is reached. At the acceleration height the FMC provides pitch commands to accelerate.

The VNAV commanded speed is limited by the airplane configuration. At acceleration height, VNAV commands a speed 5 knots below the flap placard speed.

Passing 10,000 feet, VNAV commands an acceleration to the economy climb speed, which is maintained until reaching the cruise altitude unless the climb profile contains other constraints.

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.

If the climb speed profile results in a climb angle that will cause the airplane to miss a waypoint altitude constraint, the CDU scratchpad message UNABLE NEXT ALTITUDE is displayed. A different speed profile that gives a steeper climb angle must be selected.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

A decrease in airspeed may be observed during VNAV level off to cruise altitude if the rate of climb is high at the level off capture point. VNAV will continue a smooth level off and eventually accelerate to the selected cruise speed. During level off under these conditions, VNAV will not allow the airspeed to decrease below the best hold speed for that altitude, which is above the minimum maneuvering speed.

Climb Page

| VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG

The climb page is selected by pushing the CDU VNAV function key while on the ground, during takeoff, or in climb.

| VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

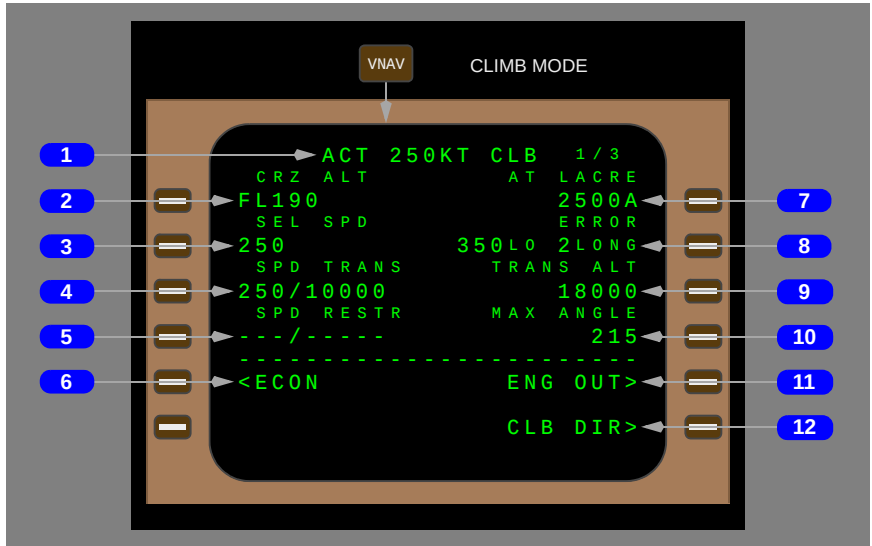
The climb page is selected by pushing the CLB function key on the CDU.

767 Flight Crew Operations Manual

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 FMC data bases.

The FMC manages the climb to comply with the active route. The climb mode is indicated by the CLB page title. The mode can be economy, selected speed, or engine out. In each mode, the same type of data is shown on the page.

VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG



VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA



1 Page Title

ACT is displayed when the climb phase is active.

The page title displays the type of climb:

- ECON – speed based on the cost index
- LIM SPD – speed based on airplane configuration limiting speed
- MCP SPD – MCP speed intervention selected

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

- EO – engine out mode selected

VP-BOZ, VQ-BRA

- E/O – engine out mode selected
- XXXKT – fixed CAS climb speed profile
- M.XXX – fixed Mach climb speed profile.

Fixed climb speeds are for:

- climb segment constraints
- waypoint speed constraints
- an altitude constraint associated with a speed constraint
- a speed transition
- a flight crew selected speed.

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 transition altitude.

3 Economy Speed (ECON SPD), Selected Speed (SEL SPD)

ECON SPD

- economy speed based on cost index
- displays CAS and Mach values.

SEL SPD

- displayed when intermediate level off required below an existing speed constraint
- displayed when flight crew enters speed
- CAS or Mach value may be entered.

4 Speed Transition (SPD TRANS)

Displays the transition speed/altitude from one of these sources:

- the navigation database value for the origin airport
- a default speed of 250 knots and 10,000 feet.

Not displayed above the transition altitude.

Can be deleted.

5 Speed Restriction (SPD RESTR)

Speed restrictions not associated with specific waypoints are manually entered on this line.

Displays dashes before entry by flight crew.

Valid entry is a CAS and altitude (example 240/8000).

6 Economy (ECON)

Push – changes climb speed to ECON. Must be executed.

Prompt is shown on line 5L when the climb mode is not ECON.

7 Waypoint Constraint (AT XXXXX)

Displays next airspeed and/or altitude constraint at waypoint XXXXX.

FMC commands the slower of constraint speed or performance speed.

Constraints are entered on RTE LEGS page or are inserted as part of a SID.

Delete here or on RTE LEGS page.

Blank if no constraint exists.

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.

Altitude information displayed on the CDU changes from altitudes to flight levels above the transition altitude.

10 Maximum Angle (MAX ANGLE)

Maximum angle of climb speed.

Entry not allowed.

11 Engine Out (ENG OUT)

Push – modifies page to show engine out (ENG OUT) performance data.

12 Climb Direct (CLB DIR)

Push – deletes all waypoint altitude constraints between the airplane altitude and the MCP altitude. FMC cruise altitude is not affected.

Blank if no constraints exist.

Engine Out Climb

Engine out VNAV climb guidance is displayed on the EO CLB page. The EO CLB page must be selected and executed by the flight crew. Engine out data is available with all engines operating. Engine out climb (EO CLB) changes to engine out cruise (EO CRZ) at the top of climb.

Engine Out CLB Page

The modified page displays engine out performance limitations. Manual entries are allowed. After the modification is executed VNAV gives engine out guidance in the climb.



1 Cruise Altitude (CRZ ALT)

Displays cruise altitude if less than MAX ALT.

Displays MAX ALT if less than cruise altitude.

Manual entry is allowed.

2 Speed Line

Displays engine out best gradient climb speed (EO SPD) when page first selected. Any valid speed can be entered.

Valid entry is XXX for CAS.

Valid entry is 0.XXX for Mach. Trailing zeros can be omitted.

A manual entry changes the line heading to SEL SPD and may cause MAX ALT to change.

3 Engine Out Speed (EO SPD)

Push – resets command speed to best gradient speed. Blank when EO SPD is displayed on the speed line.

4 Maximum Altitude (MAX ALT)

Lower of maximum altitude at engine out climb speed or cruise speed.

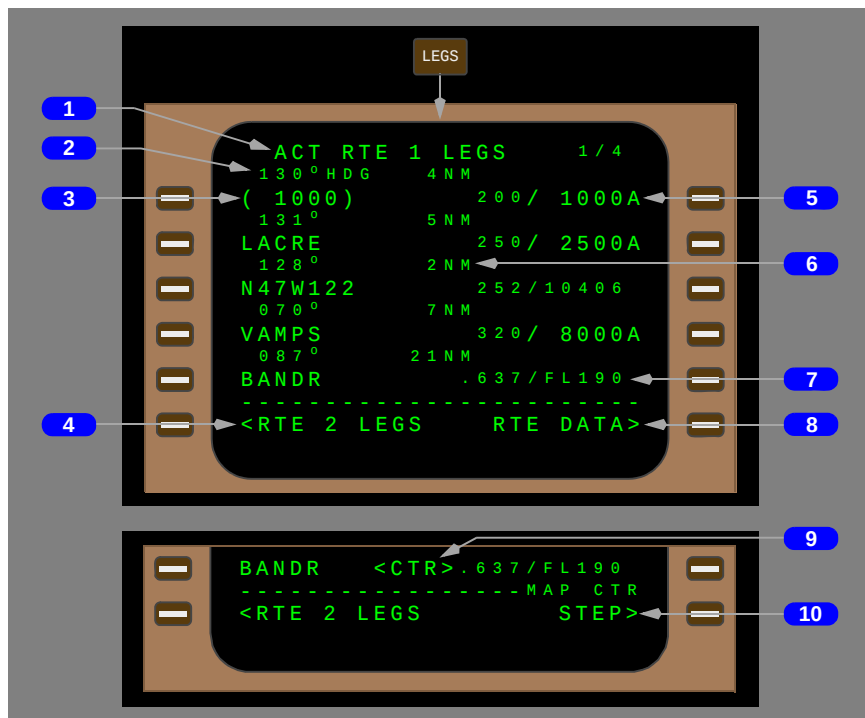
Entry not allowed.

5 All Engine (ALL ENG)

Push – modifies page to display all engine (ALL ENG) performance data.

Route Legs Page

The legs page is used to evaluate and modify the planned route of flight during the climb and to add or delete waypoint constraints to comply with the ATC clearance. The data on the climb page comes from preflight entries made on the route and departure pages, and from the FMC data bases.



1 Page Title

Title format shows route status:

- RTE X LEGS – inactive route
- ACT RTE X LEGS – active route
- MOD RTE X LEGS – modified active route.

2 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.

Calculated great circle route leg directions may be different than chart values.

Dashes are shown for an undefined course.

3 Waypoint Identifier

Displays waypoints by name or condition.

Active leg is always the first line of the first active RTE X LEGS page.

All route waypoints are shown in flight sequence.

Waypoints can be modified. Examples:

- add waypoints
- delete waypoints
- change waypoint sequence
- connect route discontinuities.

Boxes are shown for route discontinuities.

Dashes are in the line after the end of the route.

4 Route 2 Legs (RTE 2 LEGS)

Push –

- displays the RTE 2 LEGS
- when RTE 2 LEGS page is shown, prompt changes to RTE 1 LEGS.

5 Waypoint Speed/Altitude Constraints

Waypoint speed or altitude constraint in large font.

Manual entry allowed in climb or descent phase. Entered by FMC when constraints are part of a procedure.

Speed constraint is assumed to be at or below the displayed speed.

Valid entries are:

- speed in airspeed or Mach
- altitude in thousands of feet or flight level (19000, 190)
- XXX/XXXXX – airspeed/altitude entered simultaneously
- XXX/ – airspeed only (requires an existing altitude constraint)
- XXXXX or /XXXXX – altitude only.

Altitude constraint suffixes:

- blank – cross at altitude
- A – cross at or above altitude
- B – cross at or below altitude
- both – altitude block. Example: 220A240B
- S – planned step climb (refer to Flight Management, Navigation, Cruise).

6 Distance to Waypoint

Distance from airplane to active waypoint or from waypoint to waypoint.

The first line displays the distance from the airplane to the active waypoint.

7 Waypoint Speed/Altitude Predictions

Waypoint speed and altitude predictions are displayed in small font.

Dashes are displayed in the descent region prior to descent path calculation.

Descent path calculation requires altitude constraint below cruise altitude.

8 ACTIVATE, Route Data (RTE DATA)

Push – three possible prompts

- ACTIVATE – activates inactive flight plan; shows RTE DATA prompt
- RTE DATA (route data) – shows route data page
- CTR – see below

9 Center (<CTR>)

Displayed when PLAN mode selected.

Displayed adjacent to the waypoint around which plan mode is centered.

10 MAP Center (CTR) STEP

Replaces ACTIVATE or RTE DATA when PLAN mode selected.

Push – steps <CTR> to next waypoint. Plan mode recenters.

Engine Out Departure



1 Engine Out Standard Instrument Departure (EO SID)

Engine out SIDs can be created by the airline for specific runways. If there is an EO SID in the database for the departure runway it will be listed on the departures page after the runway is selected.

The FMC puts the EO SID into the route as a modification if:

- an engine failure is sensed
- flaps are extended
- and the navigation database has an EO SID for the departure runway.

The modification can be executed or erased.

Air Turn-Back 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 if the airplane is less than 400 miles from the origin and less than half way to the destination, push the DEP ARR key to show the ARRIVALS page for the origin airport.



1 Standard Terminal Arrivals (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.



Flight Management, Navigation

FMC Cruise

Chapter 11

Section 42

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
- REF NAV DATA page – display data about waypoints, nav aids, airports, or runways, and can be used to inhibit nav aids
- RTE X page – 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.
- WINDS page – enter forecast wind and temperature

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 shows typical techniques to modify the route. The modifications include:

- add and delete waypoints
- connect discontinuities
- change waypoint's sequence
- intercept a course.

RTE LEGS Page Modifications

Modifications to the LNAV route are usually made on the RTE LEGS page. When the route is modified, MOD is displayed in the title and the execute light is illuminated.

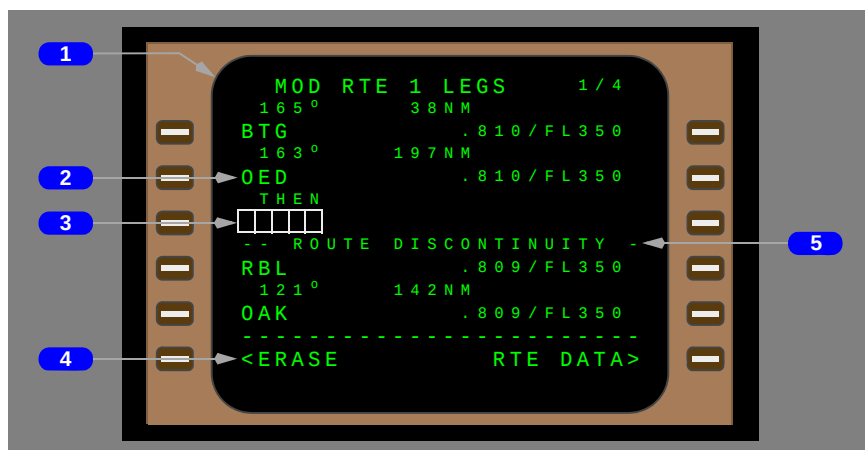
Add Waypoints

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 correct 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 are kept but, are put after the route discontinuity.



1 Page Title

MOD – replaces ACT when modification is in progress.

ACT – replaces MOD when ERASE is selected or execute key is pushed.

2 Modified Waypoint

OED waypoint entered into the route after BTG. Modification creates a route discontinuity because OED was not in the active route. The FMC now requires routing beyond OED.

3 Discontinuity Waypoint

Discontinuity is corrected when applicable waypoint is entered in boxes.

4 ERASE

Push – removes all modifications and shows active data.

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Displayed when the FMC contains modified data.

Removed when selected or the modifications are 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 DEL function key
- change the waypoint's sequence.

The data in the route before the deleted waypoint does not change. A discontinuity is put in the route when the DEL 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 is displayed.

Change Waypoint Sequence

Waypoints moved from one position in the flight plan to another do not cause route discontinuities.

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The waypoint may be manually typed or copied from any of the RTE LEGS pages. To copy the waypoint, 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.

To remove a discontinuity, copy the subsequent waypoint from the route into the scratchpad and enter it into the discontinuity.



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.

If a waypoint which does not already exist on the route is entered into the boxes the discontinuity moves one waypoint further down the route.

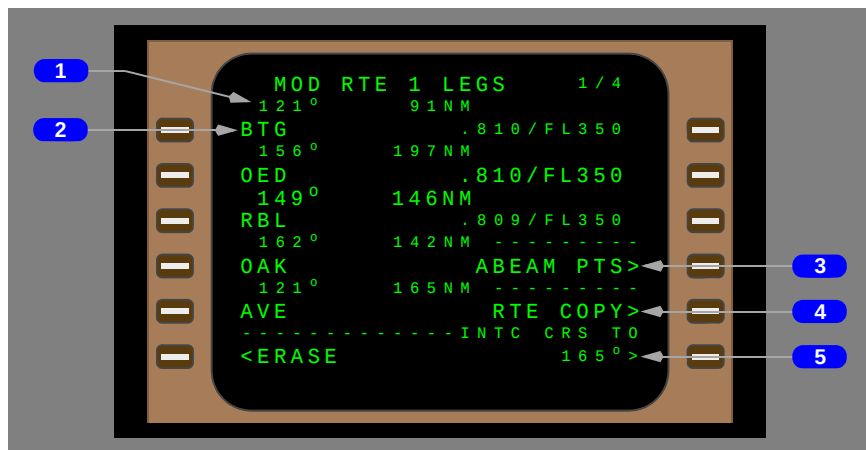
Direct To And Intercept Course To

If the airplane is not on the active leg segment, LNAV may deactivate or it may not activate when armed. This happens after the airplane crosses a discontinuity, or is not on an intercept heading to the active leg segment. Here are three ways to arm or activate LNAV:

- When the airplane is within 2.5 miles of the active leg, push the LNAV switch. LNAV activates and intercepts the active route leg
- When more than 2.5 miles from the active leg, push the LNAV switch when the airplane is on an intercept heading to the active route leg. Initially, LNAV arms and then activates as the airplane approaches the active leg. An 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 prompt in line 6R to create an intercept course to the waypoint. When the modification has been executed, push the LNAV switch and LNAV arms or activates, depending on the distance from the active leg.

Modification of the Active Waypoint

The following example shows a modification to go direct to a waypoint using the RTE LEGS page. After vectors off the original route a clearance is received to proceed direct to BTG.



1 Course to Active Waypoint

Prior to execution, displays direct-to inbound course at waypoint; changed by entry in INTC CRS line or by selecting intercept course.

After execution, displays current required track to fly inbound course to waypoint.

2 Active Waypoint

Displays crew entered direct/intercept waypoint. If entered waypoint is not part of the active route it will be followed by a discontinuity.

3 ABEAM Points (PTS)

Push –

- creates abeam points on new route to indicate waypoints bypassed by direct to function
- abeam points are perpendicular to the waypoints bypassed
- line title displays ABEAM PTS, line data displays SELECTED
- subsequent route modifications remove ABEAM PTS prompt.

4 Route (RTE) COPY

Push –

- copies active unmodified route into inactive route
- erases previous inactive route
- line title displays RTE COPY, line data displays COMPLETE
- subsequent route modifications remove RTE COPY prompt.

5 Intercept Course (INTC CRS) TO

Displays boxes if entered waypoint not in the active route.

Displays current route course and prompt caret if the entered waypoint is in the active route. Allows entry of a different inbound course via the scratchpad.

When boxes displayed, valid entry is intercept course from 000 to 360.

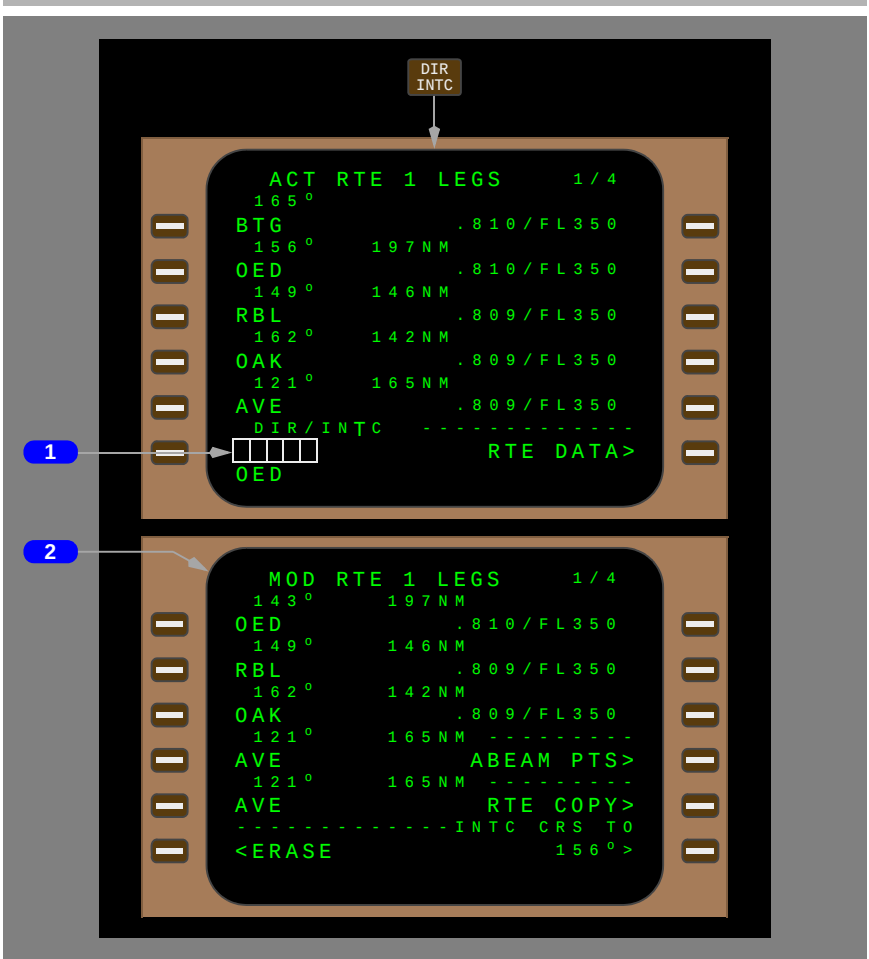
Push –

- when course displayed, selects current route course as intercept course to active waypoint
- when course is displayed and a different course has been entered in the scratchpad, the scratchpad value is entered as the intercept course to the active waypoint
- selection or entry is displayed as the course to the active waypoint
- selection or entry removes ABEAM PTS and RTE COPY prompts.

Direct /Intercept Route Legs (DIR/INTC RTE LEGS) Page

VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

The active waypoint can also be modified by using the DIR/INTC function on the RTE LEGS page.



1 Direct Intercept (DIR/INTC) Boxes

Enter the waypoint identifier into the DIR/INTC boxes.

2 Modified Active Waypoint Page

The waypoint is displayed as the modified active waypoint. The selections available are the same as described above under Modification of the Active Waypoint.

Intercept Course From

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

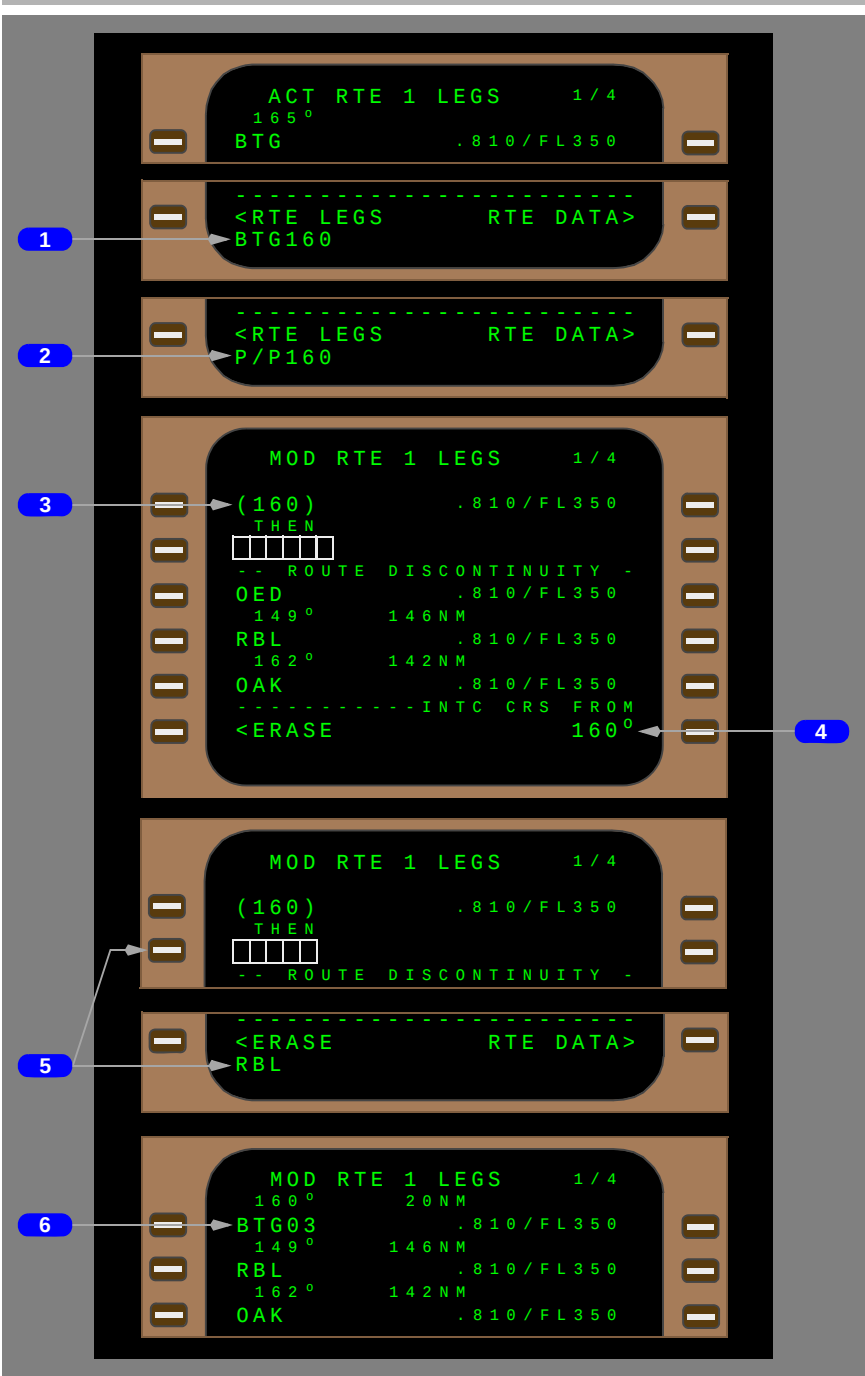
The steps to create an intercept course from a waypoint are nearly the same as the steps for an intercept course to. The waypoint name in the scratchpad is suffixed with the outbound course.



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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 following example demonstrates entering a 160° course from BTG. BTG160 is entered in the scratchpad. When this entry is line selected to the active waypoint line, the entered course is displayed as a conditional waypoint.



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 is displayed. The waypoint name is not used.

For example, BTG160 is entered into the active waypoint line. The FMC calculates a new route leg with BTG as the origin on a outbound course of 160°.

4 Intercept Course From (INTC CRS FROM)

Displays outbound course from the entered waypoint. Allows input of a different outbound course until the modification is executed.

Valid entry is any course from 000° through 360°.

5 Next Waypoint

Enter a down track waypoint into the boxes. To resolve the discontinuity the waypoint must be part of the active route and the inbound course to that waypoint must be intersected by the entered course.

6 Created Waypoint

If the 160° course intercepts the course inbound to the entered waypoint, a new waypoint is created at the intercept point. Line selecting the new waypoint results in a place, bearing, distance format in the scratchpad.

SELECT DESIRED Waypoint (WPT) Page

The SELECT DESIRED WPT page is displayed when a waypoint identifier or name is entered and the navigation database contains more than one location for that name. Selection of a waypoint returns the display to the previous page.



1 Identifier

Displays a list of the waypoints in the navigation database that have the same identifier as entered.

VP-BOZ, VQ-BRA

Up to twelve waypoints (2 pages) can be listed.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Up to 48 waypoints (8 pages) can be listed.

Waypoints are sorted as follows:

- when page is accessed as a result of a flight plan entry or modification, sort is based on proximity to the waypoint preceding the entered waypoint
- when page is accessed as a result of a DIR/INTC, FIX INFO, or REF NAV DATA entry, sort is based on proximity to current aircraft position.

Select the desired waypoint by pushing either the left or right line select key adjacent to the waypoint. The CDU page where the waypoint identifier was entered is redisplayed with the selected waypoint inserted.

2 Frequency

Displays frequency of the waypoint if it is a navaid. Blank if the waypoint is not a navaid.

3 Type

Displays the type of waypoint for each duplicate name.

4 Latitude/Longitude

Displays the latitude/longitude for each duplicate name.

Airway Intercept

Just as in intercept to, LNAV can be used to intercept an airway. An airway intercept changes the active waypoint on the RTE and LEGS pages.

Enter the airway identifier under VIA on line 1 of the RTE page. Boxes display under TO. Enter the desired airway exit waypoint in the boxes. For this open-ended airway intercept, the FMC selects the waypoint preceding the closest abeam location as the starting waypoint of the airway. This waypoint is displayed on line 1. The entered airway and the desired exit point are displayed on line 2. When the modification is executed the leg inbound to the FMC selected starting waypoint becomes the active leg.

If the clearance heading intercepts the active leg segment, LNAV can be armed and the intercept will occur. In most airway intercept situations, the commanded heading will not intercept the active leg.

If the clearance heading does not intercept the active leg segment, use the intercept-course-to procedure to make the course inbound to the waypoint after the crossing location the active leg segment.

Example

The active route is direct to EPH, then direct to MWH. ATC clears the airplane to:

- turn right heading 110°
- intercept V2 to MWH.

Following the V2 modification to MWH and execution, the LEGS page displays this waypoint sequence:

- BANDR
- BEEZR
- ELN
- PLUSS
- MWH.

Modify the LEGS page using a course intercept to the waypoint after the crossing location. In this case, it would be PLUSS. PLUSS becomes the active waypoint on the V2 airway. The LEGS page now displays:

- PLUSS
- MWH.



1 Active RTE 1 Page

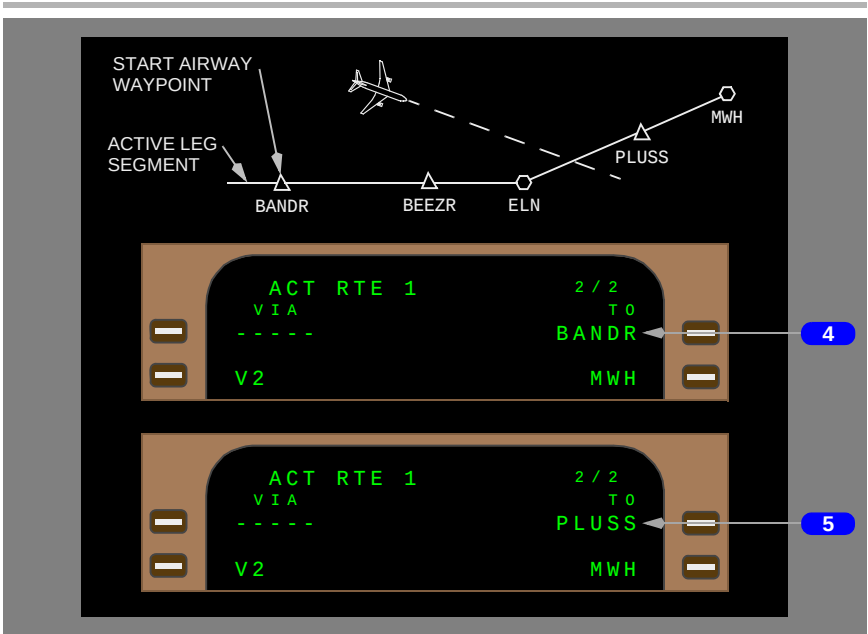
The route page before the ATC clearance.

2 Input 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 in the boxes.



4 Start Airway Waypoint

After entering MWH in the boxes:

- the FMC selects BANDR as the airway start waypoint
- the airway line moves down one line
- dashes are shown in the VIA to the start airway waypoint.

5 New Active Waypoint

Following modification and execution of the course intercept procedure to PLUSS, the LEGS page displays PLUSS as the active waypoint. LNAV can be armed and the airway intercept can be completed.

Route Offset

Route offsets are selected on the RTE page. The OFFSET prompt is displayed on the RTE page when the airplane is airborne and not on a SID, STAR, or transition. Entering a distance value into the OFFSET dashes creates the selected offset. An offset propagates along the route from the active waypoint until a discontinuity, approach, approach transition, holding pattern, course change of greater than 135°, or end of route is reached. An offset can be removed by deleting the offset, proceeding direct, or entering an offset value of zero.

The offset is shown as a white dashed line on the map display until the offset modification is executed or erased.

After execution, the offset route is shown as a dashed magenta line on the map display. The original route remains a solid magenta line.

If LNAV is engaged when the offset is executed, the airplane turns to an intercept heading and captures the offset course.



1 OFFSET

Enter the necessary offset. When executed, the CDU offset (OFST) light illuminates.

Valid entries are L (left) or R (right) followed by a distance from 0 to 99 in nautical miles.

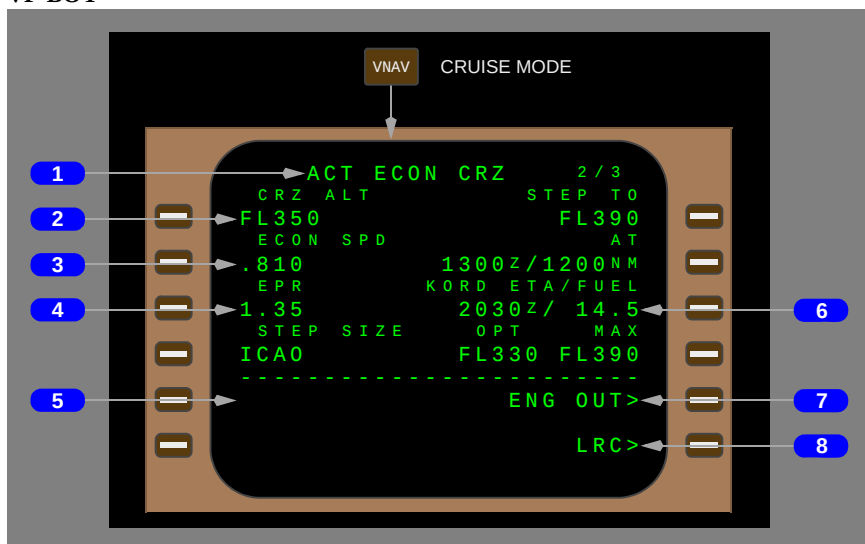
Cruise Page

All Engine Cruise

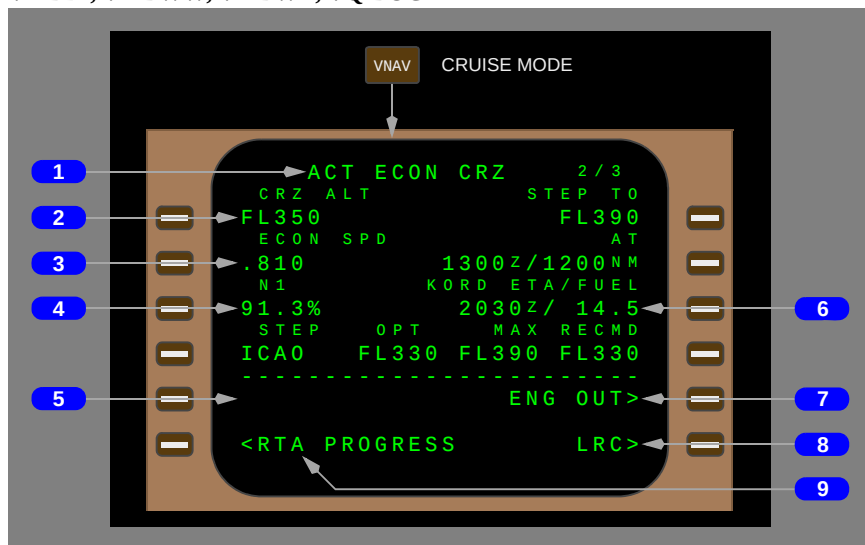
The cruise page is used to monitor and change cruise altitude and speed. Speed changes can be manually selected or automatically selected with the selection of other VNAV modes. Cruise climbs, cruise descents, and step climbs can be accomplished from the cruise page.

When using the 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 changes to include the airplane capabilities with one engine inoperative. The long range cruise (LRC) mode calculates speeds to maximize airplane range.

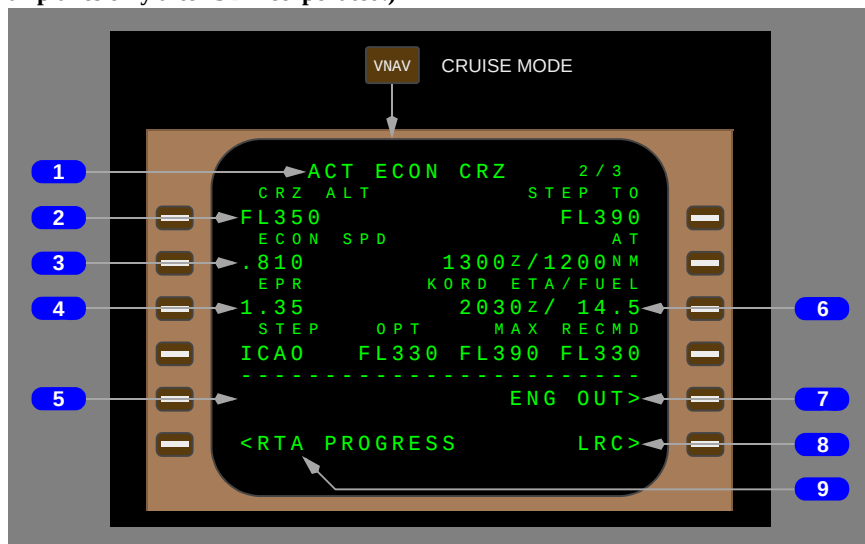
VP-BOY



VP-BDI, VP-BWW, VP-BWX, VQ-BOG

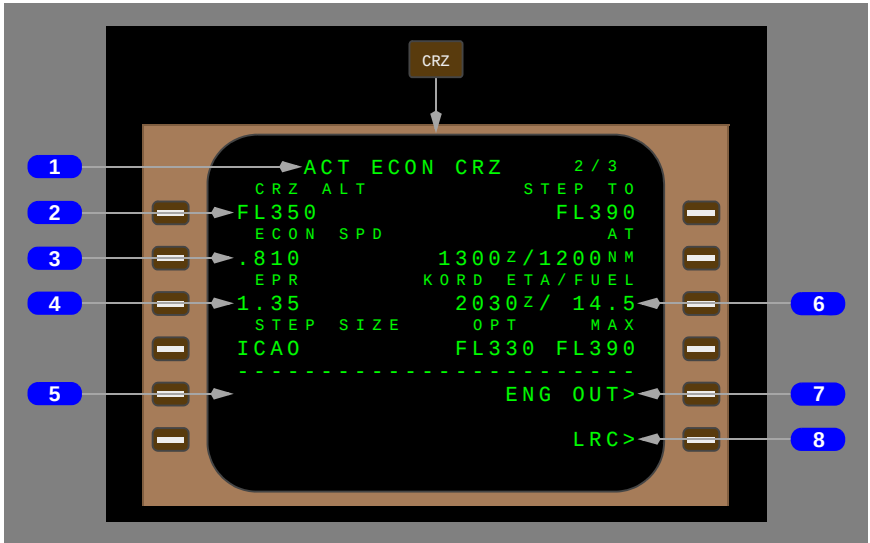


(SB Adds VP-BMC . SB updates FMCs to Pegasus. Graphic valid for "SB Adds..." airplanes only after SB incorporated.)

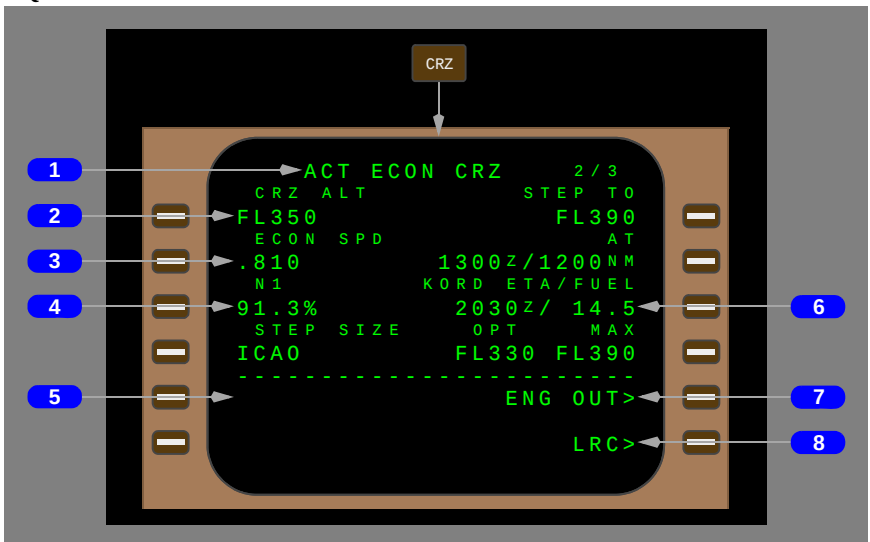


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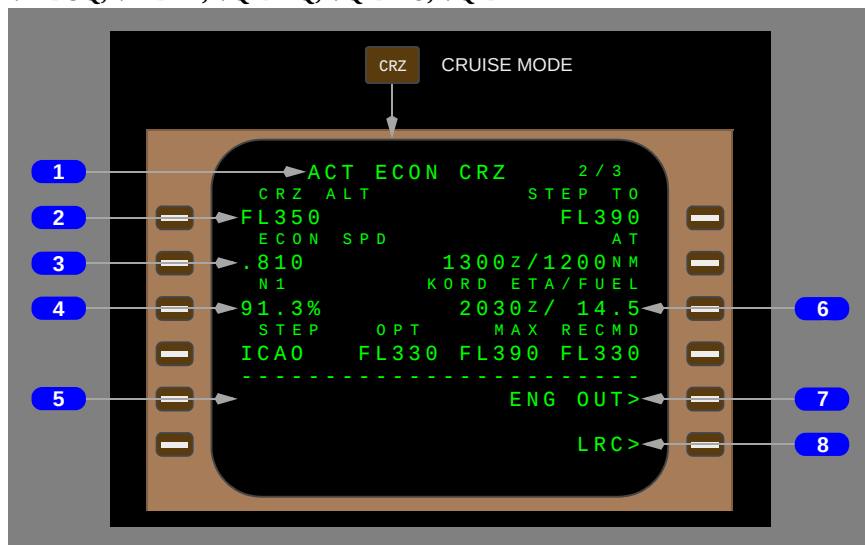
VP-BOZ



VQ-BRA



VP-BOQ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT

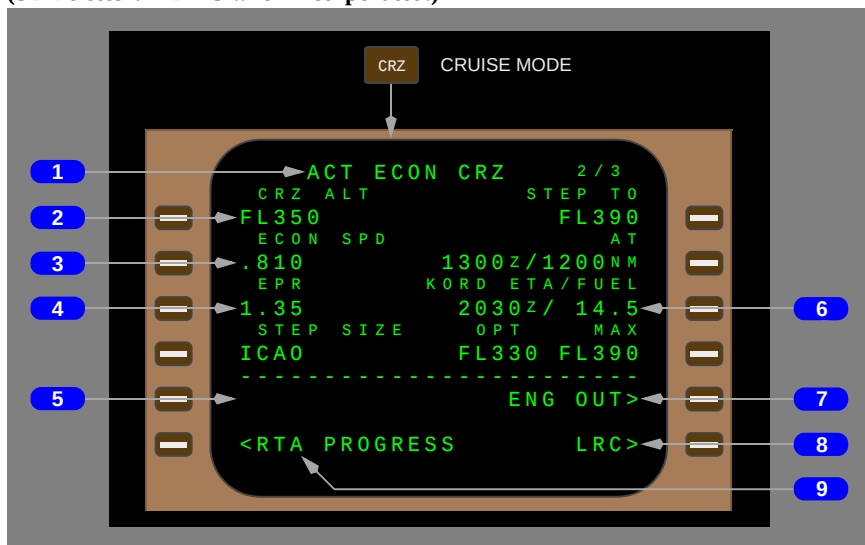


(SB Deletes VP-BMC when incorporated.)



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(SB Deletes VP-BMC when incorporated.)



1 Page Title

The page title displays active (ACT) or modified (MOD) cruise. Usually, the title contains ECON for economy cruise. Fixed speed, engine out, and long range cruise modify the title.

Page titles include:

- CO – engine out mode and company speed selected
- CRZ CLB or CRZ DES – cruise climb or descent
- ECON – speed based on cost index
- EO – engine out mode selected
- EO D/D – engine out drift down displays when EO selected and the airplane altitude is above the maximum altitude for engine out performance
- LIM SPD – based on an airplane configuration limiting speed
- LRC – long range cruise selected
- MCP SPD – speed intervention applied from the MCP
- M.XXX – fixed Mach cruise speed
- XXXKT – fixed CAS cruise speed.

Fixed cruise speeds are for:

- waypoint speed constraints
- an altitude constraint associated with a speed constraint
- a flight crew selected speed (SEL SPD).

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. Changing the MCP altitude enters the new altitude in the scratchpad for entry. Entry creates a modification.

When the modification is executed the page title changes to CRZ CLB or CRZ DES.

VQ-BPT

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)

Displays target speed or Mach.

Allows entry of any valid speed or mach number. MOD displays in the page title until the modification is erased or executed.

A manually entered speed changes the line title to SEL SPD.

ECON can be replaced with LRC or company speed (CO SPD), depending on the VNAV mode.

VP-BMC, VP-BOY, VP-BOZ

4 EPR

Displays EPR necessary for level flight at the target airspeed.

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA

4 N1

Displays N1 necessary for level flight at the target airspeed.

5 Economy (ECON)

Push – selects economy cruise speed.

Displayed when speed or Mach is not ECON.

6 Destination ETA/FUEL

Estimated time of arrival and calculated fuel remaining at the destination.

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.

7 Engine Out (ENG OUT)

Push –

- displays engine out cruise page
- commands engine out performance calculations
- changes CRZ ALT if above maximum engine out altitude
- changes target speed to engine out speed
- upon execution, thrust reference mode changes to CON.

8 Long Range Cruise (LRC)

Push – displays long range cruise page.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

9 Required Time Of Arrival (RTA) PROGRESS

Push – displays RTA PROGRESS 3/3.

Engine Out Cruise

Engine out VNAV cruise guidance displays on the EO CRZ page. Engine out data is also available with both engines operating.

The initial page data includes engine out performance limitations. Manual entries are allowed. When above the maximum engine out cruise altitude, VNAV calculates engine out (EO) guidance for drift down (D/D). The EO D/D page changes to the EO CRZ page when reaching the engine out cruise altitude. 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 first selected, the default speed is EO SPD.

VP-BOY, VP-BOZ, VQ-BRA
(SB Deletes VP-BMC when incorporated.)



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VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

(SB Adds VP-BMC . SB updates FMC with Pegasus 2000 series software. This graphic valid for "SB Adds..." airplanes only after SB incorporated.)


1 Page Title

Displays EO D/D (for this example, airplane is above MAX altitude).

Displays MCP SPD D/D when controlling to a manually entered speed during the driftdown.

Displays EO LRC (long range cruise) D/D when LRC selected during driftdown.

Displays EO LRC when in level cruise flight and the LRC speed is selected.

Displays EO CRZ CLB or EO CRZ DES during engine out cruise climbs or descents and the airplane is below the engine out maximum altitude.

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.

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.

ECON can be replaced with long range cruise (LRC), company (CO SPD), or engine out (EO SPD) speed using prompts at the bottom of the page.

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 Engine Out (EO SPD)

Push – enables execution of engine out minimum drag speed profile.

Display when EO LRC, EO SEL SPD, or CO SPD is the active speed mode.

VP-BOY, VP-BOZ, VQ-BRA
(SB Deletes VP-BMC when incorporated.)

6 Optimum Altitude and Maximum Altitude (OPT MAX)

OPT – displays the most economical altitude based on airplane gross weight.

MAX – displays the maximum cruise altitude based on:

- engine out operation
- selected speed option
- without any altitude or speed constraints, and
- capable of a 100 feet per minute climb rate.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT
(SB Adds VP-BMC . SB updates FMC with Pegasus 2000 series software. This callout valid for "SB Adds..." airplanes only after SB incorporated.)

6 Optimum, Maximum and Recommended Altitude (OPT MAX RECMD)

OPT – displays the most economical altitude based on airplane gross weight.

MAX – displays the maximum cruise altitude based on:

- engine out operation
- selected speed option
- without any altitude or speed constraints, and
- capable of a 100 feet per minute climb rate.

RECMD – displays the most economical altitude based on airplane performance and winds.

7 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.

8 Long Range Cruise (LRC)

Push – enables execution of engine out long range cruise.

Displayed when EO or SEL SPD is the active mode.

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

VQ-BPT

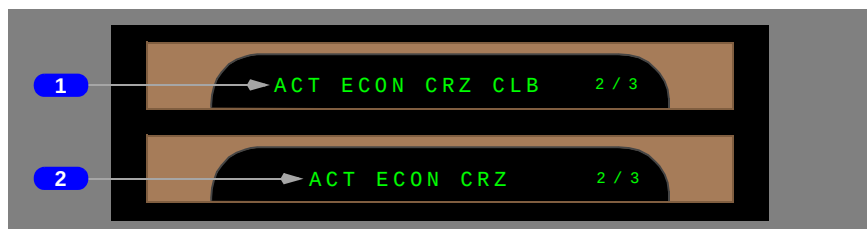
Select a higher MCP altitude and push the MCP altitude selector to start a cruise climb. The FMC CRZ ALT changes to the MCP altitude. VNAV starts a climb with CLB as the thrust limit and VNAV SPD as the pitch flight mode annunciation.

VQ-BPT

Another method to start a cruise climb: select a higher MCP altitude, enter the altitude into the CRZ ALT line, then execute.

VP-BDI through VQ-BOG, VQ-BRA

To initiate a cruise climb set the higher altitude on the MCP, then enter the altitude in the CRZ ALT line and execute. When the CRZ page is displayed, the new MCP altitude is automatically copied to the scratchpad to be line selected to the CRZ ALT line.



1 During Cruise Climb

VNAV page title displays ACT ECON CRZ CLB in a climb to a new cruise altitude. ECON is replaced by an indication of the selected speed if other than ECON.

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 CRZ and PROGRESS page. The corresponding altitude profile point and identifier are shown on the map display.



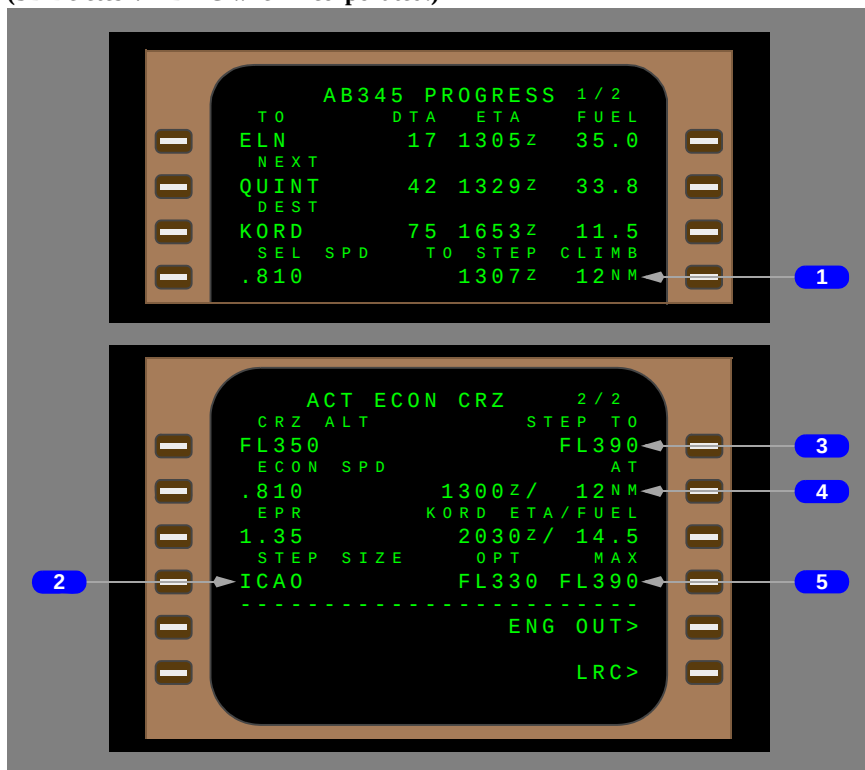
1 Step Climb Altitude

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

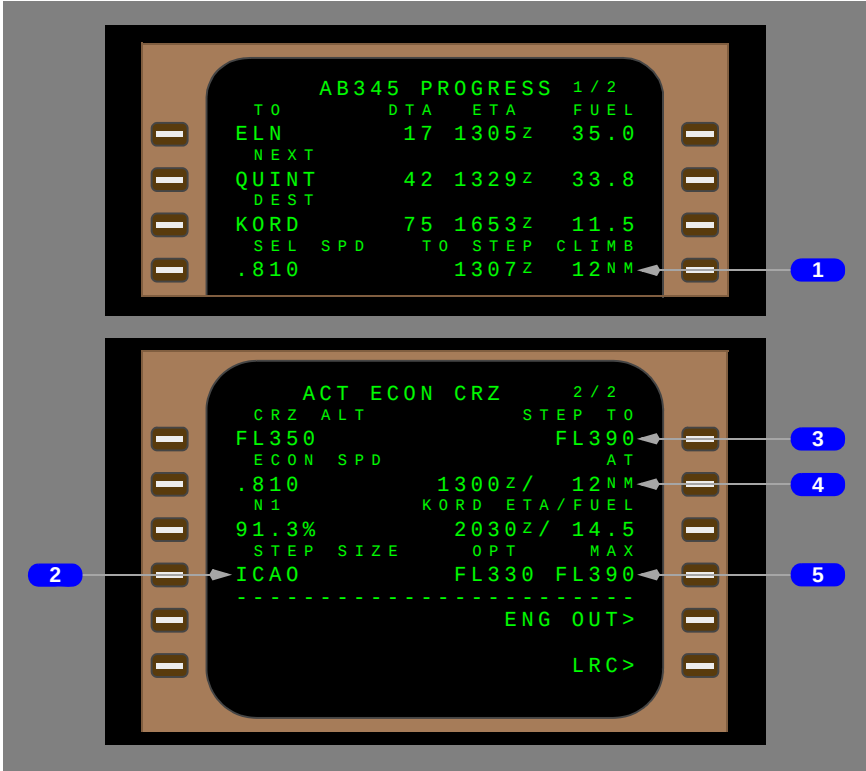
When a non-zero value is entered into the STEP SIZE line on the PERF INIT or CRZ page, the FMC calculates optimum points for step climbs as the airplane performance permits. The climb altitude is determined by the value in STEP SIZE. Multiple step climbs are possible based on performance and route length. VNAV commands the step climbs, if the MCP altitude and the FMC CRZ ALT are set to the new altitude.

