777-200ER/-200F/-300/300ER Flight Crew Operations Manual

Korean Air Lines Co., Ltd.

EXPORT CONTROLLED - This document is subject to the U.S. Export Administration Regulations (EAR), (15 C.F.R. Parts 730-774). No authorization from the U.S. Department of Commerce is required for export, re-export, in-country transfer, or access EXCEPT to country group E:1 or E:2 countries/persons per Supp.1 to Part 740 of the EAR. ECCN: 9E991

BOEING PROPRIETARY

Copyright © 1996-2023 The Boeing Company. All rights reserved.

Boeing claims copyright in each page of this document only to the extent that the page contains copyrightable subject matter. Boeing also claims copyright in this document as a compilation and/or collective work.

This document includes proprietary information owned by The Boeing Company and/or one or more third parties. Treatment of the document and the information it contains is governed by contract with Boeing. For more information, contact The Boeing Company, P.O. Box 3707, Seattle Washington 98124.

Document Number D632W001-KAL(KAL)
Revision Number: 60
Revision Date: December 15, 2023

Intentionally
Blank

Volume 1

Title Page 0
Model Identification 0.1
Introduction 0.2
Abbreviations 0.3
Revision Record 0.4
V1V2 List of Effective Pages 0.5

777-8 & -9 Incorporation Notice 0

Volume 2

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

Landing Gear 14
Warning Systems 15

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The airplanes listed in the table below are covered in this manual. The numbers are used to distinguish data peculiar to one or more, but not all of the airplanes. Where data applies to all airplanes listed, no reference is made to individual airplane numbers.

The table permits flight crew correlation of configuration differences by Registry Number in alpha/numeric order within an operator's fleet for airplanes covered in this manual. Configuration data reflects the airplane as delivered configuration and is updated for service bulletin incorporations in conformance with the policy stated in the introduction section of this chapter.

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

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
221	HL7202	60377	WE479
222	HL7203	60378	WE480
223	HL7204	60380	WE481
224	HL7205	60379	WE482
005	HL7532	28371	WB552
006	HL7533	27948	WB553
004	HL7534	27950	WB551
007	HL7573	27952	WB554
101	HL7574	28444	WB134
102	HL7575	28445	WB135
103	HL7598	27949	WB136
107	HL7733	34206	WB140

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

Airplane Number	Registry Number	Serial Number	Tabulation Number
108	HL7734	34207	WB141
109	HL7743	34208	WB142
110	HL7750	34209	WB143
111	HL7751	34210	WB144
112	HL7752	34211	WB145
113	HL7764	34214	WB146
114	HL7765	34212	WB147
115	HL7766	34213	WB148
201	HL7782	37643	WD946
202	HL7783	37644	WD947
305	HL8005	37642	WF140
215	HL8006	37652	WE473
216	HL8007	43815	WE474
217	HL8008	43816	WE475
218	HL8009	41999	WE476
213	HL8010	42120	WE471
214	HL8011	42123	WE472
219	HL8041	60375	WE477
220	HL8042	60376	WE478
306	HL8043	62693	WF141
307	HL8044	62694	WF142
308	HL8045	62695	WF143
309	HL8046	62696	WF144
310	HL8075	62631	WF191
311	HL8076	62632	WF216
312	HL8077	62697	WF217
204	HL8208	37645	WD949

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

Airplane Number	Registry Number	Serial Number	Tabulation Number
205	HL8209	37646	WD950
206	HL8210	40377	WD951
207	HL8216	37647	WD952
208	HL8217	37648	WD953
209	HL8218	37649	WD954
303	HL8226	37640	WF138
210	HL8250	37650	WD955
301	HL8251	37639	WF136
302	HL8252	37638	WF137
211	HL8274	41998	WD956
212	HL8275	37651	WD957
304	HL8285	37641	WF139
225	HL8346	63434	WE483
226	HL8347	63435	WE484

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

General

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

- provide the limitations and operational information, procedures, performance, and systems information the flight crew needs to safely and efficiently operate the 777 airplane during all anticipated airline operations
- serve as a comprehensive reference for use during transition training for the 777 airplane
- serve as a review guide for use in recurrent training and proficiency checks
- provide necessary operational data from the FAA approved Airplane Flight Manual (AFM) to ensure that legal requirements are satisfied
- establish standardized procedures and practices to enhance Boeing operational philosophy and policy.

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

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

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

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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

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

Please submit all correspondence regarding content or use of this manual, including bulletin status, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Organization

The FCOM is organized in the following manner.

Volume 1 –

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

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

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Page Numbering

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

Example Page Number

Page Identification

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

Example Page Identification

Warnings, Cautions, and Notes

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

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

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

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

Special Note

This FCOM contains information which has been included at the request of your airline for airplanes covered by this manual. This information may differ from Boeing recommended information. By including this information in the manual, Boeing is providing a publishing service only and such inclusion does not imply that The Boeing Company in any way endorses or approves such information. The technical accuracy and validity of all such airline originated information, and its effect, if any, on other portions of this manual, is the sole responsibility of the airline.

All airline originated information is uniquely identified by revision dots as shown in the margin of this paragraph.

Airplane Effectivities

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

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

Example (with subordinate items):

N-AA - N-BB
CABIN CREW COMMUNICATIONS.....ESTABLISH
Evacuate lower crew rest compartment and close hatches.

Plan to land at the nearest suitable airport

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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

Example (without subordinate items):

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

NOTE: Use flaps 20 and VREF20 for landing.

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

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

PACK L, R
N-XX - N-YY

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

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

Example (‘before’ version):

(N-AA - N-BB ; before SB, ELMS software update not installed)
On the ground:
The C2 pump may be load shed by the electrical load management system.

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Example ('after' version):

N-XX - N-YY

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

On the ground:

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

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

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

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

777-8 & -9 Incorporation Notice

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

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

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

Administrative Information

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The following abbreviations may be found throughout the manual. Some abbreviations may also appear in lowercase letters. Abbreviations having very limited use are explained in the chapter where they are used.

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

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

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

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

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

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

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

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

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

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

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

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

INIT	Initialization
ILS	Instrument Landing System
INBD	Inboard
IND	Indicator
INOP	Inoperative
INT or INTPH	Interphone
INT	Interior Intermittent
INTC	Intercept
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	International Standard Atmosphere
ISFD	Integrated Standby Flight Display
ISLN	Isolation
ITP	In-Trail Procedures
K	
KGS	Kilograms
KT or KTS	Knots
L	
L	Left
LAV	Lavatory
LBS	Pounds
LDA	Localizer-type Directional Aid
LDG	Landing
LIM	Limit
LKD	Locked
LNAV	Lateral Navigation
LO	Low
LOC	Localizer
LOM	Locator Outer Marker
LPV	Localizer Performance with Vertical Guidance
LRC	Long Range Cruise
LT	Light
M	
M	Mach Meters
MAG	Magnetic
MAN	Manual
MAX	Maximum
MCP	Mode Control Panel
MDA(H)	Minimum Descent Altitude (Height)
MEL	Minimum Equipment List
MFD	Multifunction Display
MIC	Microphone
MIN	Minimum
MISC	Miscellaneous
MKR	Marker
MLG	Main Landing Gear
MLS	Microwave Landing System
MLW	Maximum Landing Weight
MMO	Maximum Mach Operating Speed
MOD	Modified Modify

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

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

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

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

RA	Radio Altitude Radio Altimeter Resolution Advisory
RAAS	Runway Awareness and Advisory System
RAD	Radio
RAT	Ram Air Turbine
RECIR or RECIRC	Recirculation
REF	Reference
REV	Reverse Reverser
RF	Radius-to-Fix Refill
RNAV	Area Navigation (RNAV)
RNP	Required Navigational Performance
RPM	Revolutions Per Minute
RST	Reset
R/T	Radio Transmitter
RTA	Required Time of Arrival
RTE	Route
RTO	Rejected Takeoff
RVSM	Reduced Vertical Separation Minimum
S	
S	South
SAT	Satellite Communication Static Air Temperature
SATCOM	Satellite Communication
SB	Service Bulletin
S/C	Step Climb
SDF	Simplified Directional Facility
SEL	Select
SELCAL	Selective Calling
SENS	Sensitivity
SERV	Service
SPD	Speed
STAB	Stabilizer
STAT	Status
STBY	Standby
SYS	System
SUPR or SUPRNMRY	Supernumerary
T	
TA	Traffic Advisory
TAI	Thermal Anti–Ice
TAT	Total Air Temperature
T/C	Top of Climb
TCAS	Traffic Alert and Collision Avoidance System
T/D	Top of Descent
TEMP	Temperature
TERR	Terrain
TFC	Traffic
TFR	Transfer
TGT	Target
THR	Throttle Thrust
TK or TRK	Track
TO or T/O	Takeoff
TO/GA	Takeoff/Go–Around

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

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

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

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

Revision Transmittal Letter

To: All holders of Korean Air Lines Co., Ltd. 777 Flight Crew Operations Manual (FCOM), Boeing Document Number D632W001-KAL(KAL).

Subject: Flight Crew Operations Manual Revision.

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

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

Revision Record

No.	Revision Date	Date Filed	No.	Revision Date	Date Filed
42	June 15, 2015		43	December 15, 2015	
44	June 15, 2016		45	September 1, 2016	
46	December 15, 2016		47	June 15, 2017	
48	December 15, 2017		49	June 15, 2018	
50	December 15, 2018		51	June 15, 2019	
52	December 15, 2019		53	June 15, 2020	
54	December 15, 2020		55	June 15, 2021	
56	December 15, 2021		57	June 15, 2022	
58	December 15, 2022		59	June 15, 2023	
60	December 15, 2023				

General

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

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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

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

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

Filing Instructions

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

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

Revision Highlights

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

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Chapter 1 - Airplane General, Emergency Equipment, Doors, Windows -200 & -300 Series (tab)

Section 50 - Doors, Windows, Seats

Flight Deck Seats

1.50.20 - Added graphic to reflect installation of 4Flight observer seat.

Chapter 2 - Air Systems

Section 20 - Air Conditioning System Description

Air Distribution

2.20.3 - Add content to FCOM Volume 2 Chapter 2 about air outlets so that the crew knows which air outlets to check when running the checklist.

Chapter 3 - Anti-Ice, Rain

Section 10 - Controls and Indicators

Engine and Wing Anti Icing

3.10.1 - Revised callout to note effects of Wing Anti-Ice system operation.

3.10.1 - Revised callout to remove reference to stick shaker logic for OFF switch position and to note effects of Wing Anti-Ice system operation.

Window Heat and Wiper Panels

3.10.3 - Changed sequenced to moved.

Section 20 - System Description

Anti-Icing Systems

3.20.1 - Reformatted system description.

3.20.1 - Revised description of EAI and WAI activation.

3.20.1 - Revised description of EAI and WAI deactivation.

3.20.2 - Revised and reformatted Wing Anti-Ice description for clarity.

3.20.2 - Revised to reflect aircraft configuration.

3.20.2 - Added note to reference switch position during WAI inhibit.

3.20.2 - Deleted WAI description above 10 degrees C to reflect fleet configuration.

3.20.2 - Revised formatting, no change in content.

3.20.2 - Added section to describe anti-ice system effects.

3.20.3 - Revised to reflect fleet configuration.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Deck Windows

3.20.4 - Added controlled to anti-fogging interior surface heating system.

Chapter 4 - Automatic Flight

Section 20 - System Description

Autothrottle System

4.20.11 - Revised capitalization of system states to off, armed, or active. Revised capitalization of ON to on, as it is not a labeled switch position. Revised switch terminology to A/T ARM, to match the mode control panel.

Chapter 6 - Electrical

Section 10 - Controls and Indicators

Electrical Synoptic Display

6.10.7 - Revised to include bus status.

6.10.8 - Added display information for a powered, unpowered, and unknown bus status.

Section 20 - System Description

AC Electrical System

6.20.4 - Revised AC description to include the ground handling bus.

DC Electrical System

6.20.9 - Revised DC electrical system to note battery chargers.

Standby Electrical System

6.20.14 - Revised paragraph formatting in RAT description.

6.20.14 - Revised RAT description to include impact from loss of both transfer busses.

Chapter 7 - Engines, APU

Section 10 - Controls and Indicators

EICAS Display

7.10.11 - Revised X-BLD indication logic.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Chapter 8 - Fire Protection

Section 10 - Controls and Indicators

APU and Cargo Fire Panel

8.10.3 - Described the operating flow valve in more detail.

8.10.3 - Corrected pack commands that occur when system Cargo Fire Suppression System Armed.

Chapter 10 - Flight Instruments, Displays -200 & -300 Series

Section 40 - Navigation Displays

Typical ND Map Displays

10.40.17 - Revised the section for better clarity

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

Section 42 - FMC Cruise

Navigation Data

11.42.38 - Deleted inadvertent text referencing effectivity.

Section 60 - EICAS Messages

FMC Alerting Messages

11.60.7 - Added FMC alerting message.

FMC Entry Error Messages

11.60.11 - Added sentence to ROUTE FULL to define allowable waypoint capacity.

Chapter 14 - Landing Gear

Section 20 - System Description

Brake System

14.20.6 - Revised AUTOBRAKE message text, added AUTOBRAKE DISARMED, and restructured content.

Chapter 15 - Warning Systems

Section 10 - Controls and Indicators

Traffic Alert and Collision Avoidance System (TCAS)

15.10.9 - Deleted inadvertent 777-8/9 title.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

유효페이지 목록

(List of Effective Pages)

Approved by MOLIT	REV NO.
신고필 2024.01.15 국토교통부 MOLIT	*REV 60* *Corresponding to B777 FCOM* *REVISION ISSUED 15 JAN 2024*

Volume 1

* Title Page 1-2	December 15, 2023
0.TOC.1-2	June 15, 2019

Model Identification

* 0.1.1-4	December 15, 2023

Introduction

0.2.1	June 15, 2022
0.2.2	June 15, 2018
0.2.3	October 31, 2014
0.2.4	June 15, 2015
0.2.5	June 15, 2015
0.2.6	June 15, 2019

Abbreviations

0.3.1	December 15, 2019
0.3.2	December 15, 2019
0.3.3	December 15, 2019
0.3.4	June 15, 2021
0.3.5	June 15, 2021
0.3.6	June 15, 2021
0.3.7	June 15, 2021
0.3.8	June 15, 2021

Revision Record (tab)

* 0.4.1	December 15, 2023
* 0.4.2	December 15, 2023

Revision Highlights

* 0.4.3	December 15, 2023
* 0.4.4	December 15, 2023
* 0.4.5	December 15, 2023
* 0.4.6-10	Deleted

V1V2 List of Effective Pages

* 0.5.1-26	December 15, 2023

Performance Dispatch (tab)

PD.TOC.1-2	June 15, 2023

777-200ER PW4090 LB FT FAA TO1-10 TO2-20 TALPA

PD.TOC.10.1-2	December 15, 2020
* PD.ModID.10.1-2	December 15, 2023
PD.10.1	October 31, 2014
PD.10.2	December 15, 2020
PD.10.3	December 15, 2020
PD.10.4	December 15, 2020
PD.10.5	October 31, 2014
PD.10.6	October 31, 2014
PD.10.7	October 31, 2014
PD.10.8	October 31, 2014
PD.10.9	October 31, 2014
PD.10.10	October 31, 2014
PD.11.1	October 31, 2014
PD.11.2	October 31, 2014
PD.11.3	October 31, 2014
PD.11.4	October 31, 2014
PD.11.5	October 31, 2014
PD.11.6	October 31, 2014
PD.11.7	October 31, 2014
PD.11.8	October 31, 2014
PD.11.9	October 31, 2014
PD.11.10	October 31, 2014
PD.12.1	October 31, 2014
PD.12.2	December 15, 2020
PD.12.3	October 31, 2014

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PD.12.4	October 31, 2014
PD.13.1	October 31, 2014
PD.13.2	December 15, 2020
PD.13.3	October 31, 2014
PD.13.4	October 31, 2014
PD.13.5	October 31, 2014
PD.13.6	October 31, 2014
PD.13.7	October 31, 2014
PD.13.8	October 31, 2014
PD.13.9	October 31, 2014
PD.13.10	October 31, 2014
PD.14.1	October 31, 2014
PD.14.2	December 15, 2020
PD.14.3	December 15, 2020
PD.14.4	June 15, 2020
PD.14.5	December 15, 2015
PD.14.6	December 15, 2020
PD.14.7	December 15, 2020
PD.14.8	October 31, 2014

777-300 PW4090 LB FT FAA TO1-10 TO2-20 TALPA

PD.TOC.20.1-2	December 15, 2020
PD.ModID.20.1-2	December 15, 2015
PD.20.1	December 15, 2015
PD.20.2	December 15, 2015
PD.20.3	December 15, 2015
PD.20.4	December 15, 2015
PD.20.5	December 15, 2015
PD.20.6	December 15, 2015
PD.20.7	December 15, 2015
PD.20.8	December 15, 2015
PD.20.9	December 15, 2015
PD.20.10	December 15, 2015
PD.21.1	December 15, 2015
PD.21.2	December 15, 2015
PD.21.3	December 15, 2015
PD.21.4	December 15, 2015
PD.21.5	December 15, 2015
PD.21.6	December 15, 2015
PD.21.7	December 15, 2015
PD.21.8	December 15, 2015
PD.21.9	December 15, 2015
PD.21.10	December 15, 2015
PD.22.1	December 15, 2015
PD.22.2	December 15, 2015
PD.22.3	December 15, 2020
PD.22.4	December 15, 2015
PD.22.5	December 15, 2015
PD.22.6	December 15, 2015
PD.23.1	December 15, 2015
PD.23.2	December 15, 2020
PD.23.3	December 15, 2015
PD.23.4	December 15, 2015
PD.23.5	December 15, 2015
PD.23.6	December 15, 2015
PD.23.7	December 15, 2015
PD.23.8	December 15, 2015
PD.23.9	December 15, 2015
PD.23.10	December 15, 2015
PD.24.1	December 15, 2015
PD.24.2	December 15, 2020
PD.24.3	December 15, 2020
PD.24.4	December 15, 2015
PD.24.5	December 15, 2015
PD.24.6	December 15, 2020
PD.24.7	December 15, 2020
PD.24.8	December 15, 2015

777-300ER GE90-115BL LB C FT FAA TO1-10 TO2-20 HIGH_ALT TALPA

PD.TOC.30.1-2	December 15, 2020
PD.ModID.30.1-2	June 15, 2022
PD.30.1	December 15, 2022
PD.30.2	December 15, 2022
PD.30.3	December 15, 2022
PD.30.4	December 15, 2022
PD.30.5	December 15, 2022
PD.30.6	December 15, 2022
PD.30.7	December 15, 2022
PD.30.8	December 15, 2022
PD.30.9	December 15, 2022
PD.30.10	December 15, 2022
PD.30.11	December 15, 2022
PD.30.12	December 15, 2022
PD.30.13	December 15, 2022
PD.30.14	December 15, 2022
PD.30.15	December 15, 2022
PD.30.16	December 15, 2022
PD.30.17	December 15, 2022
PD.30.18	December 15, 2022
PD.31.1	December 15, 2022
PD.31.2	December 15, 2022
PD.31.3	December 15, 2022
PD.31.4	December 15, 2022
PD.31.5	December 15, 2022

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PD.31.6	December 15, 2022
PD.31.7	December 15, 2022
PD.31.8	December 15, 2022
PD.31.9	December 15, 2022
PD.31.10	December 15, 2022
PD.31.11	December 15, 2022
PD.31.12	December 15, 2022
PD.32.1	December 15, 2022
PD.32.2	December 15, 2022
PD.32.3	December 15, 2022
PD.32.4	December 15, 2022
PD.32.5	December 15, 2022
PD.32.6	December 15, 2022
PD.33.1	December 15, 2022
PD.33.2	December 15, 2022
PD.33.3	December 15, 2022
PD.33.4	December 15, 2022
PD.33.5	December 15, 2022
PD.33.6	December 15, 2022
PD.33.7	December 15, 2022
PD.33.8	December 15, 2022
PD.33.9	December 15, 2022
PD.33.10	December 15, 2022
PD.34.1	December 15, 2022
PD.34.2	December 15, 2022
PD.34.3	December 15, 2022
PD.34.4	December 15, 2022
PD.34.5	December 15, 2022
PD.34.6	December 15, 2022
PD.34.7	December 15, 2022
PD.34.8	December 15, 2022

777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA

PD.TOC.40.1-2	June 15, 2021
PD.ModID.40.1-2	December 15, 2021
PD.40.1	June 15, 2021
PD.40.2	June 15, 2021
PD.40.3	June 15, 2021
PD.40.4	June 15, 2021
PD.40.5	June 15, 2021
PD.40.6	June 15, 2021
PD.40.7	June 15, 2021
PD.40.8	June 15, 2021
PD.40.9	June 15, 2021
PD.40.10	June 15, 2021
PD.40.11	June 15, 2021
PD.40.12	June 15, 2021
PD.40.13	June 15, 2021
PD.40.14	June 15, 2021
PD.40.15	June 15, 2021
PD.40.16	June 15, 2021
PD.41.1	June 15, 2021
PD.41.2	June 15, 2021
PD.41.3	June 15, 2021
PD.41.4	June 15, 2021
PD.41.5	June 15, 2021
PD.41.6	June 15, 2021
PD.41.7	June 15, 2021
PD.41.8	June 15, 2021
PD.41.9	June 15, 2021
PD.41.10	June 15, 2021
PD.41.11	June 15, 2021
PD.41.12	June 15, 2021
PD.42.1	June 15, 2021
PD.42.2	June 15, 2021
PD.42.3	June 15, 2021
PD.42.4	June 15, 2021
PD.42.5	June 15, 2021
PD.42.6	June 15, 2021
PD.43.1	June 15, 2021
PD.43.2	June 15, 2021
PD.43.3	June 15, 2021
PD.43.4	June 15, 2021
PD.43.5	June 15, 2021
PD.43.6	June 15, 2021
PD.43.7	June 15, 2021
PD.43.8	June 15, 2021
PD.43.9	June 15, 2021
PD.43.10	June 15, 2021
PD.44.1	June 15, 2021
PD.44.2	June 15, 2021
PD.44.3	June 15, 2021
PD.44.4	June 15, 2021
PD.44.5	June 15, 2021
PD.44.6	June 15, 2021
PD.44.7	June 15, 2021
PD.44.8	June 15, 2021

777F GE90-110B1L LB FT FAA TO1-10 TO2-20 CREW3 TALPA HIGH_ALT

PD.TOC.50.1-2	June 15, 2022
PD.ModID.50.1-2	June 15, 2023
PD.50.1	June 15, 2022
PD.50.2	June 15, 2022
PD.50.3	June 15, 2022

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PD.50.4	June 15, 2022
PD.50.5	June 15, 2022
PD.50.6	June 15, 2022
PD.50.7	June 15, 2022
PD.50.8	June 15, 2022
PD.50.9	June 15, 2022
PD.50.10	June 15, 2022
PD.50.11	June 15, 2022
PD.50.12	June 15, 2022
PD.50.13	June 15, 2022
PD.50.14	June 15, 2022
PD.50.15	June 15, 2022
PD.50.16	June 15, 2022
PD.51.1	June 15, 2021
PD.51.2	June 15, 2021
PD.51.3	June 15, 2021
PD.51.4	June 15, 2021
PD.51.5	June 15, 2021
PD.51.6	June 15, 2021
PD.51.7	June 15, 2021
PD.51.8	June 15, 2022
PD.51.9	June 15, 2021
PD.51.10	June 15, 2021
PD.52.1	June 15, 2021
PD.52.2	June 15, 2021
PD.52.3	June 15, 2021
PD.52.4	June 15, 2021
PD.52.5	June 15, 2021
PD.52.6	June 15, 2021
PD.53.1	June 15, 2021
PD.53.2	June 15, 2021
PD.53.3	June 15, 2021
PD.53.4	June 15, 2021
PD.53.5	June 15, 2021
PD.53.6	June 15, 2021
PD.53.7	June 15, 2021
PD.53.8	June 15, 2021
PD.53.9	June 15, 2021
PD.53.10	June 15, 2021
PD.54.1	June 15, 2022
PD.54.2	June 15, 2023
PD.54.3	June 15, 2022
PD.54.4	June 15, 2022
PD.54.5	June 15, 2021
PD.54.6	June 15, 2021
PD.54.7	June 15, 2021
PD.54.8	June 15, 2021

Performance Inflight (tab)

PI.TOC.1-2	June 15, 2023

777-200ER PW4090 LB FT FAA TO1-10 TO2-20 TALPA

PI.TOC.10.1-4	June 15, 2023
* PI.ModID.10.1-2	December 15, 2023
PI.10.1	December 15, 2020
PI.10.2	December 15, 2020
PI.10.3	December 15, 2020
PI.10.4	December 15, 2020
PI.10.5	December 15, 2020
PI.10.6	December 15, 2020
PI.10.7	December 15, 2020
PI.10.8	December 15, 2020
PI.10.9	December 15, 2020
PI.10.10	December 15, 2020
PI.10.11	December 15, 2020
PI.10.12	December 15, 2020
PI.10.13	December 15, 2020
PI.10.14	December 15, 2020
PI.10.15	December 15, 2020
PI.10.16	December 15, 2020
PI.10.17	December 15, 2020
PI.10.18	December 15, 2020
PI.10.19	December 15, 2020
PI.10.20	December 15, 2020
PI.10.21	December 15, 2020
PI.10.22	December 15, 2020
PI.10.23	December 15, 2020
PI.10.24	December 15, 2020
PI.10.25	December 15, 2020
PI.10.26	December 15, 2020
PI.10.27	December 15, 2020
PI.10.28	December 15, 2020
PI.10.29	June 15, 2023
PI.10.30	December 15, 2020
PI.10.31	December 15, 2020
PI.10.32	December 15, 2020
PI.11.1	October 31, 2014
PI.11.2	October 31, 2014
PI.11.3	October 31, 2014
PI.11.4	October 31, 2014
PI.11.5	October 31, 2014
PI.11.6	October 31, 2014
PI.11.7	October 31, 2014
PI.11.8	October 31, 2014

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PI.11.9	October 31, 2014
PI.11.10	October 31, 2014
PI.12.1	December 15, 2020
PI.12.2	October 31, 2014
PI.12.3	December 15, 2020
PI.12.4	October 31, 2014
PI.12.5	December 15, 2020
PI.12.6	October 31, 2014
PI.12.7	December 15, 2020
PI.12.8	June 15, 2023
PI.12.9	June 15, 2023
PI.12.10	June 15, 2023
PI.12.11	June 15, 2023
PI.12.12	June 15, 2023
PI.12.13	June 15, 2023
PI.12.14	June 15, 2023
PI.12.15	June 15, 2023
PI.12.16	June 15, 2023
PI.12.17	June 15, 2023
PI.12.18	June 15, 2023
PI.12.19	June 15, 2023
PI.12.20	June 15, 2023
PI.12.21	June 15, 2023
PI.12.22	June 15, 2023
PI.12.23	June 15, 2023
PI.12.24	June 15, 2023
PI.12.25	June 15, 2023
PI.12.26	June 15, 2023
PI.12.27	June 15, 2023
PI.12.28	June 15, 2023
PI.12.29	June 15, 2023
PI.12.30	June 15, 2023
PI.12.31	June 15, 2023
PI.12.32	June 15, 2023
PI.12.33	June 15, 2023
PI.12.34	June 15, 2023
PI.12.35	June 15, 2023
PI.12.36	June 15, 2023
PI.12.37	June 15, 2023
PI.12.38	June 15, 2023
PI.12.39	June 15, 2023
PI.12.40	June 15, 2023
PI.12.41	June 15, 2023
PI.12.42	June 15, 2023
PI.12.43	June 15, 2023
PI.12.44	June 15, 2023
PI.13.1	October 31, 2014
PI.13.2	October 31, 2014
PI.13.3	October 31, 2014
PI.13.4	October 31, 2014
PI.13.5	October 31, 2014
PI.13.6	October 31, 2014
PI.13.7	October 31, 2014
PI.13.8	October 31, 2014
PI.13.9	October 31, 2014
PI.13.10	October 31, 2014
PI.13.11	October 31, 2014
PI.13.12	December 15, 2020
PI.14.1	December 15, 2020
PI.14.2	October 31, 2014
PI.14.3	October 31, 2014
PI.14.4	October 31, 2014
PI.14.5	October 31, 2014
PI.14.6	October 31, 2014
PI.15.1	October 31, 2014
PI.15.2	October 31, 2014
PI.15.3	October 31, 2014
PI.15.4	October 31, 2014
PI.16.1	June 15, 2023
PI.16.2	October 31, 2014
PI.16.3	October 31, 2014
PI.16.4	October 31, 2014
PI.16.5	October 31, 2014
PI.16.6	October 31, 2014
PI.16.7	October 31, 2014
PI.16.8	October 31, 2014
PI.17.1	October 31, 2014
PI.17.2	October 31, 2014
PI.17.3	October 31, 2014
PI.17.4	October 31, 2014
PI.17.5	October 31, 2014
PI.17.6	October 31, 2014
PI.18.1	December 15, 2020
PI.18.2	June 15, 2022
PI.18.3	June 15, 2022
PI.18.4	June 15, 2023
PI.18.5	December 15, 2020
PI.18.6	December 15, 2020
PI.18.7	December 15, 2020
PI.18.8	December 15, 2020
PI.18.9	December 15, 2020
PI.18.10	December 15, 2020
PI.18.11	December 15, 2020
PI.18.12	December 15, 2020

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PI.18.13	December 15, 2020
PI.18.14	October 31, 2014

777-300 PW4090 LB FT FAA TO1-10 TO2-20 TAL-PA

PI.TOC.20.1-4	June 15, 2023
PI.ModID.20.1-2	December 15, 2015
PI.20.1	December 15, 2020
PI.20.2	December 15, 2020
PI.20.3	December 15, 2020
PI.20.4	December 15, 2020
PI.20.5	December 15, 2020
PI.20.6	December 15, 2020
PI.20.7	December 15, 2020
PI.20.8	December 15, 2020
PI.20.9	December 15, 2020
PI.20.10	December 15, 2020
PI.20.11	December 15, 2020
PI.20.12	December 15, 2020
PI.20.13	December 15, 2020
PI.20.14	December 15, 2020
PI.20.15	December 15, 2020
PI.20.16	December 15, 2020
PI.20.17	December 15, 2020
PI.20.18	December 15, 2020
PI.20.19	December 15, 2020
PI.20.20	December 15, 2020
PI.20.21	December 15, 2020
PI.20.22	June 15, 2023
PI.20.23	December 15, 2020
PI.20.24	December 15, 2020
PI.20.25	December 15, 2020
PI.20.26	December 15, 2020
PI.21.1	December 15, 2015
PI.21.2	December 15, 2015
PI.21.3	December 15, 2015
PI.21.4	December 15, 2015
PI.21.5	December 15, 2015
PI.21.6	December 15, 2015
PI.21.7	December 15, 2015
PI.21.8	December 15, 2015
PI.21.9	December 15, 2015
PI.21.10	December 15, 2015
PI.22.1	December 15, 2020
PI.22.2	December 15, 2015
PI.22.3	December 15, 2020
PI.22.4	December 15, 2015
PI.22.5	December 15, 2020
PI.22.6	December 15, 2015
PI.22.7	December 15, 2020
PI.22.8	June 15, 2023
PI.22.9	June 15, 2023
PI.22.10	June 15, 2023
PI.22.11	June 15, 2023
PI.22.12	June 15, 2023
PI.22.13	June 15, 2023
PI.22.14	June 15, 2023
PI.22.15	June 15, 2023
PI.22.16	June 15, 2023
PI.22.17	June 15, 2023
PI.22.18	June 15, 2023
PI.22.19	June 15, 2023
PI.22.20	June 15, 2023
PI.22.21	June 15, 2023
PI.22.22	June 15, 2023
PI.22.23	June 15, 2023
PI.22.24	June 15, 2023
PI.22.25	June 15, 2023
PI.22.26	June 15, 2023
PI.22.27	June 15, 2023
PI.22.28	June 15, 2023
PI.22.29	June 15, 2023
PI.22.30	June 15, 2023
PI.22.31	June 15, 2023
PI.22.32	June 15, 2023
PI.22.33	June 15, 2023
PI.22.34	June 15, 2023
PI.22.35	June 15, 2023
PI.22.36	June 15, 2023
PI.22.37	June 15, 2023
PI.22.38	June 15, 2023
PI.22.39	June 15, 2023
PI.22.40	June 15, 2023
PI.22.41	June 15, 2023
PI.22.42	June 15, 2023
PI.22.43	June 15, 2023
PI.22.44	June 15, 2023
PI.23.1	December 15, 2015
PI.23.2	December 15, 2015
PI.23.3	December 15, 2015
PI.23.4	December 15, 2015
PI.23.5	December 15, 2015
PI.23.6	December 15, 2015
PI.23.7	December 15, 2015
PI.23.8	December 15, 2015

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PI.23.9	December 15, 2015
PI.23.10	December 15, 2015
PI.23.11	December 15, 2015
PI.23.12	December 15, 2015
PI.23.13	December 15, 2015
PI.23.14	December 15, 2015
PI.24.1	December 15, 2020
PI.24.2	December 15, 2015
PI.24.3	December 15, 2015
PI.24.4	December 15, 2015
PI.24.5	December 15, 2015
PI.24.6	December 15, 2015
PI.25.1	December 15, 2015
PI.25.2	December 15, 2015
PI.25.3	December 15, 2015
PI.25.4	December 15, 2015
PI.26.1	June 15, 2023
PI.26.2	December 15, 2015
PI.26.3	December 15, 2015
PI.26.4	December 15, 2015
PI.26.5	December 15, 2015
PI.26.6	December 15, 2015
PI.26.7	December 15, 2015
PI.26.8	December 15, 2015
PI.27.1	December 15, 2015
PI.27.2	December 15, 2015
PI.27.3	December 15, 2015
PI.27.4	December 15, 2015
PI.27.5	December 15, 2015
PI.27.6	December 15, 2015
PI.28.1	December 15, 2021
PI.28.2	June 15, 2022
PI.28.3	June 15, 2022
PI.28.4	June 15, 2023
PI.28.5	December 15, 2020
PI.28.6	December 15, 2020
PI.28.7	December 15, 2020
PI.28.8	December 15, 2020
PI.28.9	December 15, 2015
PI.28.10	December 15, 2015
PI.28.11	December 15, 2020
PI.28.12	December 15, 2015
PI.28.13	December 15, 2015
PI.28.14	December 15, 2015

777-300ER GE90-115BL LB C FT FAA TO1-10 TO2-20 HIGH_ALT TALPA

PI.TOC.30.1-4	June 15, 2023
PI.ModID.30.1-2	June 15, 2022
PI.30.1	December 15, 2022
PI.30.2	December 15, 2022
PI.30.3	December 15, 2022
PI.30.4	December 15, 2022
PI.30.5	December 15, 2022
PI.30.6	December 15, 2022
PI.30.7	December 15, 2022
PI.30.8	December 15, 2022
PI.30.9	December 15, 2022
PI.30.10	December 15, 2022
PI.30.11	December 15, 2022
PI.30.12	December 15, 2022
PI.30.13	December 15, 2022
PI.30.14	December 15, 2022
PI.30.15	December 15, 2022
PI.30.16	December 15, 2022
PI.30.17	December 15, 2022
PI.30.18	December 15, 2022
PI.30.19	December 15, 2022
PI.30.20	December 15, 2022
PI.30.21	December 15, 2022
PI.30.22	December 15, 2022
PI.30.23	December 15, 2022
PI.30.24	December 15, 2022
PI.30.25	December 15, 2022
PI.30.26	December 15, 2022
PI.30.27	December 15, 2022
PI.30.28	December 15, 2022
PI.30.29	December 15, 2022
PI.30.30	December 15, 2022
PI.30.31	December 15, 2022
PI.30.32	December 15, 2022
PI.31.1	December 15, 2022
PI.31.2	December 15, 2022
PI.31.3	December 15, 2022
PI.31.4	December 15, 2022
PI.31.5	December 15, 2022
PI.31.6	December 15, 2022
PI.31.7	December 15, 2022
PI.31.8	December 15, 2022
PI.31.9	December 15, 2022
PI.31.10	December 15, 2022
PI.31.11	December 15, 2022
PI.31.12	December 15, 2022
PI.32.1	December 15, 2022
PI.32.2	December 15, 2022

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PI.32.3	December 15, 2022
PI.32.4	December 15, 2022
PI.32.5	December 15, 2022
PI.32.6	December 15, 2022
PI.32.7	December 15, 2022
PI.32.8	June 15, 2023
PI.32.9	June 15, 2023
PI.32.10	June 15, 2023
PI.32.11	June 15, 2023
PI.32.12	June 15, 2023
PI.32.13	June 15, 2023
PI.32.14	June 15, 2023
PI.32.15	June 15, 2023
PI.32.16	June 15, 2023
PI.32.17	June 15, 2023
PI.32.18	June 15, 2023
PI.32.19	June 15, 2023
PI.32.20	June 15, 2023
PI.32.21	June 15, 2023
PI.32.22	June 15, 2023
PI.32.23	June 15, 2023
PI.32.24	June 15, 2023
PI.32.25	June 15, 2023
PI.32.26	June 15, 2023
PI.32.27	June 15, 2023
PI.32.28	June 15, 2023
PI.32.29	June 15, 2023
PI.32.30	June 15, 2023
PI.32.31	June 15, 2023
PI.32.32	June 15, 2023
PI.32.33	June 15, 2023
PI.32.34	June 15, 2023
PI.32.35	June 15, 2023
PI.32.36	June 15, 2023
PI.32.37	June 15, 2023
PI.32.38	June 15, 2023
PI.32.39	June 15, 2023
PI.32.40	June 15, 2023
PI.32.41	June 15, 2023
PI.32.42	June 15, 2023
PI.32.43	June 15, 2023
PI.32.44	June 15, 2023
PI.33.1	December 15, 2022
PI.33.2	December 15, 2022
PI.33.3	December 15, 2022
PI.33.4	December 15, 2022
PI.33.5	December 15, 2022
PI.33.6	December 15, 2022
PI.33.7	December 15, 2022
PI.33.8	December 15, 2022
PI.33.9	December 15, 2022
PI.33.10	December 15, 2022
PI.33.11	December 15, 2022
PI.33.12	December 15, 2022
PI.34.1	December 15, 2022
PI.34.2	December 15, 2022
PI.35.1	December 15, 2022
PI.35.2	December 15, 2022
PI.35.3	December 15, 2022
PI.35.4	December 15, 2022
PI.35.5	December 15, 2022
PI.35.6	December 15, 2022
PI.35.7	December 15, 2022
PI.35.8	December 15, 2022
PI.36.1	December 15, 2022
PI.36.2	December 15, 2022
PI.36.3	December 15, 2022
PI.36.4	December 15, 2022
PI.36.5	December 15, 2022
PI.36.6	December 15, 2022
PI.37.1	December 15, 2022
PI.37.2	December 15, 2022
PI.37.3	December 15, 2022
PI.37.4	June 15, 2023
PI.37.5	December 15, 2022
PI.37.6	December 15, 2022
PI.37.7	December 15, 2022
PI.37.8	December 15, 2022
PI.37.9	December 15, 2022
PI.37.10	December 15, 2022
PI.37.11	December 15, 2022
PI.37.12	December 15, 2022

777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA

PI.TOC.40.1-4	June 15, 2023
PI.ModID.40.1-2	December 15, 2021
PI.40.1	June 15, 2021
PI.40.2	June 15, 2021
PI.40.3	June 15, 2021
PI.40.4	June 15, 2021
PI.40.5	June 15, 2021
PI.40.6	June 15, 2021
PI.40.7	June 15, 2021
PI.40.8	June 15, 2021

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PI.40.9	June 15, 2021	PI.42.12	June 15, 2023
PI.40.10	June 15, 2021	PI.42.13	June 15, 2023
PI.40.11	June 15, 2021	PI.42.14	June 15, 2023
PI.40.12	June 15, 2021	PI.42.15	June 15, 2023
PI.40.13	June 15, 2021	PI.42.16	June 15, 2023
PI.40.14	June 15, 2021	PI.42.17	June 15, 2023
PI.40.15	June 15, 2021	PI.42.18	June 15, 2023
PI.40.16	June 15, 2021	PI.42.19	June 15, 2023
PI.40.17	June 15, 2021	PI.42.20	June 15, 2023
PI.40.18	June 15, 2021	PI.42.21	June 15, 2023
PI.40.19	June 15, 2021	PI.42.22	June 15, 2023
PI.40.20	June 15, 2021	PI.42.23	June 15, 2023
PI.40.21	June 15, 2021	PI.42.24	June 15, 2023
PI.40.22	June 15, 2021	PI.42.25	June 15, 2023
PI.40.23	June 15, 2021	PI.42.26	June 15, 2023
PI.40.24	June 15, 2021	PI.42.27	June 15, 2023
PI.40.25	June 15, 2021	PI.42.28	June 15, 2023
PI.40.26	June 15, 2021	PI.42.29	June 15, 2023
PI.40.27	June 15, 2021	PI.42.30	June 15, 2023
PI.40.28	June 15, 2021	PI.42.31	June 15, 2023
PI.40.29	June 15, 2021	PI.42.32	June 15, 2023
PI.40.30	June 15, 2021	PI.42.33	June 15, 2023
PI.40.31	June 15, 2021	PI.42.34	June 15, 2023
PI.40.32	June 15, 2021	PI.42.35	June 15, 2023
PI.41.1	June 15, 2021	PI.42.36	June 15, 2023
PI.41.2	June 15, 2021	PI.42.37	June 15, 2023
PI.41.3	June 15, 2021	PI.42.38	June 15, 2023
PI.41.4	June 15, 2021	PI.42.39	June 15, 2023
PI.41.5	June 15, 2021	PI.42.40	June 15, 2023
PI.41.6	June 15, 2021	PI.42.41	June 15, 2023
PI.41.7	June 15, 2021	PI.42.42	June 15, 2023
PI.41.8	June 15, 2021	PI.42.43	June 15, 2023
PI.41.9	June 15, 2021	PI.42.44	June 15, 2023
PI.41.10	June 15, 2021	PI.43.1	June 15, 2021
PI.41.11	June 15, 2021	PI.43.2	June 15, 2021
PI.41.12	June 15, 2021	PI.43.3	June 15, 2021
PI.42.1	June 15, 2021	PI.43.4	June 15, 2021
PI.42.2	June 15, 2021	PI.43.5	June 15, 2021
PI.42.3	June 15, 2021	PI.43.6	June 15, 2021
PI.42.4	June 15, 2021	PI.43.7	June 15, 2021
PI.42.5	June 15, 2021	PI.43.8	June 15, 2021
PI.42.6	June 15, 2021	PI.43.9	June 15, 2021
PI.42.7	June 15, 2021	PI.43.10	June 15, 2021
PI.42.8	June 15, 2023	PI.43.11	June 15, 2021
PI.42.9	June 15, 2023	PI.43.12	June 15, 2021
PI.42.10	June 15, 2023	PI.44.1	June 15, 2021
PI.42.11	June 15, 2023	PI.44.2	June 15, 2021

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PI.45.1	June 15, 2021
PI.45.2	June 15, 2021
PI.45.3	June 15, 2021
PI.45.4	June 15, 2021
PI.45.5	June 15, 2021
PI.45.6	June 15, 2021
PI.45.7	June 15, 2021
PI.45.8	June 15, 2021
PI.46.1	June 15, 2021
PI.46.2	June 15, 2021
PI.46.3	June 15, 2021
PI.46.4	June 15, 2021
PI.46.5	June 15, 2021
PI.46.6	June 15, 2021
PI.47.1	June 15, 2021
PI.47.2	June 15, 2022
PI.47.3	June 15, 2022
PI.47.4	June 15, 2023
PI.47.5	June 15, 2021
PI.47.6	June 15, 2021
PI.47.7	June 15, 2021
PI.47.8	June 15, 2021
PI.47.9	June 15, 2021
PI.47.10	June 15, 2021
PI.47.11	June 15, 2021
PI.47.12	June 15, 2021

777F GE90-110B1L LB FT FAA TO1-10 TO2-20 CREW3 TALPA HIGH_ALT

PI.TOC.50.1-4	June 15, 2023
PI.ModID.50.1-2	June 15, 2023
PI.50.1	June 15, 2021
PI.50.2	June 15, 2021
PI.50.3	June 15, 2021
PI.50.4	June 15, 2021
PI.50.5	June 15, 2021
PI.50.6	June 15, 2021
PI.50.7	June 15, 2021
PI.50.8	June 15, 2021
PI.50.9	June 15, 2021
PI.50.10	June 15, 2021
PI.50.11	June 15, 2021
PI.50.12	June 15, 2021
PI.50.13	June 15, 2021
PI.50.14	June 15, 2021
PI.50.15	June 15, 2021
PI.50.16	June 15, 2021
PI.50.17	June 15, 2021
PI.50.18	June 15, 2021
PI.50.19	June 15, 2021
PI.50.20	June 15, 2021
PI.50.21	June 15, 2021
PI.50.22	June 15, 2021
PI.50.23	June 15, 2021
PI.50.24	June 15, 2021
PI.50.25	June 15, 2021
PI.50.26	June 15, 2021
PI.50.27	June 15, 2021
PI.50.28	June 15, 2021
PI.50.29	June 15, 2021
PI.50.30	June 15, 2021
PI.50.31	June 15, 2021
PI.50.32	June 15, 2023
PI.50.33	June 15, 2021
PI.50.34	June 15, 2021
PI.50.35	June 15, 2021
PI.50.36	June 15, 2021
PI.51.1	June 15, 2021
PI.51.2	June 15, 2021
PI.51.3	June 15, 2021
PI.51.4	June 15, 2021
PI.51.5	June 15, 2021
PI.51.6	June 15, 2021
PI.51.7	June 15, 2021
PI.51.8	June 15, 2021
PI.51.9	June 15, 2021
PI.51.10	June 15, 2021
PI.52.1	June 15, 2021
PI.52.2	June 15, 2021
PI.52.3	June 15, 2021
PI.52.4	June 15, 2021
PI.52.5	June 15, 2021
PI.52.6	June 15, 2021
PI.52.7	June 15, 2021
PI.52.8	June 15, 2023
PI.52.9	June 15, 2023
PI.52.10	June 15, 2023
PI.52.11	June 15, 2023
PI.52.12	June 15, 2023
PI.52.13	June 15, 2023
PI.52.14	June 15, 2023
PI.52.15	June 15, 2023
PI.52.16	June 15, 2023
PI.52.17	June 15, 2023
PI.52.18	June 15, 2023

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

PI.52.19	June 15, 2023
PI.52.20	June 15, 2023
PI.52.21	June 15, 2023
PI.52.22	June 15, 2023
PI.52.23	June 15, 2023
PI.52.24	June 15, 2023
PI.52.25	June 15, 2023
PI.52.26	June 15, 2023
PI.52.27	June 15, 2023
PI.52.28	June 15, 2023
PI.52.29	June 15, 2023
PI.52.30	June 15, 2023
PI.52.31	June 15, 2023
PI.52.32	June 15, 2023
PI.52.33	June 15, 2023
PI.52.34	June 15, 2023
PI.52.35	June 15, 2023
PI.52.36	June 15, 2023
PI.52.37	June 15, 2023
PI.52.38	June 15, 2023
PI.52.39	June 15, 2023
PI.52.40	June 15, 2023
PI.52.41	June 15, 2023
PI.52.42	June 15, 2023
PI.52.43	June 15, 2023
PI.52.44	June 15, 2023
PI.53.1	June 15, 2021
PI.53.2	June 15, 2021
PI.53.3	June 15, 2021
PI.53.4	June 15, 2021
PI.53.5	June 15, 2021
PI.53.6	June 15, 2021
PI.53.7	June 15, 2021
PI.53.8	June 15, 2021
PI.53.9	June 15, 2021
PI.53.10	June 15, 2021
PI.53.11	June 15, 2021
PI.53.12	June 15, 2021
PI.54.1	June 15, 2021
PI.54.2	June 15, 2021
PI.55.1	June 15, 2021
PI.55.2	June 15, 2021
PI.55.3	June 15, 2021
PI.55.4	June 15, 2021
PI.55.5	June 15, 2021
PI.55.6	June 15, 2021
PI.55.7	June 15, 2021
PI.55.8	June 15, 2021
PI.56.1	June 15, 2021
PI.56.2	June 15, 2021
PI.56.3	June 15, 2021
PI.56.4	June 15, 2021
PI.56.5	June 15, 2021
PI.56.6	June 15, 2021
PI.57.1	June 15, 2023
PI.57.2	June 15, 2022
PI.57.3	June 15, 2022
PI.57.4	June 15, 2023
PI.57.5	June 15, 2023
PI.57.6	June 15, 2023
PI.57.7	June 15, 2023
PI.57.8	June 15, 2023
PI.57.9	June 15, 2023
PI.57.10	June 15, 2023
PI.57.11	June 15, 2023
PI.57.12	June 15, 2023
0.1.1-2	June 15, 2019

(blank tab)

Volume 2

Airplane General, Emergency Equipment, Doors, Windows -200 & -300 Series (tab)

1.TOC.1-6	December 15, 2020
* 1.10.1	December 15, 2023
1.10.2	December 15, 2015
1.10.3	December 15, 2021
1.10.4	June 15, 2017
* 1.10.5	December 15, 2023
1.10.6	December 15, 2018
1.10.7	December 15, 2018
1.10.8	December 15, 2021
1.20.1	June 15, 2014
1.20.2	August 5, 1999
1.21.1	June 14, 2010
1.21.2	December 14, 2009
* 1.22.1	December 15, 2023
1.22.2	June 15, 2019
* 1.22.3	December 15, 2023
1.22.4	June 15, 2019
* 1.22.5	December 15, 2023

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

*	1.22.6	December 15, 2023	
	1.22.7	September 1, 2016	
	1.22.8	September 1, 2016	
*	1.22.9	December 15, 2023	
*	1.22.10	December 15, 2023	
	1.23.1	June 14, 2010	
	1.23.2	June 14, 2010	
	1.23.3	June 14, 2010	
	1.23.4	December 14, 2009	
	1.30.1	June 14, 2010	
	1.30.2	June 13, 2011	
*	1.30.3	December 15, 2023	
*	1.30.4	December 15, 2023	
*	1.30.5	December 15, 2023	
	1.30.6	June 15, 2014	
	1.30.7	December 15, 2021	
	1.30.8	June 15, 2017	
	1.30.9	December 15, 2021	
	1.30.10	September 1, 2016	
	1.30.11	June 15, 2014	
	1.30.12	December 15, 2021	
	1.30.13	December 15, 2012	
	1.30.14	September 1, 2016	
*	1.30.15	December 15, 2023	
	1.30.16	June 15, 2017	
*	1.30.17	December 15, 2023	
	1.30.18	December 15, 2016	
*	1.30.19	December 15, 2023	
	1.30.20	June 15, 2017	
	1.30.21	December 15, 2021	
	1.30.22	December 15, 2022	
	1.30.23	December 15, 2021	
	1.30.24	December 15, 2016	
	1.30.25	December 15, 2016	
	1.30.26	December 15, 2016	
	1.30.27	December 15, 2021	
	1.30.28	December 15, 2021	
	1.30.29	December 15, 2016	
*	1.30.30	December 15, 2023	
*	1.30.31	December 15, 2023	
*	1.30.32	December 15, 2023	
*	1.30.33	December 15, 2023	
	1.30.34	December 15, 2016	
	1.40.1	December 15, 2021	
	1.40.2	December 15, 2020	
	1.40.3	December 15, 2020	
*	1.40.4	December 15, 2023	
*	1.40.5	December 15, 2023	
	1.40.6	December 15, 2021	
	1.40.7	December 15, 2021	
	1.40.8	December 15, 2021	
*	1.40.9	December 15, 2023	
	1.40.10	December 15, 2020	
*	1.40.11	December 15, 2023	
*	1.40.12	December 15, 2023	
*	1.40.13	December 15, 2023	
	1.40.14	December 15, 2020	
	1.45.1	December 15, 2021	
*	1.45.2	December 15, 2023	
	1.45.3	June 15, 2019	
	1.45.4	December 15, 2021	
	1.45.5	June 15, 2017	
	1.45.6	June 15, 2017	
	1.45.7	December 15, 2021	
*	1.45.8	December 15, 2023	
	1.45.9	June 15, 2016	
	1.45.10	June 15, 2016	
	1.45.11	December 15, 2021	
	1.45.12	June 15, 2021	
	1.45.13	June 15, 2019	
	1.45.14	June 15, 2019	
	1.45.15	June 15, 2019	
	1.45.16	June 15, 2019	
*	1.46.1	December 15, 2023	
*	1.46.2	December 15, 2023	
	1.46.3	December 15, 2021	
	1.46.4	June 15, 2019	
	1.46.5	December 15, 2021	
	1.46.6	December 15, 2021	
	1.46.7	December 15, 2021	
	1.46.8	June 15, 2015	
*	1.46.9	December 15, 2023	
	1.46.10	June 15, 2015	
	1.46.11	June 15, 2015	
	1.46.12	June 15, 2015	
	1.46.13	June 15, 2019	
	1.46.14	June 15, 2015	
*	1.46.15	December 15, 2023	
*	1.46.16	December 15, 2023	
*	1.46.17	December 15, 2023	
	1.46.18	June 15, 2019	
*	1.46.19	December 15, 2023	
	1.46.20	June 15, 2016	
*	1.46.21	December 15, 2023	

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

	1.46.22	December 15, 2021
*	1.46.23	December 15, 2023
	1.46.24	December 15, 2017
	1.46.25	June 15, 2015
	1.46.26	June 15, 2015
*	1.46.27	December 15, 2023
	1.46.28	June 15, 2015
	1.47.1	June 15, 2017
	1.47.2	October 31, 2014
	1.47.3	June 15, 2015
	1.47.4	June 15, 2015
	1.47.5	December 15, 2013
	1.47.6	December 15, 2013
	1.47.7	December 15, 2013
	1.47.8	December 15, 2013
	1.47.9	December 15, 2013
	1.47.10	December 15, 2013
	1.47.11	June 15, 2015
	1.47.12	December 15, 2020
	1.47.13	December 15, 2022
	1.47.14	December 15, 2022
	1.47.15	December 15, 2022
	1.47.16	December 15, 2016
	1.47.17	December 15, 2016
	1.47.18	December 15, 2016
	1.47.19	December 15, 2016
	1.47.20	December 15, 2016
*	1.50.1	December 15, 2023
	1.50.2	December 15, 2021
	1.50.3	September 1, 2016
*	1.50.4	December 15, 2023
*	1.50.5	December 15, 2023
*	1.50.6	December 15, 2023
	1.50.7	December 15, 2021
*	1.50.8	December 15, 2023
*	1.50.9	December 15, 2023
	1.50.10	September 1, 2016
*	1.50.11	December 15, 2023
	1.50.12	June 15, 2017
*	1.50.13	December 15, 2023
	1.50.14	December 15, 2021
	1.50.15	June 15, 2020
	1.50.16	June 15, 2020
	1.50.17	June 15, 2021
	1.50.18	June 15, 2020
*	1.50.19	December 15, 2023
*	1.50.20	December 15, 2023
*	1.60.1	December 15, 2023
*	1.60.2	December 15, 2023
*	1.60.3	December 15, 2023
	1.60.4	June 15, 2016

Air Systems (tab)

*	2.TOC.1-2	December 15, 2023
	2.10.1	December 15, 2021
	2.10.2	December 15, 2021
	2.10.3	June 15, 2015
	2.10.4	June 15, 2017
	2.10.5	December 12, 2011
	2.10.6	June 15, 2017
	2.10.7	June 15, 2020
	2.10.8	December 15, 2021
	2.10.9	June 15, 2018
	2.10.10	June 15, 2021
	2.10.11	June 15, 2019
	2.10.12	June 15, 2019
	2.10.13	June 15, 2019
	2.10.14	December 15, 2021
	2.10.15	December 15, 2021
	2.10.16	June 15, 2017
	2.10.17	June 15, 2023
	2.10.18	December 15, 2012
*	2.20.1	December 15, 2023
	2.20.2	June 15, 2016
*	2.20.3	December 15, 2023
*	2.20.4	December 15, 2023
*	2.20.5	December 15, 2023
*	2.20.6	December 15, 2023
*	2.20.7	December 15, 2023
*	2.20.8	December 15, 2023
	2.20.9	December 15, 2021
	2.20.10	December 15, 2017
	2.20.11	December 15, 2021
	2.20.12	December 15, 2021
	2.20.13	December 15, 2017
	2.20.14	December 15, 2017
	2.30.1	June 15, 2019
	2.30.2	June 15, 2022
	2.30.3	June 15, 2020
	2.30.4	December 15, 2017
	2.40.1	June 15, 2019
	2.40.2	June 15, 2019
	2.40.3	June 15, 2020
	2.40.4	December 15, 2021

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

2.40.5	June 15, 2019
2.40.6	June 15, 2019
* 2.50.1	December 15, 2023
2.50.2	June 15, 2020
2.50.3	June 15, 2022
2.50.4	June 15, 2013

Anti-Ice, Rain (tab)

* 3.TOC.1-2	December 15, 2023
* 3.10.1	December 15, 2023
* 3.10.2	December 15, 2023
* 3.10.3	December 15, 2023
3.10.4	December 14, 2009
* 3.20.1	December 15, 2023
* 3.20.2	December 15, 2023
* 3.20.3	December 15, 2023
* 3.20.4	December 15, 2023
* 3.20.5	December 15, 2023
* 3.20.6	December 15, 2023
* 3.30.1	December 15, 2023
3.30.2	December 15, 2022

Automatic Flight (tab)

* 4.TOC.1-2	December 15, 2023
4.10.1	December 15, 2019
4.10.2	June 15, 2020
4.10.3	June 15, 2020
4.10.4	December 15, 2020
4.10.5	December 15, 2020
4.10.6	December 15, 2020
4.10.7	December 15, 2020
4.10.8	June 15, 2021
4.10.9	June 15, 2022
4.10.10	June 15, 2022
4.10.11	June 15, 2022
4.10.12	June 15, 2021
4.10.13	June 15, 2021
4.10.14	December 15, 2020
4.10.15	June 15, 2021
* 4.10.16	December 15, 2023
4.10.17	June 15, 2021
4.10.18	December 15, 2020
4.10.19	December 15, 2020
4.10.20	June 15, 2021
4.10.21	December 15, 2022
4.10.22	December 15, 2020
4.10.23	December 15, 2020
4.10.24	December 15, 2020
4.20.1	December 15, 2019
* 4.20.2	December 15, 2023
* 4.20.3	December 15, 2023
* 4.20.4	December 15, 2023
* 4.20.5	December 15, 2023
4.20.6	June 15, 2023
4.20.7	June 15, 2023
4.20.8	June 15, 2023
4.20.9	June 15, 2023
4.20.10	June 15, 2023
* 4.20.11	December 15, 2023
* 4.20.12	December 15, 2023
* 4.20.13	December 15, 2023
4.20.14	June 15, 2023
4.20.15	June 15, 2023
4.20.16	June 15, 2023
4.20.17	June 15, 2023
4.20.18	June 15, 2023
4.20.19	June 15, 2023
4.20.20	June 15, 2023
4.20.21	June 15, 2023
* 4.20.22	December 15, 2023
* 4.20.23	December 15, 2023
4.20.24	June 15, 2023
4.20.25	June 15, 2023
4.20.26	June 15, 2023
* 4.30.1	December 15, 2023
* 4.30.2	December 15, 2023

Communications -200 & -300 Series (tab)

5.TOC.1-6	June 15, 2023
5.10.1	December 15, 2021
5.10.2	December 15, 2021
5.10.3	December 13, 2010
* 5.10.4	December 15, 2023
5.10.5	June 15, 2021
5.10.6	June 15, 2021
5.10.7	June 15, 2020
5.10.8	June 15, 2020
5.10.9	June 15, 2023
5.10.10	June 15, 2023
5.10.11	June 15, 2023
5.10.12	June 15, 2023
5.10.13	June 15, 2023
5.10.14	June 15, 2023

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

5.10.15	June 15, 2023	* 5.40.10	December 15, 2023
5.10.16	June 15, 2020	5.40.11	October 31, 2014
5.10.17	June 15, 2020	5.40.12	August 20, 2013
5.10.18	June 15, 2020	* 5.40.13	December 15, 2023
5.10.19	June 15, 2020	* 5.40.14	December 15, 2023
* 5.10.20	December 15, 2023	* 5.40.15	December 15, 2023
* 5.10.21	December 15, 2023	5.40.16	December 15, 2015
* 5.10.22	December 15, 2023	5.40.17	October 31, 2014
5.10.23	June 15, 2021	5.40.18	June 15, 2015
* 5.10.24	December 15, 2023	5.40.19	September 1, 2016
5.10.25	December 15, 2021	5.40.20	September 1, 2016
5.10.26	June 15, 2020	5.40.21	September 1, 2016
5.20.1	December 15, 2021	* 5.40.22	December 15, 2023
* 5.20.2	December 15, 2023	* 5.40.23	December 15, 2023
* 5.20.3	December 15, 2023	* 5.40.24	December 15, 2023
* 5.20.4	December 15, 2023	* 5.40.25	December 15, 2023
5.20.5	December 15, 2020	5.40.26	June 15, 2019
* 5.20.6	December 15, 2023	* 5.40.27	December 15, 2023
* 5.20.7	December 15, 2023	* 5.40.28	December 15, 2023
* 5.20.8	December 15, 2023	5.40.29	June 15, 2019
5.20.9	October 31, 2014	5.40.30	October 31, 2014
5.20.10	June 15, 2015	5.40.31	June 15, 2019
5.20.11	June 15, 2019	* 5.40.32	December 15, 2023
5.20.12	September 1, 2016	* 5.40.33	December 15, 2023
5.20.13	June 15, 2015	5.40.34	October 31, 2014
5.20.14	September 1, 2016	* 5.40.35	December 15, 2023
5.20.15	December 15, 2020	* 5.40.36	December 15, 2023
5.20.16	December 15, 2020	* 5.40.37	December 15, 2023
5.30.1	December 15, 2021	* 5.40.38	December 15, 2023
5.30.2	December 15, 2021	* 5.40.39	December 15, 2023
5.30.3	December 15, 2021	5.40.40	October 31, 2014
5.30.4	September 1, 2016	* 5.40.41	December 15, 2023
5.30.5	June 15, 2014	* 5.40.42	December 15, 2023
5.30.6	June 15, 2014	5.40.43	June 15, 2019
5.30.7	June 15, 2019	* 5.40.44	December 15, 2023
5.30.8	December 15, 2012	* 5.40.45	December 15, 2023
5.30.9	June 15, 2017	* 5.40.46	December 15, 2023
5.30.10	June 15, 2017	* 5.40.47	December 15, 2023
5.40.1	June 14, 2010	5.40.48	June 15, 2019
5.40.2	December 7, 2001	* 5.40.49	December 15, 2023
* 5.40.3	December 15, 2023	* 5.40.50	December 15, 2023
5.40.4	June 15, 2015	* 5.40.51	December 15, 2023
5.40.5	June 15, 2015	* 5.40.52	December 15, 2023
5.40.6	December 15, 2012	* 5.40.53	December 15, 2023
5.40.7	December 15, 2012	* 5.40.54	December 15, 2023
5.40.8	December 15, 2012	* 5.40.55	December 15, 2023
5.40.9	August 20, 2013	* 5.40.56	December 15, 2023