VP-BOY, VP-BOZ
(SB Deletes VP-BMC when incorporated.)





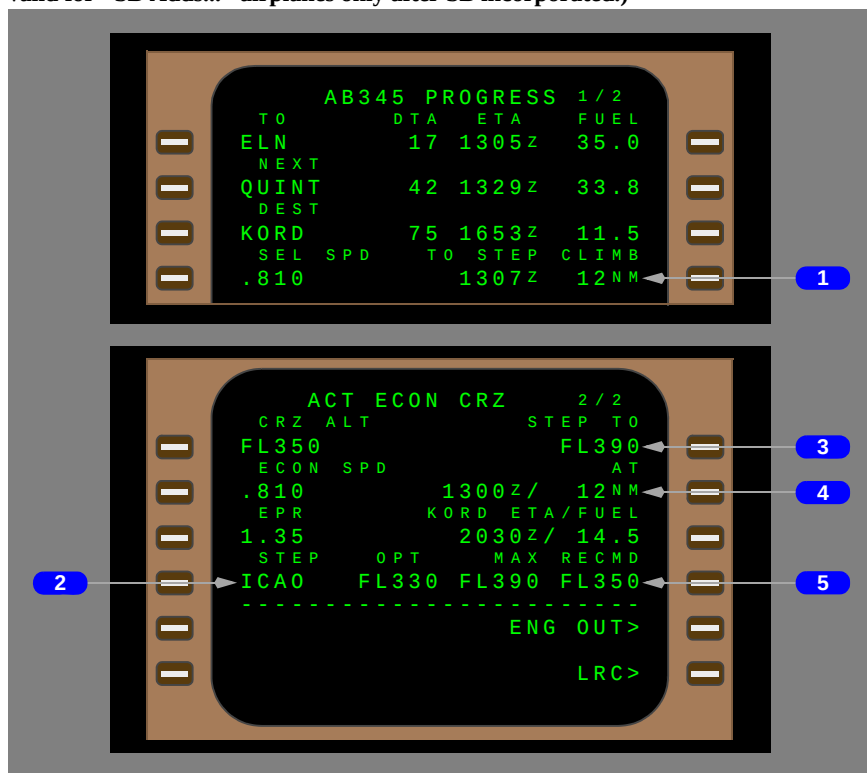
VQ-BRA



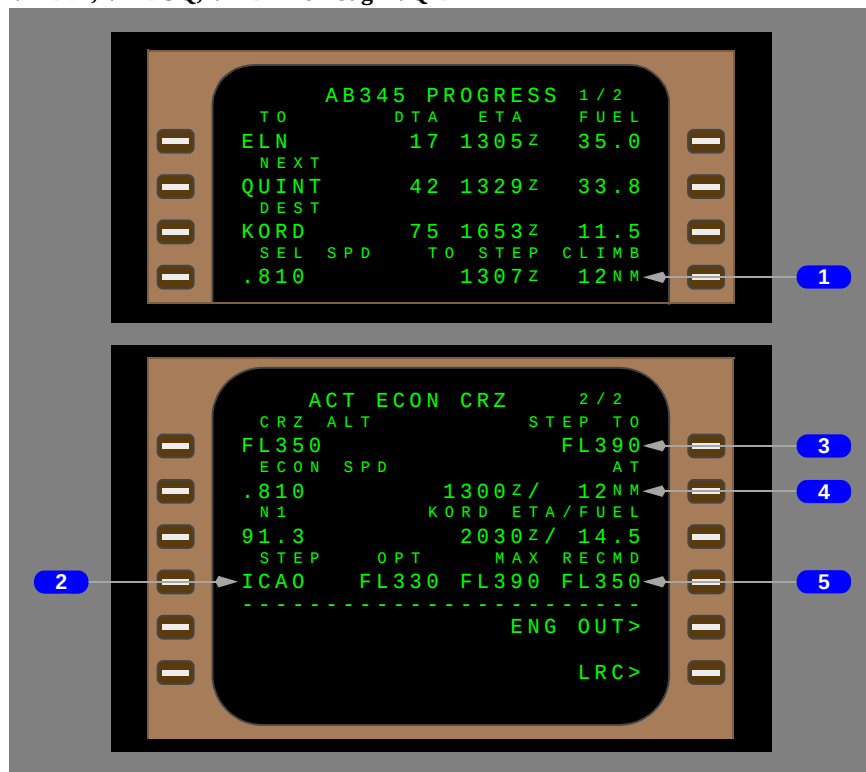


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(SB Adds VP-BMC . SB updates FMC software to Pegasus 2000 series. This graphic valid for "SB Adds..." airplanes only after SB incorporated.)



VP-BDI, VP-BOQ, VP-BRL through VQ-BPT



1 TO STEP CLIMB

When the step 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 that a step climb is not advised, the ETA and DTG are replaced with the word NONE.

2 STEP SIZE

Displays the default step climb size of ICAO.

Valid entries are altitudes from 0 to 9000 in 1000 foot increments.

Used for calculation of optimum step point and step climb predictions.

Deletion of a manual entry defaults back to ICAO.

3 STEP TO

An altitude can be entered for a step climb evaluation. The FMC calculates the predicted step climb data and displays the results on this page and the PROGRESS page.

Entering a zero value for STEP SIZE causes the FMC to calculate performance based on a constant altitude flight at the CRZ ALT. Entering a valid, non-zero increment or ICAO step size causes the FMC to calculate performance based on accomplishing step climbs at calculated step climb points.

Step climb altitudes entered on the RTE LEGS page can be higher or lower than the CRZ ALT. These step climb altitudes cannot be overwritten on the CRZ page.

When using the ICAO step size, the STEP TO altitude is the next higher altitude above the OPT altitude corresponding to the direction of flight, based on the CRZ ALT entered before takeoff. Changes to CRZ ALT while in flight do not affect calculation of STEP TO altitudes using ICAO step sizes. However, if an alternate route (for example, Route 2) is activated in flight, the hemispheric altitude will be calculated using the current CRZ ALT.

When using an altitude increment step size, the STEP TO altitude is the next higher altitude above OPT calculated by adding the STEP SIZE increment to the FMC CRZ ALT.

When entering a cruise altitude above maximum altitude, the scratchpad message MAX ALT FLXXX is displayed.

Displays:

- the STEP TO altitude from the RTE LEGS page
- a calculated step climb altitude based on the step size.

Manual entry is allowed.

Blank when:

- there is no active flight plan
- within 200 NM of the T/D point or 500 miles from the destination
- the step size is zero
- in the EO D/D phase.

4 AT

Displays the ETA and DTG to the step climb point.

Displays NOW when past the calculated step climb point.

Line title changes to AVAIL AT when the climb is restricted by thrust or buffet.

Line title displays AT XXXXX where XXXXX is the waypoint where a planned step climb has been entered on the RTE LEGS page.

Line title changes to TO T/D when within 200 NM of the top of descent point.
ETA and DTG are relative to the T/D point.

The data is the same as displayed on the PROGRESS page.

VP-BOY, VP-BOZ, VQ-BRA
(SB Deletes VP-BMC when incorporated.)

5 Optimum Altitude and Maximum Altitude (OPT MAX)

OPT – displays the most economical altitude to fly based on gross weight and the active cruise speed.

MAX – displays the two engine maximum altitude based on gross weight, climb and cruise speeds within the speed envelope, and sufficient excess thrust to provide a specified residual rate of climb capability.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT
(SB Adds VP-BMC . SB updates FMC software to Pegasus 2000 series. This callout valid for "SB Adds..." airplanes only after SB incorporated.)

**5 Optimum, Maximum and Recommended Altitude (OPT MAX
RECMD)**

OPT – displays the most economical altitude based on gross weight and the active cruise speed.

MAX – displays the two engine maximum altitude based on gross weight, climb and cruise speeds within the speed envelope, and sufficient excess thrust to provide a specified residual rate of climb capability.

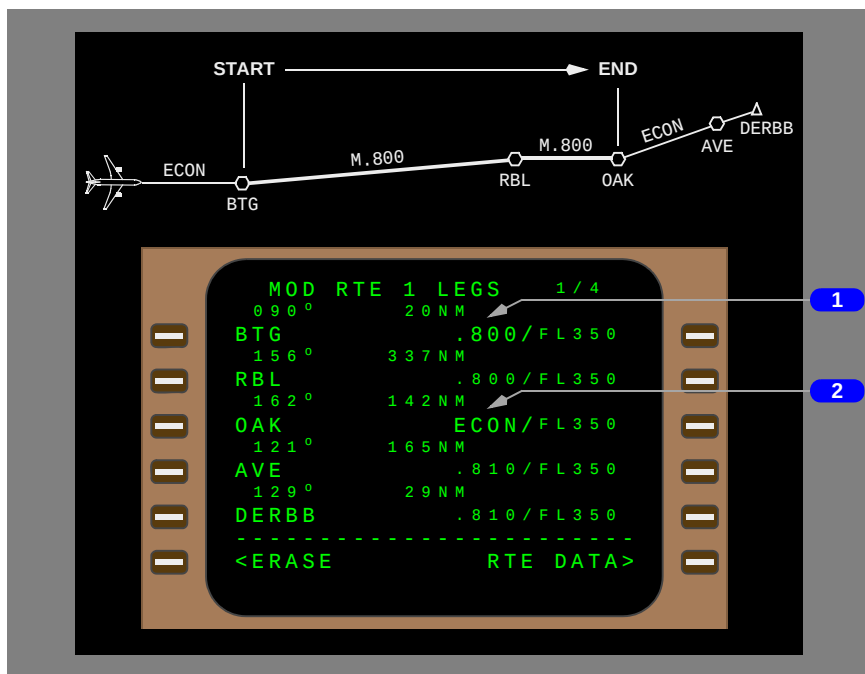
RECMD – displays the most economical altitude based on winds and airplane performance.

Constant Speed Cruise

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

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.

Entry can be a Mach number, ECON/ or E/, LRC/ or L/.

If no end waypoint is specified, the constant speed terminates at top of descent.

Cruise Descent

Cruise descents can be started in the cruise phase when more than 50 miles from the T/D point.

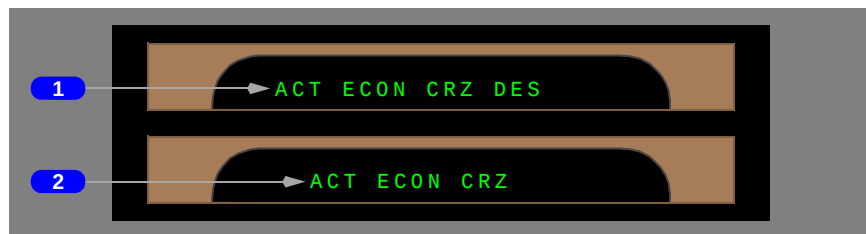
VQ-BPT

A cruise descent can be started by selecting a lower altitude on the MCP and pushing the altitude selector. A VNAV cruise descent is commanded at the current cruise speed and approximately 1250 feet per minute rate of descent. The FMC cruise altitude is automatically changed to the new altitude.

VP-BDI through VQ-BOG, VQ-BRA

A cruise descent can be started by selecting a lower altitude on the MCP, entering the new altitude in the CRZ ALT line and executing. A VNAV cruise descent is commanded at the current cruise speed and approximately 1250 feet per minute rate of descent.

The autothrottles adjust thrust to maintain the target descent rate; pitch maintains the commanded speed. Thrust levers can be manually positioned to adjust the descent rate.



1 During Cruise Descent

VNAV page title shows cruise phase in a descent to a new cruise altitude.

2 End of Cruise Descent

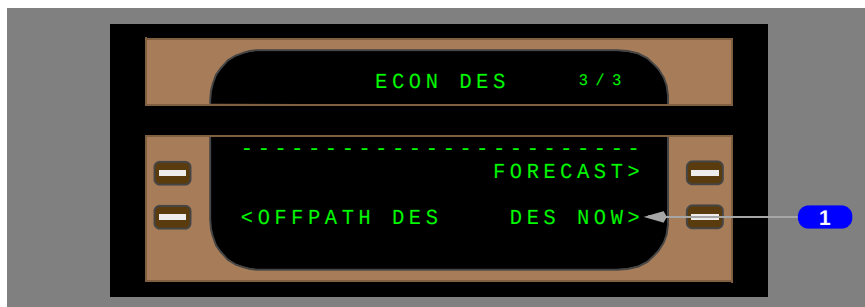
VNAV page title shows cruise phase after level off at new cruise altitude.

Early Descent

An early descent starts when the descent for landing is commenced prior to the top of descent point. Early descents should not be started when the distance to the top of descent point is greater than 50 nautical miles. When further from the top of descent point, the cruise descent function should be used.

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Early descents are started on the DES page. Once an early descent is started, VNAV changes to the descent phase and cruise features are no longer available. The autothrottle adjusts thrust to maintain the target descent rate; pitch maintains the commanded speed. Thrust levers can be manually positioned to adjust the descent rate.


1 Descend Now (DES NOW)

The DES NOW prompt is shown on the descent page when the cruise phase is active. Reset the MCP altitude and select the DES NOW prompt and execute to start an early descent. The descent page becomes active and the airplane starts a VNAV ECON descent of approximately 1250 feet per minute at ECON descent speed.

Once the descent is established the autothrottle mode changes to THR HOLD to allow the pilot to adjust the rate of descent with power changes.

Upon reaching the planned descent path, VNAV commands pitch to maintain the planned descent path and ECON speed.



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.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT



VP-BOZ, VQ-BRA



1 Identification (IDENT)

Valid entries are any waypoint, navaid, airport, or runway from the navigation database. Only runways at the destination airport can be entered.

Dashes are displayed when the page is first selected. Entry changes to dashes when the page is exited and then reselected.

2 LATITUDE

Displays latitude of entered identifier. When the identifier is a runway the latitude displayed is for the threshold of the runway.

3 Magnetic Variation (MAG VAR), LENGTH

MAG VAR - displays magnetic variation when entered identifier is a navaid.

LENGTH - displays runway length when entered identifier is a runway.

4 NAVAID INHIBIT

When a navigation radio is known to provide erroneous position information, the FMC must be inhibited from automatically tuning that navaid.

Enter the identifier of up to two VOR, VOR/DME, VORTAC, or DME stations that must not be used for FMC position updates.

Entries are blanked at flight completion. Deleting or overwriting removes a previous inhibit.

5 VOR ONLY INHIBIT

Use this line when only the VOR portion of a VOR/DME or VORTAC navaid must be inhibited. ALL is displayed if the VOR/DME NAV prompt is selected to OFF.

Enter the identifier of up to two VORs that must not be used for FMC position updates. Only the VOR portion of the navaid is inhibited, the FMC will still tune the DME for DME-DME updating.

Entries are blanked at flight completion. Deleting or overwriting removes a previous inhibit.

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. When the identifier is a runway the longitude displayed is for the threshold of the runway.

9 ELEVATION

Displays elevation of entered identifier when it is a navaid, airport, or runway.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

10 VOR/DME NAV

Alternately switches VOR/DME NAV updating between OFF and ON

Push – when ON is displayed in large font

- changes OFF to large font and ON to small font
- inhibits VOR/DME updates to the FMC by inhibiting all VORs. DME-DME updating is not inhibited.
- displays ALL in both locations of the VOR ONLY INHIBIT line.

Push – when OFF is displayed in large font

- changes ON to large font and OFF to small font
- enables VOR/DME updating to the FMC
- deletes the ALL from the VOR ONLY INHIBIT line.

VP-BOZ, VQ-BRA**10 VOR/DME NAV**

Alternately switches VOR/DME/ NAV updating between INHIBIT and ENABLE.

Push – when prompt reads INHIBIT

- changes the prompt to ENABLE
- inhibits all VOR/DME updates by inhibiting all VORs. DME-DME updating is not inhibited.
- displays ALL in both locations of the VOR ONLY INHIBIT line

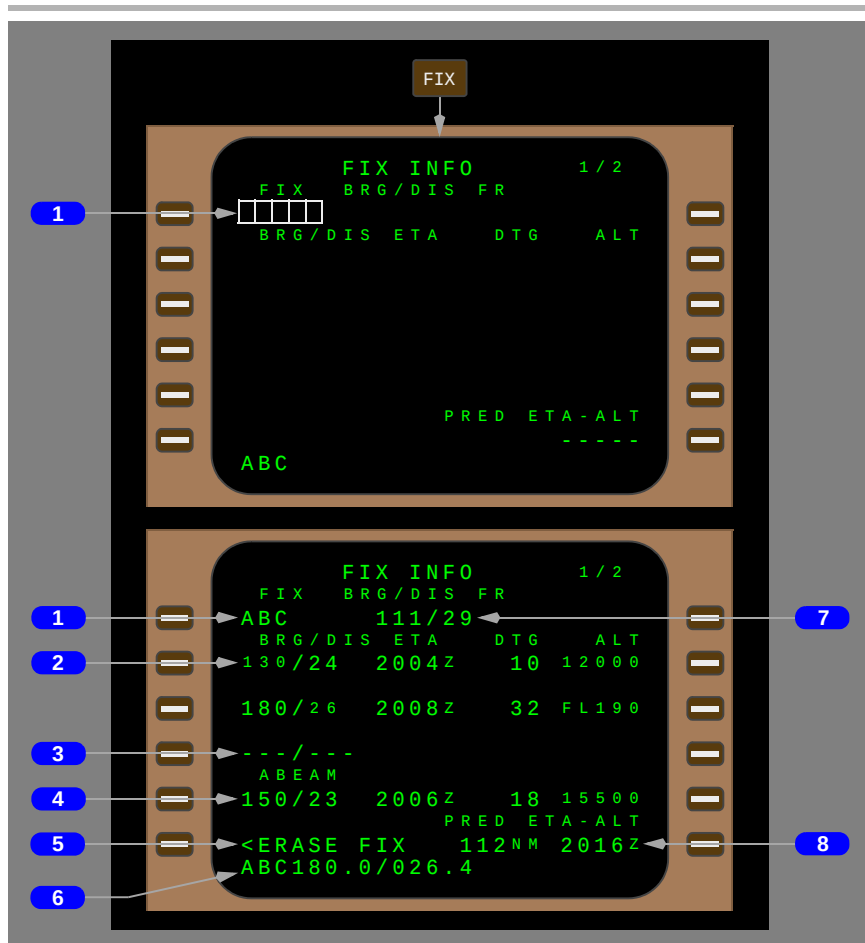
Push – when prompt reads ENABLE:

- changes the prompt to INHIBIT
- enables all VOR/DME updating
- deletes the ALL from the VOR ONLY INIBIT line.

Fix Information Page

Two identical fix information pages are used to create waypoint fixes and waypoints for the map display. Some of the created waypoints can be copied into the route.

Magnetic or true fix bearings depend on the position of the heading reference switch or airplane location. Refer to FMC Polar Operations, Flight Management Navigation, section 31.



1 FIX

Before entry of a name or identifier, boxes displayed and most data lines are blank. Valid entries are airports, nav aids, and waypoints from the navigation database. The selected fix appears on the map display highlighted by a green circle.

2 Bearing/Distance (BRG/DIS), ETA, DTG, ALT

Valid entries are XXX/YYY.Y:

- decimal values can be omitted
- leading zeros can be omitted for distance entries
- distance only entries must start with a slash (/).

Distances from the fix appear on the map display as a circle around the fix.

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When the circle intersects the active route, the ETA, DTG, and predicted altitude at the intersection display for the closest of the two intersections.

Bearings from the fix appear on the map display as radial lines from the fix.

When the bearing intersects the active route, the ETA, DTG, and predicted altitude at the 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

Enter a bearing, distance, or both bearing and distance from the fix. A bearing and distance from the fix appear on the map display as a waypoint fix point. ETA, DTG, and predicted do not display.

4 ABEAM

Displays ABEAM prompt.

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 map display.

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 appears on the map as a green circle with the entered altitude/flight level or time.

In-Flight Position Update

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

FMC position update can be accomplished on the POS REF 2/4 page in flight.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT



767 Flight Crew Operations Manual
VP-BRL


VP-BOQ



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 NOW

Push – to update the FMC position from the desired source. The FMC position is momentarily changed to the position of the selected system. If other valid sensor position exist, it returns to the most reliable sensor position.

Route and Waypoint Data

Route Data Page

The route data page displays progress 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.

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One page shows data for five waypoints.

The ETA and calculated fuel remaining at the waypoint display for each waypoint. Manual entry is not possible.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT



1 Waypoint (WPT)

Displays identifier for waypoint.

2 ETA

Displays ETA for waypoint.

3 LEGS

Push – displays RTE LEGS page.

4 FUEL

Displays the FMC calculated fuel remaining at the waypoint.

Note: ETA and estimated fuel calculations assume a direct flight across route discontinuities.

5 WIND Page Prompt

Push – selects WIND page for the selected waypoint.

A "W" next to the prompt indicates that wind data has been entered on the wind page for that waypoint.

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.

VP-BOQ through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BRA



1 Waypoint (WPT)

Displays identifier for waypoint.

2 ETA

Displays ETA for waypoint.

3 FUEL

Displays the FMC calculated fuel remaining at the waypoint.

Note: ETA and estimated fuel calculations assume a direct flight across route discontinuities.

4 WIND Page Prompts

Push – selects WIND page for the selected waypoint.

A "W" next to the prompt indicates that wind data has been entered on the wind page for that waypoint.

5 LEGS

Push – displays RTE LEGS page.

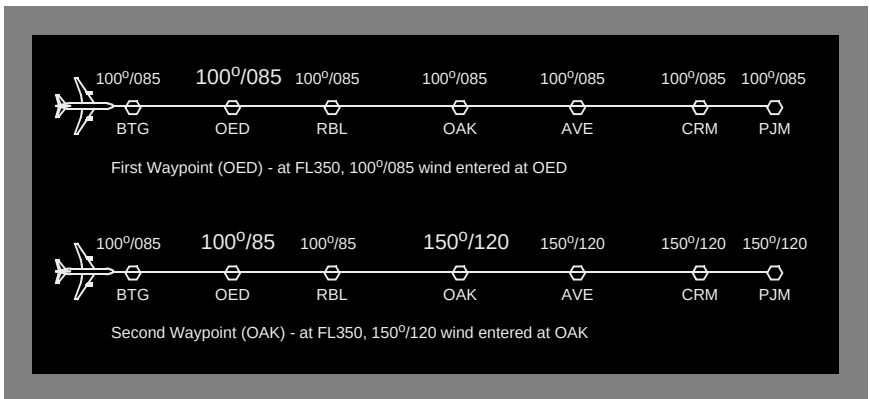
Wind Data

The FMC uses wind data to improve performance prediction accuracy.

The FMC applies the first entered wind data to all waypoints in the flight plan. Wind data includes altitude and direction/speed.

Wind data entered at another waypoint (at the same altitude) changes wind data down track 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 down track 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 are displayed on the HSI and on progress page 2.

Wind Page

The wind page is used to enter forecast winds and temperatures at specific altitudes for specific waypoints to enhance VNAV performance. The FMC calculates step climb points based on the wind effect.

The wind page displays waypoint wind data for one to four altitudes per waypoint. This data can be uplinked or manually entered.

The altitudes are entered first. The altitudes can be entered in any order and are sorted and displayed in ascending order.

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.



1 Page Title

Displays ACT XXXXX WIND, where XXXXX is the waypoint for which the wind page was selected.

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When a route is being modified, MOD is shown in the page title. If ACT is displayed when the wind page is first accessed, entry of wind data caused MOD to be displayed. Wind entries must be executed.

2 Altitude (ALT)

Enter altitude or flight level for wind entries. Altitude data entry is possible only on line 1L.

After altitude entry, data is sorted in ascending order 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.

Entered altitudes are propagated to all wind pages.

3 Altitude/Flight Level Data

Displays the altitude or flight level for wind entries. Data entered on 1L is displayed on lines 1 through 4 in ascending order. Altitude entry is not possible in lines 2L through 4L.

Calculated OAT based on standard lapse rate from the entry made on the ALT/OAT line are 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 predicted wind direction and speed for the altitude.

Values propagate to other waypoint winds. Propagated values display in small font.

Manual entries display in large font.

6 Altitude/Outside Air Temperature (ALT/OAT)

Enter altitude and OAT. The altitude for OAT does not have to be one of the wind altitudes. The FMC uses standard lapse rate to calculate the temperature at the other altitudes.

Entries must be executed.

7 Route Data (RTE DATA)

Push – displays the RTE DATA page.

Progress Pages

The progress page displays general flight progress data.

The position report page is accessed from the progress page.

Progress Page 1

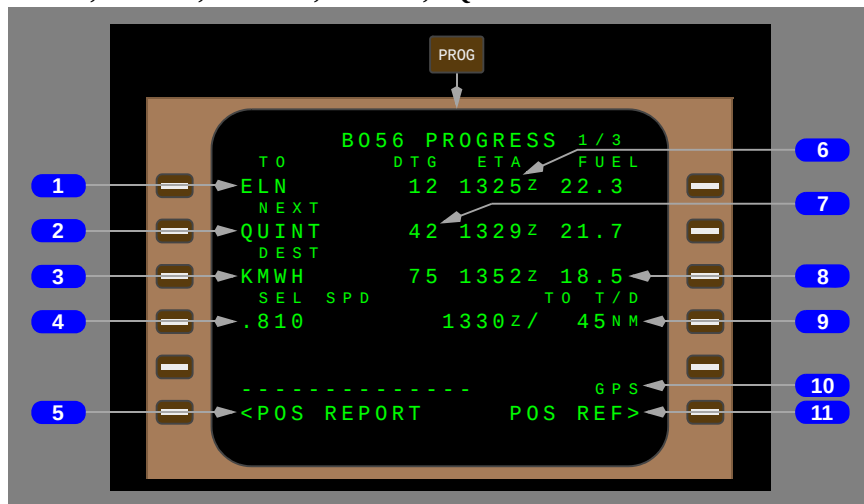
The page title displays the company flight number entered on the RTE page.

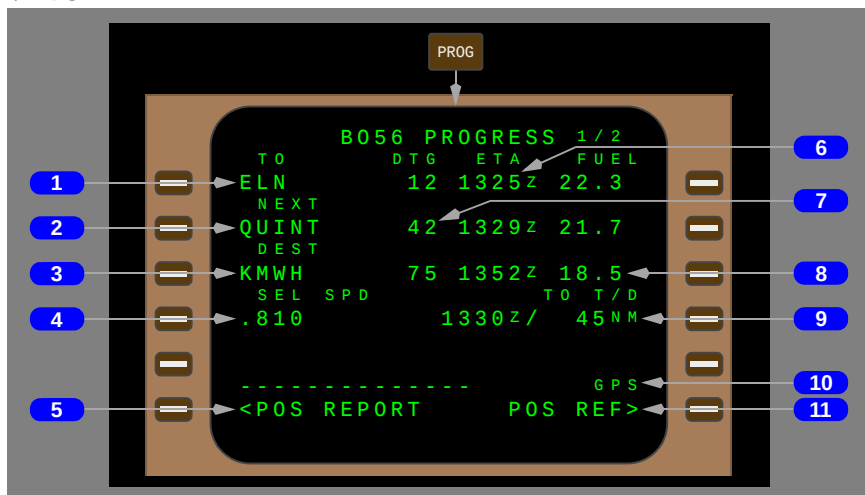
Page one of the progress pages displays general data about:

- waypoints (active and next)
- FMC speed
- destination
- next VNAV profile point.

VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG



VP-BOY

1 TO

Active waypoint is displayed.

Can not be modified.

2 NEXT

Waypoint after TO waypoint is displayed.

Can not be modified

3 Destination (DEST)

When the page is selected the active route destination is displayed. Any waypoint or airport in navigation database can be entered over the destination.

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 overhead 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.

Entries do not modify the active route and are deleted when all CDUs are changed to a different page.

4 Selected Speed (SEL SPD)

Displays the FMC active command speed.

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The active speed mode is the same as on the performance page, unless changed by the MCP or a limit. The speed modes are:

- LRC SPD – long range cruise speed
- ECON SPD – economy speed
- SEL SPD – selected speed manually entered on the CDU
- LIM SPD – speed is limited by VMO, MMO, flap limit, or buffet limit
- MCP SPD – MCP speed entered on the MCP IAS/MACH indicator
- EO SPD – engine out speed
- 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 Top Of Descent (T/D)

ETA and DTG to next VNAV profile point.

The line title and data change for other phases of flight. Other line titles:

- TO T/C – top of climb data
- TO E/D – end of descent data
- TO STEP CLIMB – step climb data
- LEVEL AT – time and distance to level off in engine out mode.

10 Navigation Updating Mode

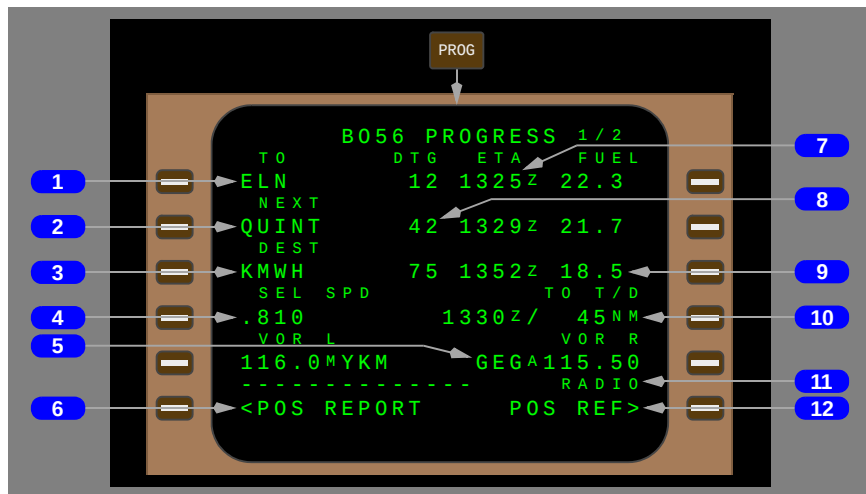
Displays the current FMC position updating source. Possible displays are:

- GPS
- RADIO
- IRS
- LOC–GPS
- LOC–RADIO
- LOC

11 Position Reference (POS REF)

Push – displays position reference page.

VP-BOQ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT



1 TO

Active waypoint is displayed.

Can not be modified.

2 NEXT

Waypoint after TO waypoint is displayed.

Can not be modified

3 Destination (DEST)

When the page is selected the active route destination is displayed. Any waypoint or airport in navigation database can be entered over the destination.

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 overhead 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.

Entries do not modify the active route and are deleted when all CDUs are changed to a different page.

4 Selected Speed (SEL SPD)

Displays the FMC active command speed.

The active speed mode is the same as on the performance page, unless changed by the MCP or a limit. The speed modes are:

- LRC SPD – long range cruise speed
- ECON SPD – economy speed
- SEL SPD – selected speed manually entered on the CDU
- LIM SPD – speed is limited by VMO, MMO, flap limit, or buffet limit
- MCP SPD – MCP speed entered on the MCP IAS/MACH indicator
- EO SPD – engine out speed
- CO SPD – engine out operations at airline specified engine out company speed

5 VOR Tuning Data

Displays the tuned frequency and identifier for the left and right VOR receivers.

The mode of tuning is indicated by the letter between the frequency and identifier as follows:

- M – manually tuned
- A – auto tuned by the FMC
- P – auto tuned by the FMC to comply with a procedure in the active route
- R – remotely tuned by the flight crew.

Remote tuning is accomplished by entering the frequency or identifier of the desired navaid. Enter an A to return the VOR to automatic tuning.

6 Position Report (POS REPORT)

Push – displays the POS REPORT page.

7 ETA

Estimated time of arrival at waypoint or destination.

8 Distance To Go (DTG)

Distance to go to waypoint or destination.

9 FUEL

Estimated fuel remaining at waypoint or destination.

10 TO Top Of Descent (T/D)

ETA and DTG to next VNAV profile point.

The line title and data change for other phases of flight. Other line titles:

767 Flight Crew Operations Manual

- TO T/C – top of climb data
- TO STEP CLIMB – step climb data
- TO E/D – end of descent data
- LEVEL AT – time and distance to level off in engine out mode.

11 Navigation Updating Mode

Displays the current FMC position updating source. Possible displays are:

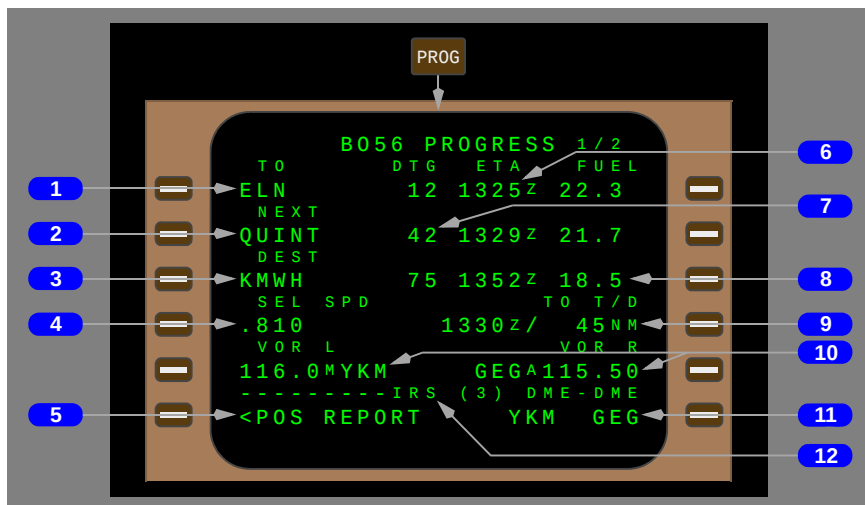
- VQ-BMQ, VQ-BMU, VQ-BPT**
- GPS
- RADIO
- IRS

- VQ-BMQ, VQ-BMU, VQ-BPT**
- LOC-GPS
- LOC-RADIO
- LOC

12 Position Reference (POS REF)

Push – displays position reference page.

VP-BOZ, VQ-BRA



1 TO

Active waypoint is displayed.

Can not be modified.

2 NEXT

Waypoint after TO waypoint is displayed.

Can not be modified

3 Destination (DEST)

When the page is selected the active route destination is displayed. Any waypoint or airport in navigation database can be entered over the destination.

The line titles are:

- DEST – performance predictions to destination. Default display.
- DIR TO ALTERNATE– 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.

Entries do not modify the active route and are deleted when all CDUs are changed to a different page.

4 Selected Speed (SEL SPD)

Displays the FMC active command speed.

The active speed mode is the same as on the performance page, unless changed by the MCP or a limit. The speed modes are:

• LRC SPD – long range cruise speed	• MCP SPD – MCP speed entered on the MCP IAS/MACH indicator
• ECON SPD – economy speed	• EO SPD – engine out speed
• SEL SPD – selected speed manually entered on the CDU	• CO SPD – engine out operations at airline specified engine out company speed
• LIM SPD – speed is limited by VMO, MMO, flap limit, or buffet limit	

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 Top Of Descent (T/D)

ETA and DTG to next VNAV profile point.

The line title and data change for other phases of flight. Other line titles:

- TO T/C – top of climb data
- TO E/D – end of descent data
- TO STEP CLIMB – step climb data
- LEVEL AT – time and distance to level off in engine out mode.

10 VOR Tuning Data

Displays the tuned frequency and identifier for the left and right VOR receivers.

The mode of tuning is indicated by the letter between the frequency and identifier as follows:

- M – manually tuned
- A – auto tuned by the FMC
- P – auto tuned by the FMC to comply with a procedure in the active route
- R – remotely tuned by the flight crew.

Remote tuning is accomplished by entering the frequency or identifier of the desired navaid. Enter an A to return the VOR to automatic tuning.

11 Radio Update Display

Indicates the current mode of FMC radio updating.

- DME-DME
- VOR-DME
- LOC

The identifiers of the navaids being used for updating are listed.

12 IRS Status

Indicates the number or identification of valid IRSs supplying data to the FMC:

- (3) – all IRSs being used
- (L), (C), or (R) – left, center or right IRS being used.

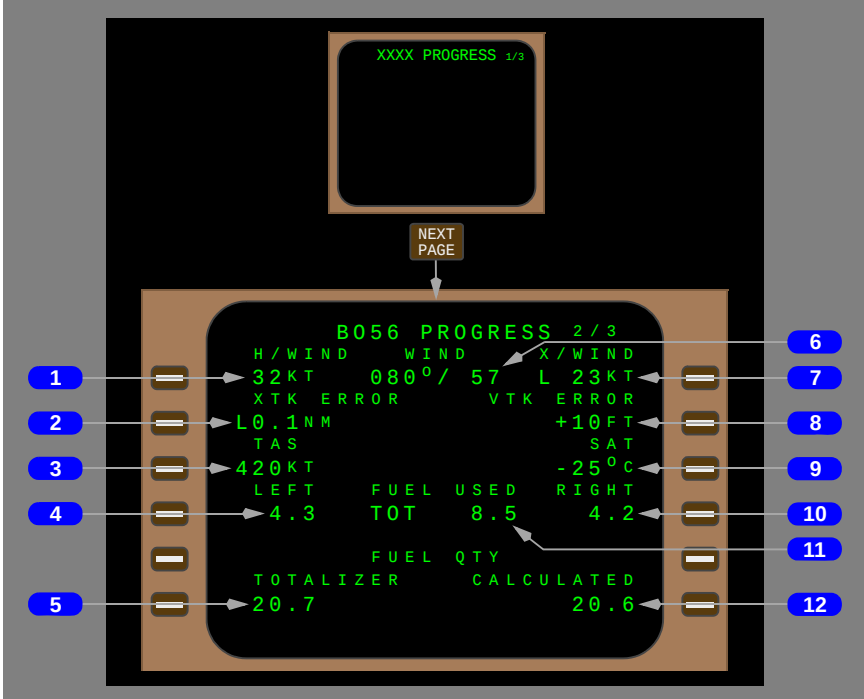
Progress Page 2

Progress page two contains:

767 Flight Crew Operations Manual

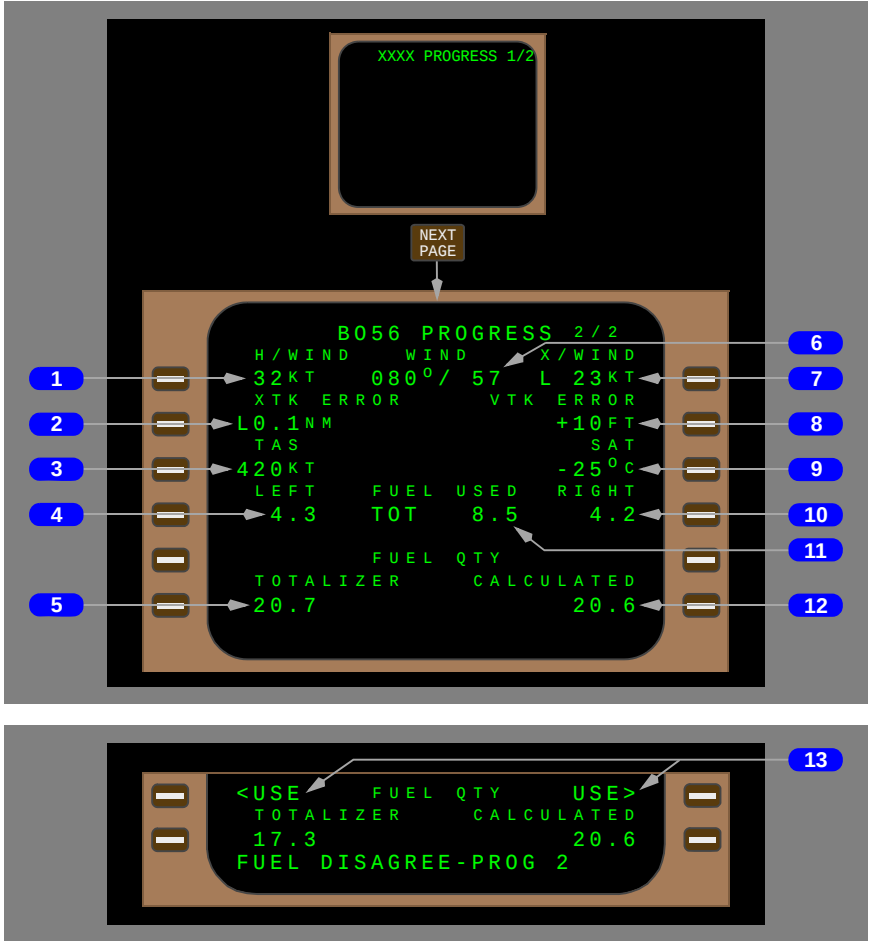
- wind data
- true airspeed
- fuel data
- track error data.
- static air temperature

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG



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VP-BOQ through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA



1 Headwind (H/WIND), Tailwind (T/WIND)

Displays headwind (H/WIND) or tailwind (T/WIND) component relative to the airplane heading.

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)

Displays total fuel quantity from the fuel system quantity processor.

The fuel remaining line displays two independent fuel remaining values, TOTALIZER and CALCULATED. They can be compared to validate FMC calculations.

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 FUEL Quantity (QTY) CALCULATED

Displays fuel remaining as calculated by the FMC with these methods:

- before engine start, fuel quantity calculated by fuel quantity system totalizer
- after engine start, fuel quantity at engine start decreased by EICAS engine fuel flow rate
- after fuel dump or after erasing a manually entered fuel quantity, resets to fuel quantity system totalizer
- after all engines are shutdown, resets to fuel quantity system totalizer.

The fuel remaining line displays two independent fuel remaining values, TOTALIZER and CALCULATED. They can be compared to validate FMC calculations.

13 USE

USE prompts display when TOTALIZER and CALCULATED values disagree by a significant amount. The scratchpad message FUEL DISAGREE–PROG 2 is also displayed.

VP-BRL

On older FMCs the scratchpad message reads FUEL QTY ERROR–PROG 2/2.

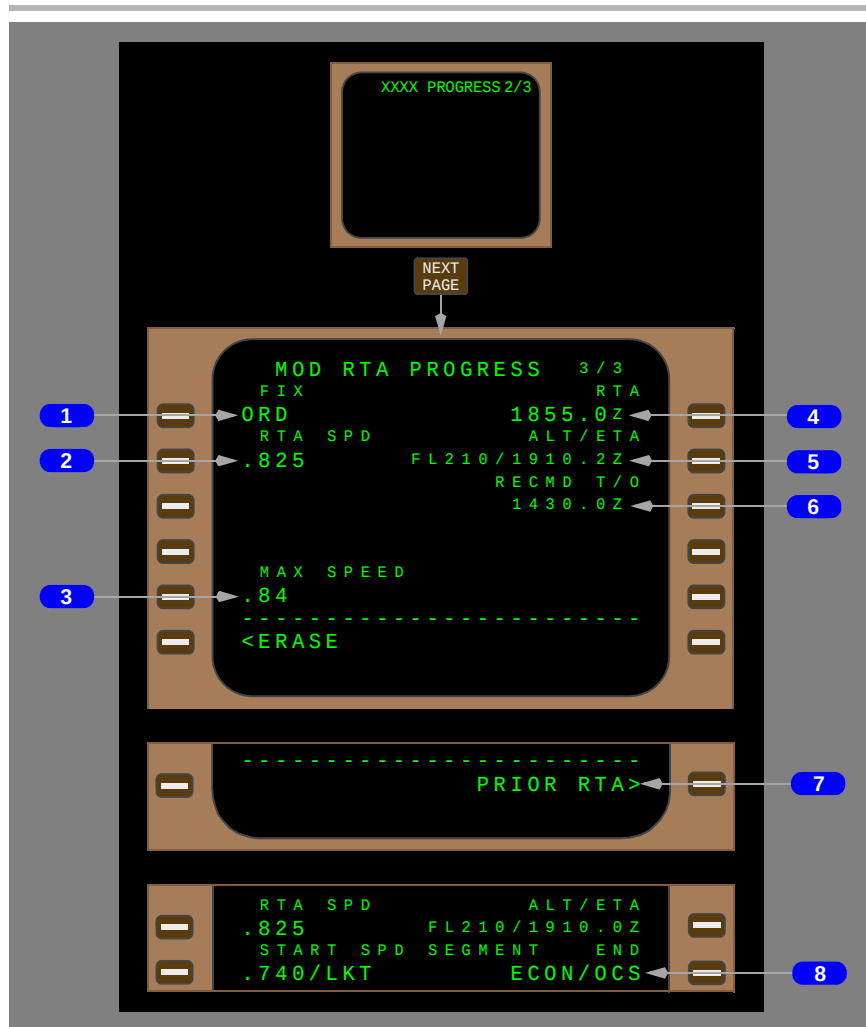
Push – selects method to calculate fuel quantity, either TOTALIZER or CALCULATED.

When one is selected:

- it is used for remainder of flight
- the other fuel calculation method blanks
- scratchpad clears.

RTA Progress Page 3**VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG**

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 PROGRESS and CRZ page titles to include RTA. RTA operations only impact speeds in the cruise phase.



1 FIX

Displays boxes prior to RTA fix entry. Displays is blank when an engine-out mode is active or there is no active or pending active route.

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.

ALT/ETA is displayed in line 2R after a valid FIX is entered.

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When RTA is active, deletion of FIX terminates RTA and resumes ECON. Display returns to boxes.

When RTA not is active, deletion of FIX erases a pending RTA MOD. Display returns to boxes.

2 Required Time Of Arrival Speed (RTA SPD)

Displays FMC computed cruise speed to accomplish RTA.

Blank if no RTA fix or time entered, or with descent active.

3 Maximum Speed (MAX SPD)

Valid entry is Mach .100M to .990M.

Deletion of entered value displays default Mach.

Default Mach .84M displays in small font.

4 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 shows recommended T/O time.

Deletion terminates RTA and returns ECON as cruise mode.

5 Altitude/ETA (ALT/ETA)

Displays predicted altitude and ETA at RTA fix after entry of FIX in 1L.

Blank until performance data is entered.

6 Recommended Takeoff (RECMD T/O)

Displays recommended takeoff time to meet RTA at ECON speed.

Dashes until FIX is entered.

Blanks in flight.

Valid entry is time from 0000.0 to 2359.9. Decimal entry of .0 is optional.

Manual entry recalculates all flight plan time predictions.

Changes to NOW after recommended takeoff time.

When unable to meet the RTA based on a manual takeoff time entry the scratchpad message UNABLE RTA is displayed.

7 PRIOR RTA

Displays when RTA is not active but RTA fix and time previously entered and activated.

Push -

- displays previously active RTA fix and time
- initiates RTA modification.

8 Constant Speed Cruise

Displays constant speed cruise start and end waypoint

Position Report Page

The position report page displays current flight data formatted as a position report. The page contains reference data only. Manual entries are inhibited.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

A data linked position report can be initiated from the page.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

VP-BDI, VP-BMC, VQ-BPT



767 Flight Crew Operations Manual

VP-BWW, VP-BWX, VQ-BOG



VP-BOQ, VP-BOY, VP-BRL, VQ-BMQ, VQ-BMU



1 Position (POS)

Waypoint used to report position. This is the previous active waypoint.

The actual time of arrival (ATA) and altitude (ALT) at the waypoint follow the waypoint name.

2 Estimate (EST)

The active waypoint is displayed with the ETA to that waypoint.

3 NEXT

The waypoint following the active waypoint.

4 Temperature and Wind (TEMP WIND)

TEMP displays the OAT in degrees C.

WIND displays the wind direction and speed. Wind direction is shown in degrees true.

5 Destination ETA (DEST ETA)

The FMC calculated ETA for the destination is displayed.

6 Speed (SPD)

Displays the target FMC speed.

7 Position Fuel (POS FUEL)

Displays the fuel on board at the POS waypoint.

VP-BDI, VP-BMC, VQ-BPT

8 COMPANY SEND

Push – sends a position report to the company via data link.

VP-BWW, VP-BWX, VQ-BOG

8 SEND Prompts

Push – sends a position report to the company or ATC via data link.

VP-BOZ, VQ-BRA

1 Position (POS)

Waypoint used to report position. This is the previous active waypoint.

The actual time of arrival (ATA) and altitude (ALT) at the waypoint follow the waypoint name.

2 Estimate (EST)

The active waypoint is displayed with the ETA to that waypoint.

3 NEXT

The waypoint following the active waypoint.

4 Temperature and Wind (TEMP WIND)

TEMP displays the OAT in degrees C.

WIND displays the wind direction and speed. Wind direction is shown in degrees true.

5 PROGRESS

Push – displays progress page.

6 Position Fuel (POS FUEL)

Displays the fuel on board at the POS waypoint.



Flight Management, Navigation

FMC Descent and Approach

Chapter 11

Section 43

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 at the end of descent point and continues to touchdown or go-around. When a go-around is accomplished, the FMC enters a modified cruise or approach phase, depending on the route and cruise conditions.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Alternates can be selected at any time. Alternates are available from preflight through all phases of flight and can be updated at any time. Diversion to an alternate can be accomplished during cruise, descent, or approach.

As the airplane passes the top of descent point with VNAV engaged, the descent page becomes active and the CDU automatically changes from the cruise page to the descent page.

Early Descent

Descent for the approach and landing may be commenced before reaching the top of descent point. The description of early descent options and functions is in Section 42, FMC Cruise.

Descent

During descent, LNAV is managed using the RTE LEGS page, as in the cruise phase. VNAV descent management is accomplished primarily on the DES page.

Other pages which support descent are:

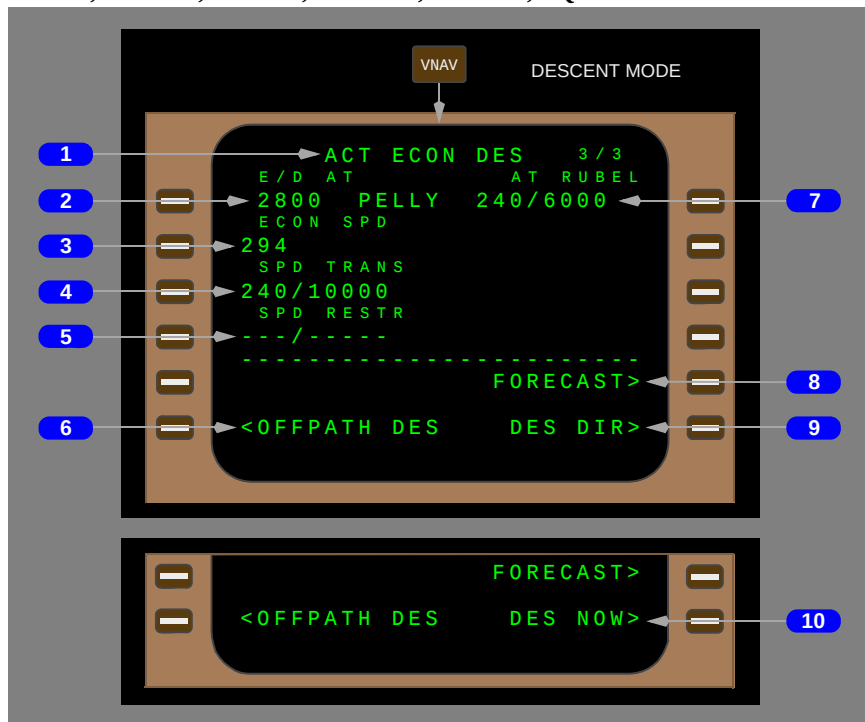
- DESCENT FORECAST page – to enter forecast wind data to aid descent planning
- OFFPATH DES page – to analyze descent performance with and without the use of speedbrakes

Descent Page

The descent page is used to monitor and revise the descent path. Descent speed modes 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 is no longer available after the end of descent.

The 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 until a lower speed restriction is reached.

VP-BDI, VP-BMC, VP-BOY, VP-BWW, VP-BWX, VQ-BOG



VP-BOQ, VP-BOZ, VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA



1 Page Title

The title usually shows ECON during descent. Fixed speed descents modify the title.

The page title shows the type of descent:

- ECON – speed based on a cost index
- LIM SPD – speed based on airplane configuration limiting speed
- MCP SPD – MCP speed intervention is selected
- XXXKT – fixed CAS descent speed profile
- M.XXX – fixed Mach descent speed profile
- ACT – prefix shown when descent phase is active
- MOD – prefix shown when descent phase is active and the flight plan is modified.

Reasons for fixed descent speeds are:

- waypoint speed constraints
- an altitude constraint associated with a speed constraint
- a speed transition
- a flight crew entered selected speed (SEL SPD).

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.

Blank if no E/D point exists.

3 Economy Speed (ECON SPD), Selected Speed (SEL SPD)

Shows the current target descent speed.

ECON SPD –

- economy speed based on cost index
- shows CAS or Mach.

SEL SPD –

- shows when intermediate level off required below an existing speed constraint
- shows when flight crew enters speed
- CAS or Mach value may be entered.
- page title changes to ACT XXXKT DES or ACT M.XXX DES
- <ECON prompt appears at line 5L to allow selection of economy descent speed.

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 is shown. The transition altitude is the point that the transition speed is active for the destination airport. When no altitude exists in the navigation database, the default of 10,000 feet is shown.

Blanks when the transition has occurred.

Can be deleted.

5 Speed Restriction (SPD RESTR)

Speed restrictions not associated with specific waypoints 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.

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.

Line title shows:

- AT XXXXX (the waypoint identifier)
- HOLD AT XXXXX
- AT VECTORS
- AT (INTC).

The constraint is speed/altitude. Blank when no constraint exists.

Can be deleted on this page.

VNAV commands the lesser of constraint speed or present performance speed.

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.

Shown in descent phase with altitude constraint between airplane and E/D.

10 Descend Now (DES NOW)

Shown when the descent phase is not active.

Push –

- starts a 1250 feet per minute descent schedule until intercepting the planned descent path
- activates the FMC descent phase.

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.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT



TRANS LVL	TAI/ON	ALT
FL180	---	---
FL290	090°/105KT	---
FL210	078°/69KT	---
5000	130°/29KT	---
---	---°/---KT	---
REQUEST		---
<SEND		DES>

1 Transition Level (TRANS LVL)

Shows 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 REQUEST SEND

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. The FMC calculates the descent profile based on the higher thrust caused by thermal anti-ice operation below this altitude.

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 – shows the DES page.

VP-BOQ through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BRA



1 Transition Level (TRANS LVL)

Shows 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 Thermal Anti-Ice On Altitude (TAI/ON ALT)

Enter the altitude where anti-ice is first turned on during the descent. The FMC calculates the descent profile based on the higher thrust caused by thermal anti-ice operation below this altitude.

4 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.

5 Descent (DES)

Push – shows the DES page.

Offpath Descent Page

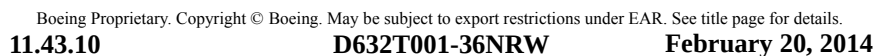
The offpath descent page allows the analysis of descent performance off the present route of flight, direct to a selected waypoint. Data entered on the page shows clean and drag descent ranges on the page and on the map display. The ranges are based on an entered waypoint and altitude constraint. The range can be used to determine if the altitude constraint can be met in a direct descent to the waypoint.

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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.

VP-BDI through VP-BOY, VP-BWW through VQ-BPT





VP-BRL

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)

Shows the straight line distance to the entered waypoint.

3 Speed/Altitude (SPD/ALT)

Shows the speed/altitude constraint for the entered waypoint.

A manual waypoint entry shows 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 is shown on the map display 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 is shown on the map display when the DISPLAY prompt is ON and the airplane is inside the clean circle.

VP-BDI through VP-BOY, VP-BWW through VQ-BPT

6 DISPLAY

Push – alternates between ON and OFF.

ON – shows the clean and drag circles on the map display. The drag circle is not displayed until the airplane position is inside the clean circle.

OFF – removes the clean and drag circles from the map display.

Selected state is large font.

Automatically changes to OFF within 150 feet of the waypoint constraint altitude.

VP-BOZ, VQ-BRA

6 DISPLAY

Push – when SELECT ON is displayed, displays the clean circle on the map display and changes the prompt to SELECT OFF. The drag circle is not displayed until the airplane position is inside the clean circle.

Push – when SELECT OFF is displayed, removes the clean and drag circles from the map display and changes the prompt to SELECT ON.

The displayed circles are automatically selected off and the prompt changes to SELECT ON when the airplane is 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.

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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 DESCENT 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
- HOLD page – to manage holding patterns
- **VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA**
- APPROACH REF page – to specify approach flap settings and set the approach VREF speed
- **VP-BMC, VP-BOY, VP-BOZ, VQ-BMU**
- APPROACH REF page – to access the FMC calculated approach VREF speed

Holding is described in this section but it can be used during any phase of flight.

Arrivals Page – IFR Approaches

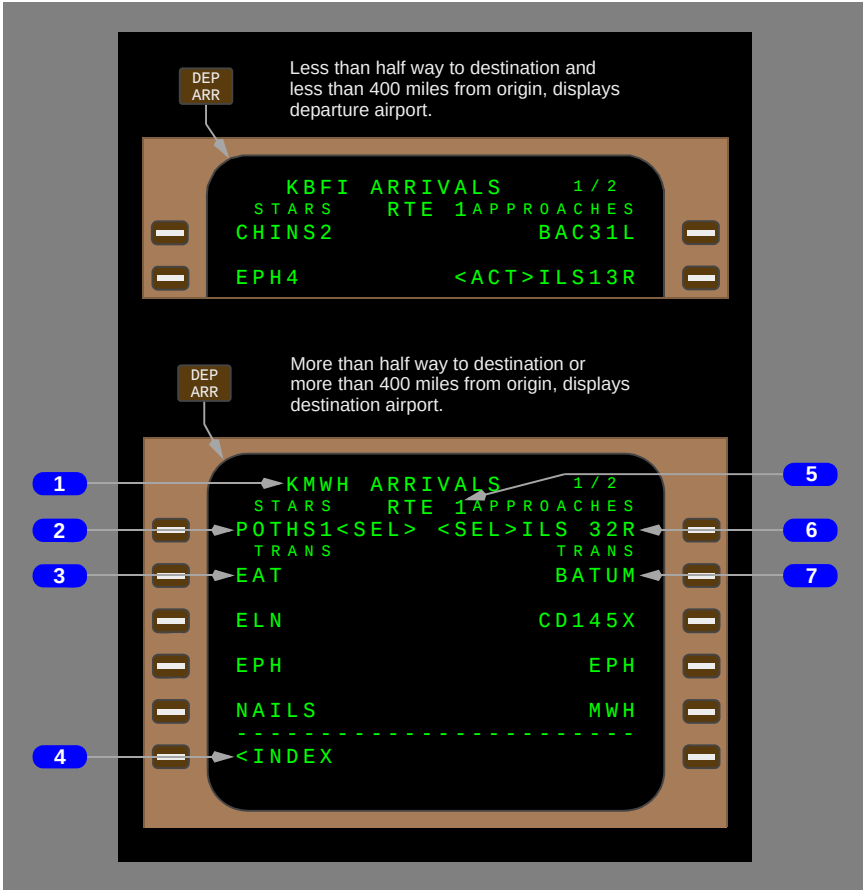
The arrivals page allows selection of an approach, standard terminal arrival route (STAR), and an arrival transition to the destination airport. This page can also be used to view data about a selected airport that is not the destination. Route 1 and Route 2 have separate arrival pages.

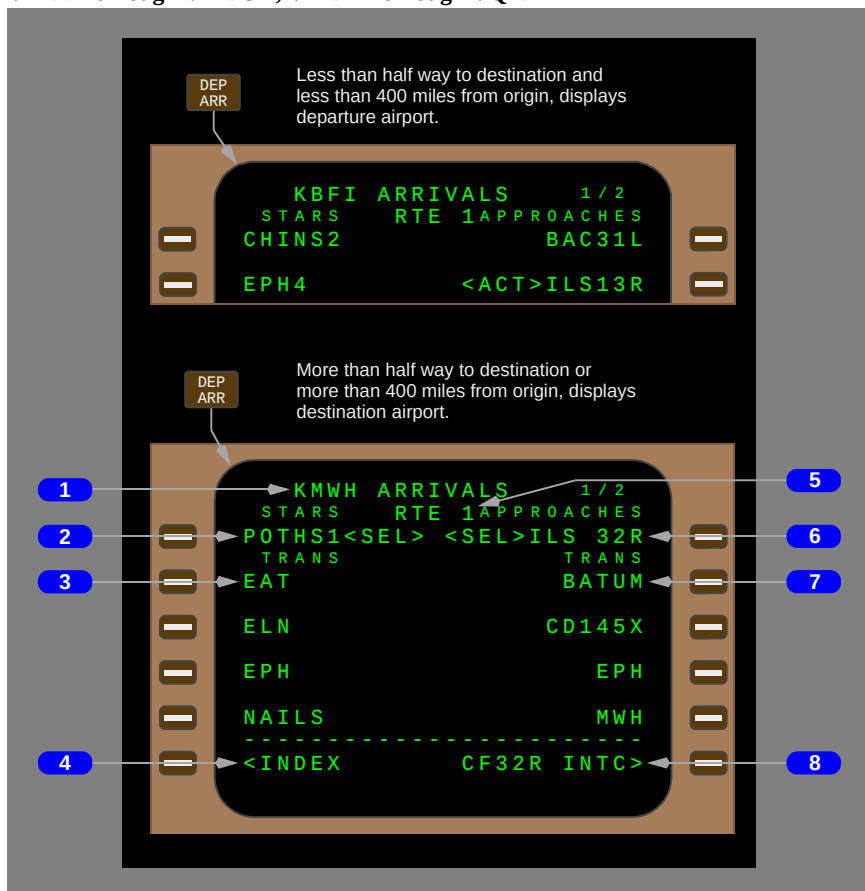
The approaches, STARS/profile descents, and transitions are shown and selected on this page.

Selecting Options

Selecting a runway, approach, approach transition, STAR/profile descent, or descent transition option shows <SEL> inboard of the selection, and makes a route modification. The other options within the same category are removed from the list. When the modification is executed, <SEL> changes to <ACT>. Select another page and return to ARRIVALS to show all options; the applicable <SEL> or <ACT> prompts are shown.

VP-BOZ, VQ-BRA



VP-BDI through VP-BOY, VP-BRL through VQ-BPT

1 Page Title

The destination airport identifier is shown in the title.

Airports with more than 5 runways or STARS produce multiple arrivals pages.

2 Standard Terminal Arrivals (STARS)

Lists the STARS and PROFILE DESCENTS for the airport.

STARS are shown first in a list under the STAR line title. Profile descents are listed after the STARS under the PROF DES line title.

When a selection is made the procedures not selected are removed from the page. The selected procedure is listed with <SEL> and a list of compatible transitions is shown.

3 Standard Terminal Arrivals Transitions (STARS TRANS)

Lists all the transitions for the selected STAR.

When a selection is made the transitions not selected are removed from the page. The selected transition is listed and marked <SEL>.

4 INDEX

Push – shows the DEP/ARR INDEX page.

5 Route 1 (RTE 1)

Shows the active route number (RTE 1 or RTE 2).

6 APPROACHES

Lists all approaches and runways for the destination airport.

When a selection is made, other approaches and runways are removed from the page and compatible transitions are listed. The list of STARS and profile descents is reduced to those compatible with the selected approach.

7 Approach Transitions (APPROACHES TRANS)

Transitions are listed when an approach is selected. Shows a list of available transitions to the selected approach.

Approach transitions include:

- IAF
- feeder fix
- fixes which define routing to the FAF.

Selecting an approach without a transition makes a straight-in approach which starts at:

- a charted fix or CFXXX, where XXX is the runway number
- a waypoint 4–8 miles outside the final approach fix.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

8 Final Approach Fix Intercept (XXXXX INTC)

Selecting the prompt shows a modified RTE LEGS page with an intercept course to the approach transition fix (usually the IAF) for the selected approach.

Vertical Angle Display on the Route Legs Page

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

When a runway is selected as part of the active route the vertical angle of the flight path approaching the runway is displayed on the RTE LEGS page.



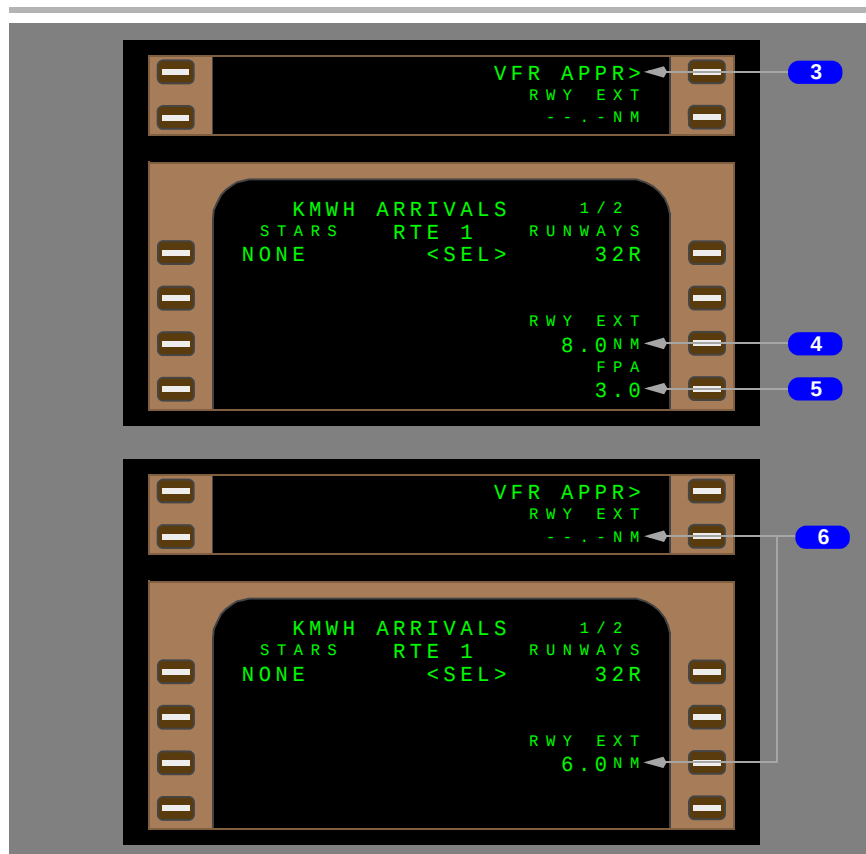
1 Glide Path (GP) Angle

Displays the vertical angle for use by VNAV on the 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

The arrivals page also allows selection of a VFR approach if the navigation database contains a VFR approach for the selected runway.





1 RUNWAYS

Push – removes approach list and other runways. Displays RWY EXT prompt and VFR APPR prompt in line 2 if a VFR approach is in the navigation database.

The RUNWAYS list for other runways is shown if a runway is not selected. Example shows runway 32R selected. Change the CDU to another page and return to the ARRIVALS page to show all arrival procedures.

2 ROUTE

Push – shows the active route page 2/X.

3 VFR Approach (VFR APPR)

Push – makes a transition waypoint, FAXXX at 8 NM and 2000 feet above the runway.

Shown when a VFR approach is in navigation data base for selected runway.

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LNAV and VNAV guidance to the runway is available.

4 Runway Extension (RWY EXT)

After VFR APPR is selected, RWY EXT can not be modified.

5 Flight Path Angle (FPA)

Shows flight path angle. Shown only after VFR APPR is selected.

Default is 3.0 degrees. Valid entries are from 2.4 to 3.7 degrees.

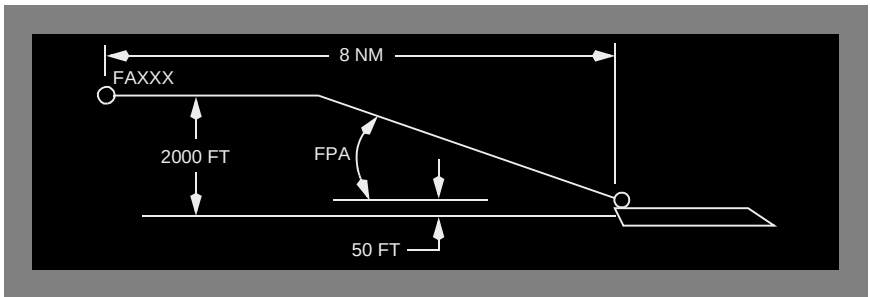
6 Runway Extension (RWY EXT)

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.

VFR Approach Path



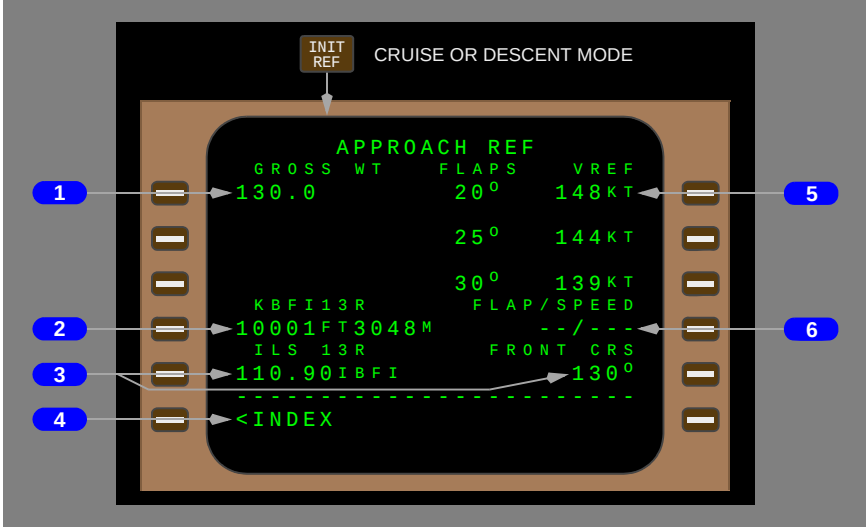
The VFR approach is a level path until the FPA is intercepted. The FPA goes from the FAXXX waypoint altitude to the runway threshold at 50 feet and 170 knots. Default values are shown in RWY EXT and FPA.



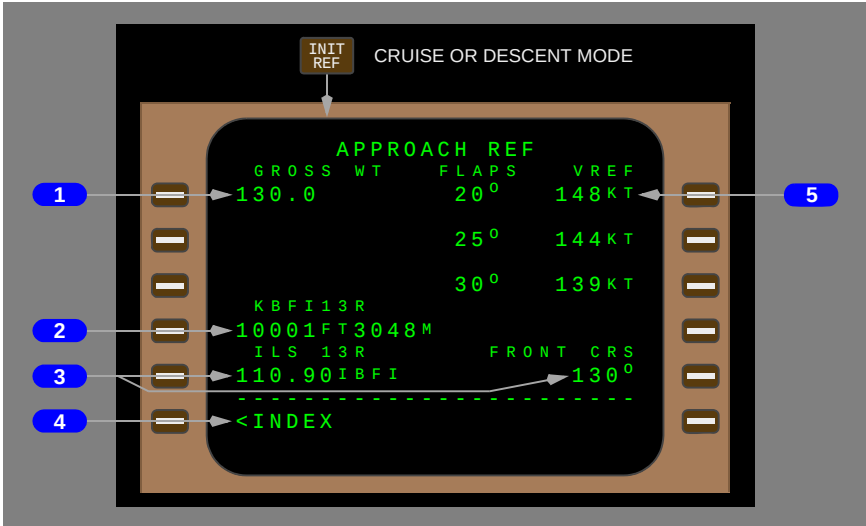
Approach Reference Page

The approach reference page shows approach planning data and approach reference speed (VREF) selection.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA



VP-BMC, VP-BOY, VP-BOZ, VQ-BMU



1 Gross Weight (GROSS WT)

FMC calculated airplane gross weight is usually shown.

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 is for reference only and is deleted when a different page is selected. Permanent changes to gross weight may only be made on the PERF INIT page.

Shows boxes when gross weight is not available from the FMC.

Valid entry is XXX.X.

2 Runway Length

The shown runway reference changes based on route progress. The destination runway is the reference when the present position is more than halfway to the destination or more than 400 NM from the origin airport. The origin airport runway is the reference when less than halfway or less than 400 NM from the origin airport.

Shows the length of the referenced runway in feet and meters.

3 ILS Frequency and FRONT Course (CRS)

Display is blank prior to entering a destination runway in the active route.

Displays the runway, corresponding ILS frequency, facility identifier and FRONT CRS from the navigation database for the runway shown.

4 INDEX

Push – shows 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.

Shows the calculated reference speed for flaps 20°, 25°, and 30°.

The display is blank until a gross weight is shown.

VP-BDI, VP-BOQ, VP-BRL through VQ-BMQ, VQ-BOG through VQ-BRA

6 FLAP/SPEED

The flap position and VREF speed is entered for landing.

The VREF speed is shown on the ADI speedtape.

Deletion of the data removes VREF from the ADI.

Alternate Airport Diversions

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

The ALTN page data helps the flight crew find the best alternate airport. The page has four airports shown in an ETA sequence. Each airport on the list has an ALTN XXXX page with more data. Select the ALTN XXXX page with a caret.

I VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

There are three uplinks messages that provide alternate airport data. The Company Preferred Alternates Uplink provides up to 4 alternate airports that are listed on the ALTN page 1/2. The Alternates Flight List Uplink provides a list of up to twenty alternate airports that are listed on ALTN page 2/2. And the Alternates Inhibit Uplink provides up to two alternate airports that are listed on the inhibit lines of ALTN page 1/2.

Alternate Page

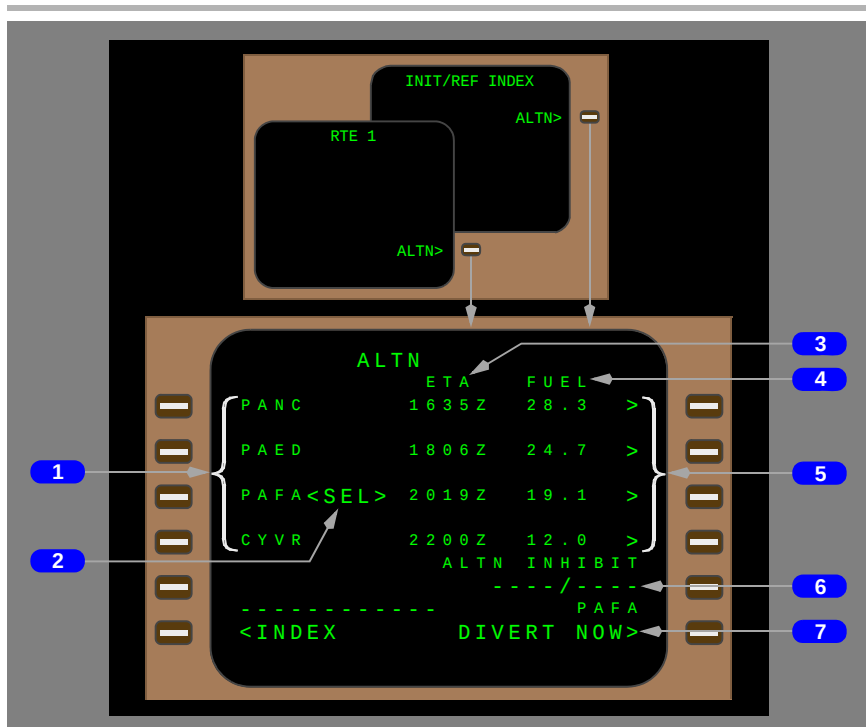
VP-BOQ, VP-BOY, VP-BRL, VQ-BMQ, VQ-BMU

The alternate page displays a list of alternate airports. An alternate airport can be selected from this page to change the flight plan destination.

The page displays a list of up to four alternate airports sorted in order of the ETA to the airport while airborne. The source of alternate airports can be:

- automatic selection from the navigation database
- manual entry.

Alternate airports automatically selected from the navigation database are displayed in small font. The presently selected alternate airport is shown on the map display in normal airport symbology. All four alternate airports are shown on the plan mode.



1 Alternate Airports

Displays the identifier of four alternate airports in ETA order when airborne. Displays the identifier of four alternate airports in distance order when on the ground.

Valid manual entry is an airport from the navigation database. A manual entry replaces the alternate where the entry is made and is shown in large font. After entry, the four airports are resequenced according to ETA.

Use the DELETE function to remove manually entered alternate airports from the ALTN page.

2 Selected (<SEL>), Automatically Selected (<A>)

<SEL> indicates a manually selected alternate airport.

A manual selection of an alternate airport is made by pushing the line select key left of the airport identifier with nothing in the scratchpad.

When there is no manually selected alternate the FMC automatically selects the alternate airport with the earliest ETA. Automatically selected alternates are indicated by <A> next to the airport identifier.

The selected alternate identifier is shown in the line title of the DIVERT NOW prompt.

Entering a new airport into the list deletes the last airport in the list and selects the new airport. After entry, the airports are rearranged in ETA sequence. Manually entered airports are shown in large font and can be removed using the DELETE function.

Use the DELETE function to remove the <SEL> from a manually selected alternate. The automatic selection function selects a new alternate.

3 ETA

Displays the alternate airport ETA.

ETA is calculated based on the routing, altitude, and speed shown on the XXXX ALTN page. ETA is blank when the airplane is on the ground.

4 FUEL

Displays the alternate airport predicted arrival fuel.

Predicted arrival fuel is calculated based on the routing, altitude, and speed shown on the XXXX ALTN page and includes a descent direct from a computed T/D to the ALTN airport at idle thrust. The message UNABLE FUEL is shown in the FUEL column if the predicted arrival fuel is less than zero.

Fuel values are blank when the airplane is on the ground.

5 Alternate Select

Selects the XXXX ALTN page, which contains more data about the specific airport.

6 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 manually entered.

Valid entries are airports from the navigation database.

7 DIVERT NOW

The DIVERT NOW selection modifies the route to go from the present position to the selected alternate using the route shown on the XXXX ALTN page.

Push –

- makes an LNAV route modification for a divert to the selected alternate
- automatically displays the MOD XXXX ALTN page for the selected alternate



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- displays SELECTED in this position on the CDUs not involved with the modification
- blank on ground
- blank in the air when a diversion is not permitted.

The DIVERT NOW selection changes the display to 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
- if a descent path exists, deletes all descent constraints (the scratchpad message DESCENT PATH DELETED is shown when DIVERT NOW is selected).

After a divert is executed the XXXX ALTN page is not updated until all CDUs are selected off of the XXXX ALTN page.

Alternate Page 1/2

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

The first alternate page displays alternate airport data. An alternate airport can be selected to change the flight plan destination.

The page displays a list of up to four alternate airports sorted in order of the ETA to the airport while airborne. 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 are shown in a small font. The presently selected alternate airport is shown on the map display in normal airport symbology. All four alternate airports are shown on the plan mode.



1 Alternate Airports

Displays the identifier of the four alternate airports in ETA order when airborne. Displays the identifier of the four alternate airports in distance order when on the ground.

Valid manual entry is an airport from the navigation database. A manual entry replaces the alternate where the entry is made and is shown in large font. After entry, the four airports are resequenced according to ETA.

The DELETE function key can be used to remove manually entered alternate airports from the ALTN page.

2 Selected (<SEL>), Automatically Selected (<A>)

<SEL> indicates a manually selected alternate airport.

A manual selection of an alternate airport is made by pushing the line select key left of the airport identifier with nothing in the scratchpad.

When there is no manually selected alternate the FMC automatically selects the alternate airport with the earliest ETA. Automatically selected alternates are indicated by <A> next to the airport identifier.

The selected alternate identifier is shown in the line title of the DIVERT NOW prompt.

Entering a new airport into the list deletes the last airport in the list. After entry, the airports are rearranged in ETA sequence. Manually entered airports are shown in large font and can be removed using the DELETE function.

Use the DELETE function to remove the <SEL> from a manually selected alternate. The automatic selection function selects a new alternate.

3 Alternate Request (REQUEST SEND)

Push – transmits a data link request for company preferred alternates (up to four).

Uplinked airports are shown 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.

4 Weather Request (WXR REQUEST SEND)

Push – transmits a data link request for alternate airport weather data.

Uplinked weather is sent to the flight deck printer.

5 ETA

Displays the alternate airport ETA.

ETA is calculated based on the routing, altitude, and speed shown on the XXXX ALTN page. ETA is blank when the airplane is on the ground.

6 FUEL

Displays the alternate airport predicted arrival fuel.

Predicted arrival fuel is calculated based on the routing, altitude, and speed shown on the XXXX ALTN page and includes a descent direct from a computed T/D to the ALTN airport at idle thrust. The message UNABLE FUEL is shown in the FUEL column if the predicted arrival fuel is less than zero.

Fuel values are blank when the airplane is on the ground.

7 Alternate Select

Selects the XXXX ALTN page, which contains more data about the specific airport.

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

The DIVERT NOW selection modifies the route to go from the present position to the selected alternate using the route shown on the XXXX ALTN page.

Push –

- makes an LNAV route modification for a divert to the selected alternate
- automatically displays the MOD XXXX ALTN page for the selected alternate
- displays SELECTED in this position on the CDUs not involved with the modification
- blank on ground
- blank in the air when a diversion is not permitted.

The DIVERT NOW selection changes the display to 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
- if a descent path exists, deletes all descent constraints (the scratchpad message DESCENT PATH DELETED is shown when DIVERT NOW is selected).

After a divert is executed the XXXX ALTN page is not updated until all CDUs are selected off of the XXXX ALTN page.

Alternate List Page 2/2

| VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

The second alternate page displays a list of previously uplinked alternate airports. The alternates shown on the ALTN 1/2 page are automatically selected from this list, or from the navigation database when a list does not exist.



1 Alternate Airports List

The four lines contain up to 20 airports from which the alternates shown on the ALTN page 1/2 are automatically selected.

The alternates shown on the ALTN 1/2 page are selected by the FMC from this list when manually selected and preferred uplinked airports do not use all four selections.

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 SEND)

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)

The entire alternate list can be deleted. A new list must be uplinked after a purge. When no list exists, the alternate airports are automatically selected from the navigation database.

Selecting PURGE arms the purge function and displays the CONFIRM prompt.

Selecting CONFIRM permanently deletes all airports from the alternate airport list.

XXXX Alternate Page

Each of the four alternate airports shown on the ALTN page 1/2 have a related XXXX ALTN page. The XXXX ALTN pages show specific data about alternate airports, the route used for a diversion, and the conditions upon which the ETA and fuel calculations are based. All data on the page is related to the alternate airport shown 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 is identified by <SEL>. ETA and fuel remaining are calculated based on the selected option. Selection of a route option for one alternate selects the same route option for the other three alternates.



1 VIA DIRECT TO

Push – selects present position DIRECT TO alternate 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 option.

Entry and exit to the offset is the same as for the RTE page offset. All flight plan waypoints are kept.

3 VIA OVERHEAD

Push –

- with scratchpad empty, selects OVERHEAD option
- with overhead data in scratchpad, enters overhead data. Does not select route option.

Displays active waypoint in flight plan.

The waypoints up to the selected or entered overhead waypoint are kept, 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 displays the message UNABLE ALT, 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 into these lines causes a recomputation of ETA and arrival fuel. A separate wind entry may be made for each of the four alternates.

Displays the estimated average wind for the divert route.

Valid entry is a direction in degrees/speed in knots from 1 to 999.

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 the calculated airport ETA and arrival fuel based on the selected route, altitude, and speed shown on this page and includes a descent direct from a computed T/D to the ALTN airport at idle thrust.

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.

VP-BOY, VP-BOZ, VQ-BRA
(SB Deletes VP-BMC when incorporated.)

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.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

(SB Adds VP-BMC when Pegasus 2003-2009 software is installed.)

Entry to a holding pattern is via the parallel, teardrop, or direct entry methods, dependant upon the airplane's track to the hold fix. However, to make efficient use of the holding airspace, the airplane may begin the initial turn to the holding entry maneuver, parallel, teardrop or direct, just prior to crossing the hold fix ("fly-by"). In all entry maneuvers the airplane will "fly-over" or "fly-by" the holding fix as appropriate to remain on the holding side of the inbound hold course. Teardrop and parallel entry flight maneuvers are flown within the confines of the displayed holding pattern. Direct entry maneuvers may extend slightly beyond the end of the hold pattern.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT

(SB Adds VP-BMC when Pegasus 2003-2009 software is installed.)

Note: The holding pattern entry flight path is shown when the selected display range is 40 NM or less, and the holding fix is the active waypoint.

Hold Page (First Hold)

The hold page is used to enter a holding pattern into the route.

When the flight plan does not have a holding pattern, push the HOLD function key to show the RTE X LEGS page with the HOLD AT line.

Two versions of the hold page are possible:

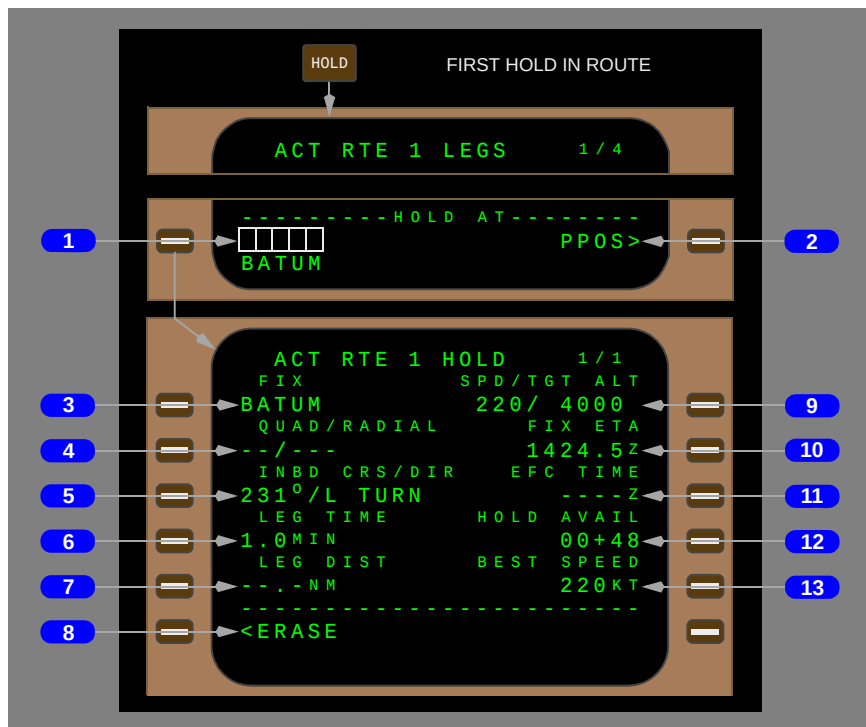
- an airway or procedure holding pattern
- a flight crew-entered holding pattern.

The holding page displays actual or default data about the holding pattern.

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Entries make route modifications, which can be erased or executed.

Active holding patterns are displayed in magenta.


1 HOLD AT

When the HOLD function key is pushed and no holding pattern exists in the route, the RTE LEGS page displays prompts to enter the holding fix. Enter the holding fix to show the RTE X HOLD page.

Normally a route waypoint is entered as the holding fix. If a waypoint that is not part of the active route is entered the scratchpad message HOLD AT XXX appears where XXX is the entered waypoint. The holding fix can then be inserted in the route in the proper sequence.

2 HOLD AT Present Position (PPOS)

Selects the airplane present position as the holding fix.

3 Holding FIX

Displays the holding fix.

4 Quadrant/Radial (QUAD/RADIAL)

The holding quadrant and radial are entered.

Valid entry is X/XXX, XX/XXX, or /XXX (example NE/040).

Automatically changes INBD CRS/DIR to agree.

5 Inbound Course/Direction (INBD CRS/DIR)

Displays the holding inbound course and turn direction.

Valid entry is XXX (inbound course), XXX/X (inbound course/turn direction), /X or X (turn direction).

Automatically changes QUAD/RADIAL to agree.

6 LEG TIME

Default display is 1.0 MIN (minute) at or below 14,000 feet or 1.5 MIN above 14,000 feet.

Displays — if a LEG DIST is entered.

Valid entry is X, X.X, or .X in minutes from 0.1 to 9.9.

When climbing/descending through 14,000 feet with VNAV engaged and the SPD/TGT ALT values are displayed in large font, the FMC adjusts leg time (1.0 MIN at or below 14, 000 feet; 1.5 MIN above 14, 000 feet).

7 Leg Distance (LEG DIST)

Default display is — NM if no leg distance has been entered or if a LEG TIME is entered.

Valid entry is X.X, XX.X, or .X.

8 ERASE

Erases all FMC modifications.

9 Speed/Target Altitude (SPD/TGT ALT)

Waypoint holding fix speed/altitude constraint from the RTE LEGS page.

Manual entries are in large font.

During cruise, an altitude entry below cruise altitude activates the descent page, unless a new cruise altitude is entered. Altitude entry must be at or below cruise altitude.

A speed entry requires an altitude constraint.

10 FIX ETA

Displays the ETA to the next passing of the holding fix.

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11 Expect Further Clearance Time (EFC TIME)

Enter the expect further clearance time to enable accurate fuel and ETA predictions after the hold.

12 Hold Available (HOLD AVAIL)

Displays calculated 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 are already in the route, push the HOLD key to show the hold page for the first holding pattern. Holding parameters can be monitored and changed on this page. New holding patterns are added using the NEXT HOLD prompt.



1 NEXT HOLD

Push – displays a new hold page for a new holding pattern entry.

2 EXIT HOLD

Push –

- arms a return to the holding fix via the inbound course for holding pattern exit
- EXIT ARMED displayed
- EXEC light illuminated.

When the EXEC key is pushed, the airplane will cross the holding fix and exit holding. If executed when outbound in the holding pattern, the airplane will immediately turn inbound and exit holding when the fix is crossed.



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VP-BDI, VP-BOQ, VP-BRL through VQ-BPT (SB Adds VP-BMC when Pegasus 2003-2009 software is installed.)

The exit flight path is displayed as part of the active route when executed. Exit from the hold will be initiated prior to crossing the holding fix ("fly-by") if the course to the next route waypoint is not closely aligned with the inbound holding course. Acute angles between the inbound holding course and the course to the next waypoint may result in a substantial distance from the airplane to the holding fix during the exit maneuver; however, flight is maintained within FAA or ICAO protected holding airspace at all times.

VP-BDI, VP-BOQ, VP-BRL through VQ-BPT (SB Adds VP-BMC when Pegasus 2003-2009 software is installed.)

Note: If a turn (course change) of 110° - 135° is required to exit the hold toward the next flight plan waypoint, the exit flight path may be displayed as a zigzag line, typically in the shape of a Z. In all instances, LNAV provides appropriate guidance via a smooth turn to intercept the active leg to the next route waypoint. There is no indication on the FMC CDU LEGS page if the displayed exit flight path is irregular.

Intentionally
Blank



This Section Applies to VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

Introduction

The CDUs can be used as an alternate navigation system if both FMCs fail. The CDUs perform lateral navigation computations. LNAV and VNAV are not available.

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.

Each CDU performs its calculations based on inputs from its own IRS and provides information for display independent of the other CDU. Each CDU can display its route on its respective map display without database symbology.

Alternate Navigation Waypoints

The CDUs do not have a performance or navigation database. The CDUs continuously load the active route from the FMC. If both FMCs fail, the CDUs keep flight plan waypoints except for conditional waypoints, offsets, and holding patterns. Waypoints which are part of the route when the FMCs fail can be referenced by either their identifier, or latitude and longitude.

New waypoints can only be entered as latitude and longitude. This includes waypoints the flight crew has deleted from the CDU. Complete departure or arrival/approach procedures cannot be manually entered.

Waypoint Operations

Waypoint operations include:

- add new waypoints (latitude/longitude entry only)
- remove existing waypoints
- change the sequence of existing waypoints
- connect discontinuities.

Alternate Lateral Navigation

All CDU calculations are based on a great-circle course between waypoints.

Route Changes

Route changes are made on IRS 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.

The two CDUs operate independently. A route change to one CDU does not change the other one. The route entered in the left CDU can be displayed on the captain's HSI using the left NAV source select switch. The route entered in the right CDU can be displayed on the first officer's HSI using the right NAV source select switch.

Course Reference

Each CDU uses its associated IRS for navigation data. The IRS supplies magnetic variation only for the present position. Therefore only the active waypoint course can be referenced to magnetic north. All subsequent courses are referenced to true north.

Alternate Navigation CDU Pages

The alternate navigation system provides two CDU pages:

- IRS LEGS
- IRS PROGRESS

Failure of a single FMC causes the related CDU to display the MENU page. Selecting the operable FMC on the NAV selector switch restores the CDU displays to normal.

If the other FMC fails, the IRS LEGS and IRS PROGRESS pages are available on either CDU via the LEGS and PROG mode select keys. Selecting CDU on the NAV source selectors provides a CDU generated map on the map display.

IRS 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 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.

2 Waypoint Identifier

Displays the waypoint by name or latitude/longitude.

Valid entries are waypoint names that were in the route when the FMCs failed, or latitude/longitude for new waypoints.

3 Distance to Waypoint

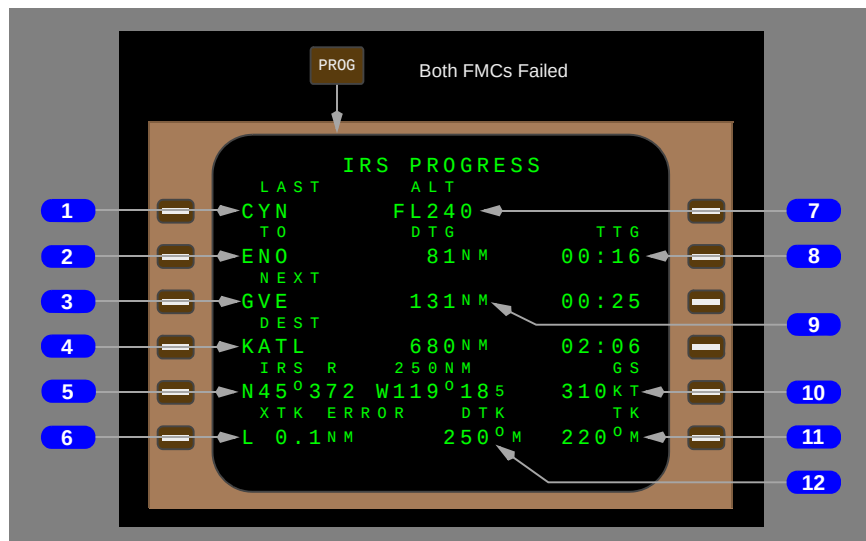
Displays the great circle distance between waypoints.

4 Waypoint Coordinates

Displays the waypoint coordinates.

IRS Progress Page

This page shows general data about flight progress.



1 LAST

Displays the identifier of the last waypoint.

2 TO

Displays the active waypoint.

3 NEXT

Displays the waypoint after the TO waypoint.

4 Destination (DEST)

Displays identifier for 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 along the track to the enroute 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 IRS Position

Displays IRS present position.

Line title displays IRS source for 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 waypoint or destination.

9 Distance to Go (DTG)

Displays distance to go to waypoint or destination.

10 Ground Speed (GS)

Displays IRS 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.

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**Flight Management, Navigation**
EICAS Messages**Chapter 11**
Section 60**EICAS and CDU Messages**

The following EICAS messages can be displayed to alert the flight crew to navigation system faults and failures.

Message	Level	Light	Aural	Condition

VP-BMC, VP-BOY, VP-BOZ, VQ-BRA

ATC FAULT	Advisory	ATC FAIL		Selected transponder has failed.

VP-BWW through VQ-BMU, VQ-BPT

ATC FAULT	Advisory			Selected transponder has failed.

VP-BDI, VP-BOQ, VP-BRL, VQ-BOG

ATC FAULT	Advisory	XPNDR FAIL		Selected transponder has failed.

L FMC FAIL R FMC FAIL	Advisory	FAIL		FMC has failed.
FMC MESSAGE	Advisory	FMC		A message is in the FMC scratchpad.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

L GPS R GPS	Advisory			Indicated GPS has failed.
GPS	Advisory			GPS system has failed.

L IRS DC FAIL C IRS DC FAIL R IRS DC FAIL	Advisory	DC FAIL		IRS DC backup power has failed and the IRS AC normal power is being used.

Message	Level	Light	Aural	Condition
L IRS FAULT C IRS FAULT R IRS FAULT	Advisory	FAULT		An IRS fault is detected.
L IRS ON DC C IRS ON DC R IRS ON DC	Advisory	ON DC		Indicated IRS AC normal power has failed and the IRS DC backup power is being used.

VP-BDI, VP-BMC, VP-BOY, VP-BRL through VQ-BPT

UNABLE RNP	Caution		Beeper	Navigation performance not meeting required accuracy. Message is a caution if fault occurs when the airplane is in "on approach" mode.
	Advisory			Message is an advisory if fault occurs when the airplane is not in "on approach" mode.

FMC Messages

FMC messages alert the flight crew to conditions that could degrade the system operation and advise the crew of input errors.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

FMC messages also alert the flight crew to FMC datalink communications.

The messages are categorized as:

- alerting messages
- advisory messages

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

- communications messages

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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 FMC light illuminates and the EICAS advisory message FMC MESSAGE displays when there is an FMC alerting message.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

The EICAS displays the white communications message •FMC when there is an FMC communications message.

VP-BWW, VP-BWX, VQ-BOG

The EICAS displays the white communications message •ATC when there is an ATC communications message.

Scratchpad advisory messages appear in the scratchpad without an EICAS message or FMC light. All FMC messages illuminate the CDU message (MSG) light. Clear the message or correct the condition to cancel the message.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

Keying data into the scratchpad that contains an FMC message temporarily removes the message from the scratchpad. The message reappears in the scratchpad when the data is line selected into a display or cleared from the scratchpad.

VP-BOZ, VQ-BRA

The scratchpad must be cleared of any FMC messages before manual entries are possible.

FMC Alerting Messages

FMC alerting messages:

- display in the CDU scratchpad
- illuminate the amber FMC light on the center instrument panel
- 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.

VP-BWW, VP-BWX, VQ-BOG

ATC COMM ESTABLISHED – the active ATC data link connection is successfully established following initial AFN logon or a successful transfer.

VP-BWW, VP-BWX, VQ-BOG

ATC COMM TERMINATED – the active ATC data link connection is terminated without transfer.

VP-BWW, VP-BWX, VQ-BOG

ATC REPORT LIST FULL – an uplink message which includes an ATC REPORT or CONFIRM request is received and the ATC report list contains 10 reports.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

CHECK AIRLINE POLICY – after loading a new airline modifiable information file, the FMC determines a parameter is invalid. The FMC uses the default value. This is a maintenance function.

CHECK ALT TGT – VNAV active and the airplane is between the MCP and FMC altitudes. VNAV maintains level flight.

CYCLE IRS OFF – NAV – With the airplane on the ground any IRS has detected a condition that requires cycling inertial power off and back to NAV.

DESCENT PATH DELETED – VNAV active and all waypoint altitude constraints defining the descent profile deleted.

Note: This message displays 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 a VECTORS legs).

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 overflowed.

END OF ROUTE – LNAV active and end of active route overflowed. AFDS maintains last heading.

ENTER IRS POSITION – the flight crew-entered present position did not pass one of the IRS comparison checks, or the IRS is ready to change to navigate mode and has not received a present position entry. Use the CLEAR key to remove this message.

FMC L (or R) OUTPUT LOSS – data output or discrete signals from indicated FMC are lost.

FUEL DISAGREE-PROG 2 – totalizer (TOTL) fuel quantity and FMC calculated (CALC) fuel quantity disagree by a significant amount.

VP-BRL

FUEL QTY ERROR – PROG 2 – totalizer fuel quantity and FMC calculated fuel quantity disagree by a significant amount. This message is replaced by the FUEL DISAGREE message on later FMCs.

INSUFFICIENT FUEL – estimated fuel at destination less than entered RESERVES value.

VP-BWW, VP-BWX, VQ-BOG

INVALID ATC UPLINK – an ATC uplink message received by the FMC contains errors.

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IRS MOTION – an IRS has detected motion while in ALIGN.

VP-BOQ, VP-BOZ, VP-BRL, VQ-BRA

IRS NAV ONLY – the FMC has been without radio updating for a predetermined time.

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

IRS NAV ONLY – the FMC has been without radio or GPS updating for a predetermined time.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

IRS POS/ORIGIN DISAGREE – valid inertial position differs from active origin airport.

LIMIT ALT FLXXX – the flight crew– or FMC–selected altitude is greater than the VNAV limit altitude.

VP-BWW, VP-BWX, VQ-BOG

MESSAGE LIMIT EXCEEDED – the flight crew attempts to select more than 5 message elements for inclusion in a downlink message.

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.

VP-BWW, VP-BWX, VQ-BOG

PARTIAL CLEARANCE LOADED – the FMC was able to load only a portion of the data contained in an ATC uplink clearance.

PERF/VNAV UNAVAILABLE – VNAV selected and gross weight, cost index, or cruise altitude are not entered.

VP-BOZ, VQ-BRA

PURGE UPDATES – POS 2 – multiple navaids rejected by the FMC due to a position error.

VP-BWW, VP-BWX, VQ-BOG

RE–LOGON TO ATC COMM – one of the following conditions requires the flight crew to re–initiate ATC logon procedures.

- an invalid END SERVICE message is received
- an ATC LOGON message was transmitted and
 - no valid response received in the allotted time
 - the flight number is changed via the CDU
 - the tail number is changed via the CDU
 - the addressed ATC center sends a negative response.

RESET MCP ALT – 2 minutes prior to the top of descent point with VNAV active and MCP not set to altitude below cruise altitude.

VP-BWW, VP-BWX, VQ-BOG

RESPOND TO ATC UPLINKS – an ATC uplink is received which causes the pending uplink storage to be full.

VP-BOZ, VQ-BRA

RESYNC FAIL – SINGLE FMC – re synchronization attempt failed and one FMC is shut down.

VP-BOZ, VQ-BRA

RESYNCING OTHER FMC – offside FMC has just powered up or failed comparison data check and is being re synchronized to onside FMC.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

RTA FIX DELETED – RTA fix has been deleted from the modified flight plan.

RW/ILS CRS ERROR – LOC mode armed and the selected ILS course is incorrect for the active route runway.

RW/ILS FREQ ERROR – the selected ILS frequency does not match frequency for runway in active route.

VP-BWW, VP-BWX, VQ-BOG

SET CLOCK TO UTC TIME – the UTC time from the GPS disagrees with the captain's clock by more than 12 seconds.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

SET THRUST MODE – TO X – uplinked takeoff data is accepted and the thrust mode in the accepted data is different than currently set on the TMC.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

SINGLE FMC L (or R) OPERATION – one FMC has failed, only the indicated FMC is operational.

VP-BOZ, VQ-BRA

SINGLE FMC OPERATION – one FMC has failed.

SPLIT IRS OPERATION – a fault exists on an IRS making only two IRSs available for navigation.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

TAKEOFF SPEEDS DELETED – selected V speeds have been deleted due to changes in takeoff performance or configuration data.

THRUST REQUIRED – VNAV active, autothrottle disconnected, and additional thrust required to track VNAV descent path and maintain speed.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

UNABLE FLXXX AT RTA FIX – predicted crossing altitude at RTA fix less than FLXXX, but predicted ETA within tolerance.

UNABLE NEXT ALT – VNAV active and climb not sufficient to comply with waypoint altitude constraint.

767 Flight Crew Operations Manual**VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG**

UNABLE RTA – RTA not achievable within applicable arrival time tolerance.

VP-BWW, VP-BWX, VQ-BOG

UNABLE TO LOAD CLEARANCE – the FMC is unable to load any of the data contained in a loadable ATC uplink clearance/

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

UNABLE TO SEND MSG – FMC is unable to send a message after a manual initiation of a downlink.

VERIFY POSITION – the difference between the FMC position and other position data exceeds a comparison threshold. The possible conflicts are:

- the left FMC position differs from the right FMC position
- the radio position, with radio updating, differs from the FMC position

VP-BDI, VP-BMC, VP-BOY, VP-BWW through VQ-BPT

- the GPS position, with GPS updating, differs from the FMC position

VP-BDI, VP-BMC, VP-BOY, VP-BRL through VQ-BPT

VERIFY RNP – POS REF 2 – 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.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

VIA OFFSET INVALID – flight conditions invalidate the modification with a divert to an alternate airport via OFFSET.

FMC Communications Messages**VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT**

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.

VP-BMC, VQ-BOG

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.

VP-BMC, VQ-BOG

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 are displayed on the CDU scratchpad and illuminate the CDU message light (MSG). There are no EICAS messages associated with these messages and they do not cause the FMC light to illuminate.

Those messages which are caused by an entry error must be cleared before the entry can continue.

VP-BOZ, VQ-BRA

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.

DELETE – DELETE key pushed.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

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.