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

* 5.40.57	December 15, 2023
* 5.40.58	December 15, 2023
5.40.59	June 15, 2016
5.40.60	June 15, 2016
* 5.40.61	December 15, 2023
* 5.40.62	December 15, 2023
5.40.63	September 1, 2016
5.40.64	September 1, 2016
5.40.65	September 1, 2016
5.40.66	December 15, 2016
* 5.40.67	December 15, 2023
* 5.40.68	December 15, 2023
5.40.69	December 15, 2016
* 5.40.70	December 15, 2023
5.40.71	June 15, 2016
5.40.72	June 15, 2016
5.40.73	June 15, 2016
5.40.74	June 15, 2016
* 5.40.75	December 15, 2023
* 5.40.76	December 15, 2023
* 5.40.77	December 15, 2023
* 5.40.78	December 15, 2023
5.40.79	September 1, 2016
5.40.80	September 1, 2016
* 5.40.81	December 15, 2023
* 5.40.82	December 15, 2023
5.40.83	June 15, 2022
* 5.40.84	December 15, 2023
* 5.40.85	December 15, 2023
* 5.40.86	December 15, 2023
* 5.40.87	December 15, 2023
* 5.40.88	December 15, 2023
* 5.40.89	December 15, 2023
* 5.40.90	December 15, 2023
5.40.91	September 1, 2016
5.40.92	September 1, 2016
5.50.1	June 15, 2017
5.50.2	December 15, 2021
5.50.3	June 15, 2017
5.50.4	June 15, 2017

Electrical (tab)

6.TOC.1-2	December 15, 2022
6.10.1	December 15, 2021
6.10.2	June 15, 2020
6.10.3	June 15, 2020
6.10.4	December 15, 2021
6.10.5	December 15, 2022
6.10.6	December 15, 2022
* 6.10.7	December 15, 2023
* 6.10.8	December 15, 2023
6.20.1	September 1, 2016
6.20.2	June 15, 2020
6.20.3	June 15, 2020
* 6.20.4	December 15, 2023
6.20.5	June 15, 2021
6.20.6	June 15, 2019
6.20.7	June 15, 2022
6.20.8	June 15, 2019
* 6.20.9	December 15, 2023
6.20.10	June 15, 2021
6.20.11	December 15, 2020
6.20.12	December 15, 2020
6.20.13	December 15, 2020
* 6.20.14	December 15, 2023
6.20.15	December 15, 2021
6.20.16	December 15, 2020
6.30.1	December 15, 2019
6.30.2	December 15, 2019

Engines, APU (tab)

7.TOC.1-4	June 15, 2019
* 7.10.1	December 15, 2023
* 7.10.2	December 15, 2023
7.10.3	June 15, 2019
* 7.10.4	December 15, 2023
* 7.10.5	December 15, 2023
* 7.10.6	December 15, 2023
7.10.7	June 15, 2019
7.10.8	December 15, 2019
* 7.10.9	December 15, 2023
* 7.10.10	December 15, 2023
* 7.10.11	December 15, 2023
* 7.10.12	December 15, 2023
7.10.13	December 15, 2016
* 7.10.14	December 15, 2023
* 7.10.15	December 15, 2023
7.10.16	June 15, 2019
7.10.17	December 15, 2016
* 7.10.18	December 15, 2023
* 7.10.19	December 15, 2023
* 7.10.20	December 15, 2023
7.10.21	December 15, 2019
* 7.10.22	December 15, 2023

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

* 7.10.23	December 15, 2023
7.10.24	September 1, 2016
7.10.25	December 15, 2016
7.10.26	September 1, 2016
* 7.20.1	December 15, 2023
* 7.20.2	December 15, 2023
* 7.20.3	December 15, 2023
* 7.20.4	December 15, 2023
* 7.20.5	December 15, 2023
* 7.20.6	December 15, 2023
7.20.7	December 15, 2019
* 7.20.8	December 15, 2023
* 7.20.9	December 15, 2023
7.20.10	June 15, 2021
7.20.11	December 15, 2019
* 7.20.12	December 15, 2023
7.20.13	December 15, 2019
* 7.20.14	December 15, 2023
7.20.15	June 15, 2020
* 7.20.16	December 15, 2023
* 7.20.17	December 15, 2023
7.20.18	June 15, 2019
* 7.20.19	December 15, 2023
* 7.20.20	December 15, 2023
* 7.20.21	December 15, 2023
7.20.22	June 15, 2023
7.20.23	June 15, 2019
7.20.24	December 15, 2022
7.30.1	December 15, 2019
7.30.2	December 15, 2015
7.30.3	June 15, 2020
7.30.4	June 26, 2000
7.40.1	December 15, 2022
* 7.40.2	December 15, 2023
* 7.40.3	December 15, 2023
7.40.4	December 15, 2013

Fire Protection (tab)

* 8.TOC.1-2	December 15, 2023
8.10.1	December 15, 2018
8.10.2	December 15, 2021
* 8.10.3	December 15, 2023
8.10.4	December 15, 2021
8.10.5	June 15, 2017
8.10.6	June 15, 2019
8.10.7	December 15, 2019
8.10.8	December 12, 2011
8.10.9	December 12, 2011
8.10.10	December 12, 2011
* 8.20.1	December 15, 2023
8.20.2	June 15, 2015
8.20.3	December 13, 2004
8.20.4	December 15, 2012
* 8.20.5	December 15, 2023
* 8.20.6	December 15, 2023
8.20.7	June 15, 2017
* 8.20.8	December 15, 2023
* 8.20.9	December 15, 2023
8.20.10	December 15, 2019
8.20.11	December 15, 2019
8.20.12	December 15, 2015
8.30.1	June 15, 2019
8.30.2	June 15, 2019
* 8.30.3	December 15, 2023
8.30.4	September 1, 2016

Flight Controls (tab)

9.TOC.1-4	June 15, 2022
9.10.1	August 5, 1999
9.10.2	June 15, 2021
9.10.3	June 15, 2021
9.10.4	June 15, 2021
9.10.5	June 15, 2021
9.10.6	June 15, 2021
9.10.7	June 15, 2021
9.10.8	June 15, 2021
9.10.9	June 15, 2021
9.10.10	June 15, 2021
* 9.10.11	December 15, 2023
9.10.12	June 15, 2021
9.10.13	June 15, 2021
9.10.14	June 15, 2021
9.10.15	June 15, 2021
9.10.16	June 15, 2021
9.10.17	June 15, 2021
9.10.18	June 15, 2021
9.10.19	June 15, 2021
9.10.20	June 15, 2021
9.20.1	June 15, 2021
9.20.2	June 15, 2023
9.20.3	June 15, 2021
9.20.4	June 15, 2021
9.20.5	June 15, 2021
9.20.6	June 15, 2021

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

	9.20.7	June 15, 2021
	9.20.8	June 15, 2022
	9.20.9	June 15, 2021
	9.20.10	June 15, 2022
	9.20.11	June 15, 2022
	9.20.12	June 15, 2022
	9.20.13	June 15, 2022
	9.20.14	June 15, 2022
	9.20.15	June 15, 2022
	9.20.16	June 15, 2022
	9.20.17	June 15, 2022
	9.20.18	June 15, 2022
	9.20.19	June 15, 2022
	9.20.20	June 15, 2022
	9.20.21	June 15, 2022
	9.20.22	June 15, 2022
*	9.20.23	December 15, 2023
*	9.20.24	December 15, 2023
	9.20.25	June 15, 2022
*	9.20.26	December 15, 2023
	9.20.27	June 15, 2022
	9.20.28	June 15, 2022
	9.30.1	December 15, 2012
	9.30.2	December 15, 2022

Flight Instruments, Displays -200 & -300 Series (tab)

*	10.TOC.1-6	December 15, 2023
	10.10.1	September 1, 2016
*	10.10.2	December 15, 2023
	10.10.3	September 1, 2016
*	10.10.4	December 15, 2023
	10.10.5	December 15, 2022
	10.10.6	December 15, 2022
	10.10.7	December 15, 2022
	10.10.8	December 15, 2022
	10.10.9	June 15, 2019
	10.10.10	June 15, 2021
	10.10.11	June 15, 2019
*	10.10.12	December 15, 2023
	10.10.13	June 15, 2017
	10.10.14	December 15, 2016
	10.10.15	June 15, 2017
	10.10.16	June 15, 2021
	10.10.17	December 15, 2016
	10.10.18	December 15, 2016
	10.10.19	December 15, 2016
	10.10.20	December 15, 2016
*	10.10.21	December 15, 2023
	10.10.22	June 15, 2019
*	10.10.23	December 15, 2023
	10.10.24	June 15, 2019
	10.10.25	June 15, 2019
*	10.10.26	December 15, 2023
	10.10.27	December 15, 2016
	10.10.28	December 15, 2016
	10.10.29	December 15, 2016
	10.10.30	December 15, 2016
	10.10.31	December 15, 2016
*	10.10.32	December 15, 2023
	10.10.33	December 15, 2016
	10.10.34	December 15, 2016
	10.10.35	June 15, 2020
	10.10.36	December 15, 2016
	10.10.37	December 15, 2016
	10.10.38	December 15, 2016
	10.10.39	December 15, 2017
*	10.10.40	December 15, 2023
*	10.10.41	December 15, 2023
*	10.10.42	December 15, 2023
	10.10.43	June 15, 2019
	10.10.44	December 15, 2017
	10.10.45	June 15, 2019
*	10.10.46	December 15, 2023
*	10.10.47	December 15, 2023
	10.10.48	June 15, 2021
	10.10.49	June 15, 2021
	10.10.50	June 15, 2021
	10.10.51	June 15, 2021
*	10.10.52	December 15, 2023
	10.10.53	June 15, 2021
	10.10.54	June 15, 2021
	10.10.55	June 15, 2021
	10.10.56	June 15, 2021
	10.10.57	June 15, 2021
	10.10.58	June 15, 2021
	10.10.59	June 15, 2021
	10.10.60	June 15, 2021
	10.10.61	June 15, 2021
	10.10.62	June 15, 2021
	10.10.63	June 15, 2021
	10.10.64	June 15, 2021
	10.20.1	June 15, 2019
*	10.20.2	December 15, 2023

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

* 10.20.3	December 15, 2023
10.20.4	June 15, 2015
10.20.5	December 15, 2012
10.20.6	June 13, 2005
10.20.7	August 5, 1999
10.20.8	August 5, 1999
10.20.9	August 5, 1999
* 10.20.10	December 15, 2023
10.20.11	June 14, 2010
* 10.20.12	December 15, 2023
* 10.20.13	December 15, 2023
10.20.14	June 15, 2019
10.20.15	December 15, 2017
10.20.16	September 1, 2016
* 10.30.1	December 15, 2023
* 10.30.2	December 15, 2023
10.30.3	December 15, 2017
10.30.4	December 15, 2017
10.30.5	December 15, 2017
* 10.30.6	December 15, 2023
10.30.7	December 15, 2021
* 10.30.8	December 15, 2023
10.30.9	December 15, 2021
* 10.30.10	December 15, 2023
10.30.11	December 15, 2021
* 10.30.12	December 15, 2023
10.30.13	December 15, 2021
* 10.30.14	December 15, 2023
10.30.15	December 15, 2021
* 10.30.16	December 15, 2023
10.30.17	December 15, 2021
10.30.18	December 15, 2016
10.40.1	September 1, 2016
10.40.2	September 1, 2016
* 10.40.3	December 15, 2023
* 10.40.4	December 15, 2023
10.40.5	June 15, 2019
* 10.40.6	December 15, 2023
10.40.7	June 15, 2019
* 10.40.8	December 15, 2023
10.40.9	June 15, 2019
10.40.10	June 15, 2019
10.40.11	September 1, 2016
10.40.12	September 1, 2016
10.40.13	September 1, 2016
10.40.14	September 1, 2016
10.40.15	September 1, 2016
10.40.16	December 15, 2018
* 10.40.17	December 15, 2023
* 10.40.18	December 15, 2023
10.40.19	December 15, 2018
10.40.20	December 15, 2018
10.40.21	June 15, 2019
10.40.22	December 15, 2016
10.40.23	September 1, 2016
* 10.40.24	December 15, 2023
* 10.40.25	December 15, 2023
* 10.40.26	December 15, 2023
10.40.27	December 15, 2016
10.40.28	September 1, 2016
10.50.1	June 15, 2015
10.50.2	June 15, 2015
10.50.3	June 15, 2014
10.50.4	June 15, 2014
10.50.5	June 15, 2014
10.50.6	June 15, 2015
10.50.7	June 15, 2015
10.50.8	December 15, 2013
10.50.9	June 15, 2014
10.50.10	June 15, 2015
10.50.11	June 15, 2015
10.50.12	December 15, 2013
10.50.13	December 15, 2013
10.50.14	June 15, 2015
10.50.15	June 15, 2015
10.50.16	September 1, 2016
10.60.1	June 15, 2014
10.60.2	June 15, 2014
10.60.3	June 15, 2014
10.60.4	June 15, 2014
10.60.5	June 15, 2014
10.60.6	June 15, 2014
10.60.7	June 15, 2014
* 10.60.8	December 15, 2023
10.60.9	June 15, 2014
* 10.60.10	December 15, 2023
10.60.11	June 15, 2022
10.60.12	June 15, 2022
10.60.13	June 15, 2022
10.60.14	June 15, 2022
10.65.1	June 15, 2019
10.65.2	December 14, 2009
10.65.3	December 11, 2006
10.65.4	December 15, 2016

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

	10.65.5	December 15, 2016
	10.65.6	December 15, 2016
	10.65.7	June 15, 2019
	10.65.8	June 15, 2018
	10.65.9	June 15, 2018
	10.65.10	June 15, 2018
	10.65.11	June 15, 2018
	10.65.12	June 15, 2018
	10.65.13	June 15, 2018
	10.65.14	June 15, 2018
	10.65.15	June 15, 2018
	10.65.16	June 15, 2023
	10.65.17	June 15, 2018
	10.65.18	June 15, 2018
	10.65.19	June 15, 2018
	10.65.20	June 15, 2019
	10.65.21	June 15, 2019
	10.65.22	June 15, 2018
	10.65.23	June 15, 2018
	10.65.24	June 15, 2018
	10.65.25	June 15, 2018
	10.65.26	June 15, 2018
	10.65.27	June 15, 2023
	10.65.28	June 15, 2018
	10.65.29	June 15, 2018
	10.65.30	June 15, 2018
	10.65.31	June 15, 2018
	10.65.32	June 15, 2018
	10.65.33	June 15, 2018
	10.65.34	June 15, 2018
	10.65.35	June 15, 2018
	10.65.36	June 15, 2018
	10.65.37	June 15, 2019
	10.65.38	June 15, 2018
	10.65.39	June 15, 2019
	10.65.40	June 15, 2018
	10.65.41	June 15, 2018
	10.65.42	June 15, 2018
	10.65.43	June 15, 2018
	10.65.44	June 15, 2018
	10.65.45	June 15, 2018
	10.65.46	June 15, 2018
	10.65.47	June 15, 2018
	10.65.48	June 15, 2018
	10.65.49	June 15, 2018
	10.65.50	June 15, 2018
	10.65.51	June 15, 2018
	10.65.52	June 15, 2018
	10.65.53	June 15, 2018
	10.65.54	June 15, 2018
*	10.70.1	December 15, 2023
	10.70.2	December 15, 2013

Flight Management, Navigation -200 & -300 Series (tab)

*	11.TOC.1-8	December 15, 2023
*	11.10.1	December 15, 2023
*	11.10.2	December 15, 2023
*	11.10.3	December 15, 2023
	11.10.4	June 15, 2009
	11.10.5	June 15, 2021
	11.10.6	December 15, 2022
	11.10.7	June 15, 2021
	11.10.8	June 15, 2021
	11.10.9	June 15, 2021
	11.10.10	June 15, 2021
	11.10.11	June 15, 2021
	11.10.12	June 15, 2021
	11.10.13	June 15, 2021
	11.10.14	June 15, 2021
*	11.10.15	December 15, 2023
	11.10.16	June 15, 2021
	11.10.17	June 15, 2021
	11.10.18	June 15, 2021
	11.10.19	June 15, 2021
	11.10.20	June 15, 2021
	11.20.1	June 15, 2021
	11.20.2	June 15, 2021
	11.20.3	June 15, 2021
	11.20.4	June 15, 2021
	11.20.5	June 15, 2021
	11.20.6	June 15, 2021
	11.20.7	June 15, 2021
	11.20.8	June 15, 2021
	11.20.9	June 15, 2021
	11.20.10	June 15, 2021
	11.20.11	June 15, 2021
	11.20.12	June 15, 2021
	11.20.13	June 15, 2021
*	11.20.14	December 15, 2023
	11.20.15	June 15, 2021
	11.20.16	June 15, 2021
	11.30.1	June 15, 2021
	11.30.2	June 15, 2021

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

	11.30.3	June 15, 2021
	11.30.4	June 15, 2021
	11.31.1	June 15, 2013
	11.31.2	June 15, 2013
	11.31.3	December 15, 2020
	11.31.4	June 15, 2021
	11.31.5	June 15, 2021
	11.31.6	June 15, 2021
	11.31.7	June 15, 2021
	11.31.8	June 15, 2021
	11.31.9	June 15, 2021
	11.31.10	June 15, 2021
	11.31.11	June 15, 2021
	11.31.12	June 15, 2021
	11.31.13	June 15, 2021
	11.31.14	June 15, 2021
	11.31.15	June 15, 2021
	11.31.16	June 15, 2021
	11.31.17	June 15, 2021
	11.31.18	June 15, 2021
	11.31.19	June 15, 2021
	11.31.20	June 15, 2021
	11.31.21	June 15, 2021
	11.31.22	June 15, 2021
	11.31.23	June 15, 2021
	11.31.24	June 15, 2021
	11.31.25	June 15, 2021
*	11.31.26	December 15, 2023
	11.31.27	June 15, 2021
	11.31.28	June 15, 2021
	11.31.29	June 15, 2021
	11.31.30	June 15, 2021
	11.31.31	June 15, 2021
	11.31.32	June 15, 2021
	11.31.33	June 15, 2021
	11.31.34	June 15, 2021
*	11.31.35	December 15, 2023
	11.31.36	June 15, 2021
	11.31.37	June 15, 2021
	11.31.38	June 15, 2021
	11.31.39	June 15, 2021
	11.31.40	June 15, 2021
	11.31.41	June 15, 2021
	11.31.42	June 15, 2021
	11.32.1	December 13, 2010
*	11.32.2	December 15, 2023
	11.32.3	June 15, 2021
	11.32.4	June 15, 2021
*	11.32.5	December 15, 2023
	11.32.6	June 15, 2021
	11.32.7	June 15, 2021
	11.32.8	June 15, 2021
	11.33.1	August 5, 1999
	11.33.2	August 5, 1999
	11.34.1	August 5, 1999
	11.34.2	June 15, 2021
	11.34.3	June 15, 2021
	11.34.4	June 15, 2021
	11.34.5	June 15, 2021
	11.34.6	June 15, 2021
	11.34.7	June 15, 2021
	11.34.8	June 15, 2021
	11.34.9	June 15, 2021
	11.34.10	June 15, 2021
	11.34.11	June 15, 2021
	11.34.12	June 15, 2021
	11.34.13	June 15, 2021
	11.34.14	June 15, 2021
	11.40.1	September 1, 2016
	11.40.2	June 15, 2021
	11.40.3	June 15, 2021
	11.40.4	December 15, 2021
	11.40.5	December 15, 2021
	11.40.6	December 15, 2021
*	11.40.7	December 15, 2023
*	11.40.8	December 15, 2023
*	11.40.9	December 15, 2023
*	11.40.10	December 15, 2023
	11.40.11	December 15, 2021
*	11.40.12	December 15, 2023
	11.40.13	December 15, 2021
	11.40.14	December 15, 2021
	11.40.15	December 15, 2021
	11.40.16	December 15, 2021
	11.40.17	December 15, 2021
	11.40.18	December 15, 2021
	11.40.19	December 15, 2021
	11.40.20	December 15, 2021
*	11.40.21	December 15, 2023
	11.40.22	December 15, 2021
	11.40.23	December 15, 2021
	11.40.24	December 15, 2021
	11.40.25	December 15, 2021
	11.40.26	December 15, 2021

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

	11.40.27	December 15, 2021
	11.40.28	December 15, 2021
	11.40.29	December 15, 2021
	11.40.30	December 15, 2021
	11.40.31	December 15, 2021
	11.40.32	December 15, 2021
	11.40.33	December 15, 2021
	11.40.34	December 15, 2021
	11.40.35	December 15, 2021
	11.40.36	December 15, 2021
	11.40.37	December 15, 2021
	11.40.38	December 15, 2021
	11.40.39	December 15, 2021
*	11.40.40	December 15, 2023
*	11.40.41	December 15, 2023
*	11.40.42	December 15, 2023
	11.40.43	December 15, 2021
*	11.40.44	December 15, 2023
	11.40.45	December 15, 2021
	11.40.46	December 15, 2021
*	11.40.47	December 15, 2023
	11.40.48	December 15, 2021
*	11.40.49	December 15, 2023
	11.40.50	December 15, 2021
	11.40.51	December 15, 2021
*	11.40.52	December 15, 2023
	11.40.53	December 15, 2021
	11.40.54	December 15, 2021
*	11.40.55	December 15, 2023
	11.40.56	December 15, 2021
	11.41.1	December 14, 2009
	11.41.2	December 15, 2013
	11.41.3	June 15, 2013
	11.41.4	June 15, 2013
	11.41.5	June 15, 2013
	11.41.6	December 15, 2012
	11.41.7	December 15, 2013
	11.41.8	December 15, 2012
	11.41.9	December 15, 2013
*	11.41.10	December 15, 2023
	11.41.11	June 15, 2019
	11.41.12	June 15, 2013
	11.41.13	June 15, 2013
	11.41.14	June 15, 2013
	11.41.15	June 15, 2013
	11.41.16	June 15, 2013
	11.42.1	December 15, 2012
	11.42.2	June 15, 2021
	11.42.3	June 15, 2021
	11.42.4	June 15, 2021
	11.42.5	June 15, 2021
	11.42.6	June 15, 2021
	11.42.7	June 15, 2021
	11.42.8	June 15, 2021
	11.42.9	June 15, 2021
	11.42.10	June 15, 2021
	11.42.11	June 15, 2021
	11.42.12	June 15, 2021
	11.42.13	June 15, 2021
	11.42.14	June 15, 2021
	11.42.15	June 15, 2021
	11.42.16	June 15, 2021
	11.42.17	June 15, 2021
	11.42.18	June 15, 2021
*	11.42.19	December 15, 2023
	11.42.20	June 15, 2021
*	11.42.21	December 15, 2023
	11.42.22	June 15, 2021
	11.42.23	June 15, 2023
	11.42.24	June 15, 2023
	11.42.25	June 15, 2023
	11.42.26	June 15, 2021
*	11.42.27	December 15, 2023
	11.42.28	June 15, 2021
*	11.42.29	December 15, 2023
	11.42.30	June 15, 2021
	11.42.31	June 15, 2021
	11.42.32	June 15, 2021
	11.42.33	June 15, 2021
	11.42.34	June 15, 2021
	11.42.35	June 15, 2021
	11.42.36	June 15, 2021
	11.42.37	June 15, 2021
*	11.42.38	December 15, 2023
	11.42.39	June 15, 2021
	11.42.40	June 15, 2021
	11.42.41	June 15, 2021
	11.42.42	June 15, 2021
	11.42.43	June 15, 2021
	11.42.44	June 15, 2021
	11.42.45	June 15, 2021
	11.42.46	June 15, 2021
	11.42.47	June 15, 2021
	11.42.48	June 15, 2021

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

	11.42.49	June 15, 2021
	11.42.50	June 15, 2021
	11.42.51	June 15, 2021
	11.42.52	June 15, 2021
	11.42.53	June 15, 2021
	11.42.54	June 15, 2021
	11.42.55	June 15, 2021
*	11.42.56	December 15, 2023
	11.42.57	June 15, 2021
	11.42.58	June 15, 2021
	11.42.59	June 15, 2021
	11.42.60	June 15, 2021
*	11.42.61	December 15, 2023
	11.42.62	June 15, 2021
	11.42.63	June 15, 2021
	11.42.64	June 15, 2021
	11.42.65	June 15, 2021
	11.42.66	June 15, 2021
	11.43.1	June 15, 2021
	11.43.2	June 15, 2021
	11.43.3	June 15, 2021
	11.43.4	June 15, 2021
	11.43.5	June 15, 2021
	11.43.6	June 15, 2021
*	11.43.7	December 15, 2023
	11.43.8	June 15, 2021
	11.43.9	June 15, 2021
	11.43.10	June 15, 2021
	11.43.11	June 15, 2021
	11.43.12	June 15, 2021
	11.43.13	June 15, 2021
	11.43.14	June 15, 2021
	11.43.15	June 15, 2021
	11.43.16	June 15, 2021
	11.43.17	June 15, 2021
	11.43.18	June 15, 2021
	11.43.19	June 15, 2021
	11.43.20	June 15, 2021
	11.43.21	June 15, 2021
	11.43.22	June 15, 2021
	11.43.23	June 15, 2021
	11.43.24	June 15, 2021
	11.43.25	June 15, 2021
	11.43.26	June 15, 2021
	11.43.27	June 15, 2021
	11.43.28	June 15, 2021
	11.43.29	June 15, 2021
	11.43.30	June 15, 2021
	11.43.31	June 15, 2021
	11.43.32	June 15, 2021
	11.43.33	June 15, 2021
	11.43.34	June 15, 2021
	11.43.35	June 15, 2021
	11.43.36	June 15, 2021
	11.43.37	June 15, 2021
	11.43.38	June 15, 2021
	11.43.39	June 15, 2021
	11.43.40	June 15, 2021
	11.50.1	June 15, 2021
	11.50.2	June 15, 2021
	11.50.3	June 15, 2021
	11.50.4	June 15, 2021
	11.50.5	June 15, 2021
	11.50.6	June 15, 2021
	11.50.7	June 15, 2021
	11.50.8	June 15, 2021
*	11.60.1	December 15, 2023
*	11.60.2	December 15, 2023
	11.60.3	June 15, 2021
*	11.60.4	December 15, 2023
*	11.60.5	December 15, 2023
	11.60.6	June 15, 2021
*	11.60.7	December 15, 2023
	11.60.8	June 15, 2021
	11.60.9	December 15, 2021
*	11.60.10	December 15, 2023
*	11.60.11	December 15, 2023
*	11.60.12	December 15, 2023
	11.60.13	June 15, 2021
	11.60.14	June 15, 2021

Fuel (tab)

	12.TOC.1-2	June 15, 2019
	12.10.1	December 15, 2013
	12.10.2	December 15, 2013
	12.10.3	June 15, 2018
	12.10.4	June 15, 2020
	12.10.5	June 15, 2021
	12.10.6	December 15, 2018
	12.10.7	June 15, 2019
	12.10.8	June 15, 2019
	12.10.9	December 15, 2018
	12.10.10	June 15, 2018
*	12.20.1	December 15, 2023

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

12.20.2	June 15, 2020
* 12.20.3	December 15, 2023
* 12.20.4	December 15, 2023
12.20.5	June 15, 2019
12.20.6	June 15, 2019
* 12.20.7	December 15, 2023
12.20.8	June 15, 2019
12.30.1	September 1, 2016
* 12.30.2	December 15, 2023

Hydraulics (tab)

13.TOC.1-2	June 15, 2020
13.10.1	June 14, 2010
13.10.2	December 15, 2020
13.10.3	June 15, 2019
13.10.4	December 15, 2019
13.10.5	December 15, 2019
13.10.6	June 15, 2020
13.20.1	August 5, 1999
13.20.2	December 15, 2021
13.20.3	December 15, 2021
13.20.4	June 15, 2020
13.30.1	June 15, 2019
13.30.2	June 15, 2019

Landing Gear (tab)

14.TOC.1-2	June 15, 2020
14.10.1	December 15, 2016
14.10.2	June 15, 2020
14.10.3	September 1, 2016
14.10.4	December 15, 2018
14.10.5	June 15, 2020
14.10.6	December 15, 2020
14.10.7	September 1, 2016
14.10.8	September 1, 2016
14.20.1	June 15, 2019
14.20.2	June 15, 2020
14.20.3	June 15, 2023
14.20.4	December 15, 2021
14.20.5	December 15, 2012
* 14.20.6	December 15, 2023
14.20.7	September 1, 2016
14.20.8	December 13, 2010
14.20.9	December 15, 2021
14.20.10	December 13, 2010
14.30.1	December 15, 2012
14.30.2	December 15, 2021

Warning Systems (tab)

* 15.TOC.1-4	December 15, 2023
15.10.1	June 15, 2020
15.10.2	June 15, 2020
15.10.3	June 15, 2020
15.10.4	June 15, 2023
* 15.10.5	December 15, 2023
15.10.6	June 15, 2023
15.10.7	June 15, 2023
15.10.8	June 15, 2023
* 15.10.9	December 15, 2023
* 15.10.10	December 15, 2023
* 15.10.11	December 15, 2023
* 15.10.12	December 15, 2023
* 15.10.13	December 15, 2023
* 15.10.14	December 15, 2023
* 15.10.15	December 15, 2023
* 15.10.16	December 15, 2023
* 15.10.17	December 15, 2023
* 15.10.18	December 15, 2023
15.10.19	June 15, 2023
15.10.20	June 15, 2023
15.20.1	June 15, 2019
15.20.2	June 15, 2018
15.20.3	June 15, 2018
15.20.4	June 15, 2019
15.20.5	June 15, 2019
15.20.6	June 15, 2019
15.20.7	June 15, 2018
15.20.8	June 15, 2018
* 15.20.9	December 15, 2023
15.20.10	June 15, 2018
15.20.11	June 15, 2018
15.20.12	June 15, 2019
15.20.13	June 15, 2021
15.20.14	June 15, 2019
15.20.15	December 15, 2019
15.20.16	June 15, 2020
15.20.17	June 15, 2018
15.20.18	June 15, 2018
15.20.19	June 15, 2018
15.20.20	June 15, 2021
* 15.20.21	December 15, 2023
15.20.22	December 15, 2019
15.20.23	June 15, 2018
* 15.20.24	December 15, 2023

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

15.20.25	June 15, 2018	
15.20.26	June 15, 2022	
15.20.27	June 15, 2021	
15.20.28	June 15, 2018	
15.20.29	June 15, 2019	
* 15.20.30	December 15, 2023	
15.20.31	June 15, 2018	
15.20.32	June 15, 2018	
15.20.33	June 15, 2018	
15.20.34	June 15, 2018	
* 15.20.35	December 15, 2023	
15.20.36	June 15, 2018	
15.20.37	December 15, 2021	
15.20.38	June 15, 2018	
15.20.39	June 15, 2018	
15.20.40	December 15, 2021	
15.20.41	June 15, 2023	
15.20.42	June 15, 2018	
15.30.1	December 15, 2021	
15.30.2	December 15, 2018	
15.30.3	December 15, 2018	
15.30.4	December 13, 2010	
(blank tab)		

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

Intentionally
Blank

* = Revised, Added, or Deleted

Boeing Proprietary. Copyright © Boeing. ECCN:9E991. See title page for details.

777-200ER PW4090 LB FT FAA TO1-10 TO2-20 TALPA - PD.10.1

777-300 PW4090 LB FT FAA TO1-10 TO2-20 TALPA - PD.20.1

777-300ER GE90-115BL LB C FT FAA TO1-10 TO2-20 HIGH_ALT TALPA - PD.30.1

777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA - PD.40.1

777F GE90-110B1L LB FT FAA TO1-10 TO2-20 CREW3 TALPA HIGH_ALT - PD.50.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777-200ER PW4090 LB FT FAA TO1-10 TO2-20 TALPA

Pkg Model Identification PD.ModID.10.1

Takeoff. PD.10.1

Takeoff Field Corrections PD.10.1
Takeoff Field & Climb Limit Weights PD.10.2
Takeoff Obstacle Limit Weight. PD.10.5
Brake Energy Limits VMBE PD.10.7
Takeoff Speeds PD.10.8

Enroute PD.11.1

Long Range Cruise Maximum Operating Altitude. PD.11.1
Long Range Cruise Trip Fuel and Time PD.11.3
Long Range Cruise Step Climb Trip Fuel and Time PD.11.5
Short Trip Fuel and Time PD.11.6
Holding Planning PD.11.7
Crew Oxygen Requirements. PD.11.8
Net Level Off Weight PD.11.9

Landing PD.12.1

Landing Field Limit Weight - Dry Runway PD.12.1
Approach or Landing Climb Limited Weight. PD.12.2
Go-Around Climb Gradient PD.12.3
Quick Turnaround Limit Weight. PD.12.4

Gear Down. PD.13.1

Takeoff Climb Limit Weight. PD.13.1
Approach or Landing Climb Limited Weight. PD.13.2
Takeoff Obstacle Limit Weight. PD.13.3
Long Range Cruise Altitude Capability PD.13.5
Long Range Cruise Trip Fuel and Time PD.13.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding Planning PD.13.8
Net Level Off Weight PD.13.9

Text. PD.14.1

Introduction. PD.14.1
Takeoff PD.14.1
Enroute PD.14.4
Landing PD.14.6
Gear Down PD.14.7

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
101	HL7574	28444	WB134
102	HL7575	28445	WB135
103	HL7598	27949	WB136
107	HL7733	34206	WB140
108	HL7734	34207	WB141
109	HL7743	34208	WB142
110	HL7750	34209	WB143
111	HL7751	34210	WB144
112	HL7752	34211	WB145

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airplane Number	Registry Number	Serial Number	Tabulation Number
113	HL7764	34214	WB146
114	HL7765	34212	WB147
115	HL7766	34213	WB148

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field Corrections

Slope Adjustments

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4360	4320	4280	4240	4200	4170	4130	4100	4060
4600	4800	4750	4700	4650	4600	4540	4490	4430	4370
5000	5240	5180	5120	5060	5000	4920	4840	4760	4680
5400	5680	5610	5540	5470	5400	5300	5190	5090	4980
5800	6120	6040	5960	5880	5800	5670	5540	5420	5290
6200	6560	6470	6380	6290	6200	6050	5900	5750	5600
6600	7000	6900	6800	6700	6600	6430	6250	6080	5900
7000	7440	7330	7220	7110	7000	6800	6600	6410	6210
7400	7880	7760	7640	7520	7400	7180	6960	6740	6510
7800	8320	8190	8060	7930	7800	7560	7310	7070	6820
8200	8760	8620	8480	8340	8200	7930	7660	7400	7130
8600	9200	9050	8900	8750	8600	8310	8020	7730	7430
9000	9640	9480	9320	9160	9000	8690	8370	8060	7740
9400	10080	9910	9740	9570	9400	9060	8720	8380	8050
9800	10520	10340	10160	9980	9800	9440	9080	8710	8350
10200	10960	10770	10580	10390	10200	9810	9430	9040	8660
10600	11400	11200	11000	10800	10600	10190	9780	9370	8970
11000	11840	11630	11420	11210	11000	10570	10140	9700	9270
11400	12280	12060	11840	11620	11400	10940	10490	10030	9580
11800	12720	12490	12260	12030	11800	11320	10840	10360	9880

Wind Adjustments

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	2870	3320	3760	4200	4480	4770	5070	5380
4600	3210	3680	4140	4600	4890	5200	5510	5840
5000	3550	4040	4520	5000	5310	5620	5950	6290
5400	3900	4400	4900	5400	5720	6050	6390	6740
5800	4240	4760	5280	5800	6130	6470	6820	7190
6200	4580	5120	5660	6200	6540	6900	7260	7640
6600	4920	5480	6040	6600	6960	7320	7700	8090
7000	5260	5840	6420	7000	7370	7750	8140	8540
7400	5600	6200	6800	7400	7780	8180	8580	8990
7800	5940	6560	7180	7800	8200	8600	9020	9440
8200	6280	6920	7560	8200	8610	9030	9450	9890
8600	6620	7280	7940	8600	9020	9450	9890	10340
9000	6960	7640	8320	9000	9440	9880	10330	10790
9400	7300	8000	8700	9400	9850	10300	10770	11240
9800	7640	8360	9080	9800	10260	10730	11210	11690
10200	7980	8720	9460	10200	10670	11160	11640	12140
10600	8330	9080	9840	10600	11090	11580	12080	12590
11000	8670	9440	10220	11000	11500	12010	12520	13040
11400	9010	9800	10600	11400	11910	12430	12960	13490
11800	9350	10170	10980	11800	12330	12860	13400	13940

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT										
°C	-40	14	18	22	24	26	28	30	42	46	50
°F	-40	57	64	72	75	79	82	86	108	115	122
4600	474.3	430.5	427.7	425.0	423.7	422.3	421.0	419.7	389.6	377.5	364.2
5000	500.1	454.5	451.7	448.8	447.4	446.0	444.7	443.3	412.1	399.5	385.6
5400	520.3	473.5	470.5	467.6	466.1	464.7	463.3	461.9	429.7	416.8	402.5
5800	539.8	491.6	488.6	485.6	484.1	482.6	481.1	479.7	446.7	433.4	418.7
6200	558.3	508.9	505.8	502.7	501.2	499.7	498.2	496.7	462.8	449.2	434.2
6600	576.0	525.5	522.3	519.1	517.6	516.0	514.5	513.0	478.3	464.3	448.9
7000	593.2	541.5	538.2	535.0	533.4	531.8	530.2	528.7	493.2	478.9	463.2
7400	609.6	556.8	553.5	550.2	548.5	546.9	545.3	543.8	507.5	493.0	476.9
7800	625.6	571.7	568.3	564.9	563.3	561.6	560.0	558.4	521.4	506.6	490.2
8200	641.5	586.6	583.1	579.7	578.0	576.3	574.6	573.0	535.3	520.1	503.4
8600	656.8	600.8	597.3	593.8	592.1	590.4	588.7	587.0	548.6	533.1	516.1
9000	670.9	613.9	610.3	606.7	605.0	603.2	601.5	599.8	560.7	545.0	527.6
9400	684.1	626.1	622.4	618.8	617.0	615.3	613.5	611.8	571.9	555.9	538.3
9800	697.0	638.0	634.2	630.5	628.7	626.9	625.2	623.4	582.9	566.6	548.7
10200	699.9	649.2	645.4	641.7	639.8	638.0	636.2	634.4	593.3	576.8	558.6
10600	699.9	660.0	656.1	652.3	650.5	648.6	646.8	645.0	603.3	586.6	568.1
11000	699.9	670.5	666.6	662.7	660.9	659.0	657.1	655.3	613.1	596.2	577.5
11400	699.9	680.8	676.8	672.9	671.0	669.1	667.2	665.4	622.7	605.5	586.6
CLIMB LIMIT WT (1000 LB)	634.1	632.6	632.4	632.3	632.2	632.1	632.0	631.9	565.9	538.9	509.0

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT										
°C	-40	14	18	22	24	26	28	30	42	46	50
°F	-40	57	64	72	75	79	82	86	108	115	122
4600	445.1	403.7	401.1	398.5	397.3	394.9	392.4	389.5	361.5	349.7	337.0
5000	469.7	426.7	424.0	421.3	420.0	417.5	414.9	412.0	382.8	370.6	357.4
5400	489.1	444.8	442.0	439.3	437.9	435.4	432.7	429.6	399.6	387.0	373.4
5800	507.7	462.2	459.3	456.5	455.1	452.5	449.7	446.6	415.8	402.8	388.8
6200	525.4	478.7	475.8	472.9	471.4	468.8	465.9	462.7	431.1	417.8	403.5
6600	542.3	494.6	491.6	488.6	487.1	484.4	481.5	478.2	445.8	432.2	417.6
7000	558.7	509.9	506.8	503.7	502.2	499.4	496.5	493.1	460.0	446.1	431.1
7400	574.4	524.6	521.4	518.3	516.7	513.9	510.9	507.4	473.6	459.4	444.1
7800	589.7	538.8	535.6	532.4	530.8	527.9	524.8	521.3	486.8	472.4	456.7
8200	604.9	553.0	549.7	546.5	544.9	541.9	538.8	535.2	500.0	485.3	469.4
8600	619.5	566.6	563.3	560.0	558.4	555.3	552.1	548.5	512.7	497.6	481.4
9000	632.9	579.1	575.7	572.3	570.7	567.6	564.3	560.6	524.1	508.8	492.3
9400	645.4	590.7	587.2	583.8	582.1	578.9	575.6	571.8	534.7	519.1	502.3
9800	657.6	601.9	598.4	594.9	593.2	590.0	586.6	582.8	545.0	529.1	512.0
10200	669.2	612.6	609.0	605.5	603.8	600.5	597.1	593.2	554.9	538.8	521.4
10600	680.2	622.9	619.3	615.7	613.9	610.6	607.2	603.2	564.4	548.1	530.5
11000	691.0	632.9	629.3	625.6	623.9	620.5	617.0	613.0	573.7	557.1	539.3
11400	699.9	642.8	639.0	635.4	633.6	630.2	626.6	622.6	582.8	566.0	548.0
CLIMB LIMIT WT (1000 LB)	597.9	596.6	596.4	596.2	595.9	593.4	588.2	582.9	524.1	497.8	470.3

With engine bleed for packs off, increase field limit weight by 1400 lb and climb limit weight by 4410 lb.
With engine anti-ice on, decrease field limit weight by 500 lb and climb limit weight by 500 lb.
With engine and wing anti-ice on, decrease field limit weight by 2300 lb and climb limit weight by 4250 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT										
°C	-40	14	18	22	24	26	28	30	42	46	50
°F	-40	57	64	72	75	79	82	86	108	115	122
4600	416.2	377.1	374.0	369.9	367.8	365.7	363.5	360.8	334.4	323.1	312.3
5000	439.6	399.1	395.9	391.6	389.4	387.2	384.9	382.1	354.7	343.0	331.7
5400	458.1	416.4	413.1	408.6	406.4	404.1	401.8	398.9	370.7	358.6	347.0
5800	475.8	433.0	429.6	425.0	422.7	420.4	418.0	415.0	386.0	373.6	361.7
6200	492.7	448.8	445.3	440.6	438.3	435.8	433.4	430.4	400.6	387.9	375.7
6600	508.9	463.9	460.3	455.5	453.2	450.7	448.1	445.0	414.6	401.6	389.1
7000	524.5	478.5	474.8	469.9	467.5	465.0	462.4	459.2	428.1	414.8	402.0
7400	539.5	492.5	488.8	483.8	481.3	478.7	476.1	472.8	441.0	427.4	414.4
7800	554.1	506.1	502.3	497.2	494.7	492.0	489.3	486.0	453.6	439.7	426.4
8200	568.6	519.7	515.8	510.6	508.0	505.3	502.6	499.2	466.1	452.0	438.4
8600	582.5	532.7	528.7	523.4	520.8	518.0	515.2	511.8	478.1	463.7	449.9
9000	595.2	544.5	540.5	535.1	532.4	529.6	526.7	523.3	488.9	474.3	460.2
9400	607.1	555.4	551.3	545.8	543.1	540.3	537.4	533.8	498.9	483.9	469.6
9800	618.6	566.1	561.9	556.4	553.6	550.7	547.7	544.1	508.6	493.4	478.8
10200	629.6	576.3	572.1	566.4	563.6	560.6	557.6	554.0	517.9	502.5	487.7
10600	640.1	586.1	581.8	576.0	573.2	570.2	567.2	563.4	526.9	511.3	496.3
11000	650.3	595.6	591.3	585.5	582.6	579.6	576.5	572.7	535.7	519.9	504.7
11400	660.4	605.0	600.6	594.7	591.8	588.7	585.6	581.8	544.3	528.3	512.9
CLIMB LIMIT WT (1000 LB)	561.3	560.1	558.1	553.0	550.5	547.5	544.5	539.9	484.1	459.9	438.9

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT										
°C	-40	14	18	22	24	26	28	30	42	46	50
°F	-40	57	64	72	75	79	82	86	108	115	122
4600	387.4	349.9	345.9	342.0	340.1	338.2	336.3	333.7	307.7	298.0	288.1
5000	409.8	370.8	366.7	362.7	360.7	358.7	356.7	354.0	327.1	316.9	306.7
5400	427.4	387.3	383.0	378.9	376.8	374.8	372.7	370.0	342.2	331.8	321.2
5800	444.3	403.1	398.7	394.4	392.3	390.2	388.1	385.3	356.8	346.0	335.2
6200	460.4	418.1	413.6	409.2	407.1	404.9	402.7	399.8	370.6	359.6	348.5
6600	475.8	432.5	427.9	423.4	421.2	419.0	416.8	413.8	383.9	372.6	361.2
7000	490.7	446.4	441.7	437.1	434.8	432.6	430.3	427.3	396.7	385.1	373.5
7400	504.9	459.7	454.9	450.3	447.9	445.6	443.3	440.2	408.9	397.2	385.3
7800	518.8	472.7	467.8	463.0	460.6	458.3	455.9	452.7	420.8	408.8	396.7
8200	532.6	485.6	480.6	475.7	473.3	470.9	468.5	465.3	432.8	420.5	408.1
8600	545.8	497.9	492.9	487.9	485.4	483.0	480.5	477.2	444.1	431.6	419.0
9000	557.9	509.1	503.9	498.9	496.4	493.9	491.4	488.0	454.3	441.6	428.7
9400	569.1	519.4	514.2	509.0	506.5	503.9	501.4	497.9	463.6	450.7	437.6
9800	580.0	529.5	524.1	518.9	516.3	513.7	511.1	507.6	472.7	459.6	446.3
10200	590.4	539.1	533.7	528.4	525.7	523.1	520.5	516.9	481.5	468.2	454.7
10600	600.3	548.4	542.9	537.5	534.8	532.2	529.5	525.9	490.0	476.5	462.8
11000	610.1	557.5	551.9	546.5	543.8	541.1	538.4	534.7	498.4	484.7	470.8
11400	619.6	566.4	560.7	555.2	552.5	549.8	547.0	543.4	506.5	492.7	478.6
CLIMB LIMIT WT (1000 LB)	524.2	520.3	515.4	510.7	508.4	505.9	503.4	498.9	447.1	429.1	411.1

With engine bleed for packs off, increase field limit weight by 1400 lb and climb limit weight by 4410 lb.
With engine anti-ice on, decrease field limit weight by 500 lb and climb limit weight by 500 lb.
With engine and wing anti-ice on, decrease field limit weight by 2300 lb and climb limit weight by 4250 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT										
	°C	-40	14	18	22	24	26	28	30	42	46	50
	°F	-40	57	64	72	75	79	82	86	108	115	122
4600	359.4	322.4	318.6	314.8	312.8	310.7	308.5	306.2	282.8	274.3	264.9
5000	380.7	342.3	338.4	334.4	332.3	330.1	327.8	325.4	301.2	292.4	282.6
5400	397.4	357.9	353.9	349.7	347.6	345.3	343.0	340.5	315.6	306.5	296.5
5800	413.5	372.8	368.7	364.5	362.3	360.0	357.6	355.0	329.4	320.1	309.7
6200	428.7	387.1	382.9	378.5	376.3	373.9	371.4	368.8	342.5	333.0	322.4
6600	443.4	400.7	396.4	392.0	389.7	387.2	384.7	382.0	355.1	345.3	334.5
7000	457.5	413.9	409.5	405.0	402.6	400.1	397.5	394.8	367.3	357.3	346.1
7400	471.1	426.6	422.1	417.4	415.0	412.5	409.8	407.0	378.9	368.7	357.4
7800	484.3	438.8	434.2	429.5	427.1	424.4	421.8	418.9	390.2	379.8	368.2
8200	497.4	451.1	446.4	441.6	439.1	436.4	433.7	430.8	401.5	390.9	379.1
8600	510.0	462.8	458.0	453.1	450.6	447.8	445.1	442.1	412.3	401.5	389.5
9000	521.4	473.3	468.5	463.4	460.9	458.1	455.3	452.2	421.9	410.9	398.6
9400	531.9	483.0	478.0	472.9	470.3	467.5	464.6	461.5	430.6	419.4	406.9
9800	542.2	492.4	487.4	482.2	479.6	476.7	473.7	470.6	439.2	427.8	415.1
10200	552.0	501.5	496.4	491.1	488.4	485.5	482.5	479.3	447.5	435.9	423.0
10600	561.5	510.3	505.1	499.8	497.1	494.1	491.1	487.8	455.5	443.8	430.8
11000	570.7	518.9	513.6	508.2	505.5	502.5	499.4	496.1	463.4	451.5	438.4
11400	579.8	527.3	522.0	516.5	513.7	510.7	507.6	504.3	471.2	459.1	445.8
CLIMB LIMIT WT (1000 LB)	487.0	478.1	473.8	469.5	467.3	464.3	461.1	457.7	416.8	401.8	384.4

With engine bleed for packs off, increase field limit weight by 1400 lb and climb limit weight by 4410 lb.
With engine anti-ice on, decrease field limit weight by 500 lb and climb limit weight by 500 lb.
With engine and wing anti-ice on, decrease field limit weight by 2300 lb and climb limit weight by 4250 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Based on engine bleed for packs on, engine anti-ice off, wing anti-ice off or auto

Sea Level, 30°C & Below, Zero Wind

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	554.4	613.8	651.1	676.8					
50	517.1	568.7	609.5	638.6	657.8	672.4			
100	483.3	531.4	569.5	601.6	626.2	642.9	655.7	665.8	673.8
150	455.8	502.9	541.8	572.9	598.0	618.1	633.6	644.9	654.4
200	432.2	480.5	519.1	550.0	574.9	595.5	612.5	626.3	637.1
250	414.3	461.2	499.6	530.4	555.6	576.1	593.6	608.3	620.6
300	398.5	443.8	482.4	513.1	538.4	559.4	576.9	592.0	605.1
350	383.2	428.3	466.9	497.6	523.0	544.3	562.2	577.4	590.7
400	369.3	415.7	452.4	483.5	509.0	530.4	548.7	564.3	577.7
450	356.6	404.3	439.1	470.4	496.0	517.7	536.2	552.1	565.8
500	345.0	392.4	426.9	458.0	484.0	505.8	524.5	540.7	554.7
550		381.3	416.6	446.5	472.7	494.7	513.5	529.9	544.3
600		370.8	407.4	435.8	462.0	484.2	503.2	519.8	534.3
650		361.0	397.7	425.7	451.8	474.2	493.4	510.2	524.9
700		351.8	388.6	417.0	442.2	464.8	484.1	501.0	515.9
750		343.0	379.7	409.1	433.2	455.7	475.3	492.3	507.4
800			371.4	401.1	424.6	447.1	466.8	484.0	499.2
850			363.4	393.3	417.1	438.9	458.6	476.0	491.3
900			355.7	385.7	410.1	431.0	450.8	468.3	483.7
950			348.4	378.4	403.2	423.5	443.3	460.8	476.4
1000			341.4	371.4	396.4	416.9	436.1	453.6	469.4

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)							
	400	440	480	520	560	600	640	680
30 & BELOW	0	0	0	0	0	0	0	0
32	-6.3	-7.0	-7.7	-8.4	-9.1	-9.8	-10.5	-11.1
34	-12.5	-13.9	-15.3	-16.7	-18.1	-19.5	-20.9	-22.3
36	-18.8	-20.9	-23.0	-25.1	-27.2	-29.3	-31.4	-33.4
38	-25.1	-27.9	-30.7	-33.5	-36.2	-39.0	-41.8	-44.6
40	-31.4	-34.9	-38.3	-41.8	-45.3	-48.8	-52.3	-55.7
42	-40.0	-44.5	-48.9	-53.4	-57.9	-62.4	-66.8	-71.3
44	-48.6	-54.1	-59.5	-65.0	-70.5	-76.0	-81.4	-86.9
46	-57.2	-63.7	-70.1	-76.6	-83.1	-89.5	-96.0	-102.5
48	-65.8	-73.3	-80.7	-88.2	-95.7	-103.1	-110.6	-118.1
50	-74.4	-82.9	-91.3	-99.8	-108.3	-116.7	-125.2	-133.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Based on engine bleed for packs on, engine anti-ice off, wing anti-ice off or auto

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	400	440	480	520	560	600	640	680
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-15.3	-16.9	-18.4	-19.9	-21.4	-22.9	-24.5	-26.0
2000	-30.7	-33.7	-36.7	-39.8	-42.8	-45.9	-48.9	-51.9
3000	-46.1	-50.6	-55.0	-59.4	-63.9	-68.3	-72.7	-77.1
4000	-61.6	-67.4	-73.3	-79.1	-84.9	-90.7	-96.5	-102.3
5000	-75.1	-82.2	-89.3	-96.5	-103.6	-110.8	-117.9	-125.0
6000	-88.5	-97.0	-105.4	-113.9	-122.4	-130.8	-139.3	-147.8
7000	-101.5	-111.4	-121.2	-131.1	-141.0	-150.9	-160.7	-170.6
8000	-114.5	-125.8	-137.0	-148.3	-159.6	-170.9	-182.2	-193.5

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	400	440	480	520	560	600	640	680
15 TW	-64.2	-62.9	-61.7	-60.4	-59.2	-57.9	-56.6	-55.4
10 TW	-42.8	-41.9	-41.1	-40.3	-39.4	-38.6	-37.8	-36.9
5 TW	-21.4	-21.0	-20.6	-20.1	-19.7	-19.3	-18.9	-18.5
0	0	0	0	0	0	0	0	0
10 HW	7.1	6.7	6.2	5.7	5.2	4.7	4.2	3.8
20 HW	14.3	13.3	12.4	11.4	10.4	9.4	8.5	7.5
30 HW	22.0	20.5	19.0	17.4	15.9	14.3	12.8	11.3
40 HW	29.8	27.7	25.6	23.4	21.3	19.2	17.1	15.0

With engine bleed for packs off, increase weight by 2100 lb.
With engine anti-ice on, decrease weight by 500 lb.
With engine and wing anti-ice on, decrease weight by 2900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Brake Energy Limits VMBE

Maximum Brake Energy Speed

OAT (°C)	REFERENCE VMBE (KIAS)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	187	181				
50	187	181	175			
46	187	181	175	169		
42	188	181	175	170	164	
38	188	182	176	170	164	158
34	190	182	176	170	165	159
30	191	183	177	171	165	160
26	193	184	178	172	166	161
22	195	186	179	173	168	162
18	196	188	181	175	169	163
14	198	189	182	176	170	164
10	200	191	184	177	171	165
6	202	193	186	179	173	167
2	204	194	187	181	174	168
-2	205	196	189	182	176	169
-6	208	198	191	184	177	171
-10	210	200	193	185	179	172

Weight Adjusted VMBE

WEIGHT (1000 LB)	REFERENCE VMBE (KIAS)										
	160	165	170	175	180	185	190	195	200	205	210
360	208	210	210	210	210	210	210	210	210	210	210
380	200	206	210	210	210	210	210	210	210	210	210
400	193	200	206	210	210	210	210	210	210	210	210
420	188	194	200	207	210	210	210	210	210	210	210
440	183	189	195	201	207	210	210	210	210	210	210
460	178	184	190	196	201	207	210	210	210	210	210
480	174	180	185	191	197	202	208	210	210	210	210
500	170	175	181	186	192	197	203	208	210	210	210
520	166	172	177	182	188	193	198	204	209	210	210
540	163	168	173	179	184	189	194	199	204	209	210
560	160	165	170	175	180	185	190	195	200	205	210
580	157	162	167	172	176	181	186	191	196	201	206
600	154	159	164	168	173	178	183	187	192	197	201
620	152	156	161	165	170	175	179	184	188	193	198
640	149	154	158	163	167	172	176	181	185	189	194
660	147	151	156	160	164	169	173	178	182	186	191
680	145	149	154	158	162	166	170	175	179	183	187
700	143	147	151	156	160	164	168	172	176	180	184

Increase VMBE by 2 knots per 1% uphill runway slope. Decrease VMBE by 6 knots per 1% downhill runway slope.
Increase VMBE by 4 knots per 10 knots headwind. Decrease VMBE by 22 knots per 10 knots tailwind.
Decrease VMBE by 11 knots for one brake deactivated and 22 knots for two brakes deactivated.
Decrease brake release weight by 3750 lb for each knot V1 exceeds VMBE.
Determine normal V1, VR, V2 speeds for lower brake release weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
660	156	162	168
640	153	159	165
620	150	156	163
600	147	154	160
580	144	151	158
560	141	148	155
540	138	145	153
520	134	142	150
500	131	138	148
480	128	135	145
460	124	132	142
440	120	128	139
420	115	125	136
400	111	121	134
380	107	118	130
360	102	114	127
340	98	110	124
320	93	106	121

Check V1(MCG), Minimum VR and Minimum V2.