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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 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.

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG

INVALID ENTRY – RTA ACTIVE – entry of an ECON cruise speed while RTA is active.

INVALID TUNE REQUEST – attempt to remotely tune a VOR is not valid.

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

KEY/FUNCTION INOP – selected mode key is inoperative.

MANUALLY TUNED – attempt to remotely tune a VOR that is manually tuned.

MAX ALT FLXXX – the altitude entry on any CDU page is above the performance calculated maximum altitude.

NOT IN DATABASE – data is not in the route or the navigation database.

NOT ON INTERCEPT HEADING – LNAV selected and the airplane is outside active capture criteria and the present heading will not intercept the active leg.

VP-BRL

RE-ENTER IRS POSITION – the flight crew-entered SET IRS POS disagrees with data in the IRS. This message has been replaced by the ENTER IRS POSITION on later FMCs.

ROUTE FULL – the route is filled to the allowable capacity.

RUNWAY N/A FOR SID – selected runway not compatible with SID.

STANDBY ONE – the FMC requires more than 4 seconds to display data.

VP-BOZ, VQ-BRA

TAKEOFF SPEEDS DELETED – selected V speeds have been deleted due to changes in takeoff performance or configuration data.

VP-BDI through VP-BOZ, VP-BWW through VQ-BRA

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.

VP-BDI, VP-BMC, VP-BOY, VP-BRL through VQ-BPT

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.

VOR AAA INVALID – signal is lost from remotely tuned VOR. AAA is the identifier for the VOR.

XXXXX – altitude set in the MCP window when VNAV is engaged, the CLB or CRZ page is displayed, and the altitude is above, within 4000 feet below, and not equal to the CRZ ALT.

FMC Datalink Advisory Messages

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT

FMC datalink advisory messages are displayed the same as other FMC advisory messages but are associated with datalink operations.

INVALID ALTN UPLINK – a company-preferred list of alternate airports and associated alternate data has been received but the data is not valid and can not be displayed.

INVALID ALTN LIST UPLINK – a company list of up to 20 alternate airports has been received but the data is not valid and cannot be displayed.

INVALID FLT NO UPLINK – a new flight number has been received but the data is not valid and cannot be displayed.

INVALID FORECAST UPLINK – descent forecast data has been received but the data is not valid and cannot be displayed.

INVALID PERF INIT UPLINK – performance initialization data has been received but 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 but 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 but the data is not valid and cannot be displayed.

INVALID WIND DATA UPLINK – en route wind data has been received but the data is not valid and cannot be displayed.

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.

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.

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OFST – an offset path has been entered and executed.

MSG – an FMC message is waiting to display or is displayed.

FAIL – the associated FMC has failed.

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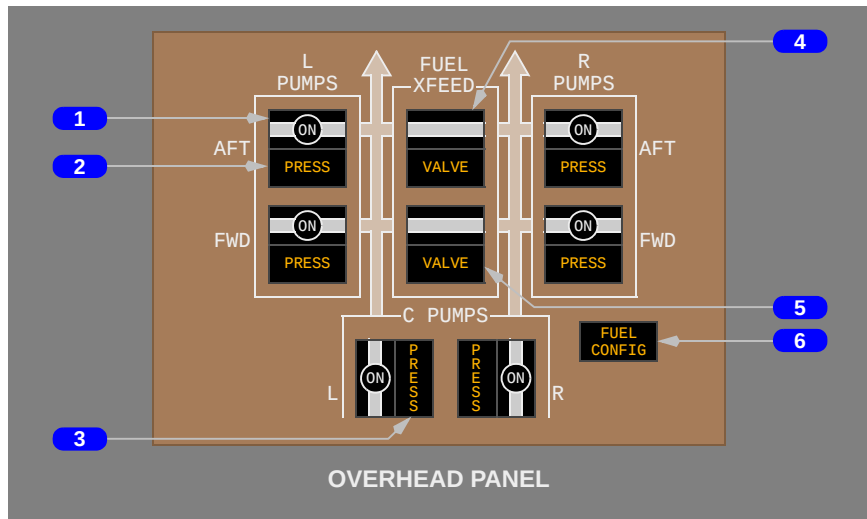


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Fuel Controls and Indicators

Chapter 12 Section 10

Fuel System



1 Left/Center/Right (L/C/R PUMPS) Switches

ON – the fuel pump is selected ON

Off (ON not visible) – the fuel pump is selected off

2 Left/Right Pump Pressure (PRESS) Lights

Illuminated (amber) – fuel pump output pressure is low

3 Center Pump Pressure (PRESS) Lights

Illuminated (amber) –

- fuel pump output pressure is low with the pump selected ON
- associated N2 below 50% with pump switch ON

Note: Illumination is inhibited when the center tank fuel pump switch is selected OFF.

4 Fuel Crossfeed (FUEL XFEED) Switches

On (bar visible) – the crossfeed valve is selected open

Off (bar not visible) – the crossfeed valve is selected closed

5 Crossfeed VALVE Light

Illuminated (amber) – the crossfeed valve is not in the selected position

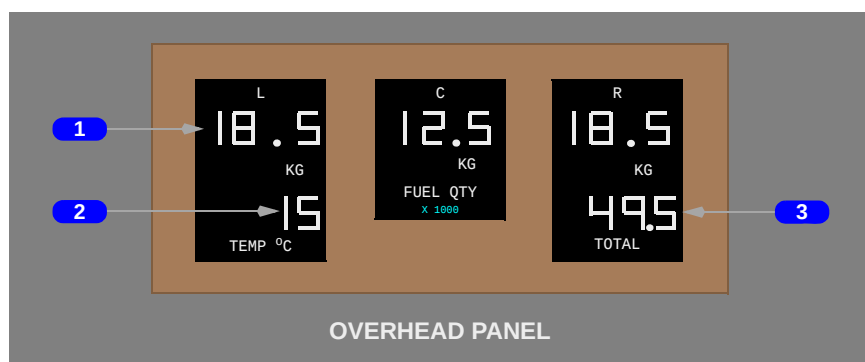
6 Fuel Configuration (FUEL CONFIG) Light

Illuminated (amber) –

- low fuel quantity
- imbalance between left and right main tanks
- center tank fuel pumps off with fuel in center tanks

Fuel Indications

Fuel Quantity Indicator



1 Fuel Quantity (L/C/R FUEL QTY) Indication

Displays usable fuel quantity in the left main, center, and right main tank (kilograms x 1000)

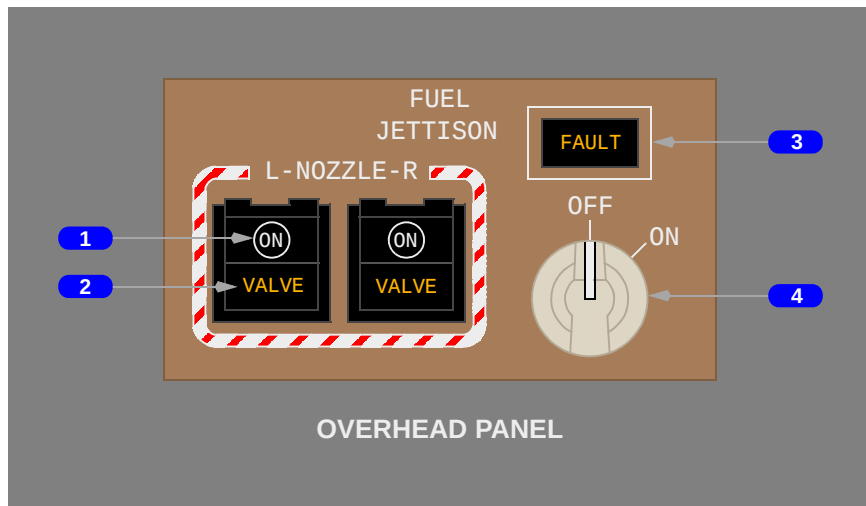
2 Fuel Temperature (TEMP) Indication

Displays temperature of fuel in the left main tank (degrees celsius)

3 TOTAL Fuel Quantity Indication

Displays total usable fuel quantity in all tanks (kilograms x 1000)

Fuel Jettison



1 Fuel Jettison Nozzle Switches (L-NOZZLE-R)

ON – opens respective jettison nozzle

Off (ON not visible) – closes respective jettison nozzle

2 Fuel Jettison Nozzle VALVE Lights

Illuminated (amber) – the jettison nozzle valve is not in the selected position

3 FAULT Light

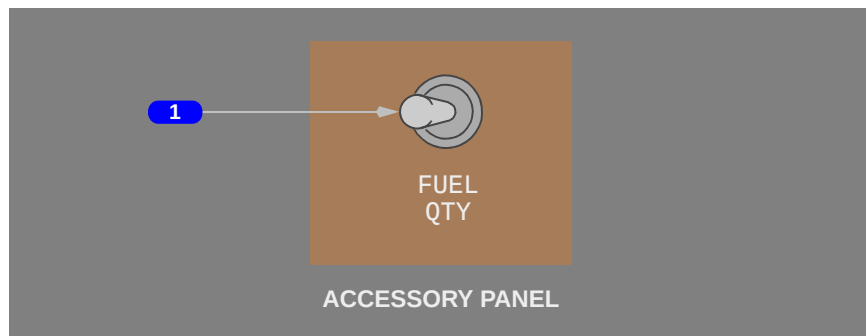
Illuminated (amber) – jettison pump(s) and/or transfer valve(s) disagree with jettison switch position

4 Fuel Jettison Selector

OFF – closes both jettison transfer valves and turns off jettison pumps

ON – opens both jettison transfer valves and turns on jettison pumps

Fuel Quantity Test



1 Fuel Quantity (FUEL QTY) Test Switch

Spring-loaded to center

Initiates fuel quantity test



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.

Refer to Chapter 7, Engines, APU, for an additional description of the engine and APU fuel systems.

Fuel Quantity

Fuel quantity data, measured by probes in each tank, is fed to the fuel quantity processor where it is corrected for density then displayed on a fuel quantity indicator for each tank. Total fuel quantity, from a separate calculation, is shown on the total fuel quantity indicator and is also provided to the FMC.

When total usable fuel in either the left or right main tank drops below approximately 1000 kilograms, the FUEL CONFIG light illuminates and the LOW FUEL caution message is displayed.

Fuel Temperature

Temperature of the fuel in the left main tank is displayed on the fuel temperature indicator.

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 have greater output pressure than the left and right main tank fuel pumps. When all six pumps are operating, the center tank pumps override the left and right main tank pumps so that center tank fuel is used before left or right main tank fuel.

If any pump has low output pressure, the appropriate switch PRESS light illuminates and the pump pressure EICAS message is displayed. If the main tank pump switches are OFF, the low pressure lights are illuminated and EICAS messages for the pumps are displayed. When the center pump switches are OFF, the low pressure lights and EICAS messages for the center pumps are inhibited.

To reduce electrical loads, the center tank pumps are inhibited when the associated N2 is less than 50% RPM. Thus both center tank pumps are inhibited when the engines are shutdown. As an engine is started and N2 RPM increases above 50%, the inhibit is removed for the associated center tank pump.

The EICAS caution messages, L or R FUEL SYS PRESS, displays when all fuel pumps have low output pressure or all fuel pumps on one side have low output pressure and the crossfeed switches are off.

The fuel pump low pressure messages are inhibited by the corresponding L or R FUEL SYS PRESS messages.

During normal operation, the EICAS advisory messages CTR L FUEL PUMP and CTR R FUEL PUMP display to indicate depletion of center tank fuel.

With either message displayed, a small amount of center tank fuel may be indicated. A scavenge system will operate automatically to transfer any remaining center tank fuel to the main tanks. Fuel scavenge begins when the main tanks are approximately half empty.

**VP-BMC, VP-BOQ, VP-BOZ through VP-BWX, VQ-BMU, VQ-BOG
(SB Adds VP-BDI, VQ-BRA when center tank fuel pumps auto shutoff system installed.)**

An automatic center tank fuel pump power removal system is installed on each center tank fuel pump. Several seconds after display of the CTR L FUEL PUMP or CTR R FUEL PUMP message on EICAS, power is automatically removed from the respective pump. Operation of the automatic power removal system is transparent to the flight crew and is installed to ensure continued center tank fuel pump operation is terminated. Reselecting a center tank fuel pump switch on will reset power to the respective pump.

The left main tank contains a DC-powered fuel pump. It has no controls or indicators. The DC pump operates automatically to provide fuel to the APU when AC power is not available and the APU selector is ON.

Fuel Crossfeed

The fuel manifolds are arranged so that any fuel tank pump can supply either engine. Two crossfeed valves isolate the left fuel manifold from the right. These valves are normally closed providing fuel feed from tank to engine. Both valves are opened any time it becomes necessary to feed an engine from an opposite fuel tank. Only one open crossfeed valve is required for successful crossfeed operation. A valve disagreement light illuminates and the EICAS advisory message FWD FUEL X-FEED or AFT FUEL X-FEED displays if a valve position does not agree with its switch position. The L or R FUEL SYS PRESS messages are inhibited with either crossfeed valve open.

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.

Fuel pressure can be provided from a main tank with operating fuel pumps to both engines by opening the fuel crossfeed valves. Continued crossfeed use will result in a progressive fuel imbalance.

The dissolved air in the fuel tank will eventually deplete after reaching cruise altitude. The depletion time is dependent upon airplane altitude, fuel temperature, and type of fuel. Once the dissolved air is depleted, the engine may be capable of suction feed operation at cruise power.

Fuel Configuration Light

When the fuel quantity in left and right main tanks differ by 900 kilograms (plus or minus 200 kilograms) or center fuel pump switches are OFF with more than 500 kilograms in the center tank, the FUEL CONFIG light illuminates and the EICAS advisory message FUEL CONFIG is displayed.

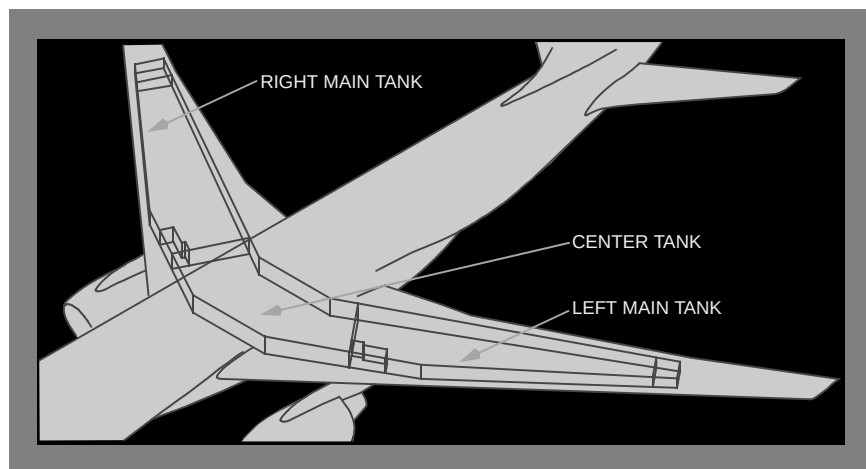
The FUEL CONFIG light also illuminates when the EICAS caution message LOW FUEL is displayed.

Fuel Imbalance

Fuel balancing is accomplished by opening the crossfeed valves and turning off the fuel pump switches for the left or right main fuel tank that has the lowest quantity. Fuel balancing may be done in any phase of flight.

Fuel Tank Locations and Capacities

Fuel Tank Locations



Fuel Tank Capacities

VP-BMC through VP-BOZ, VP-BWW through VQ-BRA

(SB Deletes VP-BRL when Simmonds fuel quantity indicating system in kilograms or fuel tanks with a total fuel quantity of 90,547 liters removed.)

Tank	Liters	Kilograms *
Left main	22,751	18,267
Right main	22,751	18,267
Center	45,045	36,167
Total	90,547	72,700
* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter		



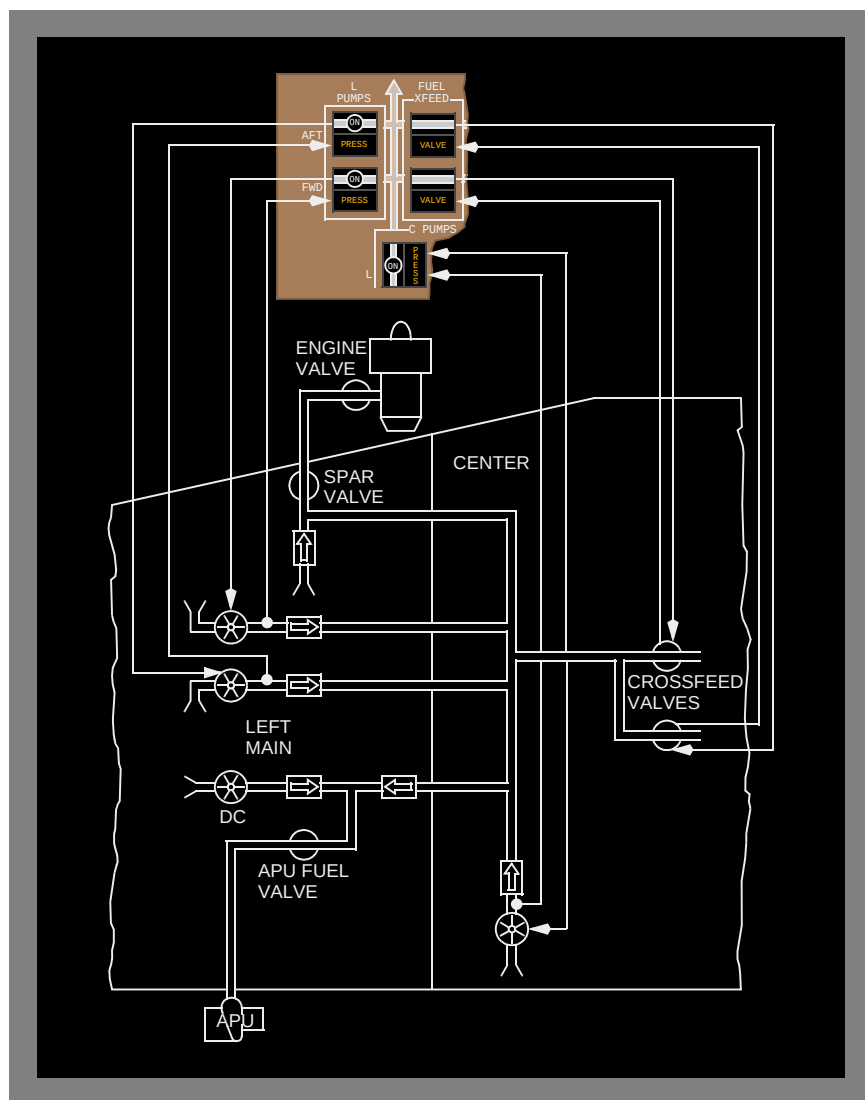
767 Flight Crew Operations Manual

VP-BDI

(SB Adds VP-BRL when Simmonds fuel quantity indicating system in kilograms and fuel tanks with a total fuel quantity of 90,774 liters installed.)

Tank	Liters	Kilograms *
Left main	22,751	18,267
Right main	22,751	18,267
Center	45,272	36,349
Total	90,774	72,882
* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter		

Fuel System Schematic



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.

767 Flight Crew Operations Manual

On the ground, with the APU selector 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.

Fuel Jettison

The fuel jettison system allows jettison from the center fuel tank. Fuel is jettisoned through nozzles inboard of each outboard aileron. The common fuel manifold allows jettison pumps in the center tank to pump fuel overboard.

Two dual pump units provide a high capacity jettison rate of approximately 1200 kilograms per minute.

**VP-BMC, VP-BOQ, VP-BOZ through VP-BWX, VQ-BMU, VQ-BOG
(SB Adds VP-BDI, VQ-BRA when center tank fuel pumps auto shutoff system
installed.)**

The automatic center tank fuel pump power removal system is inhibited during fuel jettison operation. All center tank fuel pumps associated with fuel jettison operation will continue to operate whenever the Fuel Jettison Selector is positioned ON.

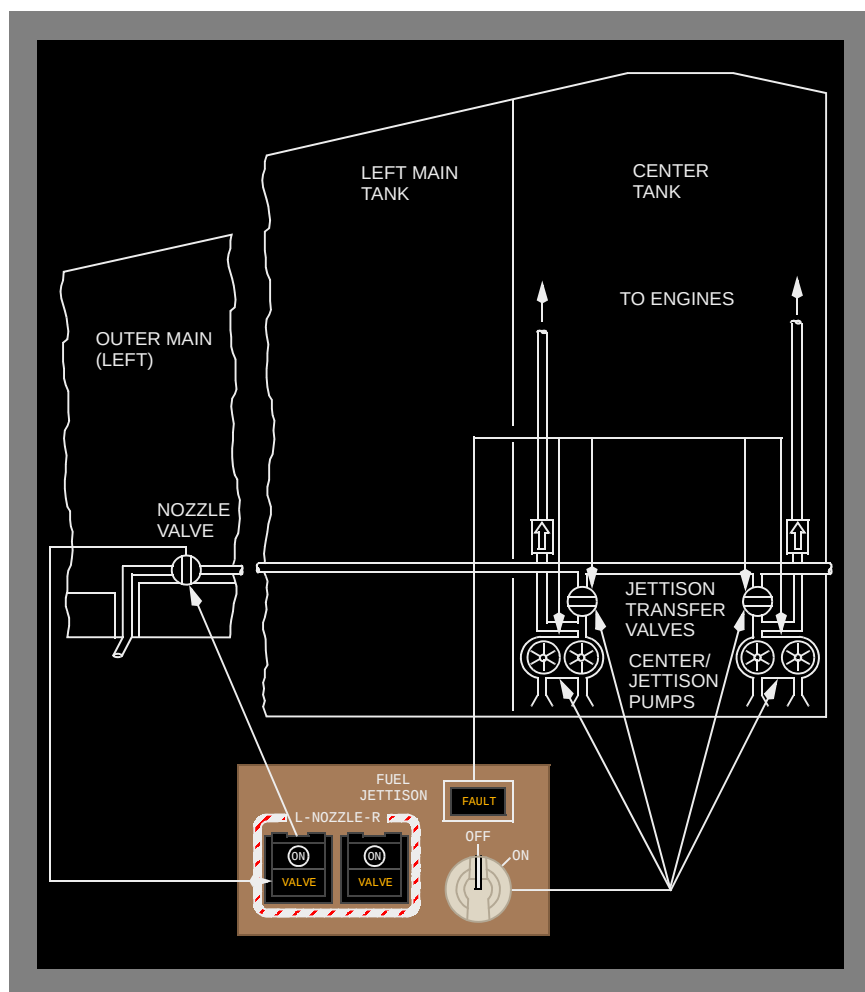
Fuel jettison begins when:

- the FUEL JETTISON selector is selected ON
- the jettison transfer valves open
- the jettison pumps operate
- the FUEL JETTISON NOZZLE switches are selected ON
- the nozzle valves open

The FMC discontinues fuel value calculations and the totalizer value is used during fuel jettison operation. After fuel jettison is complete, the calculated value will reset using the same value as the totalizer value.

The fuel disagree message is not displayed during fuel jettison operation.

Fuel Jettison Schematic



Fuel System FMS CDU Messages

The CDU can display the following messages.

INSUFFICIENT FUEL – Predicted fuel at destination is less than the FMC reserves

VP-BDI through VP-BOY, VP-BRL through VQ-BPT

FUEL DISAGREE-PROG 2 – The fuel totalizer and calculated fuel quantity disagree



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VP-BOZ, VQ-BRA

FUEL DISAGREE–PROG 2/2 – The fuel totalizer and calculated fuel quantity disagree

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**Fuel**
EICAS Messages**Chapter 12**
Section 30**Fuel System EICAS Messages**

The following EICAS messages can be displayed.

Message	Level	Light	Aural	Condition
FUEL CONFIG	Advisory	FUEL CONFIG		Both center pump switches are OFF with fuel in the center tank, or a fuel imbalance between main tanks, or the fuel quantity is low in a main tank.
AFT FUEL X-FEED FWD FUEL X-FEED	Advisory	VALVE		The crossfeed valve position disagrees with the commanded position
FUEL JET NOZ	Advisory	VALVE		In flight, the nozzle valve position disagrees with the commanded position On the ground indicates one or both fuel nozzle valves are open
L FUEL JET PUMP R FUEL JET PUMP	Advisory	FAULT		The associated fuel jettison pump is inoperative
L JET XFER VALVE R JET XFER VALVE	Advisory	FAULT		The associated fuel jettison transfer valve is not in the commanded position



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Message	Level	Light	Aural	Condition
CTR L FUEL PUMP CTR R FUEL PUMP L AFT FUEL PUMP R AFT FUEL PUMP L FWD FUEL PUMP R FWD FUEL PUMP	Advisory	PRESS		Fuel pump output pressure is low
L FUEL SYS PRESS R FUEL SYS PRESS	Caution		Beeper	All fuel pumps have low output pressure or all fuel pumps on one side have low output pressure and the crossfeed switches are off
LOW FUEL	Caution	FUEL CONFIG	Beeper	Fuel quantity is low in either left or right main tank

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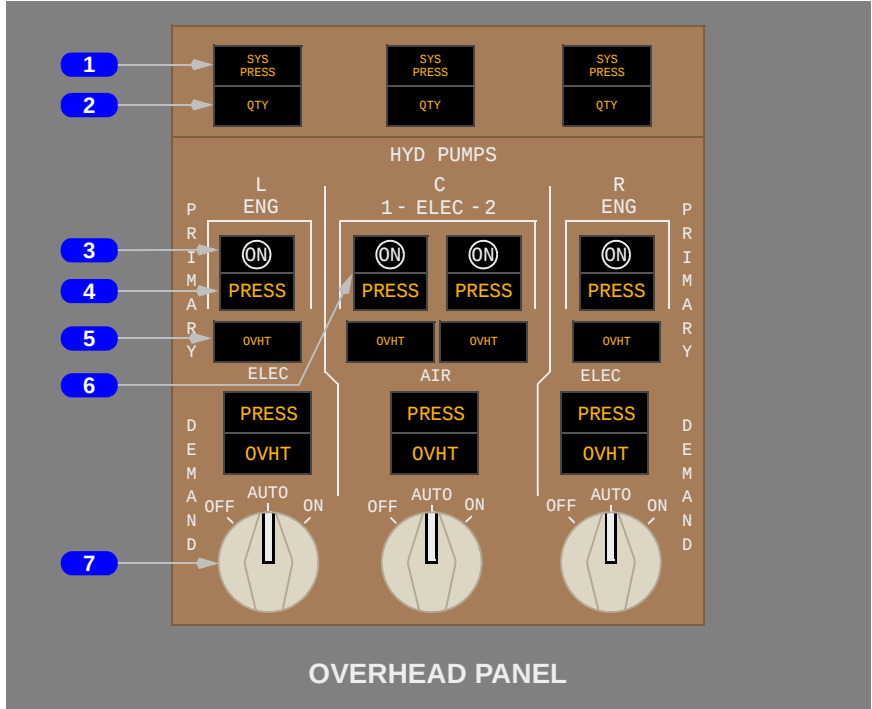


Hydraulics Controls and Indicators

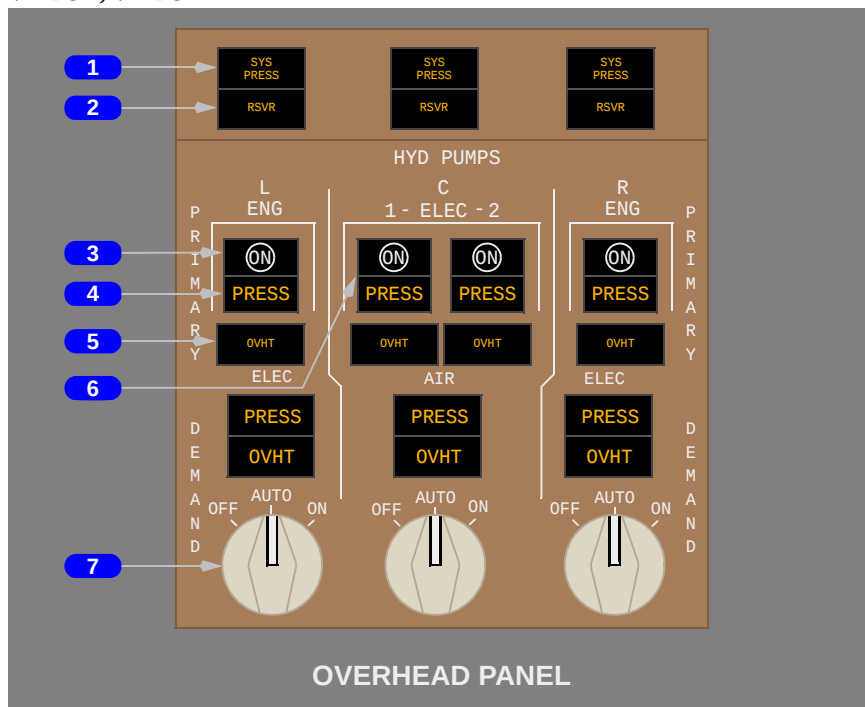
Chapter 13 Section 10

Hydraulic Panel

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA



VP-BOY, VP-BOZ



1 System Pressure (SYS PRESS) Lights

Illuminated (amber) – system pressure is low.

VP-BOY, VP-BOZ

2 Reservoir Low Quantity (RSVR) Lights

Illuminated (amber) – reservoir quantity is low.

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

2 Reservoir Low Quantity (QTY) Lights

Illuminated (amber) – reservoir quantity is low.

3 Left/Right Engine (L/R ENG) Primary Pump Switches

ON – the engine-driven hydraulic pump pressurizes when engine rotates.

Off (ON not visible) – the engine-driven hydraulic pump is turned off and depressurized.

4 Pump Pressure (PRESS) Lights

Illuminated (amber) – pump output pressure is low.

5 Pump Overheat (OVHT) Lights

Illuminated (amber) – pump temperature is high.

6 Center 1/2 Electric (C1/2 ELEC) Primary Pump Switches

ON – the electric motor–driven pump pressurizes the center hydraulic system.

OFF (ON not visible) – the electric motor–driven hydraulic pump is turned off.

7 Left/Right Electric and Center Air (L/R ELEC and C AIR) Demand Pump Selectors

ON – continuous operation.

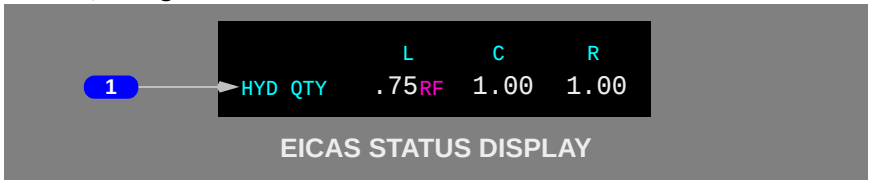
AUTO –

- left/right electric pumps operate when engine pump pressure is low
- center air demand pump operates when both center electric pump pressures are low
- center air demand pump operates when heavy load items are selected

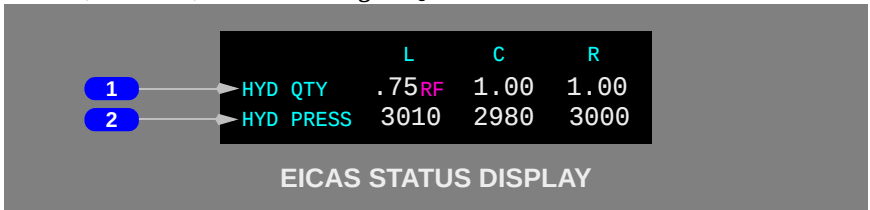
OFF – pump off.

Status Display

VP-BOQ through VP-BOZ



VP-BDI, VP-BMC, VP-BRL through VQ-BRA



1 Hydraulic Fluid Quantities (HYD QTY)

- displays system reservoir quantity (1.00 is the normal service level)
- RF (magenta) – displayed when the reservoir requires refilling

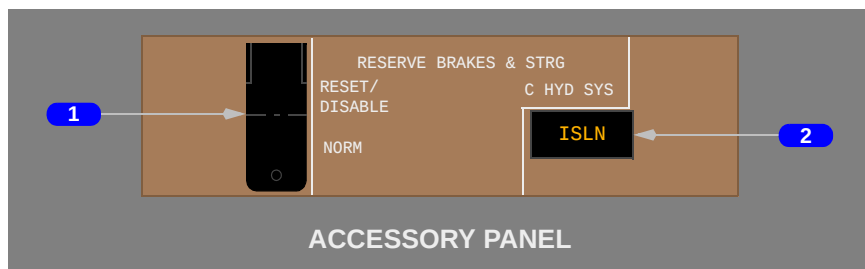
VP-BDI, VP-BMC, VP-BRL through VQ-BRA

2 Hydraulic System Pressures (HYD PRESS)

Displays hydraulic pressure in pounds per square inch of the pump with the highest pressure.

Miscellaneous Hydraulic System Controls

Reserve Brakes and Steering Reset/Disable Switch



1 Reset/Disable Switch

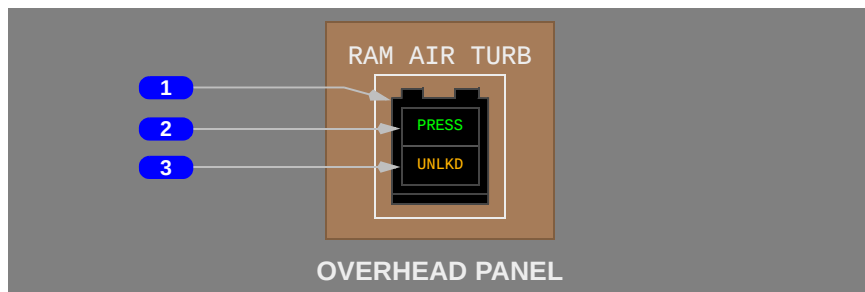
RESET/DISABLE – resets or disables the automatic isolation feature of the center hydraulic system.

NORM – the isolation feature is armed for automatic operation.

2 Isolation (ISLN) Light

Illuminated (white) – the center number one electric primary hydraulic pump is isolated to provide hydraulic pressure to the reserve brakes and steering system.

Ram Air Turbine



1 RAM AIR Turbine (TURB) Switch

Push – deploys the RAT.

2 Ram Air Turbine Pressure (PRESS) Light

Illuminated (green) –

- the RAT is deployed
- the RAT is producing hydraulic pressure

3 Ram Air Turbine Unlocked (UNLKD) Light

Illuminated (amber) – the RAT is not stowed and locked.

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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 wheel steering
- autopilot servos

VP-BMC, VP-BOY, VP-BOZ

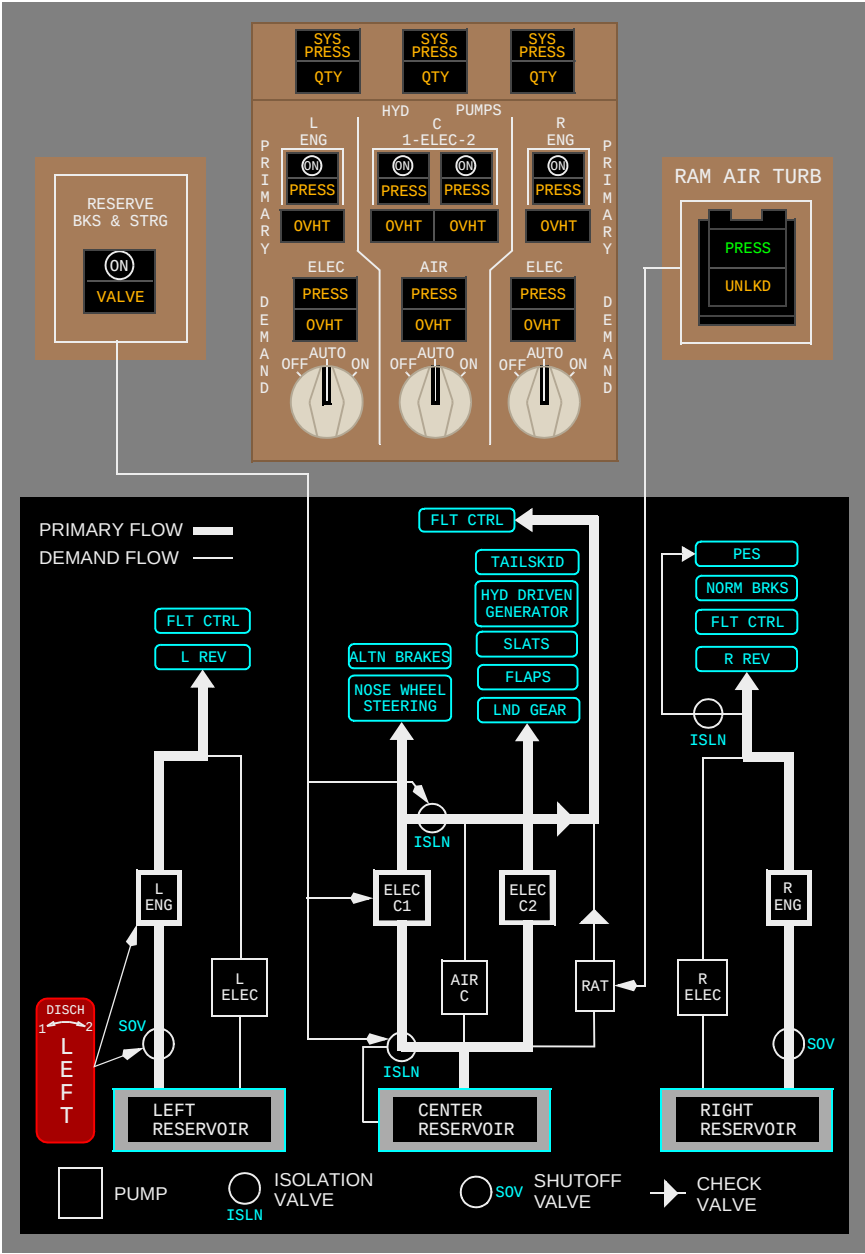
- thrust reversers
- tailskid
- yaw dampers

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.

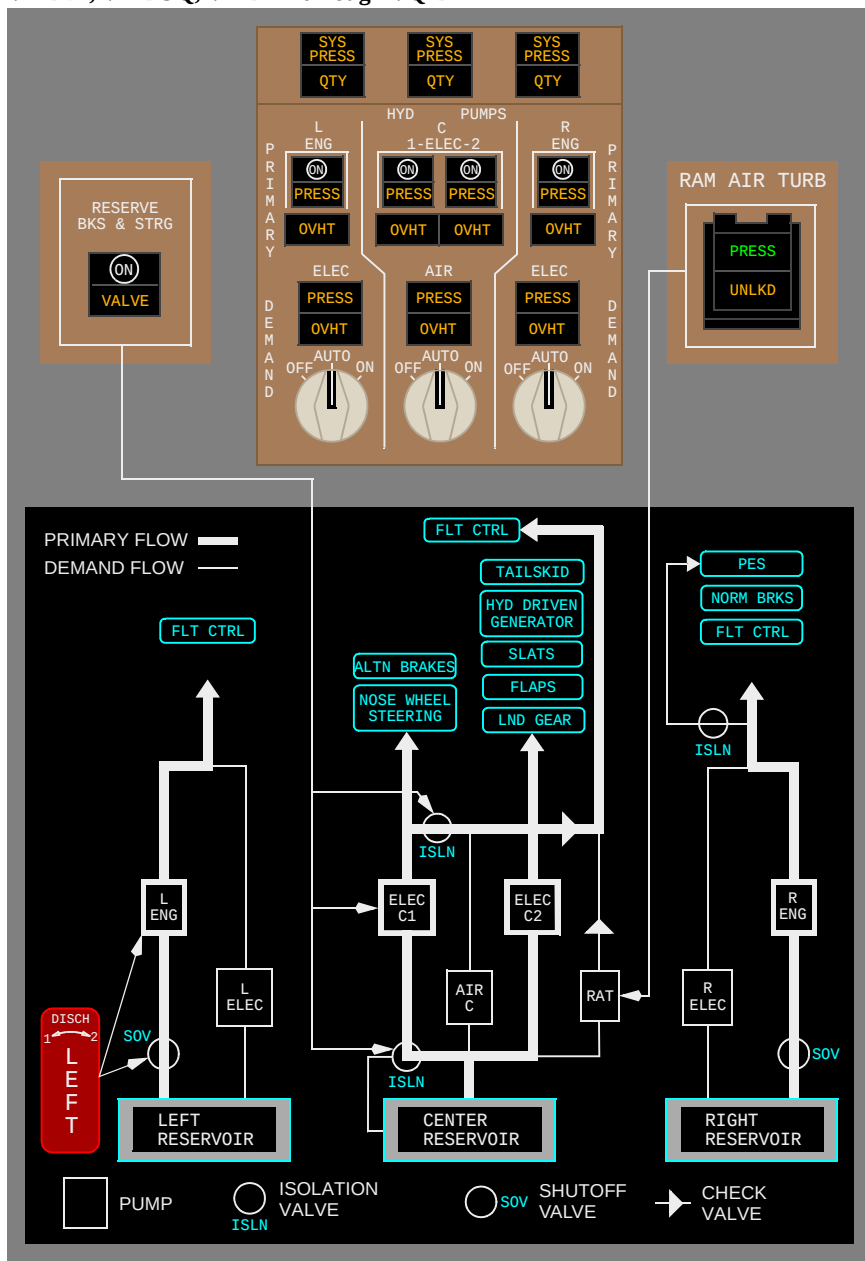
Hydraulic Systems Schematic

VP-BMC

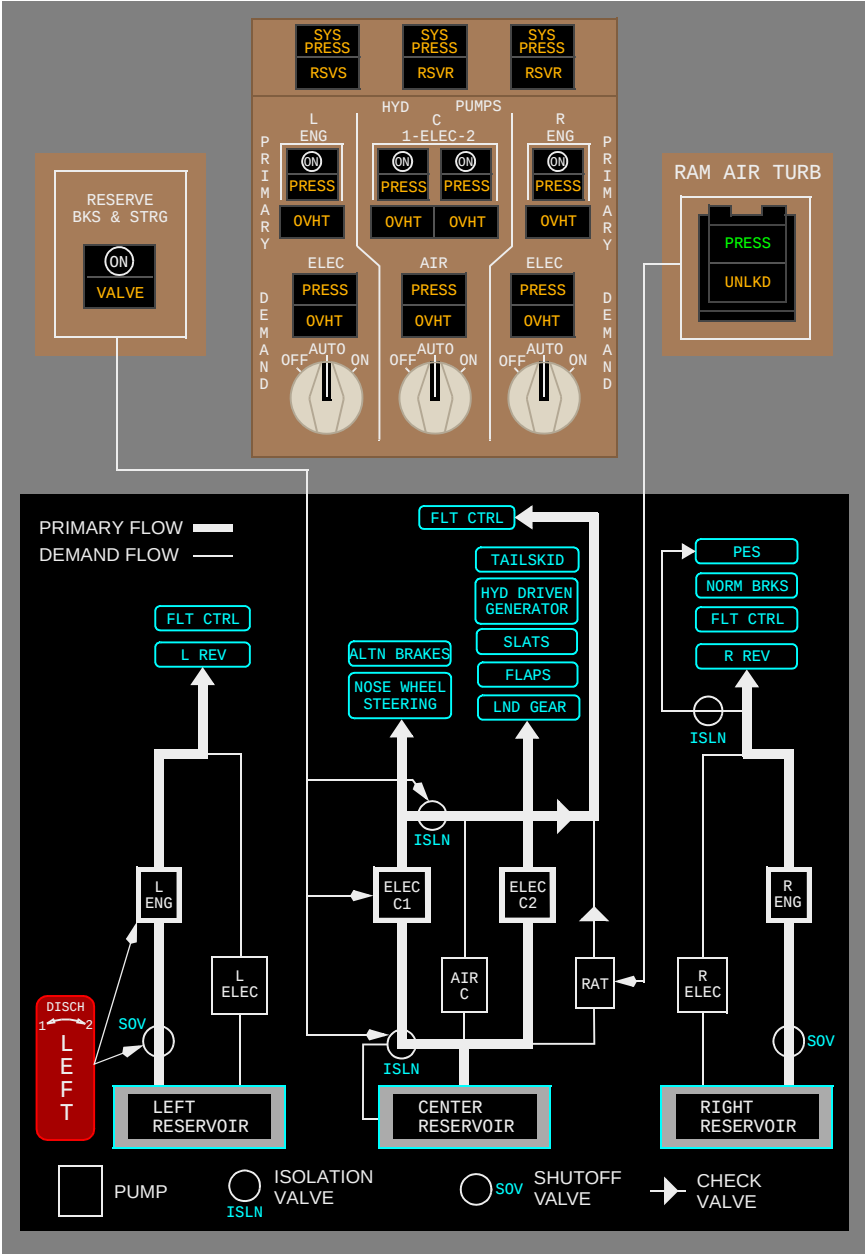


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VP-BDI, VP-BOQ, VP-BRL through VQ-BRA



VP-BOY, VP-BOZ



Left Hydraulic System

The left hydraulic system powers:

- flight controls
- **VP-BMC, VP-BOY, VP-BOZ**
- left engine thrust reverser
- right yaw damper

The system consists of a reservoir, engine-driven primary pump, and an electric motor-driven demand pump.

Fluid Supply

Hydraulic fluid is supplied to each hydraulic pump from a reservoir. The reservoir is pressurized by the bleed air system. A quantity measuring system provides information to the EICAS status display. RF displays on the EICAS status page when a reservoir requires refilling prior to dispatch.

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

The QTY light illuminates and the EICAS advisory message L HYD QTY displays when the reservoir quantity is low.

VP-BOY, VP-BOZ

The RSVR light illuminates and the EICAS advisory message L HYD QTY displays when the reservoir quantity is low.

Fluid for the engine-driven pump flows through a shutoff valve controlled by the engine fire switch. Pulling the fire switch shuts off the flow of fluid to the engine pump and depressurizes the pump.

Engine-driven Primary Pump

The primary hydraulic system pump is an engine-driven pump.

The primary pump PRESS light illuminates and the EICAS advisory message L HYD PRIM PUMP displays when the pump output pressure is low. The pump OVHT light illuminates and the EICAS advisory message L PRIM HYD OVHT displays when the pump temperature is high.

Electric Motor-driven Demand Pump

An electric motor-driven demand pump provides additional hydraulic power either on demand or continuously for periods of high system demand. The demand pump also provides a backup hydraulic power source for the engine-driven primary pump.

The pump PRESS light illuminates and the EICAS advisory message L HYD DEM PUMP displays when the pump output pressure is low. The pump OVHT light illuminates and the EICAS advisory message L DEM HYD OVHT displays when the pump temperature is high.

To reduce electrical load, the left electric demand pump is inhibited on the ground during engine start of either engine, when only one electrical generator is operating. The left demand pump PRESS and SYS PRESS lights may illuminate when starting engines on the ground.

System Pressure Indications

The SYS PRESS light illuminates and the EICAS caution message L HYD SYS PRESS displays when the hydraulic system pressure is low.

VP-BDI, VP-BMC, VP-BRL through VQ-BRA

Hydraulic system pressure displays on the EICAS status page.

Right Hydraulic System

The right hydraulic system is similar to the left system. The right system powers:

- flight controls
- normal brakes
- pitch enhancement system

VP-BMC, VP-BOY, VP-BOZ

- right engine thrust reverser

The system consists of a reservoir, engine-driven primary pump, and an electric motor-driven demand pump.

Fluid Supply

The right reservoir is similar to the left system. The associated EICAS message for low reservoir quantity is R HYD QTY.

Engine-driven Primary Pump

The right engine-driven primary pump is identical to the left system. The associated EICAS messages for low pump output pressure or high pump temperature are R HYD PRIM PUMP and R PRIM HYD OVHT.

Electric Motor-driven Demand Pump

The right electric motor-driven demand pump is identical to the left system. The associated EICAS messages for low pump output pressure or high pump temperature are R HYD DEM PUMP and R DEM HYD OVHT.

System Pressure Indications

The right system pressure indications are similar to the left system. The associated message for low system pressure is R HYD SYS PRESS.

VP-BDI, VP-BMC, VP-BRL through VQ-BRA

Hydraulic system pressure displays on the EICAS status page.

Center Hydraulic System

The center system powers:

- flight controls
- nose wheel steering
- flaps and slats
- alternate brakes
- landing gear
- hydraulic driven generator
- tailskid
- left yaw damper

The system consists of a reservoir, two electric motor-driven pumps, an air-driven demand pump, and a ram air turbine (RAT) pump.

Fluid Supply

The center reservoir is similar to the left system. The associated EICAS messages for low reservoir quantity is C HYD QTY.

The reservoir maintains reserve hydraulic fluid for use by the brakes and steering in the event of a center system hydraulic leak.

Electric Motor-driven Primary Pumps

The two center electric motor-driven primary pumps are identical to the left and right system electric motor-driven pumps. The C2 pump may be load shed automatically to reduce electrical loads. The associated EICAS messages for low pump output pressure or high pump temperature are C HYD PRIM 1, C HYD PRIM 2, C HYD 1 OVHT, and C HYD 2 OVHT.

Air-driven Demand Pump

An air-driven demand pump provides additional hydraulic power either on demand or continuously for periods of high system demand. The demand pump also provides a backup hydraulic power source for the electric motor-driven primary pumps.

The pump PRESS light illuminates and the EICAS advisory message C HYD DEM PUMP displays when the pump output pressure is low. The pump OVHT light illuminates and the EICAS advisory message C DEM HYD OVHT displays when the pump temperature is high.

Note: Landing gear retraction and flap extension/retraction times will be increased when the air-driven demand pump is inoperative.

System Pressure Indications

The center system pressure indications are similar to the left system. The associated message for low system pressure is C HYD SYS PRESS.

VP-BDI, VP-BMC, VP-BRL through VQ-BRA

Hydraulic system pressure displays on the EICAS status page.

Reserve Brakes and Steering Isolation

The center number one electric primary hydraulic pump is automatically isolated, if system quantity is sensed low, to provide hydraulic pressure to the reserve brakes and steering system.

Hydraulic Driven Generator

A hydraulic driven generator is automatically powered by the center hydraulic system when electrical power is lost from both main AC busses. The center air demand pump will then operate continuously to ensure sufficient hydraulic pressure to drive the generator.

Ram Air Turbine (RAT) Pump

When deployed, the RAT, provides hydraulic power to the flight controls portion of the center hydraulic system. The RAT provides adequate hydraulic power at speeds above 130 knots. In flight, the RAT deploys automatically when both engines fail. The RAT is inhibited from auto deployment on the ground.

The RAT can be deployed manually by pushing the RAM AIR TURB switch. The UNLKD light illuminates and the EICAS advisory message RAT UNLOCKED displays when the RAT is not stowed and locked. Once the RAT is producing pressure the ram air turbine PRESS light illuminates. The SYS PRESS light remains illuminated if the RAT is the only source of center system pressure. Once deployed, the RAT cannot be stowed in flight.



Hydraulics

EICAS Messages

Chapter 13

Section 30

Hydraulics EICAS Messages

The following EICAS messages can be displayed.

Message	Level	Light	Aural	Condition
C DEM HYD OVHT L DEM HYD OVHT R DEM HYD OVHT C HYD 1 OVHT C HYD 2 OVHT L PRIM HYD OVHT R PRIM HYD OVHT	Advisory	OVHT		Pump temperature is high.
C HYD DEM PUMP L HYD DEM PUMP R HYD DEM PUMP L HYD PRIM PUMP R HYD PRIM PUMP C HYD PRIM 1 C HYD PRIM 2	Advisory	PRESS		Pump output pressure is low.

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

C HYD QTY L HYD QTY R HYD QTY	Advisory	QTY		Hydraulic quantity is low.

VP-BOY, VP-BOZ

C HYD QTY L HYD QTY R HYD QTY	Advisory	RSVR		Hydraulic quantity is low.



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Message	Level	Light	Aural	Condition
C HYD SYS PRESS L HYD SYS PRESS R HYD SYS PRESS	Caution	SYS PRESS	Beeper	Hydraulic system pressure is low.
RAT UNLOCKED	Advisory	UNLKD		The ram air turbine is not stowed and locked.

**Landing Gear**
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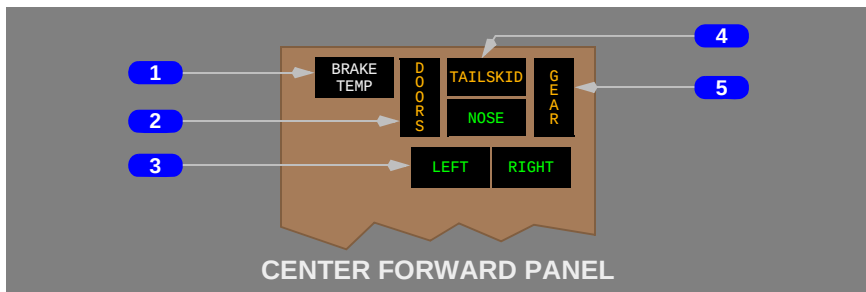
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Landing Gear Controls and Indicators

Chapter 14 Section 10

Landing Gear Panel

VP-BDI, VP-BOQ through VQ-BPT



1 Brake Temperature (BRAKE TEMP) Light

Illuminated (white) – a wheel brake temperature is in high range (a value of 5 or above on the status page).

2 DOORS Light

Illuminated (amber) – a door is not closed.

3 Landing Gear Down Lights (NOSE, LEFT, and RIGHT)

Illuminated (green) – the associated landing gear is down and locked.

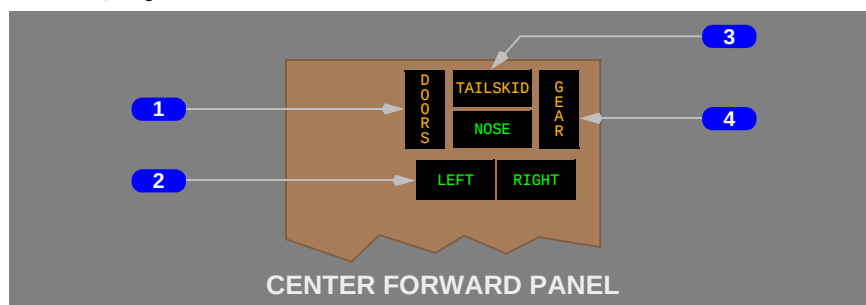
4 TAILSKID Light

Illuminated (amber) – the tailskid position disagrees with the landing gear lever position.

5 Landing GEAR Disagree Light

Illuminated (amber) – the gear position disagrees with the lever position.

VP-BMC, VQ-BRA



1 DOORS Light

Illuminated (amber) – a door is not closed.

2 Landing Gear Down Lights (NOSE, LEFT, and RIGHT)

Illuminated (green) – the associated landing gear is down and locked.

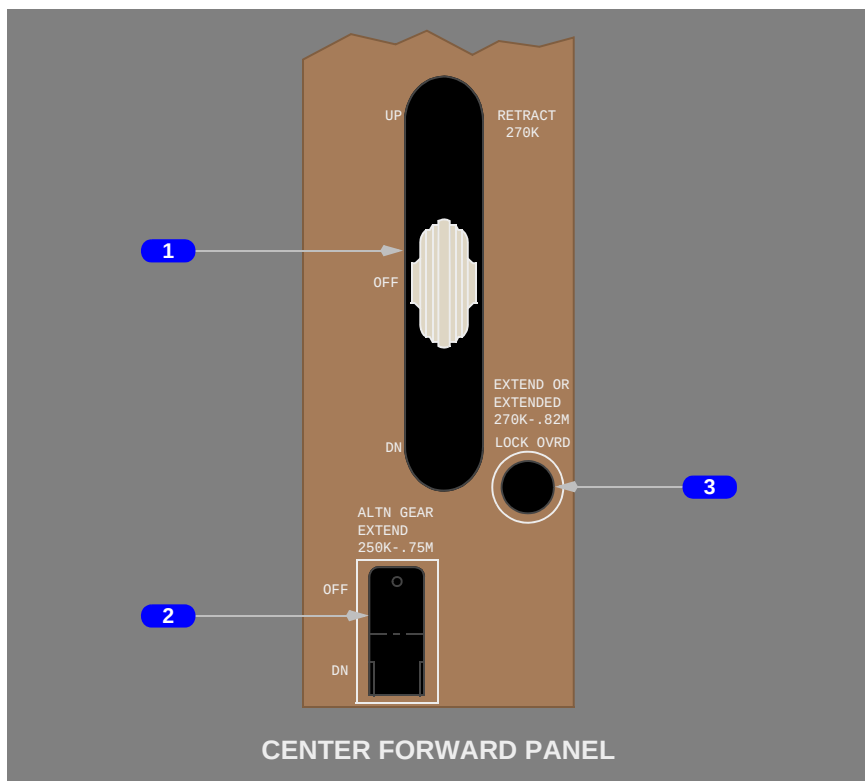
3 TAILSKID Light

Illuminated (amber) – the tailskid position disagrees with the landing gear lever position.

4 Landing GEAR Disagree Light

Illuminated (amber) –the gear position disagrees with the lever position.

Gear Extension/Retraction



1 Landing Gear Lever

UP – the landing gear retracts.

OFF – hydraulic pressure is removed from landing gear system.

DN – the landing gear extends.

2 Alternate Gear Extend (ALTN GEAR EXTEND) Switch

OFF – the landing gear lever operates normally.

DN (down) – the landing gear extends by the alternate extension system.

3 Landing Gear Lever Lock Override (LOCK OVRD) Switch

Push – releases the landing gear lever lock.

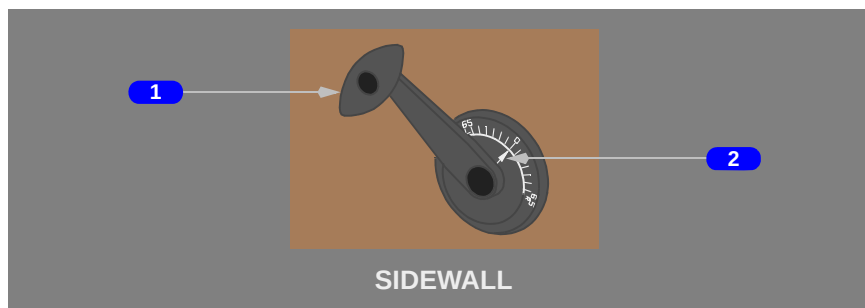
Nose Wheel Steering Tiller

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

A nose wheel steering tiller is installed on the left sidewall.

VP-BWW through VQ-BMQ, VQ-BPT

A nose wheel steering tiller is installed on each the left and right sidewalls.



1 Nose Wheel Steering Tiller

Rotate –

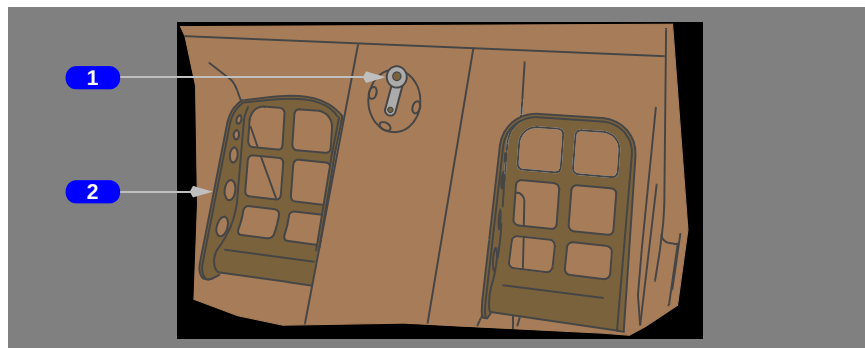
- turns the nose wheels up to 65 degrees in either direction
- overrides rudder pedal steering

2 Tiller Position Indicator

Shows tiller displacement from the straight-ahead, neutral position.

Brake System

Rudder/Brake Pedals



1 Rudder Pedal Adjust Crank

Pull and Rotate – adjusts the rudder pedals forward or aft.

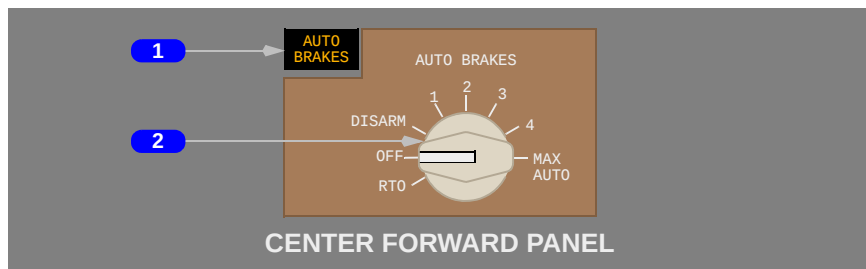
2 Rudder/Brake Pedals

Push the full pedal –turns the nose wheel up to seven degrees in either direction.

Push the top of the pedals – actuates the wheel brakes.

Refer to Chapter 9, Flight Controls for the description of rudder operation.

Auto Brakes Selector



1 AUTO BRAKES Light

Illuminated (amber) – the auto brakes are disarmed or inoperative.

2 AUTO BRAKES Selector

OFF – deactivates the autobrake system.

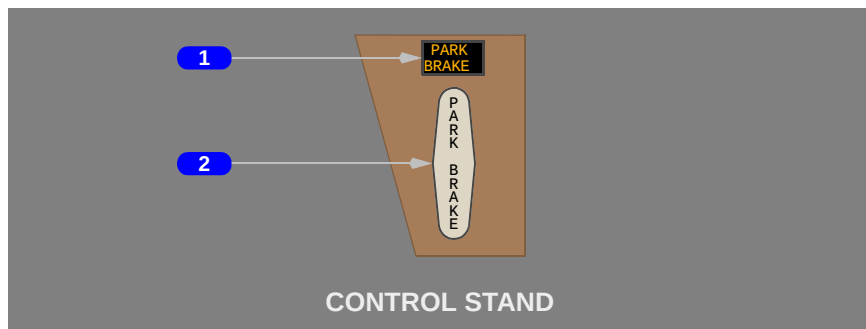
DISARM –

- disengages the auto brake 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.

Parking Brake Handle



1 Parking Brake (PARK BRAKE) Light

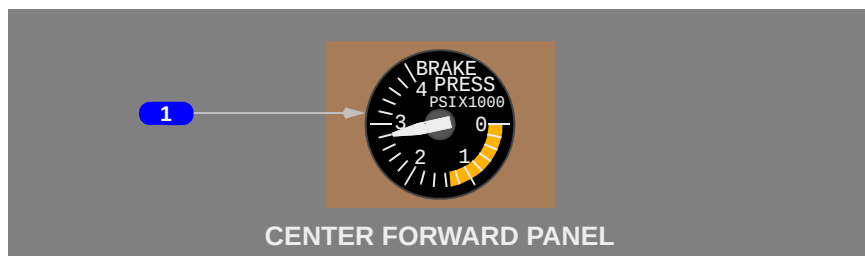
Illuminated (amber) – the parking brake is set.

2 Parking Brake (PARK BRAKE) Handle

Pull – sets the parking brake when both brake pedals are simultaneously depressed.

Release – simultaneously depress both brake pedals.

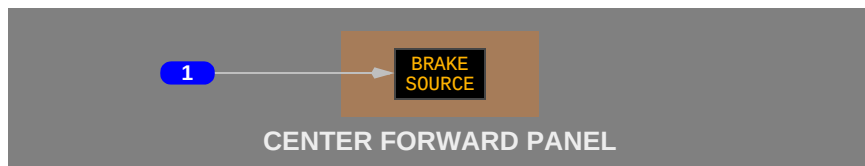
Brake Accumulator Pressure Indicator



1 Brake Accumulator Pressure (BRAKE PRESS) Indicator

Indicates brake accumulator pressure (psi x 1000).

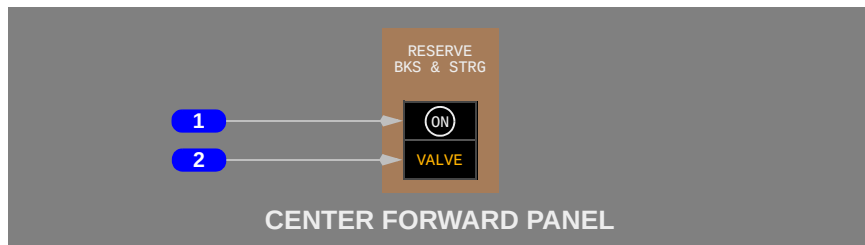
Brake Source Light



1 BRAKE SOURCE Light

Illuminated (amber) – both normal and alternate brake system pressures are low.

Reserve Brakes and Steering Switch



767 Flight Crew Operations Manual
1 RESERVE Brakes and Steering (BKS & STRG) Switch

ON – provides pressure to alternate brake system and nose wheel steering system.

Off – (ON not visible) – the reserve brakes and steering system is commanded off.

2 Reserve Brakes and Steering VALVE Light

Illuminated (amber) –

- switch OFF – valve(s) disagree with commanded position from automatic isolation feature
- switch ON – valve(s) disagree with manually selected switch position

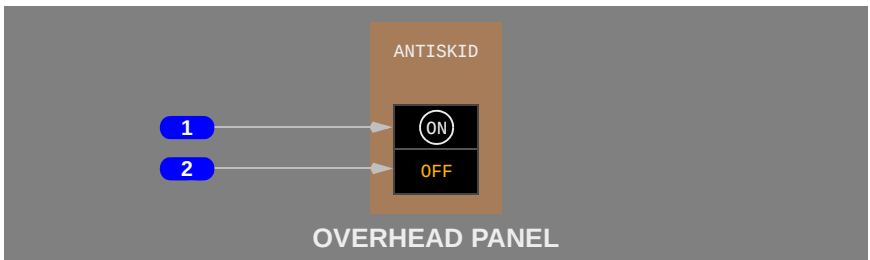
Antiskid Light

1 ANTISKID Light

Illuminated (amber) – a fault is detected in the antiskid system.

Antiskid Switch

VP-BOZ


1 Antiskid Switch

ON – the antiskid system is commanded on.

OFF – (ON not visible) – the antiskid system is commanded off.

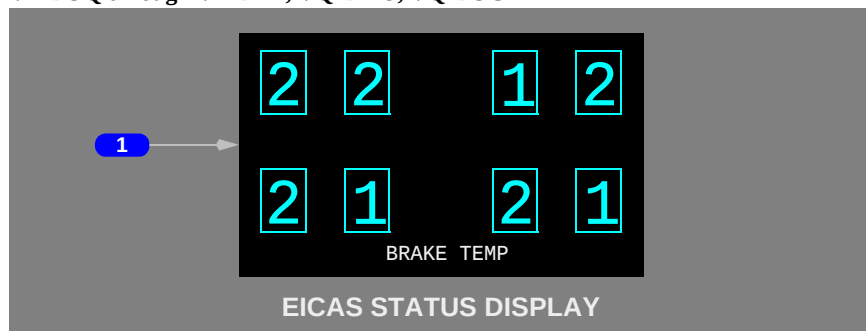
2 Antiskid OFF Light

Illuminated (amber) – the antiskid switch is OFF.

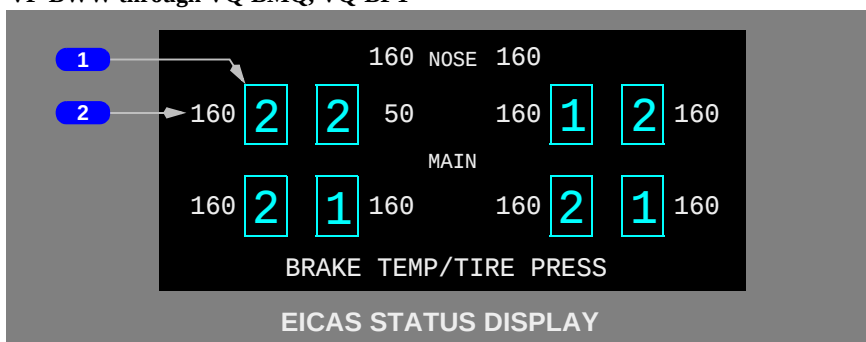
Brake Temperature

VP-BOQ through VQ-BPT

VP-BOQ through VP-BRL, VQ-BMU, VQ-BOG



VP-BWW through VQ-BMQ, VQ-BPT



1 Brake Temperature (BRAKE TEMP)

Indicates a relative value of wheel brake temperature.

- values range from 0 to 9
- 0 to 2 – initial range, box and number are cyan
- 3 to 4 – normal range, box is white for the first brake per truck that exceeds a value of 2 and number is cyan
- 5 to 9 – high range, box and number are white for each brake with a value of 5 or above

VP-BWW through VQ-BMQ, VQ-BPT

2 Tire Pressure (TIRE PRESS)

Indicates current tire pressure in pounds per square inch.

- normal range, number is cyan
- outside normal range, number is white

Tire Pressure Light

VP-BWW through VQ-BMQ, VQ-BPT



1 TIRE PRESSURE Light

Illuminated (amber) –

- low tire pressure
- differential pressure between tires
- deviation from average tire pressure

Intentionally
Blank



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 four wheels in tandem pairs.

Hydraulic power for retraction, extension, and steering is supplied by the center hydraulic system. An alternate extension system is also provided.

The normal brake hydraulic system is powered by the right hydraulic system. The alternate brake hydraulic system is powered by the center hydraulic system. Antiskid protection is provided with both systems, but the autobrake system is available only through the normal system.

VP-BOQ through VP-BRL, VQ-BMU, VQ-BOG

A brake temperature monitor system displays each brake temperature on the EICAS status display.

VP-BWW through VQ-BMQ, VQ-BPT

A brake temperature monitor system and tire pressure indication system displays each brake temperature and tire pressure on the EICAS status display.

Air/Ground Sensing System

In-flight and ground operation of various airplane systems are controlled by the air/ground sensing system and the nose air/ground sensing system.

The air/ground sensing system receives air/ground logic signals from tilt sensors located on each main landing gear. These signals are used to configure the airplane systems to the appropriate air or ground status.

A nose air/ground sensing system receives air/ground logic signals from nose gear strut compression sensors. These signals are for controlling stall warning and portions of the caution and warning system.

An EICAS advisory message AIR/GND SYS or NOSE A/G SYS indicates that some portion of the sensing system failed. Affected equipment and systems will not operate normally and therefore takeoff is not allowed.

Landing Gear Operation

The landing gear are normally controlled by the landing gear lever. On the ground, the lever is prevented from moving to the UP position by an automatic lever lock controlled by the main gear tilt sensors. When the gear is not tilted (aircraft on the ground) the lock is engaged. The lever lock can be manually overridden by pushing and holding the landing gear lever LOCK OVRD switch. In flight, the lever lock is automatically released through air/ground sensing of main gear tilt sensor.

Landing Gear Retraction

After takeoff both main gear tilt, releasing the lever lock. When the landing gear lever is positioned to UP, the tilted landing gear begins to retract. The landing gear doors open and the gear retracts to up position. Automatic wheel braking occurs during gear retraction.

The GEAR and DOORS lights illuminate as the landing gear retracts into the wheel wells. After retraction, the nose gear is held up by uplocks and the main gear is held up by the door structure. The GEAR and DOORS lights extinguish. The landing gear lever is placed in the OFF position to depressurize the landing gear system. The GEAR light remains illuminated and the EICAS caution message GEAR DISAGREE displays if any gear is not up and locked up after the normal transit time. The affected gear's, gear down light, remains illuminated if the gear never unlocked from the down position. The DOORS light remains illuminated.

Landing Gear Extension

When the landing gear lever is moved to DN, the landing gear doors open, the gear are unlocked, and the GEAR and DOORS lights illuminate.

The gear are hydraulically powered 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 gear down lights illuminate and the GEAR and DOORS lights extinguish.

The amber GEAR light remains illuminated and the EICAS caution messages GEAR DISAGREE, L or R SIDE BRACE, L or R DRAG BRACE displays if any gear is not locked down after the normal transit time. The extinguished green gear down light indicates the affected gear. The DOORS light remains illuminated and the EICAS advisory message GEAR DOORS displays only if any main gear door is not closed after the normal transit time.

Landing Gear Alternate Extension

The alternate landing gear extension system uses an electric motor to trip the locking mechanism for each gear. Selecting DN on the ALTN GEAR EXTEND switch releases all door and gear uplocks. The landing gear free-fall to the down and locked position.

When all gear are down and locked, the gear down lights illuminate and the GEAR light extinguishes. During alternate extension, the DOORS light remains illuminated and the EICAS advisory message GEAR DOORS displays because all the hydraulically powered gear doors remain open.

Nose Wheel Steering

Nose wheel steering is powered by the center hydraulic system. In the event of a center hydraulic system leak, a reserve brakes and steering system can power the nose wheel steering.

Primary steering control is provided by the nose wheel steering tiller. Limited steering control is available through the rudder pedals. The tiller can turn the nose wheel up to 65 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 seven degrees in either direction. Tiller inputs override rudder pedal inputs.

Brake System

Each main gear wheel has a multiple disc brake. The nose wheels have no brakes. The brake system includes:

- normal brake hydraulic system
- alternate brake hydraulic system
- brake accumulator
- antiskid protection
- autobrake system
- parking brake

Normal Brake Hydraulic System

The normal brake hydraulic system is powered by the right hydraulic system. The brake pedals provide independent control of the left and right brakes.

Alternate Brake Hydraulic System

Alternate brake hydraulic system selection is automatic. If the right hydraulic system pressure is low, the center hydraulic system automatically supplies pressure to the alternate brake system. Pushing a brake pedal then sends hydraulic pressure through the alternate antiskid valves to the brakes.

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The BRAKE SOURCE light illuminates and the EICAS advisory message BRAKE SOURCE displays if both normal and alternate brake system pressures are low.

Reserve Brakes and Steering

Pressing the RESERVE BKS & STRG switch provides hydraulic fluid to the center number one electric primary hydraulic pump. Pump pressure is then supplied exclusively to the alternate brake system and nose wheel steering system. The BRAKE SOURCE light and EICAS message extinguish when pressure is available.

The VALVE light illuminates and the EICAS advisory message RSV BRAKE VAL displays if a reserve brake valve disagrees with the commanded position.

Brake Accumulator

If normal and alternate brake hydraulic power is lost, the brake accumulator can provide several braking applications or parking brake application.

Antiskid Protection

Antiskid protection is provided in the normal and alternate brake hydraulic systems.

The normal brake hydraulic 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 hydraulic system provides antiskid protection to laterally paired wheels.

Touchdown, hydroplaning, and locked wheel protection are provided.

The ANTISKID light illuminates and the EICAS advisory message ANTISKID displays to indicate a fault is detected in the antiskid system.

VP-BDI through VP-BOY, VP-BRL through VQ-BRA

The ANTISKID light illuminates and the EICAS advisory message ANTISKID OFF displays to indicate the antiskid system is inoperative.

VP-BOZ

The antiskid OFF light illuminates and the EICAS advisory message ANTISKID OFF displays if the antiskid system is inoperative. The antiskid OFF light is on whenever the antiskid switch is off or anytime the parking brake valve in the antiskid return line is not open after releasing the parking brake.

Autobrake System

The autobrake system provides automatic braking at pre-selected deceleration rates for landing.

The system operates only when the normal brake system is functioning. Antiskid system protection is provided during autobrake operation.

The AUTO BRAKES light illuminates and the EICAS advisory message AUTOBRAKES displays if the autobrake system is disarmed or inoperative.

Rejected Takeoff

Selecting RTO 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.

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. Deceleration is limited until main landing gear truck untilt occurs, then deceleration increases to the selected 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 system disarms immediately, the AUTO BRAKES light illuminates, and the EICAS advisory message AUTOBRAKES displays if any of the following occur:

- pedal braking applied
- either thrust lever advanced after landing

- speedbrake lever is moved from the full up position after the speedbrakes have deployed on the ground
- DISARM or OFF position selected on the autobrakes selector
- autobrake fault
- normal antiskid system fault

When the autobrakes system disarms after landing:

- the autobrakes selector automatically moves to the DISARM position
- power is removed from the autobrake system
- the AUTO BRAKES light illuminates

When the autobrake system disarms during takeoff, the autobrakes selector remains in the RTO position. After takeoff, the autobrakes selector automatically moves to OFF.

Parking Brake

The parking brake can be set with the normal or alternate brake hydraulic system pressurized. If the normal and alternate brake systems are not pressurized, parking brake pressure is maintained by the brake accumulator. The brake accumulator is pressurized by the right hydraulic system. Accumulator pressure is shown on the BRAKE PRESS indicator.

The parking brake is set by fully depressing both brake pedals, pulling the parking brake handle 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 handle releases.

The PARK BRAKE light illuminates and the EICAS advisory message PARKING BRAKE displays when the parking brake is set.

Brake Temperature Indication

VP-BOQ through VQ-BPT

Wheel brake temperatures are displayed on the EICAS status page. Numerical values related to wheel brake temperature are displayed for each main gear brake. Brake temperature values range from 0 to 9. Temperature values are not instantaneous and tend to build for 10 to 15 minutes after the brakes are applied. Initial range values of 0 to 2 are cyan numbers in a cyan box. For normal range values of 3 and 4, the number is cyan and the box is white for the first brake per truck that exceeds a value of 2. Values in the high range of 5 to 9 have a white number and box. The BRAKE TEMP light illuminates for values of 5 and above.

Tire Pressure

VP-BWW through VQ-BMQ, VQ-BPT

Wheel tire pressures are displayed on the EICAS status page. Numerical values related to wheel brake temperature are displayed for each main gear tire and nose gear tire. For normal range values, the number is cyan. Values outside the normal range have a white number.

The TIRE PRESSURE light illuminates when a non-normal condition exists.

The EICAS advisory message TIRE PRESSURE is displayed when a non-normal condition exists.

Tailskid

The airplane is equipped with a tailskid system. The tailskid extends for takeoff and landing and retracts during flight. It helps to protect the pressurized part of the airplane from contact with the runway. The tailskid uses the main landing gear actuation system.

The TAILSKID light illuminates and the EICAS advisory message TAILSKID is displayed when the tailskid position disagrees with the landing gear lever position.

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**Landing Gear**
EICAS Messages**Chapter 14**
Section 30**Landing Gear EICAS Messages**

The following EICAS messages can be displayed.

Note: Refer to Chapter 15, Warning Systems, for configuration warning messages.

Brakes

Message	Level	Light	Aural	Condition
ANTISKID	Advisory	ANTISKID		A fault is detected in the antiskid system.

VP-BDI through VP-BOY, VP-BRL through VQ-BRA

ANTISKID OFF	Advisory	ANTISKID		Antiskid system is inoperative.

VP-BOZ

ANTISKID OFF	Advisory	OFF		Antiskid system is inoperative.

AUTOBRAKES	Advisory	AUTO BRAKES		Auto brakes are disarmed or inoperative.
BRAKE SOURCE	Advisory	BRAKE SOURCE		Normal and alternate brake system pressures are low.
PARKING BRAKE	Advisory	PARK BRAKE		The parking brake is set.
RSV BRAKE VAL	Advisory	VALVE		Valve(s) position disagrees with the commanded position.

Landing Gear

Message	Level	Light	Aural	Condition
AIR/GND SYS	Advisory			Air/ground sensing system failed.

Message	Level	Light	Aural	Condition
GEAR DISAGREE	Caution	GEAR	Beeper	Gear position disagrees with landing gear lever position.
GEAR DOORS	Advisory	DOORS		One or more gear doors are not closed.
L DRAG BRACE R DRAG BRACE	Caution	GEAR	Beeper	The main gear drag brace is not locked down.
L SIDE BRACE R SIDE BRACE	Caution	GEAR	Beeper	The main gear side brace is not locked down.
NOSE A/G SYS	Advisory			Nose air/ground sensing system failed.

Tailskid

Message	Level	Light	Aural	Condition
TAILSKID	Advisory	TAILSKID		Tailskid position disagrees with landing gear lever position.

Tire Pressure

VP-BWW through VQ-BMQ, VQ-BPT

Message	Level	Light	Aural	Condition
TIRE PRESSURE	Advisory	TIRE PRESSURE		One or more tire pressures are not normal.

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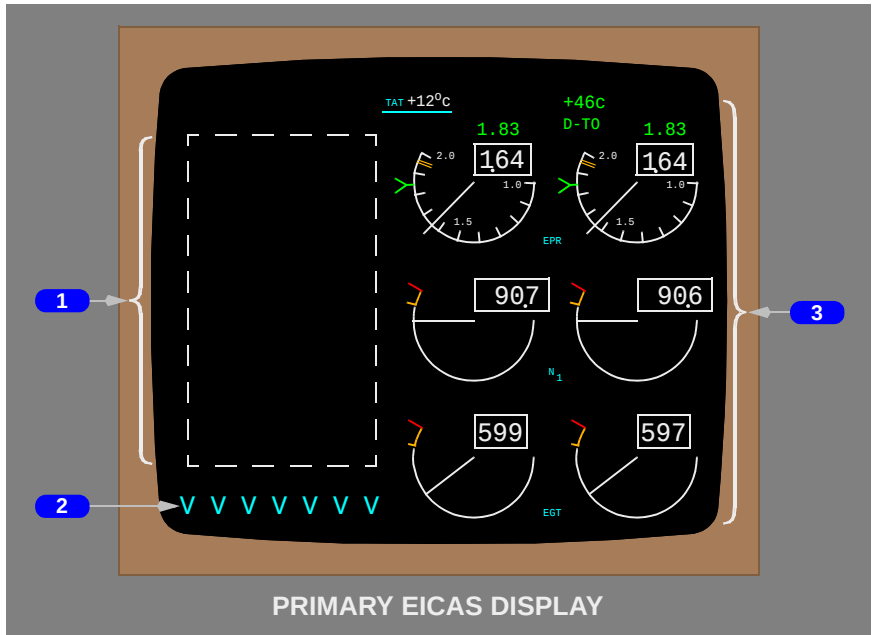


Warning Systems Controls and Indicators

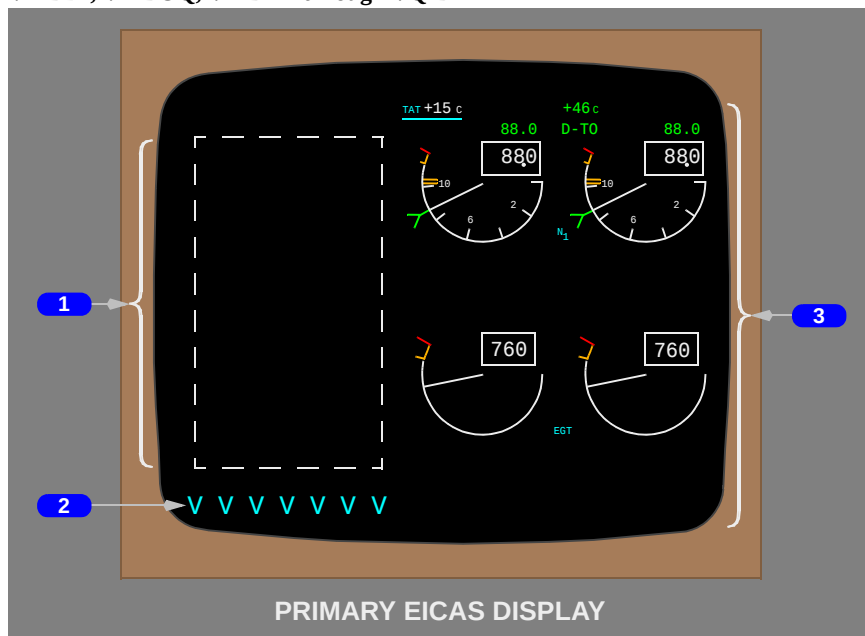
Chapter 15 Section 10

Engine Indication and Crew Alerting System (EICAS) Primary EICAS Display

VP-BMC, VP-BOY, VP-BOZ



VP-BDI, VP-BOQ, VP-BRL through VQ-BRA



1 EICAS Message Field

Eleven lines are available for system alerts. Additional pages are available, if need.

Communications alerts are also displayed.

2 Engine Secondary Data Cue

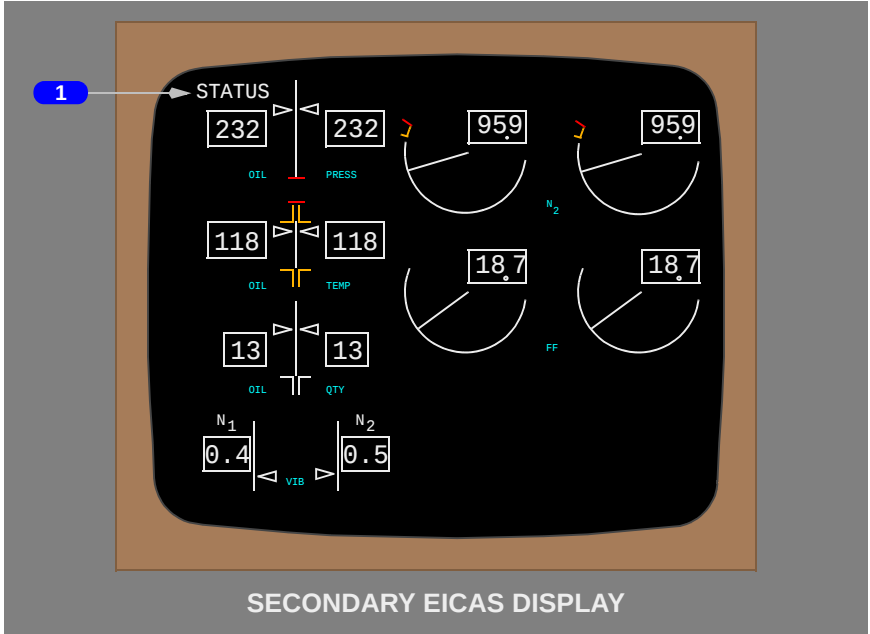
Displays (cyan) – secondary engine data should be displayed on lower CRT

3 Primary Engine Indications

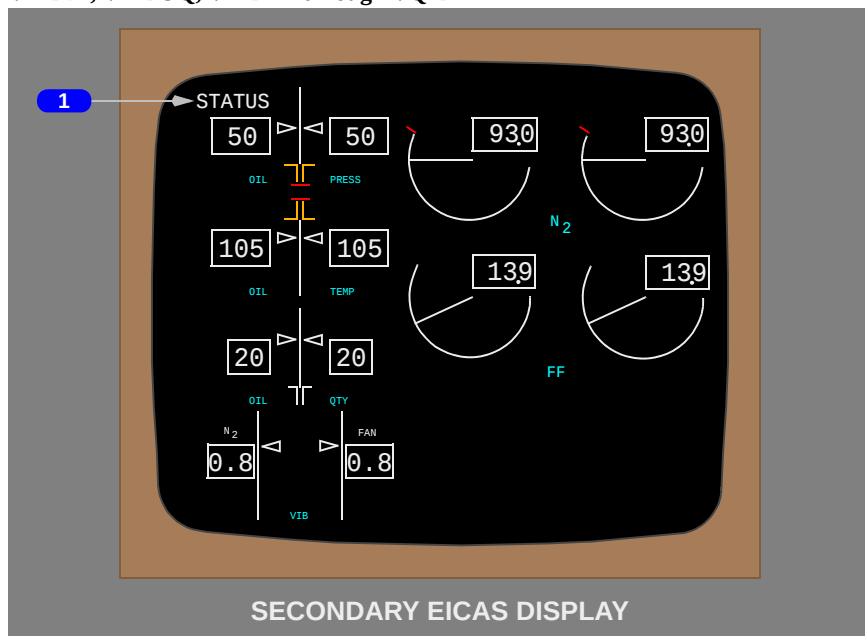
Displays full time on the EICAS display.

Secondary EICAS Display

VP-BMC, VP-BOY, VP-BOZ



VP-BDI, VP-BOQ, VP-BRL through VQ-BRA



1 Status Cue

Displays when a new status message exists

Removed when the status page is displayed.

EICAS Message Display

VP-BMC, VP-BOY, VP-BOZ



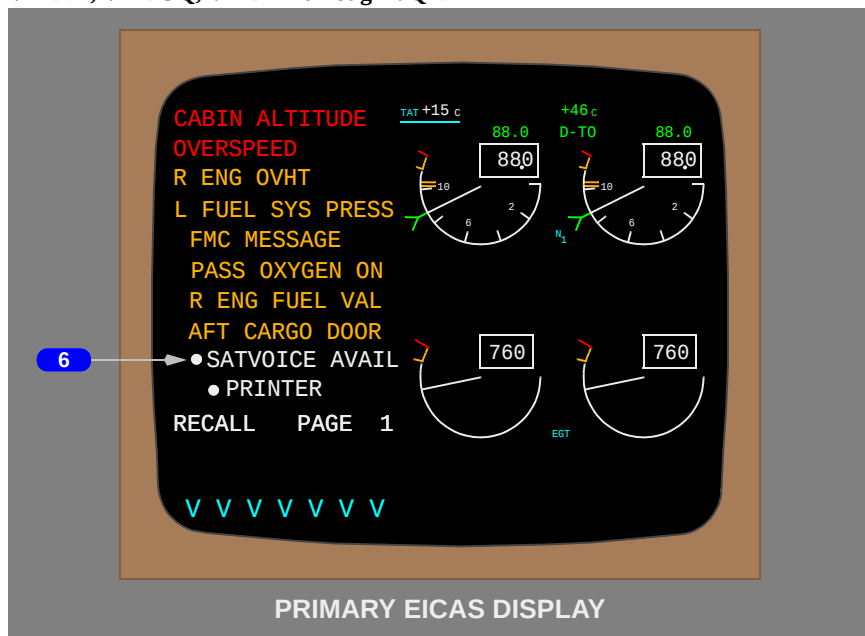


VP-BDI, VP-BOQ, VP-BRL through VQ-BRA



767 Flight Crew Operations Manual
VP-BMC, VP-BOY, VP-BOZ


VP-BDI, VP-BOQ, VP-BRL through VQ-BRA



1 Warning Messages

Displays (red) – the highest priority alert messages

2 Caution Messages

Displays (amber) – the next highest priority alert messages after warning messages

3 Advisory Messages

Displays (amber) –

- the lowest priority alert messages
- indented one space

4 Recall Indication

Displays when the RECALL switch is pushed

Remains displayed for one second after the switch is released

5 Page Number

Displays (white) –

- more than one page of alert or communication messages exists
- indicates the number of the page selected

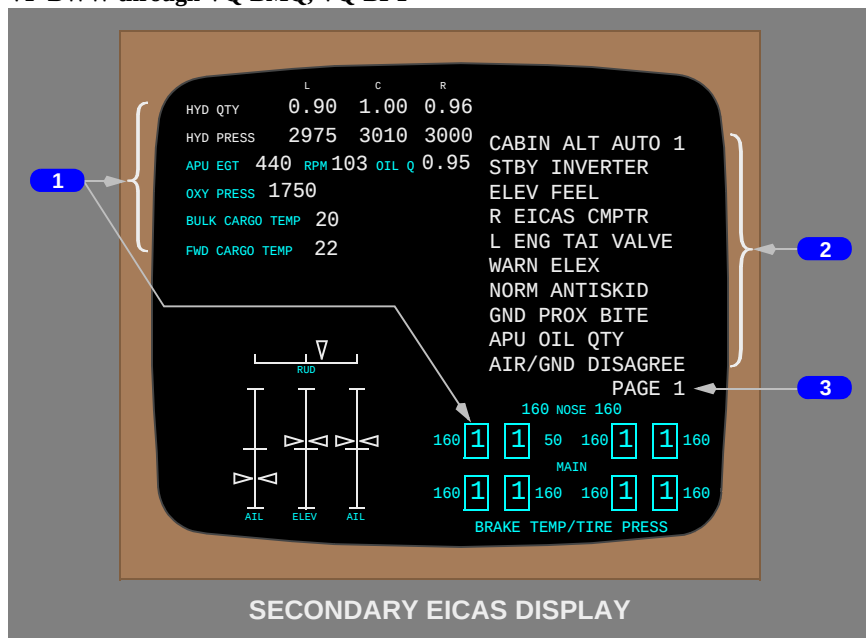
6 Communication Messages

Displays (white) –

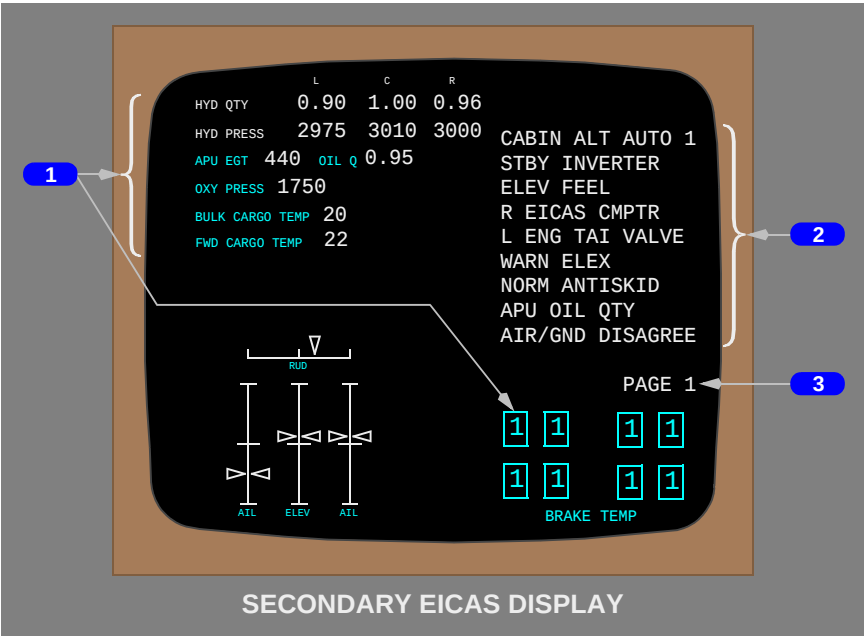
- indicates incoming communication messages
- preceded by a white dot
- COMM LOW messages are indented one space

EICAS Status Display

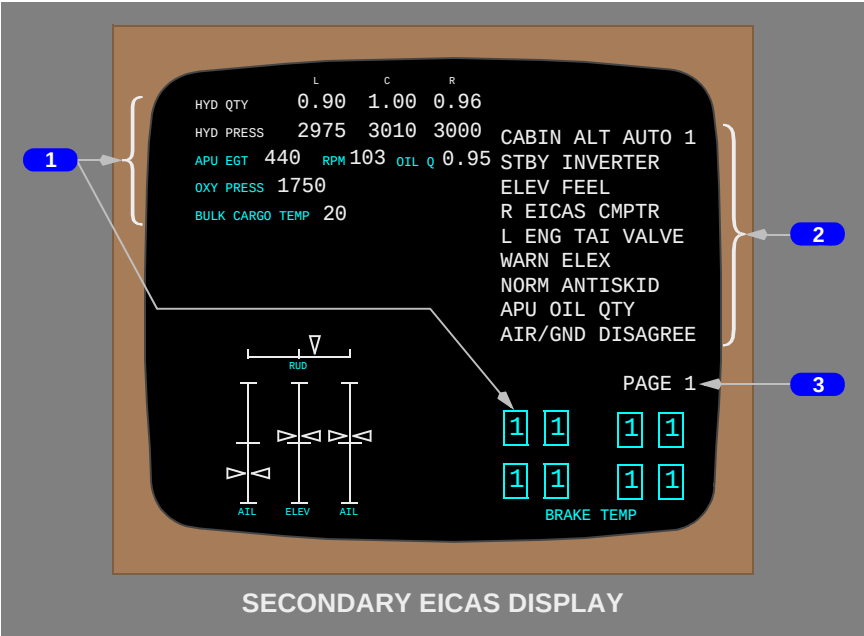
VP-BWW through VQ-BMQ, VQ-BPT



VQ-BMU

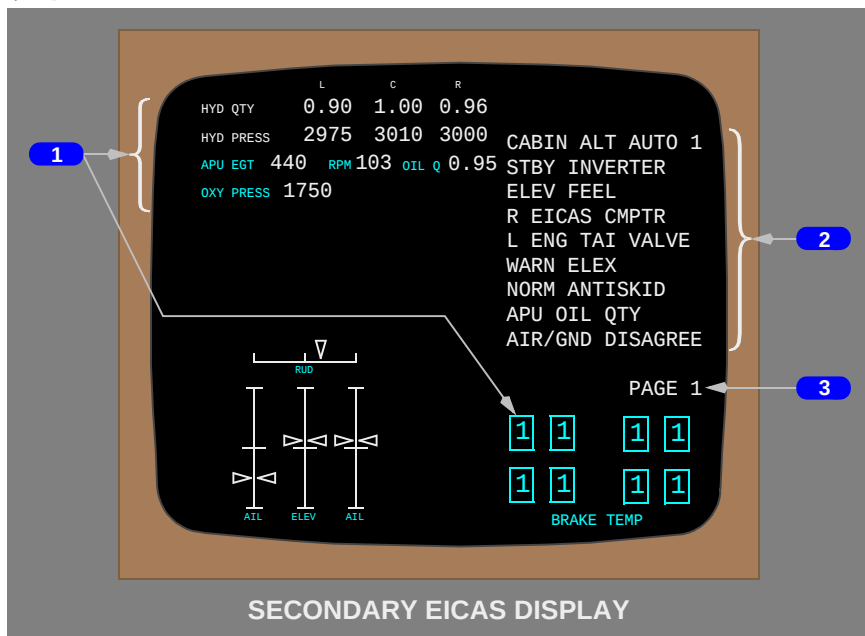


VQ-BOG

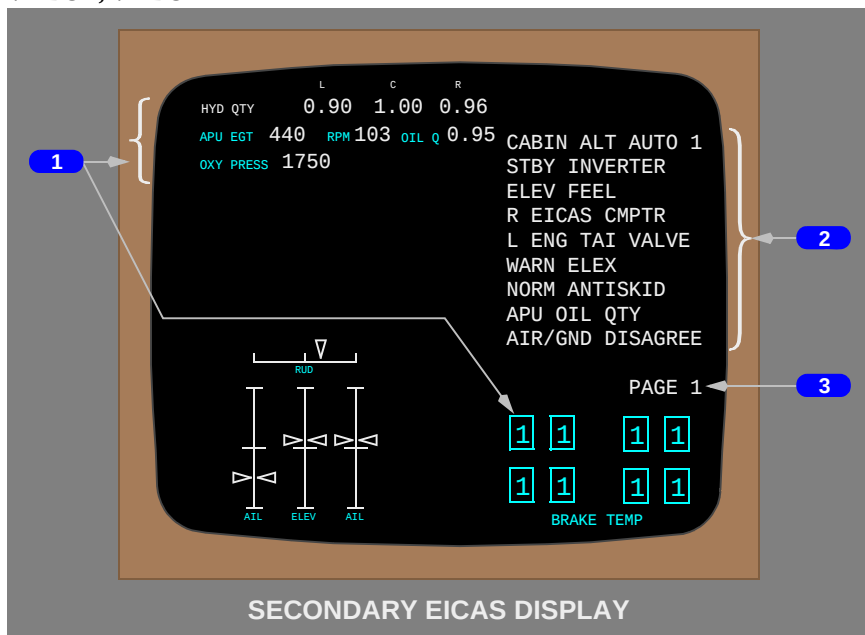


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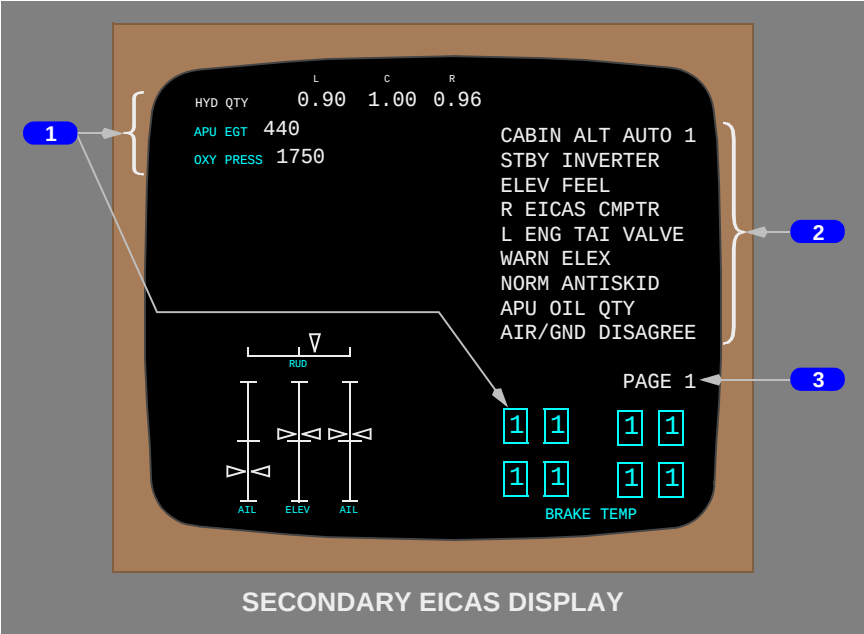
VP-BRL



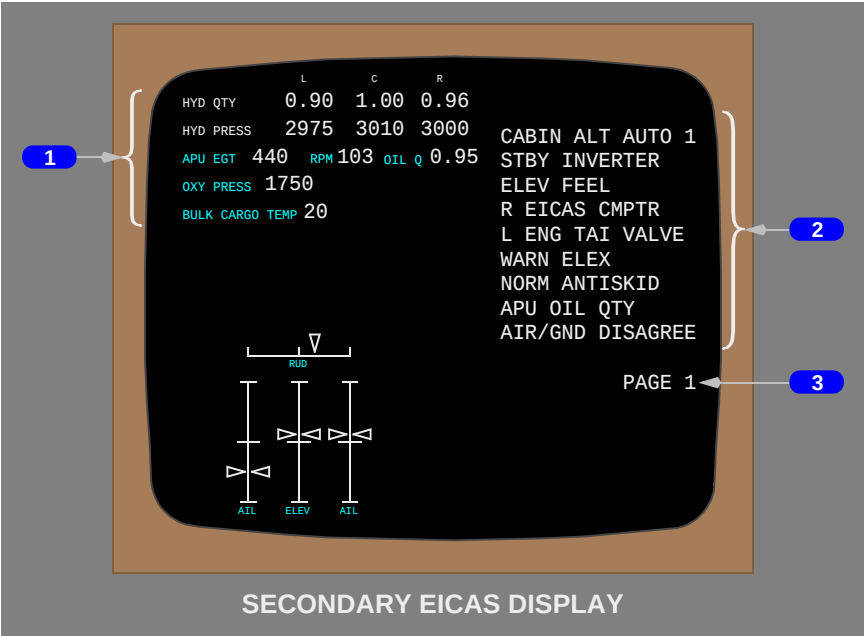
VP-BOY, VP-BOZ



VP-BOQ

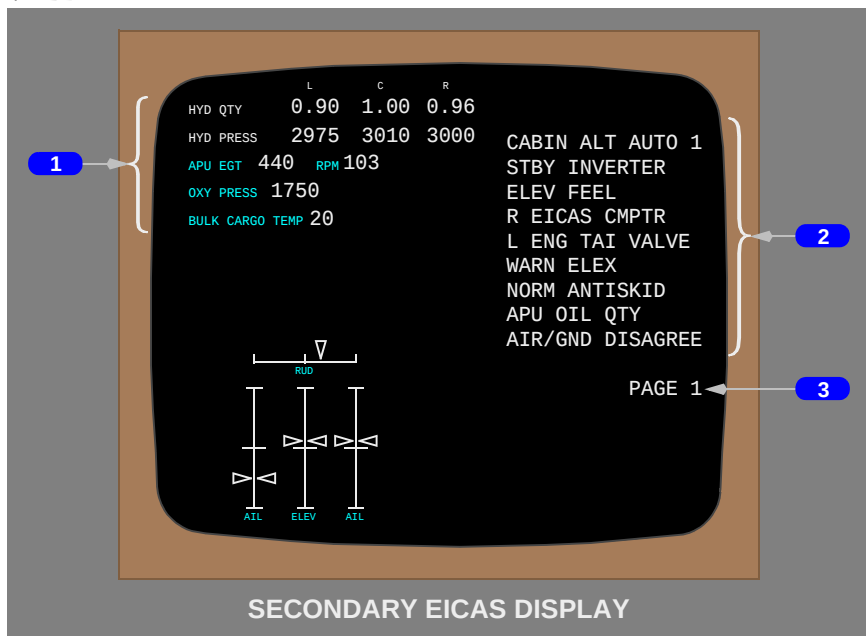


VQ-BRA

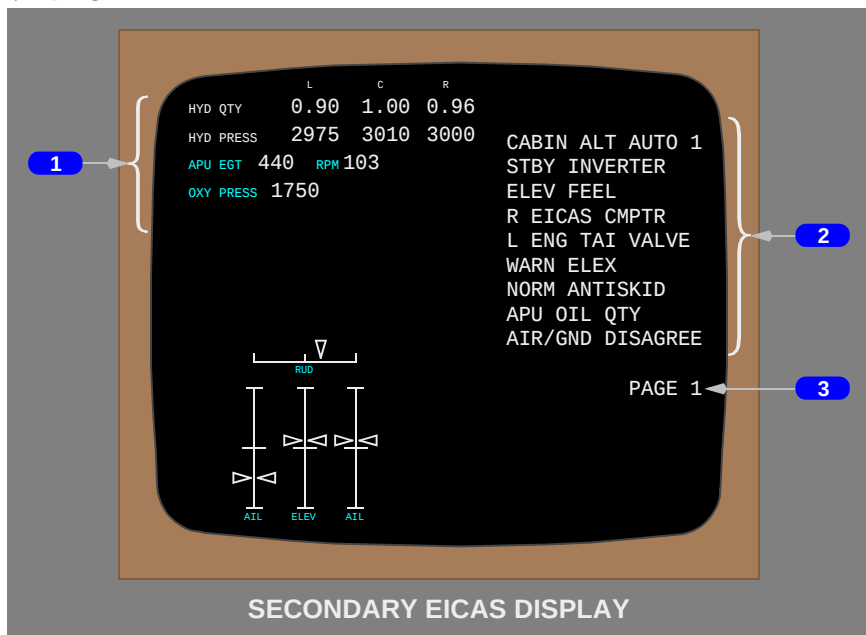


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VP-BDI



VP-BMC



1 System Indications

System indications are displayed.