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	-2	0	2	4	6	8	-2	0	2	4	6	8	-2	0	2	4	6	8
60	140	9	11	13	15			4	5	5	6			-2	-2	-3	-3		
50	122	4	6	9	11	13	15	2	3	4	5	6	6	-1	-1	-2	-2	-3	-3
40	104	0	3	5	7	10	12	0	1	2	3	4	5	0	-1	-1	-2	-2	-3
30	86	0	0	3	5	7	10	0	0	1	2	3	5	0	0	-1	-1	-2	-2
20	68	0	0	2	4	6	9	0	0	1	2	3	4	0	0	0	-1	-1	-2
-60	-76	0	0	2	4	6	8	0	0	1	2	3	4	0	0	0	-1	-1	-2

Slope/Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)					
	-2	-1	0	1	2	-15	-10	-5	0	20	40
680	-5	-2	0	3	5	-3	-1	-1	0	1	2
640	-5	-2	0	2	4	-2	-1	0	0	1	2
600	-4	-2	0	2	4	-2	-1	0	0	1	2
560	-4	-2	0	2	4	-2	-1	0	0	1	2
520	-3	-1	0	2	3	-2	-1	0	0	1	2
480	-3	-1	0	2	3	-1	-1	0	0	1	2
440	-3	-1	0	2	3	-1	-1	0	0	1	2
400	-3	-1	0	2	3	-1	-1	0	0	1	2
360	-3	-1	0	2	3	-2	-1	0	0	1	2
320	-3	-1	0	2	3	-2	-1	0	0	1	2

***V1 not to exceed VR**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds

Flaps 15

V1(MCG), Minimum VR

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	108	115	104	111	103	109	101	108				
50	122	111	118	107	114	103	110	101	108	99	106	98	104
40	104	117	123	113	119	109	115	105	111	101	107	98	104
30	86	117	124	117	124	113	119	109	115	104	111	100	107
20	68	118	124	117	124	114	120	110	117	106	112	101	108
-60	-76	119	124	118	124	115	121	111	117	107	113	104	110

Minimum V2

Max Takeoff Thrust

PRESSURE ALTITUDE (FT)	-2000	0	2000	4000	6000	8000
SPEED (KIAS)	119	118	116	115	113	111

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29600	0	33100*	33100*	33100*	33100*	32000
640	30200	-1	33900*	33900*	33900*	33900*	32600
620	30900	-3	34700*	34700*	34700*	34700	33300
600	31600	-4	35400*	35400*	35400*	35400	34000
580	32400	-6	36100*	36100*	36100*	36100	34700
560	33100	-8	36700*	36700*	36700*	36700*	35500
540	33900	-9	37500*	37500*	37500*	37500*	36200
520	34700	-11	38200*	38200*	38200*	38200*	37000
500	35500	-13	39100*	39100*	39100*	39100*	37800
480	36400	-14	39900*	39900*	39900*	39900*	38700
460	37300	-14	40800*	40800*	40800*	40800*	39600
440	38200	-14	41700*	41700*	41700*	41700*	40500
420	39200	-14	42600*	42600*	42600*	42600*	41500
400	40200	-14	43100	43100	43100	43100	42500
380	41200	-14	43100	43100	43100	43100	43100
360	42400	-14	43100	43100	43100	43100	43100
340	43100	-14	43100	43100	43100	43100	43100

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29600	6	32200*	32200*	32200*	32200*	32000
640	30200	5	33000*	33000*	33000*	33000*	32600
620	30900	3	33800*	33800*	33800*	33800*	33300
600	31600	1	34700*	34700*	34700*	34700*	34000
580	32400	0	35500*	35500*	35500*	35500*	34700
560	33100	-2	36100*	36100*	36100*	36100*	35500
540	33900	-4	36800*	36800*	36800*	36800*	36200
520	34700	-6	37600*	37600*	37600*	37600*	37000
500	35500	-7	38500*	38500*	38500*	38500*	37800
480	36400	-9	39300*	39300*	39300*	39300*	38700
460	37300	-9	40200*	40200*	40200*	40200*	39600
440	38200	-9	41100*	41100*	41100*	41100*	40500
420	39200	-9	42000*	42000*	42000*	42000*	41500
400	40200	-9	43000*	43000*	43000*	43000*	42500
380	41200	-9	43100	43100	43100	43100	43100
360	42400	-9	43100	43100	43100	43100	43100
340	43100	-9	43100	43100	43100	43100	43100

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29600	12	30800*	30800*	30800*	30800*	30800*
640	30200	10	31700*	31700*	31700*	31700*	31700*
620	30900	9	32700*	32700*	32700*	32700*	32700*
600	31600	7	33600*	33600*	33600*	33600*	33600*
580	32400	5	34500*	34500*	34500*	34500*	34500*
560	33100	4	35400*	35400*	35400*	35400*	35400*
540	33900	2	36100*	36100*	36100*	36100*	36100*
520	34700	0	36800*	36800*	36800*	36800*	36800*
500	35500	-2	37600*	37600*	37600*	37600*	37600*
480	36400	-3	38400*	38400*	38400*	38400*	38400*
460	37300	-3	39300*	39300*	39300*	39300*	39300*
440	38200	-3	40200*	40200*	40200*	40200*	40200*
420	39200	-3	41100*	41100*	41100*	41100*	41100*
400	40200	-3	42100*	42100*	42100*	42100*	42100*
380	41200	-3	43100	43100	43100	43100	43100
360	42400	-3	43100	43100	43100	43100	43100
340	43100	-3	43100	43100	43100	43100	43100

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
527	496	468	443	420	400	383	367	352	339	326
1046	986	932	883	840	800	767	736	708	682	657
1562	1474	1394	1323	1259	1200	1151	1106	1063	1024	989
2077	1962	1856	1763	1678	1600	1535	1475	1419	1367	1320
2590	2448	2318	2201	2096	2000	1920	1845	1775	1710	1651
3101	2932	2778	2640	2515	2400	2304	2214	2130	2053	1982
3610	3416	3237	3077	2933	2800	2688	2583	2486	2396	2313
4119	3898	3696	3515	3351	3200	3072	2953	2842	2739	2645
4627	4381	4154	3952	3769	3600	3456	3322	3197	3082	2976
5134	4862	4612	4389	4187	4000	3841	3692	3553	3425	3307
5639	5342	5070	4826	4604	4400	4224	4061	3908	3767	3638
6143	5822	5527	5262	5022	4800	4608	4430	4263	4110	3969
6647	6301	5983	5698	5439	5200	4993	4799	4619	4453	4301
7150	6779	6439	6133	5856	5600	5377	5168	4975	4796	4632
7652	7257	6894	6569	6273	6000	5761	5538	5330	5139	4963
8153	7735	7350	7004	6690	6400	6145	5907	5686	5481	5294
8655	8212	7805	7440	7107	6800	6529	6277	6042	5824	5625
9157	8690	8261	7875	7524	7200	6914	6646	6397	6167	5956
9659	9168	8717	8311	7942	7600	7298	7015	6752	6510	6287
10161	9647	9173	8747	8359	8000	7681	7384	7107	6852	6618

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 29		31		33		35		37	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
400	14.5	1:03	14.4	1:02	14.2	1:01	11.2	0:49	11.1	0:48
800	26.4	1:58	25.9	1:55	25.4	1:53	25.0	1:51	24.6	1:50
1200	38.6	2:52	37.7	2:48	36.8	2:44	36.0	2:42	35.4	2:40
1600	51.0	3:45	49.7	3:40	48.4	3:35	47.3	3:32	46.4	3:30
2000	63.4	4:38	61.7	4:32	60.0	4:27	58.5	4:22	57.4	4:20
2400	76.3	5:30	74.1	5:23	72.0	5:17	70.2	5:12	69.1	5:10
2800	89.1	6:22	86.5	6:14	84.1	6:07	81.9	6:02	80.7	6:00
3200	102.3	7:14	99.3	7:04	96.4	6:57	94.0	6:52	92.7	6:49
3600	115.7	8:05	112.2	7:54	109.0	7:46	106.3	7:41	105.1	7:39
4000	129.1	8:55	125.2	8:44	121.6	8:36	118.7	8:31	117.4	8:29
4400	143.1	9:45	138.7	9:33	134.8	9:25	131.8	9:21	130.9	9:19
4800	157.0	10:35	152.3	10:23	148.0	10:14	144.9	10:10	144.4	10:09
5200	171.3	11:25	166.2	11:12	161.6	11:03	158.5	11:00		
5600	185.9	12:14	180.3	12:01	175.6	11:52	172.6	11:49		
6000	200.5	13:03	194.5	12:50	189.5	12:42	186.7	12:39		
6400	215.7	13:51	209.5	13:38	204.5	13:31	202.2	13:29		
6800	231.0	14:40	224.5	14:27	219.4	14:20	217.8	14:19		
7200	246.6	15:29	240.0	15:16	235.0	15:09				
7600	262.6	16:18	255.9	16:05	251.3	15:59				
8000	278.6	17:07	271.9	16:54	267.6	16:48				

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)							
	320	340	360	380	400	420	440	460
20	-2.1	-1.6	-1.1	-0.6	0.0	0.7	1.4	2.3
40	-4.1	-3.2	-2.2	-1.1	0.0	1.4	3.0	4.9
60	-6.1	-4.7	-3.2	-1.6	0.0	2.2	4.9	8.1
80	-8.2	-6.3	-4.3	-2.1	0.0	3.1	7.0	11.8
100	-10.3	-8.0	-5.4	-2.7	0.0	4.1	9.4	15.9
120	-12.4	-9.6	-6.5	-3.3	0.0	5.2	12.1	20.6
140	-14.6	-11.3	-7.6	-3.8	0.0	6.5	15.1	25.8
160	-16.8	-13.0	-8.8	-4.4	0.0	7.8	18.3	31.5
180	-19.1	-14.7	-10.0	-5.0	0.0	9.2	21.8	37.7
200	-21.4	-16.4	-11.2	-5.7	0.0	10.7	25.5	44.4
220	-23.7	-18.2	-12.4	-6.3	0.0	12.3	29.6	51.6
240	-26.1	-20.0	-13.6	-6.9	0.0	14.1	33.9	59.4
260	-28.5	-21.8	-14.9	-7.6	0.0	15.9	38.4	67.6
280	-31.0	-23.7	-16.1	-8.3	0.0	17.8	43.3	76.3
300	-33.4	-25.6	-17.4	-9.0	0.0	19.9	48.4	85.6

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Step Climb Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1037	979	927	881	838	800	765	733	704	676	651
1542	1459	1384	1317	1256	1200	1149	1102	1059	1019	982
2047	1939	1841	1753	1673	1600	1533	1471	1415	1362	1313
2552	2419	2298	2189	2090	2000	1917	1841	1770	1705	1644
3057	2898	2755	2626	2508	2400	2301	2210	2126	2048	1976
3561	3378	3212	3062	2925	2800	2685	2579	2482	2391	2307
4066	3857	3669	3498	3342	3200	3069	2949	2838	2734	2638
4570	4336	4125	3934	3760	3600	3453	3318	3193	3078	2970
5074	4815	4582	4370	4177	4000	3838	3688	3549	3421	3301
5578	5294	5038	4806	4594	4400	4222	4057	3905	3764	3633
6082	5773	5495	5242	5011	4800	4606	4427	4261	4107	3964
6586	6252	5951	5678	5428	5200	4990	4796	4617	4451	4296
7090	6731	6408	6114	5846	5600	5374	5166	4973	4794	4628
7594	7211	6864	6550	6263	6000	5758	5535	5329	5138	4959
8097	7690	7321	6986	6680	6400	6142	5905	5685	5481	5291
8602	8169	7777	7422	7097	6800	6527	6274	6041	5824	5622
9106	8648	8234	7858	7515	7200	6911	6644	6397	6167	5954
9610	9127	8691	8294	7932	7600	7295	7013	6753	6511	6285
10114	9606	9147	8730	8349	8000	7679	7383	7108	6854	6617

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB)								TIME (HR:MIN)
	LANDING WEIGHT (1000 LB)								
	320	340	360	380	400	420	440	460	
1200	29.4	30.9	32.5	33.7	35.2	36.7	38.4	39.5	2:39
1600	38.3	40.4	42.5	44.2	46.1	48.2	50.3	51.9	3:29
2000	47.5	50.1	52.7	54.8	57.3	60.0	62.5	64.6	4:19
2400	56.9	60.0	63.0	65.8	68.8	72.0	75.0	77.6	5:09
2800	66.5	70.1	73.7	77.0	80.6	84.2	87.7	91.0	5:59
3200	76.4	80.5	84.6	88.4	92.6	96.7	100.9	104.7	6:48
3600	86.4	91.0	95.8	100.2	104.8	109.5	114.3	118.8	7:38
4000	96.7	101.9	107.2	112.2	117.4	122.7	128.1	133.2	8:27
4400	107.1	113.0	119.0	124.4	130.2	136.2	142.2	147.8	9:17
4800	117.9	124.4	130.9	137.0	143.3	150.0	156.7	162.9	10:06
5200	128.9	136.1	143.1	149.8	156.8	164.2	171.4	178.2	10:56
5600	140.2	148.0	155.6	162.9	170.7	178.7	186.6	194.0	11:45
6000	151.8	160.1	168.4	176.4	184.9	193.5	202.1	210.1	12:34
6400	163.6	172.5	181.5	190.3	199.4	208.7	217.9	226.7	13:24
6800	175.6	185.2	195.0	204.5	214.2	224.2	234.1	243.6	14:13
7200	188.0	198.3	208.8	219.0	229.5	240.1	250.8	261.0	15:03
7600	200.6	211.6	222.9	233.8	245.0	256.4	267.8	278.8	15:52
8000	213.5	225.3	237.4	249.0	261.0	273.1	285.3	297.1	16:42

Based on 310/.84 climb, LRC and .84/310/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
89	77	68	61	55	50	46	43	40	37	35
156	140	127	117	108	100	93	87	82	78	74
221	202	186	172	160	150	141	133	126	119	114
284	262	243	227	213	200	189	179	170	162	154
346	322	300	281	265	250	237	225	214	204	196
408	380	357	335	317	300	285	271	259	248	237
469	439	413	390	369	350	333	318	304	291	279
531	498	469	444	421	400	381	364	349	334	321
593	558	526	498	473	450	429	410	393	377	362
658	619	584	553	525	500	477	456	437	419	403

Trip Fuel and Time

AIR DIST (NM)		LANDING WEIGHT (1000 LB)					TIME (HRS:MIN)
		300	340	380	420	460	
50	FUEL (1000 LB) ALT (FT)	2.6 9000	2.9 9000	3.1 9000	3.3 7000	3.5 7000	0:13
100	FUEL (1000 LB) ALT (FT)	4.4 19000	4.7 17000	5.0 17000	5.3 15000	5.6 15000	0:22
150	FUEL (1000 LB) ALT (FT)	6.0 25000	6.4 25000	6.7 23000	7.1 21000	7.5 21000	0:29
200	FUEL (1000 LB) ALT (FT)	7.3 31000	7.8 29000	8.3 27000	8.8 27000	9.3 25000	0:36
250	FUEL (1000 LB) ALT (FT)	8.5 37000	9.2 35000	9.7 33000	10.3 31000	10.9 29000	0:42
300	FUEL (1000 LB) ALT(FT)	9.6 41000	10.4 39000	11.1 35000	11.8 33000	12.5 31000	0:48
350	FUEL (1000 LB) ALT (FT)	10.6 43000	11.5 41000	12.3 37000	13.2 35000	14.1 35000	0:53
400	FUEL (1000 LB) ALT (FT)	11.7 43000	12.6 41000	13.6 39000	14.6 37000	15.5 35000	0:59
450	FUEL (1000 LB) ALT (FT)	12.7 43000	13.7 41000	14.8 39000	15.9 37000	17.0 35000	1:05
500	FUEL (1000 LB) ALT (FT)	13.7 43000	14.9 41000	16.1 39000	17.3 37000	18.5 35000	1:12

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
660	19350	19020	18770	18480	18890	19270	20160			
620	18110	17890	17600	17240	17440	17890	18500	20580		
580	17190	17000	16690	16300	15990	16560	17000	18030		
540	16050	15800	15580	15160	14920	15270	15580	16310		
500	14930	14630	14470	14040	13690	13910	14260	14740		
460	13830	13530	13310	12950	12600	12810	12980	13280	14510	
420	12740	12470	12170	11880	11600	11540	11730	11920	12810	14110
380	11690	11430	11120	10840	10630	10410	10570	10690	11240	11840
340	10690	10410	10130	9830	9680	9390	9320	9710	9840	10280
300	9740	9450	9180	8870	8760	8410	8320	8350	8780	9020

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
660	19840	19620	19460	18950	19090
620	18590	18380	18240	17750	17700
580	17670	17430	17240	16810	16320
540	16490	16230	16050	15640	15370
500	15300	15050	14860	14520	14240
460	14110	13880	13670	13390	13140
420	12950	12740	12530	12270	12060
380	11800	11600	11420	11190	11030
340	10720	10500	10340	10130	10030
300	9670	9430	9260	9040	9050

These tables include 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Oxygen Requirements

Required Pressure (PSI) for One 114/115 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

For more extensive than normal crew usage, add 1.2 psi/person/minute.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
28	340.0	335.5	324.6
27	354.6	351.1	339.1
26	369.4	367.3	354.0
25	384.3	384.0	369.5
24	399.7	397.5	382.4
23	415.5	411.3	395.9
22	431.7	425.3	409.7
21	448.6	439.7	423.6
20	465.7	454.4	437.7
19	491.1	473.1	452.2
18	517.5	492.3	466.5
17	538.1	511.5	483.8
16	559.3	531.3	501.5
15	581.2	551.7	519.4
14	603.8	572.6	537.7
13	628.1	595.9	560.8
12	653.3	620.0	584.7
11	661.0	627.1	592.1
10	668.2	630.8	596.9
9	682.2	644.2	609.6
8	695.2	656.9	622.1
7		668.9	634.7
6		680.0	647.3
5		690.8	659.5

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)									
	PRESSURE ALTITUDE (1000 FT)									
	8	10	12	14	16	18	20	22	24	26
ENGINE ONLY	-9.4	-7.8	-5.6	-4.3	-4.9	-6.0	-7.1	-6.9	-6.8	-6.3
ENGINE AND WING	-15.9	-13.2	-10.2	-8.5	-9.1	-10.2	-11.9	-11.4	-11.1	-10.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Dry Runway
Flaps 30
Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4000			3650	4000	4250	4500	4770	5060
4400		3690	4020	4400	4660	4940	5220	5520
4800	3660	4020	4380	4800	5080	5370	5670	5990
5200	3970	4360	4750	5200	5490	5800	6120	6460
5600	4270	4690	5110	5600	5910	6230	6570	6930
6000	4570	5020	5470	6000	6320	6670	7020	7390
6400	4870	5350	5840	6400	6740	7100	7470	7860
6800	5170	5680	6200	6800	7160	7530	7920	8330
7200	5470	6010	6560	7200	7570	7960	8370	8790
7600	5780	6340	6930	7600	7990	8400	8820	9260
8000	6080	6670	7290	8000	8400	8830	9270	9730
8400	6380	7000	7650	8400	8820	9260	9720	10200
8800	6680	7330	8020	8800	9230	9690	10170	10660
9200	6980	7660	8380	9200	9650	10130	10620	11130
9600	7290	8000	8750	9600	10070	10560	11070	11600
10000	7590	8330	9110	10000	10480	10990	11520	12060
10400	7890	8660	9470	10400	10900	11420	11970	12530
10800	8190	8990	9840	10800	11310	11860	12420	13000
11200	8490	9320	10200	11200	11730	12290	12870	13470
11600	8790	9650	10560	11600	12140	12720	13320	13930

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)				
	0	2000	4000	6000	8000
4800	413.3	388.9	365.4	343.1	321.4
5200	458.7	431.7	405.8	381.0	357.1
5600	496.9	474.3	446.6	419.4	393.2
6000	523.5	505.0	484.7	458.3	429.8
6400	549.3	530.0	511.1	491.6	466.7
6800	574.3	554.2	534.6	515.3	495.8
7200	601.6	577.9	557.4	537.3	517.6
7600	627.0	603.9	580.1	558.8	538.4
8000	651.6	627.8	604.3	580.6	558.6
8400	675.0	651.2	626.7	602.7	579.5
8800	697.7	673.3	648.8	623.5	599.8
9200		694.5	669.6	643.8	619.0
9600		715.7	686.4	660.9	635.8
10000			701.4	675.0	649.8
10400			716.4	688.6	663.1
10800				702.0	675.6
11200				715.3	687.6
11600					699.2
12000					710.9

With manual speedbrakes, decrease weight by 66100 lb.
With 1 brake deactivated, decrease weight by 83600 lb.
With 2 brakes deactivated, decrease weight by 85400 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	549.5	508.8				
52	126	565.6	523.4				
50	122	581.1	537.6	496.9			
48	118	597.7	553.7	511.6			
46	115	614.6	569.1	525.4	485.5		
44	111	630.1	584.0	540.3	498.8		
42	108	646.1	599.2	554.1	511.3	472.8	
40	104	661.2	613.5	567.1	523.6	485.0	
38	100	665.4	626.7	578.8	534.9	495.8	467.9
36	97	665.7	639.5	590.3	546.1	506.3	472.3
34	93	665.9	651.0	600.9	556.0	515.5	476.8
32	90	666.0	660.0	609.8	563.9	522.1	481.2
30	86	666.2	669.1	618.6	571.8	528.8	485.6
28	82	666.4	669.2	624.3	577.6	534.1	489.1
26	79	666.5	669.3	628.7	581.2	536.9	492.8
24	75	666.7	669.4	632.6	584.7	539.7	496.3
22	72	666.8	669.5	632.7	587.7	542.3	498.6
20	68	666.9	669.6	632.8	590.7	544.9	500.9
18	64	667.0	669.7	632.9	593.6	547.5	503.3
16	61	667.1	669.8	633.0	595.7	550.2	505.6
14	57	667.2	669.9	633.1	595.8	552.9	507.9
12	54	667.4	670.1	633.2	595.9	555.5	510.4
10	50	667.6	670.2	633.3	596.0	555.8	512.9
-40	-40	669.9	672.2	635.3	597.9	557.6	518.2

Based on engine bleed for 2 packs on and engine anti-ice off and wing anti-ice off.
With engine bleed for packs off, increase weight by 5000 lb.
With engine anti-ice on, decrease weight by 600 lb.
With engine and wing anti-ice on, decrease weight by 4400 lb.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 50°F, decrease weight by 43900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 20, Gear Up

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	5.84	4.68				
50	6.79	5.56	4.37			
46	7.72	6.41	5.20	4.06		
42	8.56	7.23	5.98	4.77	3.66	
38	9.09	8.01	6.71	5.41	4.31	3.24
34	9.09	8.69	7.29	6.01	4.82	3.72
30	9.10	9.16	7.73	6.42	5.20	3.99
26	9.11	9.16	8.03	6.65	5.41	4.18
22	9.12	9.17	8.10	6.81	5.55	4.33
18	9.13	9.18	8.11	6.96	5.69	4.46
14	9.14	9.18	8.11	7.01	5.83	4.59
10	9.15	9.19	8.12	7.02	5.91	4.72

Weight Adjustment

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)							
	3	4	5	6	7	8	9	10
600	-4.12	-4.52	-4.89	-5.26	-5.62	-5.97	-6.32	-6.69
550	-3.42	-3.74	-4.05	-4.35	-4.65	-4.93	-5.22	-5.52
500	-2.53	-2.77	-3.00	-3.22	-3.44	-3.65	-3.87	-4.08
450	-1.42	-1.55	-1.68	-1.80	-1.93	-2.05	-2.16	-2.28
400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
350	1.83	1.99	2.15	2.32	2.48	2.66	2.85	3.05
300	4.30	4.66	5.05	5.44	5.85	6.28	6.72	7.14

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)									
	-2	0	2	4	6	8	10	12	14	16
VREF	-0.25	-0.27	-0.29	-0.30	-0.32	-0.32	-0.32	-0.30	-0.29	-0.33
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF+10	0.19	0.18	0.18	0.19	0.19	0.18	0.17	0.16	0.15	0.14
VREF+20	0.42	0.41	0.40	0.39	0.35	0.30	0.25	0.21	0.18	0.13
VREF+30	0.45	0.49	0.46	0.36	0.26	0.15	0.06	0.00	-0.05	-0.15

With engine bleed for packs off, increase gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.1%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 0.6%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Quick Turnaround Limit Weight

Flaps 30 Limit Weight (1000 LB)

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	518.7	498.5			
50	122	522.1	501.9	482.3	464.0	
45	113	526.5	506.1	486.4	467.9	449.8
40	104	531.0	510.5	490.5	471.8	453.6
35	95	535.6	514.9	494.7	475.6	457.4
30	86	540.3	519.5	499.1	479.6	461.2
25	77	545.2	524.1	503.5	483.7	465.1
20	68	550.2	528.9	508.2	488.0	469.1
15	59	555.4	533.8	512.9	492.5	473.2
10	50	560.7	538.8	517.8	497.1	477.4
5	41	566.3	544.0	522.7	501.9	481.8
0	32	571.9	549.4	527.8	506.8	486.3
-5	23	577.6	554.9	533.1	511.9	491.1
-10	14	585.1	560.7	538.5	517.1	496.0
-15	5	591.5	566.7	544.1	522.4	501.2
-20	-4	598.0	572.7	549.9	527.9	506.5
-30	-22	611.9	587.0	562.2	539.5	517.6
-40	-40	626.8	601.1	575.2	551.9	529.4
-50	-58	642.4	616.2	590.8	565.4	541.8
-54	-65	648.9	622.5	596.7	571.0	546.8

Increase weight 4800 lb per 1% uphill slope. Decrease weight 11200 lb per 1% downhill slope.
Increase weight 13000 lb per 10 knots headwind. Decrease weight 77500 lb per 10 knots tailwind.

Decrease weight by 28800 lb when one brake is deactivated. Decrease weight by 59900 lb when two brakes are deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Climb Limit Weight

Flaps 15

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	408.3	372.8	361.6	354.8	337.9	320.9
52	126	416.1	382.7	361.6	354.7	337.8	320.8
50	122	424.0	392.5	363.9	354.6	337.6	320.7
48	118	432.2	402.5	374.7	354.6	337.5	320.6
46	115	440.8	412.1	385.5	356.8	337.5	320.5
44	111	449.1	421.0	395.6	366.2	337.4	320.4
42	108	458.0	429.9	405.8	375.7	339.5	320.3
40	104	467.1	438.5	415.6	384.9	347.6	320.2
38	100	477.7	447.6	424.8	393.9	355.8	322.2
36	97	489.7	456.4	434.1	402.9	363.8	329.2
34	93	501.6	466.5	442.4	411.8	371.5	336.1
32	90	514.3	477.5	450.5	420.5	380.6	342.8
30	86	523.3	486.8	457.9	427.9	390.2	349.3
28	82	526.2	496.2	464.5	434.9	399.5	358.2
26	79	526.3	505.1	470.8	440.8	406.7	368.4
24	75	526.4	509.4	477.6	445.7	413.5	377.9
22	72	526.4	509.4	484.0	450.4	418.7	384.7
20	68	526.5	509.5	487.0	455.4	422.5	391.4
18	64	526.6	509.5	487.0	460.3	426.0	395.7
16	61	526.6	509.6	487.0	462.5	429.8	398.7
14	57	526.6	509.6	487.0	462.5	433.5	401.6
12	54	526.7	509.6	487.0	462.4	435.0	404.5
10	50	526.7	509.6	486.9	462.4	435.0	407.2
-40	-40	526.5	509.0	485.0	459.9	432.4	405.8

Based on engine bleed for packs on, engine anti-ice off, wing anti-ice off or auto.
With engine bleed for packs off, decrease weight by 1200 lb.
With engine anti-ice on, decrease weight by 16900 lb.
With engine and wing anti-ice on, decrease weight by 23100 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	440.0				
52	126	452.4				
50	122	464.6	429.7			
48	118	478.8	442.6			
46	115	492.0	454.5	420.5		
44	111	504.7	467.1	431.9		
42	108	517.1	478.9	442.5	409.3	
40	104	528.6	490.0	452.6	419.5	
38	100	540.2	500.6	462.4	429.2	396.5
36	97	550.7	510.2	472.0	438.1	405.7
34	93	559.5	518.4	480.6	445.9	413.3
32	90	567.2	526.3	488.6	451.9	416.4
30	86	574.5	532.5	493.6	456.5	419.6
28	82	574.6	537.1	498.3	460.8	422.7
26	79	574.7	541.6	501.6	463.1	425.6
24	75	574.8	543.8	503.9	465.3	428.4
22	72	574.9	543.8	506.1	467.5	430.4
20	68	575.0	543.9	508.5	469.6	432.3
18	64	575.1	544.0	510.9	471.7	434.2
16	61	575.2	544.1	512.5	473.9	436.1
14	57	575.3	544.2	512.6	476.2	438.0
12	54	575.4	544.3	512.7	478.4	440.1
10	50	575.5	544.3	512.7	478.7	442.1
-40	-40	577.1	545.8	514.2	480.1	446.4

Based on engine bleed for 2 packs on, APU on or off, engine anti-ice off and wing anti-ice off.
With engine bleed for packs off, increase weight by 4200 lb.
With engine bleed for engine anti-ice on, decrease weight by 500 lb.
With engine bleed for engine and wing anti-ice on, decrease weight by 3800 lb.
When operating in icing conditions during any part of the flight when forecast landing temperature is below 10°C, decrease weight by 56200 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 30°C & Below, Zero Wind

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	488.3								
50	488.3	488.3							
100	471.2	488.3							
150	445.0	484.3	488.3						
200	423.7	463.2	488.3	488.3	488.3	488.3	488.3	488.3	488.3
250	408.5	444.7	474.5	488.3	488.3	488.3	488.3	488.3	488.3
300	391.9	428.5	458.6	481.9	488.2	488.2	488.2	488.2	488.2
350	376.9	415.3	444.3	468.3	487.2	488.1	488.1	488.1	488.1
400	363.2	403.3	431.3	455.5	475.1	488.0	488.0	488.0	488.0
450	350.7	391.0	419.7	443.8	463.8	480.2	487.9	487.9	487.9
500	339.1	379.5	410.0	432.9	453.2	470.1	484.2	487.8	487.8
550		368.8	399.9	422.7	443.2	460.4	474.9	487.2	487.6
600		358.7	390.2	414.1	433.9	451.3	466.1	478.8	487.5
650		349.2	380.8	405.8	425.0	442.6	457.7	470.7	481.9
700		340.1	372.0	397.4	417.1	434.4	449.7	462.9	474.4
750			363.6	389.3	409.9	426.6	442.0	455.5	467.2
800			355.5	381.5	402.6	419.4	434.7	448.3	460.2
850			347.8	374.0	395.4	412.8	427.7	441.4	453.5
900			340.4	366.7	388.5	406.4	421.0	434.8	447.0
950				359.8	381.7	400.0	415.0	428.4	440.8
1000				353.0	375.2	393.8	409.2	422.3	434.8

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)							
	340	360	380	400	420	440	460	480
30 & BELOW	0	0	0	0	0	0	0	0
32	-4.8	-5.5	-6.2	-6.9	-7.6	-8.3	-9.0	-9.7
34	-9.5	-10.9	-12.3	-13.8	-15.2	-16.6	-18.0	-19.4
36	-14.3	-16.4	-18.5	-20.6	-22.8	-24.9	-27.0	-29.1
38	-19.0	-21.9	-24.7	-27.5	-30.4	-33.2	-36.0	-38.9
40	-23.8	-27.3	-30.9	-34.4	-38.0	-41.5	-45.0	-48.6
42	-29.8	-33.8	-37.7	-41.7	-45.6	-49.6	-53.5	-57.5
44	-35.9	-40.3	-44.6	-49.0	-53.3	-57.7	-62.0	-66.4
46	-42.0	-46.7	-51.5	-56.2	-61.0	-65.7	-70.5	-75.2
48	-48.0	-53.2	-58.3	-63.5	-68.7	-73.8	-79.0	-84.1
50	-54.1	-59.7	-65.2	-70.8	-76.3	-81.9	-87.4	-93.0

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	340	360	380	400	420	440	460	480
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-17.4	-17.4	-17.5	-17.6	-17.7	-17.7	-17.8	-17.9
2000	-34.7	-34.9	-35.0	-35.2	-35.3	-35.5	-35.6	-35.8
3000	-48.9	-49.4	-49.8	-50.3	-50.8	-51.2	-51.7	-52.2
4000	-63.1	-63.9	-64.7	-65.4	-66.2	-67.0	-67.8	-68.5
5000	-74.0	-75.4	-76.8	-78.2	-79.6	-81.0	-82.4	-83.9
6000	-84.8	-86.9	-88.9	-91.0	-93.0	-95.1	-97.1	-99.2
7000	-89.7	-93.4	-97.2	-100.9	-104.7	-108.4	-112.2	-115.9
8000	-94.6	-100.0	-105.5	-110.9	-116.3	-121.8	-127.2	-132.7

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	340	360	380	400	420	440	460	480
15 TW	-72.7	-68.8	-64.9	-61.0	-57.0	-53.1	-49.2	-45.2
10 TW	-48.5	-45.9	-43.3	-40.6	-38.0	-35.4	-32.8	-30.2
5 TW	-24.2	-22.9	-21.6	-20.3	-19.0	-17.7	-16.4	-15.1
0	0	0	0	0	0	0	0	0
10 HW	7.1	6.8	6.4	6.1	5.7	5.4	5.0	4.6
20 HW	14.3	13.6	12.9	12.1	11.4	10.7	10.0	9.3
30 HW	21.4	20.4	19.3	18.2	17.1	16.1	15.0	13.9
40 HW	28.6	27.1	25.7	24.3	22.9	21.4	20.0	18.6

With engine bleed for packs off, increase weight by 200 lb.
With engine anti-ice on, decrease weight by 15700 lb.
With engine and wing anti-ice on, decrease weight by 21500 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	13700	13600	11100
640	15100	15000	12700
620	16600	16500	14300
600	18000	17900	15900
580	19500	19400	17400
560	20700	20600	18900
540	21800	21800	20300
520	23000	22900	21500
500	24100	24100	22700
480	25300	25200	23900
460	26300	26100	25200
440	27300	27100	26200
420	28400	28100	27300
400	29600	29200	28400
380	30700	30300	29500
360	31600	31300	30700
340	32300	32000	31600
320	33100	32800	32500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
335	297	264	239	218	200	188	176	166	157	149
504	446	397	358	327	300	281	264	249	235	224
671	595	529	478	436	400	375	352	332	314	298
838	742	661	597	545	500	469	440	415	393	373
1004	890	792	716	654	600	563	529	498	471	448
1169	1037	924	835	763	700	656	617	582	550	523
1333	1183	1055	954	872	800	750	705	665	629	598
1496	1329	1186	1073	980	900	844	794	748	708	673
1658	1474	1316	1191	1089	1000	938	882	832	787	748
1819	1619	1446	1309	1197	1100	1032	970	915	866	823
1980	1763	1576	1427	1306	1200	1126	1058	998	945	899
2140	1906	1705	1545	1414	1300	1219	1147	1081	1024	974
2299	2049	1834	1663	1523	1400	1313	1235	1165	1103	1050
2457	2192	1963	1781	1631	1500	1407	1324	1249	1183	1126
2615	2333	2091	1898	1739	1600	1502	1412	1333	1262	1201
2772	2475	2219	2015	1847	1700	1596	1501	1417	1342	1277
2928	2616	2347	2132	1955	1800	1690	1590	1501	1422	1353
3083	2756	2475	2249	2063	1900	1784	1679	1585	1501	1429
3238	2897	2602	2366	2171	2000	1878	1768	1669	1581	1505

Reference Fuel and Time Required

AIR DIST(NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	16.3	0:51	15.4	0:49	14.7	0:47	14.6	0:46	14.8	0:45
300	24.3	1:14	22.7	1:11	21.3	1:08	20.9	1:06	21.2	1:04
400	32.3	1:37	30.1	1:33	28.0	1:28	27.3	1:25	27.5	1:22
500	40.3	2:00	37.4	1:55	34.6	1:48	33.6	1:45	33.9	1:40
600	48.2	2:23	44.7	2:17	41.3	2:09	39.9	2:05	40.2	1:59
700	56.5	2:45	52.3	2:38	48.2	2:29	46.6	2:24		
800	64.7	3:07	60.0	2:59	55.1	2:49	53.3	2:43		
900	73.0	3:30	67.6	3:21	62.1	3:09	59.9	3:02		
1000	81.3	3:52	75.2	3:42	69.0	3:29	66.6	3:22		
1100	89.8	4:14	83.2	4:03	76.2	3:48	73.6	3:41		
1200	98.4	4:35	91.1	4:24	83.5	4:08	80.6	3:59		
1300	106.9	4:57	99.1	4:44	90.7	4:28	87.7	4:18		
1400	115.5	5:19	107.0	5:05	98.0	4:47	94.7	4:37		
1500	124.4	5:40	115.3	5:25	105.6	5:06	102.1	4:56		
1600	133.3	6:01	123.6	5:46	113.2	5:26	109.6	5:15		
1700	142.2	6:22	131.8	6:06	120.8	5:45	117.0	5:33		
1800	151.1	6:43	140.1	6:26	128.4	6:04	124.5	5:52		
1900	160.3	7:04	148.7	6:46	136.4	6:23				
2000	169.6	7:24	157.4	7:06	144.4	6:42				

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	300	350	400	450	500
20	-2.5	-1.4	0.0	1.8	3.7
40	-4.7	-2.5	0.0	3.5	7.4
60	-7.0	-3.6	0.0	5.3	11.3
80	-9.3	-4.7	0.0	7.2	15.3
100	-11.5	-5.8	0.0	9.2	19.6
120	-13.7	-6.9	0.0	11.3	24.0
140	-15.9	-8.0	0.0	13.5	28.6
160	-18.1	-9.1	0.0	15.8	33.4
180	-20.3	-10.2	0.0	18.2	38.4
200	-22.5	-11.3	0.0	20.7	43.5
220	-24.6	-12.4	0.0	23.3	48.9
240	-26.8	-13.5	0.0	26.0	54.4

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
660	30190	29620	29890	30510			
620	28590	27960	28090	28420			
580	27070	26420	26370	26510	27980		
540	25440	24890	24620	24610	25490		
500	23800	23410	23010	22810	23250		
460	22180	21860	21450	21070	21260	22480	
420	20630	20270	19960	19380	19440	20080	
380	19090	18720	18470	17830	17740	18100	19500
340	18110	17760	17750	17140	16650	16890	17680
300	17830	17480	17150	16550	16240	16100	16530

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
660	28660	28110	28420	28870	
620	27060	26510	26600	26850	28570
580	25460	25030	24870	25010	26070
540	23800	23510	23200	23170	23710
500	22180	21900	21630	21390	21600
460	20570	20280	20080	19630	19730
420	19010	18700	18540	17960	17990
380	17760	17480	17240	16730	16340
340	16720	16450	16180	15720	15500
300	16060	15800	15520	15070	14810

These tables include 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

Based on engine bleed for packs on, APU on or off and anti-ice off

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
16	331.5	328.1	
14	352.6	345.0	331.7
12	379.9	374.7	368.6
10	398.6	392.6	386.1
8	422.5	414.9	407.2
6	446.7	436.8	427.1
4	470.0	456.4	443.6

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)				
	PRESSURE ALTITUDE (1000 FT)				
	8	10	12	14	16
ENGINE ONLY	-7.3	-6.3	-5.0	-4.0	-3.5
ENGINE AND WING	-11.1	-9.9	-8.1	-7.5	-6.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Brake Energy, and Obstacle Limit Weights as determined from the following tables. Tire Limit is not shown as it is not limiting for the range of conditions shown in this chapter.

Field Limit Weight - Slope and Wind Corrections

These tables provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude.

Obstacle Limit Weight

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Brake Energy Limits VMBE

Tables are presented to determine the Maximum Brake Energy Speed VMBE. Compliance with this limitation is required to ensure that the brakes have enough capacity to execute a maximum effort stop from V1 without the use of thrust reversers. Enter the upper table with pressure altitude and OAT to determine the reference VMBE. Then enter the lower table with the reference VMBE and brake release weight to determine VMBE for a specific takeoff. Adjust for slope, wind and deactivated brakes as described below the table. The resulting VMBE must be greater than or equal to V1. If VMBE is less than V1, brake release weight must be decreased by the amount shown below the table.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Normal takeoff speeds, V1, VR, and V2 are read from the table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle 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 7900 lb and the V1 associated with the reduced weight by one knot. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 16600 lb and the V1 associated with the reduced weight by three knots. If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate stop distance available corrected for wind and slope exceeds approximately 4900 ft for one brake deactivated or 5100 ft for two brakes deactivated.

For brake(s) deactivated, reduce VMBE by the amount shown on the Brake Energy Limit VMBE Chart. If the resulting VMBE is less than V1, the brake release weight must be reduced according to the instructions on the brake energy limit chart. The resulting V1 must not be less than V1(MCG). Determine VR and V2 for the actual weight.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time Table with air distance from the Ground to Air Miles Conversion Table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the planned landing weight to obtain fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time required with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Oxygen Requirements

Flight Crew System

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with these requirements is achieved with the minimum dispatch oxygen cylinder pressure. Enter the Crew Oxygen Requirements table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate bottle temperature.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 2.05 liters/person/minute (1.2 psi/person/minute for the single cylinder system), or 13 liters/person/minute (8 psi/person/minute) if 100% oxygen is selected during normal usage.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-around Gradient table with airport OAT and pressure altitude to determine the reference Go-Around Gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted Go-Around Gradient. Apply the necessary engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777-300 PW4090 LB FT FAA TO1-10 TO2-20 TALPA

Pkg Model Identification PD.ModID.20.1

Takeoff. PD.20.1

Takeoff Field Corrections PD.20.1
Takeoff Field & Climb Limit Weights PD.20.2
Takeoff Obstacle Limit Weight. PD.20.5
Tire Speed Limit PD.20.7
Brake Energy Limits VMBE PD.20.8
Takeoff Speeds PD.20.9

Enroute PD.21.1

Long Range Cruise Maximum Operating Altitude. PD.21.1
Long Range Cruise Trip Fuel and Time PD.21.3
Long Range Cruise Step Climb PD.21.5
Short Trip Fuel and Time PD.21.6
Holding Planning PD.21.7
Crew Oxygen Requirements. PD.21.8
Net Level Off Weight PD.21.9

Landing PD.22.1

Landing Field Limit Weight PD.22.1
Approach or Landing Climb Limited Weight. PD.22.3
Go-Around Climb Gradient PD.22.4
Quick Turnaround Limit Weight. PD.22.5

Gear Down. PD.23.1

Takeoff Climb Limit Weight. PD.23.1
Approach or Landing Climb Limited Weight. PD.23.2
Takeoff Obstacle Limit Weight. PD.23.3
Long Range Cruise Altitude Capability PD.23.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time PD.23.6
Short Trip Fuel and Time PD.23.8
Holding Planning PD.23.9
Net Level Off Weight PD.23.10

Text PD.24.1

Introduction PD.24.1
Takeoff PD.24.1
Enroute PD.24.4
Landing PD.24.6
Gear Down PD.24.7

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
005	HL7532	28371	WB552
006	HL7533	27948	WB553
004	HL7534	27950	WB551
007	HL7573	27952	WB554

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field Corrections

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4310	4280	4260	4230	4200	4110	4020	3930	3840
4600	4730	4700	4670	4630	4600	4510	4410	4320	4220
5000	5150	5110	5080	5040	5000	4900	4800	4700	4600
5400	5570	5530	5490	5440	5400	5300	5190	5090	4980
5800	5990	5940	5900	5850	5800	5690	5580	5470	5360
6200	6430	6370	6320	6260	6200	6080	5970	5850	5740
6600	6890	6820	6750	6670	6600	6480	6350	6230	6110
7000	7350	7260	7180	7090	7000	6870	6740	6610	6480
7400	7810	7710	7610	7500	7400	7260	7120	6980	6850
7800	8270	8150	8040	7920	7800	7650	7510	7360	7220
8200	8720	8590	8460	8330	8200	8040	7880	7720	7560
8600	9150	9010	8870	8740	8600	8420	8240	8060	7880
9000	9580	9430	9290	9140	9000	8800	8600	8400	8200
9400	10010	9850	9700	9550	9400	9180	8960	8740	8520
9800	10440	10280	10120	9960	9800	9560	9320	9080	8840
10200	10880	10710	10540	10370	10200	9940	9680	9420	9160
10600	11330	11140	10960	10780	10600	10320	10040	9760	9480
11000	11780	11580	11390	11190	11000	10700	10400	10100	9800
11400	12230	12020	11810	11610	11400	11080	10760	10440	10120
11800	12680	12460	12240	12020	11800	11460	11120	10780	10440

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	2930	3350	3780	4200	4390	4620	4860	5140
4600	3290	3730	4160	4600	4810	5050	5310	5610
5000	3650	4100	4550	5000	5220	5480	5760	6080
5400	4010	4470	4940	5400	5640	5910	6210	6550
5800	4370	4850	5320	5800	6050	6340	6660	7020
6200	4720	5210	5710	6200	6460	6770	7110	7490
6600	5050	5560	6080	6600	6880	7200	7550	7960
7000	5380	5920	6460	7000	7290	7630	8000	8430
7400	5710	6270	6840	7400	7700	8060	8450	8900
7800	6040	6620	7210	7800	8120	8490	8900	9370
8200	6370	6980	7590	8200	8540	8920	9350	9830
8600	6700	7330	7970	8600	8960	9360	9800	10280
9000	7030	7680	8340	9000	9380	9800	10250	10730
9400	7360	8040	8720	9400	9810	10240	10700	11180
9800	7690	8390	9100	9800	10230	10680	11140	11630
10200	8020	8740	9470	10200	10650	11120	11590	12090
10600	8350	9100	9850	10600	11060	11550	12040	12560
11000	8680	9450	10230	11000	11480	11980	12490	13030
11400	9010	9800	10600	11400	11890	12410	12940	13500
11800	9340	10160	10980	11800	12310	12840	13390	13970

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT										
	°C -40	15	20	22	24	28	30	32	36	44	50
	°F -40	59	68	72	75	82	86	90	97	111	122
4000	413.1	373.1	370.0	368.8	367.6	365.2	364.0	360.5	352.5	331.7	314.4
4200	425.0	384.0	380.8	379.5	378.3	375.8	374.6	371.0	362.8	341.6	323.9
4600	447.6	404.8	401.5	400.2	398.9	396.4	395.1	391.3	382.8	360.6	342.2
5000	468.8	424.4	421.0	419.6	418.3	415.6	414.3	410.4	401.5	378.5	359.4
5400	488.1	442.3	438.7	437.3	436.0	433.2	431.9	427.8	418.7	395.0	375.2
5800	506.5	459.4	455.8	454.3	452.9	450.1	448.7	444.6	435.1	410.8	390.5
6200	523.9	475.7	471.9	470.5	469.0	466.1	464.7	460.4	450.8	425.8	405.0
6600	540.6	491.2	487.4	485.9	484.4	481.4	480.0	475.7	465.8	440.2	418.9
7000	556.8	506.3	502.4	500.9	499.3	496.3	494.8	490.4	480.3	454.2	432.4
7400	572.4	520.8	516.8	515.3	513.7	510.6	509.1	504.6	494.3	467.6	445.3
7800	587.6	535.0	530.9	529.3	527.7	524.5	523.0	518.3	507.8	480.6	457.9
8200	602.7	549.0	544.8	543.2	541.6	538.4	536.8	532.1	521.3	493.5	470.3
8600	617.2	562.5	558.2	556.6	554.9	551.6	550.0	545.2	534.2	505.9	482.3
9000	630.6	574.8	570.5	568.8	567.1	563.8	562.1	557.2	546.1	517.2	493.1
9400	643.0	586.3	581.8	580.1	578.4	575.0	573.3	568.3	557.0	527.6	503.1
9800	655.1	597.4	592.9	591.1	589.4	585.9	584.2	579.2	567.6	537.7	512.8
10200	666.7	608.1	603.6	601.8	600.0	596.5	594.8	589.6	577.9	547.5	522.3
10600	677.9	618.5	613.9	612.1	610.3	606.8	605.0	599.8	587.9	557.1	531.5
CLIMB LIMIT WT (1000 LB)	660.6	658.8	658.6	658.5	658.4	658.2	658.1	649.8	630.7	578.2	532.5

1000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT										
	°C -40	15	20	22	24	28	30	32	36	44	50
	°F -40	59	68	72	75	82	86	90	97	111	122
4000	400.0	361.1	358.1	356.9	355.8	353.4	350.3	347.0	339.0	319.3	302.6
4200	411.5	371.7	368.6	367.4	366.2	363.8	360.6	357.2	349.0	328.9	311.8
4600	433.6	392.1	388.8	387.6	386.3	383.8	380.5	376.9	368.4	347.4	329.5
5000	454.3	411.2	407.8	406.5	405.2	402.6	399.1	395.5	386.6	364.8	346.3
5400	473.1	428.6	425.2	423.8	422.5	419.8	416.2	412.4	403.3	380.8	361.7
5800	491.0	445.4	441.8	440.4	439.0	436.3	432.6	428.7	419.3	396.2	376.6
6200	508.1	461.3	457.6	456.2	454.8	452.0	448.2	444.2	434.5	410.8	390.7
6600	524.4	476.5	472.8	471.3	469.8	467.0	463.1	459.0	449.1	424.9	404.4
7000	540.2	491.2	487.4	485.9	484.4	481.5	477.6	473.4	463.3	438.5	417.5
7400	555.5	505.4	501.5	500.0	498.5	495.5	491.5	487.2	476.9	451.6	430.1
7800	570.3	519.2	515.3	513.7	512.1	509.1	505.0	500.6	490.1	464.2	442.3
8200	585.1	533.0	528.9	527.3	525.7	522.6	518.4	514.0	503.2	476.9	454.5
8600	599.3	546.1	542.0	540.4	538.7	535.6	531.3	526.8	515.8	488.9	466.1
9000	612.3	558.2	553.9	552.3	550.6	547.4	543.1	538.5	527.3	499.9	476.7
9400	624.4	569.3	565.0	563.3	561.6	558.3	553.9	549.2	537.8	510.0	486.3
9800	636.2	580.1	575.8	574.1	572.3	569.0	564.5	559.7	548.1	519.8	495.7
10200	647.5	590.6	586.2	584.5	582.7	579.3	574.8	569.9	558.1	529.4	504.9
10600	658.5	600.8	596.3	594.5	592.8	589.3	584.7	579.8	567.9	538.7	514.0
CLIMB LIMIT WT (1000 LB)	643.3	641.6	641.4	641.3	641.2	640.7	633.8	626.2	607.0	557.1	512.9

With engine bleed for packs off, increase field limit weight by 1400 lb and climb limit weight by 4400 lb.
With engine anti-ice on, decrease field limit weight by 200 lb and climb limit weight by 1100 lb.
With engine and wing anti-ice on, decrease field limit weight by 2300 lb and climb limit weight by 4600 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights

Flaps 15

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT										
°C	-40	15	20	22	24	28	30	32	36	44	50
°F	-40	59	68	72	75	82	86	90	97	111	122
4000	386.9	349.2	346.2	345.1	343.9	339.6	337.0	333.9	326.2	307.1	290.2
4200	398.1	359.5	356.5	355.3	354.1	349.7	347.0	343.8	336.0	316.4	299.1
4600	419.6	379.3	376.1	374.9	373.7	369.0	366.3	363.0	354.8	334.3	316.3
5000	439.7	397.9	394.6	393.4	392.1	387.3	384.4	381.0	372.4	351.2	332.5
5400	458.0	414.9	411.6	410.3	409.0	404.0	401.0	397.5	388.7	366.8	347.6
5800	475.6	431.3	427.8	426.5	425.1	420.0	417.0	413.3	404.3	381.8	362.0
6200	492.3	446.8	443.3	441.9	440.5	435.3	432.2	428.4	419.2	396.1	375.8
6600	508.2	461.7	458.1	456.7	455.3	449.9	446.7	442.9	433.4	409.9	389.1
7000	523.7	476.2	472.5	471.0	469.6	464.1	460.8	456.9	447.2	423.1	401.9
7400	538.6	490.0	486.3	484.8	483.3	477.7	474.4	470.4	460.5	435.8	414.1
7800	553.1	503.5	499.6	498.1	496.6	490.9	487.5	483.4	473.3	448.2	426.0
8200	567.5	516.9	513.0	511.4	509.9	504.1	500.6	496.4	486.1	460.5	437.9
8600	581.3	529.8	525.7	524.2	522.6	516.6	513.1	508.9	498.4	472.2	449.2
9000	594.0	541.5	537.4	535.8	534.2	528.1	524.5	520.2	509.5	482.9	459.4
9400	605.8	552.3	548.2	546.5	544.9	538.7	535.1	530.7	519.8	492.6	468.7
9800	617.2	562.9	558.6	557.0	555.3	549.0	545.3	540.8	529.8	502.2	477.8
10200	628.3	573.1	568.8	567.1	565.4	559.0	555.3	550.7	539.5	511.5	486.8
10600	639.0	583.0	578.7	577.0	575.3	568.8	565.0	560.4	549.0	520.6	495.6
CLIMB LIMIT WT (1000 LB)	624.8	623.2	623.0	622.8	622.6	615.2	610.0	603.1	584.3	535.2	491.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights

Flaps 15

3000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT										
	°C	-40	15	20	22	24	28	30	32	36	44	50
	°F	-40	59	68	72	75	82	86	90	97	111	122
4000	373.8		337.2	334.3	332.6	330.7	326.4	323.8	320.8	313.7	295.2	278.4
4200	384.6		347.2	344.3	342.5	340.5	336.1	333.5	330.4	323.1	304.2	287.1
4600	405.5		366.5	363.4	361.6	359.5	354.9	352.2	349.0	341.3	321.6	303.7
5000	425.1		384.6	381.4	379.5	377.4	372.6	369.8	366.4	358.5	338.0	319.5
5400	443.0		401.2	398.0	396.0	393.8	388.9	386.0	382.5	374.4	353.2	334.1
5800	460.2		417.2	413.9	411.8	409.6	404.5	401.5	398.0	389.6	367.8	348.1
6200	476.4		432.4	429.0	426.9	424.6	419.4	416.3	412.7	404.1	381.8	361.6
6600	492.0		447.0	443.5	441.3	438.9	433.6	430.5	426.8	418.0	395.2	374.5
7000	507.1		461.0	457.5	455.3	452.9	447.4	444.2	440.4	431.4	408.1	387.0
7400	521.7		474.6	470.9	468.7	466.2	460.7	457.4	453.5	444.3	420.5	399.0
7800	535.8		487.7	484.0	481.7	479.2	473.5	470.2	466.2	456.8	432.5	410.5
8200	549.9		500.8	497.0	494.7	492.1	486.4	483.0	478.9	469.3	444.5	422.1
8600	563.4		513.4	509.5	507.1	504.5	498.6	495.1	491.0	481.2	455.9	433.0
9000	575.7		524.8	520.8	518.4	515.7	509.7	506.2	502.0	492.0	466.3	443.0
9400	587.2		535.3	531.3	528.8	526.1	520.0	516.4	512.1	502.0	475.7	452.0
9800	598.3		545.6	541.5	538.9	536.2	530.0	526.3	522.0	511.7	485.0	460.8
10200	609.1		555.5	551.4	548.8	546.0	539.7	536.0	531.6	521.1	494.0	469.5
10600	619.5		565.3	561.0	558.4	555.6	549.2	545.5	541.0	530.4	502.9	478.1
CLIMB LIMIT WT (1000 LB)	606.5		605.0	604.5	602.2	599.5	592.3	586.9	579.8	562.5	514.5	474.8

With engine bleed for packs off, increase field limit weight by 1400 lb and climb limit weight by 4400 lb.
With engine anti-ice on, decrease field limit weight by 200 lb and climb limit weight by 1100 lb.
With engine and wing anti-ice on, decrease field limit weight by 2300 lb and climb limit weight by 4600 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off
Sea Level, 30°C & Below, Zero Wind

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	522.3	580.8	628.0	664.2	685.1	703.4			
50	493.7	547.0	590.7	625.5	653.7	671.4	685.7	698.3	708.8
100	465.5	515.2	556.5	590.3	618.3	642.2	660.8	673.2	683.8
150	440.7	489.7	529.4	563.8	592.9	616.6	636.2	652.5	664.6
200	419.6	468.4	507.8	542.5	571.4	595.4	615.2	632.0	646.2
250	401.2	448.9	489.9	523.9	552.6	576.8	597.0	614.1	628.8
300	384.8	433.0	474.1	507.3	535.8	560.0	580.7	598.1	613.1
350	370.0	418.7	459.4	492.4	520.6	544.9	565.7	583.6	598.9
400	357.5	405.6	445.7	478.9	506.8	531.0	551.9	570.0	585.8
450	346.2	393.5	433.0	466.4	494.0	518.1	539.1	557.4	573.5
500		382.3	421.3	454.4	482.3	506.2	527.2	545.7	561.9
550		371.9	410.4	443.2	471.3	495.0	516.0	534.6	551.0
600		362.2	400.2	432.7	460.7	484.6	505.5	524.1	540.6
650		353.0	390.6	422.8	450.7	474.8	495.6	514.3	530.9
700		344.4	381.5	413.5	441.2	465.5	486.3	504.9	521.5
750		346.6	373.0	404.6	432.2	456.4	477.4	495.9	512.7
800			364.8	396.2	423.6	447.7	469.0	487.5	504.2
850			357.1	388.2	415.5	439.5	460.7	479.4	496.1
900			349.7	380.6	407.7	431.6	452.8	471.7	488.3
950			342.7	373.4	400.3	424.0	445.2	464.2	480.9
1000				366.4	393.1	416.8	437.9	456.9	473.8

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)						
	400	450	500	550	600	650	700
30 & Below	0	0	0	0	0	0	0
32	-6.0	-6.8	-7.5	-8.3	-9.1	-9.9	-10.6
34	-12.0	-13.5	-15.1	-16.6	-18.2	-19.7	-21.3
36	-18.0	-20.3	-22.6	-25.0	-27.3	-29.6	-31.9
38	-24.0	-27.1	-30.2	-33.3	-36.4	-39.5	-42.6
40	-30.0	-33.9	-37.7	-41.6	-45.5	-49.3	-53.2
42	-37.4	-42.5	-47.7	-52.8	-57.9	-63.0	-68.2
44	-44.8	-51.2	-57.6	-64.0	-70.3	-76.7	-83.1
46	-52.2	-59.8	-67.5	-75.1	-82.8	-90.4	-98.1
48	-59.6	-68.5	-77.4	-86.3	-95.2	-104.1	-113.0
50	-67.0	-77.2	-87.3	-97.5	-107.7	-117.8	-128.0

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	400	450	500	550	600	650	700
S.L. & Below	0	0	0	0	0	0	0
1000	-14.9	-16.7	-18.5	-20.2	-22.0	-23.8	-25.6
2000	-29.7	-33.1	-36.5	-39.9	-43.3	-46.7	-50.1
3000	-43.6	-48.8	-54.0	-59.1	-64.3	-69.5	-74.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	400	450	500	550	600	650	700
15 TW	-57.6	-57.6	-57.6	-57.6	-57.6	-57.6	-57.5
10 TW	-38.4	-38.4	-38.4	-38.4	-38.4	-38.4	-38.4
5 TW	-19.2	-19.2	-19.2	-19.2	-19.2	-19.2	-19.2
0	0	0	0	0	0	0	0
10 HW	8.2	7.7	7.1	6.5	6.0	5.4	4.8
20 HW	16.5	15.3	14.2	13.1	11.9	10.8	9.6
30 HW	25.8	23.8	21.9	20.0	18.1	16.1	14.2
40 HW	35.1	32.4	29.6	26.9	24.2	21.5	18.7

With engine bleed for packs off, increase weight by 1700 lb.
With engine anti-ice on, decrease weight by 1000 lb.
With engine and wing anti-ice on, decrease weight by 3200 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Tire Speed Limit
Flaps 15

AIRPORT		TIRE SPEED LIMIT WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	715.0	701.8	651.8	602.8	556.8	514.0
52	126	715.0	705.6	655.7	606.3	560.1	517.0
50	122	715.0	709.4	659.5	609.8	563.3	519.9
48	118	715.0	711.6	663.2	613.5	566.7	523.0
46	115	715.0	713.8	666.9	617.1	570.1	526.1
44	111	715.0	715.0	670.7	620.8	573.6	529.3
42	108	715.0	715.0	674.5	624.5	577.0	532.6
40	104	715.0	715.0	678.2	628.2	580.5	535.9
38	100	715.0	715.0	682.3	632.1	584.1	539.2
36	97	715.0	715.0	686.3	636.0	587.7	542.5
34	93	715.0	715.0	690.4	640.0	591.3	545.9
32	90	715.0	715.0	694.7	644.2	595.2	549.6
30	86	715.0	715.0	699.1	648.6	599.3	553.4
28	82	715.0	715.0	703.7	653.1	603.4	557.3
26	79	715.0	715.0	708.4	657.7	607.7	561.2
24	75	715.0	715.0	713.1	662.5	612.1	565.1
22	72	715.0	715.0	715.0	667.0	616.5	569.2
20	68	715.0	715.0	715.0	671.6	621.0	573.4
18	64	715.0	715.0	715.0	676.3	625.6	577.6
16	61	715.0	715.0	715.0	681.1	630.2	581.8
14	57	715.0	715.0	715.0	686.0	634.9	586.2
12	54	715.0	715.0	715.0	691.0	639.7	590.6
10	50	715.0	715.0	715.0	696.0	644.7	595.0
-40	-40	715.0	715.0	715.0	715.0	715.0	715.0

Increase tire speed limit weight by 5200 lb per knot headwind.
Decrease tire speed limit weight by 6600 lb per knot tailwind.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Brake Energy Limits VMBE

Maximum Brake Energy Speed

OAT (°C)	REFERENCE VMBE (KIAS)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	195	188				
50	196	189	182			
46	196	189	182	176		
42	196	189	183	176	170	
38	197	190	183	176	170	164
34	199	190	184	177	171	165
30	200	191	184	178	172	165
26	202	193	185	179	173	167
22	204	194	187	180	174	168
18	206	196	189	182	175	169
14	208	198	190	183	176	170
10	210	200	192	185	178	171
6	210	202	194	186	179	173
2	210	204	196	188	181	174
-2	210	206	198	190	183	176
-6	210	208	200	192	185	178
-10	210	210	202	194	186	179

Weight Adjusted VMBE

WEIGHT (1000 LB)	REFERENCE VMBE (KIAS)										
	160	165	170	175	180	185	190	195	200	205	210
420	185	191	197	204	210	210	210	210	210	210	210
440	180	186	192	198	204	210	210	210	210	210	210
460	175	181	187	192	198	204	210	210	210	210	210
480	171	176	182	187	193	199	204	210	210	210	210
500	167	172	178	183	188	194	199	204	210	210	210
520	163	168	174	179	184	189	194	200	205	210	210
540	160	165	170	175	180	185	190	195	200	205	210
560	157	162	167	171	176	181	186	191	196	200	205
580	154	159	163	168	173	177	182	187	191	196	201
600	151	156	160	165	169	174	178	183	187	192	197
620	149	153	157	162	166	171	175	179	184	188	193
640	146	151	155	159	164	168	172	176	181	185	189
660	144	148	153	157	161	165	169	173	177	182	186

Increase VMBE by 3 knots per 1% uphill runway slope. Decrease VMBE by 6 knots per 1% downhill runway slope.
Increase VMBE by 5 knot per 10 knots headwind. Decrease VMBE by 23 knots per 10 knots tailwind.
Decrease VMBE by 11 knots for one brake deactivated and 22 knots for two brakes deactivated.
Decrease brake release weight by 5200 lb for each knot V1 exceeds VMBE.
Determine normal V1, VR, V2 speeds for lower brake release weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
680	170	179	184
660	167	176	181
640	164	173	179
620	161	170	176
600	158	167	174
580	154	164	171
560	151	161	169
540	147	157	166
520	144	154	163
500	140	151	160
480	136	147	158
460	132	143	155
440	127	140	151
420	122	136	148
400	117	132	145
380	113	128	142
360	108	124	138
340	102	119	134

Check V1(MCG) and minimum VR.

V1, VR, V2 Adjustments*

TEMP		V1					VR					V2				
		PRESS ALT (FT)					PRESS ALT (FT)					PRESS ALT (FT)				
°C	°F	-2000	0	1000	2000	3000	-2000	0	1000	2000	3000	-2000	0	1000	2000	3000
50	122	5	8	9	11	12	2	3	4	4	5	-1	-2	-2	-2	-2
40	104	0	4	5	6	8	0	2	2	3	3	0	-1	-1	-1	-1
30	86	0	0	2	3	5	0	0	1	2	2	0	0	0	-1	-1
20	68	0	0	1	2	3	0	0	1	1	1	0	0	0	0	-1
-40	-40	0	0	1	2	3	0	0	1	1	1	0	0	0	0	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
680	-5	-2	0	3	5	-3	-1	-1	0	0	1	1	2
660	-5	-2	0	3	5	-3	-1	-1	0	0	1	1	2
620	-4	-2	0	3	5	-2	-1	0	0	1	2	2	2
580	-3	-1	0	3	5	-1	0	0	0	1	2	2	2
540	-3	-1	0	3	4	-1	0	0	0	1	2	2	3
500	-2	0	0	3	4	-1	0	0	0	1	2	2	3
460	-2	0	0	3	4	-1	0	0	0	1	2	2	3
420	-2	0	0	3	4	-1	0	0	0	1	2	2	3
380	-2	0	0	3	4	-1	0	0	0	1	2	2	3
340	-2	0	0	3	4	-1	0	0	0	1	2	2	3

***V1 not to exceed VR**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds

Flaps 15

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)									
		-2000		0		1000		2000		3000	
°C	°F	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR
50	122	104	109	100	105	98	104	96	102	95	101
40	104	110	114	106	111	104	109	102	107	100	105
30	86	110	115	110	115	108	113	106	111	103	109
20	68	110	115	110	115	108	113	107	112	105	110
-40	-40	111	115	111	115	109	113	107	112	106	110

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29500	0	32800*	32800*	32800*	32800*	32200
640	30100	-1	33600*	33600*	33600*	33600*	32900
620	30800	-3	34300*	34300*	34300*	34300*	33500
600	31500	-4	35100*	35100*	35100*	35100*	34200
580	32300	-6	35800*	35800*	35800*	35800*	35000
560	33000	-8	36300*	36300*	36300*	36300*	35700
540	33800	-9	37000*	37000*	37000*	37000*	36400
520	34600	-11	37800*	37800*	37800*	37800*	37200
500	35400	-13	38600*	38600*	38600*	38600*	38000
480	36300	-14	39400*	39400*	39400*	39400*	38900
460	37200	-14	40200*	40200*	40200*	40200*	39800
440	38100	-14	41100*	41100*	41100*	41100*	40700
420	39100	-14	42000*	42000*	42000*	42000*	41700
400	40100	-14	43000*	43000*	43000*	43000*	42700
380	41100	-14	43100	43100	43100	43100	43100
360	42300	-14	43100	43100	43100	43100	43100
340	43100	-14	43100	43100	43100	43100	43100

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29500	6	31800*	31800*	31800*	31800*	31800*
640	30100	5	32600*	32600*	32600*	32600*	32600*
620	30800	3	33400*	33400*	33400*	33400*	33400*
600	31500	1	34300*	34300*	34300*	34300*	34200
580	32300	0	35100*	35100*	35100*	35100*	35000
560	33000	-2	35800*	35800*	35800*	35800*	35700
540	33800	-4	36400*	36400*	36400*	36400*	36400
520	34600	-5	37200*	37200*	37200*	37200*	37200
500	35400	-7	38000*	38000*	38000*	38000*	38000
480	36300	-9	38800*	38800*	38800*	38800*	38800*
460	37200	-9	39600*	39600*	39600*	39600*	39600*
440	38100	-9	40500*	40500*	40500*	40500*	40500*
420	39100	-9	41400*	41400*	41400*	41400*	41400*
400	40100	-9	42300*	42300*	42300*	42300*	42300*
380	41100	-9	43100	43100	43100	43100	43100
360	42300	-9	43100	43100	43100	43100	43100
340	43100	-9	43100	43100	43100	43100	43100

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29500	12	30300*	30300*	30300*	30300*	30300*
640	30100	10	31200*	31200*	31200*	31200*	31200*
620	30800	9	32100*	32100*	32100*	32100*	32100*
600	31500	7	33000*	33000*	33000*	33000*	33000*
580	32300	6	34000*	34000*	34000*	34000*	34000*
560	33000	4	34900*	34900*	34900*	34900*	34900*
540	33800	2	35600*	35600*	35600*	35600*	35600*
520	34600	0	36200*	36200*	36200*	36200*	36200*
500	35400	-2	37000*	37000*	37000*	37000*	37000*
480	36300	-3	37800*	37800*	37800*	37800*	37800*
460	37200	-3	38700*	38700*	38700*	38700*	38700*
440	38100	-3	39500*	39500*	39500*	39500*	39500*
420	39100	-3	40400*	40400*	40400*	40400*	40400*
400	40100	-3	41300*	41300*	41300*	41300*	41300*
380	41100	-3	42300*	42300*	42300*	42300*	42300*
360	42300	-3	43100	43100	43100	43100	43100
340	43100	-3	43100	43100	43100	43100	43100

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
527	496	468	443	420	400	382	366	351	337	324
1041	982	929	882	839	800	766	735	706	679	655
1553	1468	1390	1320	1258	1200	1150	1104	1061	1022	987
2063	1952	1850	1758	1676	1600	1534	1473	1417	1365	1318
2572	2435	2309	2196	2094	2000	1919	1843	1773	1708	1649
3079	2916	2767	2633	2512	2400	2303	2213	2129	2051	1980
3584	3397	3224	3070	2929	2800	2687	2582	2485	2395	2312
4089	3877	3681	3506	3347	3200	3072	2952	2841	2738	2644
4594	4356	4138	3942	3764	3600	3456	3322	3197	3082	2976
5097	4835	4594	4378	4182	4000	3840	3692	3553	3425	3308
5599	5313	5050	4814	4599	4400	4225	4061	3909	3769	3640
6101	5791	5506	5249	5016	4800	4609	4431	4265	4112	3972
6603	6269	5961	5685	5433	5200	4994	4801	4622	4456	4304
7105	6746	6417	6120	5850	5600	5378	5170	4978	4800	4636
7607	7224	6873	6556	6267	6000	5762	5540	5334	5143	4968
8109	7703	7329	6991	6684	6400	6147	5910	5690	5486	5299
8612	8181	7785	7427	7101	6800	6531	6280	6046	5830	5631
9114	8659	8241	7863	7519	7200	6915	6649	6402	6173	5963
9617	9138	8696	8298	7936	7600	7300	7019	6758	6517	6295
10119	9616	9152	8734	8353	8000	7684	7389	7114	6860	6627

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	29		31		33		35 & ABOVE	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
400	16.1	1:02	16.1	1:02	15.9	1:02	15.9	1:02
800	29.3	1:56	28.8	1:56	28.4	1:56	28.1	1:56
1200	42.6	2:48	41.8	2:48	41.0	2:48	40.5	2:48
1600	56.2	3:40	55.0	3:40	53.9	3:40	53.2	3:40
2000	69.8	4:31	68.2	4:31	66.8	4:31	65.9	4:31
2400	83.9	5:22	81.9	5:22	80.3	5:22	79.4	5:22
2800	98.1	6:12	95.7	6:12	93.8	6:12	92.8	6:12
3200	112.5	7:02	109.8	7:02	107.7	7:02	106.8	7:02
3600	127.3	7:52	124.3	7:52	122.0	7:52	121.2	7:52
4000	142.0	8:41	138.7	8:41	136.3	8:41	135.7	8:41
4400	157.5	9:30	153.9	9:30	151.5	9:30	151.6	9:30
4800	172.9	10:19	169.1	10:19	166.7	10:19	167.5	10:19
5200	188.7	11:08	184.8	11:08	182.6	11:08		
5600	204.9	11:57	200.9	11:57	199.1	11:57		
6000	221.1	12:45	217.0	12:45	215.6	12:45		
6400	238.1	13:34	234.2	13:34				
6800	255.0	14:23	251.4	14:23				
7200	272.6	15:11						
7600	290.9	16:00						
8000	309.1	16:49						

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	350	400	450	500	550
20	-2.5	-1.3	0.0	1.5	3.1
40	-4.9	-2.5	0.0	3.0	6.5
60	-7.3	-3.6	0.0	4.7	10.3
80	-9.8	-4.9	0.0	6.5	14.7
100	-12.3	-6.1	0.0	8.6	19.4
120	-14.9	-7.5	0.0	10.8	24.7
140	-17.5	-8.8	0.0	13.2	30.4
160	-20.2	-10.2	0.0	15.7	36.5
180	-23.0	-11.7	0.0	18.4	43.1
200	-25.8	-13.2	0.0	21.3	50.2
220	-28.6	-14.7	0.0	24.4	57.7
240	-31.6	-16.3	0.0	27.6	65.7
260	-34.5	-17.9	0.0	31.0	74.2
280	-37.5	-19.6	0.0	34.5	83.1
300	-40.6	-21.4	0.0	38.3	92.5
320	-43.8	-23.1	0.0	42.2	102.3
340	-46.9	-25.0	0.0	46.3	112.6

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAIL WIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1293	1221	1157	1100	1047	1000	957	917	880	847	815
1923	1820	1728	1645	1569	1500	1437	1379	1325	1276	1230
2553	2419	2299	2190	2091	2000	1917	1841	1770	1705	1644
3183	3018	2869	2735	2612	2500	2397	2302	2215	2134	2058
3812	3617	3440	3280	3134	3000	2877	2764	2660	2563	2473
4442	4215	4010	3824	3655	3500	3358	3226	3105	2992	2888
5072	4814	4581	4369	4177	4000	3838	3688	3550	3422	3302
5701	5412	5151	4914	4698	4500	4318	4150	3995	3851	3717
6331	6011	5722	5459	5219	5000	4798	4612	4440	4280	4131
6961	6610	6292	6004	5741	5500	5278	5074	4885	4709	4546
7591	7208	6863	6549	6262	6000	5759	5536	5330	5139	4961
8221	7807	7433	7094	6784	6500	6239	5998	5775	5568	5375
8851	8406	8004	7639	7306	7000	6719	6460	6220	5997	5789
9481	9005	8575	8184	7827	7500	7199	6921	6664	6426	6204
10112	9605	9146	8729	8349	8000	7679	7383	7109	6855	6618

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB)					TIME (HRS:MIN)
	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	
1000	28.6	31.9	34.6	37.7	40.8	2:16
1500	41.2	46.0	50.4	55.0	59.6	3:18
2000	54.2	60.6	66.6	72.7	79.0	4:20
2500	67.6	75.5	83.3	91.0	98.9	5:22
3000	81.4	90.9	100.4	109.8	119.4	6:24
3500	95.5	106.9	118.0	129.2	140.4	7:25
4000	110.1	123.3	136.1	149.2	162.0	8:27
4500	125.0	140.1	154.8	169.6	184.3	9:29
5000	140.4	157.5	174.0	190.6	207.4	10:31
5500	156.3	175.3	193.8	212.2	231.2	11:32
6000	172.7	193.6	214.2	234.6	256.0	12:34
6500	189.6	212.5	235.0	257.6	282.3	13:36
7000	206.9	232.0	256.5	281.5	308.5	14:38
7500	224.7	252.0	278.7	306.2	337.5	15:40
8000	243.0	272.6	301.5	331.9	366.4	16:43

Based on 310/.84 climb, LRC and .84/310/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
94	80	69	61	55	50	46	42	39	36	34
159	142	129	118	108	100	93	87	82	77	73
224	204	187	173	161	150	141	132	125	119	113
287	264	245	228	213	200	189	178	169	161	153
349	324	301	282	265	250	237	224	214	204	195
411	382	358	336	317	300	285	271	258	247	236
472	441	414	390	369	350	333	317	303	290	278
534	500	471	445	421	400	381	364	348	333	320
597	560	528	499	473	450	429	410	392	376	361
661	621	586	554	526	500	477	456	436	418	402

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 LB)					TIME (HRS:MIN)
		350	400	450	500	550	
50	FUEL (1000 LB)	3.5	3.8	4.0	4.3	4.6	0:14
	ALT (FT)	11000	9000	9000	9000	9000	
100	FUEL (1000 LB)	5.4	5.7	6.0	6.4	6.8	0:22
	ALT (FT)	17000	17000	17000	15000	15000	
150	FUEL (1000 LB)	7.1	7.5	8.0	8.5	9.0	0:30
	ALT (FT)	21000	21000	21000	21000	19000	
200	FUEL (1000 LB)	8.6	9.1	9.7	10.4	11.0	0:36
	ALT (FT)	29000	25000	25000	23000	23000	
250	FUEL (1000 LB)	10.0	10.7	11.4	12.2	13.0	0:43
	ALT (FT)	31000	29000	27000	27000	25000	
300	FUEL (1000 LB)	11.3	12.2	13.1	13.9	14.9	0:48
	ALT (FT)	37000	35000	31000	29000	27000	
350	FUEL (1000 LB)	12.5	13.5	14.6	15.6	16.7	0:54
	ALT (FT)	39000	37000	35000	31000	29000	
400	FUEL (1000 LB)	13.7	14.9	16.1	17.3	18.5	1:00
	ALT (FT)	39000	37000	35000	33000	31000	
450	FUEL (1000 LB)	15.0	16.3	17.6	18.9	20.3	1:06
	ALT (FT)	39000	37000	35000	33000	31000	
500	FUEL (1000 LB)	16.2	17.6	19.1	20.6	22.1	1:13
	ALT (FT)	41000	37000	35000	33000	31000	

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
660	19330	19010	18750	18570	19100	19500	20510			
620	18120	17920	17630	17320	17650	18150	18860			
580	17220	17070	16770	16380	16200	16850	17340	18550		
540	16100	15890	15690	15270	15110	15570	15920	16790		
500	15010	14740	14610	14190	13860	14190	14590	15210		
460	13930	13670	13490	13130	12760	12800	13330	13690	15160	
420	12860	12620	12370	12090	11790	11770	12050	12300	13340	
380	11810	11580	11320	11060	10850	10610	10850	11020	11700	12440
340	10800	10550	10320	10050	9910	9610	9540	9850	10220	10760

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
660	20100	19880	19700	19200	19370
620	18840	18630	18490	17990	17990
580	17910	17670	17470	17040	16580
540	16710	16460	16270	15860	15590
500	15510	15260	15070	14720	14440
460	14320	14090	13880	13580	13320
420	13140	12930	12720	12460	12240
380	11970	11770	11590	11350	11190
340	10850	10640	10470	10270	10160

These tables include 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Oxygen Requirements

Required Pressure (PSI) for One 114/115 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

For more extensive than normal crew usage, add 1.2 psi/person/minute.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
27	351.2	347.7	
26	365.9	363.7	350.5
25	380.6	380.3	365.9
24	395.8	393.6	378.6
23	411.3	407.3	391.9
22	427.4	421.2	405.6
21	444.0	435.3	419.4
20	460.9	449.9	433.4
19	486.0	468.2	447.7
18	512.1	487.1	461.8
17	532.5	506.1	478.7
16	553.5	525.6	495.9
15	575.1	545.8	513.5
14	597.4	566.5	531.4
13	621.6	589.5	554.4
12	646.5	613.4	578.3
11	654.0	620.6	585.8
10	661.1	623.5	590.8
9	675.1	637.0	603.6
8	686.8	649.8	616.1
7	697.7	661.9	628.7
6	709.0	673.1	641.3
5	715.0	683.9	653.5
4	715.0	693.8	663.6

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)										
	PRESSURE ALTITUDE (1000 FT)										
	6	8	10	12	14	16	18	20	22	24	26
ENGINE ONLY	-12.6	-9.2	-7.6	-5.7	-4.4	-5.1	-6.2	-7.4	-7.2	-7.1	-6.7
ENGINE AND WING	-19.6	-15.8	-13.0	-10.2	-8.6	-9.2	-10.3	-11.9	-11.6	-11.2	-10.3

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight
Flaps 30
Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000			2650	3000	3210	3430	3640	3850
3400		2690	3010	3400	3610	3840	4070	4310
3800	2740	3030	3370	3800	4010	4250	4500	4770
4200	3070	3380	3740	4200	4420	4670	4930	5230
4600	3400	3730	4110	4600	4840	5100	5380	5680
5000	3730	4080	4480	5000	5250	5530	5820	6140
5400	4060	4430	4850	5400	5670	5960	6270	6600
5800	4390	4790	5220	5800	6090	6390	6710	7050
6200	4720	5140	5590	6200	6500	6820	7160	7510
6600	5050	5490	5960	6600	6920	7250	7610	7980
7000	5380	5850	6330	7000	7330	7680	8050	8440
7400	5710	6200	6700	7400	7740	8110	8520	8960
7800	6040	6550	7070	7800	8150	8550	8990	9470
8200	6370	6900	7440	8200	8560	8980	9450	9990
8600	6710	7260	7820	8600	8970	9410	9920	10500
9000	7040	7610	8190	9000	9390	9860	10400	11020
9400	7370	7960	8560	9400	9820	10310	10880	11510
9800	7660	8280	8920	9800	10250	10760	11350	12010
10200	7930	8590	9280	10200	10670	11210	11820	12500
10600	8200	8900	9640	10600	11100	11660	12290	12990

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight

Flaps 30

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)							
	0		1000		2000		3000	
	DRY	WET	DRY	WET	DRY	WET	DRY	WET
4200	346.2		335.8		325.4			
4600	390.2	324.3	378.6		367.1		356.0	
5000	434.8	362.4	422.0	351.6	409.2	340.8	396.9	330.4
5400	480.1	400.8	465.9	389.0	451.8	377.1	438.3	365.7
5800	509.6	439.7	500.5	426.8	491.3	413.8	478.4	401.4
6200	536.0	479.1	526.4	465.0	516.8	450.9	507.4	437.4
6600	561.8	505.4	551.8	495.6	541.7	485.9	531.9	472.5
7000	587.0	528.6	576.5	519.1	566.0	509.6	555.7	500.4
7400	611.5	551.3	600.6	541.4	589.7	531.5	579.0	521.8
7800	635.6	573.4	624.2	563.1	612.9	552.9	601.8	542.8
8200	658.7	595.0	647.1	584.4	635.5	573.8	624.1	563.4
8600	678.0	616.3	667.7	605.3	657.4	594.3	645.7	583.5
9000	696.3	637.1	686.1	625.7	675.9	614.4	665.2	603.2
9400	711.2	657.2	701.3	645.6	691.4	634.1	681.0	622.6
9800	724.1	674.3	714.1	663.8	704.2	653.2	693.7	641.5
10200		690.4	726.5	680.3	716.1	670.2	705.7	659.0
10600		705.3		695.3	727.9	685.3	717.2	674.9
11000		716.5		706.7		696.9	728.5	686.4
11400		727.7		717.6		707.5		697.1
11800				728.4		717.9		707.5
12200						728.2		717.5
12600								727.3

With manual speedbrakes, decrease weight by 36800 lb.
With 1 brake deactivated, decrease weight by 36200 lb.
With 2 brakes deactivated, decrease weight by 73800 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	129	509.5			
52	126	524.1	504.0		
50	122	539.1	519.0	497.5	
48	118	555.3	533.9	512.5	493.3
46	115	571.0	549.5	526.9	506.8
44	111	586.0	564.3	541.8	520.4
42	108	600.7	578.4	555.9	533.9
40	104	614.6	591.8	569.1	546.8
38	100	628.0	604.4	581.5	559.3
36	97	640.3	616.1	592.9	570.6
34	93	651.1	627.0	603.2	581.0
32	90	660.2	636.1	612.5	588.7
30	86	668.7	644.0	619.6	596.1
28	82	668.8	651.9	625.1	601.9
26	79	668.9	652.0	630.4	606.1
24	75	669.0	652.2	633.1	610.0
22	72	669.2	652.3	633.3	612.9
20	68	669.3	652.4	633.4	615.3
18	64	669.4	652.5	633.5	615.4
16	61	669.5	652.6	633.6	615.5
14	57	669.6	652.8	633.7	615.6
12	54	669.8	652.9	633.8	615.7
10 & BELOW	50 & BELOW	669.9	653.0	634.0	615.9

Based on engine bleed for 2 packs on and engine anti-ice on or off and wing anti-ice off.
With engine bleed for packs off, increase weight by 4800 lb.
With engine anti-ice on, decrease weight by 1100 lb.
With engine and wing anti-ice on, decrease weight by 4800 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 43300 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 20, Gear Up

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.93					
50	3.70	2.65				
46	4.45	3.41	2.39			
42	5.18	4.08	3.02	2.05		
38	5.86	4.72	3.59	2.63	1.69	
34	6.46	5.24	4.12	3.08	2.12	1.21
39	6.87	5.62	4.48	3.42	2.36	1.36
26	6.88	5.89	4.70	3.60	2.53	1.49
22	6.88	5.95	4.83	3.73	2.66	1.62
18	6.89	5.96	4.97	3.85	2.77	1.74
14	6.89	5.97	5.01	3.98	2.89	1.84
10	6.90	5.97	5.02	4.05	3.01	1.94

Weight Adjustment

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)						
	1	2	3	4	5	6	7
650	-3.13	-3.53	-3.89	-4.23	-4.57	-4.90	-5.21
600	-2.58	-2.89	-3.19	-3.46	-3.74	-4.00	-4.26
550	-1.91	-2.12	-2.34	-2.53	-2.73	-2.93	-3.12
500	-1.06	-1.19	-1.30	-1.41	-1.52	-1.63	-1.74
450	0.00	0.00	0.00	0.00	0.00	0.00	0.00
400	1.35	1.49	1.62	1.76	1.90	2.06	2.21
350	3.10	3.40	3.71	4.03	4.36	4.72	5.10

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)							
	1	2	3	4	5	6	7	8
VREF	-0.30	-0.31	-0.32	-0.33	-0.34	-0.34	-0.34	-0.34
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF+10	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24
VREF+20	0.55	0.54	0.53	0.52	0.50	0.49	0.47	0.45
VREF+30	0.63	0.60	0.55	0.49	0.44	0.39	0.35	0.32

With engine bleed for packs off, increase gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.1%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 0.6%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Quick Turnaround Limit Weight

Flaps 30 Limit Weight (1000 LB)

AIRPORT OAT		PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	512				
50	122	516	496			
45	113	520	500	481		
40	104	525	504	484	466	
35	95	530	509	489	470	452
30	86	534	513	493	474	456
25	77	539	518	497	478	460
20	68	544	523	502	482	464
15	59	550	528	507	486	468
10	50	555	533	512	491	472
5	41	560	538	517	496	476
0	32	566	544	522	501	480
-5	23	572	549	527	506	485
-10	14	578	555	533	511	490
-15	5	584	561	538	516	495
-20	-4	591	567	544	522	500
-30	-22	604	580	556	534	511
-40	-40	618	594	570	546	523
-50	-58	633	608	584	560	536
-54	-65	640	614	589	565	541

Increase weight by 4800 lb per 1% uphill slope. Decrease weight by 10700 lb per 1% downhill slope. Increase weight by 13000 lb per 10 knots headwind. Decrease weight by 74000 lb per 10 knots tailwind.

Decrease weight by 28000 lb when one brake is deactivated. Decrease weight by 57300 lb when two brakes are deactivated.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Climb Limit Weight

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 LB)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	129	369.1	361.1	358.5	355.6
52	126	378.8	363.3	358.5	355.4
50	122	388.5	374.1	360.7	355.4
48	118	398.2	384.9	371.0	357.6
46	115	408.3	395.5	381.6	367.5
44	111	418.0	406.3	391.5	377.0
42	108	427.0	416.2	401.2	386.5
40	104	435.8	425.5	410.9	395.9
38	100	444.7	434.7	420.0	405.0
36	97	453.5	443.6	428.8	413.8
34	93	462.5	451.9	436.7	422.4
32	90	471.6	459.9	444.4	429.9
30	86	480.4	467.2	451.7	437.2
28	82	489.6	474.0	457.9	443.3
26	79	498.2	481.7	464.1	448.9
24	75	502.6	489.0	470.7	454.1
22	72	502.6	492.3	477.1	459.9
20	68	502.6	492.3	480.2	465.6
18	64	502.6	492.3	480.2	468.0
16	61	502.6	492.3	480.2	468.0
14	57	502.6	492.3	479.9	468.0
12	54	502.9	492.3	479.9	468.0
10	50	502.9	492.3	479.9	468.0

With engine anti-ice on, decrease weight by 17000 lb.
With engine and wing anti-ice on, decrease weight by 23100 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	129	439.8			
52	126	452.1	435.0		
50	122	464.7	447.8	429.5	
48	118	478.5	460.6	442.5	426.2
46	115	491.7	473.6	454.8	437.8
44	111	504.3	485.9	467.1	449.3
42	108	516.7	497.6	478.7	460.3
40	104	528.6	509.1	489.7	470.9
38	100	540.4	520.0	500.4	481.3
36	97	551.1	530.0	510.1	490.9
34	93	560.0	539.0	518.4	499.5
32	90	567.8	546.8	526.3	506.0
30	86	575.2	553.7	532.6	512.3
28	82	575.3	560.2	537.3	517.0
26	79	575.4	560.3	541.7	520.4
24	75	575.6	560.4	544.0	523.6
22	72	575.7	560.5	544.1	526.0
20	68	575.7	560.6	544.2	528.0
18	64	575.8	560.7	544.3	528.1
16	61	575.9	560.8	544.3	528.1
14	57	576.0	560.9	544.4	528.2
12	54	576.2	561.0	544.5	528.3
10	50	576.3	561.1	544.6	528.4
-40	-40	578.0	562.8	546.3	530.0

Based on engine bleed for 2 packs on, APU on or off, engine anti-ice off and wing anti-ice off.
With engine bleed for packs off, increase weight by 4000 lb.
With engine anti-ice on, decrease weight by 1000 lb.
With engine and wing anti-ice on, decrease weight by 4200 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 57600 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 30°C & Below, Zero Wind

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	506.0	542.7	573.4	598.1					
50	484.0	517.4	544.5	566.1	582.9	595.6			
100	455.7	494.1	520.0	540.9	557.8	571.3	582.0	590.6	597.5
150	431.8	474.1	500.6	521.5	538.5	552.5	564.0	573.5	581.3
200	412.1	453.8	484.4	505.1	522.3	536.8	548.8	558.8	567.3
250	395.1	436.0	468.0	490.8	508.2	522.9	535.3	545.9	554.9
300	380.0	420.4	452.4	477.6	495.4	510.4	523.2	534.1	543.6
350	366.5	406.5	438.3	464.0	484.0	499.0	512.0	523.3	533.1
400	354.3	393.8	425.5	451.3	472.3	488.5	501.7	513.3	523.3
450	343.1	382.2	413.7	439.6	461.0	478.6	492.1	503.9	514.2
500	343.9	371.4	402.9	428.7	450.3	468.4	483.2	495.0	505.6
550		361.4	392.7	418.6	440.3	458.6	474.1	486.8	497.4
600		352.1	383.2	409.1	430.9	449.4	465.2	478.7	489.7
650		343.4	374.3	400.2	422.0	440.7	456.7	470.5	482.3
700			365.9	391.7	413.6	432.4	448.6	462.6	474.8
750			357.9	383.7	405.6	424.5	440.8	455.0	467.5
800			350.3	376.0	398.0	416.9	433.4	447.8	460.4
850			343.2	368.8	390.7	409.7	426.2	440.8	453.6
900				361.8	383.8	402.8	419.4	434.0	447.0
950				355.2	377.1	396.2	412.9	427.6	440.6
1000				348.8	370.7	389.8	406.5	421.3	434.5

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)							
	340	380	420	460	500	540	580	620
30 & Below	0	0	0	0	0	0	0	0
32	-4.9	-5.6	-6.4	-7.2	-7.9	-8.7	-9.4	-10.2
34	-9.8	-11.3	-12.8	-14.3	-15.8	-17.3	-18.8	-20.3
36	-14.7	-16.9	-19.2	-21.5	-23.7	-26.0	-28.2	-30.5
38	-19.6	-22.6	-25.6	-28.6	-31.6	-34.6	-37.6	-40.6
40	-24.5	-28.2	-32.0	-35.8	-39.5	-43.3	-47.0	-50.8
42	-31.6	-36.4	-41.2	-45.9	-50.7	-55.5	-60.2	-65.0
44	-38.7	-44.5	-50.3	-56.1	-61.9	-67.7	-73.5	-79.2
46	-45.9	-52.7	-59.5	-66.3	-73.1	-79.9	-86.7	-93.5
48	-53.0	-60.8	-68.6	-76.4	-84.2	-92.1	-99.9	-107.7
50	-60.1	-68.9	-77.8	-86.6	-95.4	-104.3	-113.1	-121.9

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	340	380	420	460	500	540	580	620
S.L. & Below	0	0	0	0	0	0	0	0
1000	-12.7	-14.2	-15.6	-17.1	-18.6	-20.0	-21.5	-23.0
2000	-26.6	-29.5	-32.3	-35.2	-38.0	-40.9	-43.7	-46.5
3000	-39.8	-44.1	-48.3	-52.6	-56.8	-61.1	-65.3	-69.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	340	380	420	460	500	540	580	620
15 TW	-54.4	-51.7	-49.0	-46.4	-43.7	-41.0	-38.4	-35.7
10 TW	-36.3	-34.5	-32.7	-30.9	-29.1	-27.4	-25.6	-23.8
5 TW	-18.1	-17.2	-16.3	-15.5	-14.6	-13.7	-12.8	-11.9
0	0	0	0	0	0	0	0	0
10 HW	8.0	7.2	6.3	5.5	4.7	3.8	3.0	2.2
20 HW	16.0	14.3	12.7	11.0	9.3	7.7	6.0	4.3
30 HW	24.0	21.7	19.3	17.0	14.7	12.3	10.0	7.7
40 HW	32.0	29.0	26.0	23.0	20.0	17.0	14.0	11.0

With engine bleed for packs off, increase weight by 300 lb.
With engine anti-ice on, decrease weight by 2400 lb.
With engine and wing anti-ice on, decrease weight by 3500 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	14400	14300	12000
640	15800	15700	13600
620	17100	17000	15100
600	18400	18300	16500
580	19700	19600	17900
560	20800	20700	19300
540	21900	21800	20500
520	23000	22900	21700
500	24200	24100	22800
480	25300	25200	24000
460	26300	26100	25100
440	27300	27100	26200
420	28300	28000	27200
400	29400	29100	28300
380	30600	30100	29400
360	31500	31200	30600
340	32200	31900	31500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
323	289	260	236	217	200	187	175	165	156	148
483	433	389	354	325	300	281	263	248	234	222
642	576	518	472	434	400	375	352	331	313	297
800	718	647	590	542	500	468	440	414	391	372
958	860	775	707	650	600	562	528	497	470	447
1115	1002	904	824	758	700	656	616	581	549	522
1272	1143	1031	941	866	800	750	705	664	628	597
1428	1284	1159	1058	974	900	844	793	747	707	672
1583	1424	1286	1174	1082	1000	938	881	830	786	747
1737	1564	1413	1291	1189	1100	1032	970	914	865	823
1891	1703	1540	1408	1297	1200	1126	1058	998	944	898
2045	1842	1667	1524	1405	1300	1219	1146	1081	1023	973
2198	1981	1793	1640	1513	1400	1313	1235	1165	1103	1049
2350	2120	1920	1757	1620	1500	1408	1324	1249	1183	1125
2502	2258	2046	1873	1728	1600	1502	1413	1333	1263	1201
2653	2396	2171	1988	1835	1700	1596	1501	1417	1342	1276
2804	2533	2297	2104	1943	1800	1690	1590	1500	1421	1352
2955	2671	2423	2220	2050	1900	1784	1679	1585	1501	1429
3105	2808	2548	2336	2157	2000	1878	1768	1669	1581	1505
3254	2944	2673	2451	2265	2100	1973	1857	1753	1661	1581
3403	3080	2797	2566	2372	2200	2067	1946	1837	1741	1657

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	18.2	0:50	17.3	0:49	16.8	0:47	16.7	0:46	17.1	0:46
300	26.6	1:13	25.2	1:10	24.1	1:08	23.7	1:06	24.1	1:06
400	35.0	1:35	33.0	1:31	31.5	1:28	30.8	1:25	31.2	1:25
500	43.5	1:57	41.0	1:52	38.9	1:48	38.0	1:45		
600	52.1	2:19	48.9	2:13	46.4	2:09	45.2	2:04		
700	60.8	2:41	57.1	2:34	54.1	2:29	52.6	2:23		
800	69.5	3:03	65.2	2:55	61.7	2:49	60.0	2:43		
900	78.3	3:24	73.5	3:16	69.5	3:08	67.6	3:02		
1000	87.2	3:46	81.8	3:36	77.4	3:28	75.3	3:21		
1100	96.3	4:07	90.3	3:57	85.4	3:48	83.1	3:39		
1200	105.3	4:28	98.8	4:17	93.4	4:07	90.9	3:58		
1300	114.6	4:49	107.4	4:37	101.5	4:27	99.0	4:17		
1400	123.8	5:10	116.0	4:57	109.7	4:46	107.1	4:36		
1500	133.2	5:30	124.9	5:17	118.1	5:06				
1600	142.7	5:51	133.7	5:37	126.5	5:25				
1700	152.3	6:12	142.7	5:57	135.1	5:44				
1800	161.9	6:32	151.7	6:16	143.7	6:03				
1900	171.7	6:52	160.8	6:36	152.6	6:22				
2000	181.5	7:12	170.0	6:55	161.4	6:41				
2100	191.5	7:32	179.4	7:15	170.5	7:00				
2200	201.5	7:52	188.8	7:34	179.5	7:19				

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	350	400	450	500	550
20	-2.4	-1.2	0.0	1.6	3.3
40	-4.6	-2.3	0.0	3.2	6.6
60	-6.7	-3.4	0.0	4.8	10.1
80	-8.9	-4.5	0.0	6.5	13.7
100	-11.2	-5.6	0.0	8.2	17.4
120	-13.5	-6.8	0.0	10.1	21.3
140	-15.8	-8.0	0.0	12.0	25.4
160	-18.1	-9.2	0.0	14.0	29.7
180	-20.5	-10.4	0.0	16.0	34.0
200	-22.9	-11.7	0.0	18.2	38.6
220	-25.4	-12.9	0.0	20.4	43.3
240	-27.9	-14.2	0.0	22.6	48.2
260	-30.4	-15.5	0.0	24.9	53.2

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
99	83	71	62	55	50	46	42	39	36	33
174	152	134	121	109	100	92	85	80	75	70
249	220	197	178	163	150	139	129	121	114	107
323	287	259	236	216	200	186	174	163	153	145
396	354	321	293	270	250	233	218	205	193	183
468	421	382	350	323	300	280	262	247	233	221
541	488	444	407	377	350	327	307	289	273	259
614	554	506	465	430	400	374	351	331	313	297
687	622	568	522	483	450	421	395	373	353	335
762	690	630	580	537	500	468	440	414	392	372

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)					TIME (HRS:MIN)
		300	350	400	450	500	
50	FUEL (1000 LB)	4.2	4.6	4.9	5.3	5.7	0:15
	ALT (FT)	14000	12000	10000	10000	8000	
100	FUEL (1000 LB)	7.2	7.8	8.5	9.2	9.9	0:26
	ALT (FT)	22000	18000	18000	16000	16000	
150	FUEL (1000 LB)	9.8	10.8	11.8	12.8	13.9	0:36
	ALT (FT)	26000	22000	20000	20000	18000	
200	FUEL (1000 LB)	12.3	13.7	15.0	16.4	17.8	0:46
	ALT (FT)	28000	26000	24000	22000	20000	
250	FUEL (1000 LB)	14.8	16.5	18.1	19.8	21.6	0:55
	ALT (FT)	30000	28000	24000	22000	20000	
300	FUEL (1000 LB)	17.3	19.3	21.3	23.3	25.5	1:05
	ALT (FT)	30000	28000	24000	22000	20000	
350	FUEL (1000 LB)	19.8	22.1	24.5	26.9	29.4	1:14
	ALT (FT)	30000	28000	26000	22000	20000	
400	FUEL (1000 LB)	22.3	24.9	27.7	30.4	33.3	1:24
	ALT (FT)	30000	28000	26000	22000	20000	
450	FUEL (1000 LB)	24.8	27.8	30.9	34.0	37.2	1:33
	ALT (FT)	30000	28000	26000	22000	20000	
500	FUEL (1000 LB)	27.3	30.6	34.1	37.6	41.2	1:43
	ALT (FT)	30000	28000	26000	22000	20000	

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
660	30550	30000	30290	31040			
620	28790	28170	28320	28710			
580	27230	26590	26570	26740	28330		
540	25720	25160	24930	24950	25940		
500	24120	23720	23360	23190	23690		
460	22510	22210	21830	21490	21710	23080	
420	20910	20590	20290	19770	19850	20560	
380	19320	18980	18770	18150	18100	18490	20080
340	18050	17720	17440	16880	16410	16660	17400

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
660	29330	28790	29140	29660	
620	27540	26970	27120	27400	
580	25860	25370	25270	25430	26620
540	24250	23930	23630	23640	24270
500	22600	22330	22030	21840	22100
460	20980	20680	20460	20040	20160
420	19350	19040	18880	18300	18350
380	18020	17740	17510	16990	16620
340	16410	16160	15900	15460	15220

These tables include 5% additional fuel for holding in a racetrack pattern.
Do not hold at Flaps 1 in icing conditions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
14	350.1	342.7	
12	377.2	372.0	366.0
10	395.9	389.9	383.5
8	419.6	412.0	404.3
6	443.6	433.7	424.0
4	466.7	453.2	440.3
2	487.9	470.6	453.6
0	503.1	475.5	

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)						
	PRESSURE ALTITUDE (1000 FT)						
	2	4	6	8	10	12	14
ENGINE ONLY	-14.3	-12.2	-10.4	-8.4	-7.1	-5.2	-4.0
ENGINE AND WING	-21.0	-18.1	-15.7	-13.1	-10.9	-8.6	-6.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Tire, Brake Energy and Obstacle Limit Weights as determined from the following tables.

Field Limit Weight - Slope and Wind Corrections

These tables provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude.

Obstacle Limit Weight

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Tire Speed Limit

Maximum tire speed limited weights are presented for 235 MPH tires. To determine the tire speed limit weight, enter the table with OAT, move to airport pressure altitude and read the tire speed limit weight. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limits VMBE

Tables are presented to determine the Maximum Brake Energy Speed VMBE. Compliance with this limitation is required to ensure that the brakes have enough capacity to execute a maximum effort stop from V1 without the use of thrust reversers. Enter the upper table with pressure altitude and OAT to determine the reference VMBE. Then enter the lower table with the reference VMBE and brake release weight to determine VMBE for a specific takeoff. Adjust for slope, wind and deactivated brakes as described below the table. The resulting VMBE must be greater than or equal to V1. If VMBE is less than V1, brake release weight must be decreased by the amount shown below the table.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal takeoff speeds, V1, VR, and V2 are read from the table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle and brake energy limit weights and the V1 and VMBE must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 8100 lb and the V1 associated with the reduced weight by one knot. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 17000 lb and the V1 associated with the reduced weight by three knots. If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate stop distance available corrected for wind and slope exceeds approximately 4200 ft for one brake deactivated or 4400 ft for two brakes deactivated.

For brake(s) deactivated, reduce VMBE by the amount shown on the Brake Energy Limit VMBE Chart. If the resulting VMBE is less than V1, the brake release weight must be reduced according to the instructions on the brake energy limit chart. The resulting V1 must not be less than V1(MCG). Determine VR and V2 for the actual weight.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time Table with air distance from the Ground to Air Miles Conversion Table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the planned landing weight to obtain fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time required with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Oxygen Requirements

Flight Crew System

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with these requirements is achieved with the minimum dispatch oxygen cylinder pressure. Enter the Crew Oxygen Requirements table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate bottle temperature.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 2.05 liters/person/minute (1.2 psi/person/minute for the single cylinder system), or 13 liters/person/minute (8 psi/person/minute) if 100% oxygen is selected during normal usage.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-around Gradient table with airport OAT and pressure altitude to determine the reference Go-Around Gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted Go-Around Gradient. Apply the necessary engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777-300ER GE90-115BL LB C FT FAA TO1-10 TO2-20 HIGH_ALT TALPA

Pkg Model Identification PD.ModID.30.1

Takeoff. PD.30.1

Takeoff Field Corrections - Dry Runway PD.30.1
Takeoff Field & Climb Limit Weights - Dry Runway PD.30.2
Takeoff Field Corrections - Wet Runway PD.30.6
Takeoff Field & Climb Limit Weights - Wet Runway PD.30.7
Takeoff Obstacle Limit Weight. PD.30.11
Tire Speed Limit PD.30.13
Takeoff Speeds - Dry Runway PD.30.14
Takeoff Speeds - Wet Runway PD.30.16

Enroute PD.31.1

Long Range Cruise Maximum Operating Altitude. PD.31.1
Long Range Cruise Trip Fuel and Time PD.31.5
Long Range Cruise Step Climb PD.31.7
Short Trip Fuel and Time PD.31.8
Holding Planning PD.31.9
Crew Oxygen Requirements. PD.31.10
Net Level Off Weight PD.31.11

Landing PD.32.1

Landing Field Limit Weight - Dry Runway PD.32.1
Landing Field Limit Weight - Wet Runway PD.32.3
Approach or Landing Climb Limited Weight. PD.32.4
Go-Around Climb Gradient PD.32.5
Quick Turnaround Limit Weight. PD.32.6

Gear Down. PD.33.1

Takeoff Climb Limit Weight. PD.33.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight PD.33.2
Takeoff Obstacle Limit Weight PD.33.3
Long Range Cruise Altitude Capability PD.33.5
Long Range Cruise Trip Fuel and Time PD.33.6
Short Trip Fuel and Time PD.33.8
Holding Planning PD.33.9
Net Level Off Weight PD.33.10

Text PD.34.1

Introduction PD.34.1
Takeoff PD.34.1
Enroute PD.34.4
Landing PD.34.6
Gear Down PD.34.7

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
221	HL7202	60377	WE479
222	HL7203	60378	WE480
223	HL7204	60380	WE481
224	HL7205	60379	WE482
219	HL8041	60375	WE477
220	HL8042	60376	WE478
225	HL8346	63434	WE483
226	HL8347	63435	WE484

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field Corrections - Dry Runway

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4300	4270	4250	4220	4200	4150	4110	4060	4020
4600	4700	4680	4650	4630	4600	4540	4480	4420	4360
5000	5110	5090	5060	5030	5000	4930	4860	4780	4710
5400	5520	5490	5460	5430	5400	5310	5230	5140	5060
5800	5930	5900	5870	5830	5800	5700	5600	5500	5410
6200	6340	6310	6270	6240	6200	6090	5980	5860	5750
6600	6750	6710	6680	6640	6600	6470	6350	6220	6100
7000	7160	7120	7080	7040	7000	6860	6720	6580	6450
7400	7590	7540	7490	7450	7400	7250	7100	6940	6790
7800	8040	7980	7920	7860	7800	7630	7470	7300	7140
8200	8490	8420	8340	8270	8200	8020	7840	7670	7490
8600	8940	8850	8770	8680	8600	8410	8220	8030	7830
9000	9390	9290	9190	9100	9000	8800	8590	8390	8180
9400	9840	9730	9620	9510	9400	9180	8960	8750	8530
9800	10290	10170	10040	9920	9800	9570	9340	9110	8870
10200	10720	10590	10460	10330	10200	9960	9710	9470	9220
10600	11160	11020	10880	10740	10600	10340	10080	9830	9570
11000	11590	11440	11290	11150	11000	10730	10460	10190	9920
11400	12020	11870	11710	11560	11400	11120	10830	10550	10260
11800	12460	12290	12130	11960	11800	11500	11200	10910	10610

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3160	3500	3850	4200	4480	4710	4870	4960
4600	3490	3860	4230	4600	4890	5130	5310	5440
5000	3820	4220	4610	5000	5300	5550	5750	5910
5400	4160	4570	4990	5400	5700	5970	6200	6380
5800	4490	4930	5360	5800	6110	6390	6640	6850
6200	4820	5280	5740	6200	6520	6810	7080	7330
6600	5160	5640	6120	6600	6920	7230	7520	7800
7000	5490	5990	6500	7000	7330	7650	7970	8270
7400	5830	6350	6880	7400	7740	8080	8410	8740
7800	6160	6710	7250	7800	8150	8500	8840	9190
8200	6490	7060	7630	8200	8560	8920	9280	9640
8600	6830	7420	8010	8600	8970	9340	9710	10090
9000	7160	7770	8390	9000	9380	9760	10150	10540
9400	7490	8130	8760	9400	9790	10180	10580	10990
9800	7830	8490	9140	9800	10200	10600	11010	11440
10200	8160	8840	9520	10200	10610	11020	11450	11890
10600	8500	9200	9900	10600	11020	11440	11880	12340
11000	8830	9550	10280	11000	11430	11870	12320	12790
11400	9160	9910	10650	11400	11840	12290	12750	13240
11800	9500	10270	11030	11800	12250	12710	13190	13690

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	549.2	495.8	492.5	489.3	486.1	483.0	473.2	461.4	448.3	434.8	421.2
5000	575.4	519.8	516.3	513.0	509.7	506.4	496.3	483.9	470.3	456.2	442.0
5400	600.5	542.7	539.2	535.7	532.3	528.9	518.3	505.5	491.3	476.7	462.0
5800	624.7	564.9	561.2	557.6	554.0	550.5	539.6	526.3	511.7	496.5	481.3
6200	647.9	586.2	582.4	578.6	575.0	571.4	560.1	546.3	531.2	515.6	499.9
6600	670.2	606.6	602.7	598.9	595.1	591.4	579.8	565.6	550.1	534.0	517.8
7000	691.6	626.3	622.3	618.3	614.5	610.7	598.7	584.2	568.2	551.7	535.1
7400	711.9	645.1	640.9	636.9	632.9	629.0	616.8	602.0	585.6	568.7	551.7
7800	731.5	663.2	659.0	654.9	650.8	646.9	634.4	619.2	602.5	585.2	567.8
8200	751.3	681.6	677.3	673.1	668.9	664.9	652.1	636.7	619.6	601.9	584.2
8600	770.2	699.1	694.7	690.4	686.2	682.1	669.1	653.3	635.9	617.9	599.8
9000	787.1	714.7	710.2	705.8	701.5	697.3	684.1	668.0	650.3	631.9	613.5
9400	802.6	728.8	724.3	719.8	715.4	711.2	697.7	681.3	663.2	644.5	625.8
9800	817.8	742.7	738.1	733.6	729.1	724.7	711.0	694.3	676.0	656.9	637.8
10200	832.6	756.3	751.6	747.0	742.4	738.0	724.0	707.1	688.4	669.0	649.6
10600	834.9	769.5	764.7	760.0	755.4	750.9	736.7	719.5	700.5	680.8	661.1
11000	834.9	782.4	777.5	772.8	768.1	763.5	749.1	731.6	712.3	692.3	672.2
CLIMB LIMIT WT (1000 LB)	823.3	823.2	822.9	822.6	822.3	821.9	794.3	763.1	728.8	695.6	662.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	513.5	465.3	462.2	459.2	456.3	447.9	438.5	427.2	414.9	400.0	386.1
5000	538.2	488.0	484.8	481.7	478.6	469.9	460.1	448.3	435.5	420.0	405.5
5400	561.9	509.8	506.4	503.1	500.0	490.9	480.8	468.5	455.2	439.1	424.0
5800	584.7	530.7	527.3	523.9	520.6	511.2	500.7	488.0	474.2	457.5	442.0
6200	606.6	550.9	547.3	543.8	540.4	530.7	519.9	506.8	492.5	475.3	459.3
6600	627.7	570.4	566.7	563.1	559.6	549.6	538.4	524.9	510.3	492.5	476.0
7000	647.9	589.1	585.3	581.6	578.0	567.7	556.3	542.4	527.4	509.2	492.2
7400	667.2	606.9	603.1	599.3	595.6	585.1	573.4	559.2	543.8	525.2	507.8
7800	685.8	624.3	620.3	616.4	612.7	601.9	590.0	575.4	559.7	540.7	522.9
8200	704.7	641.8	637.8	633.8	630.0	619.0	606.8	592.0	575.9	556.5	538.4
8600	722.6	658.6	654.4	650.4	646.5	635.3	622.9	607.7	591.4	571.6	553.1
9000	738.7	673.4	669.2	665.1	661.1	649.7	637.0	621.6	604.9	584.7	565.9
9400	753.2	686.7	682.5	678.3	674.2	662.6	649.7	634.0	617.0	596.5	577.3
9800	767.6	699.9	695.6	691.3	687.2	675.4	662.2	646.2	629.0	608.0	588.5
10200	781.6	712.7	708.3	704.0	699.8	687.8	674.4	658.1	640.6	619.3	599.4
10600	795.2	725.2	720.7	716.3	712.1	699.9	686.2	669.7	651.9	630.2	610.1
11000	808.5	737.4	732.9	728.4	724.0	711.7	697.8	681.1	662.9	641.0	620.4
CLIMB LIMIT WT (1000 LB)	779.2	778.9	778.6	778.4	778.1	756.9	733.8	704.6	673.5	640.1	610.2

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	479.2	434.6	431.7	428.8	422.4	414.1	403.9	393.0	380.3	367.0	355.3
5000	502.5	456.0	453.0	450.0	443.3	434.7	424.0	412.7	399.4	385.6	373.4
5400	524.8	476.4	473.3	470.2	463.3	454.4	443.2	431.5	417.7	403.3	390.7
5800	546.3	496.2	493.0	489.8	482.7	473.4	461.8	449.7	435.4	420.5	407.4
6200	567.0	515.3	512.0	508.7	501.3	491.7	479.8	467.3	452.5	437.2	423.6
6600	586.9	533.7	530.3	526.8	519.3	509.4	497.1	484.2	469.1	453.2	439.3
7000	606.1	551.4	547.9	544.4	536.6	526.5	513.9	500.6	485.1	468.8	454.5
7400	624.3	568.4	564.8	561.2	553.2	542.9	530.0	516.4	500.5	483.9	469.2
7800	642.1	584.9	581.2	577.5	569.4	558.8	545.6	531.8	515.5	498.5	483.5
8200	660.0	601.6	597.9	594.1	585.8	575.0	561.5	547.4	530.8	513.4	498.1
8600	677.1	617.6	613.7	609.9	601.4	590.4	576.7	562.3	545.3	527.6	512.1
9000	692.2	631.6	627.7	623.8	615.2	603.9	590.0	575.3	558.0	540.0	524.1
9400	706.0	644.2	640.2	636.3	627.5	616.0	601.8	586.9	569.3	550.9	534.8
9800	719.5	656.6	652.6	648.5	639.6	627.9	613.5	598.2	580.3	561.6	545.2
10200	732.6	668.7	664.6	660.5	651.4	639.5	624.8	609.3	591.1	572.1	555.3
10600	745.4	680.5	676.3	672.1	662.8	650.8	635.8	620.1	601.6	582.3	565.2
11000	758.0	692.0	687.7	683.5	674.1	661.8	646.6	630.6	611.8	592.2	574.9
CLIMB LIMIT WT (1000 LB)	726.9	726.6	726.4	726.1	714.1	696.2	673.1	648.6	619.1	589.4	564.4

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	445.9	403.3	400.3	394.9	386.8	377.0	368.3	358.8	347.6	336.6	326.0
5000	467.8	423.3	420.3	414.6	406.2	396.0	386.9	377.1	365.3	353.9	342.8
5400	488.7	442.6	439.4	433.5	424.8	414.2	404.7	394.5	382.3	370.4	358.9
5800	509.0	461.2	457.9	451.8	442.8	431.8	422.0	411.4	398.8	386.5	374.6
6200	528.4	479.1	475.7	469.4	460.1	448.8	438.6	427.7	414.7	402.0	389.7
6600	547.2	496.4	492.9	486.4	476.9	465.2	454.8	443.5	430.1	417.0	404.4
7000	565.3	513.1	509.6	502.9	493.1	481.1	470.4	458.8	445.0	431.6	418.7
7400	582.6	529.2	525.6	518.7	508.7	496.4	485.5	473.7	459.5	445.8	432.5
7800	599.4	544.8	541.1	534.1	523.8	511.3	500.1	488.0	473.6	459.6	446.0
8200	616.4	560.7	556.9	549.8	539.3	526.5	515.1	502.8	488.0	473.7	459.9
8600	632.7	575.9	572.0	564.7	554.0	541.0	529.3	516.8	501.8	487.2	473.0
9000	647.0	589.1	585.2	577.8	566.9	553.6	541.7	528.9	513.6	498.7	484.3
9400	659.9	601.0	597.0	589.4	578.3	564.8	552.7	539.6	524.1	508.9	494.3
9800	672.6	612.6	608.5	600.8	589.5	575.7	563.4	550.2	534.3	518.9	504.0
10200	684.9	623.9	619.8	611.9	600.4	586.4	573.9	560.4	544.3	528.6	513.4
10600	697.0	635.0	630.7	622.8	611.1	596.8	584.1	570.4	554.0	538.1	522.6
11000	708.7	645.7	641.4	633.3	621.5	607.0	594.1	580.2	563.5	547.3	531.6
CLIMB LIMIT WT (1000 LB)	674.9	674.9	674.6	667.1	651.5	631.2	612.9	592.5	567.3	543.2	520.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	409.4	369.4	364.4	357.3	348.5	340.4	331.8	322.0	311.9	302.0	292.0
5000	429.8	388.0	382.9	375.5	366.3	357.8	348.9	338.7	328.1	317.8	307.4
5400	449.2	405.9	400.5	392.8	383.3	374.5	365.2	354.7	343.7	333.0	322.2
5800	468.1	423.2	417.6	409.7	399.8	390.7	381.1	370.1	358.8	347.7	336.5
6200	486.2	439.9	434.2	425.9	415.8	406.3	396.4	385.1	373.4	361.9	350.4
6600	503.7	456.0	450.2	441.7	431.2	421.5	411.3	399.7	387.6	375.8	363.9
7000	520.7	471.7	465.6	456.9	446.2	436.2	425.8	413.8	401.4	389.3	377.1
7400	536.9	486.8	480.6	471.7	460.7	450.5	439.8	427.6	414.9	402.5	390.0
7800	552.7	501.5	495.2	486.1	474.8	464.4	453.4	440.9	427.9	415.3	402.5
8200	568.8	516.5	510.0	500.7	489.3	478.6	467.5	454.7	441.4	428.5	415.5
8600	584.1	530.8	524.2	514.7	503.0	492.2	480.8	467.8	454.2	441.1	427.8
9000	597.5	543.2	536.5	526.8	514.9	503.8	492.2	479.0	465.2	451.8	438.3
9400	609.5	554.2	547.3	537.5	525.4	514.1	502.3	488.8	474.8	461.1	447.3
9800	621.3	564.9	558.0	548.0	535.6	524.2	512.2	498.4	484.1	470.2	456.2
10200	632.7	575.4	568.4	558.2	545.6	534.0	521.7	507.8	493.2	479.1	464.8
10600	643.9	585.7	578.5	568.1	555.3	543.5	531.1	516.9	502.1	487.7	473.2
11000	654.8	595.7	588.4	577.9	564.9	552.9	540.2	525.8	510.8	496.2	481.5
CLIMB LIMIT WT (1000 LB)	620.6	620.5	613.3	599.8	581.8	565.4	547.3	526.4	504.0	482.8	461.8

9000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	391.4	351.8	346.5	338.4	330.2	322.3	313.3	303.6	293.8	284.1	274.4
5000	411.1	369.8	364.2	355.8	347.2	338.9	329.6	319.5	309.3	299.2	289.0
5400	429.9	387.0	381.2	372.4	363.5	354.9	345.2	334.7	324.1	313.6	303.1
5800	448.0	403.6	397.6	388.6	379.3	370.4	360.4	349.5	338.6	327.7	316.8
6200	465.5	419.7	413.5	404.1	394.6	385.4	375.1	363.8	352.5	341.3	330.0
6600	482.4	435.3	428.9	419.2	409.4	400.0	389.3	377.7	366.1	354.5	342.9
7000	498.8	450.4	443.8	433.9	423.8	414.1	403.2	391.3	379.3	367.4	355.5
7400	514.8	465.3	458.5	448.4	438.1	428.2	417.0	404.8	392.6	380.4	368.2
7800	529.9	479.3	472.4	462.1	451.5	441.4	429.9	417.5	405.0	392.6	380.2
8200	545.4	493.9	486.9	476.4	465.6	455.3	443.6	431.0	418.2	405.6	392.9
8600	560.6	508.1	501.0	490.3	479.3	468.8	457.0	444.1	431.1	418.2	405.4
9000	573.4	520.1	512.8	501.9	490.8	480.1	468.1	455.0	441.8	428.7	415.6
9400	584.6	530.4	523.0	511.9	500.6	489.8	477.5	464.2	450.8	437.5	424.2
9800	595.6	540.5	533.0	521.8	510.3	499.2	486.8	473.3	459.6	446.1	432.5
10200	606.5	550.5	542.9	531.4	519.7	508.5	495.8	482.1	468.3	454.5	440.7
10600	617.2	560.2	552.5	540.9	529.0	517.6	504.7	490.8	476.7	462.7	448.7
11000	627.6	569.8	561.9	550.1	538.1	526.5	513.4	499.3	485.0	470.8	456.6
CLIMB LIMIT WT (1000 LB)	595.3	592.3	583.3	566.8	551.1	535.0	515.5	494.7	473.4	453.7	432.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

9800 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	378.0	339.1	332.7	324.7	317.0	309.0	299.8	290.5	281.0	271.4	261.8
5000	397.1	356.5	349.8	341.4	333.4	325.2	315.6	305.8	295.9	285.9	275.9
5400	415.3	373.2	366.2	357.5	349.2	340.6	330.6	320.5	310.2	299.8	289.5
5800	433.0	389.3	382.2	373.1	364.5	355.6	345.3	334.8	324.2	313.4	302.7
6200	450.0	404.9	397.5	388.2	379.3	370.1	359.5	348.6	337.6	326.5	315.4
6600	466.5	420.0	412.4	402.8	393.6	384.2	373.2	362.0	350.7	339.3	327.9
7000	482.4	434.7	426.9	417.1	407.6	397.9	386.7	375.2	363.6	351.9	340.1
7400	498.1	449.3	441.3	431.2	421.5	411.6	400.1	388.4	376.5	364.5	352.5
7800	512.7	462.9	454.8	444.5	434.6	424.5	412.7	400.7	388.6	376.3	364.1
8200	528.0	477.2	468.9	458.4	448.4	438.1	426.1	413.8	401.5	389.0	376.5
8600	542.8	491.2	482.7	472.0	461.8	451.3	439.1	426.7	414.1	401.4	388.7
9000	555.4	502.8	494.2	483.4	473.0	462.3	449.9	437.3	424.5	411.6	398.6
9400	566.3	512.9	504.1	493.1	482.5	471.7	459.0	446.2	433.2	420.1	406.9
9800	577.0	522.7	513.8	502.6	491.9	480.8	468.0	454.9	441.7	428.4	415.0
10200	587.5	532.4	523.3	511.9	501.0	489.8	476.8	463.5	450.1	436.5	422.9
10600	597.9	541.9	532.7	521.1	510.0	498.6	485.3	471.9	458.2	444.4	430.6
11000	608.0	551.1	541.8	530.0	518.8	507.2	493.7	480.0	466.2	452.2	438.2
CLIMB LIMIT WT (1000 LB)	577.2	571.5	560.0	543.5	528.5	512.0	492.4	471.4	451.5	432.2	411.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4290	4270	4240	4220	4200	4150	4110	4060	4020
4600	4720	4690	4660	4630	4600	4540	4480	4420	4360
5000	5160	5120	5080	5040	5000	4930	4860	4780	4710
5400	5600	5550	5500	5450	5400	5320	5230	5150	5060
5800	6030	5970	5920	5860	5800	5700	5600	5510	5410
6200	6470	6400	6330	6270	6200	6090	5980	5870	5760
6600	6900	6830	6750	6680	6600	6480	6350	6230	6110
7000	7340	7260	7170	7090	7000	6860	6730	6590	6450
7400	7780	7680	7590	7490	7400	7250	7100	6950	6800
7800	8210	8110	8010	7900	7800	7640	7480	7310	7150
8200	8650	8540	8420	8310	8200	8020	7850	7670	7500
8600	9090	8960	8840	8720	8600	8410	8220	8040	7850
9000	9520	9390	9260	9130	9000	8800	8600	8400	8200
9400	9960	9820	9680	9540	9400	9190	8970	8760	8540
9800	10390	10250	10100	9950	9800	9570	9350	9120	8890
10200	10830	10670	10520	10360	10200	9960	9720	9480	9240
10600	11270	11100	10930	10770	10600	10350	10090	9840	9590
11000	11700	11530	11350	11180	11000	10730	10470	10200	9940
11400	12140	11950	11770	11580	11400	11120	10840	10560	10290
11800	12580	12380	12190	11990	11800	11510	11220	10930	10630

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3050	3440	3820	4200	4480	4750	4990	5220
4600	3390	3790	4200	4600	4890	5170	5430	5680
5000	3720	4150	4570	5000	5300	5590	5870	6130
5400	4060	4510	4950	5400	5710	6020	6310	6590
5800	4390	4860	5330	5800	6120	6440	6750	7040
6200	4730	5220	5710	6200	6530	6860	7180	7500
6600	5060	5570	6090	6600	6940	7280	7620	7950
7000	5400	5930	6470	7000	7350	7710	8060	8410
7400	5730	6290	6840	7400	7760	8130	8500	8870
7800	6070	6640	7220	7800	8170	8550	8930	9320
8200	6400	7000	7600	8200	8580	8980	9370	9780
8600	6740	7360	7980	8600	8990	9400	9810	10230
9000	7070	7710	8360	9000	9400	9820	10250	10690
9400	7410	8070	8740	9400	9810	10240	10690	11140
9800	7740	8430	9110	9800	10220	10670	11120	11600
10200	8080	8780	9490	10200	10630	11090	11560	12050
10600	8410	9140	9870	10600	11040	11510	12000	12510
11000	8750	9500	10250	11000	11450	11930	12440	12970
11400	9080	9850	10630	11400	11870	12360	12880	13420
11800	9420	10210	11010	11800	12280	12780	13310	13880