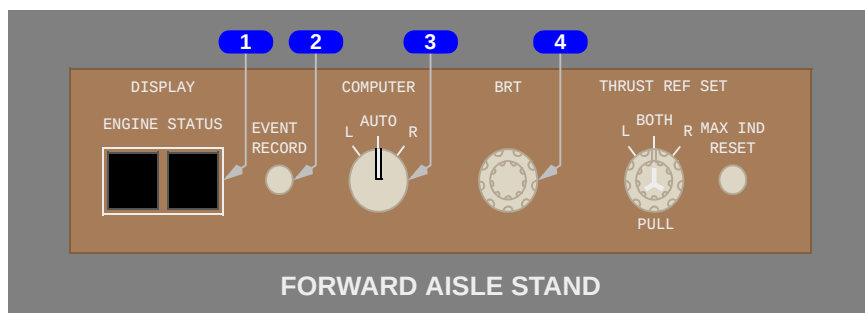
2 Status Messages

Status messages indicate conditions requiring minimum equipment list (MEL) reference for dispatch.

3 Page Number

A page number appears if additional pages of status messages exist.

EICAS Control Panel



1 STATUS Display Switch

Push – displays the status display on the lower EICAS CRT.

Subsequent pushes –

- displays the next page of status messages when additional pages exist
- the status display blanks after the last page of status messages is displayed.

2 EVENT RECORD Switch

Push – records the last EICAS event into memory.

3 COMPUTER Selector

L – left EICAS computer controls displays.

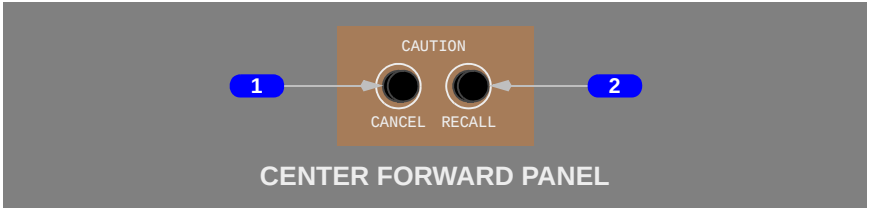
AUTO – EICAS display control automatically transfers to the right EICAS computer if the left computer fails.

R – right EICAS computer controls displays.

4 Brightness (BRT) Control

Rotate –

- Outer control – adjusts brightness of lower display
- Inner control – adjusts brightness of upper display

Caution Cancel/Recall Switches**1 CANCEL Switch**

Push –

- displays the next page of EICAS messages when additional pages exist
- cancels caution and advisory messages when the last page is displayed

Note: Warning messages remain

Note: Communication messages remain

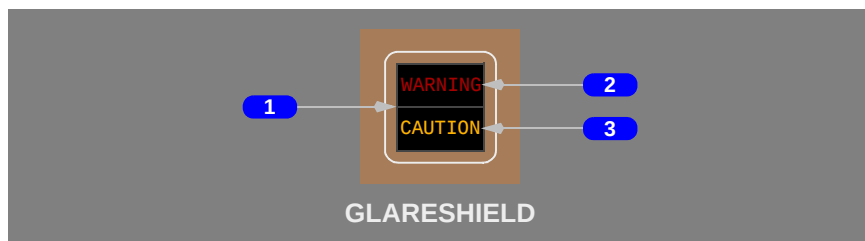
2 RECALL Switch

Push –

- displays the previously cancelled EICAS messages, if the associated condition(s) still exist
- displays the first page of messages when multiple pages exist.

Warning System Switches and Lights

Master Warning/Caution Reset Switches and Lights



1 Master WARNING/CAUTION Reset Switch

Push –

- extinguishes the master WARNING lights
- extinguishes the Master CAUTION lights
- silences most associated aural alerts (for exceptions, see Section 20, Master Warning/Caution Reset Switches and Lights)

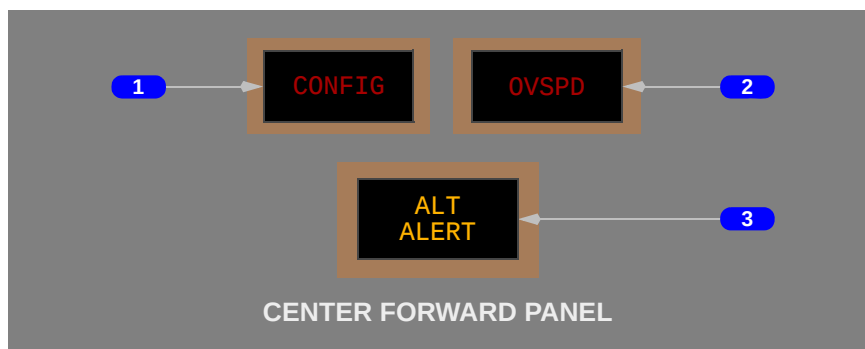
2 Master WARNING Light

Illuminated (red) – a time critical warning or warning condition exists

3 Master CAUTION Light

Illuminated (amber) – a caution condition exists

Miscellaneous Lights



1 Configuration (CONFIG) Light

Illuminated (red) – a configuration warning exists

2 Overspeed (OVSPD) Light

Illuminated (red) – airplane is exceeding Mmo or Vmo

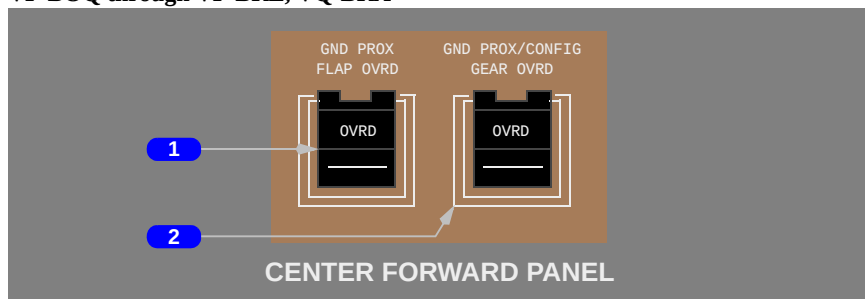
3 Altitude Alert (ALT ALERT) Light

Illuminated (amber) –

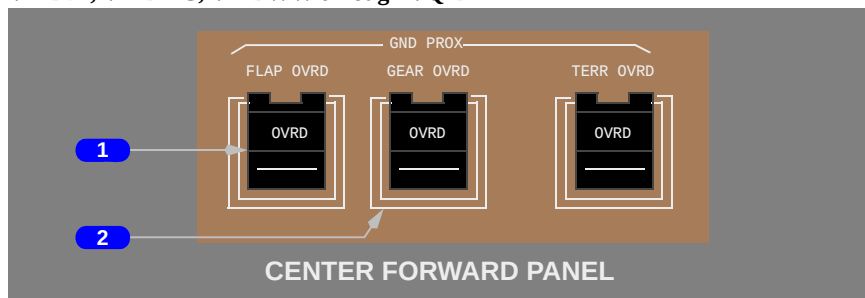
- **VP-BMC through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA**
between 300 and 900 foot deviation from selected altitude
- **VP-BDI, VP-BWW, VP-BWX, VQ-BOG**
between 200 and 500 foot deviation from selected altitude

Ground Proximity Warning System (GPWS) GPWS Controls

VP-BOQ through VP-BRL, VQ-BRA



VP-BDI, VP-BMC, VP-BWW through VQ-BPT



1 Ground Proximity Flap Override (GND PROX FLAP OVRD) Switch

Push (OVRD visible) –

- inhibits the ground proximity TOO LOW FLAPS caution
- inhibits the ground proximity TOO LOW TERRAIN caution

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

Note: The EICAS advisory message GND PROX SYS is displayed when FLAP OVRD is selected for more than 60 seconds while airspeed is greater than 250 knots.

2 Ground Proximity Configuration Gear Override (GND PROX/CONFIG GEAR OVRD) Switch

Push (OVRD visible) –

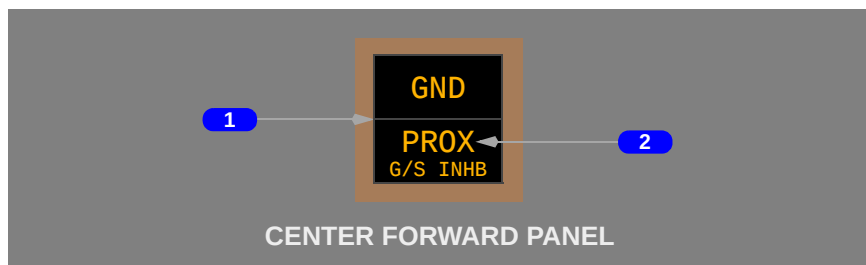
- inhibits the ground proximity TOO LOW GEAR caution
- inhibits the ground proximity TOO LOW TERRAIN caution

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- inhibits the landing configuration warning siren

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

Note: The EICAS advisory message GND PROX SYS is displayed when GEAR OVRD is selected for more than 60 seconds while airspeed is greater than 290 knots.


1 Ground Proximity Glideslope Inhibit (GND PROX G/S INHB) Switch

Push (momentary) –

- inhibits the ground proximity GLIDESLOPE caution when below 1,000 feet radio altitude

VP-BMC, VP-BOQ, VQ-BMU

- enables the GPWS voice callout FIVE HUNDRED at 500 feet radio altitude

2 Ground Proximity (GND PROX) Light

Illuminated (amber) –.

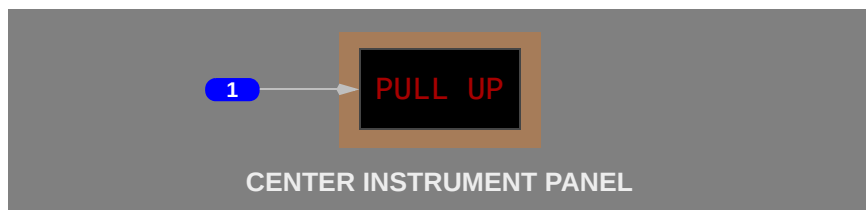
- a ground proximity caution exists

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

- an enhanced GPWS look-ahead caution exists

VP-BOQ

- an enhanced GPWS look-ahead caution exists

GPWS Immediate-Alert Annunciations


1 PULL UP Light

PULL UP (red) –

- the airplane descent rate is severe
- the airplane closure rate is excessive with the landing gear and/or flaps not in the landing configuration

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

- an enhanced GPWS look-ahead warning exists

VP-BOQ

- an enhanced GPWS look-ahead warning exists

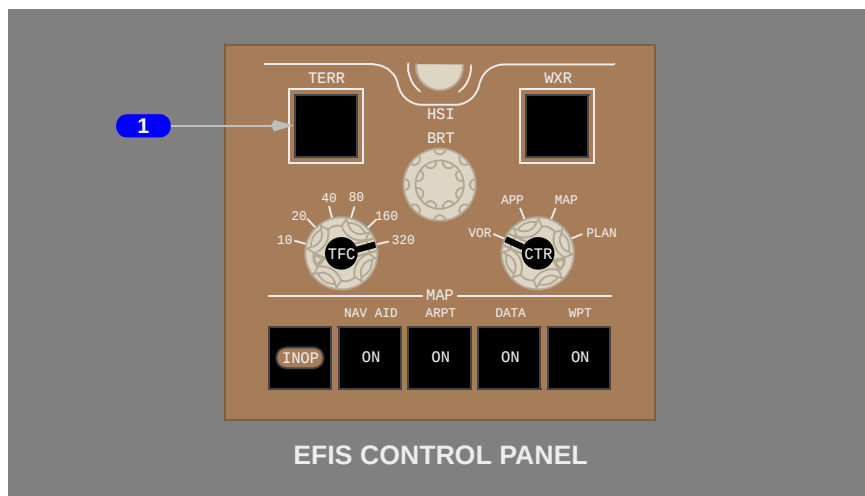
Enhanced GPWS

VP-BDI through VP-BOQ, VP-BWW through VQ-BPT

GPWS with Look-Ahead Display and Alerting

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

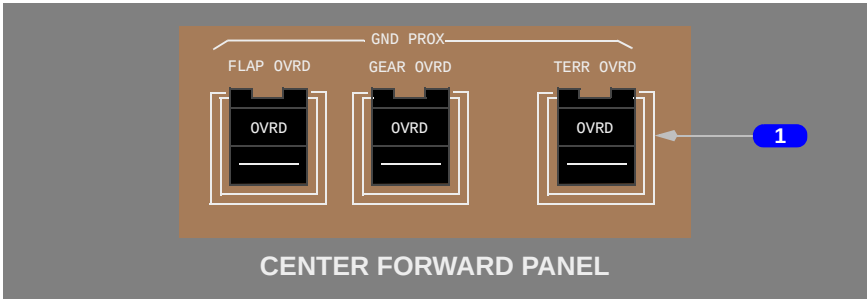
Look-Ahead Display Switches



1 Terrain (TERR) Display Select Switch

Push –

- displays GPWS look-ahead data in VOR, APP, MAP, and CTR MAP modes
- arms GPWS look-ahead data in CTR VOR, CTR APP, and PLAN modes
- deselects the weather radar display regardless of the HSI mode selector position
- second push deselects GPWS look-ahead display

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Look-Ahead Inhibit Switches

1 Terrain System Override Switch

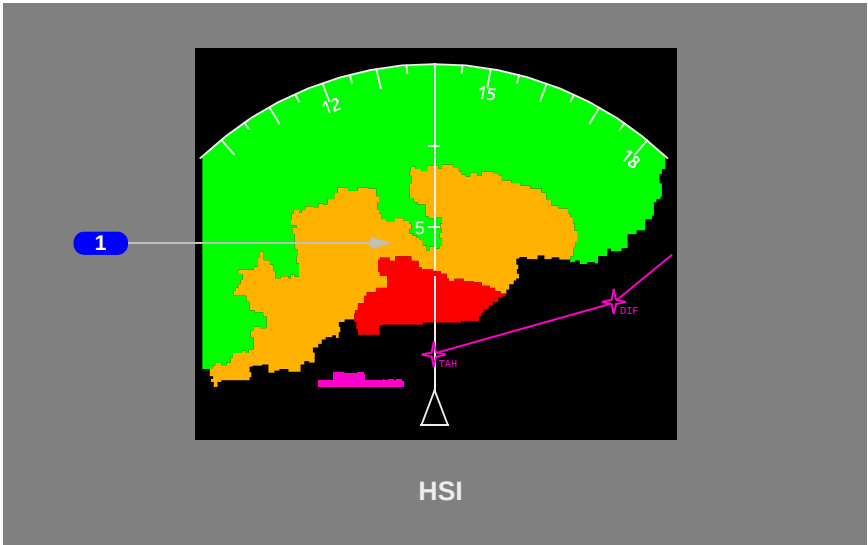
Push – (OVRD visible)

- inhibits GPWS look-ahead alerts and displays
- second push deselects inhibit

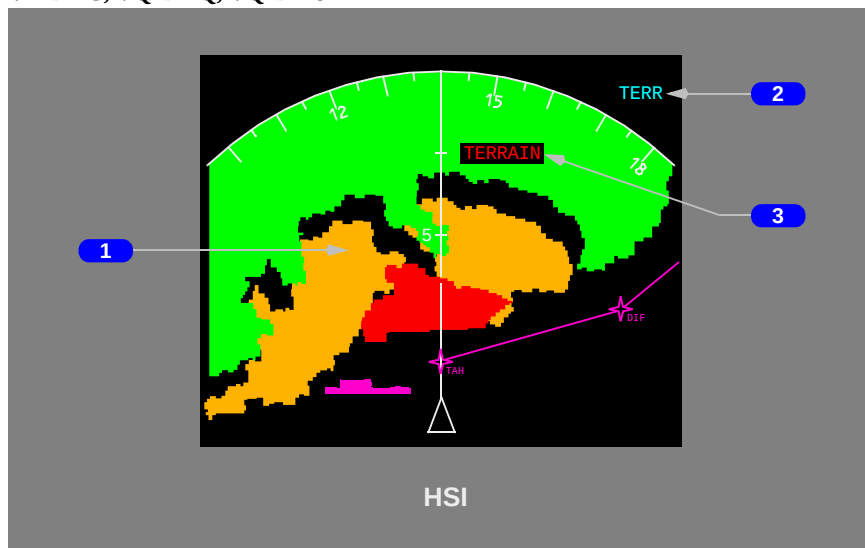
Terrain Display

VP-BMC, VQ-BMQ, VQ-BMU, VQ-BPT

VQ-BPT



VP-BMC, VQ-BMQ, VQ-BMU



1 Terrain Display

Color and density vary based on terrain height verse airplane altitude:

- dotted green: terrain from 2,000 feet below to 500 feet (250 feet with gear down) below the airplane's current altitude
- dotted amber: terrain 500 feet (250 feet with gear down) below to 2,000 feet above the airplane's current altitude
- dotted red: terrain more than 2,000 feet above airplane's current altitude
- dotted magenta: no terrain data available
- solid amber: look-ahead terrain caution active.
- solid red: look-ahead terrain warning active

Note: In areas without terrain data, look-ahead terrain alerting and display functions are not available. GPWS immediate-alert modes function normally.

Note: Terrain more than 2,000 feet below airplane altitude or within 400 feet of nearest airport runway elevation is not displayed.

Terrain is displayed automatically when:

- a look-ahead terrain alert occurs; and
- Terrain (TERR) Display Select Switch is not selected by either pilot; and
- HSI Mode Selector in the VOR, APP, MAP, or CTR MAP mode

The look-ahead display updates with a sweep similar to the weather radar display.

VP-BMC, VQ-BMQ, VQ-BMU

2 Terrain (TERR) Mode Annunciation

TERR (cyan) – terrain display enabled (manual or automatic display)

VP-BMC, VQ-BMQ, VQ-BMU

3 TERRAIN Annunciation

TERRAIN (red):

- terrain warning is occurring
- 20-30 seconds from projected impact with terrain

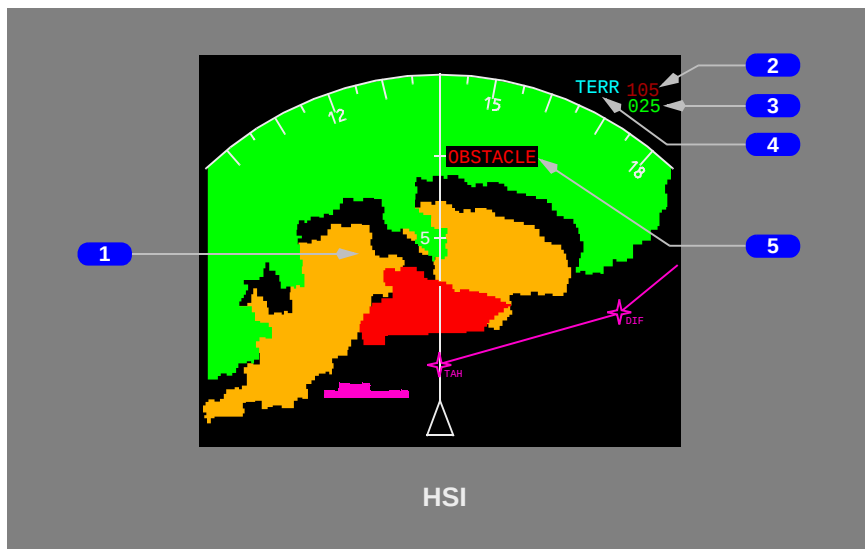
TERRAIN (amber):

- terrain caution is occurring
- 40-60 seconds from projected impact with terrain

Note: TERRAIN annunciation displays in all HSI modes.

Obstacles and Terrain Display

VP-BDI, VP-BWW, VP-BWX, VQ-BOG



1 Obstacle and Terrain Display

When the airplane is higher than 2,000 feet above the terrain, display color density depends on obstacle or terrain height:

- solid green – highest obstacles or terrain displayed
- high density green – intermediate height obstacles or terrain displayed
- low density green – lowest obstacles or terrain displayed

When the airplane is at or lower than 2,000 feet above the terrain, color and density depends 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 obstacle or terrain caution is occurring
- solid red – look-ahead obstacle or terrain warning is occurring

Note: In areas without obstacle or terrain data, look-ahead obstacle or terrain alerting and display functions are not available. GPWS immediate-alert modes function normally.

Note: Terrain within 400 feet of nearest airport runway elevation is not displayed.

Obstacles or terrain are displayed automatically when:

- a look-ahead obstacle or terrain alert occurs; and
- Terrain (TERR) Display Select Switch is not selected by either pilot; and
- HSI Mode Selector in the VOR, APP, MAP, or CTR MAP mode

The look-ahead display updates with a sweep similar to the weather radar display.

2 Highest Elevation of Obstacle or Terrain Displayed

Highest elevation within selected map range expressed in hundreds of feet above sea level. Color (amber, green, or red) same as color of corresponding obstacle or terrain displayed.

3 Lowest Elevation of Obstacle or Terrain Displayed

Lowest elevation within selected map range expressed in hundreds of feet above sea level. Color (amber, green, or red) same as color of corresponding obstacle or terrain displayed. Blank above level terrain or if all terrain is within 400 feet of nearest airport elevation.

4 Terrain Mode Annunciation

TERR (cyan) – GPWS look-ahead display enabled

5 TERRAIN/OBSTACLE Annunciations

TERRAIN (red):

- terrain warning is occurring
- 20-30 seconds from projected impact with terrain

767 Flight Crew Operations Manual
OBSTACLE (red):

- obstacle warning is occurring
- 20-30 seconds from projected impact with an obstacle

TERRAIN (amber):

- terrain caution is occurring
- 40-60 seconds from projected impact with terrain

OBSTACLE (amber):

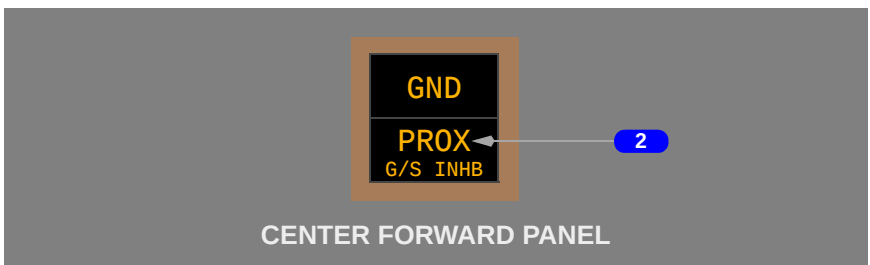
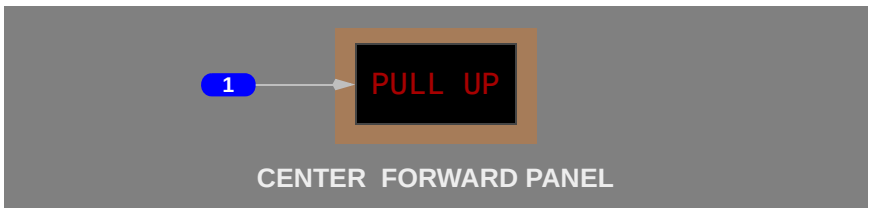
- obstacle caution is occurring
- 40-60 seconds from projected impact with an obstacle

Displays in all HSI navigation modes.

Note: If an obstacle alert occurs while a TERRAIN alert message is displayed, the OBSTACLE alert message replaces the TERRAIN alert message. Both messages can not be displayed at the same time.

Look-Ahead Annunciations
VQ-BPT

The EFIS signal generators are not integrated with the enhanced GPWS computer and visual look-ahead status and alert annunciations are not displayed on the HSI. Visual look-ahead alerting is available on the PULL UP and GND PROX lights. See Look-Ahead Control and Inhibit Switches for visual status annunciations.



1 PULL UP Light

PULL UP (red) –

- look-ahead terrain warning is active

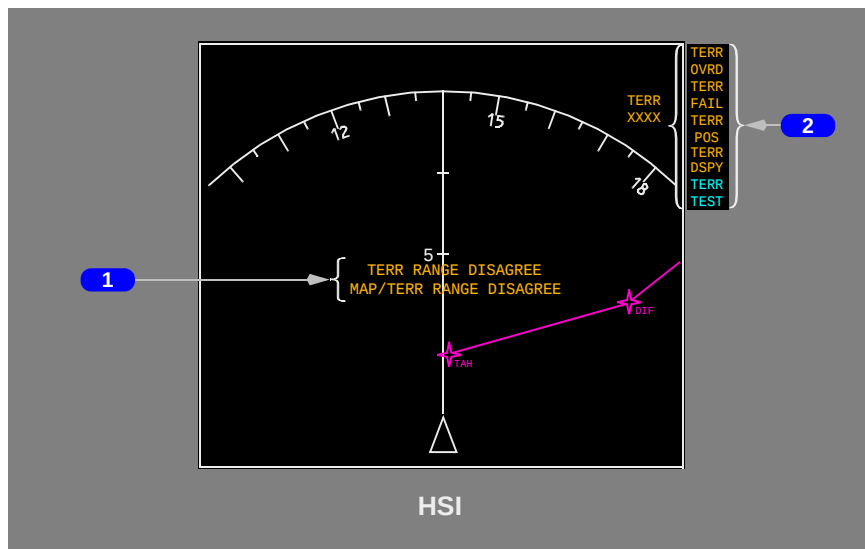
2 Ground Proximity (GND PROX) Light

Illuminated (amber) –

- look-ahead terrain caution is active

Look-Ahead HSI Systems Annunciations

VP-BDI, VP-BMC, VP-BWW through VQ-BOG



1 Terrain Range Disagree Annunciation

TERR RANGE DISAGREE (amber) –

- GPWS look-ahead display enabled
- GPWS look-ahead display output range disagrees with the HSI Range Selector

MAP/TERR RANGE DISAGREE (amber) –

- GPWS look-ahead display enabled
- GPWS look-ahead display output range disagrees with the HSI Range Selector
- map display output range disagrees with the HSI Range Selector

2 GPWS Status/Mode Annunciation

TERR OVRD (amber) – GND PROX TERR OVRD switch pushed

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TERR FAIL (amber) – GPWS look-ahead alerting and display have failed

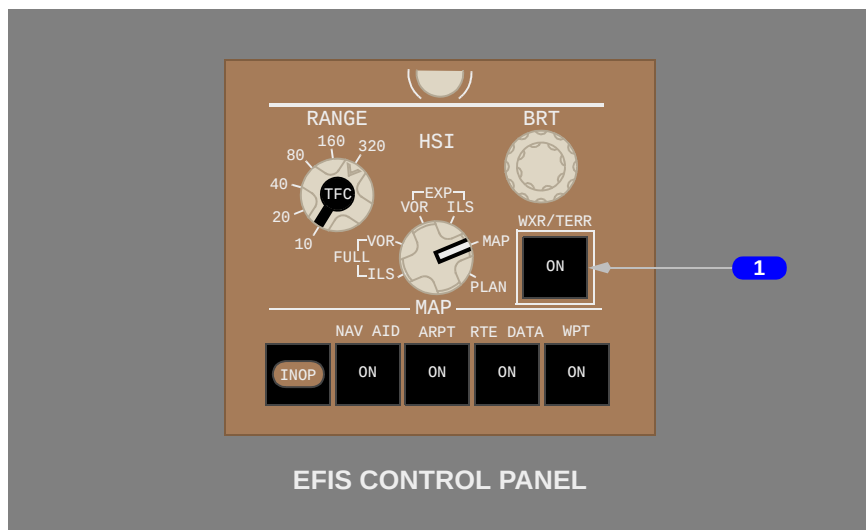
TERR POS (amber) – GPWS look-ahead alerting and display unavailable due to FMS position uncertainty

TERR DSPY (amber) - HSI overhear or loss of distribution unit cooling.

TERR TEST (cyan) – GPWS operating in self-test mode

GPWS with Look-Ahead Capability Installed Under Supplemental Type Certificate (STC) VP-BOQ

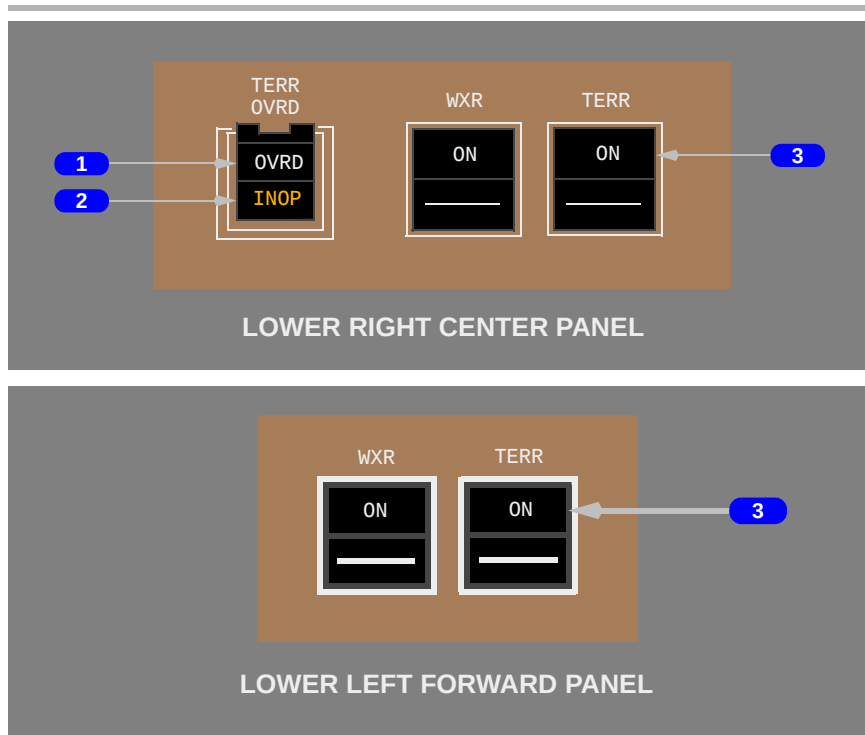
Look-Ahead Control and Inhibit Switches



1 Weather Radar and Terrain (WXR/TERR) Display Enable Switch

Push –

- enables GPWS look-ahead terrain data in EXP VOR, EXP ILS, and MAP modes
- enables the weather radar display
- second push disables GPWS look-ahead terrain data and weather radar display



1 Ground Proximity Terrain Override (TERR OVRD) Switch

Push – (OVRD visible)

- inhibits enhanced GPWS look-ahead alerts and displays
- second push deselected inhibit

2 Ground Proximity Terrain System (TERR OVRD) Inoperative (INOP) Light

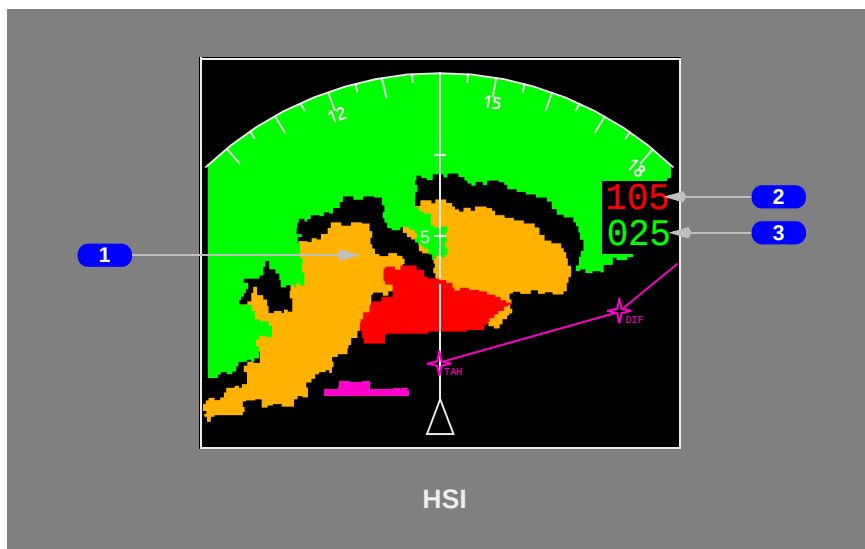
Illuminated – (INOP amber)

- enhanced GPWS look-ahead alerts and displays are inoperative

3 Terrain (TERR) Display Select Switch

Push – (ON white)

- displays enhanced GPWS look-ahead data in EXP VOR, EXP ILS, and MAP modes when the Weather Radar (WXR/TERR) Switch is pushed
- deselected the weather radar display regardless of the HSI mode selector position
- second push deselected look-ahead display



When the airplane is higher than 2,000 feet above the terrain, display color density depends on obstacle or terrain height:

- solid green – highest obstacles or terrain displayed
- high density green – intermediate height obstacles or terrain displayed
- low density green – lowest obstacles or terrain displayed

When the airplane is at or lower than 2,000 feet above the terrain, color and density depends 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 obstacle or terrain caution is occurring
- solid red – look-ahead obstacle or terrain warning is occurring

Note: In areas without obstacle or terrain data, look-ahead obstacle or terrain alerting and display functions are not available. GPWS immediate-alert modes function normally.

Note: Terrain within 400 feet of nearest airport runway elevation is not displayed.

Obstacles or terrain are displayed automatically when:

- a look-ahead obstacle or terrain alert occurs; and
- Terrain (TERR) Display Select Switch is not selected by either pilot; and
- HSI Mode Selector in the EXP VOR, EXP ILS or MAP mode

The look-ahead display updates with a sweep similar to the weather radar display.

2 Highest Elevation of Obstacle or Terrain Displayed

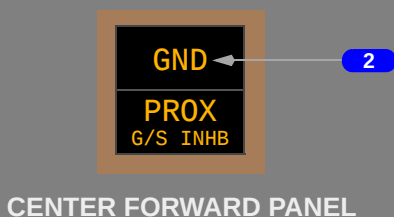
Highest elevation within selected map range expressed in hundreds of feet above sea level. Color (amber, green, or red) same as color of corresponding obstacle or terrain displayed.

3 Lowest Elevation of Obstacle or Terrain Displayed

Lowest elevation within selected map range expressed in hundreds of feet above sea level. Color (amber, green, or red) same as color of corresponding obstacle or terrain displayed. Blank above level terrain or if all terrain is within 400 feet of nearest airport elevation.

Look-Ahead Annunciations

The EFIS signal generators are not integrated with the enhanced GPWS computer and visual look-ahead status and alert annunciations are not displayed on the HSI. Visual look-ahead alerting is available on the PULL UP and GND PROX lights. See Look-Ahead Control and Inhibit Switches for visual status annunciations.





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1 PULL UP Light

PULL UP (red) –

- look-ahead obstacle or look-ahead terrain warning is active

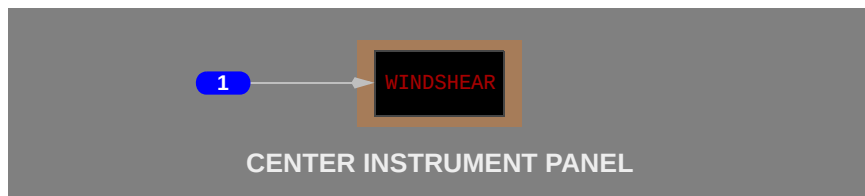
2 Ground Proximity (GND PROX) Light

Illuminated (amber) –

- look-ahead obstacle or look-ahead terrain caution is active

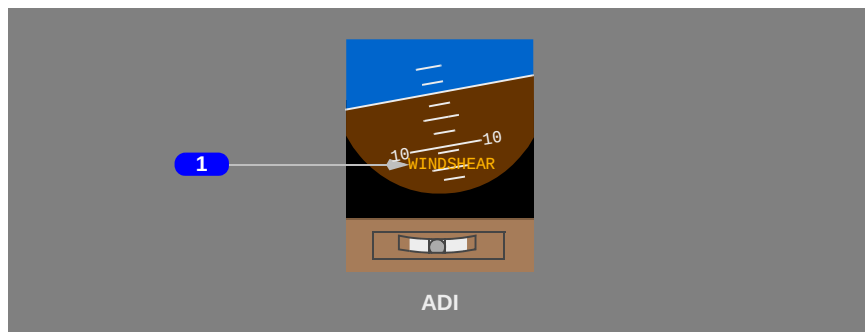
Windshear Warning System

Windshear Immediate-Alert Annunciations



1 WINDSHEAR Light

WINDSHEAR (red) – encountering a windshear condition



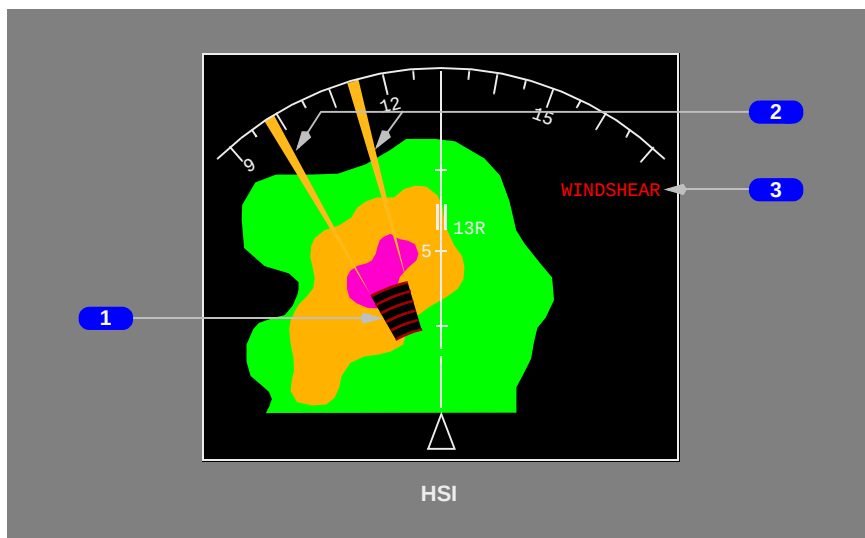
1 WINDSHEAR Annunciation

WINDSHEAR (red) – encountering a windshear condition

Predictive Windshear (PWS)

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG

PWS Displays



1 Predictive Windshear Symbol

Displayed (red and black) – PWS alert active

Shows predicted windshear location and approximate geometric size (width and depth).

Symbol, radials and weather radar returns display automatically on an HSI when:

- the aircraft is below 1200' AGL
- a PWS alert occurs
- weather (WXR) display select switch is not selected by either pilot; and
- respective HSI Mode Selector in the VOR, APP, MAP, or CTR MAP mode

Note: If a PWS alert occurs when terrain (TERR) is selected on both pilot HSI displays and there is not an active terrain alert occurring, weather radar display replaces terrain display. The weather radar display, including PWS symbology, can be deselected by pushing the TERR switch for the respective HSI.

2 Predictive Windshear Symbol Radials

Displayed (amber) – PWS alert active

Extend from predictive windshear symbol to help identify location of the PWS event.

3 WINDSHEAR

WINDSHEAR (red) – PWS warning is active

WINDSHEAR (amber) – PWS caution is active

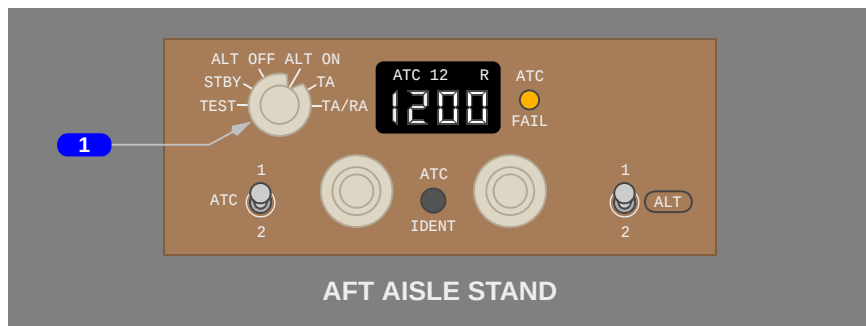
Note: The size of the PWS symbol is proportional to the geographic size of the PWS event it represents and bears no relationship to its intensity.

Traffic Alert and Collision Avoidance System (TCAS)

TCAS Controls

Transponder Panel

VP-BOY, VP-BOZ



1 TCAS Mode Selector

STBY – places transponders and TCAS system in standby

- displays TCAS STBY on TCAS Display

ALT OFF/ALT ON – activates transponders with or without altitude reporting, TCAS system in standby

- displays TCAS STBY on TCAS Display

TA – enables TCAS in Traffic Advisory mode

- display of Traffic Advisory (TA) symbols
- voice alerts
- displays TA ONLY or TA AUTO on TCAS Display

TA/RA – enables TCAS in Traffic Advisory and Resolution Advisory mode

- display of Traffic Advisory (TA) and Resolution Advisory (RA) symbols
- voice alerts
- vertical guidance for RAs
- displays TA/RA or TA/RA AUTO on TCAS Display

VP-BMC, VQ-BRA



1 TCAS Mode Selector

STBY – places transponders and TCAS system in standby

- displays TCAS OFF on HSI

ALT RPTG OFF – deactivates altitude reporting, TCAS system in standby

- displays TCAS OFF on HSI

XPDR – activates transponder only mode, TCAS system in standby

- displays TCAS OFF on HSI

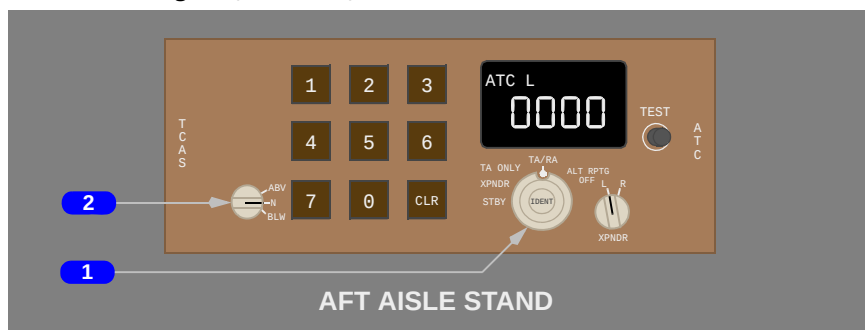
TA ONLY – enables TCAS in Traffic Advisory mode

- display of Traffic Advisory (TA) symbols
- voice alerts
- displays TA ONLY on HSI

TA/RA – enables TCAS in Traffic Advisory and Resolution Advisory mode

- display of Traffic Advisory (TA) and Resolution Advisory (RA) symbols
- voice alerts
- vertical guidance for RAs
- displays TFC on HSI

VP-BWW through VQ-BMU, VQ-BPT



1 TCAS Mode Selector

STBY – places transponders and TCAS system in standby

- displays TCAS OFF on HSI
- **VP-BWW, VP-BWX, VQ-BPT**
- displays TCAS OFF on VSI

XPDR – activates transponder only mode, TCAS system in standby:

- displays TCAS OFF on HSI
- **VP-BWW, VP-BWX, VQ-BPT**
- displays TCAS OFF on VSI

TA ONLY – enables TCAS in Traffic Advisory mode

- display of Traffic Advisory (TA) symbols
- voice alerts
- displays TA ONLY on HSI
- **VP-BWW, VP-BWX, VQ-BPT**
- displays TA ONLY on VSI

TA/RA – enables TCAS in Traffic Advisory and Resolution Advisory mode

- display of Traffic Advisory (TA) and Resolution Advisory (RA) symbols
- voice alerts
- vertical guidance for RAs
- displays TFC on HSI

ALT RPTG OFF – deactivates altitude reporting, TCAS system in standby

- displays TCAS OFF on HSI
- **VP-BWW, VP-BWX, VQ-BPT**
- displays TCAS OFF on VSI

2 Altitude Display Select Switch

ABV (Above) - displays TCAS traffic:

- from 7,000 feet above to 2,700 feet below own airplane

N (Normal) – displays TCAS traffic:

- from 2,700 feet above to 2,700 feet below own airplane

BLW (Below) – displays TCAS traffic:

- from 2,700 feet above to 7,000 feet below own airplane

VP-BDI, VP-BRL, VQ-BOG



1 TCAS Mode Selector

STBY – places transponders and TCAS system in standby

- displays TCAS OFF on HSI

ALT RPTG OFF – deactivates altitude reporting, TCAS system in standby

- displays TCAS OFF on HSI

XPNDR – activates transponder only mode, TCAS system in standby

- displays TCAS OFF on HSI

TA ONLY – enables TCAS in Traffic Advisory mode

- display of Traffic Advisory (TA) symbols
- voice alerts
- displays TA ONLY on HSI

TA/RA – enables TCAS in Traffic Advisory and Resolution Advisory mode

- display of Traffic Advisory (TA) and Resolution Advisory (RA) symbols
- voice alerts
- vertical guidance for RAs
- displays TFC on HSI

VP-BOQ



1 TCAS Mode Selector

STBY – places transponders and TCAS system in standby, no TCAS information provided

- displays TCAS OFF on HSI

ALT OFF – deactivates altitude reporting, TCAS system in standby

- displays TCAS OFF on HSI

XPNDR – activates transponder only mode, TCAS system in standby:

- displays TCAS OFF on HSI

TA – enables TCAS in Traffic Advisory mode:

- display of Traffic Advisory (TA) symbols
- voice alerts
- displays TA ONLY on HSI

TA/RA – enables TCAS in Traffic Advisory and Resolution Advisory mode:

- display of Traffic Advisory (TA) and Resolution Advisory (RA) symbols
- voice alerts
- vertical guidance for RAs
- displays TFC on HSI

2 Altitude Display Selector

ABV (Above) - displays TCAS traffic:

- from 9,900 feet above to 2,700 feet below own airplane

N (Normal) – displays TCAS traffic:

- from 2,700 feet above to 2,700 feet below own airplane

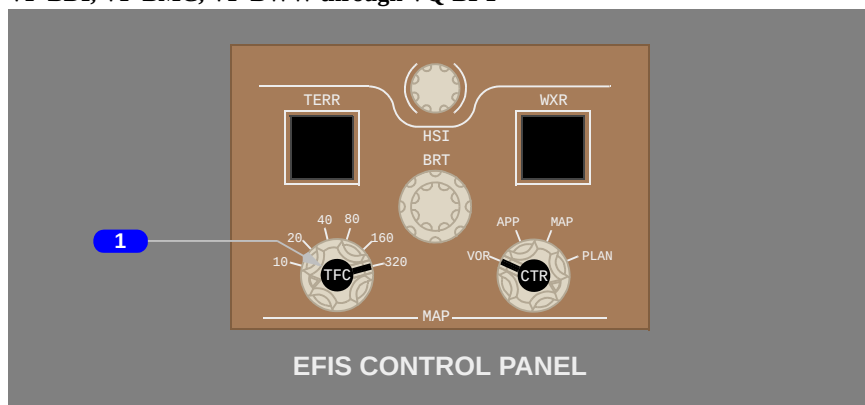
BLW (Below) – displays TCAS traffic:

- from 2,700 feet above to 9,900 feet below own airplane

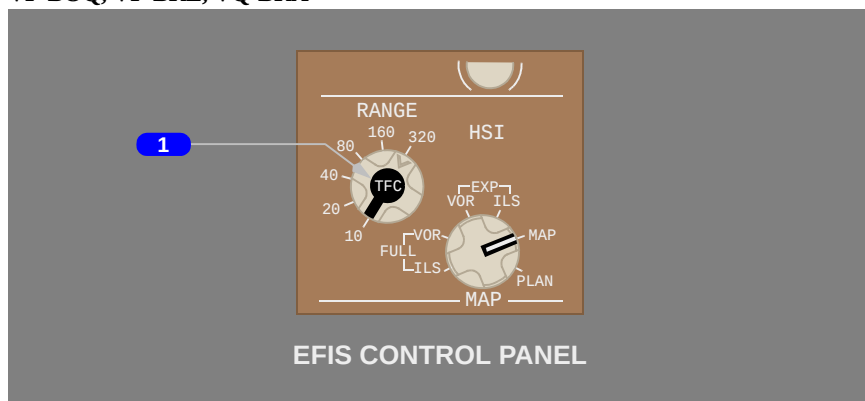
EFIS Control Panel

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

VP-BDI, VP-BMC, VP-BWW through VQ-BPT



VP-BOQ, VP-BRL, VQ-BRA



1 Traffic (TFC) Switch

Note: TCAS must be enabled on the Transponder Panel.

Push –

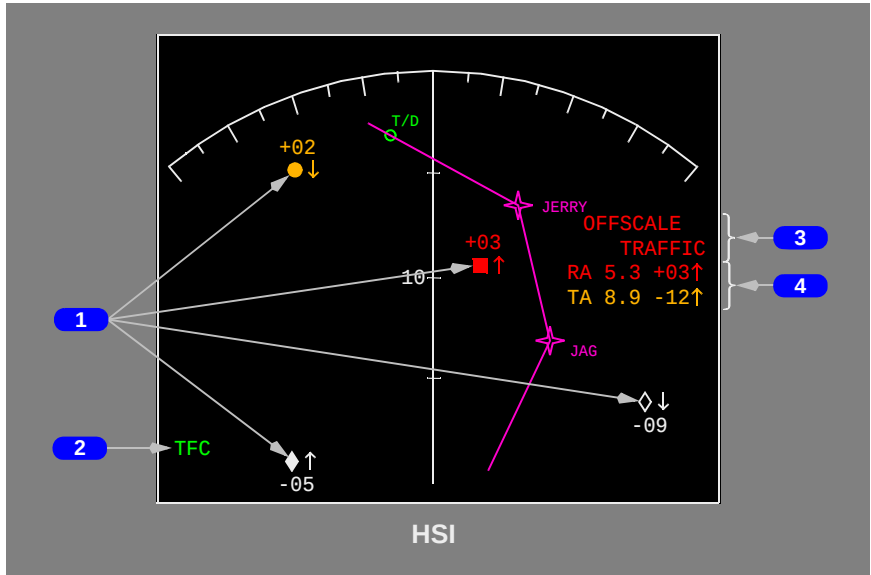
- displays or removes TCAS traffic information on HSI

TCAS Displays

HSI

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

Note: See HSI TCAS symbology tables for description.



1 Traffic Aircraft Symbology

Indicates the relative position of traffic aircraft.

2 Mode Annunciations

3 Traffic Messages

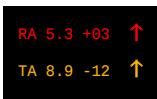
4 No-Bearing Symbology

HSI TCAS Symbology

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

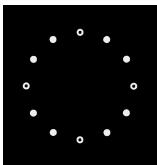
Symbol	Name (Color)	Applicable Mode(s)	Remarks
	TCAS resolution advisory (RA), relative altitude (R)	MAP EXPILS EXP VOR CTR MAP APP VOR	These symbols are displayed only when the EFIS control panel traffic (TFC) switch is selected on.
	TCAS traffic advisory (TA), relative altitude (A)		The arrow indicates traffic climbing or descending at a rate greater than or equal to 500 fpm. At rates less than 500 fpm, the arrow is not displayed.
	TCAS proximate traffic, relative altitude (W)		The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane.
	TCAS other traffic, relative altitude (W)		The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.

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Symbol	Name (Color)	Applicable Mode(s)	Remarks
	TCAS no bearing message (RA-R, TA-A)	MAP EXPILS EXP VOR CTR MAP APP VOR	A TA (amber) or RA (red) is occurring and bearing information is not available • maximum of two messages • data tag provides distance (nm), relative altitude (hundreds of feet), and vertical motion (in excess of 500 feet per minute) Only displayed when the EFIS control panel traffic (TFC) switch is selected on.

VQ-BOG

(SB Deletes VP-BMC with 3 NM range ring display.)

	3 NM Range Ring (W)	MAP CTR MAP APP VOR	Displayed when TFC is selected on the EFIS control panel and range is 80 NM or less. Ring is centered around the airplane symbol.
	TCAS traffic alert message (RA-R, TA-A)	All	Displayed whenever a TCAS RA or TA is active. EFIS control panel TFC switch does not have to be selected on.