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	626.2	563.5	559.7	555.9	552.2	548.6	537.1	523.2	507.8	492.1	476.6
6200	643.2	578.7	574.8	570.9	567.1	563.4	551.6	537.2	521.5	505.3	489.4
6600	664.8	598.0	593.9	589.9	586.0	582.2	569.9	555.1	538.8	522.1	505.6
7000	685.6	616.7	612.5	608.4	604.3	600.3	587.7	572.4	555.5	538.3	521.2
7400	705.5	634.5	630.1	625.9	621.7	617.6	604.6	588.8	571.5	553.7	536.1
7800	725.1	652.1	647.6	643.2	638.9	634.7	621.4	605.1	587.3	569.0	550.9
8200	745.6	670.6	666.0	661.5	657.1	652.8	639.0	622.4	604.0	585.3	566.7
8600	765.6	688.7	684.0	679.4	674.8	670.4	656.3	639.2	620.4	601.2	582.2
9000	783.6	704.8	700.0	695.3	690.7	686.1	671.7	654.2	634.9	615.2	595.7
9400	800.0	719.4	714.4	709.6	704.9	700.2	685.4	667.5	647.8	627.6	607.7
9800	816.2	733.8	728.7	723.8	718.9	714.1	699.1	680.7	660.6	639.9	619.5
10200	832.7	748.5	743.3	738.2	733.3	728.4	713.0	694.2	673.6	652.5	631.7
10600	834.9	763.2	757.9	752.8	747.7	742.7	727.0	707.8	686.8	665.3	644.0
11000	834.9	777.7	772.3	767.0	761.8	756.8	740.7	721.2	699.7	677.7	656.0
11400	834.9	791.7	786.2	780.9	775.6	770.4	754.1	734.2	712.3	689.9	667.7
11800	834.9	805.5	799.9	794.4	789.1	783.8	767.1	746.9	724.6	701.8	679.2
12200	834.9	818.8	813.1	807.5	802.1	796.7	779.7	759.1	736.5	713.3	690.3
12600	834.9	831.7	825.9	820.2	814.7	809.3	792.0	771.1	748.0	724.5	701.2
CLIMB LIMIT WT (1000 LB)	823.3	823.2	822.9	822.6	822.3	821.9	794.3	763.1	728.8	695.6	662.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	583.5	527.5	524.0	520.4	517.0	507.2	496.3	483.2	469.1	453.9	439.7
6200	599.3	541.7	538.0	534.4	530.9	520.8	509.6	496.1	481.7	466.0	451.4
6600	619.4	559.8	555.9	552.2	548.5	538.1	526.5	512.5	497.6	481.3	466.3
7000	638.7	577.2	573.2	569.4	565.6	554.8	542.8	528.4	513.0	496.2	480.6
7400	657.2	593.8	589.7	585.7	581.9	570.7	558.4	543.6	527.6	510.4	494.3
7800	675.4	610.2	606.0	601.9	597.9	586.5	573.8	558.6	542.2	524.4	508.0
8200	694.5	627.6	623.3	619.1	615.0	603.3	590.2	574.5	557.7	539.5	522.6
8600	713.3	644.6	640.2	635.9	631.7	619.6	606.3	590.2	573.0	554.3	536.9
9000	730.0	659.7	655.2	650.7	646.4	634.1	620.4	603.9	586.3	567.1	549.3
9400	745.1	673.1	668.5	664.0	659.6	647.0	633.0	616.1	598.0	578.4	560.2
9800	760.1	686.5	681.7	677.1	672.6	659.7	645.4	628.1	609.7	589.6	571.0
10200	775.4	700.1	695.3	690.6	686.0	672.8	658.1	640.5	621.6	601.1	582.1
10600	790.7	713.9	708.9	704.1	699.4	685.9	671.0	653.0	633.7	612.8	593.3
11000	805.7	727.3	722.3	717.3	712.5	698.8	683.5	665.2	645.5	624.1	604.3
11400	820.3	740.4	735.3	730.3	725.4	711.4	695.8	677.1	657.0	635.3	615.1
11800	834.6	753.2	748.0	742.9	737.9	723.6	707.8	688.7	668.3	646.2	625.6
12200	834.9	765.6	760.3	755.1	750.0	735.5	719.4	700.0	679.3	656.7	635.8
12600	834.9	777.6	772.2	767.0	761.8	747.1	730.7	711.0	689.9	667.0	645.7
CLIMB LIMIT WT (1000 LB)	779.2	778.9	778.6	778.4	778.1	756.9	733.8	704.6	673.5	640.1	610.2

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	543.5	491.5	488.2	484.9	477.5	468.0	457.2	446.1	433.0	419.3	407.4
6200	558.1	504.7	501.3	497.9	490.3	480.5	469.4	457.9	444.5	430.5	418.2
6600	576.7	521.4	517.9	514.3	506.5	496.4	484.9	473.0	459.1	444.6	431.9
7000	594.7	537.6	533.9	530.3	522.2	511.7	499.9	487.6	473.3	458.3	445.1
7400	611.8	553.0	549.2	545.5	537.2	526.4	514.1	501.5	486.7	471.3	457.8
7800	628.8	568.2	564.4	560.5	552.0	540.9	528.3	515.4	500.1	484.2	470.3
8200	646.7	584.5	580.5	576.6	567.8	556.4	543.5	530.2	514.5	498.2	483.9
8600	664.1	600.4	596.3	592.3	583.3	571.6	558.3	544.7	528.7	511.9	497.3
9000	679.7	614.4	610.2	606.1	596.8	584.9	571.3	557.3	540.9	523.8	508.7
9400	693.6	626.8	622.5	618.3	608.9	596.6	582.7	568.4	551.6	534.1	518.7
9800	707.4	639.1	634.7	630.4	620.7	608.2	594.0	579.3	562.2	544.2	528.5
10200	721.5	651.7	647.2	642.8	632.9	620.1	605.6	590.6	573.1	554.7	538.7
10600	735.7	664.4	659.8	655.3	645.2	632.1	617.3	602.0	584.1	565.4	549.0
11000	749.6	676.8	672.2	667.5	657.3	643.9	628.8	613.2	594.9	575.8	559.1
11400	763.2	689.0	684.2	679.5	669.0	655.4	640.0	624.1	605.5	586.0	568.9
11800	776.4	700.8	696.0	691.2	680.5	666.7	651.0	634.8	615.8	596.0	578.6
12200	789.2	712.3	707.4	702.5	691.7	677.6	661.6	645.2	625.9	605.7	588.0
12600	801.6	723.5	718.5	713.6	702.5	688.2	672.0	655.3	635.6	615.1	597.2
CLIMB LIMIT WT (1000 LB)	726.9	726.6	726.4	726.1	714.1	696.2	673.1	648.6	619.1	589.4	564.4

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	504.6	456.3	453.2	447.5	439.2	429.1	420.1	410.4	398.8	387.5	376.6
6200	518.2	468.5	465.3	459.4	450.9	440.5	431.2	421.3	409.3	397.7	386.6
6600	535.4	484.0	480.7	474.6	465.7	455.0	445.4	435.1	422.7	410.7	399.2
7000	552.0	498.9	495.5	489.2	480.1	469.0	459.1	448.4	435.7	423.3	411.4
7400	567.9	513.2	509.7	503.2	493.8	482.4	472.1	461.2	448.0	435.3	423.0
7800	583.6	527.3	523.7	517.0	507.4	495.6	485.1	473.8	460.3	447.2	434.6
8200	600.2	542.4	538.7	531.9	522.0	509.9	499.1	487.5	473.7	460.2	447.2
8600	616.5	557.3	553.5	546.4	536.3	523.9	512.8	500.9	486.7	472.9	459.6
9000	630.9	570.2	566.3	559.1	548.7	536.0	524.7	512.5	497.9	483.8	470.1
9400	643.7	581.6	577.6	570.3	559.6	546.6	535.0	522.5	507.6	493.1	479.2
9800	656.4	592.8	588.8	581.2	570.4	557.1	545.2	532.4	517.2	502.4	488.1
10200	669.3	604.4	600.3	592.6	581.4	567.9	555.7	542.7	527.1	511.9	497.4
10600	682.4	616.1	611.9	604.0	592.6	578.8	566.4	553.1	537.2	521.7	506.8
11000	695.2	627.6	623.2	615.2	603.6	589.5	576.8	563.2	547.0	531.2	516.0
11400	707.7	638.8	634.4	626.2	614.4	600.0	587.0	573.2	556.7	540.6	525.1
11800	719.9	649.7	645.2	636.9	624.9	610.2	597.0	583.0	566.1	549.7	533.9
12200	731.8	660.3	655.8	647.3	635.1	620.1	606.8	592.4	575.3	558.6	542.6
12600	743.2	670.7	666.0	657.4	645.0	629.8	616.2	601.7	584.3	567.3	551.0
CLIMB LIMIT WT (1000 LB)	674.9	674.9	674.6	667.1	651.5	631.2	612.9	592.5	567.3	543.2	520.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	465.5	420.9	415.7	408.4	399.3	390.9	382.1	372.0	361.6	351.7	341.9
6200	477.9	432.1	426.8	419.2	409.9	401.2	392.2	381.8	371.1	360.9	350.8
6600	493.7	446.2	440.7	432.9	423.3	414.3	404.9	394.2	383.2	372.6	362.1
7000	509.0	460.0	454.3	446.2	436.3	427.0	417.3	406.3	394.9	384.0	373.1
7400	523.5	473.0	467.2	458.9	448.6	439.1	429.1	417.7	406.0	394.8	383.6
7800	537.9	486.0	480.0	471.5	460.9	451.1	440.9	429.2	417.1	405.5	394.1
8200	553.4	500.1	493.9	485.1	474.3	464.2	453.7	441.7	429.3	417.4	405.6
8600	568.5	513.8	507.5	498.5	487.4	477.0	466.2	453.9	441.2	429.0	416.9
9000	581.7	525.7	519.2	510.0	498.6	488.0	477.0	464.3	451.3	438.8	426.5
9400	593.3	536.0	529.4	520.0	508.3	497.5	486.2	473.2	459.9	447.2	434.5
9800	604.9	546.2	539.5	529.8	517.9	506.8	495.2	482.0	468.4	455.3	442.4
10200	616.7	556.8	549.9	540.0	527.8	516.5	504.7	491.1	477.2	463.9	450.6
10600	628.7	567.5	560.4	550.3	537.9	526.3	514.2	500.4	486.2	472.6	459.0
11000	640.4	578.0	570.7	560.4	547.7	535.9	523.6	509.5	495.0	481.1	467.3
11400	651.8	588.2	580.8	570.3	557.4	545.4	532.8	518.5	503.7	489.5	475.4
11800	663.0	598.2	590.7	580.0	566.9	554.6	541.8	527.2	512.1	497.7	483.4
12200	673.8	608.0	600.3	589.5	576.1	563.6	550.6	535.7	520.4	505.8	491.2
12600	684.4	617.5	609.7	598.7	585.1	572.4	559.2	544.1	528.5	513.6	498.8
CLIMB LIMIT WT (1000 LB)	620.6	620.5	613.3	599.8	581.8	565.4	547.3	526.4	504.0	482.8	461.8

9000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	446.5	402.7	397.1	388.8	380.3	372.2	363.0	353.3	343.6	333.9	324.2
6200	458.5	413.4	407.7	399.2	390.4	382.1	372.7	362.7	352.7	342.7	332.8
6600	473.7	427.1	421.2	412.3	403.3	394.7	384.9	374.6	364.2	353.9	343.6
7000	488.4	440.3	434.2	425.0	415.7	406.8	396.8	386.1	375.4	364.8	354.1
7400	502.4	452.8	446.6	437.1	427.6	418.4	408.0	397.1	386.0	375.1	364.1
7800	516.2	465.3	458.8	449.1	439.3	429.9	419.2	407.9	396.6	385.3	374.1
8200	531.1	478.8	472.1	462.2	452.1	442.4	431.4	419.8	408.2	396.6	385.1
8600	545.6	492.0	485.2	475.0	464.6	454.7	443.5	431.6	419.6	407.8	395.9
9000	558.3	503.4	496.4	486.0	475.3	465.2	453.7	441.5	429.3	417.1	405.0
9400	569.4	513.2	506.1	495.4	484.5	474.2	462.4	449.9	437.4	425.0	412.5
9800	580.4	522.9	515.6	504.7	493.6	482.9	470.9	458.1	445.3	432.6	419.9
10200	591.7	532.9	525.5	514.3	502.9	492.1	479.8	466.7	453.6	440.7	427.7
10600	603.1	543.1	535.5	524.1	512.5	501.4	488.8	475.5	462.1	448.8	435.6
11000	614.3	553.1	545.3	533.6	521.8	510.5	497.7	484.1	470.4	456.9	443.4
11400	625.2	562.8	554.9	543.0	530.9	519.4	506.3	492.5	478.6	464.8	451.0
11800	635.9	572.4	564.3	552.2	539.9	528.2	514.9	500.8	486.6	472.6	458.5
12200	646.4	581.7	573.5	561.2	548.7	536.8	523.2	508.9	494.5	480.2	465.9
12600	656.6	590.9	582.5	570.0	557.3	545.2	531.4	516.9	502.2	487.7	473.2
CLIMB LIMIT WT (1000 LB)	595.3	592.3	583.3	566.8	551.1	535.0	515.5	494.7	473.4	453.7	432.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

9800 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	432.2	389.4	382.8	374.5	366.6	358.6	349.3	339.8	330.3	320.8	311.4
6200	443.8	399.7	393.0	384.5	376.4	368.1	358.6	348.8	339.0	329.3	319.6
6600	458.4	412.9	405.9	397.1	388.7	380.2	370.4	360.2	350.1	340.0	330.0
7000	472.7	425.7	418.4	409.4	400.7	391.9	381.7	371.3	360.8	350.4	340.0
7400	486.2	437.8	430.3	421.0	412.1	403.0	392.6	381.8	371.0	360.3	349.6
7800	499.6	449.8	442.2	432.6	423.4	414.0	403.3	392.2	381.2	370.2	359.2
8200	514.0	462.9	455.0	445.2	435.7	426.1	415.1	403.7	392.4	381.1	369.8
8600	528.1	475.7	467.6	457.5	447.8	438.0	426.7	415.0	403.4	391.8	380.2
9000	540.4	486.7	478.4	468.1	458.2	448.1	436.5	424.6	412.6	400.8	388.9
9400	551.1	496.1	487.7	477.1	467.0	456.7	444.8	432.6	420.4	408.2	396.1
9800	561.6	505.4	496.8	486.0	475.6	465.1	452.9	440.4	427.9	415.5	403.1
10200	572.5	515.1	506.2	495.2	484.6	473.8	461.4	448.6	435.9	423.2	410.5
10600	583.5	524.8	515.8	504.5	493.7	482.7	470.0	457.0	443.9	431.0	418.0
11000	594.3	534.4	525.2	513.7	502.7	491.4	478.5	465.2	451.9	438.7	425.4
11400	604.8	543.8	534.5	522.7	511.4	500.0	486.8	473.2	459.7	446.2	432.7
11800	615.2	553.1	543.5	531.5	520.1	508.4	495.0	481.2	467.4	453.6	439.9
12200	625.2	562.1	552.4	540.2	528.5	516.7	503.0	488.9	474.9	461.0	447.0
12600	635.1	570.9	561.0	548.7	536.8	524.8	510.9	496.6	482.3	468.2	454.0
CLIMB LIMIT WT (1000 LB)	577.2	571.5	560.0	543.5	528.5	512.0	492.4	471.4	451.5	432.2	411.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	638.0	712.6	780.9	830.6					
50	608.8	677.5	735.3	785.3	822.5				
100	578.6	643.6	696.9	741.7	780.0	808.9	830.1		
150	553.0	615.6	666.9	709.6	745.7	776.8	800.5	819.8	833.9
200	530.7	591.6	641.6	683.4	718.5	748.4	774.3	794.5	811.4
250	510.9	570.3	619.6	660.8	695.4	724.9	750.1	772.2	790.1
300	492.9	551.1	599.9	640.6	675.0	704.3	729.5	751.3	770.5
350	476.6	533.8	582.0	622.4	656.6	685.8	711.0	732.9	752.0
400	461.5	518.1	565.5	605.7	639.7	668.9	694.2	716.1	735.5
450	447.6	503.4	550.3	590.2	624.1	653.4	678.7	700.8	720.2
500	435.0	489.8	536.1	575.7	609.6	638.8	664.2	686.5	706.1
550	423.1	477.1	522.9	562.1	596.0	625.2	650.7	673.0	692.8
600	411.9	465.1	510.5	549.4	583.1	612.4	637.9	660.4	680.3
650	401.4	453.9	498.8	537.4	570.9	600.2	625.8	648.4	668.4
700	391.5	443.4	487.7	526.0	559.4	588.7	614.3	637.0	657.1
750	381.8	433.4	477.2	515.3	548.5	577.7	603.4	626.1	646.4
800	372.6	424.0	467.2	505.0	538.0	567.1	592.9	615.7	636.0
850	372.5	414.9	457.7	495.2	528.1	557.1	582.9	605.7	626.2
900		406.3	448.7	485.9	518.6	547.5	573.2	596.2	616.7
950		398.1	440.1	476.9	509.5	538.2	563.9	586.9	607.5
1000		390.2	432.0	468.4	500.7	529.4	555.0	578.0	598.7

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
30 & Below	0	0	0	0	0	0	0
32	-6.2	-7.6	-9.0	-10.4	-11.7	-13.1	-14.5
34	-12.5	-15.2	-18.0	-20.7	-23.5	-26.2	-29.0
36	-18.7	-22.8	-27.0	-31.1	-35.2	-39.3	-43.5
38	-24.9	-30.4	-36.0	-41.5	-47.0	-52.5	-58.0
40	-31.2	-38.1	-44.9	-51.8	-58.7	-65.6	-72.5
42	-38.9	-47.2	-55.5	-63.8	-72.1	-80.4	-88.7
44	-46.6	-56.4	-66.1	-75.8	-85.6	-95.3	-105.0
46	-54.4	-65.5	-76.7	-87.8	-99.0	-110.1	-121.3
48	-62.1	-74.7	-87.3	-99.8	-112.4	-125.0	-137.6
50	-69.8	-83.8	-97.8	-111.8	-125.8	-139.8	-153.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
S.L. & Below	0	0	0	0	0	0	0
1000	-15.6	-18.4	-21.3	-24.1	-27.0	-29.8	-32.7
2000	-31.2	-36.9	-42.6	-48.3	-54.0	-59.7	-65.4
3000	-45.5	-53.9	-62.2	-70.6	-78.9	-87.3	-95.6
4000	-59.9	-70.9	-81.9	-92.9	-103.9	-114.9	-125.9
5000	-75.3	-89.2	-103.0	-116.8	-130.7	-144.5	-158.3
6000	-90.8	-107.5	-124.1	-140.8	-157.5	-174.1	-190.8
7000	-105.7	-125.4	-145.1	-164.7	-184.4	-204.1	-223.7
8000	-120.7	-143.3	-166.0	-188.7	-211.3	-234.0	-256.7
9000	-132.2	-158.1	-183.9	-209.7	-235.5	-261.4	-287.2
10000	-143.7	-172.7	-201.7	-230.7	-259.7	-288.7	-317.7

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
15 TW	-47.0	-55.0	-63.0	-71.0	-79.0	-87.0	-95.0
10 TW	-31.3	-36.7	-42.0	-47.3	-52.7	-58.0	-63.3
5 TW	-15.7	-18.3	-21.0	-23.7	-26.3	-29.0	-31.7
0	0	0	0	0	0	0	0
10 HW	7.9	7.7	7.4	7.2	7.0	6.7	6.5
20 HW	15.9	15.4	14.9	14.4	13.9	13.4	12.9
30 HW	24.6	23.7	22.7	21.8	20.9	20.0	19.1
40 HW	33.3	31.9	30.6	29.2	27.9	26.6	25.2

With engine bleed for packs off, increase weight by 2000 lb.
With engine and wing anti-ice on, decrease weight by 4400 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Tire Speed Limit
Flaps 15

AIRPORT OAT		TIRE SPEED LIMIT WEIGHT (1000 LB)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	0	2000	4000	6000	8000	9000	9800
54	129	810.2						
52	126	814.5						
50	122	819.0	755.0					
48	118	823.5	759.5					
46	115	828.0	765.8	705.8				
44	111	832.6	773.9	709.8				
42	108	835.0	778.6	713.9	661.1			
40	104	835.0	783.0	718.1	665.0			
38	100	835.0	787.5	722.4	668.9	619.4		
36	97	835.0	792.0	727.1	672.9	623.2	599.4	
34	93	835.0	796.7	731.8	677.2	627.1	603.1	584.4
32	90	835.0	801.5	736.8	681.5	631.0	606.9	588.1
30	86	835.0	806.5	741.6	685.8	635.1	610.7	591.8
28	82	835.0	811.7	746.7	690.2	639.2	614.7	595.6
26	79	835.0	816.8	752.0	694.7	643.5	618.7	599.5
24	75	835.0	822.5	757.5	699.2	647.8	622.9	603.5
22	72	835.0	828.3	764.0	704.1	652.0	627.1	607.5
20	68	835.0	834.2	774.4	709.1	656.4	631.3	611.6
18	64	835.0	835.0	780.2	714.2	661.0	635.6	615.7
16	61	835.0	835.0	785.9	719.6	665.7	640.1	620.0
14	57	835.0	835.0	791.6	725.4	670.5	644.8	624.5
12	54	835.0	835.0	797.4	731.2	675.6	649.5	629.1
10	50	835.0	835.0	803.2	737.1	680.7	654.4	633.8
-40	-40	835.0	835.0	835.0	835.0	835.0	813.9	

Increase tire speed limit weight by 5300 lb per knot headwind.
Decrease tire speed limit weight by 11900 lb per knot tailwind.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Dry Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
840	175	185	190
800	171	179	186
760	166	175	182
720	162	170	178
680	157	164	174
640	152	159	169
600	146	153	165
560	140	146	160
520	133	140	155
480	125	133	150
440	117	126	145
400	108	119	139
360	99	111	133

Check V1(MCG), Minimum VR.

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	12	14						7	8						-4	-4					
60	140	8	10	12	14				4	6	7	8				-3	-3	-4	-4			
50	122	5	6	8	10	13	16	19	3	4	5	6	8	9	11	-2	-2	-3	-3	-4	-5	-6
40	104	1	3	5	7	10	13	16	1	2	3	5	6	8	9	-1	-1	-2	-2	-3	-4	-5
30	86	0	0	2	5	8	11	14	0	0	2	3	5	7	8	0	0	-1	-2	-2	-3	-4
20	68	0	0	2	4	6	9	12	0	0	1	2	4	6	7	0	0	-1	-1	-2	-3	-3
-60	-76	0	0	2	4	6	8	11	0	0	1	2	4	5	6	0	0	-1	-1	-2	-2	-3

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
840	-4	-1	0	3	5	-3	-1	0	0	1	3	4	4
800	-4	-1	0	3	5	-2	-1	0	0	1	3	3	4
760	-3	-1	0	3	4	-2	-1	0	0	1	2	3	4
720	-3	-1	0	3	4	-2	-1	0	0	1	2	3	3
680	-3	-1	0	2	4	-2	-1	0	0	1	2	2	3
640	-2	-1	0	2	4	-2	-1	0	0	1	2	2	3
600	-2	-1	0	2	3	-2	-1	0	0	1	2	2	3
560	-2	0	0	2	3	-2	-1	0	0	1	2	2	3
520	-2	0	0	2	3	-1	-1	0	0	1	2	3	3
480	-1	0	0	2	3	-1	-1	0	0	1	2	3	3
440	-1	0	0	2	4	-1	0	0	0	1	2	3	4
400	-1	0	0	3	4	-1	0	1	0	1	3	3	4
360	-1	0	0	3	4	-1	0	1	0	2	3	4	5

***V1 not to exceed VR**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Dry Runway

Flaps 15

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111						
50	122	119	121	116	118	111	113	109	111	107	109	103	106	99	102
40	104	126	127	123	124	118	120	113	115	108	111	103	106	99	102
30	86	128	130	128	130	123	125	118	120	112	115	107	109	101	104
20	68	129	130	129	130	125	126	120	122	116	118	110	113	105	108
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114	107	110

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Wet Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
840	169	185	190
800	164	179	186
760	158	175	182
720	153	170	178
680	147	164	174
640	141	159	169
600	134	153	165
560	128	146	160
520	121	140	155
480	113	133	150
440	105	126	145
400	97	119	139
360	87	111	133

Check V1(MCG), Minimum VR.

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	14	16						7	8						-4	-4					
60	140	10	11	14	16				4	6	7	8				-3	-3	-4	-4			
50	122	5	7	9	12	14	17	20	3	4	5	6	8	9	11	-2	-2	-3	-3	-4	-5	-6
40	104	2	3	6	8	11	14	17	1	2	3	5	6	8	9	-1	-1	-2	-2	-3	-4	-5
30	86	0	0	3	5	8	12	15	0	0	2	3	5	7	8	0	0	-1	-2	-2	-3	-4
20	68	0	0	2	4	7	10	13	0	0	1	2	4	6	7	0	0	-1	-1	-2	-3	-3
-60	-76	0	0	2	4	6	9	12	0	0	1	2	4	5	6	0	0	-1	-1	-2	-2	-3

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
840	-6	-2	0	4	6	-3	-2	-1	0	1	2	3	4
800	-6	-3	0	3	6	-4	-2	-1	0	1	2	3	4
760	-6	-3	0	3	5	-4	-3	-1	0	1	2	3	4
720	-5	-3	0	3	5	-5	-3	-2	0	1	2	3	4
680	-5	-3	0	2	5	-5	-3	-2	0	1	2	3	4
640	-5	-3	0	2	5	-5	-3	-2	0	1	2	3	4
600	-5	-2	0	2	4	-5	-3	-2	0	1	2	3	4
560	-4	-2	0	2	4	-5	-3	-1	0	1	2	3	4
520	-4	-2	0	3	4	-5	-3	-1	0	1	3	4	5
480	-3	-1	0	3	5	-4	-3	-1	0	1	3	4	5
440	-2	0	0	3	5	-4	-2	0	0	2	4	5	6
400	-1	0	0	3	5	-4	-2	0	0	2	4	5	6
360	-1	1	0	4	5	-3	-1	1	0	2	5	6	7

***V1 not to exceed VR**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Wet Runway

Flaps 15

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111						
50	122	119	121	116	118	111	113	109	111	107	109	103	106	99	102
40	104	126	127	123	124	118	120	113	115	108	111	103	106	99	102
30	86	128	130	128	130	123	125	118	120	112	115	107	109	101	104
20	68	129	130	129	130	125	126	120	122	116	118	110	113	105	108
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114	107	110

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	30800	29100	27600
760	28800	2	31300	29700	28200
740	29400	0	31800	30200	28700
720	30000	-1	32300	30700	29100
700	30700	-2	32800	31100	29600
680	31300	-4	33200	31600	30100
660	31900	-5	33700	32100	30600
640	32600	-7	34300	32700	31200
620	33300	-8	34800	33200	31700
600	34000	-10	35300	33800	32300
580	34700	-11	35900	34300	32900
560	35400	-13	36500	34900	33500
540	36200	-15	37100	35600	34100
520	37000	-15	37800	36200	34800
500	37800	-15	38400	36900	35500
480	38600	-15	39100	37600	36200
460	39500	-15	39900	38300	36900
440	40400	-15	40600	39100	37700
420	41400	-15	41400	39900	38600
400	42400	-15	42300	40800	39400
380	43100	-15	43100	41800	40500

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	30800	29100	27600
760	28800	8	31300	29700	28200
740	29400	6	31800	30200	28700
720	30000	5	32300	30700	29100
700	30700	3	32800	31100	29600
680	31300	2	33200	31600	30100
660	31900	1	33700	32100	30600
640	32600	-1	34300	32700	31200
620	33300	-2	34800	33200	31700
600	34000	-4	35300	33800	32300
580	34700	-6	35900	34300	32900
560	35400	-7	36500	34900	33500
540	36200	-9	37100	35600	34100
520	37000	-9	37800	36200	34800
500	37800	-9	38400	36900	35500
480	38600	-9	39100	37600	36200
460	39500	-9	39900	38300	36900
440	40400	-9	40600	39100	37700
420	41400	-9	41400	39900	38600
400	42400	-9	42300	40800	39400
380	43100	-9	43100	41800	40500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	30800	29100	27600
760	28800	13	31300	29700	28200
740	29400	12	31800	30200	28700
720	30000	11	32300	30700	29100
700	30700	9	32800	31100	29600
680	31300	8	33200	31600	30100
660	31900	6	33700	32100	30600
640	32600	5	34300	32700	31200
620	33300	3	34800	33200	31700
600	34000	2	35300	33800	32300
580	34700	0	35900	34300	32900
560	35400	-2	36500	34900	33500
540	36200	-3	37100	35600	34100
520	37000	-3	37800	36200	34800
500	37800	-3	38400	36900	35500
480	38600	-3	39100	37600	36200
460	39500	-3	39900	38300	36900
440	40400	-3	40600	39100	37700
420	41400	-3	41400	39900	38600
400	42400	-3	42300	40800	39400
380	43100	-3	43100	41800	40500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Mid C.G. (30% MAC)

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	31800	30200	28600
760	28800	2	32400	30700	29200
740	29400	0	32900	31300	29700
720	30000	-1	33300	31700	30200
700	30700	-2	33800	32200	30700
680	31300	-4	34300	32700	31200
660	31900	-5	34800	33200	31700
640	32600	-7	35300	33700	32200
620	33300	-8	35800	34200	32700
600	34000	-10	36300	34800	33300
580	34700	-11	36900	35300	33900
560	35400	-13	37500	35900	34500
540	36200	-15	38100	36600	35100
520	37000	-15	38800	37200	35800
500	37800	-15	39400	37900	36400
480	38600	-15	40100	38600	37100
460	39500	-15	40900	39300	37900
440	40400	-15	41600	40100	38700
420	41400	-15	42400	40900	39500
400	42400	-15	43100	41700	40300
380	43100	-15	43100	42800	41400

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	31800	30200	28600
760	28800	8	32400	30700	29200
740	29400	6	32900	31300	29700
720	30000	5	33300	31700	30200
700	30700	3	33800	32200	30700
680	31300	2	34300	32700	31200
660	31900	1	34800	33200	31700
640	32600	-1	35300	33700	32200
620	33300	-2	35800	34200	32700
600	34000	-4	36300	34800	33300
580	34700	-6	36900	35300	33900
560	35400	-7	37500	35900	34500
540	36200	-9	38100	36600	35100
520	37000	-9	38800	37200	35800
500	37800	-9	39400	37900	36400
480	38600	-9	40100	38600	37100
460	39500	-9	40900	39300	37900
440	40400	-9	41600	40100	38700
420	41400	-9	42400	40900	39500
400	42400	-9	43100	41700	40300
380	43100	-9	43100	42800	41400

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Mid C.G. (30% MAC)

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	31800	30200	28600
760	28800	13	32400	30700	29200
740	29400	12	32900	31300	29700
720	30000	11	33300	31700	30200
700	30700	9	33800	32200	30700
680	31300	8	34300	32700	31200
660	31900	6	34800	33200	31700
640	32600	5	35300	33700	32200
620	33300	3	35800	34200	32700
600	34000	2	36300	34800	33300
580	34700	0	36900	35300	33900
560	35400	-2	37500	35900	34500
540	36200	-3	38100	36600	35100
520	37000	-3	38800	37200	35800
500	37800	-3	39400	37900	36400
480	38600	-3	40100	38600	37100
460	39500	-3	40900	39300	37900
440	40400	-3	41600	40100	38700
420	41400	-3	42400	40900	39500
400	42400	-3	43100	41700	40300
380	43100	-3	43100	42800	41400

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1058	994	937	886	841	800	766	735	706	679	655
1580	1487	1403	1328	1261	1200	1150	1104	1061	1021	985
2101	1979	1868	1769	1681	1600	1534	1473	1416	1364	1316
2620	2469	2332	2210	2100	2000	1918	1842	1771	1706	1647
3138	2959	2795	2650	2520	2400	2302	2211	2127	2049	1978
3654	3447	3258	3090	2939	2800	2687	2581	2483	2392	2309
4168	3933	3719	3529	3358	3200	3071	2950	2838	2735	2641
4679	4418	4180	3968	3776	3600	3455	3320	3194	3078	2972
5190	4903	4640	4406	4194	4000	3839	3689	3550	3421	3303
5699	5386	5099	4844	4612	4400	4224	4059	3906	3764	3635
6207	5868	5558	5281	5030	4800	4608	4429	4262	4108	3966
6713	6348	6015	5717	5448	5200	4992	4798	4618	4451	4298
7217	6828	6472	6153	5865	5600	5376	5168	4973	4794	4629
7721	7307	6928	6590	6283	6000	5761	5537	5329	5137	4960
8224	7786	7385	7026	6700	6400	6145	5906	5685	5480	5292
8726	8264	7841	7461	7117	6800	6529	6276	6040	5823	5623
9228	8742	8296	7897	7534	7200	6913	6645	6396	6166	5955
9728	9219	8751	8332	7951	7600	7297	7015	6752	6509	6286
10228	9695	9206	8767	8368	8000	7681	7384	7107	6852	6617

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 27		29		31		33		35	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
800	29.5	2:01	29.0	1:59	28.6	1:56	28.2	1:53	27.7	1:52
1200	43.1	2:57	42.1	2:53	41.4	2:49	40.7	2:45	39.9	2:42
1600	56.8	3:52	55.5	3:47	54.4	3:41	53.3	3:35	52.2	3:32
2000	70.5	4:47	68.8	4:41	67.4	4:33	66.0	4:26	64.5	4:22
2400	84.8	5:41	82.8	5:33	80.9	5:23	79.2	5:16	77.3	5:12
2800	99.1	6:34	96.7	6:25	94.5	6:14	92.3	6:06	90.1	6:02
3200	113.7	7:27	110.9	7:16	108.3	7:04	105.8	6:56	103.2	6:51
3600	128.6	8:19	125.5	8:07	122.4	7:54	119.5	7:45	116.5	7:41
4000	143.6	9:11	140.0	8:58	136.6	8:44	133.2	8:35	129.9	8:31
4400	159.2	10:02	155.1	9:47	151.2	9:33	147.4	9:24	144.0	9:20
4800	174.8	10:53	170.3	10:37	165.9	10:23	161.7	10:13	158.2	10:10
5200	190.8	11:43	185.7	11:26	180.9	11:12	176.3	11:02	172.8	11:00
5600	207.1	12:33	201.5	12:15	196.1	12:01	191.3	11:52	188.1	11:50
6000	223.4	13:22	217.2	13:04	211.4	12:49	206.2	12:41	203.3	12:39
6400	240.3	14:11	233.6	13:53	227.3	13:38	222.2	13:30	220.0	13:29
6800	257.3	15:00	250.0	14:42	243.2	14:27	238.2	14:20	236.6	14:19
7200	274.6	15:48	266.7	15:30	259.6	15:16	254.8	15:09	254.3	15:09
7600	292.3	16:37	283.8	16:19	276.5	16:05	272.1	15:58	273.0	15:59
8000	309.9	17:25	300.9	17:07	293.3	16:54	289.5	16:48	291.8	16:49

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	600
20	-2.2	-1.1	0.0	1.5	2.8	4.6
40	-4.6	-2.3	0.0	2.6	5.6	10.0
60	-7.1	-3.6	0.0	3.9	9.0	16.5
80	-9.5	-4.9	0.0	5.4	13.1	24.0
100	-12.0	-6.2	0.0	7.4	17.8	32.7
120	-14.5	-7.5	0.0	9.6	23.1	42.4
140	-17.0	-8.8	0.0	12.2	29.2	53.2
160	-19.6	-10.1	0.0	15.1	35.8	65.1
180	-22.2	-11.4	0.0	18.3	43.2	78.1
200	-24.8	-12.7	0.0	21.8	51.1	92.2
220	-27.4	-14.0	0.0	25.7	59.8	107.3
240	-30.0	-15.3	0.0	29.8	69.0	123.6
260	-32.7	-16.6	0.0	34.3	79.0	140.9
280	-35.3	-17.9	0.0	39.1	89.6	159.3
300	-38.0	-19.3	0.0	44.2	100.8	178.8
320	-40.7	-20.6	0.0	49.7	112.7	199.3
340	-43.5	-21.9	0.0	55.4	125.2	221.0
360	-46.2	-23.2	0.0	61.4	138.4	243.7

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1040	981	928	881	839	800	765	732	703	675	650
1545	1461	1386	1318	1256	1200	1149	1102	1058	1018	981
2050	1941	1843	1754	1673	1600	1533	1471	1414	1361	1312
2555	2421	2300	2190	2091	2000	1917	1840	1769	1704	1643
3060	2900	2757	2626	2508	2400	2301	2209	2125	2047	1974
3564	3380	3213	3063	2925	2800	2685	2579	2481	2390	2306
4068	3859	3670	3499	3343	3200	3069	2948	2837	2733	2637
4572	4338	4127	3935	3760	3600	3453	3318	3193	3077	2969
5076	4817	4583	4371	4177	4000	3837	3687	3549	3420	3300
5580	5296	5039	4807	4594	4400	4221	4057	3905	3763	3632
6083	5775	5496	5242	5011	4800	4606	4426	4261	4107	3964
6587	6253	5952	5678	5429	5200	4990	4796	4617	4450	4296
7090	6732	6408	6114	5846	5600	5374	5166	4973	4794	4628
7593	7210	6864	6550	6263	6000	5758	5536	5329	5138	4960
8095	7688	7320	6985	6680	6400	6143	5905	5686	5482	5292
8598	8166	7776	7421	7097	6800	6527	6275	6042	5826	5624
9100	8644	8231	7856	7514	7200	6911	6645	6398	6169	5956
9602	9122	8687	8292	7931	7600	7296	7015	6755	6513	6289
10104	9599	9142	8727	8348	8000	7680	7385	7111	6858	6621

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB)											TIME (HRS:MIN)
	LANDING WEIGHT (1000 LB)											
	360	380	400	420	440	460	480	500	520	540	560	
800	23.3	24.0	24.9	25.7	26.8	27.7	28.5	29.3	30.2	31.4	32.3	1:50
1200	33.0	34.1	35.3	36.7	38.4	39.6	40.7	42.0	43.6	45.3	46.5	2:40
1600	42.9	44.4	46.0	48.0	50.1	51.7	53.3	55.1	57.3	59.4	61.0	3:30
2000	53.0	54.9	57.0	59.6	62.1	64.1	66.1	68.6	71.3	73.8	75.8	4:20
2400	63.3	65.6	68.3	71.4	74.3	76.7	79.3	82.4	85.5	88.4	90.8	5:10
2800	73.7	76.6	79.9	83.4	86.7	89.6	92.9	96.5	100.0	103.3	106.3	5:59
3200	84.4	87.9	91.7	95.6	99.3	102.9	106.8	110.8	114.7	118.6	122.1	6:49
3600	95.3	99.5	103.7	108.0	112.4	116.6	121.0	125.3	129.8	134.3	138.4	7:38
4000	106.6	111.2	115.9	120.7	125.7	130.6	135.4	140.2	145.2	150.4	155.1	8:28
4400	118.2	123.2	128.4	133.7	139.5	144.8	150.0	155.4	161.1	166.8	172.1	9:17
4800	129.9	135.4	141.1	147.2	153.5	159.3	165.0	171.0	177.3	183.6	189.3	10:07
5200	141.9	147.9	154.1	161.0	167.8	174.0	180.3	187.0	193.9	200.7	206.9	10:56
5600	154.1	160.6	167.6	175.0	182.3	189.0	196.0	203.4	210.9	218.2	224.9	11:45
6000	166.5	173.6	181.4	189.3	197.1	204.4	212.1	220.1	228.1	236.0	243.4	12:34
6400	179.1	187.0	195.4	203.9	212.2	220.3	228.6	237.2	245.7	254.1	262.3	13:23
6800	192.1	200.8	209.7	218.7	227.7	236.5	245.5	254.5	263.6	272.9	281.6	14:12
7200	205.5	214.9	224.3	233.8	243.6	253.1	262.6	272.3	282.1	291.9	301.3	15:01
7600	219.3	229.2	239.1	249.4	259.9	270.1	280.1	290.4	300.9	311.4	321.4	15:50
8000	233.3	243.7	254.3	265.4	276.6	287.3	298.0	308.9	320.1	331.4	342.0	16:39

Based on 310/.84 climb, LRC and .84/310/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
96	81	70	62	55	50	46	42	39	36	34
160	143	129	118	108	100	93	87	82	77	73
224	204	187	173	161	150	141	133	125	119	113
287	264	244	227	213	200	189	178	169	161	154
348	323	301	282	265	250	237	225	214	204	195
410	382	357	336	317	300	285	271	259	247	237
471	440	414	390	369	350	333	317	303	290	279
533	499	470	444	421	400	381	364	348	334	320
595	559	527	499	473	450	429	410	393	376	362
660	620	585	554	525	500	477	456	437	419	403

Trip Fuel and Time Required

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)						TIME (HRS:MIN)
		360	400	440	480	520	560	
50	FUEL (1000 LB)	3.7	3.9	4.2	4.4	4.6	4.8	0:14
	ALT (FT)	11000	11000	9000	7000	7000	5000	
100	FUEL (1000 LB)	5.5	5.8	6.1	6.4	6.7	7.0	0:22
	ALT (FT)	15000	15000	13000	13000	13000	13000	
150	FUEL (1000 LB)	7.2	7.6	8.0	8.4	8.7	9.2	0:30
	ALT (FT)	23000	23000	23000	21000	21000	21000	
200	FUEL (1000 LB)	8.7	9.2	9.6	10.1	10.6	11.1	0:36
	ALT (FT)	29000	27000	27000	27000	25000	25000	
250	FUEL (1000 LB)	10.1	10.7	11.2	11.8	12.4	13.0	0:42
	ALT (FT)	37000	31000	29000	29000	27000	29000	
300	FUEL (1000 LB)	11.3	12.0	12.7	13.4	14.1	14.8	0:48
	ALT (FT)	43000	39000	37000	37000	35000	33000	
350	FUEL (1000 LB)	12.4	13.3	14.1	14.9	15.7	16.5	0:54
	ALT (FT)	43000	41000	39000	37000	35000	35000	
400	FUEL (1000 LB)	13.6	14.5	15.5	16.4	17.3	18.2	0:59
	ALT (FT)	43000	41000	39000	37000	35000	35000	
450	FUEL (1000 LB)	14.8	15.8	16.8	17.9	18.9	19.9	1:06
	ALT (FT)	43000	41000	39000	37000	37000	35000	
500	FUEL (1000 LB)	15.9	17.1	18.2	19.4	20.5	21.6	1:13
	ALT (FT)	43000	41000	39000	37000	37000	35000	

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
800	21080	20850	20650	21390	22070	22890	24000			
760	20030	19830	19600	19980	20850	21520	22350			
720	18980	18810	18560	18680	19660	20140	20800			
680	17950	17770	17530	17480	18410	18820	19430			
640	16940	16740	16500	16420	16950	17570	18140			
600	15950	15730	15480	15370	15600	16380	16850	17580		
560	15000	14750	14460	14330	14360	15200	15560	16040		
520	14110	13820	13480	13320	13300	13760	14300	14730		
480	13280	12940	12550	12370	12310	12420	13070	13450		
440	12470	12110	11680	11500	11370	11330	11850	12180	12870	
400	11690	11320	10870	10680	10490	10400	10460	10970	11530	
360	11180	10800	10350	10110	9880	9730	9680	9810	10230	10550

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
800	23060	23000	22910	23120	23640
760	21780	21670	21550	21670	22160
720	20580	20460	20320	20370	20800
680	19410	19270	19110	19130	19490
640	18250	18110	17920	17930	18180
600	17120	16950	16730	16710	16860
560	16020	15810	15570	15530	15610
520	14970	14700	14440	14360	14400
480	13970	13660	13340	13220	13210
440	13010	12650	12290	12110	12060
400	12100	11710	11300	11080	10970
360	11450	11070	10600	10350	10210

These tables include 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Oxygen Requirements

Required Pressure (PSI) for One 114/115 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

For more extensive than normal crew usage, add 1.2 psi/person/minute.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	399.4	395.0	382.9
28	430.8	421.2	405.7
26	464.5	451.9	435.2
24	500.6	484.9	467.6
22	538.7	521.7	503.0
20	592.3	577.6	555.9
18	641.7	622.3	598.3
16	695.5	671.7	645.7
14	743.0	715.0	686.1
12	790.9	760.6	730.9
10	833.2	801.9	768.0

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)								
	PRESSURE ALTITUDE (1000 FT)								
	14	16	18	20	22	24	26	28	30
ENGINE ONLY	-1.4	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE AND WING	-5.6	-3.9	-3.2	-2.2	-2.5	-2.6	-2.6	-2.7	-2.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Dry Runway
Flaps 30
Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000		2670	2870	3000	3060	3210	3320	3440
3400	2710	3000	3220	3400	3490	3660	3810	3960
3800	3010	3320	3580	3800	3910	4120	4300	4490
4200	3310	3650	3940	4200	4340	4580	4790	5020
4600	3600	3970	4290	4600	4770	5030	5280	5540
5000	3900	4300	4650	5000	5200	5490	5770	6070
5400	4190	4620	5010	5400	5630	5950	6260	6600
5800	4490	4950	5360	5800	6060	6410	6750	7120
6200	4790	5270	5720	6200	6490	6860	7250	7650
6600	5080	5600	6080	6600	6920	7320	7740	8180
7000	5380	5920	6430	7000	7350	7780	8230	8700
7400	5680	6250	6790	7400	7780	8230	8720	9230
7800	5970	6570	7150	7800	8210	8690	9210	9760
8200	6270	6900	7510	8200	8640	9150	9700	10280
8600	6560	7220	7860	8600	9070	9600	10190	10810
9000	6860	7550	8220	9000	9500	10060	10680	11340
9400	7160	7870	8580	9400	9930	10520	11170	11860
9800	7450	8200	8930	9800	10360	10980	11660	12390
10200	7750	8520	9290	10200	10790	11430	12150	12920
10600	8050	8850	9650	10600	11220	11890	12640	13440

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Dry Runway

Flaps 30

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
4600	403.3	378.7				
5000	451.4	423.9	397.7	372.7		
5400	502.1	470.6	440.9	413.4	387.0	
5800	553.3	518.9	486.1	454.7	425.8	398.4
6200	605.0	567.7	532.0	498.0	465.5	435.2
6600	649.4	616.8	578.4	541.7	506.6	473.1
7000	670.9	653.4	625.1	585.6	548.0	512.1
7400	690.1	672.5	655.1	629.9	589.7	551.2
7800	706.4	687.6	669.9	652.2	629.6	591.3
8200	723.8	702.2	683.9	666.1	647.6	623.9
8600	740.7	718.2	697.1	679.0	661.0	640.9
9000	756.7	733.8	711.5	691.4	673.2	655.0
9400	779.5	748.8	725.9	703.6	684.6	666.2
9800	796.2	764.7	739.8	716.9	695.6	677.0
10200	812.3	784.9	753.2	729.9	707.1	687.2
10600	827.8	799.9	770.6	742.3	718.9	696.9
11000	843.1	814.3	786.5	754.3	730.6	707.5
11400		828.3	800.0	770.2	741.8	718.3
11800		842.1	813.1	784.9	752.6	728.6
12200			825.7	797.1	764.5	738.5
12600			838.0	808.9	780.5	747.8
13000				820.3	791.6	758.4
13400				831.5	802.2	772.9
13800				842.6	812.6	783.7
14200					822.8	793.4
14600					832.6	802.9

With manual speedbrakes, decrease weight by 47600 lb.
With 1 brake deactivated, decrease weight by 49700 lb.
With 2 brakes deactivated, decrease weight by 101100 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Wet Runway

Flaps 30

Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000				3000	3030	3170	3270	3360
3400		3030	3250	3400	3460	3630	3760	3890
3800	3040	3360	3610	3800	3890	4090	4250	4410
4200	3330	3680	3960	4200	4320	4540	4740	4940
4600	3630	4010	4320	4600	4750	5000	5230	5470
5000	3930	4330	4680	5000	5180	5460	5720	5990
5400	4220	4660	5040	5400	5610	5920	6210	6520
5800	4520	4980	5390	5800	6040	6370	6700	7050
6200	4820	5310	5750	6200	6470	6830	7190	7570
6600	5110	5630	6110	6600	6900	7290	7680	8100
7000	5410	5960	6460	7000	7330	7740	8170	8630
7400	5700	6280	6820	7400	7760	8200	8660	9150
7800	6000	6610	7180	7800	8190	8660	9150	9680
8200	6300	6930	7530	8200	8620	9110	9640	10210
8600	6590	7260	7890	8600	9050	9570	10130	10730
9000	6890	7580	8250	9000	9480	10030	10620	11260
9400	7190	7910	8600	9400	9910	10490	11110	11790
9800	7480	8230	8960	9800	10340	10940	11600	12310
10200	7780	8560	9320	10200	10770	11400	12100	12840
10600	8070	8880	9680	10600	11200	11860	12590	13370

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
5400	414.8	389.4				
5800	456.9	428.9	402.4	377.1		
6200	501.0	469.6	440.0	412.5	386.2	
6600	545.5	511.6	479.1	448.3	419.9	392.9
7000	590.3	553.9	519.0	485.7	454.0	424.8
7400	634.1	596.5	559.2	523.6	489.6	457.2
7800	659.4	638.5	599.7	561.7	525.4	491.0
8200	677.6	660.0	637.8	600.1	561.6	524.9
8600	693.1	675.5	658.0	635.2	597.9	558.9
9000	707.6	688.6	670.8	653.1	630.8	593.9
9400	722.7	701.2	683.0	665.2	646.4	621.9
9800	737.4	715.1	694.6	676.5	658.5	637.8
10200	751.5	728.8	706.7	687.4	669.2	651.0
10600	768.6	742.0	719.3	697.9	679.5	661.2
11000	786.5	754.8	731.7	709.2	689.2	670.6
11400	800.8	771.7	743.6	720.6	698.6	679.9
11800	814.7	787.2	755.1	731.8	708.9	688.5
12200	828.1	800.2	771.0	742.6	719.2	697.1
12600	841.5	812.8	785.0	753.0	729.4	706.4
13000		825.0	796.8	764.8	739.2	715.6
13400		837.0	808.3	780.3	748.7	724.9
13800			819.5	791.1	757.9	733.7
14200			830.2	801.5	772.2	741.9
14600			840.9	811.7	783.2	750.0

With manual speedbrakes, decrease weight by 47600 lb.
With 1 brake deactivated, decrease weight by 49700 lb.
With 2 brakes deactivated, decrease weight by 101100 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)							
		AIRPORT PRESSURE ALTITUDE (FT)							
°C	°F	-2000	0	2000	4000	6000	8000	9000	9800
54	129	672.3	628.0						
52	126	690.0	643.1						
50	122	707.8	659.3	605.6					
48	118	725.5	677.8	619.9					
46	115	743.7	696.5	635.4	585.0				
44	111	761.0	714.1	652.5	600.2				
42	108	777.3	732.3	671.6	614.6	563.6			
40	104	793.0	750.7	689.9	629.6	576.5			
38	100	809.0	769.5	707.1	644.2	589.2	523.7		
36	97	823.4	785.6	722.9	658.1	600.0	534.2	502.7	
34	93	834.9	801.0	739.6	671.9	609.6	544.6	512.6	489.6
32	90	835.0	816.7	753.4	684.7	618.5	554.2	522.5	499.3
30	86	835.0	830.3	765.2	699.0	627.8	562.5	531.8	509.0
28	82	835.0	830.6	775.5	709.9	638.0	570.7	539.9	517.9
26	79	835.0	830.8	787.4	718.4	648.3	578.8	547.8	525.4
24	75	835.0	831.0	787.5	725.5	659.0	587.6	555.5	533.1
22	72	835.0	831.2	787.7	732.4	666.4	596.9	563.5	540.4
20	68	835.0	831.5	787.8	732.6	671.0	604.8	572.3	548.7
18	64	835.0	831.6	788.0	732.8	675.5	610.3	580.0	556.9
16	61	835.0	831.8	788.2	732.9	675.6	614.2	585.3	563.9
14	57	835.0	831.9	788.4	733.1	675.8	617.6	588.9	568.4
12	54	835.0	832.1	788.5	733.3	675.9	617.8	590.8	571.7
10	50	835.0	832.1	788.7	733.4	675.9	617.9	591.9	574.1
8	46	835.0	832.2	788.9	733.6	676.0	617.9	591.9	574.1
6	43	835.0	832.3	788.9	733.7	676.0	617.8	587.1	561.7
4	40	835.0	832.4	781.7	706.6	645.9	570.9	535.1	509.7
2	36	835.0	832.4	781.9	706.7	646.0	570.9	535.3	509.9
0	32	835.0	832.5	781.9	706.8	646.1	571.0	535.3	509.9
-40	-40	835.0	832.7	781.9	706.8	646.1	571.1	535.3	509.9

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.
With engine bleed for packs off, increase weight by 2800 lb.
With engine and wing anti-ice on, decrease weight by 4800 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 48400 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 20, Gear Up

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	6.10	5.13	3.96				
50	6.87	5.86	4.59	3.52	2.51	1.16	
46	7.69	6.66	5.32	4.11	3.04	1.64	0.36
42	8.44	7.49	6.11	4.83	3.61	2.13	0.82
38	9.17	8.30	6.86	5.49	4.19	2.65	1.27
34	9.62	9.05	7.54	6.08	4.67	3.14	1.72
30	9.64	9.64	8.07	6.61	5.10	3.54	2.15
26	9.66	9.65	8.51	7.03	5.59	3.93	2.56
22	9.67	9.66	8.52	7.34	5.93	4.36	2.94
18	9.69	9.66	8.52	7.34	6.15	4.65	3.26
14	9.71	9.67	8.53	7.35	6.15	4.84	3.53
10	9.72	9.68	8.54	7.35	6.15	4.84	3.69

Weight Adjustment

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
800	-3.08	-3.51	-3.94	-4.37	-4.80	-5.22	-5.64	-6.05	-6.46	-6.86	-7.26
750	-2.74	-3.13	-3.52	-3.90	-4.28	-4.65	-5.03	-5.40	-5.76	-6.12	-6.47
700	-2.41	-2.74	-3.07	-3.40	-3.72	-4.04	-4.36	-4.68	-4.99	-5.30	-5.60
650	-2.08	-2.35	-2.61	-2.87	-3.12	-3.38	-3.63	-3.88	-4.13	-4.39	-4.64
600	-1.51	-1.70	-1.89	-2.08	-2.26	-2.45	-2.63	-2.81	-2.99	-3.18	-3.37
550	-0.83	-0.93	-1.04	-1.14	-1.24	-1.34	-1.44	-1.54	-1.64	-1.74	-1.85
500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450	1.03	1.16	1.28	1.40	1.53	1.65	1.77	1.90	2.03	2.16	2.29
400	2.38	2.66	2.93	3.21	3.49	3.77	4.06	4.35	4.64	4.95	5.26

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF	-0.22	-0.23	-0.23	-0.23	-0.23	-0.22	-0.22	-0.22	-0.21	-0.21	-0.21
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF+10	0.08	0.07	0.07	0.07	0.09	0.11	0.12	0.11	0.12	0.10	0.10
VREF+20	0.17	0.14	0.12	0.13	0.16	0.19	0.19	0.17	0.17	0.14	0.13
VREF+30	0.14	0.10	0.08	0.08	0.10	0.05	0.03	0.01	-0.01	-0.07	-0.04

With engine bleed for packs off, increase gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.1%.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease gradient by 0.7%

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Quick Turnaround Limit Weight

Flaps 30 Limit Weight (1000 LB)

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	9800
54	129	510.4					
50	122	513.7	494.5				
45	113	517.9	498.5	479.8			
40	104	522.2	502.6	483.7	465.1		
35	95	526.6	506.8	487.7	469.0	450.5	434.8
30	86	531.1	511.2	491.8	473.1	454.4	438.5
25	77	535.6	515.6	496.1	477.3	458.4	442.2
20	68	540.3	520.2	500.4	481.5	462.5	446.0
15	59	545.2	524.9	504.9	485.7	466.8	450.0
10	50	550.2	529.7	509.6	490.1	471.1	454.2
5	41	555.3	534.6	514.3	494.6	475.5	458.3
0	31	560.6	539.6	519.2	499.3	480.1	462.8
-5	23	566.1	544.8	524.3	504.1	484.6	467.4
-10	14	571.7	550.2	529.5	509.0	489.3	472.0
-15	5	577.5	555.7	534.7	514.2	494.1	476.9
-20	-4	583.4	561.5	540.1	519.5	499.2	481.7
-30	-22	595.8	573.4	551.6	530.5	509.8	491.6
-40	-40	608.4	586.1	563.8	542.1	521.1	498.7
-50	-58	622.0	599.4	576.8	554.5	532.9	509.9
-54	-65	627.7	604.8	582.2	559.8	537.7	514.6

Increase weight by 4600 lb per 1% uphill slope. Decrease weight by 7800 lb per 1% downhill slope.
Increase weight by 12400 lb per 10 knots headwind. Decrease weight by 69500 lb per 10 knots tailwind.