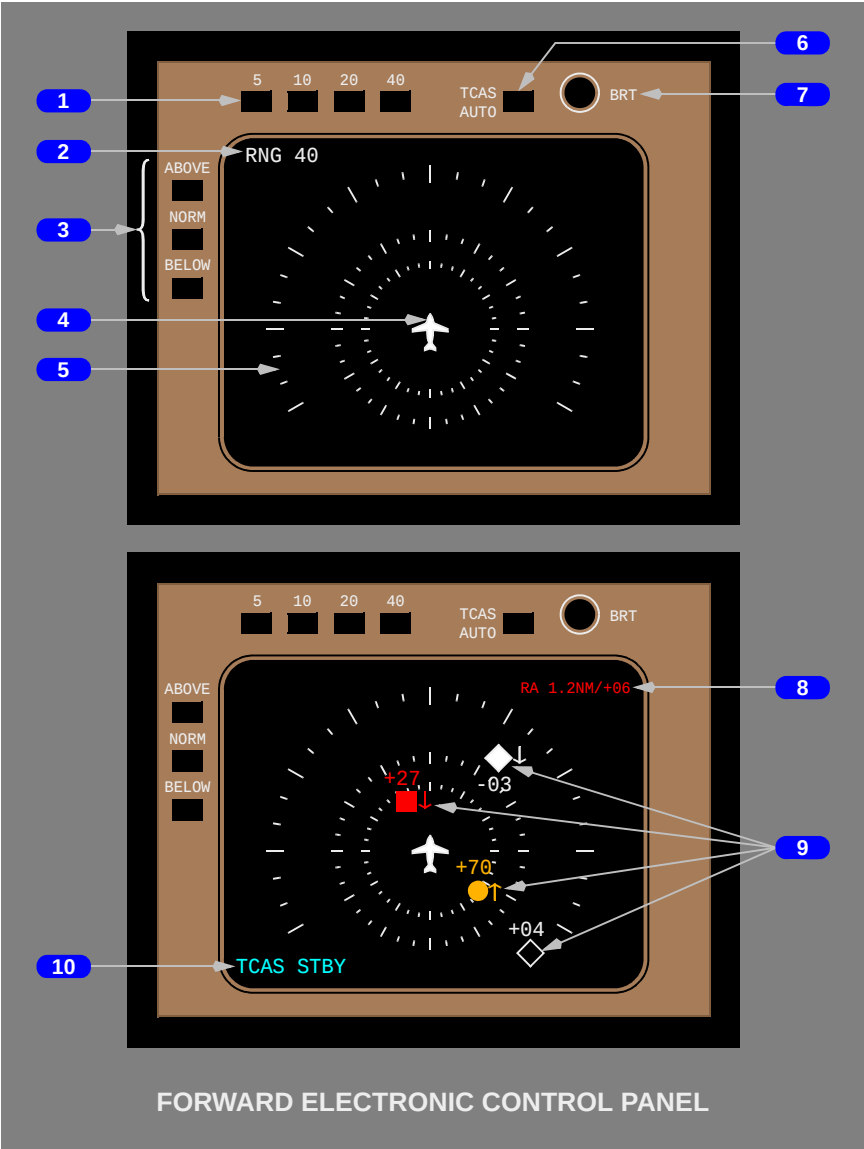
Symbol	Name (Color)	Applicable Mode(s)	Remarks
OFFSCALE	TCAS off scale message (RA-R, TA-A)	MAP EXPILS EXP VOR CTR MAP APP VOR	Displayed whenever RA or TA traffic is outside the traffic area covered by the HSI range. Displayed only if the EFIS control panel TFC switch is selected on.
TFC	TCAS mode (G)	MAP EXPILS EXP VOR CTR MAP APP VOR	Indicates the HSI TCAS display is active and the EFIS control panel TFC switch is selected on. Not displayed when TCAS TEST, TCAS FAIL, or TCAS OFF is annunciated.
TA ONLY	TCAS mode (G)	All	TCAS control panel Mode Selector in: VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT • TA VP-BDI, VP-BMC, VP-BRL, VQ-BOG, VQ-BRA • TA ONLY Indicates TCAS computer is not computing RAs. Displayed whether the EFIS control panel TFC switch is selected on or off.



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Symbol	Name (Color)	Applicable Mode(s)	Remarks
TCAS TEST	TCAS mode (W)	All	Indicates TCAS is operating in the test mode. Displayed whether EFIS control panel TFC switch is selected on or off.
TCAS OFF	TCAS off message (W)	MAP EXP ILS EXP VOR MAP CTR MAP APP VOR	Displayed when the TCAS/ATC mode switch is not in TA ONLY or TA/RA. Not displayed if TCAS is failed.
TCAS FAIL	TCAS fail message (A)	MAP EXP ILS EXP VOR CTR MAP APP VOR	Indicates TCAS failure.

Pedestal
VP-BOY, VP-BOZ



1 Range Buttons

Selects display range:

- range 5 – displays range rings at 2 and 5 nautical miles.
- range 10 – displays range rings at 2, 5 and 10 nautical miles.
- range 20 – displays range rings at 2, 10 and 20 nautical miles.
- range 40 – displays range rings at 10, 20 and 40 nautical miles.

2 Range Annunciation

Displays selected range.

3 Vertical Display Selectors

ABOVE – PUSH to display a larger monitored airspace 8,700 feet above own airplane. The monitored airspace below the airplane is 2,700 feet.

NORM – PUSH to display monitored airspace 2,700 feet above and 2,700 feet below own airplane.

BELOW – PUSH to display a larger monitored airspace 8,700 feet below own airplane. The monitored airspace above is 2,700 feet above own airplane.

4 Airplane Symbol

Displayed – traffic aircraft displayed relative to own airplane

5 Range Rings

Displayed – displays range from airplane symbol

6 TCAS AUTO

Alternates display between Pop Up Mode and Full Time Mode.

- PUSH to enable Pop Up Mode and automatically display traffic aircraft when:
 - a RA or TA occurs
 - display clears automatically when traffic aircraft is no longer a TA or RA
- PUSH to enable Full Time Mode to continuously display all traffic aircraft

7 Brightness (BRT) Control

Adjusts brightness of display screen.

8 No-Bearing Symbolology

Indicates that an traffic alert (TA or RA) is occurring with no bearing information available.

9 Traffic Aircraft Symbology

Indicates the relative position of traffic aircraft. See TCAS symbology tables for description.

10 Failure and Mode Annunciations

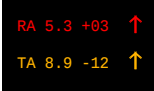
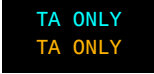
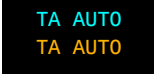
TCAS and TCAS display system annunciations. Refer to Pedestal TCAS symbology tables for messages.

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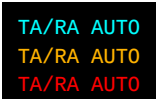
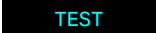
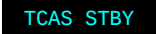
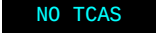
Pedestal TCAS Symbolology

VP-BOY, VP-BOZ

Symbol	Name (Color)	Applicable Mode(s)	Remarks
	TCAS resolution advisory (RA), relative altitude (R)	TA/RA	These symbols are displayed when TA or TA/RA is selected with the transponder mode selector.
	TCAS traffic advisory (TA), relative altitude (A)	TA TA/RA	In Pop Up mode traffic symbols are only displayed when a RA or TA occurs. In Full Time Mode traffic symbols are displayed continuously.
	TCAS proximate traffic, relative altitude (W)	TA TA/RA	The arrow indicates traffic climbing or descending at a rate greater than or equal to 500 fpm. At rates less than 500 fpm, the arrow is not displayed.
	TCAS other traffic, relative altitude (W)	TA TA/RA	The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane. The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.

Symbol	Name (Color)	Applicable Mode(s)	Remarks
	TCAS no bearing message RA occurring (R) TA occurring (A)	TA TA/RA	A TA (amber) or RA (red) is occurring and bearing information is not available - maximum of two messages - data tag provides distance (nm), relative altitude (hundreds of feet), and vertical motion (in excess of 500 feet per minute)
	TCAS mode (C) TA occurring (A)	TA	Indicates that TCAS computer is not computing RAs. Turns amber while a TA is in progress. TCAS control panel Mode Selector in: TA
	TCAS mode (C) TA occurring (A)	TA	Indicates that TCAS display is in pop-up mode. Turns amber while a TA is in progress. Indicates that TCAS computer is not computing RAs. TCAS control panel Mode Selector in: TA

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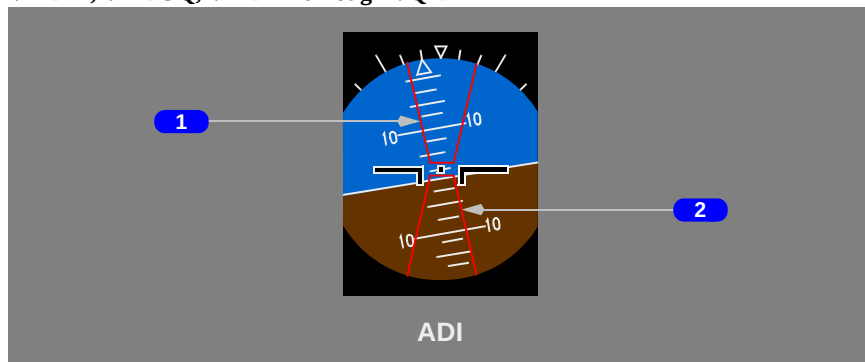
Symbol	Name (Color)	Applicable Mode(s)	Remarks
	TCAS mode (C) TA occurring (A) RA occurring (R)	TA/RA	Indicates that TCAS computer is computing and displaying both TAs and RAs. Turns red (RA) or amber (TA) while an alert is in progress.
	TCAS mode (C) TA occurring (A) RA occurring (R)	TA/RA	Indicates that TCAS display is in pop-up mode. Turns red (RA) or amber (TA) while an alert is in progress. Indicates that TCAS computer is computing and displaying both TAs and RAs.
	TCAS mode (C)	All	Indicates TCAS is operating in the test mode.
	TCAS off message (C)	All	Displayed when the TCAS/ATC mode switch is not in TA ONLY or TA/RA.
	TCAS off message (C)	All	Indicates the TCAS system is not operational.
	TCAS fail message (A)	All	Indicates TCAS failure.
	TCAS fail message (A)	All	Indicates TCAS display failure.

TCAS Vertical Guidance

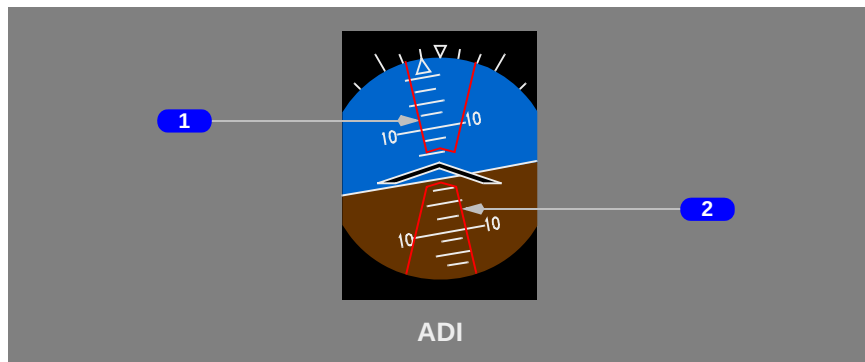
ADI

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

VP-BDI, VP-BOQ, VP-BRL through VQ-BRA



VP-BMC



1 Vertical Guidance (Down Advisory)

Displayed (red) –

- a RA is occurring
- indicates pitch attitude region to be avoided for traffic-avoidance maneuver

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2 Vertical Guidance (Up Advisory)

Displayed (red) –

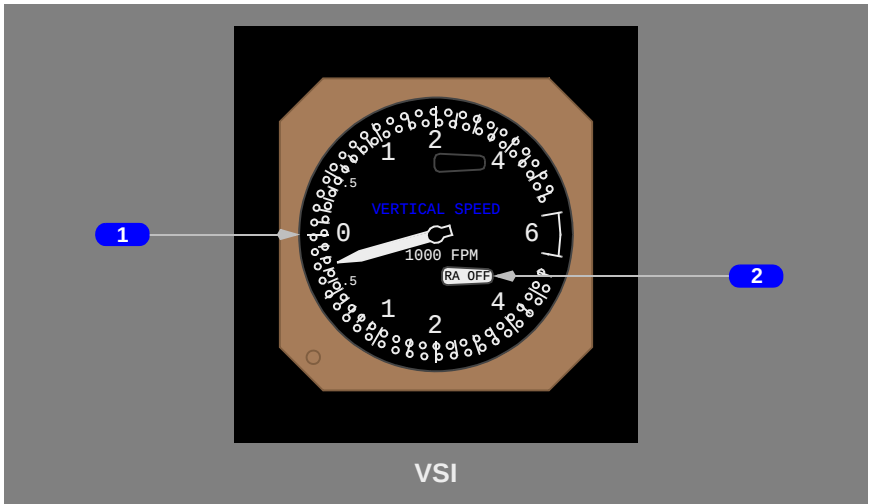
- a RA is occurring
- indicates pitch attitude region to be avoided for traffic-avoidance maneuver

Note: Both of the TCAS RA pitch commands (above and below) may be displayed at the same time and are shown for clarity.

Note: The area inside the red lines indicates the pitch region to avoid in order to resolve the traffic conflict. The center of the airplane symbol must be outside the red RA pitch command area to ensure traffic avoidance.

VSI with Vertical Guidance Only

VP-BOY, VP-BOZ


1 Vertical Guidance

Displayed (red and green):

- RA is occurring
- red indicates vertical speeds to avoid
- green (or no colored arc) indicates safe vertical speeds

2 Failure and Mode Annunciations

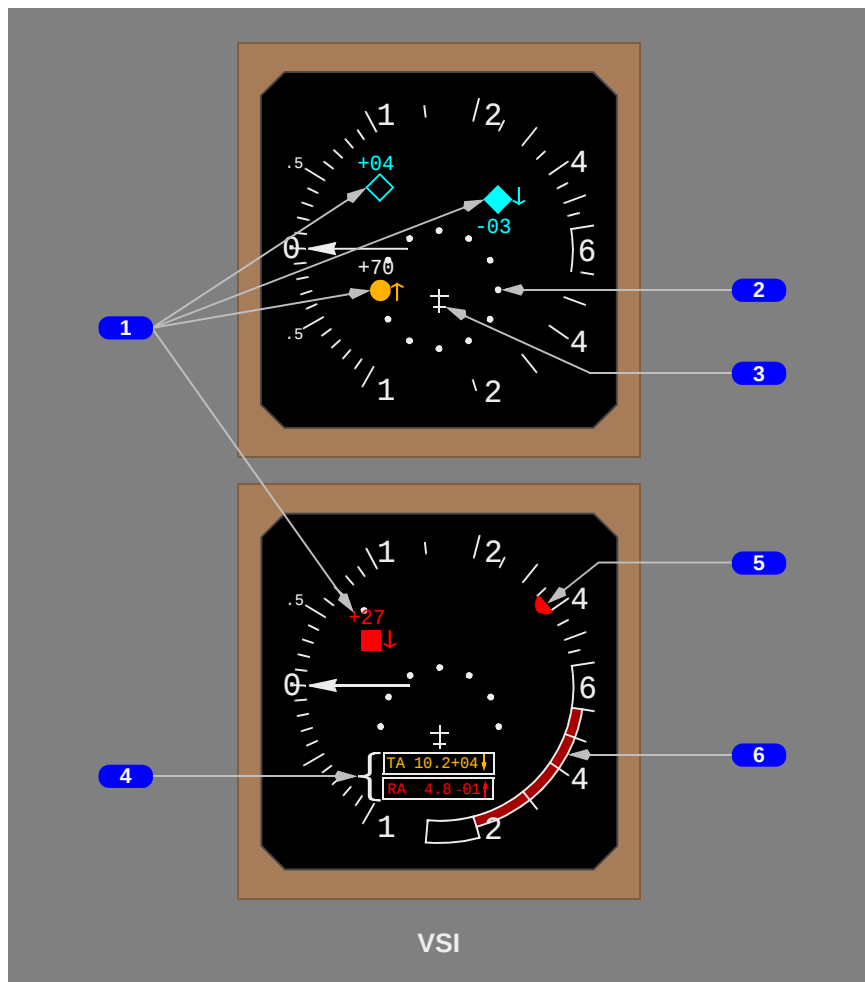
TCAS (amber) – TCAS failure. TAs and RAs not available.

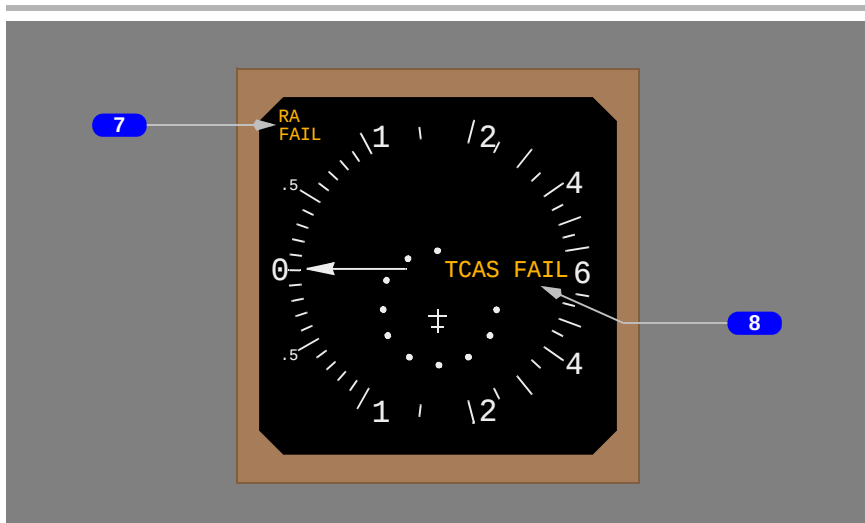
RA OFF (white):

- TCAS Mode Selector in STBY
- TCAS Mode Selector in TA
- VSI power loss.

VSI with TCAS Display

VP-BWW, VP-BWX, VQ-BPT





1 Traffic Aircraft Symbology

Indicates the relative position of traffic aircraft.

2 Range Ring

Displayed (white) – 2 mile range from airplane symbol.

3 Own Airplane Symbol

Displayed (white) – traffic aircraft are displayed relative to the airplane

4 No Bearing Symbology

Indicates that an traffic alert (TA or RA) is occurring with no bearing information available.

4 Offscale Aircraft Symbology

Displayed (red or amber):

- a TA (amber) or RA (red) is occurring outside the display range
- appears as a half-filled amber circle or a half-filled red square

6 Vertical Guidance

Displayed (red and green):

- RA is occurring
- red indicates vertical speeds to avoid
- green (or no colored arc) indicates safe vertical speeds

7 TCAS Mode Annunciations

See VSI TCAS symbology tables.

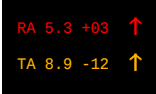
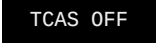
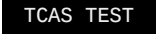
8 TCAS Failure Annunciations

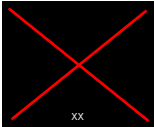
See VSI TCAS symbology tables.

VSI TCAS Symbology

Symbol	Name	Location	Remarks
	TCAS resolution advisory (RA), relative altitude (R)		These symbols are displayed when TA or TA/RA is selected with the transponder mode selector.
	TCAS traffic advisory (TA), relative altitude (A)		The arrow indicates traffic climbing or descending at a rate greater than or equal to 500 fpm. At rates less than 500 fpm, the arrow is not displayed.
	TCAS proximate traffic, relative altitude (W)		The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane.
	TCAS other traffic, relative altitude (W)		The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.

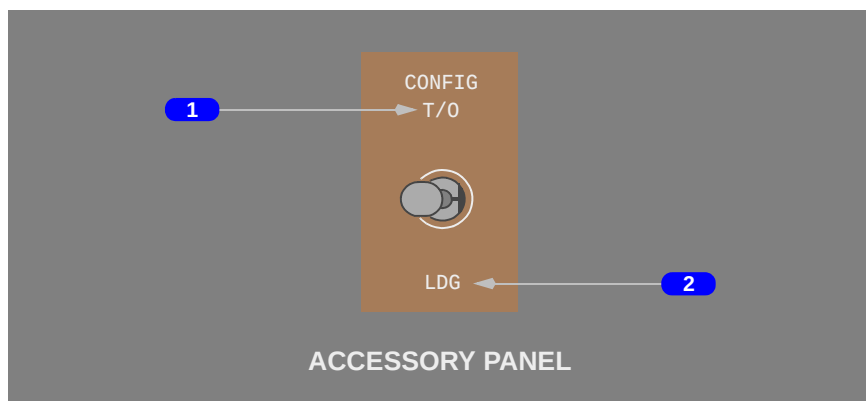
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Symbol	Name	Location	Remarks
	TCAS no bearing message (RA-R, TA-A)	Lower Center	A TA (amber) or RA (red) is occurring and bearing information is not available • maximum of two messages • data tag provides distance (nm), relative altitude (hundreds of feet), and vertical motion (in excess of 500 feet per minute)
	TCAS mode (W)	Upper Left	TCAS computer is not computing RAs. Text changes to amber (A) when an actual TA is occurring. TCAS control panel Mode Selector in: • TA
	TCAS off mode (W)	Right Center	TCAS computer is in standby or transponder only mode and not computing TAs or RAs. TCAS control panel Mode Selector not in: • TA/RA or • TA
	TCAS test mode (W)	Upper Left	TCAS system self test in progress.

Symbol	Name	Location	Remarks
	TCAS fail message (A)	Center	TCAS system is not operational.
	TCAS display fail message (A)	Center	TCAS display failure.
	RA fail message (A)	Upper Left	TCAS RAs are not available. Indicates loss of vertical speed data when accompanied by VSI FAIL (A) annunciation.
	VSI display failure (R)		Red cross on blank display indicates failure of the VSI display. TCAS Voice annunciations will still occur.

Miscellaneous Switches

Configuration (CONFIG) Test Switches



1 Takeoff (T/O) Test Switch

Spring-loaded to center

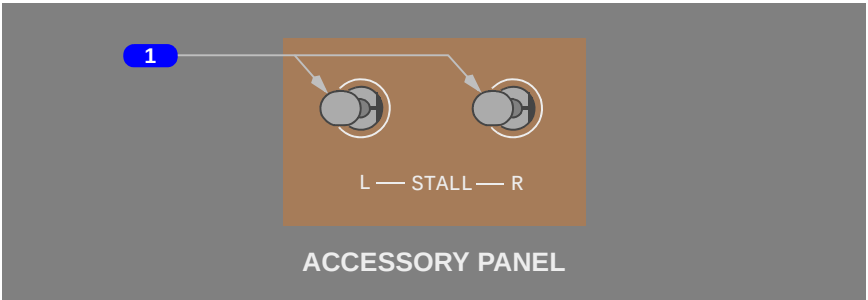
T/O – activates configuration warning if improper takeoff configuration exists

2 Landing (LDG) Test Switch

Spring-loaded to center

LDG – activates a landing configuration warning

Stall Warning Test Switches

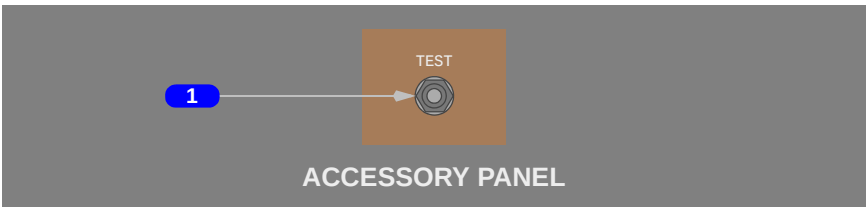


1 Stall (STALL L/R) Warning Test Switch

Spring-loaded to center

Activates stall warning system

EICAS Test Switch



1 TEST Switch

Push – activates EICAS test

Intentionally
Blank



Warning Systems

System Description

Chapter 15

Section 20

Introduction

The warning system consists of the following separate systems:

- engine indication and crew alerting system (EICAS)
- warning system
- ground proximity warning system (GPWS)
- traffic alert and collision avoidance system (TCAS)

These systems provide all airplane crew alerting.

Alert is defined as a visual, tactile and/or aural alert requiring crew awareness and possible crew action.

Engine Indication and Crew Alerting System (EICAS)

EICAS consolidates engine and subsystem indications and provides a centrally located crew alerting message display. EICAS also displays some system status and maintenance information. EICAS provides:

- system alerts
- maintenance information
- status messages
- communication alerts

System Alert Messages

System alert messages are associated with aircraft-system failures or faults. These may require performance of non-normal procedures, or affect the way the flight crew operates the airplane. There are four categories of system alert messages:

- time-critical warning
- warning
- caution
- advisory

System alert messages not associated with aircraft-system failures or faults but which may affect the way the flight crew operates the airplane include the following:

- configuration
- airspeed
- altitude
- windshear
- ground proximity warning system (GPWS)
- traffic alert and collision avoidance system (TCAS)

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- communication alert messages such as SELCAL, ACARS, ATC or PRINTER
- FMC messages (See Chapter 11, Flight Management, Navigation)

Non-normal airplane system conditions not affecting the normal airplane operations are annunciated using status or maintenance messages.

System Alert Level Definitions

Time Critical Warnings

Time critical warnings alert the crew of a non-normal operational condition requiring immediate crew awareness and corrective action to maintain safe flight. Time critical warnings are usually associated with primary flight path control. Master WARNING lights, voice alerts, and ADI indications or stick shakers announce time critical warning conditions.

Warnings

Warnings alert the crew to a non-normal operational or system condition requiring immediate crew awareness and corrective action.

Cautions

Cautions alert the crew to a non-normal operational or system condition requiring immediate crew awareness. Corrective action may be required.

Advisories

Advisories alert the crew to a non-normal operational or system condition requiring routine crew awareness. Corrective action may be required.

Communication Alerts

Communication alerts are triggered by the communication management system. These alerts direct the crew to the appropriate message display:

There are three levels of communication alert:

- low – identifies an incoming communication requiring timely awareness and response
- medium – identify an incoming communication requiring immediate awareness and a prompt response. It is accompanied by an aural chime
- high – reserved for future use.

A detailed description of the communication management system is described in Chapter 5, Communications.

Status Messages

Status messages identify system faults affecting airplane dispatch and are not considered crew alerts. The messages are displayed on the EICAS STATUS page.

Alert Message Displays

Alert messages are displayed in both prioritized and chronological order. The priority in descending order is:

- warning (red)
- caution (amber)
- advisory (amber, indented)
- medium level communication (white, preceded by a dot)
- low level communication (white, indented, preceded by a dot)

Warnings, cautions, and advisories are displayed from the top down in the EICAS display message area.

The most recent message is displayed at the top of its respective level.

If the number of messages exceeds eleven, the area below the alert field displays a page cue, indicating more than one page of messages is available for display. Paging is accomplished by pushing the CANCEL/RECALL switch on the display select panel.

Warning alerts can only be cleared by correcting the condition causing the warning. All caution and advisory alerts can be cleared. When the last page is displayed, pushing the CANCEL/RECALL switch clears all displayed caution and advisory alerts. Cleared caution and advisory alerts whose conditions still exist can be recalled by pushing the CANCEL/RECALL switch again. This also recalls the first page for review.

Communication alert messages are displayed at the bottom of the message area. Except for the Communication Alert Line, an overflow of system alert messages displaces communication alerts.

The Communication Alert Line, the bottom line of the EICAS message field (line 11), is reserved for a communication alert (medium or low) if one is active. The Communication Alert Line can not be displaced by a system alert even if more than 10 lines are active.

VP-BWW, VP-BWX, VQ-BOG

Communication alerts are removed when a pilot has acknowledged the communication alert via the appropriate display unit or selects the appropriate switch on the Pilot's call panel (See Chapter 5, Communications).

VP-BDI through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

Communication alerts are removed when a pilot selects the appropriate switch on the Pilot's call panel.

Master Warning/Caution Reset Switches and Lights

Two Master WARNING/CAUTION reset switches each contain a Master WARNING light and Master CAUTION light.

The red Master WARNING lights illuminate when any warning alert or time critical warning occurs (except a stall warning). The lights remain illuminated as long as the warning alert exists or until either Master WARNING/CAUTION reset switch is pushed. Pushing either switch:

- extinguishes both Master WARNING lights
- resets the lights for future warning alerts.

Pushing either Master WARNING/CAUTION reset switch also silences the warning siren and fire bell except for the following warnings:

- landing configuration (for example, when the flaps are in a landing position and landing gear are not down)
- autopilot disconnect
- takeoff configuration

VP-BDI, VP-BOQ through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA
• overspeed warning

VP-BMC, VP-BWW, VP-BWX, VQ-BOG

Pushing either Master WARNING/CAUTION reset switch also silences the overspeed warning siren.

The amber Master CAUTION lights illuminate when any caution alert occurs. The lights remain on as long as the caution alert exists or until either Master WARNING/CAUTION reset switch is pushed. Pushing either switch:

- extinguishes both Master CAUTION lights
- resets the lights for future caution alerts.

Flight Deck Panel Annunciator Lights

Flight deck panel annunciator lights are used in conjunction with EICAS messages to:

- help locate and identify affected systems and controls
- reduce the potential for error.

The annunciator lights provide system feedback in response to flight crew action. The lights also assist in fault detection and system preflight configuration when the engines are shut down and to supplement EICAS information.

Aural Alerts

Aural alerts are provided to ensure crew attention, recognition, and response. Aural alerts include synthetic voices and tones. Aural voice alerts are the most direct and rapid method of communicating a specific alert condition to the crew. Aural tones are used to alert the crew and to discriminate between the different alert types and levels.

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Aural alerts annunciate warnings and cautions. There are no aural annunciations associated with advisories.

Aural alerts also annunciate medium level communication alerts. There are no aural alerts associated with low level communication alerts.

The aural alerts are:

- **Beeper** – used for all system alert caution level messages. The beeper consists of a tone that sounds four times in a second. The beeper automatically silences after one series of four beeps
- **Bell** – used for fire warnings. The bell sounds repeatedly until crew action is initiated
- **Voice** – synthetic voices annunciate time critical warning alert conditions. Synthetic voices also annunciate certain normal but time critical operational information, such as approach phase altitude callouts.

VP-BMC, VP-BOY, VQ-BOG

- **Siren** – used to annunciate cabin altitude, configuration, autopilot disconnect, and overspeed warning alerts. The siren consists of alternating high and low tones

VQ-BRA

- **Siren** – used to annunciate cabin altitude, configuration, and autopilot disconnect warning alerts. The siren consists of alternating high and low tones

VP-BOZ, VP-BWW through VQ-BMQ, VQ-BPT

- **Siren** – used to annunciate cabin altitude, configuration and overspeed warning alerts. The siren consists of alternating high and low tones

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU

- **Siren** – used to annunciate cabin altitude and configuration warning alerts. The siren consists of alternating high and low tones

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BRA

- **Clacker** – used to annunciate overspeed warning.

VP-BDI, VP-BOQ, VP-BOZ through VQ-BMU, VQ-BPT

- **Wailer** – used to annunciate autopilot disconnect warning.
- **Chime** – a high–low tone chime used for medium level communication alerts. The chime sounds once for each communication alert.

All continuous aural alerts are silenced automatically when the respective alert condition no longer exists.

Alert Inhibits

Alerts are inhibited during part of the takeoff in order not to distract the crew. Alerts are also inhibited when they are operationally unnecessary or inappropriate.

Alert messages, except for warnings and messages directly relevant to flight operations, are inhibited during engine start to eliminate nuisance messages.

Alert messages are inhibited individually at other times, such as during the preflight and postflight phases or engine shutdown, when they are operationally unnecessary.

Message Consolidation

On the ground with both engines shut down, certain caution and advisory alert messages are inhibited by collecting them into more general alert messages. These include individual fuel, hydraulic, door, and electrical messages. For example, two or more individual entry, cargo, and access door EICAS messages are replaced by the EICAS advisory message DOORS.

Engine Start Message Inhibits

During ground engine start, most new caution and advisory alerts are inhibited from engine start switch engagement until one of the following occurs:

- the engine reaches idle RPM
- the start is aborted, or
- 2 minutes elapse from engine start switch engagement.

The following messages are not inhibited:

- ENG FUEL VAL
- ENG SHUTDOWN
- ENG STARTER
- STARTER CUTOUT.

Takeoff Inhibits

Warning Inhibits

The Master WARNING lights and fire bell are inhibited for fire during part of the takeoff. The inhibit begins at nose gear extension during rotation and continues until the first to occur:

- 400 feet AGL, or
- 20 seconds elapsed time

If a fire occurs during the inhibit, an EICAS warning message appears, but the fire bell and Master WARNING lights do not activate. If the warning condition still exists when the inhibit is removed, the fire bell and Master WARNING lights activate immediately.

Note: Takeoff configuration warnings are terminated at rotation.

Caution Inhibits

The Master CAUTION lights and aural annunciations are inhibited for all cautions during part of the takeoff. The inhibit begins at 80 knots and continues until the first to occur:

- 400 feet AGL, or
- 20 seconds elapsed time following nose gear extension

If a caution occurs during the inhibit and exists on the ground when the airspeed decreases below 75 knots, both Master CAUTION lights and aural activate.

Note: EICAS caution messages are not inhibited during takeoff.

Advisory Inhibits**VP-BDI, VP-BMC, VP-BRL through VQ-BRA**

(SB Adds VP-BOQ through VP-BOZ and enables the capability to inhibit certain EICAS messages.)

The following EICAS advisory messages are inhibited on takeoff:

- **VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BOG, VQ-BPT**
- DATALINK LOST to indicate data link is temporarily lost.
- WINDSHEAR SYS to indicate windshear alerting functions are inoperative.

The inhibit begins from the time either engine is advanced to takeoff thrust until the first to occur:

- 400 feet AGL, or
- 20 seconds elapsed time following nose gear extension

All other EICAS advisory messages are not inhibited on takeoff.

Advisory Inhibits

(SB Deletes VP-BOQ through VP-BOZ and inhibits certain EICAS messages.)

EICAS advisory messages are not inhibited on takeoff.

Communication Inhibits

The following are inhibited during takeoff:

- **VP-BOY, VP-BOZ, VQ-BPT, VQ-BRA**
(SB Deletes VP-BOQ with communication crew alerting.)
- EICAS communication alert messages such as SELCAL, ACARS, ATC or PRINTER and associated aural chimes. The CABIN ALERT message and its chime are not inhibited.

**VP-BDI, VP-BMC, VP-BRL through VQ-BOG
(SB Adds VP-BOQ with communication crew alerting.)**

- EICAS communication alert messages such as SELCAL, ACARS, ATC or PRINTER and associated aural chimes. The CABIN ALERT message is not inhibited. The chime associated with the CABIN ALERT message is inhibited.

The inhibit begins from the time either engine is advanced to takeoff thrust until the first to occur:

- 400 feet AGL, or
- 20 seconds elapsed time following nose gear extension

Inhibits are cleared on the ground with both engines below takeoff thrust. If a message alert occurs during the inhibit and exists when the inhibit ends, the EICAS alert message and aural chime activate.

Landing Inhibits

Caution Inhibits

VP-BWW through VQ-BMQ

When LAND 2 or LAND 3 are displayed, the Master CAUTION lights and beeper associated with most EICAS caution messages are inhibited from 200 feet AGL until:

- less than 75 knots groundspeed
- 40 seconds has elapsed, or
- radio altitude is greater than 800 feet.

EICAS caution messages which require a go-around are not inhibited.

Communication Inhibits

The following are inhibited during landing:

**VP-BOY, VP-BOZ, VQ-BPT, VQ-BRA
(SB Deletes VP-BOQ with communication crew alerting.)**

- EICAS communication alert messages such as SELCAL, ACARS, ATC or PRINTER and associated aural chimes. The CABIN ALERT message and its chime are not inhibited.

**VP-BDI, VP-BMC, VP-BRL through VQ-BOG
(SB Adds VP-BOQ with communication crew alerting.)**

- EICAS communication alert messages such as SELCAL, ACARS, ATC or PRINTER and associated aural chimes. The CABIN ALERT message is not inhibited. The chime associated with the CABIN ALERT message is inhibited.

The inhibit begins on descent at 800 feet AGL and terminates at:

- less than 75 knots groundspeed
- 900 feet AGL on missed approach

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If a communication alert message occurs during the inhibit and exists when inhibit ends, the EICAS alert message and associated aural chime activate.

Engine Shutdown Inhibits

Engine-driven pumps, generators, and other components whose alert messages would result from an engine shutdown are inhibited by the ENG SHUTDOWN message. When an engine is shutdown (FUEL CONTROL switch in cut off or fire handle pulled), the EICAS alert message L ENG SHUTDOWN or R ENG SHUTDOWN is displayed and the following L or R alerts are inhibited:

- ENG ANTI-ICE
- ENG BLEED OFF
- GEN DRIVE
- GEN OFF
- ENG OIL PRESS
- HYD PRIM PUMP
- ENG CONTROL

When the airplane is on the ground and both FUEL CONTROL switches are in the CUT OFF position, the Master CAUTION lights and the caution alert beeper are inhibited. This prevents alerts associated with routine gate operations from triggering nuisance lights and aural alerts.

When the shutdown inhibit is removed, the Master CAUTION lights and alert beeper do not activate for alerts that existed prior to its removal. For example, if the right hydraulic system is depressurized with both engines shutdown, and the left engine is then started, the Master CAUTION lights and beeper do not activate. The Master CAUTION lights and beeper activate only when the alert first occurs, provided no other inhibit is in effect.

Alert Message Inhibits

Alert message inhibits are those inhibits where one message is inhibited by the presence of another alert message. For example, individual fuel or hydraulic pump pressure messages are inhibited by higher priority system pressure messages.

Certain alert messages are time delayed, even though discrete system lights may illuminate. Time delay inhibits prevent normal in-transit indications from appearing as EICAS system alert messages. For example, valves are generally only sensed open and/or closed, not in-transit. When a valve is in-transit, the alert 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 period, an EICAS system alert message is displayed.

Altitude Alerting Inhibits

VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

Altitude alerting is inhibited in flight with all landing gear down and locked.

VP-BWW through VQ-BMQ, VQ-BPT

Altitude alerting is inhibited when the glideslope is captured. This inhibit is not dependent on whether the landing gear is down and locked.

VP-BWW through VQ-BMQ, VQ-BPT

Altitude alerting is inhibited in flight with all landing gear down and locked and the flaps are at 25 or 30.

Master Caution Lights and Beeper Inhibit

The Master CAUTION lights and the associated alert beeper are inhibited for the L and R ENG SHUTDOWN caution level message.

EICAS Event Record

The flight crew can manually capture and record any suspect condition into EICAS memory using the EICAS EVENT RECORD switch.

Systems which provide recorded information when the switch is activated include:

- anti-ice, ice detection
- air systems
- APU
- electrical
- electronic engine control
- fire protection
- flight controls/flaps and slats
- fuel quantity and fuel management
- hydraulic
- landing gear and brakes
- performance.

Only the last manual event recorded will be retained for future retrieval. The event record function also has an automatic feature. When an EICAS event occurs, conditions are automatically written to EICAS memory.

EICAS Failure Indications

If a fault is detected in one of the cathode ray tubes (CRTs), the faulty display is blanked. Engine indications and crew alerting messages appear on the operable display. An EICAS DISPLAY advisory message displays when one CRT fails.

To ensure that all engine indications can be displayed with a CRT failure, an EICAS compacted display mode is available. The compacted display mode is described in the Engines, APU chapter.

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If the EICAS control panel fails an EICAS CONT PNL advisory message displays and the EICAS full up engine mode automatically displays. The full engine mode is described in Chapter 7, Engines, APU. The cancel and recall switches will not operate when the EICAS control panel fails, however, brightness and computer select controls remain operative.

If both EICAS computers or CRTs fail, a standby engine indicator (SEI) is automatically activated. The SEI, system lights and indicators are used to monitor the engines and system operation when a total EICAS failure occurs.

Warning System

The warning system consists of flight deck speakers, Master WARNING/CAUTION lights, EICAS alert messages, and stick shaker motors.

The warning system controls and activates alerts for:

- fire (See Chapter 8, Fire Protection)
- cabin altitude (See Chapter 2, Air Systems)
- autopilot disconnect (See Chapter 4, Automatic Flight)
- configuration
- airspeed
- altitude

VP-BDI through VP-BOQ, VP-BWW through VQ-BMQ, VQ-BOG through VQ-BRA

- crew alertness
- ground proximity warning system (GPWS)
- windshear
- traffic alert and collision avoidance system (TCAS)

Configuration Alerts

Takeoff

Takeoff configuration warnings are armed when the airplane is on the ground and thrust is in the takeoff range on either engine. Takeoff configuration warnings consist of:

- Master WARNING lights illuminate
- CONFIG warning light illuminates
- aural warning siren sounds
- applicable EICAS configuration warning alert message(s) are displayed.

Takeoff configuration warning messages include:

- FLAPS
- PARKING BRAKE
- SPOILERS
- STABILIZER

Takeoff configuration warnings are disarmed at rotation.

Existing takeoff configuration warning are:

- cancelled when the configuration error is corrected
- terminated at rotation

When a takeoff configuration warning occurs, pushing either Master WARNING/CAUTION reset switch resets the Master WARNING lights but does not silence the siren or clear the EICAS alert message. Before reaching rotation, the siren can be silenced and the EICAS alert message cleared only by retarding both thrust levers or correcting the condition. If thrust is reduced, the EICAS takeoff configuration message remains displayed for 10 seconds so the crew can positively identify the configuration problem.

Holding the configuration test switch in the takeoff (T/O) position simulates accelerating an engine to takeoff power. No warnings occur when testing an airplane properly configured for takeoff. If the airplane is not configured for takeoff a configuration warning results. Releasing the test switch cancels the test.

Landing

The landing configuration warning system alerts the crew that the landing gear is not extended for landing. The landing configuration warning activates if:

- the airplane is in flight, and
- any landing gear is not down and locked, and
- either of the following conditions exists:
 - flaps in a landing position (25 or 30), or
 - any thrust lever is at idle with radio altitude below 800 feet.

The landing configuration warning consists of:

- Master WARNING lights illuminate
- CONFIG warning light illuminates
- aural warning siren activates
- the GEAR NOT DOWN EICAS warning alert message is displayed.

With the flaps in a landing position, the siren and alert message cannot be deactivated with the Master WARNING/CAUTION reset switches. The siren and message continue until the condition is corrected or the gear override switch is pushed.

If the warning is due to an idle thrust setting at low altitude, pushing either Master WARNING/CAUTION reset switch silences the siren and extinguishes the Master WARNING lights. The EICAS message remains displayed until the configuration error is corrected.

Holding the configuration test switch in the landing (LDG) position results in a configuration warning regardless of landing gear position. All warning indications disappear when the switch is released.

Airspeed Alerts

Stall Warning

Warning of an impending stall is provided by left and right stick shakers, which independently vibrate the left and right control columns. If the flaps are in the retracted position and the angle of attack continues to increase, a control column nudger moves the control column forward. Both systems are energized in flight and deactivated on the ground through air/ground logic.

Holding the stall warning tests switches to either the L or R position checks the left and right stall warning systems, respectively. If the systems are tested at the same time, both columns vibrate and the control column nudger activates.

Overspeed Warning

An overspeed warning occurs if Vmo/Mmo limits are exceeded. The overspeed warning consists of:

- Master WARNING lights illuminate
- OVSPD light illuminates
- the EICAS warning alert message OVERSPEED is displayed

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BRA

- aural warning clacker sounds

VP-BMC, VP-BOY, VP-BOZ, VP-BWW through VQ-BMQ, VQ-BOG, VQ-BPT

- aural warning siren sounds

All warning indications remain activated until airspeed is reduced below Vmo/Mmo.

VP-BMC, VP-BWW, VP-BWX, VQ-BOG

The aural warning can be silenced by pushing either Master WARNING/CAUTION reset switch.

Altitude Alerts

Altitude alerting occurs when approaching or departing the MCP-selected altitude.

Approaching A Selected Altitude

VP-BMC through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

At 900 feet prior to reaching the selected altitude, the ALT light on each pilot's altimeter illuminates. At 300 feet prior to reaching the selected altitude, the ALT lights extinguish.

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

At 500 feet prior to reaching the selected altitude, the ALT light on each pilot's altimeter illuminates. At 200 feet prior to reaching the selected altitude, the ALT lights extinguish.

Deviating From A Selected Altitude

| VP-BMC through VP-BRL, VQ-BMQ, VQ-BMU, VQ-BPT, VQ-BRA

When deviating 300 feet from the selected altitude:

- the Master CAUTION lights illuminate
- the caution aural sounds
- the EICAS caution message ALTITUDE ALERT is displayed
- the ALT ALERT light illuminates.

| VP-BDI, VP-BWW, VP-BWX, VQ-BOG

When deviating 200 feet from the selected altitude:

- the Master CAUTION lights illuminate
- the caution aural sounds
- the EICAS caution message ALTITUDE ALERT is displayed
- the ALT ALERT light illuminates.

VP-BMC through VP-BRL, VQ-BMU, VQ-BRA

When deviating more than 900 feet from the selected altitude, or upon returning to within 300 feet of the selected altitude:

- the Master CAUTION lights extinguish
- the EICAS caution message ALTITUDE ALERT is no longer displayed
- The ALT ALERT light extinguishes.

| VP-BDI, VP-BWW, VP-BWX, VQ-BOG

When deviating more than 500 feet from the selected altitude, or upon returning to within 200 feet of the selected altitude:

- the Master CAUTION lights extinguish
- the EICAS caution message ALTITUDE ALERT is no longer displayed
- The ALT ALERT light extinguishes.

Resetting To A Selected Altitude

Altitude alerting is reset when:

VP-BMC through VP-BRL, VQ-BMU, VQ-BRA

- the airplane returns to within 300 feet of the altitude selected or deviates more than 900 feet from the altitude selected

| VP-BDI, VP-BWW, VP-BWX, VQ-BOG

- the airplane returns to within 200 feet of the altitude selected or deviates more than 500 feet from the altitude selected
- the MCP-selected altitude is changed

Altitude Alert Inhibits

| VP-BDI through VP-BRL, VQ-BMU, VQ-BOG, VQ-BRA

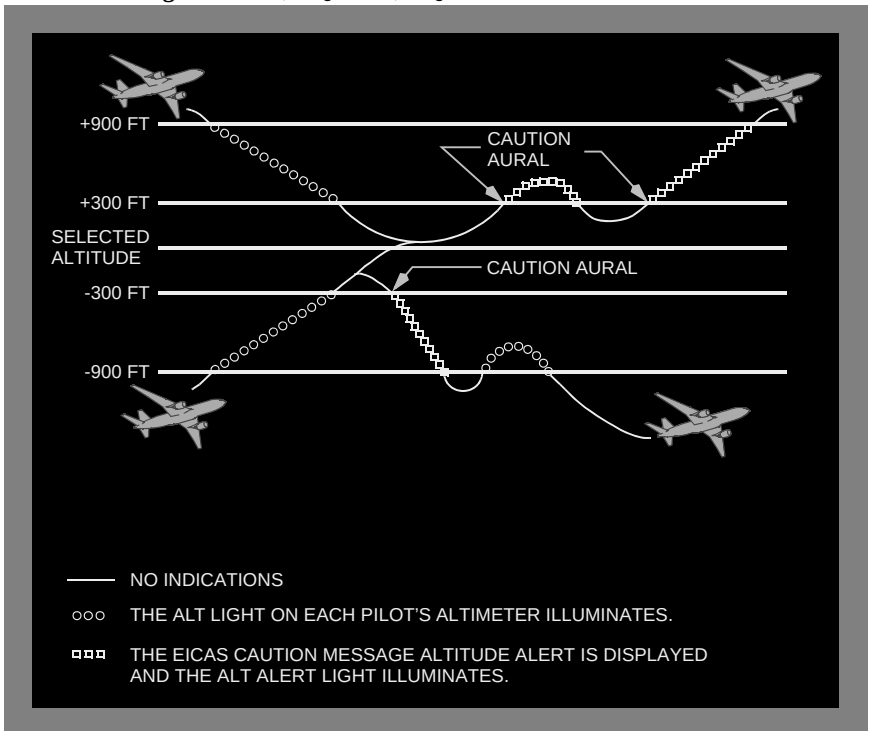
Altitude alerting is inhibited in flight with all landing gear down and locked.

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VP-BWW through VQ-BMQ, VQ-BPT

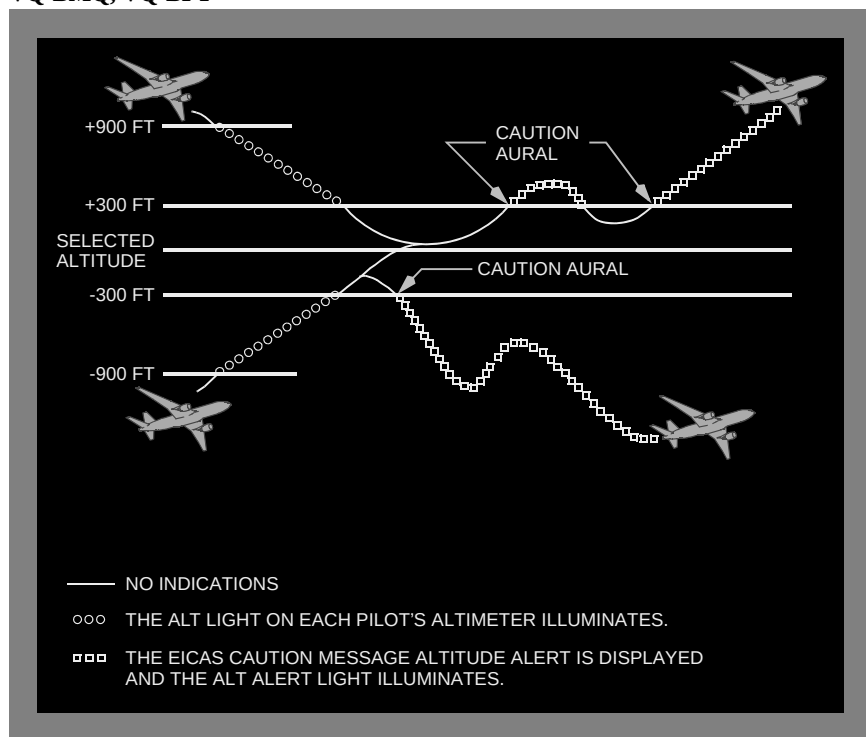
Altitude alerting is inhibited when the glideslope is captured.

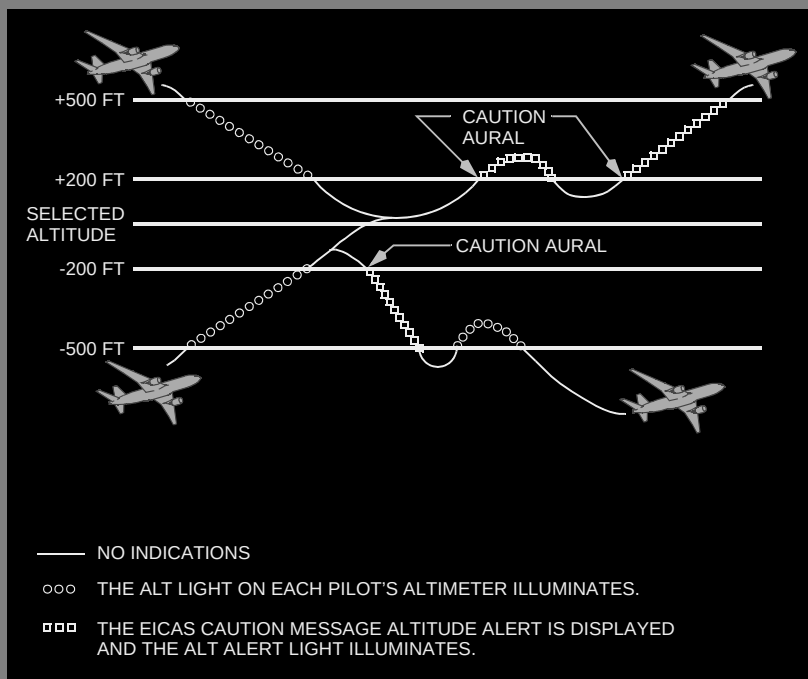
VP-BWW through VQ-BMQ, VQ-BPT

Altitude alerting is inhibited in flight with all landing gear down and locked and the flaps are at 25 or 30.

Altitude Alert Profile
VP-BMC through VP-BRL, VQ-BMU, VQ-BRA


VQ-BMQ, VQ-BPT



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VP-BDI, VP-BWW, VP-BWX, VQ-BOG

Crew Alertness Monitor
VP-BDI through VP-BOQ, VP-BWW through VQ-BMQ, VQ-BOG through VQ-BRA

The FMC continuously monitors the activation of switches on the mode control panel, EFIS control panel, display select panel, CDUs, and radio transmitter microphone switches. When a predefined time elapses after the last control activation, the EICAS advisory message PILOT RESPONSE is generated. The PILOT RESPONSE message can be cleared by pushing any control on any of the monitored systems or panels. If there is still no response after a short time, the EICAS caution message PILOT RESPONSE is displayed. If there is still no response, the warning message PILOT RESPONSE is displayed. Any control activation on the MCP, EFIS control panel, display select panel, CDUs, or radio transmitters resets the PILOT RESPONSE message.

Ground Proximity Warning System (GPWS)

Introduction

The ground proximity warning system (GPWS) provides time-critical alerts for potentially hazardous flight conditions involving imminent impact with the ground. GPWS is enabled whenever power is applied to the airplane. Override or inhibit switches allow the flight crew to inhibit certain GPWS alerts.