Decrease weight by 27900 lb when one brake is deactivated. Decrease weight by 56900 lb when two brakes are deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Climb Limit Weight
Flaps 15

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 LB)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	0	2000	4000	6000	8000	9000	9800
54	129	517.7	494.0	458.7	412.7			
52	126	529.6	493.8	471.7	424.7			
50	122	542.3	496.4	473.5	436.5	377.2		
48	118	555.5	508.7	473.4	447.8	388.6		
46	115	568.5	520.7	475.9	448.8	399.8	372.8	
44	111	581.4	532.5	486.7	448.6	410.6	383.6	
42	108	593.6	544.1	497.6	451.1	416.5	394.0	373.7
40	104	605.8	556.2	508.9	461.3	416.3	399.5	383.8
38	100	619.4	569.1	520.8	471.8	418.8	399.3	386.7
36	97	633.1	581.8	532.8	483.2	428.3	401.9	386.5
34	93	647.0	594.8	545.3	494.8	438.3	411.3	391.0
32	90	659.3	607.6	557.4	506.0	448.8	421.0	400.4
30	86	671.1	621.0	569.7	517.8	459.8	431.2	410.0
28	82	682.9	634.1	582.3	529.4	470.4	441.8	420.2
26	79	693.6	646.3	593.7	540.8	481.8	451.9	430.3
24	75	698.9	657.0	604.2	551.5	492.3	462.9	440.2
22	72	699.1	666.6	614.1	560.7	503.6	473.6	450.8
20	68	699.3	671.0	622.4	568.3	513.5	484.6	460.9
18	64	699.5	671.0	630.2	575.3	521.5	494.1	471.1
16	61	699.6	671.1	633.8	580.4	528.3	501.7	480.2
14	57	699.7	671.1	633.7	584.6	534.3	508.6	487.5
10	50	699.8	671.1	633.5	586.2	540.2	516.9	499.1
-40	-40	696.1	666.8	627.0	579.1	535.0	514.1	

With engine bleed for packs off, increase weight by 1900 lb.
With engine anti-ice on, decrease weight by 4200 lb.
With engine and wing anti-ice on, decrease weight by 9200 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)												
		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	9800
54	129	601.9	583.1	565.0										
52	126	616.2	597.9	578.9	554.5									
50	122	631.0	612.0	592.7	567.9	544.9								
48	118	646.2	626.6	607.7	581.8	558.2	535.9							
46	115	662.0	642.2	623.2	597.5	572.8	549.8	527.0						
44	111	676.8	657.6	638.1	613.1	588.5	563.5	541.2	517.6					
42	108	690.9	672.2	653.6	627.4	603.6	577.6	554.3	531.5	507.6				
40	104	705.9	688.9	669.5	643.1	618.4	593.3	567.9	544.8	519.1	490.5			
38	100	720.5	703.5	684.8	657.4	631.1	606.3	580.5	556.7	530.6	500.4	470.4		
36	97	733.3	717.2	699.4	672.9	643.8	617.7	591.9	567.2	539.9	510.6	480.0	451.3	
34	93	742.3	730.6	714.0	686.3	657.3	627.9	601.9	576.7	548.5	519.0	489.6	460.5	439.8
32	90	742.7	743.8	727.3	698.2	668.9	639.8	612.0	585.8	556.3	526.9	497.9	469.6	448.6
30	86	743.2	744.1	740.1	707.9	679.4	649.5	622.6	595.2	564.9	534.6	505.5	477.7	457.5
28	82	743.6	744.5	740.3	718.5	688.5	658.3	632.0	605.2	574.0	542.6	512.8	485.0	465.0
26	79	744.1	744.7	740.5	718.5	698.7	666.5	639.1	614.4	583.5	551.2	520.2	492.1	471.8
24	75	744.5	744.9	740.7	718.7	698.8	674.2	644.5	620.6	591.9	560.2	528.4	498.9	478.4
22	72	744.9	745.2	740.9	718.9	698.9	674.4	650.1	624.1	597.5	567.5	536.7	506.4	485.2
20	68	745.4	745.6	741.1	718.9	699.1	674.6	650.3	628.1	601.0	572.8	543.9	514.3	493.0
18	64	745.8	745.8	741.3	719.1	699.3	674.6	650.4	628.3	604.6	576.3	548.8	521.4	500.0
16	61	746.3	746.0	741.5	719.4	699.4	674.8	650.5	628.5	604.7	579.8	552.2	526.0	506.6
14	57	746.7	746.3	741.6	719.4	699.6	674.8	650.6	628.5	604.8	580.0	555.4	529.1	510.4
12	54	746.9	746.5	741.7	719.6	699.8	675.1	650.6	628.5	604.8	580.0	555.5	531.8	513.2
10	50	747.1	746.7	741.8	719.8	699.9	675.1	650.7	628.5	604.8	580.0	555.6	532.0	514.1
-40	-40	748.9	747.6	742.3	720.3	700.4	675.9	651.4	629.2	605.4	580.5	556.0	532.4	

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.
With engine bleed for packs off, increase weight by 2900 lb.
With engine and wing anti-ice on, decrease weight by 3700 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 67500 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on, engine and wing anti-ice off

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	634.3								
50	597.1	657.6							
100	562.8	619.5	662.5						
150	535.5	590.2	632.4	665.0					
200	512.6	565.8	607.6	640.5	666.4				
250	492.6	544.7	586.2	619.3	645.8	667.2			
300	474.9	526.0	567.2	600.5	627.4	649.5	667.7	681.6	681.6
350	458.9	509.2	550.0	583.4	610.8	633.3	652.1	667.9	680.5
400	444.4	493.9	534.4	567.8	595.5	618.4	637.7	654.0	667.9
450	431.2	479.9	520.1	553.4	581.3	604.6	624.3	641.0	655.4
500	419.0	466.8	506.8	540.0	568.0	591.7	611.7	628.8	643.6
550	407.6	454.7	494.4	527.5	555.6	579.4	599.9	617.3	632.5
600	396.9	443.5	482.7	515.8	543.9	567.9	588.6	606.4	621.8
650	386.9	433.1	471.8	504.8	532.9	557.0	577.9	596.0	611.7
700	377.3	423.2	461.5	494.3	522.4	546.6	567.7	586.0	602.0
750	373.5	413.8	451.7	484.4	512.5	536.8	557.9	576.5	592.7
800		404.9	442.5	475.0	503.0	527.4	548.6	567.3	583.8
850		396.5	433.9	466.0	494.0	518.4	539.7	558.5	575.2
900		388.4	425.6	457.4	485.3	509.7	531.1	550.1	566.8
950		380.7	417.6	449.2	477.1	501.5	522.9	541.9	558.8
1000		373.2	410.0	441.5	469.1	493.5	515.0	534.1	551.1

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
30 & Below	0	0	0	0	0	0	0	0	0
32	-6.1	-6.9	-7.8	-8.7	-9.5	-10.4	-11.2	-12.1	-12.9
34	-12.2	-13.9	-15.6	-17.3	-19.0	-20.7	-22.4	-24.1	-25.8
36	-18.3	-20.8	-23.4	-26.0	-28.5	-31.1	-33.6	-36.2	-38.8
38	-24.4	-27.8	-31.2	-34.6	-38.0	-41.4	-44.9	-48.3	-51.7
40	-30.4	-34.7	-39.0	-43.3	-47.5	-51.8	-56.1	-60.3	-64.6
42	-36.5	-41.6	-46.8	-51.9	-57.1	-62.2	-67.4	-72.6	-77.7
44	-42.5	-48.6	-54.6	-60.6	-66.7	-72.7	-78.7	-84.8	-90.8
46	-48.6	-55.5	-62.4	-69.3	-76.2	-83.2	-90.1	-97.0	-103.9
48	-54.6	-62.4	-70.2	-78.0	-85.8	-93.6	-101.4	-109.2	-117.0
50	-60.7	-69.3	-78.0	-86.7	-95.4	-104.1	-112.7	-121.4	-130.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
S.L. & Below	0	0	0	0	0	0	0	0	0
1000	-15.5	-17.2	-19.0	-20.8	-22.5	-24.2	-26.0	-27.8	-29.5
2000	-31.0	-34.5	-38.0	-41.5	-45.0	-48.5	-52.0	-55.5	-59.0
3000	-43.2	-48.4	-53.5	-58.6	-63.8	-68.9	-74.0	-79.1	-84.2
4000	-55.5	-62.2	-69.0	-75.8	-82.5	-89.2	-96.0	-102.8	-109.5
5000	-71.2	-79.1	-87.1	-95.1	-103.1	-111.0	-119.0	-127.0	-134.9
6000	-86.8	-96.0	-105.2	-114.4	-123.6	-132.8	-142.0	-151.2	-160.4
7000	-99.4	-110.7	-121.9	-133.2	-144.5	-155.7	-167.0	-178.3	-189.5
8000	-112.0	-125.3	-138.7	-152.0	-165.3	-178.7	-192.0	-205.3	-218.7
9000	-127.6	-142.4	-157.2	-172.0	-186.8	-201.6	-216.4	-231.3	-246.1
10000	-143.2	-159.5	-175.7	-192.0	-208.3	-224.5	-240.8	-257.3	-273.5

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
15 TW	-37.7	-41.9	-46.1	-50.3	-54.5	-58.6	-62.8	-67.0	-71.2
10 TW	-25.2	-27.9	-30.7	-33.5	-36.3	-39.1	-41.9	-44.7	-47.5
5 TW	-12.6	-14.0	-15.4	-16.8	-18.2	-19.5	-20.9	-22.3	-23.7
0	0	0	0	0	0	0	0	0	0
10 HW	8.0	7.5	7.0	6.5	6.0	5.5	5.0	4.5	4.0
20 HW	16.0	15.0	14.0	13.0	12.0	11.0	10.0	9.0	8.0
30 HW	24.0	22.5	21.0	19.5	18.0	16.5	15.0	13.5	12.0
40 HW	32.0	30.0	28.0	26.0	24.0	22.0	20.0	18.0	16.0

With engine bleed for packs off, increase weight by 1900 lb.
With engine anti-ice on, decrease weight by 3900 lb.
With engine and wing anti-ice on, decrease weight by 8700 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18600	16600	14200
760	19100	17200	14800
740	19700	17900	15500
720	20200	18500	16100
700	21000	19400	17100
680	21900	20400	18200
660	22900	21500	19400
640	23900	22500	20600
620	25000	23500	21900
600	25900	24600	23000
580	27000	25700	24200
560	28000	27000	25400
540	29100	28200	26700
520	30100	29500	28000
500	30900	30500	29300
480	31600	31300	30500
460	32400	32200	31500
440	33300	33100	32600
420	34100	33900	33600
400	34900	34800	34600
380	35800	35700	35600
360	36700	36600	36400

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
334	296	264	239	218	200	187	175	165	156	149
500	444	396	358	327	300	281	264	249	235	224
666	591	527	477	436	400	375	352	332	314	299
830	738	659	596	545	500	469	441	416	393	374
993	883	789	714	653	600	563	530	500	473	450
1156	1029	920	833	762	700	657	618	583	552	525
1318	1173	1050	951	870	800	751	707	667	632	601
1479	1318	1179	1069	979	900	845	796	751	712	677
1639	1462	1309	1187	1087	1000	939	884	835	791	753
1799	1605	1438	1305	1196	1100	1033	973	919	871	829
1958	1748	1567	1423	1304	1200	1128	1062	1003	951	905
2116	1890	1696	1540	1412	1300	1222	1151	1087	1030	981
2273	2032	1824	1658	1520	1400	1316	1240	1171	1110	1058
2430	2174	1952	1775	1628	1500	1410	1329	1255	1191	1134
2586	2315	2080	1892	1736	1600	1504	1418	1340	1271	1211
2741	2455	2208	2009	1844	1700	1599	1507	1425	1351	1287
2896	2595	2335	2125	1952	1800	1693	1596	1509	1432	1364
3050	2734	2461	2242	2060	1900	1788	1686	1594	1512	1441
3203	2873	2588	2358	2167	2000	1882	1776	1679	1593	1518

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	17.3	0:52	16.6	0:50	16.1	0:48	15.8	0:46	15.6	0:45
300	25.3	1:15	24.2	1:12	23.3	1:09	22.5	1:06	22.1	1:03
400	33.4	1:39	31.7	1:34	30.4	1:30	29.2	1:25	28.5	1:21
500	41.4	2:02	39.2	1:56	37.5	1:50	36.0	1:45	35.0	1:40
600	49.7	2:25	47.1	2:18	44.9	2:11	43.0	2:04	41.7	1:58
700	58.1	2:48	54.9	2:39	52.3	2:31	50.0	2:23	48.4	2:16
800	66.4	3:11	62.7	3:01	59.7	2:51	57.0	2:42	55.1	2:34
900	74.8	3:33	70.5	3:22	67.1	3:12	64.0	3:02	61.8	2:52
1000	83.1	3:56	78.4	3:44	74.5	3:32	71.0	3:21	68.5	3:10
1100	91.8	4:18	86.6	4:05	82.2	3:52	78.4	3:39	75.6	3:27
1200	100.6	4:40	94.8	4:25	90.0	4:11	85.7	3:58	82.7	3:45
1300	109.3	5:02	103.0	4:46	97.7	4:31	93.1	4:16	89.7	4:02
1400	118.1	5:24	111.2	5:07	105.4	4:51	100.4	4:35	96.8	4:19
1500	126.8	5:46	119.4	5:28	113.2	5:10	107.8	4:53	103.9	4:37
1600	136.0	6:07	128.0	5:48	121.2	5:29	115.5	5:11	111.4	4:54
1700	145.2	6:28	136.5	6:08	129.3	5:48	123.2	5:29	118.8	5:11
1800	154.3	6:49	145.1	6:28	137.4	6:07	130.9	5:47	126.3	5:28
1900	163.5	7:10	153.7	6:48	145.5	6:26	138.6	6:05	133.8	5:45
2000	172.6	7:32	162.3	7:08	153.6	6:45	146.3	6:23	141.3	6:02

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	600
20	-2.4	-1.2	0.0	1.5	3.0	4.6
40	-4.7	-2.4	0.0	2.9	5.9	9.2
60	-7.1	-3.6	0.0	4.4	8.9	13.9
80	-9.5	-4.9	0.0	5.9	12.0	18.8
100	-11.9	-6.1	0.0	7.4	15.2	23.7
120	-14.3	-7.3	0.0	9.0	18.4	28.9
140	-16.7	-8.5	0.0	10.6	21.8	34.1
160	-19.1	-9.7	0.0	12.2	25.1	39.4
180	-21.6	-10.9	0.0	13.8	28.6	44.9

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
105	86	73	63	56	50	45	41	38	35	33
174	152	134	120	109	100	92	85	80	75	70
245	217	195	177	163	150	139	130	122	115	108
314	282	256	234	216	200	186	175	164	155	147
384	347	316	290	269	250	234	219	207	196	185
452	411	376	347	322	300	281	264	250	236	224
521	474	436	403	375	350	328	309	292	277	264
590	539	496	459	428	400	376	354	335	318	303
659	603	556	515	480	450	423	399	378	359	342
730	668	616	572	534	500	470	444	421	399	380

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)						TIME (HRS:MIN)
		360	400	440	480	520	560	
50	FUEL (1000 LB)	4.9	5.1	5.4	5.7	6.0	6.4	0:16
	ALT (FT)	11000	11000	11000	11000	11000	9000	
100	FUEL (1000 LB)	8.0	8.5	9.0	9.5	10.0	10.6	0:26
	ALT (FT)	21000	21000	19000	19000	19000	17000	
150	FUEL (1000 LB)	10.8	11.5	12.2	13.0	13.7	14.5	0:35
	ALT (FT)	27000	25000	25000	23000	23000	21000	
200	FUEL (1000 LB)	13.5	14.4	15.3	16.3	17.3	18.3	0:44
	ALT (FT)	33000	29000	27000	27000	25000	23000	
250	FUEL (1000 LB)	16.0	17.2	18.4	19.6	20.9	22.2	0:52
	ALT (FT)	33000	31000	29000	27000	25000	23000	
300	FUEL (1000 LB)	18.6	20.0	21.5	23.0	24.5	26.0	1:01
	ALT (FT)	33000	33000	29000	29000	27000	25000	
350	FUEL (1000 LB)	21.2	22.8	24.5	26.3	28.0	29.8	1:09
	ALT (FT)	33000	33000	31000	29000	27000	25000	
400	FUEL (1000 LB)	23.8	25.7	27.6	29.6	31.6	33.7	1:17
	ALT (FT)	33000	33000	31000	29000	27000	25000	
450	FUEL (1000 LB)	26.5	28.5	30.7	33.0	35.3	37.6	1:26
	ALT (FT)	33000	33000	31000	29000	27000	25000	
500	FUEL (1000 LB)	29.1	31.4	33.8	36.3	38.9	41.5	1:34
	ALT (FT)	33000	33000	31000	29000	27000	25000	

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR) PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
800	34550						
760	33390	33420					
720	31570	31530					
680	29640	29580	29490				
640	27710	27670	27560				
600	26100	26080	25930				
560	24550	24520	24350	24470			
520	23040	22970	22800	22860	23100		
480	21610	21500	21320	21320	21540		
440	20150	20000	19800	19790	19950	20220	
400	18760	18580	18340	18340	18430	18570	19050
360	17350	17150	16890	16860	16880	17000	17360

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR) PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
800	33920	34110	34060	34600	36410
760	32630	32740	32680	33150	34530
720	30740	30780	30750	31090	32130
680	28770	28780	28750	28990	29710
640	26830	26830	26770	27030	27540
600	25180	25160	25060	25310	25710
560	23580	23520	23400	23620	23890
520	22000	21900	21750	21910	22150
480	20490	20340	20180	20260	20480
440	18960	18770	18570	18610	18790
400	17490	17280	17030	17010	17140
360	16020	15800	15520	15420	15520

These tables include 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
20	374.5	374.5	
18	397.5	393.1	384.4
16	424.4	420.7	412.2
14	453.3	451.7	440.3
12	488.9	484.2	469.7
10	524.5	518.7	503.5
8	562.0	553.8	539.5
6	604.3	588.9	567.4
4	641.4	617.7	589.7
2	671.4	642.9	613.1
0	698.4	666.6	634.4

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)									
	PRESSURE ALTITUDE (1000 FT)									
	0	2	4	6	8	10	12	14	16	18
ENGINE ONLY	0.0	-1.3	-2.2	-2.4	-2.1	-1.7	-1.4	-0.2	0.0	0.0
ENGINE AND WING	-4.7	-6.2	-6.3	-6.6	-5.7	-4.9	-4.0	-3.3	-2.6	-2.0

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Tire Speed, and Obstacle Limit Weights as determined from the following tables. Brake Energy Limit is not shown as it is not limiting for the range of conditions shown in this chapter. When determining a maximum weight for a wet runway, the dry runway limit weight must also be checked and the lower of the two weights used.

Field Limit Weight - Slope and Wind Corrections

These tables for wet and dry runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway condition and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude.

When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Obstacle Limit Weight

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Maximum tire speed limited weights are presented for 235 MPH tires. To determine the tire speed limit weight, enter the table with OAT, move to airport pressure altitude and read the tire speed limit weight. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal takeoff speeds, V1, VR, and V2 are read from either the wet or dry table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle limit weight and the V1 must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 8400 lb for a dry runway or 5000 lb for a wet runway and the V1 associated with the reduced weight by 2 knots. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 17000 lb for a dry runway or 10400 lb for a wet runway and the V1 associated with the reduced weight by 5 knots for a dry runway or 3 knots for a wet runway. If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate stop distance available corrected for wind and slope exceeds approximately 4900 ft for one brake deactivated or 5100 ft for two brakes deactivated. For wet runways, the corrected accelerate stop distance should exceed approximately 6200 ft for one brake deactivated or 6400 ft for two brakes deactivated.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

One Thrust Reverser Inoperative

Wet runway takeoff performance presented for all brakes operating is based on the use of one thrust reverser during deceleration. When operating with a thrust reverser inoperative, the runway/obstacle limited takeoff weight and V1 speed must be reduced to account for the reduced deceleration capability. A simplified method which conservatively accounts for this is to reduce the normal wet runway/obstacle limited weight by 11800 lb and the V1 associated with the reduced weight by 3 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate stop distance available corrected for wind and slope exceeds approximately 6300 ft.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability at two center of gravity positions: 7.5% MAC (FMC default) for use when no center of gravity is entered on the PERF INIT page, and 30% MAC (typical mid cruise center of gravity) for use when 30% MAC is entered. Crews may interpolate between these values to determine the airplane's capability at other specific center of gravity positions. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time Table with air distance from the Ground to Air Miles Conversion Table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the planned landing weight to obtain fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time required with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Oxygen Requirements

Flight Crew System

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with these requirements is achieved with the minimum dispatch oxygen cylinder pressure. Enter the Crew Oxygen Requirements table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate bottle temperature.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 2.05 liters/person/minute (1.2 psi/person/minute for the single cylinder system), or 13 liters/person/minute (8 psi/person/minute) if 100% oxygen is selected during normal usage.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-around Gradient table with airport OAT and pressure altitude to determine the reference Go-Around Gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted Go-Around Gradient. Apply the necessary engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA

Pkg Model Identification PD.ModID.40.1

Takeoff. PD.40.1

Takeoff Field Corrections - Dry Runway PD.40.1
Takeoff Field & Climb Limit Weights - Dry Runway PD.40.2
Takeoff Field Corrections - Wet Runway PD.40.5
Takeoff Field & Climb Limit Weights - Wet Runway PD.40.6
Takeoff Obstacle Limit Weight. PD.40.9
Tire Speed Limit PD.40.11
Takeoff Speeds - Dry Runway PD.40.12
Takeoff Speeds - Wet Runway PD.40.14

Enroute PD.41.1

Long Range Cruise Maximum Operating Altitude. PD.41.1
Long Range Cruise Trip Fuel and Time PD.41.5
Long Range Cruise Step Climb PD.41.7
Short Trip Fuel and Time PD.41.8
Holding Planning PD.41.9
Crew Oxygen Requirements. PD.41.10
Net Level Off Weight PD.41.11

Landing PD.42.1

Landing Field Limit Weight - Dry Runway PD.42.1
Landing Field Limit Weight - Wet Runway PD.42.3
Approach or Landing Climb Limited Weight. PD.42.4
Go-Around Climb Gradient PD.42.5
Quick Turnaround Limit Weight. PD.42.6

Gear Down. PD.43.1

Takeoff Climb Limit Weight. PD.43.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight PD.43.2
Takeoff Obstacle Limit Weight PD.43.3
Long Range Cruise Altitude Capability PD.43.5
Long Range Cruise Trip Fuel and Time PD.43.6
Short Trip Fuel and Time PD.43.8
Holding Planning PD.43.9
Net Level Off Weight PD.43.10

Text PD.44.1

Introduction PD.44.1
Takeoff PD.44.1
Enroute PD.44.4
Landing PD.44.6
Gear Down PD.44.7

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
201	HL7782	37643	WD946
202	HL7783	37644	WD947
215	HL8006	37652	WE473
216	HL8007	43815	WE474
217	HL8008	43816	WE475
218	HL8009	41999	WE476
213	HL8010	42120	WE471
214	HL8011	42123	WE472
204	HL8208	37645	WD949

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airplane Number	Registry Number	Serial Number	Tabulation Number
205	HL8209	37646	WD950
206	HL8210	40377	WD951
207	HL8216	37647	WD952
208	HL8217	37648	WD953
209	HL8218	37649	WD954
210	HL8250	37650	WD955
211	HL8274	41998	WD956
212	HL8275	37651	WD957

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field Corrections - Dry Runway

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4310	4280	4260	4230	4200	4150	4110	4060	4020
4600	4750	4710	4680	4640	4600	4540	4480	4420	4360
5000	5190	5140	5090	5050	5000	4930	4860	4780	4710
5400	5630	5570	5510	5460	5400	5310	5230	5140	5060
5800	6070	6000	5930	5870	5800	5700	5600	5500	5400
6200	6510	6430	6350	6280	6200	6090	5970	5860	5750
6600	6950	6860	6770	6690	6600	6470	6350	6220	6090
7000	7380	7290	7190	7100	7000	6860	6720	6580	6440
7400	7820	7720	7610	7510	7400	7250	7090	6940	6780
7800	8260	8150	8030	7920	7800	7630	7460	7300	7130
8200	8700	8580	8450	8330	8200	8020	7840	7660	7480
8600	9140	9010	8870	8740	8600	8410	8210	8020	7820
9000	9580	9440	9290	9150	9000	8790	8580	8370	8170
9400	10020	9860	9710	9550	9400	9180	8960	8730	8510
9800	10460	10290	10130	9960	9800	9560	9330	9090	8860
10200	10900	10720	10550	10370	10200	9950	9700	9450	9200
10600	11340	11150	10970	10780	10600	10340	10070	9810	9550
11000	11780	11580	11390	11190	11000	10720	10450	10170	9890
11400	12210	12010	11810	11600	11400	11110	10820	10530	10240
11800	12650	12440	12230	12010	11800	11500	11190	10890	10590

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3170	3510	3860	4200	4450	4700	4970	5250
4600	3500	3870	4230	4600	4860	5130	5410	5700
5000	3840	4220	4610	5000	5270	5550	5850	6150
5400	4170	4580	4990	5400	5680	5980	6280	6600
5800	4500	4940	5370	5800	6100	6400	6720	7050
6200	4840	5290	5750	6200	6510	6830	7160	7490
6600	5170	5650	6120	6600	6920	7250	7590	7940
7000	5500	6000	6500	7000	7330	7680	8030	8390
7400	5840	6360	6880	7400	7750	8100	8470	8840
7800	6170	6710	7260	7800	8160	8530	8900	9290
8200	6500	7070	7630	8200	8570	8950	9340	9740
8600	6840	7420	8010	8600	8980	9370	9780	10190
9000	7170	7780	8390	9000	9390	9800	10210	10640
9400	7500	8140	8770	9400	9810	10220	10650	11090
9800	7840	8490	9150	9800	10220	10650	11090	11540
10200	8170	8850	9520	10200	10630	11070	11520	11990
10600	8500	9200	9900	10600	11040	11500	11960	12430
11000	8840	9560	10280	11000	11460	11920	12400	12880
11400	9170	9910	10660	11400	11870	12350	12840	13330
11800	9500	10270	11030	11800	12280	12770	13270	13780

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	549.2	495.8	492.5	489.3	486.1	483.0	473.2	461.4	448.3	434.8	421.2
5000	575.4	519.8	516.3	513.0	509.7	506.4	496.3	483.9	470.3	456.2	442.0
5400	600.5	542.7	539.2	535.7	532.3	528.9	518.3	505.5	491.3	476.7	462.0
5800	624.7	564.9	561.2	557.6	554.0	550.5	539.6	526.3	511.7	496.5	481.3
6200	647.9	586.2	582.4	578.6	575.0	571.4	560.1	546.3	531.2	515.6	499.9
6600	670.2	606.6	602.7	598.9	595.1	591.4	579.8	565.6	550.1	534.0	517.8
7000	691.6	626.3	622.3	618.3	614.5	610.7	598.7	584.2	568.2	551.7	535.1
7400	711.9	645.1	640.9	636.9	632.9	629.0	616.8	602.0	585.6	568.7	551.7
7800	731.5	663.2	659.0	654.9	650.8	646.9	634.4	619.2	602.5	585.2	567.8
8200	751.3	681.6	677.3	673.1	668.9	664.9	652.1	636.7	619.6	601.9	584.2
8600	770.2	699.1	694.7	690.4	686.2	682.1	669.1	653.3	635.9	617.9	599.8
9000	787.1	714.7	710.2	705.8	701.5	697.3	684.1	668.0	650.3	631.9	613.5
9400	802.6	728.8	724.3	719.8	715.4	711.2	697.7	681.3	663.2	644.5	625.8
9800	817.8	742.7	738.1	733.6	729.1	724.7	711.0	694.3	676.0	656.9	637.8
10200	832.6	756.3	751.6	747.0	742.4	738.0	724.0	707.1	688.4	669.0	649.6
10600	834.9	769.5	764.7	760.0	755.4	750.9	736.7	719.5	700.5	680.8	661.1
11000	834.9	782.4	777.5	772.8	768.1	763.5	749.1	731.6	712.3	692.3	672.2
CLIMB LIMIT WT (1000 LB)	823.3	823.2	822.9	822.6	822.3	821.9	794.3	763.1	728.8	695.6	662.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	513.5	465.3	462.2	459.2	456.3	447.9	438.5	427.2	414.9	400.0	386.1
5000	538.2	488.0	484.8	481.7	478.6	469.9	460.1	448.3	435.5	420.0	405.5
5400	561.9	509.8	506.4	503.1	500.0	490.9	480.8	468.5	455.2	439.1	424.0
5800	584.7	530.7	527.3	523.9	520.6	511.2	500.7	488.0	474.2	457.5	442.0
6200	606.6	550.9	547.3	543.8	540.4	530.7	519.9	506.8	492.5	475.3	459.3
6600	627.7	570.4	566.7	563.1	559.6	549.6	538.4	524.9	510.3	492.5	476.0
7000	647.9	589.1	585.3	581.6	578.0	567.7	556.3	542.4	527.4	509.2	492.2
7400	667.2	606.9	603.1	599.3	595.6	585.1	573.4	559.2	543.8	525.2	507.8
7800	685.8	624.3	620.3	616.4	612.7	601.9	590.0	575.4	559.7	540.7	522.9
8200	704.7	641.8	637.8	633.8	630.0	619.0	606.8	592.0	575.9	556.5	538.4
8600	722.6	658.6	654.4	650.4	646.5	635.3	622.9	607.7	591.4	571.6	553.1
9000	738.7	673.4	669.2	665.1	661.1	649.7	637.0	621.6	604.9	584.7	565.9
9400	753.2	686.7	682.5	678.3	674.2	662.6	649.7	634.0	617.0	596.5	577.3
9800	767.6	699.9	695.6	691.3	687.2	675.4	662.2	646.2	629.0	608.0	588.5
10200	781.6	712.7	708.3	704.0	699.8	687.8	674.4	658.1	640.6	619.3	599.4
10600	795.2	725.2	720.7	716.3	712.1	699.9	686.2	669.7	651.9	630.2	610.1
11000	808.5	737.4	732.9	728.4	724.0	711.7	697.8	681.1	662.9	641.0	620.4
CLIMB LIMIT WT (1000 LB)	779.2	778.9	778.6	778.4	778.1	756.9	733.8	704.6	673.5	640.1	610.2

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	479.2	434.6	431.7	428.8	422.4	414.1	403.9	393.0	380.3	367.0	355.3
5000	502.5	456.0	453.0	450.0	443.3	434.7	424.0	412.7	399.4	385.6	373.4
5400	524.8	476.4	473.3	470.2	463.3	454.4	443.2	431.5	417.7	403.3	390.7
5800	546.3	496.2	493.0	489.8	482.7	473.4	461.8	449.7	435.4	420.5	407.4
6200	567.0	515.3	512.0	508.7	501.3	491.7	479.8	467.3	452.5	437.2	423.6
6600	586.9	533.7	530.3	526.8	519.3	509.4	497.1	484.2	469.1	453.2	439.3
7000	606.1	551.4	547.9	544.4	536.6	526.5	513.9	500.6	485.1	468.8	454.5
7400	624.3	568.4	564.8	561.2	553.2	542.9	530.0	516.4	500.5	483.9	469.2
7800	642.1	584.9	581.2	577.5	569.4	558.8	545.6	531.8	515.5	498.5	483.5
8200	660.0	601.6	597.9	594.1	585.8	575.0	561.5	547.4	530.8	513.4	498.1
8600	677.1	617.6	613.7	609.9	601.4	590.4	576.7	562.3	545.3	527.6	512.1
9000	692.2	631.6	627.7	623.8	615.2	603.9	590.0	575.3	558.0	540.0	524.1
9400	706.0	644.2	640.2	636.3	627.5	616.0	601.8	586.9	569.3	550.9	534.8
9800	719.5	656.6	652.6	648.5	639.6	627.9	613.5	598.2	580.3	561.6	545.2
10200	732.6	668.7	664.6	660.5	651.4	639.5	624.8	609.3	591.1	572.1	555.3
10600	745.4	680.5	676.3	672.1	662.8	650.8	635.8	620.1	601.6	582.3	565.2
11000	758.0	692.0	687.7	683.5	674.1	661.8	646.6	630.6	611.8	592.2	574.9
CLIMB LIMIT WT (1000 LB)	726.9	726.6	726.4	726.1	714.1	696.2	673.1	648.6	619.1	589.4	564.4

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	445.9	403.3	400.3	394.9	386.8	377.0	368.3	358.8	347.6	336.6	326.0
5000	467.8	423.3	420.3	414.6	406.2	396.0	386.9	377.1	365.3	353.9	342.8
5400	488.7	442.6	439.4	433.5	424.8	414.2	404.7	394.5	382.3	370.4	358.9
5800	509.0	461.2	457.9	451.8	442.8	431.8	422.0	411.4	398.8	386.5	374.6
6200	528.4	479.1	475.7	469.4	460.1	448.8	438.6	427.7	414.7	402.0	389.7
6600	547.2	496.4	492.9	486.4	476.9	465.2	454.8	443.5	430.1	417.0	404.4
7000	565.3	513.1	509.6	502.9	493.1	481.1	470.4	458.8	445.0	431.6	418.7
7400	582.6	529.2	525.6	518.7	508.7	496.4	485.5	473.7	459.5	445.8	432.5
7800	599.4	544.8	541.1	534.1	523.8	511.3	500.1	488.0	473.6	459.6	446.0
8200	616.4	560.7	556.9	549.8	539.3	526.5	515.1	502.8	488.0	473.7	459.9
8600	632.7	575.9	572.0	564.7	554.0	541.0	529.3	516.8	501.8	487.2	473.0
9000	647.0	589.1	585.2	577.8	566.9	553.6	541.7	528.9	513.6	498.7	484.3
9400	659.9	601.0	597.0	589.4	578.3	564.8	552.7	539.6	524.1	508.9	494.3
9800	672.6	612.6	608.5	600.8	589.5	575.7	563.4	550.2	534.3	518.9	504.0
10200	684.9	623.9	619.8	611.9	600.4	586.4	573.9	560.4	544.3	528.6	513.4
10600	697.0	635.0	630.7	622.8	611.1	596.8	584.1	570.4	554.0	538.1	522.6
11000	708.7	645.7	641.4	633.3	621.5	607.0	594.1	580.2	563.5	547.3	531.6
CLIMB LIMIT WT (1000 LB)	674.9	674.9	674.6	667.1	651.5	631.2	612.9	592.5	567.3	543.2	520.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
4600	409.4	369.4	364.4	357.3	348.5	340.4	331.8	322.0	311.9	302.0	292.0
5000	429.8	388.0	382.9	375.5	366.3	357.8	348.9	338.7	328.1	317.8	307.4
5400	449.2	405.9	400.5	392.8	383.3	374.5	365.2	354.7	343.7	333.0	322.2
5800	468.1	423.2	417.6	409.7	399.8	390.7	381.1	370.1	358.8	347.7	336.5
6200	486.2	439.9	434.2	425.9	415.8	406.3	396.4	385.1	373.4	361.9	350.4
6600	503.7	456.0	450.2	441.7	431.2	421.5	411.3	399.7	387.6	375.8	363.9
7000	520.7	471.7	465.6	456.9	446.2	436.2	425.8	413.8	401.4	389.3	377.1
7400	536.9	486.8	480.6	471.7	460.7	450.5	439.8	427.6	414.9	402.5	390.0
7800	552.7	501.5	495.2	486.1	474.8	464.4	453.4	440.9	427.9	415.3	402.5
8200	568.8	516.5	510.0	500.7	489.3	478.6	467.5	454.7	441.4	428.5	415.5
8600	584.1	530.8	524.2	514.7	503.0	492.2	480.8	467.8	454.2	441.1	427.8
9000	597.5	543.2	536.5	526.8	514.9	503.8	492.2	479.0	465.2	451.8	438.3
9400	609.5	554.2	547.3	537.5	525.4	514.1	502.3	488.8	474.8	461.1	447.3
9800	621.3	564.9	558.0	548.0	535.6	524.2	512.2	498.4	484.1	470.2	456.2
10200	632.7	575.4	568.4	558.2	545.6	534.0	521.7	507.8	493.2	479.1	464.8
10600	643.9	585.7	578.5	568.1	555.3	543.5	531.1	516.9	502.1	487.7	473.2
11000	654.8	595.7	588.4	577.9	564.9	552.9	540.2	525.8	510.8	496.2	481.5
CLIMB LIMIT WT (1000 LB)	620.6	620.5	613.3	599.8	581.8	565.4	547.3	526.4	504.0	482.8	461.8

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2200 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4240	4230	4220	4210	4200	4150	4110	4060	4020
4600	4690	4670	4650	4620	4600	4540	4480	4420	4360
5000	5140	5100	5070	5030	5000	4930	4850	4780	4710
5400	5590	5540	5490	5450	5400	5310	5230	5140	5060
5800	6040	5980	5920	5860	5800	5700	5600	5500	5400
6200	6480	6410	6340	6270	6200	6090	5980	5860	5750
6600	6930	6850	6770	6680	6600	6470	6350	6220	6100
7000	7380	7290	7190	7100	7000	6860	6720	6580	6450
7400	7830	7720	7610	7510	7400	7250	7100	6940	6790
7800	8280	8160	8040	7920	7800	7640	7470	7310	7140
8200	8730	8600	8460	8330	8200	8020	7840	7670	7490
8600	9180	9030	8890	8740	8600	8410	8220	8030	7830
9000	9620	9470	9310	9160	9000	8800	8590	8390	8180
9400	10070	9900	9740	9570	9400	9180	8960	8750	8530
9800	10520	10340	10160	9980	9800	9570	9340	9110	8880
10200	10970	10780	10580	10390	10200	9960	9710	9470	9220
10600	11420	11210	11010	10800	10600	10340	10090	9830	9570
11000	11870	11650	11430	11220	11000	10730	10460	10190	9920
11400	12310	12090	11860	11630	11400	11120	10830	10550	10270
11800	12760	12520	12280	12040	11800	11500	11210	10910	10610

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3050	3430	3820	4200	4470	4740	5040	5340
4600	3380	3790	4190	4600	4880	5170	5480	5800
5000	3720	4150	4570	5000	5290	5600	5920	6260
5400	4050	4500	4950	5400	5700	6020	6360	6720
5800	4390	4860	5330	5800	6110	6450	6800	7180
6200	4720	5220	5710	6200	6520	6870	7250	7640
6600	5060	5570	6090	6600	6940	7300	7690	8100
7000	5400	5930	6470	7000	7350	7730	8130	8560
7400	5730	6290	6840	7400	7760	8150	8570	9020
7800	6070	6640	7220	7800	8170	8580	9010	9480
8200	6400	7000	7600	8200	8580	9000	9450	9940
8600	6740	7360	7980	8600	9000	9430	9900	10400
9000	7070	7710	8360	9000	9410	9850	10340	10860
9400	7410	8070	8740	9400	9820	10280	10780	11320
9800	7740	8430	9110	9800	10230	10710	11220	11780
10200	8080	8790	9490	10200	10640	11130	11660	12240
10600	8410	9140	9870	10600	11060	11560	12110	12700
11000	8750	9500	10250	11000	11470	11980	12550	13160
11400	9080	9860	10630	11400	11880	12410	12990	13620
11800	9420	10210	11010	11800	12290	12830	13430	14080

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	626.2	563.5	559.7	555.9	552.2	548.6	537.1	523.2	507.8	492.1	476.6
6200	643.2	578.7	574.8	570.9	567.1	563.4	551.6	537.2	521.5	505.3	489.4
6600	664.8	598.0	593.9	589.9	586.0	582.2	569.9	555.1	538.8	522.1	505.6
7000	685.6	616.7	612.5	608.4	604.3	600.3	587.7	572.4	555.5	538.3	521.2
7400	705.5	634.5	630.1	625.9	621.7	617.6	604.6	588.8	571.5	553.7	536.1
7800	725.1	652.1	647.6	643.2	638.9	634.7	621.4	605.1	587.3	569.0	550.9
8200	745.6	670.6	666.0	661.5	657.1	652.8	639.0	622.4	604.0	585.3	566.7
8600	765.6	688.7	684.0	679.4	674.8	670.4	656.3	639.2	620.4	601.2	582.2
9000	783.6	704.8	700.0	695.3	690.7	686.1	671.7	654.2	634.9	615.2	595.7
9400	800.0	719.4	714.4	709.6	704.9	700.2	685.4	667.5	647.8	627.6	607.7
9800	816.2	733.8	728.7	723.8	718.9	714.1	699.1	680.7	660.6	639.9	619.5
10200	832.7	748.5	743.3	738.2	733.3	728.4	713.0	694.2	673.6	652.5	631.7
10600	834.9	763.2	757.9	752.8	747.7	742.7	727.0	707.8	686.8	665.3	644.0
11000	834.9	777.7	772.3	767.0	761.8	756.8	740.7	721.2	699.7	677.7	656.0
11400	834.9	791.7	786.2	780.9	775.6	770.4	754.1	734.2	712.3	689.9	667.7
11800	834.9	805.5	799.9	794.4	789.1	783.8	767.1	746.9	724.6	701.8	679.2
12200	834.9	818.8	813.1	807.5	802.1	796.7	779.7	759.1	736.5	713.3	690.3
12600	834.9	831.7	825.9	820.2	814.7	809.3	792.0	771.1	748.0	724.5	701.2
CLIMB LIMIT WT (1000 LB)	823.3	823.2	822.9	822.6	822.3	821.9	794.3	763.1	728.8	695.6	662.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	583.5	527.5	524.0	520.4	517.0	507.2	496.3	483.2	469.1	453.9	439.7
6200	599.3	541.7	538.0	534.4	530.9	520.8	509.6	496.1	481.7	466.0	451.4
6600	619.4	559.8	555.9	552.2	548.5	538.1	526.5	512.5	497.6	481.3	466.3
7000	638.7	577.2	573.2	569.4	565.6	554.8	542.8	528.4	513.0	496.2	480.6
7400	657.2	593.8	589.7	585.7	581.9	570.7	558.4	543.6	527.6	510.4	494.3
7800	675.4	610.2	606.0	601.9	597.9	586.5	573.8	558.6	542.2	524.4	508.0
8200	694.5	627.6	623.3	619.1	615.0	603.3	590.2	574.5	557.7	539.5	522.6
8600	713.3	644.6	640.2	635.9	631.7	619.6	606.3	590.2	573.0	554.3	536.9
9000	730.0	659.7	655.2	650.7	646.4	634.1	620.4	603.9	586.3	567.1	549.3
9400	745.1	673.1	668.5	664.0	659.6	647.0	633.0	616.1	598.0	578.4	560.2
9800	760.1	686.5	681.7	677.1	672.6	659.7	645.4	628.1	609.7	589.6	571.0
10200	775.4	700.1	695.3	690.6	686.0	672.8	658.1	640.5	621.6	601.1	582.1
10600	790.7	713.9	708.9	704.1	699.4	685.9	671.0	653.0	633.7	612.8	593.3
11000	805.7	727.3	722.3	717.3	712.5	698.8	683.5	665.2	645.5	624.1	604.3
11400	820.3	740.4	735.3	730.3	725.4	711.4	695.8	677.1	657.0	635.3	615.1
11800	834.6	753.2	748.0	742.9	737.9	723.6	707.8	688.7	668.3	646.2	625.6
12200	834.9	765.6	760.3	755.1	750.0	735.5	719.4	700.0	679.3	656.7	635.8
12600	834.9	777.6	772.2	767.0	761.8	747.1	730.7	711.0	689.9	667.0	645.7
CLIMB LIMIT WT (1000 LB)	779.2	778.9	778.6	778.4	778.1	756.9	733.8	704.6	673.5	640.1	610.2

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	543.5	491.5	488.2	484.9	477.5	468.0	457.2	446.1	433.0	419.3	407.4
6200	558.1	504.7	501.3	497.9	490.3	480.5	469.4	457.9	444.5	430.5	418.2
6600	576.7	521.4	517.9	514.3	506.5	496.4	484.9	473.0	459.1	444.6	431.9
7000	594.7	537.6	533.9	530.3	522.2	511.7	499.9	487.6	473.3	458.3	445.1
7400	611.8	553.0	549.2	545.5	537.2	526.4	514.1	501.5	486.7	471.3	457.8
7800	628.8	568.2	564.4	560.5	552.0	540.9	528.3	515.4	500.1	484.2	470.3
8200	646.7	584.5	580.5	576.6	567.8	556.4	543.5	530.2	514.5	498.2	483.9
8600	664.1	600.4	596.3	592.3	583.3	571.6	558.3	544.7	528.7	511.9	497.3
9000	679.7	614.4	610.2	606.1	596.8	584.9	571.3	557.3	540.9	523.8	508.7
9400	693.6	626.8	622.5	618.3	608.9	596.6	582.7	568.4	551.6	534.1	518.7
9800	707.4	639.1	634.7	630.4	620.7	608.2	594.0	579.3	562.2	544.2	528.5
10200	721.5	651.7	647.2	642.8	632.9	620.1	605.6	590.6	573.1	554.7	538.7
10600	735.7	664.4	659.8	655.3	645.2	632.1	617.3	602.0	584.1	565.4	549.0
11000	749.6	676.8	672.2	667.5	657.3	643.9	628.8	613.2	594.9	575.8	559.1
11400	763.2	689.0	684.2	679.5	669.0	655.4	640.0	624.1	605.5	586.0	568.9
11800	776.4	700.8	696.0	691.2	680.5	666.7	651.0	634.8	615.8	596.0	578.6
12200	789.2	712.3	707.4	702.5	691.7	677.6	661.6	645.2	625.9	605.7	588.0
12600	801.6	723.5	718.5	713.6	702.5	688.2	672.0	655.3	635.6	615.1	597.2
CLIMB LIMIT WT (1000 LB)	726.9	726.6	726.4	726.1	714.1	696.2	673.1	648.6	619.1	589.4	564.4

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	504.6	456.3	453.2	447.5	439.2	429.1	420.1	410.4	398.8	387.5	376.6
6200	518.2	468.5	465.3	459.4	450.9	440.5	431.2	421.3	409.3	397.7	386.6
6600	535.4	484.0	480.7	474.6	465.7	455.0	445.4	435.1	422.7	410.7	399.2
7000	552.0	498.9	495.5	489.2	480.1	469.0	459.1	448.4	435.7	423.3	411.4
7400	567.9	513.2	509.7	503.2	493.8	482.4	472.1	461.2	448.0	435.3	423.0
7800	583.6	527.3	523.7	517.0	507.4	495.6	485.1	473.8	460.3	447.2	434.6
8200	600.2	542.4	538.7	531.9	522.0	509.9	499.1	487.5	473.7	460.2	447.2
8600	616.5	557.3	553.5	546.4	536.3	523.9	512.8	500.9	486.7	472.9	459.6
9000	630.9	570.2	566.3	559.1	548.7	536.0	524.7	512.5	497.9	483.8	470.1
9400	643.7	581.6	577.6	570.3	559.6	546.6	535.0	522.5	507.6	493.1	479.2
9800	656.4	592.8	588.8	581.2	570.4	557.1	545.2	532.4	517.2	502.4	488.1
10200	669.3	604.4	600.3	592.6	581.4	567.9	555.7	542.7	527.1	511.9	497.4
10600	682.4	616.1	611.9	604.0	592.6	578.8	566.4	553.1	537.2	521.7	506.8
11000	695.2	627.6	623.2	615.2	603.6	589.5	576.8	563.2	547.0	531.2	516.0
11400	707.7	638.8	634.4	626.2	614.4	600.0	587.0	573.2	556.7	540.6	525.1
11800	719.9	649.7	645.2	636.9	624.9	610.2	597.0	583.0	566.1	549.7	533.9
12200	731.8	660.3	655.8	647.3	635.1	620.1	606.8	592.4	575.3	558.6	542.6
12600	743.2	670.7	666.0	657.4	645.0	629.8	616.2	601.7	584.3	567.3	551.0
CLIMB LIMIT WT (1000 LB)	674.9	674.9	674.6	667.1	651.5	631.2	612.9	592.5	567.3	543.2	520.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	22	26	30	34	38	42	46	50
5900	465.5	420.9	415.7	408.4	399.3	390.9	382.1	372.0	361.6	351.7	341.9
6200	477.9	432.1	426.8	419.2	409.9	401.2	392.2	381.8	371.1	360.9	350.8
6600	493.7	446.2	440.7	432.9	423.3	414.3	404.9	394.2	383.2	372.6	362.1
7000	509.0	460.0	454.3	446.2	436.3	427.0	417.3	406.3	394.9	384.0	373.1
7400	523.5	473.0	467.2	458.9	448.6	439.1	429.1	417.7	406.0	394.8	383.6
7800	537.9	486.0	480.0	471.5	460.9	451.1	440.9	429.2	417.1	405.5	394.1
8200	553.4	500.1	493.9	485.1	474.3	464.2	453.7	441.7	429.3	417.4	405.6
8600	568.5	513.8	507.5	498.5	487.4	477.0	466.2	453.9	441.2	429.0	416.9
9000	581.7	525.7	519.2	510.0	498.6	488.0	477.0	464.3	451.3	438.8	426.5
9400	593.3	536.0	529.4	520.0	508.3	497.5	486.2	473.2	459.9	447.2	434.5
9800	604.9	546.2	539.5	529.8	517.9	506.8	495.2	482.0	468.4	455.3	442.4
10200	616.7	556.8	549.9	540.0	527.8	516.5	504.7	491.1	477.2	463.9	450.6
10600	628.7	567.5	560.4	550.3	537.9	526.3	514.2	500.4	486.2	472.6	459.0
11000	640.4	578.0	570.7	560.4	547.7	535.9	523.6	509.5	495.0	481.1	467.3
11400	651.8	588.2	580.8	570.3	557.4	545.4	532.8	518.5	503.7	489.5	475.4
11800	663.0	598.2	590.7	580.0	566.9	554.6	541.8	527.2	512.1	497.7	483.4
12200	673.8	608.0	600.3	589.5	576.1	563.6	550.6	535.7	520.4	505.8	491.2
12600	684.4	617.5	609.7	598.7	585.1	572.4	559.2	544.1	528.5	513.6	498.8
CLIMB LIMIT WT (1000 LB)	620.6	620.5	613.3	599.8	581.8	565.4	547.3	526.4	504.0	482.8	461.8

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 4200 lb.
With engine and wing anti-ice on, decrease field limit weight by 2400 lb and climb limit weight by 3900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	651.6	721.7	784.7	831.0					
50	621.4	687.0	741.4	787.8	822.7				
100	588.2	653.4	703.9	746.2	782.2	809.6	830.3		
150	560.4	625.1	674.3	714.9	749.2	778.7	801.4	820.0	834.1
200	536.5	599.6	649.3	689.2	722.7	751.2	776.1	795.5	811.8
250	515.5	576.9	627.2	666.9	700.1	728.3	752.5	773.9	791.0
300	496.6	556.6	606.7	647.0	680.0	708.1	732.4	753.4	772.0
350	479.5	538.5	587.9	628.7	661.8	690.0	714.2	735.4	753.9
400	463.8	522.0	570.6	611.5	645.1	673.3	697.7	718.9	737.7
450	449.3	506.7	554.7	595.4	629.5	657.9	682.4	703.8	722.6
500	436.3	492.6	540.0	580.3	614.7	643.5	668.1	689.7	708.7
550	424.2	479.4	526.3	566.3	600.6	629.9	654.7	676.4	695.6
600	412.6	467.1	513.5	553.1	587.3	616.9	642.0	663.9	683.3
650	401.9	455.5	501.4	540.7	574.8	604.4	629.9	652.0	671.5
700	391.7	444.6	489.9	529.0	562.9	592.5	618.4	640.7	660.3
750	381.9	434.5	479.1	517.9	551.6	581.2	607.1	629.8	649.7
800	372.6	424.9	468.9	507.4	540.9	570.4	596.4	619.3	639.4
850		415.6	459.1	497.3	530.6	560.0	586.1	609.2	629.5
900		406.8	449.9	487.7	520.9	550.2	576.2	599.3	620.0
950		398.4	441.1	478.5	511.6	540.7	566.7	589.9	610.7
1000		390.3	432.8	469.8	502.6	531.7	557.6	580.8	601.6

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
30 & Below	0	0	0	0	0	0	0
32	-6.2	-7.6	-9.0	-10.4	-11.7	-13.1	-14.5
34	-12.5	-15.2	-18.0	-20.7	-23.5	-26.2	-29.0
36	-18.7	-22.8	-27.0	-31.1	-35.2	-39.3	-43.5
38	-24.9	-30.4	-36.0	-41.5	-47.0	-52.5	-58.0
40	-31.2	-38.1	-44.9	-51.8	-58.7	-65.6	-72.5
42	-38.9	-47.2	-55.5	-63.8	-72.1	-80.4	-88.7
44	-46.6	-56.4	-66.1	-75.8	-85.6	-95.3	-105.0
46	-54.4	-65.5	-76.7	-87.8	-99.0	-110.1	-121.3
48	-62.1	-74.7	-87.3	-99.8	-112.4	-125.0	-137.6
50	-69.8	-83.8	-97.8	-111.8	-125.8	-139.8	-153.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
S.L. & BELOW	0	0	0	0	0	0	0
1000	-15.5	-18.4	-21.3	-24.1	-27.0	-29.9	-32.7
2000	-31.1	-36.8	-42.5	-48.3	-54.0	-59.7	-65.4
3000	-45.4	-53.8	-62.2	-70.5	-78.9	-87.3	-95.7
4000	-59.7	-70.7	-81.8	-92.8	-103.8	-114.9	-125.9
5000	-75.1	-89.0	-102.9	-116.8	-130.7	-144.6	-158.5
6000	-90.6	-107.3	-124.1	-140.8	-157.5	-174.3	-191.0
7000	-105.3	-125.1	-144.8	-164.6	-184.4	-204.1	-223.9
8000	-120.0	-142.8	-165.6	-188.4	-211.2	-234.0	-256.8

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
15 TW	-47.0	-55.0	-63.0	-71.0	-79.0	-87.0	-95.0
10 TW	-31.3	-36.7	-42.0	-47.3	-52.7	-58.0	-63.3
5 TW	-15.7	-18.3	-21.0	-23.7	-26.3	-29.0	-31.7
0	0	0	0	0	0	0	0
10 HW	7.9	7.7	7.4	7.2	7.0	6.7	6.5
20 HW	15.9	15.4	14.9	14.4	13.9	13.4	12.9
30 HW	24.6	23.7	22.7	21.8	20.9	20.0	19.1
40 HW	33.3	31.9	30.6	29.2	27.9	26.6	25.2

With engine bleed for packs off, increase weight by 1900 lb.
With engine and wing anti-ice on, decrease weight by 4400 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Tire Speed Limit
Flaps 15

AIRPORT OAT		TIRE SPEED LIMIT WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
(°C)	(°F)	0	2000	4000	6000	8000
54	129	810.2	746.0	689.8	638.7	591.1
52	126	814.6	750.5	693.7	642.4	594.5
50	122	818.9	754.9	697.6	646.0	597.9
48	118	823.5	761.0	701.7	649.8	601.4
46	115	828.0	767.0	705.7	653.6	604.9
44	111	831.2	772.7	709.8	657.3	608.4
42	108	833.1	777.8	713.9	661.2	612.1
40	104	834.9	783.0	718.0	665.0	615.7
38	100	835.0	787.5	722.6	669.0	619.4
36	97	835.0	792.1	727.2	673.0	623.2
34	93	835.0	796.7	731.8	677.2	627.1
32	90	835.0	801.5	736.8	681.4	631.0
30	86	835.0	806.5	741.6	685.8	635.1
28	82	835.0	811.6	746.7	690.2	639.2
26	79	835.0	816.7	752.0	694.7	643.5
24	75	835.0	822.5	757.5	699.2	647.8
22	72	835.0	828.3	764.0	704.1	652.0
20	68	835.0	834.0	774.2	709.1	656.4
18	64	835.0	835.0	780.2	714.2	661.0
16	61	835.0	835.0	785.9	719.6	665.7
14	57	835.0	835.0	791.6	725.4	670.5
12	54	835.0	835.0	797.4	731.2	675.6
10	50	835.0	835.0	803.2	737.1	680.7
-40	-40	835.0	835.0	835.0	835.0	835.0

Increase tire speed limit weight by 5600 lb per knot headwind.
Decrease tire speed limit weight by 11900 lb per knot tailwind.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Dry Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
840	175	185	190
800	171	179	186
760	166	175	182
720	162	170	178
680	157	164	174
640	152	159	169
600	146	153	165
560	140	146	160
520	133	140	155
480	125	133	150
440	117	126	145
400	108	119	139
360	98	111	132

Check V1(MCG), Minimum VR.

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	-2	0	2	4	6	8	-2	0	2	4	6	8	-2	0	2	4	6	8
70	158	12	14					7	8					-4	-4				
60	140	8	10	12	14			4	6	7	8			-3	-3	-4	-4		
50	122	5	6	8	10	13	16	3	4	5	6	8	9	-2	-2	-3	-3	-4	-5
40	104	1	3	5	7	10	13	1	2	3	5	6	8	-1	-1	-2	-2	-3	-4
30	86	0	0	2	5	8	11	0	0	2	3	5	7	0	0	-1	-2	-2	-3
20	68	0	0	2	4	6	9	0	0	1	2	4	6	0	0	-1	-1	-2	-3
-60	-76	0	0	2	4	6	8	0	0	1	2	4	5	0	0	-1	-1	-2	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
840	-4	-1	0	3	6	-3	-1	0	0	1	3	4	5
800	-4	-1	0	3	5	-2	-1	0	0	1	3	3	4
760	-3	-1	0	3	4	-2	-1	0	0	1	2	3	4
720	-3	-1	0	2	4	-2	-1	0	0	1	2	3	3
680	-3	-1	0	2	4	-2	-1	0	0	1	2	2	3
640	-2	-1	0	2	4	-2	-1	0	0	1	2	2	3
600	-2	-1	0	2	3	-2	-1	0	0	1	2	2	3
560	-2	0	0	2	3	-2	-1	0	0	1	2	2	3
520	-2	0	0	2	3	-1	-1	0	0	1	2	3	3
480	-1	0	0	2	3	-1	-1	0	0	1	2	3	3
440	-1	0	0	3	4	-1	0	0	0	1	2	3	4
400	-1	0	0	3	4	-1	0	1	0	1	3	3	4
360	-1	0	0	3	4	-1	0	1	0	2	3	4	5

***V1 not to exceed VR**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Dry Runway

Flaps 15
V1(MCG), Minimum VR
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111				
50	122	119	121	116	118	111	113	109	111	106	109	103	106
40	104	126	127	123	124	118	120	113	115	108	111	103	106
30	86	128	130	128	130	123	125	118	120	112	115	106	109
20	68	129	130	129	130	125	126	120	122	116	118	110	113
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Wet Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
840	169	185	190
800	164	179	186
760	158	175	182
720	153	170	178
680	147	164	174
640	141	159	169
600	134	153	165
560	128	146	160
520	121	140	155
480	113	133	150
440	105	126	145
400	97	119	139
360	89	111	132

Check V1(MCG), Minimum VR.

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	-2	0	2	4	6	8	-2	0	2	4	6	8	-2	0	2	4	6	8
70	158	14	16					7	8					-4	-4				
60	140	10	11	14	16			4	6	7	8			-3	-3	-4	-4		
50	122	5	7	9	12	14	17	3	4	5	6	8	9	-2	-2	-3	-3	-4	-5
40	104	2	3	6	8	11	14	1	2	3	5	6	8	-1	-1	-2	-2	-3	-4
30	86	0	0	3	5	8	12	0	0	2	3	5	7	0	0	-1	-2	-2	-3
20	68	0	0	2	4	7	10	0	0	1	2	4	6	0	0	-1	-1	-2	-3
-60	-76	0	0	2	4	6	9	0	0	1	2	4	5	0	0	-1	-1	-2	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
840	-6	-3	0	3	6	-3	-2	-1	0	1	2	3	4
800	-6	-3	0	3	6	-4	-3	-1	0	1	2	3	4
760	-6	-3	0	3	5	-4	-3	-1	0	1	2	3	4
720	-5	-3	0	3	5	-4	-3	-2	0	1	2	3	4
680	-5	-3	0	2	5	-5	-3	-2	0	1	2	3	4
640	-5	-2	0	2	5	-5	-3	-2	0	1	2	3	4
600	-5	-2	0	2	5	-5	-3	-1	0	1	2	3	4
560	-4	-2	0	2	4	-5	-3	-1	0	1	2	3	4
520	-4	-2	0	3	4	-5	-3	-1	0	1	3	4	5
480	-3	-1	0	3	4	-5	-3	-1	0	1	3	4	5
440	-2	-1	0	3	5	-4	-2	-1	0	2	3	4	5
400	-2	0	0	3	5	-4	-2	0	0	2	4	5	6
360	-1	1	0	4	5	-4	-2	0	0	2	4	5	7

***V1 not to exceed VR**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Wet Runway

Flaps 15

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111				
50	122	119	121	116	118	111	113	109	111	106	109	103	106
40	104	126	127	123	124	118	120	113	115	108	111	103	106
30	86	128	130	128	130	123	125	118	120	112	115	106	109
20	68	129	130	129	130	125	126	120	122	116	118	110	113
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	30800	29100	27600
760	28800	2	31300	29700	28200
740	29400	0	31800	30200	28700
720	30000	-1	32300	30700	29100
700	30700	-2	32800	31100	29600
680	31300	-4	33200	31600	30100
660	31900	-5	33700	32100	30600
640	32600	-7	34300	32700	31200
620	33300	-8	34800	33200	31700
600	34000	-10	35300	33800	32300
580	34700	-11	35900	34300	32900
560	35400	-13	36500	34900	33500
540	36200	-15	37100	35600	34100
520	37000	-15	37800	36200	34800
500	37800	-15	38400	36900	35500
480	38600	-15	39100	37600	36200
460	39500	-15	39900	38300	36900
440	40400	-15	40600	39100	37700
420	41400	-15	41400	39900	38600
400	42400	-15	42300	40800	39400
380	43100	-15	43100	41800	40500

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	30800	29100	27600
760	28800	8	31300	29700	28200
740	29400	6	31800	30200	28700
720	30000	5	32300	30700	29100
700	30700	3	32800	31100	29600
680	31300	2	33200	31600	30100
660	31900	1	33700	32100	30600
640	32600	-1	34300	32700	31200
620	33300	-2	34800	33200	31700
600	34000	-4	35300	33800	32300
580	34700	-6	35900	34300	32900
560	35400	-7	36500	34900	33500
540	36200	-9	37100	35600	34100
520	37000	-9	37800	36200	34800
500	37800	-9	38400	36900	35500
480	38600	-9	39100	37600	36200
460	39500	-9	39900	38300	36900
440	40400	-9	40600	39100	37700
420	41400	-9	41400	39900	38600
400	42400	-9	42300	40800	39400
380	43100	-9	43100	41800	40500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	30800	29100	27600
760	28800	13	31300	29700	28200
740	29400	12	31800	30200	28700
720	30000	11	32300	30700	29100
700	30700	9	32800	31100	29600
680	31300	8	33200	31600	30100
660	31900	6	33700	32100	30600
640	32600	5	34300	32700	31200
620	33300	3	34800	33200	31700
600	34000	2	35300	33800	32300
580	34700	0	35900	34300	32900
560	35400	-2	36500	34900	33500
540	36200	-3	37100	35600	34100
520	37000	-3	37800	36200	34800
500	37800	-3	38400	36900	35500
480	38600	-3	39100	37600	36200
460	39500	-3	39900	38300	36900
440	40400	-3	40600	39100	37700
420	41400	-3	41400	39900	38600
400	42400	-3	42300	40800	39400
380	43100	-3	43100	41800	40500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Mid C.G. (30% MAC)

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	31800	30200	28600
760	28800	2	32400	30700	29200
740	29400	0	32900	31300	29700
720	30000	-1	33300	31700	30200
700	30700	-2	33800	32200	30700
680	31300	-4	34300	32700	31200
660	31900	-5	34800	33200	31700
640	32600	-7	35300	33700	32200
620	33300	-8	35800	34200	32700
600	34000	-10	36300	34800	33300
580	34700	-11	36900	35300	33900
560	35400	-13	37500	35900	34500
540	36200	-15	38100	36600	35100
520	37000	-15	38800	37200	35800
500	37800	-15	39400	37900	36400
480	38600	-15	40100	38600	37100
460	39500	-15	40900	39300	37900
440	40400	-15	41600	40100	38700
420	41400	-15	42400	40900	39500
400	42400	-15	43100	41700	40300
380	43100	-15	43100	42800	41400

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	31800	30200	28600
760	28800	8	32400	30700	29200
740	29400	6	32900	31300	29700
720	30000	5	33300	31700	30200
700	30700	3	33800	32200	30700
680	31300	2	34300	32700	31200
660	31900	1	34800	33200	31700
640	32600	-1	35300	33700	32200
620	33300	-2	35800	34200	32700
600	34000	-4	36300	34800	33300
580	34700	-6	36900	35300	33900
560	35400	-7	37500	35900	34500
540	36200	-9	38100	36600	35100
520	37000	-9	38800	37200	35800
500	37800	-9	39400	37900	36400
480	38600	-9	40100	38600	37100
460	39500	-9	40900	39300	37900
440	40400	-9	41600	40100	38700
420	41400	-9	42400	40900	39500
400	42400	-9	43100	41700	40300
380	43100	-9	43100	42800	41400

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Mid C.G. (30% MAC)

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	31800	30200	28600
760	28800	13	32400	30700	29200
740	29400	12	32900	31300	29700
720	30000	11	33300	31700	30200
700	30700	9	33800	32200	30700
680	31300	8	34300	32700	31200
660	31900	6	34800	33200	31700
640	32600	5	35300	33700	32200
620	33300	3	35800	34200	32700
600	34000	2	36300	34800	33300
580	34700	0	36900	35300	33900
560	35400	-2	37500	35900	34500
540	36200	-3	38100	36600	35100
520	37000	-3	38800	37200	35800
500	37800	-3	39400	37900	36400
480	38600	-3	40100	38600	37100
460	39500	-3	40900	39300	37900
440	40400	-3	41600	40100	38700
420	41400	-3	42400	40900	39500
400	42400	-3	43100	41700	40300
380	43100	-3	43100	42800	41400

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1058	994	937	886	841	800	766	735	706	679	655
1580	1487	1403	1328	1261	1200	1150	1104	1061	1021	985
2101	1979	1868	1769	1681	1600	1534	1473	1416	1364	1316
2620	2469	2332	2210	2100	2000	1918	1842	1771	1706	1647
3138	2959	2795	2650	2520	2400	2302	2211	2127	2049	1978
3654	3447	3258	3090	2939	2800	2687	2581	2483	2392	2309
4168	3933	3719	3529	3358	3200	3071	2950	2838	2735	2641
4679	4418	4180	3968	3776	3600	3455	3320	3194	3078	2972
5190	4903	4640	4406	4194	4000	3839	3689	3550	3421	3303
5699	5386	5099	4844	4612	4400	4224	4059	3906	3764	3635
6207	5868	5558	5281	5030	4800	4608	4429	4262	4108	3966
6713	6348	6015	5717	5448	5200	4992	4798	4618	4451	4298
7217	6828	6472	6153	5865	5600	5376	5168	4973	4794	4629
7721	7307	6928	6590	6283	6000	5761	5537	5329	5137	4960
8224	7786	7385	7026	6700	6400	6145	5906	5685	5480	5292
8726	8264	7841	7461	7117	6800	6529	6276	6040	5823	5623
9228	8742	8296	7897	7534	7200	6913	6645	6396	6166	5955
9728	9219	8751	8332	7951	7600	7297	7015	6752	6509	6286
10228	9695	9206	8767	8368	8000	7681	7384	7107	6852	6617

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 27		29		31		33		35	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
800	29.5	2:01	29.0	1:59	28.6	1:56	28.2	1:53	27.7	1:52
1200	43.1	2:57	42.1	2:53	41.4	2:49	40.7	2:45	39.9	2:42
1600	56.8	3:52	55.5	3:47	54.4	3:41	53.3	3:35	52.2	3:32
2000	70.5	4:47	68.8	4:41	67.4	4:33	66.0	4:26	64.5	4:22
2400	84.8	5:41	82.8	5:33	80.9	5:23	79.2	5:16	77.3	5:12
2800	99.1	6:34	96.7	6:25	94.5	6:14	92.3	6:06	90.1	6:02
3200	113.7	7:27	110.9	7:16	108.3	7:04	105.8	6:56	103.2	6:51
3600	128.6	8:19	125.5	8:07	122.4	7:54	119.5	7:45	116.5	7:41
4000	143.6	9:11	140.0	8:58	136.6	8:44	133.2	8:35	129.9	8:31
4400	159.2	10:02	155.1	9:47	151.2	9:33	147.4	9:24	144.0	9:20
4800	174.8	10:53	170.3	10:37	165.9	10:23	161.7	10:13	158.2	10:10
5200	190.8	11:43	185.7	11:26	180.9	11:12	176.3	11:02	172.8	11:00
5600	207.1	12:33	201.5	12:15	196.1	12:01	191.3	11:52	188.1	11:50
6000	223.4	13:22	217.2	13:04	211.4	12:49	206.2	12:41	203.3	12:39
6400	240.3	14:11	233.6	13:53	227.3	13:38	222.2	13:30	220.0	13:29
6800	257.3	15:00	250.0	14:42	243.2	14:27	238.2	14:20	236.6	14:19
7200	274.6	15:48	266.7	15:30	259.6	15:16	254.8	15:09	254.3	15:09
7600	292.3	16:37	283.8	16:19	276.5	16:05	272.1	15:58	273.0	15:59
8000	309.9	17:25	300.9	17:07	293.3	16:54	289.5	16:48	291.8	16:49

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	600
20	-2.2	-1.1	0.0	1.5	2.8	4.6
40	-4.6	-2.3	0.0	2.6	5.6	10.0
60	-7.1	-3.6	0.0	3.9	9.0	16.5
80	-9.5	-4.9	0.0	5.4	13.1	24.0
100	-12.0	-6.2	0.0	7.4	17.8	32.7
120	-14.5	-7.5	0.0	9.6	23.1	42.4
140	-17.0	-8.8	0.0	12.2	29.2	53.2
160	-19.6	-10.1	0.0	15.1	35.8	65.1
180	-22.2	-11.4	0.0	18.3	43.2	78.1
200	-24.8	-12.7	0.0	21.8	51.1	92.2
220	-27.4	-14.0	0.0	25.7	59.8	107.3
240	-30.0	-15.3	0.0	29.8	69.0	123.6
260	-32.7	-16.6	0.0	34.3	79.0	140.9
280	-35.3	-17.9	0.0	39.1	89.6	159.3
300	-38.0	-19.3	0.0	44.2	100.8	178.8
320	-40.7	-20.6	0.0	49.7	112.7	199.3
340	-43.5	-21.9	0.0	55.4	125.2	221.0
360	-46.2	-23.2	0.0	61.4	138.4	243.7

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1040	981	928	881	839	800	765	732	703	675	650
1545	1461	1386	1318	1256	1200	1149	1102	1058	1018	981
2050	1941	1843	1754	1673	1600	1533	1471	1414	1361	1312
2555	2421	2300	2190	2091	2000	1917	1840	1769	1704	1643
3060	2900	2757	2626	2508	2400	2301	2209	2125	2047	1974
3564	3380	3213	3063	2925	2800	2685	2579	2481	2390	2306
4068	3859	3670	3499	3343	3200	3069	2948	2837	2733	2637
4572	4338	4127	3935	3760	3600	3453	3318	3193	3077	2969
5076	4817	4583	4371	4177	4000	3837	3687	3549	3420	3300
5580	5296	5039	4807	4594	4400	4221	4057	3905	3763	3632
6083	5775	5496	5242	5011	4800	4606	4426	4261	4107	3964
6587	6253	5952	5678	5429	5200	4990	4796	4617	4450	4296
7090	6732	6408	6114	5846	5600	5374	5166	4973	4794	4628
7593	7210	6864	6550	6263	6000	5758	5536	5329	5138	4960
8095	7688	7320	6985	6680	6400	6143	5905	5686	5482	5292
8598	8166	7776	7421	7097	6800	6527	6275	6042	5826	5624
9100	8644	8231	7856	7514	7200	6911	6645	6398	6169	5956
9602	9122	8687	8292	7931	7600	7296	7015	6755	6513	6289
10104	9599	9142	8727	8348	8000	7680	7385	7111	6858	6621

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB)											TIME (HRS:MIN)
	LANDING WEIGHT (1000 LB)											
	360	380	400	420	440	460	480	500	520	540	560	
800	23.3	24.0	24.9	25.7	26.8	27.7	28.5	29.3	30.2	31.4	32.3	1:50
1200	33.0	34.1	35.3	36.7	38.4	39.6	40.7	42.0	43.6	45.3	46.5	2:40
1600	42.9	44.4	46.0	48.0	50.1	51.7	53.3	55.1	57.3	59.4	61.0	3:30
2000	53.0	54.9	57.0	59.6	62.1	64.1	66.1	68.6	71.3	73.8	75.8	4:20
2400	63.3	65.6	68.3	71.4	74.3	76.7	79.3	82.4	85.5	88.4	90.8	5:10
2800	73.7	76.6	79.9	83.4	86.7	89.6	92.9	96.5	100.0	103.3	106.3	5:59
3200	84.4	87.9	91.7	95.6	99.3	102.9	106.8	110.8	114.7	118.6	122.1	6:49
3600	95.3	99.5	103.7	108.0	112.4	116.6	121.0	125.3	129.8	134.3	138.4	7:38
4000	106.6	111.2	115.9	120.7	125.7	130.6	135.4	140.2	145.2	150.4	155.1	8:28
4400	118.2	123.2	128.4	133.7	139.5	144.8	150.0	155.4	161.1	166.8	172.1	9:17
4800	129.9	135.4	141.1	147.2	153.5	159.3	165.0	171.0	177.3	183.6	189.3	10:07
5200	141.9	147.9	154.1	161.0	167.8	174.0	180.3	187.0	193.9	200.7	206.9	10:56
5600	154.1	160.6	167.6	175.0	182.3	189.0	196.0	203.4	210.9	218.2	224.9	11:45
6000	166.5	173.6	181.4	189.3	197.1	204.4	212.1	220.1	228.1	236.0	243.4	12:34
6400	179.1	187.0	195.4	203.9	212.2	220.3	228.6	237.2	245.7	254.1	262.3	13:23
6800	192.1	200.8	209.7	218.7	227.7	236.5	245.5	254.5	263.6	272.9	281.6	14:12
7200	205.5	214.9	224.3	233.8	243.6	253.1	262.6	272.3	282.1	291.9	301.3	15:01
7600	219.3	229.2	239.1	249.4	259.9	270.1	280.1	290.4	300.9	311.4	321.4	15:50
8000	233.3	243.7	254.3	265.4	276.6	287.3	298.0	308.9	320.1	331.4	342.0	16:39

Based on 310/.84 climb, LRC and .84/310/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
96	81	70	62	55	50	46	42	39	36	34
160	143	129	118	108	100	93	87	82	77	73
224	204	187	173	161	150	141	133	125	119	113
287	264	244	227	213	200	189	178	169	161	154
348	323	301	282	265	250	237	225	214	204	195
410	382	357	336	317	300	285	271	259	247	237
471	440	414	390	369	350	333	317	303	290	279
533	499	470	444	421	400	381	364	348	334	320
595	559	527	499	473	450	429	410	393	376	362
660	620	585	554	525	500	477	456	437	419	403

Trip Fuel and Time Required

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)						TIME (HRS:MIN)
		360	400	440	480	520	560	
50	FUEL (1000 LB)	3.7	3.9	4.2	4.4	4.6	4.8	0:14
	ALT (FT)	11000	11000	9000	7000	7000	5000	
100	FUEL (1000 LB)	5.5	5.8	6.1	6.4	6.7	7.0	0:22
	ALT (FT)	15000	15000	13000	13000	13000	13000	
150	FUEL (1000 LB)	7.2	7.6	8.0	8.4	8.7	9.2	0:30
	ALT (FT)	23000	23000	23000	21000	21000	21000	
200	FUEL (1000 LB)	8.7	9.2	9.6	10.1	10.6	11.1	0:36
	ALT (FT)	29000	27000	27000	27000	25000	25000	
250	FUEL (1000 LB)	10.1	10.7	11.2	11.8	12.4	13.0	0:42
	ALT (FT)	37000	31000	29000	29000	27000	29000	
300	FUEL (1000 LB)	11.3	12.0	12.7	13.4	14.1	14.8	0:48
	ALT (FT)	43000	39000	37000	37000	35000	33000	
350	FUEL (1000 LB)	12.4	13.3	14.1	14.9	15.7	16.5	0:54
	ALT (FT)	43000	41000	39000	37000	35000	35000	
400	FUEL (1000 LB)	13.6	14.5	15.5	16.4	17.3	18.2	0:59
	ALT (FT)	43000	41000	39000	37000	35000	35000	
450	FUEL (1000 LB)	14.8	15.8	16.8	17.9	18.9	19.9	1:06
	ALT (FT)	43000	41000	39000	37000	37000	35000	
500	FUEL (1000 LB)	15.9	17.1	18.2	19.4	20.5	21.6	1:13
	ALT (FT)	43000	41000	39000	37000	37000	35000	

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
800	21080	20850	20650	21390	22070	22890	24000			
760	20030	19830	19600	19980	20850	21520	22350			
720	18980	18810	18560	18680	19660	20140	20800			
680	17950	17770	17530	17480	18410	18820	19430			
640	16940	16740	16500	16420	16950	17570	18140			
600	15950	15730	15480	15370	15600	16380	16850	17580		
560	15000	14750	14460	14330	14360	15200	15560	16040		
520	14110	13820	13480	13320	13300	13760	14300	14730		
480	13280	12940	12550	12370	12310	12420	13070	13450		
440	12470	12110	11680	11500	11370	11330	11850	12180	12870	
400	11690	11320	10870	10680	10490	10400	10460	10970	11530	
360	11180	10800	10350	10110	9880	9730	9680	9810	10230	10550

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
800	23060	23000	22910	23120	23640
760	21780	21670	21550	21670	22160
720	20580	20460	20320	20370	20800
680	19410	19270	19110	19130	19490
640	18250	18110	17920	17930	18180
600	17120	16950	16730	16710	16860
560	16020	15810	15570	15530	15610
520	14970	14700	14440	14360	14400
480	13970	13660	13340	13220	13210
440	13010	12650	12290	12110	12060
400	12100	11710	11300	11080	10970
360	11450	11070	10600	10350	10210

These tables include 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Oxygen Requirements

Required Pressure (PSI) for One 114/115 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

For more extensive than normal crew usage, add 1.2 psi/person/minute.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	399.4	395.0	382.9
28	430.8	421.2	405.7
26	464.5	451.9	435.2
24	500.6	484.9	467.6
22	538.7	521.7	503.0
20	592.3	577.6	555.9
18	641.7	622.3	598.3
16	695.5	671.7	645.7
14	743.0	715.0	686.1
12	790.9	760.6	730.9
10	833.2	801.9	768.0

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)								
	PRESSURE ALTITUDE (1000 FT)								
	14	16	18	20	22	24	26	28	30
ENGINE ONLY	-1.4	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE AND WING	-5.6	-3.9	-3.2	-2.2	-2.5	-2.6	-2.6	-2.7	-2.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Dry Runway
Flaps 30
Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000			2750	3000	3070	3080	3140	3200
3400	2700	2870	3110	3400	3500	3540	3640	3730
3800	2990	3200	3470	3800	3930	4000	4130	4260
4200	3280	3530	3830	4200	4360	4460	4630	4790
4600	3570	3850	4190	4600	4790	4920	5120	5320
5000	3860	4180	4550	5000	5220	5380	5620	5860
5400	4150	4510	4910	5400	5650	5840	6120	6390
5800	4450	4840	5270	5800	6080	6300	6610	6920
6200	4740	5160	5630	6200	6500	6760	7110	7450
6600	5030	5490	5990	6600	6930	7210	7600	7980
7000	5320	5820	6350	7000	7360	7670	8100	8520
7400	5610	6150	6710	7400	7790	8130	8600	9050
7800	5900	6470	7070	7800	8220	8590	9090	9580
8200	6190	6800	7430	8200	8650	9050	9590	10110
8600	6480	7130	7790	8600	9080	9510	10080	10650
9000	6770	7450	8150	9000	9510	9970	10580	11180
9400	7060	7780	8510	9400	9940	10430	11080	11710
9800	7350	8110	8870	9800	10370	10890	11570	12240
10200	7650	8440	9230	10200	10800	11350	12070	12770
10600	7940	8760	9590	10600	11230	11800	12560	13310

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Dry Runway

Flaps 30

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)				
	0	2000	4000	6000	8000
4600	403.3				
5000	451.4	423.9	397.7		
5400	502.1	470.6	440.9	413.4	387.0
5800	553.3	518.9	486.1	454.7	425.8
6200	605.0	567.7	532.0	498.0	465.5
6600	649.4	616.8	578.4	541.7	506.6
7000	670.9	653.4	625.1	585.6	548.0
7400	690.1	672.5	655.1	629.9	589.7
7800	706.4	687.6	669.9	652.2	629.6
8200	723.8	702.2	683.9	666.1	647.6
8600	740.7	718.2	697.1	679.0	661.0
9000	756.7	733.8	711.5	691.4	673.2
9400	779.5	748.8	725.9	703.6	684.6
9800	796.2	764.7	739.8	716.9	695.6
10200	812.3	784.9	753.2	729.9	707.1
10600	827.8	799.9	770.6	742.3	718.9
11000	843.1	814.3	786.5	754.3	730.6
11400		828.3	800.0	770.2	741.8
11800		842.1	813.1	784.9	752.6
12200			825.7	797.1	764.5
12600			838.0	808.9	780.5
13000			850.3	820.3	791.6
13400				831.5	802.2
13800				842.6	812.6
14200				853.7	822.8
14600					832.9

With manual speedbrakes, decrease weight by 47800 lb.
With 1 brake deactivated, decrease weight by 50200 lb.
With 2 brakes deactivated, decrease weight by 102100 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Wet Runway

Flaps 30

Wind Adjusted Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000				3000	3050	3030	3050	3080
3400			3120	3400	3480	3490	3550	3610
3800	3020	3210	3480	3800	3910	3950	4050	4140
4200	3320	3540	3840	4200	4340	4410	4540	4670
4600	3610	3870	4200	4600	4770	4870	5040	5200
5000	3900	4200	4560	5000	5190	5320	5530	5740
5400	4190	4520	4920	5400	5620	5780	6030	6270
5800	4480	4850	5280	5800	6050	6240	6520	6800
6200	4770	5180	5640	6200	6480	6700	7020	7330
6600	5060	5500	6000	6600	6910	7160	7520	7870
7000	5350	5830	6360	7000	7340	7620	8010	8400
7400	5640	6160	6720	7400	7770	8080	8510	8930
7800	5930	6490	7080	7800	8200	8540	9010	9460
8200	6220	6810	7440	8200	8630	9000	9500	9990
8600	6520	7140	7800	8600	9060	9460	10000	10530
9000	6810	7470	8160	9000	9490	9910	10490	11060
9400	7100	7800	8520	9400	9920	10370	10990	11590
9800	7390	8120	8880	9800	10340	10830	11480	12120
10200	7680	8450	9240	10200	10770	11290	11980	12660
10600	7970	8780	9600	10600	11200	11750	12480	13190

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)				
	0	2000	4000	6000	8000
5400	414.8	389.4			
5800	456.9	428.9	402.4		
6200	501.0	469.6	440.0	412.5	386.2
6600	545.5	511.6	479.1	448.4	419.9
7000	590.3	553.9	519.0	485.7	454.1
7400	634.1	596.5	559.2	523.6	489.6
7800	659.4	638.5	599.7	561.7	525.4
8200	677.6	660.0	637.8	600.1	561.6
8600	693.1	675.5	658.0	635.2	597.9
9000	707.6	688.6	670.8	653.1	630.8
9400	722.7	701.2	683.0	665.2	646.4
9800	737.4	715.1	694.6	676.5	658.5
10200	751.5	728.8	706.7	687.4	669.2
10600	768.6	742.0	719.3	697.9	679.5
11000	786.5	754.8	731.7	709.2	689.2
11400	800.8	771.7	743.6	720.6	698.7
11800	814.7	787.2	755.1	731.8	708.9
12200	828.1	800.2	771.0	742.6	719.2
12600	841.5	812.8	785.0	753.0	729.4
13000	854.8	825.0	796.8	765.4	739.2
13400		837.0	808.3	780.3	748.7
13800		849.1	819.5	791.1	757.9
14200			830.2	801.5	772.2
14600			840.9	811.7	783.2

With manual speedbrakes, decrease weight by 47800 lb.
With 1 brake deactivated, decrease weight by 50200 lb.
With 2 brakes deactivated, decrease weight by 102100 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
(°C)	(°F)	-2000	0	2000	4000	6000	8000
54	129	672.3	628.0				
52	126	690.0	643.1				
50	122	707.8	659.3	605.6			
48	118	725.5	677.8	619.9			
46	115	743.7	696.5	635.4	585.0		
44	111	761.0	714.1	652.5	600.2		
42	108	777.3	732.3	671.6	614.6	563.6	
40	104	793.0	750.7	689.9	629.6	576.5	
38	100	809.0	769.5	707.1	644.2	589.2	523.7
36	97	823.4	785.6	722.9	658.1	600.0	534.2
34	93	834.9	801.0	739.6	671.9	609.6	544.6
32	90	835.0	816.7	753.4	684.7	618.5	554.2
30	86	835.0	830.3	765.2	699.0	627.8	562.5
28	82	835.0	830.6	775.5	709.9	638.0	570.7
26	79	835.0	830.8	787.4	718.4	648.3	578.8
24	75	835.0	831.0	787.5	725.5	659.0	587.6
22	72	835.0	831.2	787.7	732.4	666.4	596.9
20	68	835.0	831.5	787.8	732.6	671.0	604.8
18	64	835.0	831.6	788.0	732.8	675.5	610.3
16	61	835.0	831.8	788.2	732.9	675.6	614.2
14	57	835.0	831.9	788.4	733.1	675.8	617.6
12	54	835.0	832.1	788.5	733.3	675.9	617.8
10	50	835.0	832.1	788.7	733.4	675.9	617.9
8	46	835.0	832.2	788.9	733.6	676.0	617.9
6	43	835.0	832.3	788.9	733.7	676.0	617.8
4	40	835.0	832.4	781.7	706.6	645.9	570.9
2	36	835.0	832.4	781.9	706.7	646.0	570.9
0	32	835.0	832.5	781.9	706.8	646.1	571.0
-40	-40	835.0	832.7	781.9	706.8	646.1	571.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.
With engine bleed for packs off, increase weight by 2900 lb.
With engine and wing anti-ice on, decrease weight by 4800 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 48400 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 20, Gear Up

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
54	6.10	5.13	3.96			
50	6.87	5.86	4.59	3.52	2.51	1.16
46	7.69	6.66	5.32	4.11	3.04	1.64
42	8.44	7.49	6.11	4.83	3.61	2.13
38	9.17	8.30	6.86	5.49	4.19	2.65
34	9.62	9.05	7.54	6.08	4.67	3.14
30	9.64	9.64	8.07	6.61	5.10	3.54
26	9.66	9.65	8.51	7.03	5.59	3.93
22	9.67	9.66	8.52	7.34	5.93	4.36
18	9.69	9.66	8.52	7.34	6.15	4.65
14	9.71	9.67	8.53	7.35	6.15	4.84
10	9.72	9.68	8.54	7.35	6.15	4.84

Weight Adjustment

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
800	-3.08	-3.51	-3.94	-4.37	-4.80	-5.22	-5.64	-6.05	-6.46	-6.86	-7.26
750	-2.74	-3.13	-3.52	-3.90	-4.28	-4.65	-5.03	-5.40	-5.76	-6.12	-6.47
700	-2.41	-2.74	-3.07	-3.40	-3.72	-4.04	-4.36	-4.68	-4.99	-5.30	-5.60
650	-2.08	-2.35	-2.61	-2.87	-3.12	-3.38	-3.63	-3.88	-4.13	-4.39	-4.64
600	-1.51	-1.70	-1.89	-2.08	-2.26	-2.45	-2.63	-2.81	-2.99	-3.18	-3.37
550	-0.83	-0.93	-1.04	-1.14	-1.24	-1.34	-1.44	-1.54	-1.64	-1.74	-1.85
500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450	1.03	1.16	1.28	1.40	1.53	1.65	1.77	1.90	2.03	2.16	2.29
400	2.38	2.66	2.93	3.21	3.49	3.77	4.06	4.35	4.64	4.95	5.26

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF	-0.22	-0.23	-0.23	-0.23	-0.23	-0.22	-0.22	-0.22	-0.21	-0.21	-0.21
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF+10	0.08	0.07	0.07	0.07	0.09	0.11	0.12	0.11	0.12	0.10	0.10
VREF+20	0.17	0.14	0.12	0.13	0.16	0.19	0.19	0.17	0.17	0.14	0.13
VREF+30	0.14	0.10	0.08	0.08	0.10	0.05	0.03	0.01	-0.01	-0.07	-0.04

With engine bleed for packs off, increase gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.1%.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease gradient by 0.7%

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Quick Turnaround Limit Weight

Flaps 30 Limit Weight (1000 LB)

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	510.4				
50	122	513.7	494.5			
45	113	517.9	498.5	479.9		
40	104	522.2	502.6	483.7	465.1	
35	95	526.6	506.8	487.7	469.0	450.5
30	86	531.1	511.2	491.8	473.1	454.4
25	77	535.6	515.6	496.1	477.3	458.4
20	68	540.3	520.2	500.4	481.5	462.5
15	59	545.2	524.9	504.9	485.7	466.8
10	50	550.2	529.7	509.6	490.1	471.1
5	41	555.3	534.6	514.3	494.6	475.5
0	32	560.6	539.6	519.2	499.3	480.1
-5	23	566.1	544.8	524.3	504.1	484.6
-10	14	571.7	550.2	529.5	509.1	489.3
-15	5	577.5	555.7	534.7	514.2	494.2
-20	-4	583.4	561.5	540.1	519.5	499.2
-30	-22	595.8	573.4	551.6	530.5	509.8
-40	-40	608.4	586.1	563.8	542.1	521.1
-50	-58	622.0	599.4	576.8	554.5	532.9
-54	-65	627.7	604.9	582.2	559.8	537.7

Increase weight by 4800 lb per 1% uphill slope. Decrease weight by 7600 lb per 1% downhill slope.
Increase weight by 13200 lb per 10 knots headwind. Decrease weight by 69500 lb per 10 knots tailwind.

Decrease weight by 27600 lb when one brake is deactivated. Decrease weight by 56100 lb when two brakes are deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Climb Limit Weight
Flaps 15

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	517.8	494.0	458.7	412.7	
52	126	529.7	493.8	471.7	424.7	
50	122	542.4	496.4	473.5	436.5	377.2
48	118	555.5	508.7	473.4	447.8	388.6
46	115	568.6	520.8	475.9	448.8	399.8
44	111	581.5	532.6	486.8	448.6	410.6
42	108	593.6	544.2	497.7	451.1	416.5
40	104	605.9	556.3	508.9	461.3	416.3
38	100	619.5	569.1	520.9	471.9	418.8
36	97	633.2	581.8	532.9	483.2	428.4
34	93	647.1	594.8	545.3	494.8	438.3
32	90	659.4	607.7	557.5	506.1	448.8
30	86	671.1	621.1	569.7	517.9	459.9
28	82	683.0	634.3	582.3	529.5	470.5
26	79	693.7	646.4	593.8	540.9	481.9
24	75	699.0	657.0	604.2	551.5	492.3
22	72	699.2	666.6	614.1	560.7	503.6
20	68	699.4	671.1	622.4	568.3	513.5
18	65	699.6	671.2	630.2	575.3	521.5
16	61	699.7	671.2	634.0	580.4	528.3
14	58	699.8	671.2	633.9	584.6	534.3
10	50	700.0	671.3	633.6	586.4	540.4
-40	-40	696.2	666.9	627.1	579.2	535.1

With engine bleed for packs off, increase weight by 1800 lb.
With engine anti-ice on, decrease weight by 4000 lb.
With engine and wing anti-ice on, decrease weight by 9200 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)				
		AIRPORT PRESSURE ALTITUDE (FT)				
°C	°F	0	2000	4000	6000	8000
54	129	565.0				
52	126	578.9				
50	122	592.7	544.9			
48	118	607.7	558.2			
46	115	623.2	572.8	527.0		
44	111	638.1	588.5	541.2		
42	108	653.6	603.6	554.3	507.6	
40	104	669.5	618.4	567.9	519.1	
38	100	684.8	631.1	580.5	530.6	470.4
36	97	699.4	643.8	591.9	539.9	480.0
34	93	714.0	657.3	601.9	548.5	489.6
32	90	727.3	668.9	612.0	556.3	497.9
30	86	740.1	679.4	622.6	564.9	505.5
28	82	740.3	688.5	632.0	574.0	512.8
26	79	740.5	698.7	639.1	583.5	520.2
24	75	740.7	698.8	644.5	591.9	528.4
22	72	740.9	698.9	650.1	597.5	536.7
20	68	741.1	699.1	650.3	601.0	543.9
18	64	741.3	699.3	650.4	604.6	548.8
16	61	741.5	699.4	650.5	604.7	552.2
14	57	741.6	699.6	650.6	604.8	555.4
12	54	741.7	699.8	650.6	604.8	555.5
10	50	741.8	699.9	650.7	604.8	555.6
-40	-40	742.3	700.4	651.4	605.4	556.0

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.
With engine bleed for packs off, increase weight by 3900 lb.
With engine and wing anti-ice on, decrease weight by 3800 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 67500 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on, engine and wing anti-ice off

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	647.4								
50	607.6	666.0							
100	570.3	627.7	668.4						
150	541.1	597.0	638.7	669.6					
200	516.9	571.3	613.6	645.4	670.1				
250	496.0	549.2	591.3	624.2	649.8	670.3			
300	477.4	529.7	571.5	605.0	631.6	652.9	670.4	681.7	681.7
350	460.9	512.3	553.8	587.4	614.8	636.8	655.0	670.2	681.0
400	445.9	496.5	537.7	571.4	599.1	622.0	640.7	656.5	670.0
450	432.4	482.0	522.9	556.6	584.6	607.9	627.4	643.7	657.7
500	419.8	468.6	509.2	542.8	571.0	594.7	614.7	631.6	646.0
550	408.1	456.2	496.5	530.0	558.3	582.3	602.7	620.1	634.9
600	397.2	444.7	484.5	518.1	546.4	570.5	591.3	609.0	624.3
650	387.0	434.0	473.3	506.8	535.1	559.4	580.4	598.4	614.1
700	377.4	423.9	462.8	496.1	524.5	548.9	570.0	588.4	604.3
750		414.4	452.8	486.0	514.4	538.8	560.1	578.7	594.9
800		405.3	443.5	476.3	504.7	529.2	550.6	569.4	585.9
850		396.7	434.6	467.2	495.5	520.1	541.6	560.4	577.1
900		388.5	426.2	458.5	486.7	511.3	532.9	551.9	568.7
950		380.7	418.2	450.1	478.3	502.9	524.5	543.6	560.6
1000		373.3	410.4	442.3	470.2	494.8	516.5	535.7	552.7

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
30 & BELOW	0	0	0	0	0	0	0	0	0
32	-6.3	-7.1	-7.9	-8.8	-9.6	-10.4	-11.3	-12.1	-12.9
34	-12.5	-14.2	-15.9	-17.5	-19.2	-20.9	-22.5	-24.2	-25.8
36	-18.8	-21.3	-23.8	-26.3	-28.8	-31.3	-33.8	-36.3	-38.8
38	-25.1	-28.4	-31.7	-35.1	-38.4	-41.7	-45.0	-48.4	-51.7
40	-31.4	-35.5	-39.7	-43.8	-48.0	-52.1	-56.3	-60.5	-64.6
42	-37.5	-42.5	-47.5	-52.5	-57.6	-62.6	-67.6	-72.7	-77.7
44	-43.5	-49.5	-55.4	-61.3	-67.2	-73.1	-79.0	-84.9	-90.8
46	-49.6	-56.4	-63.2	-70.0	-76.8	-83.6	-90.3	-97.1	-103.9
48	-55.7	-63.4	-71.0	-78.7	-86.4	-94.0	-101.7	-109.3	-117.0
50	-61.8	-70.4	-78.9	-87.4	-96.0	-104.5	-113.0	-121.6	-130.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
S.L. & BELOW	0	0	0	0	0	0	0	0	0
1000	-15.3	-16.7	-18.1	-19.5	-20.9	-22.3	-23.7	-25.1	-26.5
2000	-30.7	-33.5	-36.3	-39.1	-41.9	-44.7	-47.5	-50.3	-53.1
3000	-43.7	-48.0	-52.4	-56.7	-61.0	-65.3	-69.6	-73.9	-78.2
4000	-56.8	-62.6	-68.5	-74.3	-80.1	-85.9	-91.7	-97.5	-103.4
5000	-72.4	-79.7	-87.0	-94.3	-101.6	-108.9	-116.3	-123.6	-130.9
6000	-87.9	-96.7	-105.5	-114.3	-123.2	-132.0	-140.8	-149.6	-158.4
7000	-102.1	-112.5	-122.9	-133.3	-143.7	-154.1	-164.5	-174.9	-185.4
8000	-116.3	-128.3	-140.3	-152.3	-164.3	-176.3	-188.3	-200.3	-212.3

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)								
	360	400	440	480	520	560	600	640	680
15 TW	-38.3	-42.0	-45.7	-49.3	-53.0	-56.7	-60.3	-64.0	-67.7
10 TW	-25.6	-28.0	-30.4	-32.9	-35.3	-37.8	-40.2	-42.7	-45.1
5 TW	-12.8	-14.0	-15.2	-16.4	-17.7	-18.9	-20.1	-21.3	-22.6
0	0	0	0	0	0	0	0	0	0
10 HW	8.0	7.6	7.1	6.7	6.3	5.9	5.4	5.0	4.6
20 HW	16.0	15.1	14.3	13.4	12.6	11.7	10.9	10.0	9.1
30 HW	26.0	24.6	23.1	21.7	20.3	18.9	17.4	16.0	14.6
40 HW	36.0	34.0	32.0	30.0	28.0	26.0	24.0	22.0	20.0

With engine bleed for packs off, increase weight by 2100 lb.
With engine anti-ice on, decrease weight by 3600 lb.
With engine and wing anti-ice on, decrease weight by 8700 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18600	16600	14200
760	19100	17200	14800
740	19700	17900	15500
720	20200	18500	16100
700	21000	19400	17100
680	21900	20400	18200
660	22900	21500	19400
640	23900	22500	20600
620	25000	23500	21900
600	25900	24600	23000
580	27000	25700	24200
560	28000	27000	25400
540	29100	28200	26700
520	30100	29500	28000
500	30900	30500	29300
480	31600	31300	30500
460	32400	32200	31500
440	33300	33100	32600
420	34100	33900	33600
400	34900	34800	34600
380	35800	35700	35600
360	36700	36600	36400

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
334	296	264	239	218	200	187	175	165	156	149
500	444	396	358	327	300	281	264	249	235	224
666	591	527	477	436	400	375	352	332	314	299
830	738	659	596	545	500	469	441	416	393	374
993	883	789	714	653	600	563	530	500	473	450
1156	1029	920	833	762	700	657	618	583	552	525
1318	1173	1050	951	870	800	751	707	667	632	601
1479	1318	1179	1069	979	900	845	796	751	712	677
1639	1462	1309	1187	1087	1000	939	884	835	791	753
1799	1605	1438	1305	1196	1100	1033	973	919	871	829
1958	1748	1567	1423	1304	1200	1128	1062	1003	951	905
2116	1890	1696	1540	1412	1300	1222	1151	1087	1030	981
2273	2032	1824	1658	1520	1400	1316	1240	1171	1110	1058
2430	2174	1952	1775	1628	1500	1410	1329	1255	1191	1134
2586	2315	2080	1892	1736	1600	1504	1418	1340	1271	1211
2741	2455	2208	2009	1844	1700	1599	1507	1425	1351	1287
2896	2595	2335	2125	1952	1800	1693	1596	1509	1432	1364
3050	2734	2461	2242	2060	1900	1788	1686	1594	1512	1441
3203	2873	2588	2358	2167	2000	1882	1776	1679	1593	1518

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	17.3	0:52	16.6	0:50	16.1	0:48	15.8	0:46	15.6	0:45
300	25.3	1:15	24.2	1:12	23.3	1:09	22.5	1:06	22.1	1:03
400	33.4	1:39	31.7	1:34	30.4	1:30	29.2	1:25	28.5	1:21
500	41.4	2:02	39.2	1:56	37.5	1:50	36.0	1:45	35.0	1:40
600	49.7	2:25	47.1	2:18	44.9	2:11	43.0	2:04	41.7	1:58
700	58.1	2:48	54.9	2:39	52.3	2:31	50.0	2:23	48.4	2:16
800	66.4	3:11	62.7	3:01	59.7	2:51	57.0	2:42	55.1	2:34
900	74.8	3:33	70.5	3:22	67.1	3:12	64.0	3:02	61.8	2:52
1000	83.1	3:56	78.4	3:44	74.5	3:32	71.0	3:21	68.5	3:10
1100	91.8	4:18	86.6	4:05	82.2	3:52	78.4	3:39	75.6	3:27
1200	100.6	4:40	94.8	4:25	90.0	4:11	85.7	3:58	82.7	3:45
1300	109.3	5:02	103.0	4:46	97.7	4:31	93.1	4:16	89.7	4:02
1400	118.1	5:24	111.2	5:07	105.4	4:51	100.4	4:35	96.8	4:19
1500	126.8	5:46	119.4	5:28	113.2	5:10	107.8	4:53	103.9	4:37
1600	136.0	6:07	128.0	5:48	121.2	5:29	115.5	5:11	111.4	4:54
1700	145.2	6:28	136.5	6:08	129.3	5:48	123.2	5:29	118.8	5:11
1800	154.3	6:49	145.1	6:28	137.4	6:07	130.9	5:47	126.3	5:28
1900	163.5	7:10	153.7	6:48	145.5	6:26	138.6	6:05	133.8	5:45
2000	172.6	7:32	162.3	7:08	153.6	6:45	146.3	6:23	141.3	6:02

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)					
	350	400	450	500	550	600
20	-2.4	-1.2	0.0	1.5	3.0	4.6
40	-4.7	-2.4	0.0	2.9	5.9	9.2
60	-7.1	-3.6	0.0	4.4	8.9	13.9
80	-9.5	-4.9	0.0	5.9	12.0	18.8
100	-11.9	-6.1	0.0	7.4	15.2	23.7
120	-14.3	-7.3	0.0	9.0	18.4	28.9
140	-16.7	-8.5	0.0	10.6	21.8	34.1
160	-19.1	-9.7	0.0	12.2	25.1	39.4
180	-21.6	-10.9	0.0	13.8	28.6	44.9

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
105	86	73	63	56	50	45	41	38	35	33
174	152	134	120	109	100	92	85	80	75	70
245	217	195	177	163	150	139	130	122	115	108
314	282	256	234	216	200	186	175	164	155	147
384	347	316	290	269	250	234	219	207	196	185
452	411	376	347	322	300	281	264	250	236	224
521	474	436	403	375	350	328	309	292	277	264
590	539	496	459	428	400	376	354	335	318	303
659	603	556	515	480	450	423	399	378	359	342
730	668	616	572	534	500	470	444	421	399	380

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)						TIME (HRS:MIN)
		360	400	440	480	520	560	
50	FUEL (1000 LB)	4.9	5.1	5.4	5.7	6.0	6.4	0:16
	ALT (FT)	11000	11000	11000	11000	11000	9000	
100	FUEL (1000 LB)	8.0	8.5	9.0	9.5	10.0	10.6	0:26
	ALT (FT)	21000	21000	19000	19000	19000	17000	
150	FUEL (1000 LB)	10.8	11.5	12.2	13.0	13.7	14.5	0:35
	ALT (FT)	27000	25000	25000	23000	23000	21000	
200	FUEL (1000 LB)	13.5	14.4	15.3	16.3	17.3	18.3	0:44
	ALT (FT)	33000	29000	27000	27000	25000	23000	
250	FUEL (1000 LB)	16.0	17.2	18.4	19.6	20.9	22.2	0:52
	ALT (FT)	33000	31000	29000	27000	25000	23000	
300	FUEL (1000 LB)	18.6	20.0	21.5	23.0	24.5	26.0	1:01
	ALT (FT)	33000	33000	29000	29000	27000	25000	
350	FUEL (1000 LB)	21.2	22.8	24.5	26.3	28.0	29.8	1:09
	ALT (FT)	33000	33000	31000	29000	27000	25000	
400	FUEL (1000 LB)	23.8	25.7	27.6	29.6	31.6	33.7	1:17
	ALT (FT)	33000	33000	31000	29000	27000	25000	
450	FUEL (1000 LB)	26.5	28.5	30.7	33.0	35.3	37.6	1:26
	ALT (FT)	33000	33000	31000	29000	27000	25000	
500	FUEL (1000 LB)	29.1	31.4	33.8	36.3	38.9	41.5	1:34
	ALT (FT)	33000	33000	31000	29000	27000	25000	

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
800	34550						
760	33390	33420					
720	31570	31530					
680	29640	29580	29490				
640	27710	27670	27560				
600	26100	26080	25930				
560	24550	24520	24350	24470			
520	23040	22970	22800	22860	23100		
480	21610	21500	21320	21320	21540		
440	20150	20000	19800	19790	19950	20220	
400	18760	18580	18340	18340	18430	18570	19050
360	17350	17150	16890	16860	16880	17000	17360

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
800	33920	34110	34060	34600	36410
760	32630	32740	32680	33150	34530
720	30740	30780	30750	31090	32130
680	28770	28780	28750	28990	29710
640	26830	26830	26770	27030	27540
600	25180	25160	25060	25310	25710
560	23580	23520	23400	23620	23890
520	22000	21900	21750	21910	22150
480	20490	20340	20180	20260	20480
440	18960	18770	18570	18610	18790
400	17490	17280	17030	17010	17140
360	16020	15800	15520	15420	15520

These tables include 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
20	374.5	374.5	
18	397.5	393.1	384.4
16	424.4	420.7	412.2
14	453.3	451.7	440.3
12	488.9	484.2	469.7
10	524.5	518.7	503.5
8	562.0	553.8	539.5
6	604.3	588.9	567.4
4	641.4	617.7	589.7
2	671.4	642.9	613.1
0	698.4	666.6	634.4

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)									
	PRESSURE ALTITUDE (1000 FT)									
	0	2	4	6	8	10	12	14	16	18
ENGINE ONLY	0.0	-1.3	-2.2	-2.4	-2.1	-1.7	-1.4	-0.2	0.0	0.0
ENGINE AND WING	-4.7	-6.2	-6.3	-6.6	-5.7	-4.9	-4.0	-3.3	-2.6	-2.0

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Tire Speed, and Obstacle Limit Weights as determined from the following tables. Brake Energy Limit is not shown as it is not limiting for the range of conditions shown in this chapter. When determining a maximum weight for a wet runway, the dry runway limit weight must also be checked and the lower of the two weights used.

Field Limit Weight - Slope and Wind Corrections

These tables for wet and dry runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway condition and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude.

When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Obstacle Limit Weight

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Maximum tire speed limited weights are presented for 235 MPH tires. To determine the tire speed limit weight, enter the table with OAT, move to airport pressure altitude and read the tire speed limit weight. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal takeoff speeds, V1, VR, and V2 are read from either the wet or dry table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle limit weight and the V1 must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 8400 lb for a dry runway or 5000 lb for a wet runway and the V1 associated with the reduced weight by 2 knots. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 17000 lb for a dry runway or 10400 lb for a wet runway and the V1 associated with the reduced weight by 5 knots for a dry runway or 3 knots for a wet runway. If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate stop distance available corrected for wind and slope exceeds approximately 4900 ft for one brake deactivated or 5100 ft for two brakes deactivated. For wet runways, the corrected accelerate stop distance should exceed approximately 6200 ft for one brake deactivated or 6400 ft for two brakes deactivated.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

One Thrust Reverser Inoperative

Wet runway takeoff performance presented for all brakes operating is based on the use of one thrust reverser during deceleration. When operating with a thrust reverser inoperative, the runway/obstacle limited takeoff weight and V1 speed must be reduced to account for the reduced deceleration capability. A simplified method which conservatively accounts for this is to reduce the normal wet runway/obstacle limited weight by 11800 lb and the V1 associated with the reduced weight by 3 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate stop distance available corrected for wind and slope exceeds approximately 6300 ft.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability at two center of gravity positions: 7.5% MAC (FMC default) for use when no center of gravity is entered on the PERF INIT page, and 30% MAC (typical mid cruise center of gravity) for use when 30% MAC is entered. Crews may interpolate between these values to determine the airplane's capability at other specific center of gravity positions. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time Table with air distance from the Ground to Air Miles Conversion Table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the planned landing weight to obtain fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time required with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Oxygen Requirements

Flight Crew System

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with these requirements is achieved with the minimum dispatch oxygen cylinder pressure. Enter the Crew Oxygen Requirements table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate bottle temperature.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 2.05 liters/person/minute (1.2 psi/person/minute for the single cylinder system), or 13 liters/person/minute (8 psi/person/minute) if 100% oxygen is selected during normal usage.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-around Gradient table with airport OAT and pressure altitude to determine the reference Go-Around Gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted Go-Around Gradient. Apply the necessary engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777F GE90-110B1L LB FT FAA TO1-10 TO2-20 CREW3 TALPA HIGH_ALT

Pkg Model Identification PD.ModID.50.1

Takeoff. PD.50.1

Takeoff Field Corrections - Dry Runway PD.50.1
Takeoff Field & Climb Limit Weights - Dry Runway PD.50.2
Takeoff Field Corrections - Wet Runway PD.50.5
Takeoff Field & Climb Limit Weights - Wet Runway PD.50.6
Takeoff Obstacle Limit Weight. PD.50.9
Tire Speed Limit PD.50.11
Takeoff Speeds - Dry Runway PD.50.12
Takeoff Speeds - Wet Runway PD.50.14

Enroute PD.51.1

Long Range Cruise Maximum Operating Altitude. PD.51.1
Long Range Cruise Trip Fuel and Time PD.51.3
Long Range Cruise Step Climb Trip Fuel and Time PD.51.5
Short Trip Fuel and Time PD.51.6
Holding Planning PD.51.7
Crew Oxygen Requirements. PD.51.8
Net Level Off Weight PD.51.9

Landing PD.52.1

Landing Field Limit Weight - Dry Runway PD.52.1
Landing Field Limit Weight - Wet Runway PD.52.3
Approach or Landing Climb Limited Weight. PD.52.4
Go-Around Climb Gradient PD.52.5
Quick Turnaround Limit Weight. PD.52.6

Gear Down. PD.53.1

Takeoff Climb Limit Weight. PD.53.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight PD.53.2
Takeoff Obstacle Limit Weight PD.53.3
Long Range Cruise Altitude Capability PD.53.5
Long Range Cruise Trip Fuel and Time PD.53.6
Short Trip Fuel and Time PD.53.8
Holding Planning PD.53.9
Net Level Off Weight PD.53.10

Text PD.54.1

Introduction PD.54.1
Takeoff PD.54.1
Enroute PD.54.5
Landing PD.54.7
Gear Down PD.54.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
305	HL8005	37642	WF140
306	HL8043	62693	WF141
307	HL8044	62694	WF142
308	HL8045	62695	WF143
309	HL8046	62696	WF144
310	HL8075	62631	WF191
311	HL8076	62632	WF216
312	HL8077	62697	WF217
303	HL8226	37640	WF138

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airplane Number	Registry Number	Serial Number	Tabulation Number
301	HL8251	37639	WF136
302	HL8252	37638	WF137
304	HL8285	37641	WF139

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field Corrections - Dry Runway

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4340	4310	4270	4240	4200	4150	4090	4040	3980
4600	4790	4740	4690	4650	4600	4520	4450	4370	4300
5000	5230	5170	5110	5060	5000	4900	4810	4710	4610
5400	5670	5600	5540	5470	5400	5280	5160	5050	4930
5800	6120	6040	5960	5880	5800	5660	5520	5380	5240
6200	6560	6470	6380	6290	6200	6040	5880	5720	5560
6600	7010	6900	6800	6700	6600	6420	6240	6060	5870
7000	7450	7340	7220	7110	7000	6800	6590	6390	6190
7400	7890	7770	7650	7520	7400	7180	6950	6730	6500
7800	8340	8200	8070	7930	7800	7550	7310	7060	6820
8200	8780	8640	8490	8350	8200	7930	7670	7400	7130
8600	9230	9070	8910	8760	8600	8310	8020	7740	7450
9000	9670	9500	9330	9170	9000	8690	8380	8070	7760
9400	10110	9940	9760	9580	9400	9070	8740	8410	8080
9800	10560	10370	10180	9990	9800	9450	9100	8740	8390
10200	11000	10800	10600	10400	10200	9830	9450	9080	8710
10600	11450	11230	11020	10810	10600	10210	9810	9420	9020
11000	11890	11670	11440	11220	11000	10580	10170	9750	9340
11400	12330	12100	11870	11630	11400	10960	10530	10090	9650
11800	12780	12530	12290	12040	11800	11340	10880	10430	9970

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3140	3490	3850	4200	4450	4720	4990	5260
4600	3470	3850	4220	4600	4870	5140	5420	5710
5000	3800	4200	4600	5000	5280	5560	5850	6160
5400	4140	4560	4980	5400	5690	5980	6290	6600
5800	4470	4920	5360	5800	6100	6410	6720	7050
6200	4810	5270	5740	6200	6510	6830	7160	7490
6600	5140	5630	6110	6600	6920	7250	7590	7940
7000	5480	5980	6490	7000	7330	7670	8030	8390
7400	5810	6340	6870	7400	7740	8100	8460	8830
7800	6140	6700	7250	7800	8150	8520	8890	9280
8200	6480	7050	7630	8200	8570	8940	9330	9720
8600	6810	7410	8000	8600	8980	9360	9760	10170
9000	7150	7760	8380	9000	9390	9790	10200	10620
9400	7480	8120	8760	9400	9800	10210	10630	11060
9800	7820	8480	9140	9800	10210	10630	11060	11510
10200	8150	8830	9520	10200	10620	11050	11500	11960
10600	8480	9190	9890	10600	11030	11480	11930	12400
11000	8820	9550	10270	11000	11440	11900	12370	12850
11400	9150	9900	10650	11400	11850	12320	12800	13290
11800	9490	10260	11030	11800	12270	12740	13240	13740

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
5560	614.0	557.3	553.7	549.3	546.7	545.0	540.8	529.1	511.9	497.2	482.1
5800	628.9	570.9	567.2	562.7	560.1	558.3	554.0	542.1	524.5	509.4	494.0
6200	651.8	591.9	588.1	583.4	580.7	578.9	574.5	562.1	543.9	528.4	512.4
6600	673.9	612.1	608.2	603.4	600.6	598.7	594.1	581.4	562.7	546.7	530.2
7000	695.0	631.5	627.5	622.6	619.7	617.8	613.1	600.0	580.7	564.3	547.4
7400	715.5	650.3	646.1	641.1	638.1	636.2	631.4	617.9	598.1	581.3	563.9
7800	735.0	668.3	664.1	658.9	655.9	653.9	648.9	635.2	615.0	597.7	580.0
8200	754.3	686.2	681.9	676.6	673.5	671.5	666.5	652.4	631.8	614.2	596.1
8600	772.5	703.2	698.8	693.4	690.3	688.2	683.1	668.8	647.8	629.8	611.4
9000	789.0	718.5	714.0	708.5	705.3	703.2	698.0	683.4	662.0	643.8	625.0
9400	804.0	732.3	727.7	722.2	718.9	716.8	711.5	696.7	675.0	656.4	637.3
9800	818.5	745.7	741.1	735.4	732.1	729.9	724.5	709.5	687.4	668.6	649.2
10200	832.6	758.6	753.9	748.2	744.9	742.6	737.2	721.9	699.5	680.4	660.7
10600	846.2	771.2	766.4	760.6	757.2	754.9	749.4	733.9	711.2	691.8	671.8
11000	859.5	783.4	778.6	772.7	769.2	766.9	761.3	745.6	722.6	702.9	682.6
11400	872.4	795.3	790.4	784.5	780.9	778.6	772.9	757.0	733.7	713.7	693.2
11800	885.0	806.9	802.0	795.9	792.4	790.0	784.3	768.2	744.5	724.3	703.5
12200	897.1	818.1	813.1	807.0	803.4	801.0	795.2	778.9	754.9	734.5	713.4
CLIMB LIMIT WT (1000 LB)	773.4	772.2	771.7	771.1	770.7	770.4	769.6	742.3	704.4	673.1	640.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
5560	580.2	528.0	524.6	520.5	518.1	516.5	503.5	491.2	474.4	459.1	443.4
5800	594.4	540.9	537.5	533.3	530.9	529.2	515.9	503.4	486.1	470.5	454.4
6200	616.1	560.9	557.4	553.1	550.5	548.8	535.1	522.1	504.3	488.2	471.6
6600	637.1	580.2	576.5	572.1	569.5	567.7	553.5	540.2	521.9	505.2	488.1
7000	657.2	598.7	595.0	590.4	587.7	585.9	571.4	557.6	538.8	521.7	504.1
7400	676.6	616.6	612.8	608.1	605.3	603.4	588.5	574.4	555.1	537.5	519.5
7800	695.3	633.9	629.9	625.1	622.3	620.4	605.1	590.7	570.9	553.0	534.5
8200	713.7	651.1	647.1	642.2	639.3	637.3	621.7	607.0	586.9	568.5	549.7
8600	731.2	667.4	663.3	658.3	655.4	653.4	637.5	622.5	602.0	583.3	564.1
9000	747.0	682.0	677.9	672.8	669.8	667.8	651.6	636.4	615.5	596.5	576.9
9400	761.3	695.3	691.0	685.9	682.8	680.8	664.4	648.9	627.6	608.3	588.5
9800	775.1	708.1	703.8	698.5	695.5	693.3	676.7	661.0	639.4	619.7	599.6
10200	788.5	720.5	716.1	710.8	707.6	705.5	688.6	672.6	650.7	630.8	610.3
10600	801.5	732.4	728.0	722.6	719.4	717.3	700.1	683.9	661.7	641.4	620.7
11000	814.2	744.1	739.6	734.2	730.9	728.7	711.3	694.9	672.4	651.8	630.8
11400	826.5	755.5	751.0	745.4	742.1	739.9	722.3	705.6	682.8	662.0	640.7
11800	838.5	766.6	762.0	756.4	753.1	750.8	733.0	716.1	692.9	671.9	650.3
12200	850.1	777.3	772.7	767.0	763.6	761.3	743.3	726.2	702.8	681.4	659.6
CLIMB LIMIT WT (1000 LB)	740.1	739.7	739.4	739.0	738.8	738.5	711.2	684.9	648.7	618.0	587.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 3800 lb.
With engine and wing anti-ice on, decrease field limit weight by 2600 lb and climb limit weight by 4700 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
5560	545.8	497.4	494.2	490.4	485.1	480.7	467.4	455.1	437.8	423.8	410.9
5800	559.1	509.6	506.4	502.5	497.1	492.6	479.0	466.4	448.7	434.4	421.2
6200	579.7	528.6	525.3	521.2	515.6	511.0	496.9	484.0	465.7	450.9	437.2
6600	599.5	546.8	543.4	539.2	533.5	528.7	514.2	500.9	482.0	466.8	452.7
7000	618.7	564.5	561.0	556.7	550.8	545.8	531.0	517.3	497.9	482.2	467.7
7400	637.1	581.5	577.9	573.4	567.4	562.3	547.1	533.0	513.1	497.0	482.2
7800	654.8	597.9	594.2	589.7	583.5	578.3	562.7	548.3	527.9	511.5	496.3
8200	672.4	614.4	610.6	606.0	599.7	594.4	578.5	563.7	543.0	526.2	510.7
8600	689.2	630.0	626.2	621.5	615.1	609.7	593.4	578.4	557.3	540.2	524.4
9000	704.2	644.0	640.1	635.3	628.8	623.3	606.8	591.5	570.0	552.6	536.5
9400	717.8	656.6	652.7	647.8	641.2	635.6	618.8	603.3	581.4	563.7	547.4
9800	730.9	668.8	664.8	659.9	653.1	647.4	630.4	614.7	592.4	574.5	557.9
10200	743.6	680.6	676.5	671.5	664.6	658.9	641.6	625.6	603.0	584.8	567.9
10600	756.0	692.0	687.8	682.8	675.8	670.0	652.4	636.2	613.3	594.8	577.7
11000	768.0	703.1	698.9	693.7	686.7	680.8	663.0	646.5	623.3	604.5	587.2
11400	779.7	713.9	709.7	704.5	697.3	691.3	673.3	656.6	633.1	614.0	596.5
11800	791.1	724.5	720.2	714.9	707.7	701.6	683.3	666.4	642.6	623.3	605.5
12200	802.1	734.7	730.3	725.0	717.7	711.5	693.0	675.9	651.8	632.3	614.3
CLIMB LIMIT WT (1000 LB)	700.0	699.6	699.5	699.1	690.6	682.7	655.3	632.2	598.6	571.1	546.9

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
5560	511.8	466.4	463.4	455.7	448.2	442.6	429.8	419.0	403.9	391.6	379.7
5800	524.4	478.0	474.8	467.0	459.4	453.6	440.5	429.5	414.1	401.5	389.3
6200	543.8	495.9	492.6	484.5	476.7	470.7	457.2	445.8	429.9	416.8	404.2
6600	562.5	513.2	509.8	501.4	493.3	487.2	473.3	461.6	445.1	431.7	418.8
7000	580.6	529.9	526.4	517.8	509.5	503.2	488.9	476.8	460.0	446.2	432.8
7400	598.0	546.0	542.4	533.6	525.0	518.5	503.9	491.5	474.2	460.0	446.3
7800	614.8	561.6	557.9	548.9	540.2	533.5	518.5	505.9	488.1	473.6	459.6
8200	631.7	577.3	573.6	564.4	555.4	548.7	533.4	520.5	502.3	487.6	473.3
8600	647.6	592.2	588.5	579.1	570.0	563.1	547.5	534.3	515.9	500.8	486.3
9000	661.9	605.6	601.7	592.2	582.9	575.9	560.0	546.7	527.9	512.6	497.8
9400	674.8	617.5	613.7	603.9	594.5	587.4	571.3	557.7	538.6	523.0	508.0
9800	687.3	629.1	625.2	615.3	605.8	598.5	582.1	568.3	549.0	533.1	517.8
10200	699.4	640.3	636.3	626.3	616.6	609.2	592.6	578.6	558.9	542.8	527.3
10600	711.0	651.1	647.0	636.9	627.0	619.6	602.7	588.5	568.5	552.2	536.5
11000	722.4	661.7	657.5	647.2	637.2	629.7	612.6	598.1	577.9	561.4	545.4
11400	733.5	671.9	667.8	657.3	647.2	639.5	622.2	607.6	587.1	570.3	554.1
11800	744.3	682.0	677.7	667.1	656.9	649.1	631.6	616.8	596.0	579.0	562.6
12200	754.8	691.6	687.3	676.6	666.3	658.4	640.6	625.6	604.6	587.4	570.9
CLIMB LIMIT WT (1000 LB)	656.8	656.8	656.6	647.0	633.9	623.5	600.5	581.0	552.7	529.4	507.3

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 3800 lb.
With engine and wing anti-ice on, decrease field limit weight by 2600 lb and climb limit weight by 4700 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
5560	473.6	428.7	423.2	412.8	405.4	400.7	389.1	378.3	364.1	353.0	342.0
5800	485.3	439.4	433.8	423.1	415.6	410.8	398.9	387.9	373.3	362.0	350.8
6200	503.4	456.0	450.2	439.2	431.4	426.5	414.2	402.8	387.8	376.0	364.5
6600	520.9	472.1	466.1	454.8	446.8	441.7	429.0	417.2	401.8	389.7	377.8
7000	537.8	487.6	481.5	469.8	461.6	456.4	443.3	431.3	415.4	402.9	390.7
7400	554.1	502.6	496.3	484.3	475.9	470.5	457.1	444.7	428.4	415.7	403.1
7800	569.9	517.2	510.7	498.5	489.9	484.4	470.6	458.0	441.3	428.2	415.4
8200	585.8	532.0	525.4	512.9	504.1	498.5	484.5	471.6	454.6	441.3	428.1
8600	600.9	546.1	539.4	526.7	517.7	512.0	497.7	484.6	467.3	453.7	440.3
9000	614.4	558.6	551.8	538.9	529.7	523.9	509.4	496.0	478.4	464.6	451.0
9400	626.5	569.9	562.9	549.8	540.5	534.6	519.8	506.2	488.3	474.3	460.4
9800	638.3	580.7	573.7	560.3	550.9	544.9	529.9	516.1	497.9	483.6	469.5
10200	649.6	591.1	584.0	570.4	560.8	554.7	539.5	525.5	507.0	492.5	478.3
10600	660.5	601.2	594.0	580.2	570.5	564.3	548.9	534.6	515.9	501.2	486.7
11000	671.2	611.0	603.7	589.7	579.9	573.6	558.0	543.5	524.5	509.6	494.9
11400	681.6	620.6	613.2	599.1	589.1	582.7	566.9	552.2	533.0	517.9	503.0
11800	691.7	630.0	622.5	608.1	598.0	591.6	575.5	560.7	541.2	525.9	510.8
12200	701.5	639.1	631.4	616.9	606.7	600.2	583.9	568.9	549.2	533.7	518.4
CLIMB LIMIT WT (1000 LB)	603.6	603.4	596.5	579.2	566.0	558.2	537.6	517.6	490.6	470.0	449.8

9800 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
5560	438.7	395.5	388.4	377.2	370.8	366.5	354.3	343.7	330.7	320.5	309.6
5800	449.6	405.4	398.2	386.7	380.2	375.8	363.3	352.4	339.2	328.8	317.6
6200	466.6	421.0	413.5	401.6	394.9	390.3	377.4	366.2	352.5	341.7	330.2
6600	483.0	436.0	428.3	416.0	409.1	404.4	391.1	379.6	365.4	354.4	342.4
7000	498.8	450.5	442.6	430.0	422.9	418.0	404.4	392.5	378.0	366.6	354.4
7400	514.1	464.5	456.4	443.4	436.2	431.2	417.1	405.0	390.1	378.4	365.8
7800	529.0	478.2	469.9	456.7	449.2	444.1	429.7	417.3	402.1	390.1	377.2
8200	544.0	492.2	483.7	470.3	462.7	457.4	442.8	430.1	414.5	402.3	389.2
8600	558.4	505.6	497.0	483.2	475.5	470.1	455.2	442.3	426.5	414.0	400.6
9000	571.1	517.4	508.6	494.6	486.8	481.3	466.2	453.0	436.9	424.2	410.6
9400	582.5	528.0	519.0	504.8	496.8	491.3	475.9	462.5	446.1	433.3	419.4
9800	593.5	538.1	529.0	514.6	506.5	500.9	485.2	471.7	455.0	441.9	427.9
10200	604.2	547.9	538.7	524.0	515.8	510.1	494.2	480.4	463.5	450.3	436.0
10600	614.4	557.4	548.0	533.1	524.8	519.0	502.8	488.9	471.7	458.3	443.8
11000	624.5	566.6	557.1	542.0	533.5	527.7	511.3	497.1	479.8	466.1	451.4
11400	634.3	575.6	566.0	550.7	542.1	536.2	519.6	505.2	487.6	473.8	458.9
11800	643.8	584.4	574.6	559.2	550.5	544.5	527.6	513.1	495.3	481.3	466.2
12200	653.0	592.9	583.0	567.3	558.5	552.4	535.4	520.7	502.6	488.5	473.2
CLIMB LIMIT WT (1000 LB)	561.1	555.8	544.6	525.1	514.2	506.8	484.2	464.1	439.9	421.3	401.3