VP-BMC through VQ-BPT

GPWS provides voice callouts (Mode 6) to assist the flight crew with situational awareness and to advise the flight crew of the aircraft's approximate height above the ground.

| VP-BOQ through VQ-BMU, VQ-BPT, VQ-BRA

GPWS also provides time-critical alerts for potential hazardous flight conditions involving windshear.

In addition to aircraft configuration, GPWS requires inputs from the following for proper operation:

- air data system
- inertial reference system
- instrument landing system
- radio altimeters

Note: Loss of an input does not necessarily inhibit operation of the entire GPWS.

Standard GPWS alerts are radio altitude based and provided for the following:

- excessive and severe descent rate (Mode 1)
- excessive terrain closure rate (Mode 2)
- altitude loss after takeoff or go-around (Mode 3)
- unsafe terrain clearance when not in the landing configuration (Mode 4)
- excessive deviation below an ILS glideslope (Mode 5)
- windshear (Mode 7)

GPWS (Enhanced)

VP-BDI through VP-BOQ, VP-BWW through VQ-BPT

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

In addition to standard alerts, enhanced GPWS provides look-ahead terrain awareness, including alerting and display functions. These functions compare the airplane's geographic position and altitude against an internal terrain database to predict and display potential conflicts between the airplane flight path and terrain.

| VP-BDI, VP-BWW, VP-BWX, VQ-BOG

The enhanced GPWS internal database also provides prediction and display of potential conflicts between the airplane flight path and man-made obstacles.

VP-BOQ

In addition to standard alerts, a non-Boeing installed (STC) enhanced GPWS provides look-ahead terrain awareness, including alerting and display functions. These functions compare the airplane's geographic position and altitude against an internal terrain database to predict and display potential conflicts between the airplane flight path and terrain.

VP-BOQ

The enhanced GPWS internal database also provides prediction and display of potential conflicts between the airplane flight path and man-made obstacles.

In addition to standard GPWS inputs, enhanced GPWS requires inputs from the following for proper operation:

- **VP-BDI, VP-BMC, VP-BWW through VQ-BPT**
- global positioning system
- **VP-BOQ**
- global positioning system

Note: Loss of an input does not necessarily inhibit operation of the entire GPWS.

GPWS Alert Prioritization

GPWS and Windshear Warning System alerts are prioritized based on the level of hazard and the required flight crew response. The following are listed in order of decreasing priority:

GPWS Alerts

VP-BDI, VP-BMC, VP-BOY through VQ-BRA

Condition	Alert Level	Description
Windshear - Immediate	Warning	Mode 7 - Actual windshear conditions (downdraft) A windshear immediate-alert warning inhibits all other GPWS and windshear alerts.
Ground proximity - Immediate	Warning	Mode 1 - Severe descent rate
Ground proximity - Immediate	Warning	Mode 2 - Severe terrain closure rate

Condition	Alert Level	Description

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

Terrain - Awareness	Warning	Look-Ahead - Terrain along flight path (Near)

| VP-BDI, VP-BWW, VP-BWX, VQ-BOG

Obstacle - Awareness	Warning	Look-Ahead - Obstacle along flight path (Near)

| VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG

Windshear - Awareness	Warning	Predictive - Windshear condition along flight path

Ground proximity - Immediate	Caution	Mode 2 - Excessive terrain closure rate

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

Terrain - Awareness	Caution	Look-Ahead - Terrain along flight path

| VP-BDI, VP-BWW, VP-BWX, VQ-BOG

Obstacle - Awareness	Caution	Look-Ahead - Obstacle along flight path

Ground proximity - Immediate	Caution	Mode 4 - Unsafe terrain clearance

VP-BMC, VP-BOY through VQ-BPT

Altitude - Awareness		Mode 6 - Altitude callouts



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Condition	Alert Level	Description
Ground proximity - Immediate	Caution	Mode 4 - Unsafe terrain clearance - Gear
		Mode 4 - Unsafe terrain clearance - Flaps
		Mode 1 - Excessive descent rate
		Mode 3 - Descent (sink rate) after takeoff
		Mode 5 - Below glideslope - ILS deviation

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG

Windshear - Awareness	Caution	Predictive - Windshear adjacent to flight path

GPWS Alerts - Non-Boeing Installed (STC)

VP-BOQ

Condition	Alert Level	Description
Windshear - Immediate	Warning	Mode 7 - Actual windshear conditions (downdraft) A windshear immediate-alert warning inhibits all other GPWS and windshear alerts.
Ground proximity - Immediate	Warning	Mode 1 - Severe descent rate
Ground proximity - Immediate	Warning	Mode 2 - Severe terrain closure rate
Terrain - Awareness	Warning	Look-Ahead - Terrain along flight path (Near)
Obstacle - Awareness	Warning	Look-Ahead - Obstacle along flight path (Near)
Ground proximity - Immediate	Caution	Mode 2 - Excessive terrain closure rate
Terrain - Awareness	Caution	Look-Ahead - Terrain along flight path

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Condition	Alert Level	Description
Obstacle - Awareness	Caution	Look-Ahead - Obstacle along flight path
Ground proximity - Immediate	Caution	Mode 4 - Unsafe terrain clearance
Altitude - Awareness	Advisory	Mode 6 - Altitude callouts
Ground proximity - Immediate	Caution	Mode 4 - Unsafe terrain clearance - Gear
		Mode 4 - Unsafe terrain clearance - Flaps
		Mode 1 - Excessive descent rate
		Mode 3 - Descent (sink rate) after takeoff
		Mode 5 - Below glideslope - ILS deviation
Situational - Awareness		Mode 6 - Bank Angle

GPWS Immediate-Alerts

GPWS immediate-alert warnings (Modes 1-2) are accompanied by:

- visual alerts (see tables)
- aural alerts (see tables)

If illuminated, pushing a Master WARNING/CAUTION Reset switch resets the Master WARNING lights but does not inhibit the GPWS warning.

GPWS immediate-alert cautions (Modes 1-5) are accompanied by:

- visual alerts (see tables)
- voice aural alerts (see tables)

GPWS Immediate-Alert Warnings

Aural Alert	Visual Alert	Description
PULL UP	PULL UP light (red) Master WARNING lights	Follows SINK RATE alert if descent rate becomes severe. (Mode 1) Follows TERRAIN alert if excessive terrain closure rate continues and landing gear and/or flaps are not in landing configuration. (Mode 2)

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GPWS Immediate-Alert Cautions

Aural Alert	Visual Alert	Description
TERRAIN	GND PROX light (amber)	Excessive terrain closure rate. (Mode 2)
DON'T SINK	GND PROX light (amber)	Excessive altitude loss after takeoff or go-around. (Mode 3)
GLIDESLOPE	GND PROX light (amber)	Deviation below glideslope. (Mode 5) Volume and repetition rate increase as deviation increases. Note: Pushing the GND PROX G/S INHB switch cancels or inhibits the alert below 1,000 feet radio altitude.
SINK RATE	GND PROX light (amber)	Excessive descent rate. (Mode 1)
TOO LOW, FLAPS	GND PROX light (amber)	Unsafe terrain clearance at low airspeed with flaps not in landing configuration. (Mode 4) Note: Pushing the GND PROX FLAP OVRD switch to OVRD inhibits the alert.
TOO LOW, GEAR	GND PROX light (amber)	Unsafe terrain clearance at low airspeed with landing gear not down. (Mode 4) Note: Pushing the GND PROX/CONFIG GEAR OVRD switch to OVRD inhibits the alert.

Aural Alert	Visual Alert	Description
TOO LOW, TERRAIN	GND PROX light (amber)	Follows DON'T SINK if another descent is initiated after initial alert and before climbing to the altitude where the initial descent began. (Mode 3) Unsafe terrain clearance at low airspeed with either landing gear not down or flaps not in landing position. (Mode 4) Note: Pushing the GND PROX FLAP OVRD switch to OVRD inhibits the alert, when the alert is due to flaps not in landing position. Note: Pushing the GND PROX/CONFIG GEAR OVRD switch to OVRD inhibits the alert, when the alert is due to gear not down.

GPWS Voice Callouts

VP-BMC, VP-BOY through VQ-BPT

GPWS provides voice callouts (Mode 6) to assist the flight crew with situational awareness and to advise the flight crew of the aircraft's approximate height above the ground.

VP-BRL

The GPWS voice callouts occur at low-volume.



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Callout	Description

VP-BWW, VP-BWX, VQ-BOG

FIVE HUNDRED	Airplane is at 500 feet AGL
FOUR HUNDRED	Airplane is at 400 feet AGL
THREE HUNDRED	Airplane is at 300 feet AGL
TWO HUNDRED	Airplane is at 200 feet AGL
ONE HUNDRED	Airplane is at 100 feet AGL
FIFTY	Airplane is at 50 feet AGL
FORTY	Airplane is at 40 feet AGL
THIRTY	Airplane is at 30 feet AGL
TWENTY	Airplane is at 20 feet AGL
TEN	Airplane is at 10 feet AGL

VQ-BMQ, VQ-BPT

FIVE HUNDRED	Airplane is at 500 feet AGL
ONE HUNDRED	Airplane is at 100 feet AGL
FIFTY	Airplane is at 50 feet AGL
FORTY	Airplane is at 40 feet AGL
THIRTY	Airplane is at 30 feet AGL
TWENTY	Airplane is at 20 feet AGL
TEN	Airplane is at 10 feet AGL

Callout	Description

VP-BMC, VQ-BMU

FIVE HUNDRED	Airplane is at 500 feet AGL and on a non-precision approach or one of the following applies: - glideslope deviation exceeds 2 dots or no glideslope signal - localizer deviation exceeds 2 dots or no localizer signal - backcourse approach detected - glideslope alerting is inhibited with the G/S INHIB switch

VQ-BMU

ONE HUNDRED	Airplane is at 100 feet AGL
FIFTY	Airplane is at 50 feet AGL
THIRTY	Airplane is at 30 feet AGL
TWENTY	Airplane is at 20 feet AGL
TEN	Airplane is at 10 feet AGL

VP-BMC

ONE HUNDRED	Airplane is at 100 feet AGL
FIFTY	Airplane is at 50 feet AGL
THIRTY	Airplane is at 30 feet AGL
TWENTY	Airplane is at 20 feet AGL

VP-BRL

ONE HUNDRED	Airplane is at 100 feet AGL
FIFTY	Airplane is at 50 feet AGL
THIRTY	Airplane is at 30 feet AGL



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Callout	Description

VP-BOY, VP-BOZ

FIFTY	Airplane is at 50 feet AGL
FOURTY	Airplane is at 40 feet AGL
THIRTY	Airplane is at 30 feet AGL
TWENTY	Airplane is at 20 feet AGL
TEN	Airplane is at 10 feet AGL

VQ-BMU

APPROACHING DECISION HEIGHT	Airplane reaches 100 feet prior to the DH set in the captain's Decision Height Reference Window.

VQ-BOG

APPROACHING MINIMUMS	Airplane reaches 100 feet prior to the DH set in the captain's Decision Height Reference Window.

VP-BWW through VQ-BMQ, VQ-BOG, VQ-BPT

MINIMUMS	Airplane reaching the DH set in the captain's Decision Height Reference Window.

VP-BOY, VP-BOZ

MINIMUMS, MINIMUMS	Airplane reaching the DH set in the captain's Decision Height Reference Window.

BANK ANGLE, BANK ANGLE	Voice callout occurs when airplane roll angle reaches: • 35 degrees • 40 degrees • 45 degrees Note: Callout is reset when roll angle decreases below 30 degrees.

GPWS Voice Callouts

VP-BOQ

GPWS provides voice callouts to assist the flight crew with situational awareness and to advise the flight crew of the aircraft's approximate height above the ground.

Callout	Description
APPROACHING DECISION HEIGHT	Airplane reaches 100 feet prior to the DH set in the captain's Decision Height Reference Window.
MINIMUMS	Airplane reaching the DH set in the captain's Decision Height Reference Window.
BANK ANGLE, BANK ANGLE	Voice callout occurs when airplane roll angle reaches: • 35 degrees • 40 degrees • 45 degrees Note: Callout is reset when roll angle decreases below 30 degrees.

GPWS Look-Ahead Alerts and Display

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

GPWS provides look-ahead alerts for potentially hazardous flight conditions involving impact with the ground. GPWS monitors terrain proximity and generates a display from a world-wide terrain data base in the GPWS computer. The data base contains detailed terrain data near major airports and data in lesser detail for areas between airports.

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

In addition to terrain alerting, GPWS provides look-ahead alerts for potentially hazardous flight conditions involving impact with human-made obstacles (minimum height of approximately 100 feet). GPWS monitors obstacle proximity and generates a display from a separate obstacle data base in the GPWS computer. The data base contains detailed obstacle data near major airports and data in lesser detail for areas between airports.

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

Note: The obstacle data base is not yet world wide.

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Airplane horizontal position is determined using the:

- global positioning system. If GPS data is intermittently unavailable, GPWS derives horizontal position from the IRS.

Barometric altitude errors induced from temperature extremes or from non-standard pressure altitudes are minimized. Airplane vertical position is determined using a blended solution calculated from the following:

- GPS altitude
- barometric altitude
- radio altitude
- static air temperature

Look-Ahead Displays

When the EFIS control panel terrain (TERR) display select switch is pushed on, the TERR annunciation is displayed on the HSI and terrain contours may be displayed.

GPWS look-ahead data and weather radar returns cannot be displayed simultaneously on an HSI. If either pilot selects terrain while the other selects weather radar, each display updates on alternating sweeps. All other navigation displays can be simultaneously displayed with terrain data.

When the airplane is lower than 2,000 feet above the terrain, terrain within 2,000 feet of airplane barometric altitude is displayed on the HSI. Non-threat terrain is depicted as several densities of dot patterns in green, amber, or red depending on relative vertical distance between the airplane and the terrain.

VP-BMC, VQ-BMQ, VQ-BMU, VQ-BPT

When the airplane is higher than 2,000 feet above the terrain or within 400 feet of the nearest airport runway elevation, terrain is not displayed.

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

The HSI may also display man-made obstacles. When the airplane is higher than 2,000 feet above the terrain, non-threat obstacles and terrain peaks are displayed using solid, high density, and low density contours of green. The highest obstacle or terrain is represented by solid green, and the lowest obstacle or terrain displayed is represented by low density green.

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

When the enhanced GPWS look-ahead display is selected the HSI displays a digital indication of the highest and lowest terrain or obstacle within the selected map range. The elevation numbers are expressed in hundreds of feet above sea level (e.g. 125 is 12,500 ft. MSL) with the highest elevation on top and the lowest on the bottom. The color of the elevation numbers match the color of the represented terrain or obstacle.

Note: The GPWS look-ahead display is not designed to be used as an independent navigation aid.

Look-Ahead Alerting

The enhanced GPWS computer continuously computes clearance envelopes looking down and ahead of the airplane. Estimated time to impact is calculated from airplane position, barometric altitude, present track, vertical path, and ground speed. FMC VNAV or LNAV (Refer to Chapter 11, Flight Management, Navigation) paths are not considered in the estimated time to impact.

When the terrain clearance boundaries are crossed the GPWS issues alerts. Alert levels, warning or caution, are based on estimated time to impact. Look-ahead alerts will cause the GPWS look-ahead awareness display to "pop-up" when:

- the HSI display is in an appropriate mode (see tables)
- neither terrain (TERR) display select switch is ON

VP-BMC, VQ-BMQ, VQ-BMU, VQ-BPT

Note: Terrain ahead of the airplane may exceed available climb performance. A GPWS caution or warning alert does not guarantee terrain clearance.

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

Note: Obstacles or terrain ahead of the airplane may exceed available climb performance. A GPWS caution or warning alert does not guarantee obstacle or terrain clearance.

Look-Ahead Alerting - Warnings

GPWS look-ahead warning alerts are accompanied by:

- visual alerts (see tables)
- voice aural alerts (see tables)

VP-BMC, VQ-BMQ, VQ-BMU, VQ-BPT

- solid red terrain displayed on HSIs

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

- solid red obstacles or solid red terrain displayed on HSIs

If illuminated, pushing a Master WARNING/CAUTION Reset switch resets the Master WARNING lights but does not inhibit the GPWS warning.

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Aural Alert	Visual Alert	Description

VP-BDI, VP-BMC, VP-BWW through VQ-BMQ, VQ-BOG, VQ-BPT

TERRAIN TERRAIN PULL UP	PULL UP light (red) Master WARNING lights Solid red terrain on HSI VP-BDI, VP-BMC, VP-BWW through VQ-BMQ, VQ-BOG Red TERRAIN annunciation on both HSIs	20 to 30 seconds from projected impact with terrain shown in solid red on the HSI. Pop-up look-ahead display is only available in the following modes: • VOR, APP, MAP and CTR MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert.

VQ-BMU

TERRAIN AHEAD PULL UP	PULL UP light (red) Master WARNING lights Solid red terrain on HSI Red TERRAIN annunciation on both HSIs	20 to 30 seconds from projected impact with terrain shown in solid red on the HSI. Pop-up look-ahead display is only available in the following modes: • VOR, APP, MAP and CTR MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert.

Aural Alert	Visual Alert	Description

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

OBSTACLE OBSTACLE PULL UP	PULL UP light (red) Master WARNING lights Solid red obstacle on HSI Red OBSTACLE message on both HSIs	20 to 30 seconds from projected impact with an obstacle shown solid red on the HSI. Pop-up look-ahead display is only available in the following modes: VOR, APP, MAP and CTR MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert. Note: If an obstacle alert occurs while a TERRAIN annunciation is displayed, the OBSTACLE annunciation replaces the TERRAIN annunciation. Both annunciations can not be displayed at the same time.

Look-Ahead Alerting - Cautions

GPWS look-ahead caution alerts are accompanied by:

- visual alerts (see tables)
- voice aural alerts (see tables)

VP-BMC, VQ-BMQ, VQ-BMU, VQ-BPT

- solid amber terrain displayed on HSIs

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

- solid amber obstacles or solid amber terrain displayed on HSIs

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Aural Alert	Visual Alert	Description

VP-BDI, VP-BMC, VP-BWW through VQ-BMQ, VQ-BOG, VQ-BPT

CAUTION TERRAIN	GND PROX light (amber) Solid amber terrain on HSI VP-BDI, VP-BMC, VP-BWW through VQ-BMQ, VQ-BOG Amber TERRAIN annunciation on both HSIs	40 to 60 seconds from projected impact with terrain shown in solid amber on the HSI. Pop-up look-ahead display is only available in the following modes: • VOR, APP, MAP and CTR MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert.

VQ-BMU

TERRAIN AHEAD	GND PROX light (amber) Solid amber terrain on HSI Amber TERRAIN annunciation on both HSIs	40 to 60 seconds from projected impact with terrain shown in solid amber on the HSI. Pop-up look-ahead display is only available in the following modes: • VOR, APP, MAP and CTR MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert.



Aural Alert	Visual Alert	Description

VP-BDI, VP-BWW, VP-BWX, VQ-BOG

CAUTION OBSTACLE	GND PROX light (amber) Solid amber obstacle on HSI Amber OBSTACLE annunciation on both HSIs	40 to 60 seconds from projected impact with an obstacle shown in solid amber on the HSI. Pop-up look-ahead display is only available in the following modes: • VOR, APP, MAP and CTR MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert. Note: If an obstacle alert occurs while a TERRAIN annunciation is displayed, the OBSTACLE annunciation replaces the TERRAIN annunciation. Both annunciations can not be displayed at the same time.

TOO LOW, TERRAIN	GND PROX light (amber)	Terrain Clearance Floor (TCF) alert indicating unsafe terrain clearance based on current airplane location, nearest runway center point and radio altitude. Similar to Mode 4 but available in all flight modes. Note: Pushing the TERR OVRD switch to OVRD inhibits the alert.

GPWS Look-Ahead Alerts and Display
VP-BOQ

GPWS provides look-ahead alerts for potentially hazardous flight conditions involving impact with the ground. GPWS monitors terrain proximity and generates a display from a world-wide terrain data base in the GPWS computer. The data base contains detailed terrain data near major airports and data in lesser detail for areas between airports.

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In addition to terrain alerting, GPWS provides look-ahead alerts for potentially hazardous flight conditions involving impact with human-made obstacles (minimum height of approximately 100 feet). GPWS monitors obstacle proximity and generates a display from a separate obstacle data base in the GPWS computer. The data base contains detailed obstacle data near major airports and data in lesser detail for areas between airports.

Note: The obstacle data base is not yet world wide.

Airplane horizontal position is determined using the:

- global positioning system. If GPS data is intermittently unavailable, GPWS derives horizontal position from the IRS.

Barometric altitude errors induced from temperature extremes or from non-standard pressure altitudes are minimized. Airplane vertical position is determined using a blended solution calculated from the following:

- GPS altitude
- barometric altitude
- radio altitude
- static air temperature

Look-Ahead Displays

GPWS look-ahead displays are enabled by depressing the weather/terrain (WXR/TERR) select switch on the EFIS control panel. Selecting the respective terrain (TERR) display select switch to ON will change the HSI display to GPWS look-ahead data. Depending on airplane altitude terrain contours may be displayed. Selecting the weather (WXR) display select switch to ON will return the weather radar display with WXR annunciated on the HSI. Reselecting the active (illuminated WXR ON or TERR ON) switch will deselect both weather and look-ahead data providing a black HSI background.

GPWS look-ahead data and weather radar returns cannot be displayed simultaneously on an HSI. If either pilot selects terrain while the other selects weather radar, each display updates on alternating sweeps. All other navigation displays can be simultaneously displayed with terrain data.

When the airplane is lower than 2,000 feet above the terrain, terrain within 2,000 feet of airplane barometric altitude is displayed on the HSI. Non-threat terrain is depicted as several densities of dot patterns in green, amber, or red depending on relative vertical distance between the airplane and the terrain.

The HSI may also display man-made obstacles. When the airplane is higher than 2,000 feet above the terrain, non-threat obstacles and terrain peaks are displayed using solid, high density, and low density contours of green. The highest obstacle or terrain is represented by solid green, and the lowest obstacle or terrain displayed is represented by low density green.

When the terrain (TERR) display select switch is ON the HSI displays a digital indication of the highest and lowest terrain/obstacle within the selected map range. The elevation numbers are expressed in hundreds of feet above sea level (e.g. 125 is 12,500 ft. MSL) with the highest elevation on top and the lowest on the bottom. The color of the elevation numbers match the color of the represented terrain

Note: The GPWS look-ahead display is not designed to be used as an independent navigation aid.

Look-Ahead Alerting

The enhanced GPWS computer continuously computes clearance envelopes looking down and ahead of the airplane. Estimated time to impact is calculated from airplane position, barometric altitude, present track, vertical path, and ground speed. FMC VNAV or LNAV (Refer to Chapter 11, Flight Management, Navigation) paths are not considered in the estimated time to impact.

When the terrain clearance boundaries are crossed the GPWS issues alerts. Alert levels, warning or caution, are based on estimated time to impact. Look-ahead alerts will cause the GPWS look-ahead awareness display to "pop-up" when:

- the HSI display is in an appropriate mode (see tables)
- neither terrain (TERR) display select switch is ON
- the EFIS control panel WXR/TERR has been selected ON

Note: Obstacles or terrain ahead of the airplane may exceed available climb performance. A GPWS caution or warning alert does not guarantee obstacle or terrain clearance.

Look-Ahead Alerting - Warnings

GPWS look-ahead warning alerts are accompanied by:

- visual alerts (see tables for description)
- voice aural alerts (see tables for description)
- solid red obstacles or solid red terrain displayed on HSIs

If illuminated, pushing a Master WARNING/CAUTION Reset switch resets the Master WARNING lights but does not inhibit the GPWS warning.

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Aural Alert	Visual Alert	Description
TERRAIN TERRAIN PULL UP	PULL UP light (red) Master WARNING lights Solid red terrain on HSI	20 to 30 seconds from projected impact with terrain shown in solid red on the HSI. Pop-up look-ahead display is only available in the following modes: • EXP VOR, EXP ILS and MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert.
OBSTACLE OBSTACLE PULL UP	PULL UP light (red) Master WARNING lights Solid red obstacle on HSI	20 to 30 seconds from projected impact with an obstacle shown solid red on the HSI. Pop-up look-ahead display is only available in the following modes: • EXP VOR, EXP ILS and MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert. Note: If an obstacle alert occurs while a TERRAIN annunciation is displayed, the OBSTACLE annunciation replaces the TERRAIN annunciation. Both annunciations can not be displayed at the same time.

Look-Ahead Alerting - Cautions

GPWS look-ahead caution alerts are accompanied by:

- visual alerts (see tables for description)
- voice aural alerts (see tables for description)
- solid amber obstacles or solid amber terrain displayed on HSIs

Aural Alert	Visual Alert	Description
CAUTION TERRAIN	GND PROX light (amber) Solid amber terrain on HSI	40 to 60 seconds from projected impact with terrain shown in solid amber on the HSI. Pop-up look-ahead display is only available in the following modes: • EXP VOR, EXP ILS and MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert.
CAUTION OBSTACLE	GND PROX light (amber) Solid amber obstacle on HSI	40 to 60 seconds from projected impact with an obstacle shown in solid amber on the HSI. Pop-up look-ahead display is only available in the following modes: • EXP VOR, EXP ILS and MAP Note: Pushing the TERR OVRD switch to OVRD inhibits the alert. Note: If an obstacle alert occurs while a TERRAIN annunciation is displayed, the OBSTACLE annunciation replaces the TERRAIN annunciation. Both annunciations can not be displayed at the same time.
TOO LOW, TERRAIN	GND PROX light (amber)	Terrain Clearance Floor (TCF) alert indicating unsafe terrain clearance based on current airplane location, nearest runway center point and radio altitude. Similar to Mode 4 but available in all flight modes. Note: Pushing the TERR OVRD switch to OVRD inhibits the alert.

Windshear Warning System

Windshear Immediate-Alerts

The GPWS takes additional data from the stall warning computer (STC) and determines if decreasing-performance windshear conditions are occurring in the immediate vicinity of the airplane. GPWS issues Windshear Immediate-Warnings whenever decreasing-performance windshear conditions are present during takeoff, approach and landing.

Warnings

Windshear warnings are accompanied by:

- visual alerts (see tables)
- voice or aural alert (see tables)

If illuminated, pushing a Master WARNING/CAUTION reset switch resets the Master WARNING lights but does not deactivate the windshear warning.

Windshear Immediate-Alert Warnings

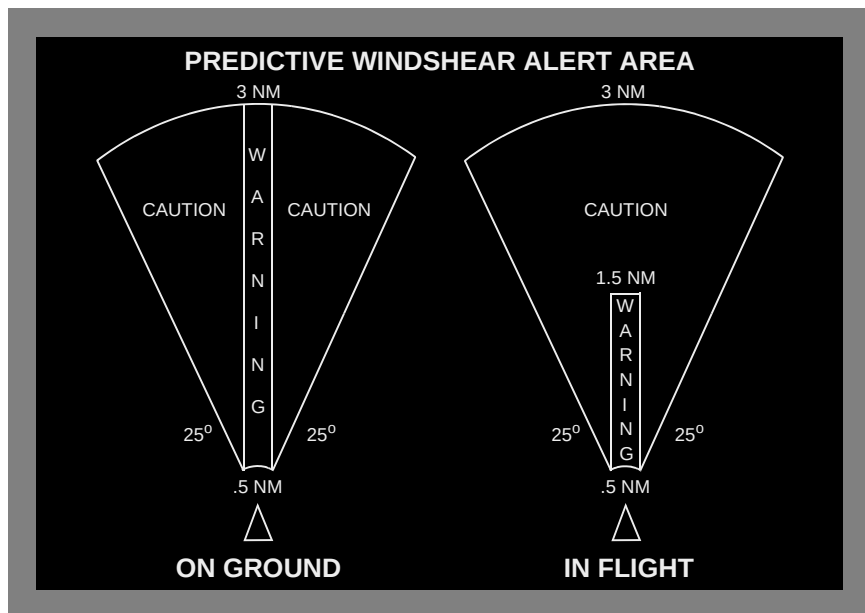
Aural Alert	Visual Alert	Description
Two-tone siren followed by WINDSHEAR	WINDSHEAR light (red) Master WARNING lights Red WINDSHEAR on both ADIs	Excessive windshear at the current airplane position detected by GPWS. Enabled below 1,500 feet radio altitude. GPWS Windshear detection begins at rotation.

Predictive Windshear (PWS)

VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG

The weather radar (See Chapter 11, Flight Management, Navigation) provides PWS alerts when it detects disturbed air ahead of the aircraft which contains moisture or particulate matter and which fits a known pattern of windshear activity.

The PWS alert area ahead of the aircraft is shown as follows:



When the PWS mode is enabled, the radar system is time-shared between the weather display and the PWS display. During the time-share:

- the weather display is slower to update
- PWS alerts are available approximately 12 seconds after the system begins scanning
- PWS automatically, regardless of actual Weather Radar Control Panel settings, adjusts the antenna TILT and the system GAIN for optimum windshear detection

The PWS mode is automatically enabled when:

- in flight, the aircraft is below 2,300 feet AGL
- on the ground, the thrust levers are set for takeoff
- on the ground, WXR is selected on the EFIS control panel and any mode other than TEST is selected on the weather radar control panel

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PWS alerts are automatically enabled below 1,200 feet AGL. If a PWS alert occurs when weather (WXR) is not selected on either pilot HSI displays and there is not an active terrain alert occurring; the weather radar display, including PWS symbology, automatically pops-up on the HSI.

Note: PWS does not provide alerting for all types of windshear. The flight crew must continue to rely on traditional windshear avoidance methods.

Warnings

PWS warnings are accompanied by:

- visual alerts (see tables)
- voice or aural alerts (see tables)

If illuminated, pushing a Master WARNING/CAUTION reset switch resets the Master WARNING lights but does not deactivate the windshear warning.

Predictive Windshear Warnings

Aural Alert	Visual Alert	Description
WINDSHEAR AHEAD WINDSHEAR AHEAD	WINDSHEAR light (Red) MASTER WARNING lights Red WINDSHEAR annunciation on both ADIs RED and BLACK PWS symbol on HSI Red WINDSHEAR annunciation on HSI (all modes)	Enabled during takeoff, below 1,200 feet AGL. Windshear within 3.0 miles and directly ahead of the airplane. If weather (WXR) is not selected on either HSI, the weather display, including PWS symbology, will automatically pop-up on the HSI. PWS symbol on the HSI shows windshear position and size only when the HSI Mode Selector is in the VOR, APP, MAP or CTR MAP mode.

Aural Alert	Visual Alert	Description
GO AROUND, WINDSHEAR AHEAD	WINDSHEAR light (Red) MASTER WARNING lights Red WINDSHEAR annunciation on both ADIs RED and BLACK PWS symbol on HSI Red WINDSHEAR annunciation on HSI (all modes)	Enabled during approach, below 1,200 feet AGL. Windshear within 1.5 miles and directly ahead of the airplane. If weather (WXR) is not selected on either HSI, the weather display, including PWS symbology, will automatically pop-up on the HSI. PWS symbol on the HSI shows windshear position and size only when the HSI Mode Selector is in the VOR, APP, MAP or CTR MAP mode.

Cautions

PWS caution alerts are accompanied by:

- visual alerts (see tables)
- voice or aural alerts (see tables)

Predictive Windshear Caution

Aural Alert	Visual Alert	Description
MONITOR RADAR DISPLAY	RED and BLACK PWS symbol on HSI Amber WINDSHEAR annunciation on HSI	Windshear within 3 miles and ahead of the airplane. Enabled during takeoff and approach, below 1,200 feet AGL. If weather (WXR) is not selected on either HSI, the weather display, including PWS symbology, will automatically pop-up on the HSI. PWS symbol on the HSI shows windshear position and size only when the HSI Mode Selector is in the VOR, APP, MAP or CTR MAP mode.

Inhibits

PWS alerts are inhibited during takeoff and landing as follows:

- WARNINGS, between 100 knots and 50 feet AGL
- CAUTIONS, between 80 knots and 400 feet AGL

Note: These inhibits do not remove existing PWS alerts.

PWS alerts are also inhibited by:

- Windshear Immediate-Alert Warnings
- GPWS Immediate-Alert Warnings
- GPWS Look-Ahead-Alert Warnings

Traffic Alert and Collision Avoidance System (TCAS)

TCAS alerts the crew to conflicting traffic. The system identifies a three-dimensional airspace around the airplane where a high likelihood of air traffic conflicts exist. These dimensions depend upon closure rates between the airplane and potentially conflicting traffic.

TCAS interrogates operating transponders in other aircraft, analyzes the replies, predicts flight paths and designates possible conflicting traffic as a "traffic aircraft."

When the system designates a traffic aircraft, TCAS provides the flight crew with a situational display. Additionally, TCAS may provide an aural annunciation and flight path guidance.

Note: Other aircraft that do not have an operating transponder can not initiate situational displays, aural annunciations or flight path guidance.

Note: TCAS is independent of ground-based air traffic control.

During normal operations, when TCAS designates a traffic aircraft, the system provides the following advisories and displays:

- Resolution Advisories (RA) and Displays
- Traffic Advisories (TA) and Displays
- Proximate Traffic and Other Traffic Displays

Normal Operations

TCAS is enabled from the Transponder Panel. The system is normally operated with the TCAS Mode Selector in the TA/RA mode.

| VP-BOQ through VP-BOZ, VP-BWW through VQ-BMU, VQ-BPT

The TA mode may be used:

- during engine out operations to prevent RAs when adequate thrust may not be available to follow the RA commands
- when intentionally operating near other traffic that may cause RAs, such as during parallel approaches or during VFR operations.

| VP-BDI, VP-BMC, VP-BRL, VQ-BOG, VQ-BRA

The TA ONLY mode may be used:

- during engine out operations to prevent RAs when adequate thrust may not be available to follow the RA commands
- when intentionally operating near other traffic that may cause RAs, such as during parallel approaches or during VFR operations.

Resolution Advisories (RA) and Displays

A Resolution Advisory (RA) is an immediate-threat prediction that traffic aircraft will enter the TCAS collision airspace within approximately 20 to 30 seconds. If altitude data from the traffic aircraft's transponder is not available, no RA can be provided.

When TCAS issues a RA:

- a voice alert sounds
- vertical guidance is displayed
- symbology is displayed

Voice Alert

When a RA is predicted, one of several initial RA voice alerts will sound. These voice alerts aurally elaborate on the displayed Vertical Guidance and are described in this Chapter under TCAS Vertical Guidance.

Display Symbology

The RA traffic symbol is a filled red square with an accompanying data tag when the traffic aircraft is providing altitude information.

The data tag appears in red and contains the following information about the traffic aircraft:

- a two-digit number preceded with a "+" or a "-" sign and positioned above or below the RA symbol. This number represents, in hundreds of feet, the relative vertical position and altitude difference between the airplane and the traffic aircraft.
- a vertical arrow appears to the right of the RA symbol when the traffic aircraft is either climbing or descending in excess of 500 feet per minute.

The RA is displayed as follows:

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA HSI

- When the red TRAFFIC message appears and the traffic aircraft is within the selected display range, the traffic symbol's relative position is displayed.
- When the traffic aircraft is outside the selected range, the red OFFSCALE message appears.
- When TCAS is unable to track the traffic aircraft's bearing, the red RA symbol is displayed below the TRAFFIC message.

VP-BOY, VP-BOZ

Pedestal Display

- When the traffic aircraft is within the selected display range, the traffic symbol's relative position is displayed.
- When TCAS is unable to track the traffic aircraft's bearing, the red RA symbol appears in the upper-right corner of the display.

VP-BWW, VP-BWX, VQ-BPT

VSI

- When the traffic aircraft is within the display range, the traffic symbol's relative position is displayed.
- When the RA is outside the display range, the red RA symbol appears as an half-filled red square and is positioned relative to the airplane on the outer edge of the display.
- When TCAS is unable to track the traffic aircraft's bearing, a No Bearing Annunciation is displayed in the lower center of the VSI.

Traffic Advisories (TA) and Displays

A Traffic Advisory (TA) is a prediction that traffic aircraft will enter the TCAS collision airspace within approximately 35 to 40 seconds. TAs are intended to assist the crew in establishing visual contact with the traffic aircraft.

When TCAS issues a TA:

- a voice alert sounds
- symbology is displayed

Voice Alert

When a TA is predicted, TRAFFIC, TRAFFIC sounds once.

Display Symbology

The TA traffic symbol is a filled amber circle with an accompanying data tag when the traffic aircraft is providing altitude information.

The data tag appears in amber and contains the following information about the traffic aircraft:

- a two-digit number preceded with a "+" or a "-" sign and positioned above or below the TA symbol. This number represents, in hundreds of feet, the relative vertical position and altitude difference between the airplane and the traffic aircraft.
- a vertical arrow appears to the right of the TA symbol when the traffic aircraft is either climbing or descending in excess of 500 feet per minute.

The TA is displayed as follows:

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

HSI

- When the amber TRAFFIC message appears and the traffic aircraft is within the selected display range, the traffic symbol's relative position is displayed.
- When TCAS is unable to track the traffic aircraft's bearing, the amber TA symbol is displayed below the TRAFFIC message.
- When the traffic aircraft is outside the selected range, the amber OFFSCALE message appears.

VP-BOY, VP-BOZ

Pedestal Display

- When the traffic aircraft is within the selected display range, the traffic symbol's relative position is displayed.
- When TCAS is unable to track the traffic aircraft's bearing, the amber TA symbol appears in the upper-right corner of the display.

VP-BWW, VP-BWX, VQ-BPT

VSI

- When the traffic aircraft is within the display range, the traffic symbol's relative position is displayed.
- When the TA is outside the display range, the amber TA symbol appears as an half-filled amber square and is positioned relative to the airplane on the outer edge of the display.
- When TCAS is unable to track the traffic aircraft's bearing, a No Bearing Annunciation is displayed in the lower center of the VSI.

Automatic TA and RA Display

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

TCAS automatically displays RA and TA symbols on the HSI when:

- a RA or TA occurs, and
- neither pilot has pushed the EFIS Traffic (TFC) Switch, and

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

- the HSI Mode Selector is in the VOR, APP, or MAP mode, and

VP-BOQ, VP-BRL, VQ-BRA

- the HSI Mode Selector is in the EXP VOR, EXP ILS, or MAP mode, and

VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT

- the TCAS Mode Selector is in TA or TA/RA

VP-BDI, VP-BMC, VP-BRL, VQ-BOG, VQ-BRA

- the TCAS Mode Selector is in TA ONLY or TA/RA

VP-BOY, VP-BOZ

TCAS automatically displays RA and TA symbols on the Pedestal Display when:

- a RA or TA occurs, and
- the TCAS AUTO Button is engaged in the Pop Up Mode, and
- the TCAS Mode Selector is in TA or TA/RA

Proximate Traffic and Other Traffic Displays

Proximate Traffic is a traffic aircraft that is neither a RA nor a TA but is within:

- six miles laterally, and
- 1,200 feet vertically

Other Traffic is a traffic aircraft that is neither a RA, TA, or Proximate Traffic

When TCAS identifies Proximate Traffic or Other Traffic:

- symbology is displayed

Display Symbology

The Proximate Traffic symbol is a filled diamond and the Other Traffic symbol is a hollow diamond. Both Proximate Traffic and Other Traffic symbols are displayed with an accompanying data tag when the traffic aircraft is providing altitude information.

The data tag contains the following information about the traffic aircraft:

- a two-digit number preceded with a "+" or a "-" sign and positioned above or below the Proximate or Other Traffic symbol. This number represents, in hundreds of feet, the relative vertical position and altitude difference between the airplane and the traffic aircraft.
- a vertical arrow appears to the right of the Proximate or Other Traffic symbol when the traffic aircraft is either climbing or descending in excess of 500 feet per minute.

Proximate Traffic and Other Traffic are displayed as follows:

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

HSI

- When Proximate Traffic is within the selected display range, the traffic aircraft's relative position is displayed as a filled white diamond.
- When Other Traffic is within the selected display range, the traffic aircraft's relative position is displayed as an unfilled white diamond.

VP-BWW, VP-BWX, VQ-BPT

VSI

- When Proximate Traffic is within the display range, the traffic aircraft's relative position is displayed as a filled cyan diamond.
- When Other Traffic is within the display range, the traffic aircraft's relative position is displayed as an unfilled cyan diamond.

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VP-BOY, VP-BOZ
Pedestal Display

- When Proximate Traffic is within the selected display range, the traffic aircraft's relative position is displayed as a filled white diamond.
- When Other Traffic is within the selected display range, the traffic aircraft's relative position is displayed as an unfilled white diamond.

TCAS Vertical Guidance

Vertical guidance is displayed for a traffic-avoidance maneuver. Traffic avoidance is ensured by adjusting or maintaining:

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

- an ADI pitch attitude outside the displayed red RA regions

VP-BOY, VP-BOZ, VP-BWW, VP-BWX, VQ-BPT

- a VSI vertical speed outside the displayed red RA regions

Note: If the traffic aircraft also has TCAS and an operating mode S transponder, vertical guidance is coordinated with the traffic aircraft.

Voice Annunciations

TCAS voice annunciations occur whenever a TA or RA is issued and elaborate on vertical guidance. Based on updated TCAS logic, corrective or preventive RA voice annunciations may be issued which adjust or reverse the initial guidance.

**VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMQ
(SB Adds VQ-BMU with updated TCAS software.)**

Note: Available voice annunciations are modified or deleted with updated TCAS software.

Voice Annunciation	Condition	Response
TRAFFIC, TRAFFIC	TCAS has issued a TA	Attempt to visually locate the traffic

Voice Annunciation	Condition	Response
VP-BMC, VP-BRL, VQ-BOG through VQ-BRA (SB Deletes VQ-BMU without updated TCAS software.) CLIMB, CLIMB, CLIMB VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMQ (SB Adds VQ-BMU with updated TCAS computer software.) CLIMB, CLIMB	Climb RA, present pitch attitude or vertical speed are within the red RA regions	Increase pitch attitude or vertical speed to remain outside the red RA regions
CLIMB, CROSSING CLIMB CLIMB, CROSSING CLIMB	Climb RA, present pitch attitude or vertical speed are within the red RA regions Airplane will climb through the traffic aircraft's altitude	

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Voice Annunciation	Condition	Response
VP-BMC, VP-BRL, VQ-BOG through VQ-BRA (SB Deletes VQ-BMU without updated TCAS software.) DESCEND, DESCEND, DESCEND VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMQ (SB Adds VQ-BMU with updated TCAS computer software.) DESCEND, DESCEND	Decent RA, present pitch attitude or vertical speed are within the red RA regions	Decrease pitch attitude or vertical speed to remain outside the red RA regions
DESCEND, CROSSING DESCEND DESCEND, CROSSING DESCEND	Decent RA, present pitch attitude or vertical speed are within the red RA regions Airplane will descend through the traffic aircraft's altitude	
INCREASE CLIMB, INCREASE CLIMB INCREASE DESCENT, INCREASE DESCENT	Existing RA, TCAS requires change in vertical rate Present pitch attitude or vertical speed are within the red RA regions	
CLIMB, CLIMB NOW CLIMB, CLIMB NOW	Corrective RA, previous vertical guidance was to descend Present pitch attitude or vertical speed are within the red RA regions	Climb and adjust pitch attitude or vertical speed to remain outside the red RA regions

Voice Annunciation	Condition	Response
DESCEND, DESCEND NOW DESCEND, DESCEND NOW	Corrective RA, previous vertical guidance was to climb Present pitch attitude and/or vertical speed are within the red RA regions	Descend and adjust pitch attitude or vertical speed to remain outside the red RA regions

VP-BMC, VP-BRL, VQ-BOG through VQ-BRA
(SB Deletes VQ-BMU with older version TCAS software.)

REDUCE CLIMB, REDUCE CLIMB	TCAS requires change in pitch attitude or vertical speed Present pitch attitude or vertical speed are within the red RA regions	Adjust pitch attitude or vertical speed to remain outside the red RA regions
REDUCE DESCENT, REDUCE DESCENT		
MONITOR VERTICAL SPEED, MONITOR VERTICAL SPEED	Preventive RA, no change in vertical rate is required, present pitch attitude or vertical speed are outside the red RA regions	Continue to keep pitch attitude or vertical speed outside the red RA regions
MONITOR VERTICAL SPEED	Minimum vertical rate required to ensure separation has changed, present pitch attitude or vertical speed are outside the red RA regions	



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Voice Annunciation	Condition	Response

VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMQ
(SB Adds VQ-BMU with updated TCAS computer software.)

MONITOR VERTICAL SPEED	Preventive RA, present pitch attitude or vertical speed are outside the red RA regions	Continue to keep pitch attitude or vertical speed outside the red RA regions
MAINTAIN VERTICAL SPEED MAINTAIN	Corrective RA, present pitch attitude or vertical speed are outside the red RA regions	
MAINTAIN VERTICAL SPEED CROSSING MAINTAIN	Corrective RA, present pitch attitude and vertical speed are outside the red RA regions Airplane will pass through the traffic aircraft's altitude	

VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMQ
(SB Adds VQ-BMU with TCAS version 7 software.)

ADJUST VERTICAL SPEED, ADJUST	Minimum vertical speed required to ensure separation has decreased, present pitch attitude or vertical speed are outside the red RA regions or, new RA, present pitch attitude or vertical speed are within the red RA region	Continue to keep pitch attitude or vertical speed outside the red RA regions. Vertical speed may be decreased, or adjust pitch attitude or vertical speed to remain outside the red RA regions.

Voice Annunciation	Condition	Response
CLEAR OF CONFLICT	Vertical guidance is no longer displayed and traffic symbology changes to TA Separation between the airplane and the traffic aircraft is increasing CLEAR OF CONFLICT will not sound if TCAS can no longer predict the track of the traffic aircraft	Attempt to visually locate the traffic aircraft

Inhibits

INCREASE DESCENT RAs are inhibited below approximately 1,450 feet radio altitude.

DESCEND RAs are inhibited below approximately 1,100 feet radio altitude.

I **VP-BMC, VP-BRL, VQ-BOG through VQ-BRA** (SB Deletes VQ-BMU without updated TCAS computer.)

All TCAS voice annunciations and all RAs are inhibited below approximately 1,000 feet radio altitude. Below approximately 1,000 feet when the TA/RA mode is selected on the transponder panel, the TA mode is enabled automatically.

VP-BDI, VP-BOQ through VP-BOZ, VP-BWW through VQ-BMQ (SB Adds VQ-BMU with updated TCAS computer.)

RAs are inhibited below approximately 1,000 feet radio altitude. Below approximately 1,000 feet when the TA/RA mode is selected on the transponder panel, the TA mode is enabled automatically. All TCAS voice annunciations are inhibited below approximately 500 feet radio altitude.

Note: All TCAS alerts are inhibited by the following

- ### I **VP-BDI, VP-BMC, VP-BWW, VP-BWX, VQ-BMU, VQ-BOG**
- PWS Annunciations
 - GPWS Immediate-Alert Annunciations
 - Windshear Immediate-Alert Annunciations

Non-Normal Operations

HSI Messages

VP-BDI through VP-BOQ, VP-BRL through VQ-BRA

When the HSI message:

- VP-BOQ, VP-BWW through VQ-BMU, VQ-BPT**
 - TCAS OFF is displayed, neither TA nor TA/RA is selected with the TCAS Mode Selector. The system cannot display symbology or vertical guidance. Voice Annunciations will not occur.
- VP-BDI, VP-BMC, VP-BRL, VQ-BOG, VQ-BRA**
 - TCAS OFF is displayed, neither TA ONLY nor TA/RA is selected with the TCAS Mode Selector. The system cannot display symbology or vertical guidance. Voice Annunciations will not occur.
 - TCAS FAIL is displayed, the system cannot display symbology or vertical guidance. Voice Annunciations will not occur.
 - TCAS OFF does not display if TCAS FAIL is annunciated.

VSI Messages

VP-BOY, VP-BOZ, VP-BWW, VP-BWX, VQ-BPT

When the VSI message:

- VP-BWW, VP-BWX, VQ-BPT**
 - RA FAIL is displayed, the system cannot display RA symbology or vertical guidance. RA voice annunciations will not occur.
 - TD FAIL is displayed, the TCAS display functions have failed.
 - TCAS FAIL is displayed, the TCAS system is not operational.
 - TD FAIL does not display if TCAS FAIL is annunciated.
- VP-BOY, VP-BOZ**
 - TCAS is displayed, the TCAS system is not operational. Neither vertical guidance nor voice annunciations will occur.
 - RA OFF is displayed, the VSI display is unable to provide vertical guidance.

Pedestal Messages

VP-BOY, VP-BOZ

When the pedestal message:

- TCAS STBY is displayed, neither TA nor TA/RA is selected with the TCAS Mode Selector. The system cannot display symbology or vertical guidance. Voice annunciations will not occur.
- TCAS FAIL is displayed, the system cannot display symbology or vertical guidance. voice annunciations will not occur.

EICAS Messages

I VP-BDI through VQ-BMQ, VQ-BOG, VQ-BPT

When the EICAS advisory message:

- TCAS is displayed, the system cannot display symbology or vertical guidance. Voice annunciations will not occur.

VP-BOQ through VP-BOZ, VP-BWW through VQ-BMQ, VQ-BPT

- TCAS OFF is displayed, neither TA nor TA/RA is selected with the TCAS Mode Selector. The system cannot display symbology or vertical guidance. Voice annunciations will not occur.

Note: The TCAS OFF message is inhibited below approximately 400 feet radio altitude.

I VP-BDI, VP-BMC, VP-BRL, VQ-BOG

- TCAS OFF is displayed, neither TA ONLY nor TA/RA is selected with the TCAS Mode Selector. The system cannot display symbology or vertical guidance. Voice annunciations will not occur.

Note: The TCAS OFF message is inhibited below approximately 400 feet radio altitude.

**Warning Systems**
EICAS Messages**Chapter 15**
Section 30**Warning Systems EICAS Messages**

The following EICAS messages can be displayed.

GPWS**VP-BDI through VQ-BPT**

Message	Level	Light	Aural	Condition

VP-BMC, VP-BOY through VQ-BPT

ALT CALLOUTS	Advisory			Altitude callouts are no longer provided.

VP-BOQ

ALT CALLOUTS	Advisory			Altitude callouts are no longer provided.

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

GND PROX SYS	Advisory			Ground proximity alerts may not be provided.

VP-BDI, VP-BMC, VP-BWW through VQ-BPT

TERR OVRD	Advisory			Ground proximity terrain override switch is in OVRD.
TERR POS	Advisory			Terrain position data has been lost.

WINDSHEAR SYS	Advisory			Windshear alerts may not be provided.

TCAS

VP-BDI through VQ-BMQ, VQ-BOG, VQ-BPT

Message	Level	Light	Aural	Condition
TCAS	Advisory			The TCAS system is inoperative.
TCAS OFF	Advisory			The TCAS system is off. Inhibited below 400 feet radio altitude.

Configuration

Message	Level	Light	Aural	Condition
FLAPS	Warning	CONFIG	Siren	Flaps are not in a takeoff position when either engine's thrust is in the takeoff range on the ground.
GEAR NOT DOWN	Warning	CONFIG	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.
PARKING BRAKE	Warning	CONFIG	Siren	Parking brake is set when either engine's thrust is in the takeoff range on the ground.
SPOILERS	Warning	CONFIG	Siren	Speedbrake lever is not DOWN when either engine's thrust is in the takeoff range on the ground.
STABILIZER	Warning	CONFIG	Siren	Stabilizer is not within the greenband when either engine's thrust is in the takeoff range on the ground.

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Miscellaneous

Message	Level	Light	Aural	Condition
ALTITUDE ALERT	Caution	ALT ALERT	Beeper	Airplane has deviated from the selected altitude.
EICAS CONT PNL	Advisory			EICAS control panel is inoperative.
EICAS DISPLAY	Advisory			One EICAS CRT is inoperative.

VP-BMC, VP-BOY, VP-BOZ, VP-BWW through VQ-BMQ, VQ-BOG, VQ-BPT

OVERSPEED	Warning	OVSPD	Siren	Airspeed has exceeded Vmo/Mmo.

VP-BDI, VP-BOQ, VP-BRL, VQ-BMU, VQ-BRA

OVERSPEED	Warning	OVSPD	Clacker	Airspeed has exceeded Vmo/Mmo.

VP-BDI through VP-BOQ, VP-BWW through VQ-BMQ, VQ-BOG through VQ-BRA

PILOT RESPONSE	Warning		Siren	No crew activity has been detected for an extended period of time.
PILOT RESPONSE	Caution		Beeper	No crew activity has been detected for an extended period of time.
PILOT RESPONSE	Advisory			No crew activity has been detected for an extended period of time.

Intentionally
Blank