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 3800 lb.
With engine and wing anti-ice on, decrease field limit weight by 2600 lb and climb limit weight by 4700 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4320	4290	4260	4230	4200	4150	4090	4040	3990
4600	4770	4730	4680	4640	4600	4530	4470	4400	4330
5000	5220	5160	5110	5050	5000	4920	4840	4760	4680
5400	5660	5600	5530	5470	5400	5310	5210	5120	5020
5800	6110	6030	5960	5880	5800	5690	5590	5480	5370
6200	6560	6470	6380	6290	6200	6080	5960	5840	5720
6600	7010	6910	6800	6700	6600	6470	6330	6200	6060
7000	7460	7340	7230	7110	7000	6850	6700	6550	6410
7400	7900	7780	7650	7530	7400	7240	7080	6910	6750
7800	8350	8210	8080	7940	7800	7620	7450	7270	7100
8200	8800	8650	8500	8350	8200	8010	7820	7630	7440
8600	9250	9090	8920	8760	8600	8400	8190	7990	7790
9000	9700	9520	9350	9170	9000	8780	8570	8350	8130
9400	10150	9960	9770	9590	9400	9170	8940	8710	8480
9800	10590	10400	10200	10000	9800	9560	9310	9070	8820
10200	11040	10830	10620	10410	10200	9940	9680	9430	9170
10600	11490	11270	11040	10820	10600	10330	10060	9790	9510
11000	11940	11700	11470	11230	11000	10710	10430	10140	9860
11400	12390	12140	11890	11650	11400	11100	10800	10500	10200
11800	12830	12580	12320	12060	11800	11490	11180	10860	10550

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3020	3420	3810	4200	4470	4760	5060	5370
4600	3360	3770	4190	4600	4890	5190	5500	5830
5000	3690	4130	4560	5000	5300	5610	5940	6280
5400	4030	4490	4940	5400	5710	6040	6380	6740
5800	4360	4840	5320	5800	6120	6470	6820	7190
6200	4700	5200	5700	6200	6540	6890	7260	7650
6600	5030	5560	6080	6600	6950	7320	7700	8100
7000	5370	5910	6460	7000	7360	7740	8140	8560
7400	5700	6270	6830	7400	7780	8170	8580	9010
7800	6040	6630	7210	7800	8190	8600	9020	9470
8200	6370	6980	7590	8200	8600	9020	9460	9920
8600	6710	7340	7970	8600	9010	9450	9900	10380
9000	7040	7700	8350	9000	9430	9870	10340	10840
9400	7380	8050	8730	9400	9840	10300	10780	11290
9800	7710	8410	9100	9800	10250	10730	11230	11750
10200	8050	8770	9480	10200	10660	11150	11670	12200
10600	8380	9120	9860	10600	11080	11580	12110	12660
11000	8720	9480	10240	11000	11490	12010	12550	13110
11400	9050	9840	10620	11400	11900	12430	12990	13570
11800	9390	10190	11000	11800	12320	12860	13430	14020

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
7350	706.7	637.2	632.8	627.5	624.4	622.3	617.2	603.1	582.3	564.9	547.1
7400	709.3	639.5	635.1	629.8	626.6	624.6	619.5	605.2	584.4	566.9	549.0
7800	728.3	656.6	652.1	646.6	643.4	641.2	636.0	621.3	599.9	582.0	563.6
8200	748.0	674.4	669.8	664.2	660.9	658.7	653.3	638.3	616.3	597.9	579.0
8600	767.5	692.1	687.4	681.6	678.2	676.0	670.5	655.1	632.6	613.7	594.3
9000	785.4	708.2	703.4	697.5	694.0	691.7	686.0	670.3	647.2	627.9	608.1
9400	802.0	723.0	718.0	712.0	708.4	706.1	700.3	684.2	660.6	640.8	620.6
9800	818.2	737.4	732.4	726.2	722.6	720.2	714.3	697.8	673.7	653.5	632.8
10200	834.1	751.6	746.4	740.1	736.4	734.0	727.9	711.1	686.5	665.9	644.7
10600	834.9	765.5	760.2	753.8	750.0	747.5	741.3	724.1	699.0	678.0	656.4
11000	834.9	779.0	773.6	767.1	763.2	760.7	754.4	736.9	711.3	689.8	667.8
11400	834.9	792.2	786.8	780.1	776.1	773.5	767.2	749.3	723.2	701.4	679.0
11800	834.9	805.1	799.5	792.7	788.7	786.1	779.6	761.4	734.9	712.7	689.9
12200	834.9	817.5	811.9	805.0	800.9	798.2	791.6	773.2	746.2	723.6	700.4
12600	834.9	829.6	823.9	816.9	812.7	810.0	803.3	784.5	757.1	734.2	710.6
13000	834.9	834.9	834.9	828.5	824.3	821.5	814.7	795.7	767.9	744.6	720.7
13400	834.9	834.9	834.9	834.9	834.9	832.9	826.0	806.7	778.5	754.8	730.6
13800	834.9	834.9	834.9	834.9	834.9	834.9	834.9	817.4	788.8	764.9	740.3
CLIMB LIMIT WT (1000 LB)	773.4	772.2	771.7	771.1	770.7	770.4	769.6	742.3	704.4	673.1	640.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
7350	664.7	601.4	597.4	592.5	589.6	587.6	571.9	557.3	537.5	520.8	504.2
7400	667.1	603.6	599.5	594.6	591.7	589.7	574.0	559.3	539.4	522.6	505.9
7800	684.9	619.7	615.5	610.4	607.4	605.4	589.3	574.1	553.7	536.5	519.3
8200	703.5	636.6	632.3	627.1	624.0	621.9	605.4	589.8	568.9	551.2	533.6
8600	721.9	653.3	648.9	643.6	640.4	638.3	621.3	605.4	583.9	565.8	547.8
9000	738.7	668.5	664.0	658.5	655.3	653.1	635.7	619.4	597.4	578.9	560.4
9400	754.2	682.3	677.8	672.2	668.9	666.6	648.8	632.2	609.7	590.7	571.8
9800	769.3	695.9	691.2	685.5	682.1	679.8	661.7	644.6	621.6	602.2	582.9
10200	784.2	709.2	704.4	698.6	695.1	692.8	674.2	656.8	633.3	613.5	593.8
10600	798.7	722.2	717.3	711.3	707.8	705.4	686.5	668.8	644.8	624.6	604.4
11000	812.9	734.9	729.9	723.8	720.2	717.8	698.5	680.4	656.0	635.4	614.8
11400	826.7	747.3	742.2	736.0	732.4	729.9	710.2	691.8	666.9	645.9	625.0
11800	834.9	759.4	754.2	747.9	744.2	741.7	721.7	702.9	677.6	656.2	635.0
12200	834.9	771.0	765.8	759.4	755.6	753.0	732.7	713.7	687.9	666.2	644.6
12600	834.9	782.4	777.1	770.6	766.7	764.1	743.5	724.1	697.9	675.9	653.9
13000	834.9	793.5	788.1	781.5	777.6	775.0	754.0	734.4	707.8	685.5	663.2
13400	834.9	804.5	799.0	792.3	788.3	785.6	764.4	744.5	717.5	694.8	672.2
13800	834.9	815.2	809.6	802.9	798.9	796.1	774.6	754.4	727.1	704.1	681.1
CLIMB LIMIT WT (1000 LB)	740.1	739.7	739.4	739.0	738.8	738.5	711.2	684.9	648.7	618.0	587.7

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 3800 lb.
With engine and wing anti-ice on, decrease field limit weight by 3000 lb and climb limit weight by 4700 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
7350	623.1	564.4	560.6	556.0	549.8	544.5	528.7	515.6	497.3	482.5	468.8
7400	625.3	566.4	562.6	558.0	551.7	546.4	530.6	517.4	499.0	484.2	470.4
7800	642.0	581.5	577.6	572.8	566.4	560.9	544.7	531.1	512.2	496.9	482.8
8200	659.5	597.3	593.4	588.5	581.9	576.3	559.6	545.7	526.3	510.6	496.1
8600	676.8	613.1	609.0	604.0	597.3	591.5	574.4	560.1	540.3	524.2	509.3
9000	692.5	627.3	623.2	618.0	611.1	605.2	587.7	573.1	552.7	536.3	521.1
9400	706.9	640.3	636.0	630.8	623.7	617.6	599.7	584.8	564.0	547.2	531.6
9800	721.0	652.9	648.5	643.2	635.9	629.8	611.5	596.2	574.9	557.7	541.8
10200	734.8	665.2	660.8	655.3	647.9	641.6	622.9	607.4	585.6	568.1	551.8
10600	748.4	677.3	672.8	667.2	659.7	653.3	634.2	618.3	596.1	578.2	561.6
11000	761.6	689.2	684.6	678.9	671.1	664.6	645.2	628.9	606.3	588.1	571.1
11400	774.5	700.7	696.0	690.2	682.4	675.7	655.9	639.4	616.3	597.8	580.5
11800	787.0	712.0	707.2	701.3	693.3	686.5	666.4	649.6	626.1	607.2	589.7
12200	799.2	722.9	718.0	712.0	703.9	697.0	676.5	659.4	635.6	616.4	598.5
12600	811.0	733.5	728.5	722.4	714.2	707.2	686.4	669.0	644.8	625.3	607.2
13000	822.5	743.9	738.9	732.7	724.3	717.2	696.1	678.5	653.9	634.1	615.7
13400	833.9	754.1	749.0	742.7	734.2	727.0	705.6	687.7	662.8	642.7	624.1
13800	834.9	764.1	759.0	752.6	744.0	736.7	715.0	696.9	671.6	651.2	632.3
CLIMB LIMIT WT (1000 LB)	700.0	699.6	699.5	699.1	690.6	682.7	655.3	632.2	598.6	571.1	546.9

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
7350	582.1	527.4	523.9	515.5	507.6	501.6	487.9	476.5	460.5	447.5	434.8
7400	584.2	529.2	525.7	517.3	509.4	503.3	489.6	478.2	462.1	449.0	436.3
7800	599.7	543.3	539.6	531.0	522.9	516.6	502.6	490.8	474.3	460.8	447.8
8200	616.1	558.2	554.4	545.6	537.2	530.8	516.4	504.3	487.4	473.6	460.2
8600	632.3	572.9	569.1	560.1	551.5	544.9	530.1	517.7	500.4	486.2	472.5
9000	647.0	586.2	582.3	573.0	564.2	557.5	542.4	529.7	511.9	497.4	483.4
9400	660.4	598.2	594.2	584.7	575.7	568.9	553.4	540.4	522.2	507.4	493.0
9800	673.4	609.9	605.8	596.1	586.9	579.9	564.1	550.8	532.2	517.1	502.4
10200	686.2	621.3	617.2	607.3	597.9	590.7	574.5	561.0	542.0	526.6	511.5
10600	698.8	632.5	628.3	618.2	608.6	601.3	584.8	570.9	551.6	535.8	520.5
11000	711.0	643.5	639.2	628.9	619.1	611.6	594.8	580.7	561.0	544.9	529.3
11400	723.0	654.2	649.8	639.3	629.3	621.8	604.6	590.2	570.2	553.8	537.9
11800	734.6	664.7	660.2	649.5	639.3	631.7	614.2	599.6	579.1	562.5	546.3
12200	745.9	674.8	670.2	659.4	649.0	641.2	623.5	608.6	587.8	570.9	554.4
12600	756.9	684.6	680.0	669.0	658.5	650.5	632.5	617.4	596.3	579.1	562.4
13000	767.6	694.3	689.6	678.4	667.8	659.7	641.4	626.1	604.6	587.2	570.2
13400	778.2	703.8	699.0	687.7	676.9	668.7	650.1	634.6	612.9	595.1	577.9
13800	788.6	713.1	708.3	696.8	685.8	677.6	658.7	643.0	621.0	603.0	585.5
CLIMB LIMIT WT (1000 LB)	656.8	656.8	656.6	647.0	633.9	623.5	600.5	581.0	552.7	529.4	507.3

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 3800 lb.
With engine and wing anti-ice on, decrease field limit weight by 3000 lb and climb limit weight by 4700 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 15

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
7350	537.0	486.4	480.5	469.3	461.5	456.5	444.1	432.7	417.7	406.0	394.4
7400	538.9	488.1	482.1	470.9	463.1	458.0	445.6	434.2	419.1	407.3	395.7
7800	553.2	501.0	494.8	483.3	475.3	470.1	457.3	445.6	430.1	418.0	406.1
8200	568.3	514.8	508.5	496.7	488.4	483.1	470.0	457.9	442.0	429.6	417.4
8600	583.4	528.5	522.0	509.9	501.4	496.0	482.6	470.2	453.9	441.2	428.6
9000	596.9	540.7	534.1	521.7	513.0	507.4	493.7	481.0	464.3	451.3	438.5
9400	609.1	551.6	544.9	532.2	523.3	517.6	503.5	490.6	473.5	460.2	447.1
9800	621.1	562.3	555.4	542.4	533.3	527.5	513.1	499.9	482.5	468.9	455.4
10200	632.7	572.7	565.7	552.4	543.1	537.2	522.5	509.0	491.2	477.3	463.6
10600	644.2	582.9	575.7	562.2	552.7	546.7	531.7	517.9	499.7	485.5	471.6
11000	655.3	592.9	585.6	571.8	562.1	556.0	540.7	526.6	508.1	493.6	479.4
11400	666.3	602.7	595.2	581.2	571.3	565.1	549.5	535.2	516.3	501.6	487.1
11800	676.9	612.2	604.6	590.4	580.3	573.9	558.1	543.5	524.3	509.3	494.6
12200	687.3	621.5	613.8	599.2	589.1	582.6	566.5	551.6	532.1	516.9	501.9
12600	697.3	630.5	622.6	607.9	597.5	590.9	574.6	559.6	539.7	524.2	509.0
13000	707.2	639.3	631.4	616.4	605.9	599.2	582.6	567.3	547.2	531.5	516.0
13400	716.8	648.0	640.0	624.8	614.1	607.3	590.5	575.0	554.6	538.7	523.0
13800	726.4	656.6	648.4	633.1	622.2	615.4	598.3	582.6	561.9	545.7	529.8
CLIMB LIMIT WT (1000 LB)	603.6	603.4	596.5	579.2	566.0	558.2	537.6	517.6	490.6	470.0	449.8

9800 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	14	18	23	26	28	33	37	42	46	50
7350	499.0	450.5	442.9	430.9	424.2	419.6	406.8	395.6	381.9	371.1	359.6
7400	500.8	452.1	444.5	432.4	425.7	421.0	408.1	397.0	383.1	372.3	360.8
7800	514.0	464.0	456.1	443.8	436.8	432.0	418.8	407.3	393.1	382.0	370.1
8200	528.1	476.8	468.7	456.0	448.9	444.0	430.4	418.7	404.1	392.6	380.5
8600	542.2	489.6	481.3	468.3	461.0	456.0	442.0	430.0	415.0	403.3	390.8
9000	554.7	500.8	492.4	479.1	471.6	466.4	452.2	439.8	424.5	412.5	399.7
9400	566.0	510.9	502.2	488.6	481.0	475.7	461.1	448.5	432.8	420.6	407.5
9800	577.0	520.6	511.8	497.9	490.1	484.7	469.8	456.9	440.9	428.3	414.9
10200	587.7	530.2	521.2	506.9	499.0	493.5	478.2	465.1	448.7	435.9	422.2
10600	598.2	539.5	530.3	515.8	507.7	502.0	486.5	473.1	456.4	443.3	429.4
11000	608.5	548.7	539.3	524.5	516.2	510.5	494.6	480.9	463.9	450.6	436.4
11400	618.6	557.6	548.1	533.0	524.5	518.7	502.6	488.6	471.3	457.7	443.2
11800	628.4	566.4	556.6	541.3	532.7	526.8	510.4	496.2	478.5	464.7	450.0
12200	637.9	574.9	565.0	549.4	540.6	534.6	517.9	503.5	485.6	471.5	456.6
12600	647.2	583.1	573.1	557.2	548.4	542.2	525.3	510.6	492.4	478.2	463.0
13000	656.3	591.3	581.1	565.0	556.0	549.8	532.6	517.7	499.2	484.7	469.3
13400	665.2	599.3	589.0	572.6	563.5	557.2	539.8	524.6	505.9	491.2	475.6
13800	674.0	607.2	596.7	580.2	570.9	564.5	546.8	531.5	512.5	497.6	481.8
CLIMB LIMIT WT (1000 LB)	561.1	555.8	544.6	525.1	514.2	506.8	484.2	464.1	439.9	421.3	401.3

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or auto.
With engine bleed for packs off, increase field limit weight by 1100 lb and climb limit weight by 3800 lb.
With engine and wing anti-ice on, decrease field limit weight by 3000 lb and climb limit weight by 4700 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 33°C & Below, Zero Wind

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or Auto

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	635.8	707.3	774.9	809.0					
50	599.3	663.3	715.1	761.0	789.9	809.9			
100	563.7	624.0	672.3	711.9	745.3	774.7	791.1	804.4	815.2
150	534.7	592.7	639.9	680.1	712.4	738.9	763.4	779.6	791.5
200	510.0	566.2	614.5	654.0	686.2	712.6	734.6	753.3	771.3
250	488.4	544.4	592.3	631.5	663.8	690.4	712.6	731.4	747.4
300	469.1	525.5	572.7	611.6	643.9	670.8	693.4	712.5	728.9
350	452.3	508.5	555.0	593.6	625.9	653.1	676.0	695.6	712.4
400	438.0	493.0	538.8	577.2	609.6	636.9	660.1	680.0	697.2
450	424.7	478.7	524.0	562.0	594.4	621.9	645.4	665.6	683.2
500	412.4	465.5	510.2	548.0	580.2	607.9	631.6	652.1	670.0
550		453.3	497.4	534.9	567.0	594.7	618.7	639.4	657.5
600		441.9	485.4	522.7	554.7	582.3	606.4	627.4	645.8
650		431.2	474.2	511.1	543.0	570.6	594.8	616.0	634.6
700		421.0	463.5	500.2	531.9	559.6	583.8	605.1	624.0
750		411.5	453.5	489.9	521.5	549.1	573.3	594.8	613.8
800			444.0	480.1	511.5	539.0	563.3	584.8	604.0
850			435.0	470.7	502.0	529.5	553.8	575.3	594.6
900			426.5	461.8	492.9	520.3	544.6	566.2	585.5
950			418.3	453.3	484.3	511.6	535.8	557.4	576.8
1000			410.5	445.3	475.9	503.2	527.4	549.0	568.4

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
33 & BELOW	0	0	0	0	0	0	0
34	-2.3	-2.9	-3.4	-3.9	-4.5	-5.0	-5.5
36	-9.0	-11.1	-13.1	-15.2	-17.2	-19.2	-21.3
38	-15.7	-19.3	-22.8	-26.4	-30.0	-33.5	-37.1
40	-22.4	-27.5	-32.6	-37.6	-42.7	-47.8	-52.8
42	-29.5	-36.2	-42.9	-49.6	-56.4	-63.1	-69.8
44	-36.5	-44.9	-53.3	-61.7	-70.0	-78.4	-86.8
46	-43.6	-53.6	-63.6	-73.7	-83.7	-93.7	-103.7
48	-50.7	-62.3	-74.0	-85.7	-97.3	-109.0	-120.7
50	-57.7	-71.1	-84.4	-97.7	-111.0	-124.3	-137.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustment

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
S.L. & BELOW	0	0	0	0	0	0	0
1000	-15.5	-18.3	-21.1	-23.9	-26.7	-29.4	-32.2
2000	-31.1	-36.6	-42.2	-47.8	-53.3	-58.9	-64.5
3000	-44.5	-52.9	-61.3	-69.6	-78.0	-86.4	-94.8
4000	-57.9	-69.1	-80.3	-91.5	-102.7	-113.9	-125.1
5000	-71.2	-85.1	-99.1	-113.0	-127.0	-140.9	-154.9
6000	-84.4	-101.1	-117.8	-134.5	-151.2	-167.9	-184.6
7000	-98.5	-118.6	-138.7	-158.9	-179.0	-199.1	-219.2
8000	-112.6	-136.1	-159.7	-183.2	-206.8	-230.3	-253.8
9000	-125.4	-152.5	-179.6	-206.7	-233.7	-260.8	-287.9
9800	-135.6	-165.6	-195.5	-225.5	-255.2	-285.2	-315.2

Wind Adjustment

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)						
	360	440	520	600	680	760	840
15 TW	-76.7	-74.7	-72.7	-70.6	-68.6	-66.5	-64.5
10 TW	-51.2	-49.8	-48.4	-47.1	-45.7	-44.4	-43.0
5 TW	-25.6	-24.9	-24.2	-23.5	-22.9	-22.2	-21.5
0	0	0	0	0	0	0	0
10 HW	10.1	9.1	8.2	7.3	6.3	5.4	4.4
20 HW	20.2	18.3	16.4	14.5	12.6	10.8	8.9
30 HW	30.7	27.8	24.9	22.0	19.1	16.2	13.3
40 HW	41.2	37.2	33.3	29.4	25.5	21.6	17.7

With engine bleed for packs off, increase weight by 2000 lb.
With engine and wing anti-ice on, decrease weight by 5000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Tire Speed Limit
Flaps 15

AIRPORT OAT		TIRE SPEED LIMIT WEIGHT (1000 LB)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	0	2000	4000	6000	8000	9000	9800
54	129	835.0	791.6	728.4	674.3	624.9		
52	126	835.0	795.9	732.9	678.0	628.4	604.8	
50	122	835.0	800.3	737.5	681.9	632.0	608.3	
48	118	835.0	804.7	742.1	685.8	635.6	611.8	
46	115	835.0	809.1	746.9	689.8	639.3	615.3	
44	111	835.0	813.6	751.5	693.8	643.0	618.8	
42	108	835.0	818.1	757.2	697.8	646.8	622.5	
40	104	835.0	822.8	763.1	701.9	650.6	626.2	
38	100	835.0	827.5	768.9	706.0	654.4	629.9	
36	97	835.0	832.4	773.4	710.2	658.4	633.6	
34	93	835.0	835.0	778.0	714.6	662.4	637.5	618.1
32	90	835.0	835.0	782.1	718.5	666.1	641.3	621.7
30	86	835.0	835.0	786.2	722.4	669.7	644.5	624.9
28	82	835.0	835.0	790.4	726.8	673.3	648.0	628.2
26	79	835.0	835.0	794.8	731.1	677.0	651.4	631.5
24	75	835.0	835.0	799.3	735.6	680.8	655.1	635.0
22	72	835.0	835.0	804.0	740.3	684.6	658.8	638.5
20	68	835.0	835.0	808.9	745.2	688.5	662.5	642.1
18	64	835.0	835.0	813.8	750.1	692.6	666.3	645.8
16	61	835.0	835.0	818.8	756.0	696.7	670.3	649.5
14	57	835.0	835.0	823.9	762.4	701.0	674.4	653.5
12	54	835.0	835.0	829.0	768.8	705.4	678.5	657.5
10	50	835.0	835.0	834.1	773.6	709.9	682.8	661.6
-40	-40	835.0	835.0	835.0	835.0	835.0	820.0	794.9

Increase tire speed limit weight by 5100 lb per knot headwind.
Decrease tire speed limit weight by 11700 lb per knot tailwind.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Dry Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
800	169	176	181
760	165	171	176
720	160	167	173
680	155	161	169
640	149	155	164
600	143	149	159
560	136	143	155
520	129	137	150
480	121	130	144
440	113	123	139
400	103	115	133
360	93	108	127
320	84	99	121

Check V1(MCG), Minimum VR, and Minimum V2.

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	12	14						6	7						-3	-3					
60	140	8	10	12	15				4	5	6	7				-2	-2	-3	-3			
50	122	4	5	8	10	13	17	21	2	3	4	6	7	8	10	-1	-1	-2	-2	-3	-4	-4
40	104	1	2	4	7	10	14	18	0	1	3	4	5	7	9	0	-1	-1	-2	-2	-3	-4
30	86	0	0	1	4	7	11	15	0	0	1	3	4	6	7	0	0	0	-1	-1	-2	-3
20	68	0	0	1	3	5	9	12	0	0	1	2	3	5	6	0	0	0	-1	-1	-2	-2
-60	-76	0	0	1	3	5	7	10	0	0	1	2	3	4	6	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
800	-5	-2	0	3	5	-3	-2	-1	0	1	2	3	3
760	-4	-2	0	3	5	-3	-2	-1	0	1	2	3	3
720	-4	-1	0	3	5	-3	-2	0	0	1	2	3	3
680	-3	-1	0	3	4	-2	-1	0	0	1	2	2	3
640	-3	-1	0	2	4	-2	-1	0	0	1	2	2	3
600	-3	-1	0	2	4	-2	-1	0	0	1	2	2	3
560	-2	-1	0	2	4	-1	-1	0	0	1	2	2	3
520	-2	0	0	2	4	-1	-1	0	0	1	2	2	3
480	-2	0	0	2	4	-1	0	0	0	1	2	2	3
440	-2	0	0	2	4	-1	0	0	0	1	2	3	3
400	-1	0	0	3	4	-1	0	1	0	1	2	3	3
360	-1	0	0	3	4	-1	0	1	0	1	2	3	3
320	-1	0	0	3	4	-1	0	1	0	1	3	3	4

***V1 not to exceed VR**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Dry Runway

Flaps 15

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	125	127	121	124	119	122	117	120						
50	122	129	131	125	128	119	122	117	120	115	118	111	114	106	110
40	104	136	138	133	135	127	130	122	125	117	120	111	114	106	110
30	86	138	140	138	140	133	136	128	130	122	125	115	118	109	112
20	68	139	140	138	140	134	137	131	133	126	129	119	123	113	116
-60	-76	140	140	139	140	136	137	132	133	127	129	121	124	116	119

Minimum V2

Max Takeoff Thrust

PRESSURE ALTITUDE (FT)	-2000	0	2000	4000	6000	8000	10000
SPEED (KIAS)	135	133	131	128	126	123	120

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Wet Runway

Flaps 15

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	KIAS		
	V1	VR	V2
800	162	176	181
760	156	171	176
720	150	167	173
680	144	161	169
640	138	155	164
600	131	149	159
560	124	143	155
520	117	137	150
480	109	130	144
440	101	123	139
400	92	115	133
360	83	108	127
320	74	99	121

Check V1(MCG), Minimum VR, and Minimum V2.

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	14	16						6	7						-3	-3					
60	140	9	11	14	16				4	5	6	7				-2	-2	-3	-3			
50	122	5	6	9	11	14	17	21	2	3	4	6	7	8	10	-1	-1	-2	-2	-3	-4	-4
40	104	1	2	5	8	10	14	18	0	1	3	4	5	7	9	0	-1	-1	-2	-2	-3	-4
30	86	0	0	2	5	7	11	15	0	0	1	3	4	6	7	0	0	0	-1	-1	-2	-3
20	68	0	0	1	3	5	9	13	0	0	1	2	3	5	6	0	0	0	-1	-1	-2	-2
-60	-76	0	0	1	3	5	8	11	0	0	1	2	3	4	6	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustment*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
800	-6	-3	0	3	6	-4	-3	-1	0	1	2	3	4
760	-6	-3	0	3	6	-4	-3	-1	0	1	2	3	4
720	-6	-3	0	3	6	-5	-3	-1	0	1	2	3	4
680	-6	-3	0	3	5	-5	-3	-2	0	1	2	3	4
640	-5	-3	0	3	5	-5	-3	-2	0	1	2	3	4
600	-5	-2	0	3	5	-5	-3	-1	0	1	2	3	4
560	-5	-2	0	3	5	-5	-3	-1	0	1	2	3	4
520	-4	-2	0	3	5	-5	-3	-1	0	1	3	4	5
480	-4	-1	0	3	5	-4	-3	-1	0	1	3	4	5
440	-3	-1	0	3	5	-4	-2	-1	0	1	3	4	5
400	-3	-1	0	3	5	-3	-2	0	0	2	3	4	5
360	-2	0	0	4	5	-3	-1	0	0	2	4	5	6
320	-1	0	0	4	6	-2	-1	0	0	2	4	5	6

***V1 not to exceed VR**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Speeds - Wet Runway

Flaps 15

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	125	127	121	124	119	122	117	120						
50	122	129	131	125	128	119	122	117	120	115	118	111	114	106	110
40	104	136	138	133	135	127	130	122	125	117	120	111	114	106	110
30	86	138	140	138	140	133	136	128	130	122	125	115	118	109	112
20	68	139	140	138	140	134	137	131	133	126	129	119	123	113	116
-60	-76	140	140	139	140	136	137	132	133	127	129	121	124	116	119

Minimum V2

Max Takeoff Thrust

PRESSURE ALTITUDE (FT)	-2000	0	2000	4000	6000	8000	10000
SPEED (KIAS)	135	133	131	128	126	123	120

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	27700	5	30800	29100	27600
760	28200	3	31400	29700	28100
740	28800	2	31900	30200	28700
720	29400	1	32300	30700	29100
700	30100	-1	32800	31200	29600
680	30700	-2	33300	31600	30100
660	31300	-4	33800	32200	30600
640	32000	-5	34300	32700	31200
620	32700	-7	34800	33200	31700
600	33400	-8	35400	33800	32300
580	34100	-10	35900	34300	32900
560	34800	-12	36500	34900	33500
540	35600	-13	37100	35600	34100
520	36400	-15	37800	36200	34800
500	37200	-15	38500	36900	35500
480	38100	-15	39100	37600	36200
460	38900	-15	39900	38300	36900
440	39900	-15	40600	39100	37700
420	40800	-15	41400	39900	38500
400	41900	-15	42300	40800	39400
380	42900	-15	43100	41800	40500
360	43100	-15	43100	42900	41600

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	27700	10	30800	29100	27600
760	28200	9	31400	29700	28100
740	28800	8	31900	30200	28700
720	29400	6	32300	30700	29100
700	30100	5	32800	31200	29600
680	30700	3	33300	31600	30100
660	31300	2	33800	32200	30600
640	32000	0	34300	32700	31200
620	32700	-1	34800	33200	31700
600	33400	-3	35400	33800	32300
580	34100	-4	35900	34300	32900
560	34800	-6	36500	34900	33500
540	35600	-8	37100	35600	34100
520	36400	-9	37800	36200	34800
500	37200	-9	38500	36900	35500
480	38100	-9	39100	37600	36200
460	38900	-9	39900	38300	36900
440	39900	-9	40600	39100	37700
420	40800	-9	41400	39900	38500
400	41900	-9	42300	40800	39400
380	42900	-9	43100	41800	40500
360	43100	-9	43100	42900	41600

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	27700	16	30800	29100	27600
760	28200	15	31400	29700	28100
740	28800	13	31900	30200	28700
720	29400	12	32300	30700	29100
700	30100	11	32800	31200	29600
680	30700	9	33300	31600	30100
660	31300	8	33800	32200	30600
640	32000	6	34300	32700	31200
620	32700	5	34800	33200	31700
600	33400	3	35400	33800	32300
580	34100	1	35900	34300	32900
560	34800	0	36500	34900	33500
540	35600	-2	37100	35600	34100
520	36400	-3	37800	36200	34800
500	37200	-3	38500	36900	35500
480	38100	-3	39100	37600	36200
460	38900	-3	39900	38300	36900
440	39900	-3	40600	39100	37700
420	40800	-3	41400	39900	38500
400	41900	-3	42300	40800	39400
380	42900	-3	43100	41800	40500
360	43100	-3	43100	42900	41600

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
670	628	590	556	527	500	478	458	439	422	406
1330	1249	1176	1111	1053	1000	957	918	881	847	816
1989	1869	1760	1664	1578	1500	1437	1378	1324	1273	1228
2645	2487	2343	2217	2104	2000	1916	1839	1767	1700	1640
3299	3104	2926	2769	2629	2500	2396	2300	2211	2128	2053
3951	3719	3508	3321	3153	3000	2877	2761	2655	2556	2466
4601	4332	4088	3872	3678	3500	3357	3223	3099	2985	2880
5247	4944	4667	4422	4202	4000	3837	3685	3544	3413	3294
5890	5553	5245	4972	4726	4500	4317	4147	3988	3842	3708
6531	6160	5821	5520	5249	5000	4798	4608	4433	4271	4122
7169	6765	6396	6067	5772	5500	5278	5070	4878	4700	4537
7804	7368	6969	6614	6294	6000	5758	5532	5322	5128	4951
8436	7968	7541	7160	6816	6500	6238	5994	5767	5557	5366
9067	8568	8112	7705	7338	7000	6718	6455	6211	5986	5780
9696	9167	8682	8250	7860	7500	7199	6917	6656	6415	6194
10324	9764	9252	8795	8381	8000	7679	7379	7100	6843	6607
10950	10361	9822	9339	8902	8500	8159	7840	7544	7271	7021
11576	10958	10391	9884	9424	9000	8639	8302	7988	7699	7434
12202	11554	10960	10427	9945	9500	9119	8763	8432	8127	7847
12827	12149	11528	10971	10466	10000	9599	9224	8876	8555	8260

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 27		29		31		33		35	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
500	18.0	1:21	17.7	1:20	17.5	1:19	17.3	1:17	17.1	1:15
1000	33.1	2:34	32.3	2:31	31.7	2:29	31.1	2:24	30.5	2:20
1500	48.7	3:45	47.4	3:42	46.3	3:37	45.4	3:31	44.3	3:25
2000	64.3	4:57	62.4	4:53	61.0	4:46	59.6	4:37	58.1	4:29
2500	80.5	6:08	78.1	6:01	76.2	5:52	74.4	5:41	72.5	5:32
3000	96.6	7:18	93.8	7:10	91.4	6:58	89.2	6:45	86.9	6:35
3500	113.5	8:27	110.1	8:16	107.3	8:03	104.6	7:48	101.8	7:38
4000	130.3	9:35	126.5	9:23	123.1	9:07	119.9	8:51	116.7	8:40
4500	147.8	10:42	143.4	10:27	139.6	10:10	135.9	9:53	132.4	9:42
5000	165.3	11:48	160.4	11:32	156.0	11:13	151.9	10:56	148.0	10:44
5500	183.6	12:53	178.1	12:35	173.1	12:15	168.6	11:57	164.4	11:46
6000	201.9	13:57	195.8	13:37	190.2	13:17	185.2	12:59	180.8	12:48
6500	220.9	15:00	214.1	14:39	208.0	14:18	202.7	14:01	198.2	13:51
7000	239.9	16:03	232.5	15:41	225.9	15:20	220.2	15:02	215.6	14:53
7500	259.7	17:04	251.6	16:42	244.5	16:21	238.6	16:04	234.3	15:55
8000	279.4	18:06	270.7	17:43	263.2	17:22	257.0	17:05	253.1	16:58
8500	300.1	19:07	290.7	18:44	282.8	18:23	276.7	18:07	273.5	18:01
9000	320.7	20:07	310.7	19:44	302.4	19:24	296.3	19:09	293.9	19:04
9500	342.4	21:08	331.9	20:45	323.3	20:25	317.8	20:11	316.5	20:07
10000	364.1	22:08	353.0	21:46	344.1	21:26	339.3	21:13	339.1	21:10

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	300	350	400	450	500
20	-2.2	-1.2	0.0	1.7	3.0
40	-4.6	-2.5	0.0	2.8	5.8
60	-7.0	-3.7	0.0	4.1	9.0
80	-9.5	-5.0	0.0	5.6	12.7
100	-12.0	-6.3	0.0	7.4	17.0
120	-14.5	-7.6	0.0	9.5	21.6
140	-17.1	-8.9	0.0	11.7	26.8
160	-19.7	-10.2	0.0	14.2	32.5
180	-22.3	-11.6	0.0	17.0	38.6
200	-24.9	-12.9	0.0	19.9	45.2
220	-27.6	-14.3	0.0	23.1	52.3
240	-30.3	-15.7	0.0	26.5	59.9
260	-33.1	-17.1	0.0	30.2	68.0
280	-35.8	-18.5	0.0	34.1	76.6
300	-38.6	-20.0	0.0	38.2	85.6
320	-41.5	-21.4	0.0	42.6	95.1
340	-44.3	-22.9	0.0	47.1	105.2
360	-47.2	-24.4	0.0	52.0	115.7
380	-50.1	-25.9	0.0	57.0	126.6

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Step Climb Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1292	1221	1157	1099	1047	1000	957	917	881	847	816
1923	1820	1728	1645	1569	1500	1437	1379	1325	1276	1229
2554	2420	2299	2190	2091	2000	1917	1840	1770	1704	1643
3185	3020	2871	2735	2612	2500	2397	2302	2214	2133	2057
3816	3619	3442	3281	3134	3000	2877	2764	2659	2562	2472
4446	4218	4012	3826	3656	3500	3357	3225	3104	2991	2886
5077	4817	4583	4371	4177	4000	3837	3687	3548	3420	3300
5707	5416	5154	4916	4699	4500	4317	4149	3993	3849	3715
6336	6015	5724	5461	5220	5000	4798	4611	4438	4278	4129
6966	6613	6295	6006	5742	5500	5278	5073	4883	4707	4544
7595	7212	6865	6550	6263	6000	5758	5535	5329	5137	4959
8224	7810	7435	7095	6784	6500	6238	5997	5774	5566	5373
8853	8408	8005	7640	7306	7000	6719	6459	6219	5996	5788
9481	9006	8575	8184	7827	7500	7199	6921	6664	6426	6204
10110	9603	9145	8729	8348	8000	7679	7384	7110	6855	6619
10738	10201	9715	9273	8870	8500	8160	7846	7555	7285	7034
11366	10798	10284	9817	9391	9000	8640	8308	8001	7715	7449
11993	11395	10854	10362	9912	9500	9121	8771	8446	8145	7865
12621	11992	11423	10906	10433	10000	9601	9233	8892	8575	8280

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB) LANDING WEIGHT (1000 LB)									TIME (HRS:MIN)
	340	360	380	400	420	440	460	480	500	
1000	26.4	27.3	28.3	29.4	30.6	31.8	32.7	33.8	34.9	2:15
1500	37.9	39.3	40.8	42.5	44.3	46.0	47.5	49.1	50.8	3:18
2000	49.6	51.5	53.6	55.9	58.3	60.6	62.5	64.8	67.2	4:20
2500	61.6	64.0	66.7	69.7	72.7	75.5	78.1	81.0	84.1	5:23
3000	73.9	76.9	80.3	83.9	87.4	90.8	94.0	97.7	101.3	6:25
3500	86.5	90.2	94.2	98.4	102.5	106.6	110.6	114.8	119.0	7:27
4000	99.4	103.8	108.5	113.2	118.0	122.8	127.5	132.3	137.1	8:29
4500	112.7	117.8	123.1	128.5	133.9	139.6	144.8	150.2	155.7	9:31
5000	126.5	132.2	138.1	144.1	150.5	156.7	162.5	168.6	174.9	10:33
5500	140.6	146.9	153.5	160.3	167.4	174.3	180.8	187.6	194.6	11:35
6000	155.0	162.0	169.3	177.0	184.7	192.3	199.5	207.1	215.0	12:37
6500	169.7	177.5	185.7	194.1	202.4	210.8	218.7	227.3	236.0	13:38
7000	184.9	193.4	202.5	211.6	220.7	229.8	238.7	248.0	257.6	14:40
7500	200.5	209.9	219.7	229.5	239.4	249.4	259.2	269.4	279.8	15:41
8000	216.5	226.8	237.3	247.9	258.6	269.6	280.3	291.4	302.6	16:43
8500	233.1	244.1	255.4	266.9	278.6	290.4	302.0	314.0	326.0	17:44
9000	250.1	261.9	274.0	286.3	299.0	311.8	324.3	337.0	350.1	18:45
9500	267.5	280.1	293.1	306.5	320.1	333.9	347.2	360.9	374.8	19:46
10000	285.3	298.8	312.8	327.2	341.8	356.6	370.7	385.4	400.1	20:47

Based on 310/.84 climb, Long Range Cruise and .84/310/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
95	81	70	62	55	50	46	42	39	36	34
161	143	129	118	108	100	93	87	82	77	73
225	205	187	173	161	150	141	132	125	118	113
288	264	245	228	213	200	189	178	169	161	153
349	323	301	282	265	250	237	225	214	204	195
410	382	357	336	317	300	285	271	258	247	237
471	440	414	390	369	350	333	317	303	290	279
532	499	470	444	421	400	381	364	348	334	320
595	559	527	499	473	450	429	410	393	376	362
660	621	585	554	526	500	477	456	436	419	402

Trip Fuel and Time

AIR DIST (NM)		LANDING WEIGHT (1000 LB)					TIME (HRS:MIN)
		340	380	420	460	500	
50	FUEL (1000 LB)	3.5	3.7	4.0	4.2	4.4	0:14
	ALT (FT)	11000	11000	9000	7000	7000	
100	FUEL (1000 LB)	5.3	5.6	5.8	6.1	6.4	0:23
	ALT (FT)	15000	13000	13000	13000	13000	
150	FUEL (1000 LB)	6.9	7.3	7.6	8.0	8.4	0:30
	ALT (FT)	21000	21000	21000	21000	21000	
200	FUEL (1000 LB)	8.3	8.8	9.2	9.7	10.1	0:36
	ALT (FT)	29000	27000	27000	27000	25000	
250	FUEL (1000 LB)	9.6	10.2	10.7	11.3	11.8	0:42
	ALT (FT)	37000	37000	29000	29000	27000	
300	FUEL (1000 LB)	10.7	11.4	12.1	12.7	13.4	0:48
	ALT (FT)	43000	39000	37000	37000	35000	
350	FUEL (1000 LB)	11.8	12.6	13.4	14.1	14.9	0:54
	ALT (FT)	43000	41000	39000	37000	35000	
400	FUEL (1000 LB)	12.9	13.8	14.7	15.6	16.5	0:59
	ALT (FT)	43000	41000	39000	37000	35000	
450	FUEL (1000 LB)	13.9	15.0	16.0	17.0	18.0	1:06
	ALT (FT)	43000	41000	39000	37000	35000	
500	FUEL (1000 LB)	15.0	16.2	17.3	18.4	19.5	1:13
	ALT (FT)	43000	43000	39000	37000	37000	

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)									
	PRESSURE ALTITUDE (FT)									
	1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
780	20190	20010	19790	19850	20940	21670	22820			
740	19180	19000	18760	18750	19740	20320	21180	24940		
700	18040	17850	17600	17550	18410	18840	19530	21580		
660	16990	16780	16530	16450	16700	17540	18160	19450		
620	16050	15820	15550	15430	15490	16350	16890	17870		
580	15120	14860	14570	14430	14450	15190	15630	16240	19370	
540	14240	13950	13610	13450	13440	13740	14390	14870	16600	
500	13410	13080	12690	12520	12450	12480	13170	13610	14800	16760
460	12640	12290	11870	11680	11540	11500	12000	12360	13180	14120
420	11980	11620	11170	10970	10780	10710	10700	11160	11770	12450
380	11370	11000	10560	10330	10120	10210	9970	10020	10490	10860
340	11120	10740	10310	9990	9750	9590	9550	9280	9560	9760

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)				
	PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
780	22260	22170	22070	22240	22740
740	21050	20930	20810	20900	21360
700	19870	19740	19590	19630	20020
660	18720	18580	18410	18430	18730
620	17580	17420	17210	17210	17410
580	16480	16290	16050	16050	16160
540	15400	15170	14910	14860	14930
500	14360	14070	13790	13690	13720
460	13390	13050	12710	12550	12520
420	12520	12150	11740	11560	11460
380	11770	11390	10940	10740	10580
340	11410	11010	10540	10290	10080

These tables include 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Oxygen Requirements

Required Pressure (PSI) for Three 115 Cubic Ft. Cylinders

Table 1 - Minimum Dispatch Pressure Using Normal Oxygen Flow

NUMBER OF CREW USING OXYGEN	TOTAL TIME ON DILUTED OXYGEN (MINUTES)				
	120	180	207	240	300
2	390	520	570	650	770
3	530	720	810	920	1110
4	680	930	1050	1190	1440

For more extensive than normal crew usage, add 0.5 psi/person/minute.

Table 2 - Minimum Dispatch Pressure Using 100% Oxygen Flow

NUMBER OF CREW USING OXYGEN	TOTAL TIME ON 100% OXYGEN (MINUTES)				
	120	180	207	240	300
2	440	590	650	740	880
3	610	830	930	1050	1280
4	770	1070	1210	1370	1670

For more extensive than normal crew usage, add 2.7 psi/person/minute.

Table 3 - Temperature Corrections

CYLINDER PRESSURE AT 21°C (PSI)	PRESSURE CORRECTION FOR EACH 5°C ABOVE/BELOW 21°C (PSI)
400	+7/-7
600	+11/-11
800	+14/-14
1000	+17/-17
1200	+21/-21
1400	+24/-24
1600	+28/-28
1800	+31/-31
2000	+34/-34

Maximum cylinder pressure = 1850 PSI at 21°C. For maximum cylinder pressure at hotter or colder temperatures, add or subtract 32 PSI per 5°C, respectively.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
32	366.0	362.7	355.0
30	405.0	400.1	387.1
28	436.3	426.1	409.6
26	469.8	456.8	436.2
24	505.9	489.7	471.6
22	544.1	526.3	507.3
20	598.3	582.7	560.0
18	647.7	627.3	602.7
16	701.5	676.6	650.3
14	748.9	719.6	691.2
12	796.6	765.9	736.8

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)								
	PRESSURE ALTITUDE (1000 FT)								
	14	16	18	20	22	24	26	28	30
ENGINE ONLY	-1.6	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINE AND WING	-6.0	-4.3	-3.6	-2.6	-2.9	-3.1	-3.3	-3.4	-3.2

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Dry Runway
Flaps 30
Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
5000				5000	5200	5450	5680	5920
5400			4930	5400	5630	5910	6170	6440
5800	4640	4900	5290	5800	6060	6360	6650	6970
6200	4930	5220	5650	6200	6480	6820	7140	7490
6600	5210	5550	6010	6600	6910	7280	7630	8010
7000	5490	5870	6370	7000	7330	7730	8120	8540
7400	5780	6190	6730	7400	7760	8190	8600	9060
7800	6060	6520	7090	7800	8180	8650	9090	9580
8200	6350	6840	7450	8200	8610	9100	9580	10110
8600	6630	7160	7810	8600	9030	9560	10060	10630
9000	6910	7490	8170	9000	9460	10020	10550	11160
9400	7200	7810	8530	9400	9880	10470	11040	11680
9800	7480	8130	8890	9800	10310	10930	11530	12200
10200	7760	8460	9250	10200	10740	11390	12010	12730
10600	8050	8780	9610	10600	11160	11840	12500	13250
11000	8330	9100	9970	11000	11590	12300	12990	13770
11400	8610	9430	10330	11400	12010	12760	13480	14300
11800	8900	9750	10690	11800	12440	13210	13960	14820
12200	9180	10070	11050	12200	12860	13670	14450	15340
12600	9470	10400	11410	12600	13290	14130	14940	15870

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Dry Runway

Flaps 30

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)						
	0	2000	4000	6000	8000	9000	9800
5000	469.0	439.8	413.1	359.1	362.3		
5400	520.7	488.7	458.0	429.5	402.2	389.1	378.8
5800	573.0	537.9	504.4	472.4	442.3	428.0	416.8
6200	604.7	582.0	551.3	516.6	483.4	467.4	455.1
6600	648.9	616.4	588.0	560.9	525.3	507.7	494.0
7000	670.7	653.1	624.6	592.0	566.9	548.3	533.1
7400	690.1	672.5	654.8	629.4	594.1	582.7	571.7
7800	706.6	687.6	669.8	652.0	629.4	610.7	596.9
8200	723.9	702.4	683.9	665.9	647.3	635.6	626.3
8600	740.8	718.5	697.3	679.0	660.8	651.8	642.9
9000	756.1	734.0	711.7	691.5	673.1	663.9	656.6
9400	770.6	749.0	726.1	703.8	684.7	675.4	668.1
9800	786.9	761.6	740.0	717.1	695.7	686.4	679.0
10200	802.4	775.9	753.1	730.0	707.3	696.8	689.3
10600	817.5	790.1	764.1	742.5	719.2	708.0	699.2
11000	832.0	803.7	777.4	754.1	730.8	719.2	710.1
11400	846.5	816.8	789.9	764.0	742.0	730.2	720.8
11800		829.6	801.8	776.0	752.7	740.9	731.3
12200		842.2	813.3	786.9	761.6	751.1	741.5
12600		854.9	824.5	797.3	771.9	759.8	751.3
13000			835.4	807.5	781.8	768.9	759.5
13400			846.4	817.3	791.0	778.6	768.0
13800				826.8	800.0	787.4	777.6
14200				836.2	808.6	795.8	785.9
14600				845.5	817.1	804.0	793.9
15000				854.8	825.3	812.0	801.7

With manual speedbrakes, decrease weight by 47300 lb.
With 1 brake deactivated, decrease weight by 45400 lb.
With 2 brakes deactivated, decrease weight by 92300 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Field Limit Weight - Wet Runway

Flaps 30

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
5000						5410	5620	5830
5400				5400	5610	5870	6100	6350
5800			5300	5800	6040	6330	6590	6870
6200			5660	6200	6460	6780	7080	7400
6600	5290	5580	6020	6600	6890	7240	7570	7920
7000	5570	5900	6380	7000	7320	7700	8050	8440
7400	5860	6230	6740	7400	7740	8150	8540	8970
7800	6140	6550	7100	7800	8170	8610	9030	9490
8200	6430	6870	7460	8200	8590	9070	9520	10010
8600	6710	7200	7820	8600	9020	9520	10000	10540
9000	6990	7520	8180	9000	9440	9980	10490	11060
9400	7280	7840	8540	9400	9870	10440	10980	11590
9800	7560	8170	8900	9800	10290	10890	11460	12110
10200	7840	8490	9260	10200	10720	11350	11950	12630
10600	8130	8810	9620	10600	11140	11810	12440	13160
11000	8410	9140	9980	11000	11570	12260	12930	13680
11400	8690	9460	10340	11400	12000	12720	13410	14200
11800	8980	9780	10700	11800	12420	13180	13900	14730
12200	9260	10110	11060	12200	12850	13630	14390	15250
12600	9550	10430	11420	12600	13270	14090	14880	15770

Field Limit Weight (1000 LB)

WIND CORRECTED FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)						
	0	2000	4000	6000	8000	9000	9800
6200	519.6	487.6	457.1	428.5	401.3	388.2	378.0
6600	565.0	530.4	497.4	465.8	436.2	422.1	411.0
7000	594.6	573.6	538.0	504.1	471.7	456.2	444.3
7400	634.8	598.0	577.2	542.7	508.0	491.1	477.9
7800	659.1	638.7	599.7	578.4	544.6	526.2	511.8
8200	677.5	659.8	639.5	599.9	578.1	561.2	545.9
8600	693.2	675.5	657.8	637.1	598.7	587.4	577.7
9000	707.8	688.6	670.7	652.9	630.6	613.3	598.4
9400	722.8	701.3	683.1	665.0	646.1	634.5	625.3
9800	737.6	715.3	694.7	676.5	658.4	649.2	639.8
10200	751.7	729.0	707.0	687.5	669.1	660.0	652.8
10600	763.4	742.2	719.5	698.0	679.5	670.3	663.0
11000	777.4	754.5	731.9	709.5	689.3	680.0	672.6
11400	791.3	765.0	743.8	720.8	698.7	689.4	681.9
11800	804.8	778.1	754.8	732.0	709.2	698.4	690.8
12200	817.8	790.4	764.3	742.8	719.5	708.2	699.4
12600	830.4	802.2	776.1	753.1	729.5	718.0	709.0
13000	843.0	813.7	786.9	761.7	739.4	727.6	718.3
13400		824.9	797.4	771.6	748.9	736.9	727.5
13800		835.9	807.6	781.5	757.2	746.0	736.5
14200		846.9	817.5	790.8	764.9	754.4	745.1
14600			827.2	799.8	774.5	761.7	753.4
15000			836.6	808.6	782.8	770.0	760.4

With manual speedbrakes, decrease weight by 47300 lb.
With 1 brake deactivated, decrease weight by 45400 lb.
With 2 brakes deactivated, decrease weight by 92300 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)							
		AIRPORT PRESSURE ALTITUDE (FT)							
°C	°F	-2000	0	2000	4000	6000	8000	9000	9800
54	129	655.4	615.4						
52	126	675.3	632.9						
50	122	694.9	649.3	594.5					
48	118	713.2	669.0	610.4					
46	115	731.7	688.8	626.4	572.4				
44	111	750.5	707.9	642.6	590.2				
42	108	771.1	725.4	659.4	606.3	554.7			
40	104	786.4	743.6	677.3	620.4	566.6			
38	100	802.1	764.9	696.8	634.6	579.4	515.4		
36	97	808.2	780.4	712.5	646.8	593.7	525.7	495.1	
34	93	808.8	795.8	728.6	661.1	605.2	535.8	504.8	482.4
32	90	809.3	801.0	744.2	675.3	614.6	544.8	514.4	492.1
30	86	809.9	801.3	760.2	690.5	623.8	553.2	523.3	501.8
28	82	810.5	801.6	772.3	703.0	633.7	561.4	531.3	510.0
26	79	811.1	801.9	772.6	711.6	644.3	569.4	539.0	517.5
24	75	811.6	802.2	772.7	718.8	654.6	579.4	546.4	524.8
22	72	812.2	802.5	772.8	721.9	662.2	591.6	554.7	532.0
20	68	812.7	802.8	773.0	722.1	666.9	601.4	563.2	540.4
18	64	813.3	803.1	773.2	722.2	671.7	606.8	570.8	548.3
16	61	813.9	803.4	773.3	722.4	671.9	610.6	576.4	555.4
14	57	814.4	803.6	773.5	722.6	672.1	614.1	581.2	559.7
12	54	814.8	803.9	773.7	722.7	672.2	614.3	585.1	562.9
10	50	815.2	804.2	773.8	722.9	672.2	614.4	585.2	565.1
8	46	815.6	804.4	774.1	723.1	672.3	614.5	585.4	565.2
6	43	815.9	804.6	771.1	723.2	672.4	601.5	555.2	527.7
4	40	816.1	804.8	752.9	691.8	632.3	562.1	527.6	503.2
2	36	816.3	804.9	753.0	691.9	632.4	562.1	527.6	503.2
0	32	816.5	805.0	753.1	691.9	632.4	562.2	527.7	503.2
-40	-40	817.9	805.6	753.1	691.9	632.4	562.2	527.7	503.3

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.
With engine bleed for packs off, increase weight by 2600 lb.
With engine anti-ice on, decrease weight by 300 lb.
With engine and wing anti-ice on, decrease weight by 5100 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 54300 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 20, Gear Up

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off.

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	8.84	7.68	6.26	5.04	3.86	2.30	
50	9.77	8.67	7.03	5.70	4.49	2.87	1.39
46	10.72	9.62	7.90	6.39	5.13	3.45	1.92
42	11.62	10.56	8.77	7.16	5.81	4.05	2.44
38	12.46	11.46	9.62	7.92	6.47	4.67	2.99
34	12.63	12.26	10.40	8.64	7.03	5.25	3.56
30	12.66	12.41	11.06	9.29	7.58	5.73	4.11
26	12.68	12.43	11.37	9.84	8.17	6.20	4.54
22	12.70	12.44	11.38	10.10	8.58	6.71	4.96
18	12.73	12.45	11.39	10.11	8.83	7.06	5.40
14	12.75	12.46	11.39	10.11	8.84	7.28	5.72
10	12.77	12.48	11.40	10.12	8.84	7.28	5.89

Weight Adjustment

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)											
	1	2	3	4	5	6	7	8	9	10	11	12
700	-3.68	-4.17	-4.63	-5.12	-5.55	-5.92	-6.39	-6.81	-7.25	-7.70	-8.19	-8.64
650	-3.35	-3.78	-4.18	-4.62	-5.00	-5.32	-5.74	-6.11	-6.49	-6.90	-7.34	-7.74
600	-2.90	-3.28	-3.61	-3.99	-4.31	-4.57	-4.93	-5.24	-5.57	-5.92	-6.31	-6.66
550	-2.32	-2.63	-2.88	-3.19	-3.45	-3.63	-3.94	-4.17	-4.42	-4.71	-5.04	-5.33
500	-1.56	-1.76	-1.92	-2.16	-2.33	-2.43	-2.64	-2.79	-2.96	-3.17	-3.43	-3.63
450	-0.58	-0.65	-0.71	-0.81	-0.87	-0.90	-0.98	-1.04	-1.10	-1.19	-1.29	-1.36
425	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
400	0.68	0.78	0.90	0.98	1.04	1.10	1.18	1.28	1.39	1.47	1.50	1.55
350	2.39	2.77	3.04	3.24	3.44	3.67	3.95	4.27	4.52	4.71	4.79	4.95

Speed Adjustment

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	-2	0	2	4	6	8	10	12	14	16	18
VREF	-0.23	-0.24	-0.25	-0.27	-0.28	-0.27	-0.23	-0.16	-0.07	0.03	0.10
VREF+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF+10	0.17	0.18	0.19	0.20	0.21	0.19	0.15	0.07	-0.03	-0.11	-0.14
VREF+20	0.38	0.40	0.42	0.43	0.44	0.37	0.23	-0.01	-0.24	-0.42	-0.56
VREF+30	0.43	0.44	0.44	0.43	0.40	0.28	0.05	-0.28	-0.61	-0.90	-1.12

With engine bleed for packs off, increase gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.1%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 1.2%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Quick Turnaround Limit Weight

Flaps 30 Limit Weight (1000 LB)

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	0	2000	4000	6000	8000	9000	9800
54	129	519.3						
50	122	522.6	503.1					
45	113	526.9	507.2	488.2				
40	104	531.2	511.4	492.2	473.6			
35	95	535.6	515.7	496.3	477.6	458.9	449.8	442.8
30	86	540.1	520.1	500.5	481.6	462.8	453.7	446.5
25	77	544.8	524.6	504.8	485.7	466.9	457.6	450.4
20	68	549.6	529.3	509.2	489.9	471.0	461.6	454.3
15	59	554.5	534.0	513.8	494.2	475.3	465.8	458.3
10	50	559.6	538.8	518.5	498.7	479.7	470.1	462.5
5	41	564.8	543.7	523.3	503.3	484.0	474.5	466.8
0	32	570.2	548.8	528.3	508.0	488.5	479.0	471.2
-5	23	575.5	554.1	533.4	512.9	493.1	483.5	475.8
-10	14	579.6	559.6	538.5	518.0	497.9	488.1	480.4
-15	5	583.9	565.2	543.8	523.2	502.8	492.9	485.1
-20	-4	588.2	571.0	549.4	528.5	508.0	497.8	489.9
-30	-22	597.1	580.9	561.0	539.6	518.7	508.3	500.0
-40	-40	608.6	590.1	573.3	551.3	530.1	519.4	510.6
-50	-58	622.1	599.7	583.3	563.9	542.0	530.8	521.2
-54	-65	627.8	605.1	587.3	569.1	546.7	535.3	526.4

Increase weight by 4600 lb per 1% uphill slope. Decrease weight by 7600 lb per 1% downhill slope. Increase weight by 12800 lb per 10 knots headwind. Decrease weight by 64900 lb per 10 knots tailwind. Decrease weight by 27800 lb when one brake is deactivated. Decrease weight by 55000 lb when two brakes are deactivated.

After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 65 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

Alternate procedure:

No sooner than 10 and no later than 15 minutes after parking, check for the BRAKE TEMP advisory message on EICAS. If the message is not displayed, no waiting period is required. If it is displayed, do not dispatch until at least 65 minutes after landing or until the Brake Temperature Monitoring System (BTMS) readings on the Landing Gear Synoptic Display are all 3.0 or lower. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or the BRAKE TEMP SYS status message is displayed, then this alternate procedure cannot be used.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Climb Limit Weight

Flaps 15

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 LB)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	0	2000	4000	6000	8000	9000	9800
54	129	522.3	496.6	462.8	417.8	352.2		
52	126	534.3	498.5	473.5	430.1	367.9		
50	122	547.1	501.1	478.8	442.2	381.9	352.0	
48	118	560.2	513.5	478.6	453.8	393.3	366.5	344.8
46	115	573.1	525.6	481.0	454.4	404.7	377.5	357.3
44	111	583.7	537.4	491.7	454.2	415.6	388.4	368.1
42	108	593.4	549.0	502.4	456.6	421.6	398.9	378.4
40	104	603.8	561.0	513.7	466.6	421.4	404.5	388.7
38	100	617.4	573.6	525.7	477.1	423.9	404.2	391.5
36	97	631.0	584.1	537.8	488.3	433.7	406.8	391.3
34	93	644.9	594.5	550.3	499.9	443.9	416.5	395.9
32	90	657.6	605.9	562.3	511.2	454.6	426.5	405.5
30	86	669.5	619.3	574.4	523.0	465.5	437.0	415.3
28	82	680.4	632.4	584.7	534.5	476.0	447.6	425.7
26	79	680.7	644.5	593.9	546.0	487.2	457.8	436.0
24	75	680.9	652.9	603.3	557.1	498.0	468.6	446.1
22	72	681.1	653.0	613.0	565.9	509.3	479.0	456.6
20	68	681.3	653.2	618.7	573.3	519.2	489.9	466.6
18	64	681.5	653.3	618.8	579.1	527.0	499.3	476.5
16	61	681.7	653.4	618.9	581.3	530.7	506.1	485.4
14	57	681.9	653.5	618.9	581.4	533.7	509.0	491.3
12	54	682.2	653.6	618.9	581.4	533.7	511.4	493.8
10	50	682.3	653.7	618.9	581.4	533.8	511.5	495.7
-40	-40	682.9	653.8	619.2	581.3	533.6	511.4	495.8

With engine bleed for packs off, increase weight by 1700 lb.
With engine anti-ice on, decrease weight by 2000 lb.
With engine and wing anti-ice on, decrease weight by 4900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	0	2000	4000	6000	8000	9000	9800
54	129	549.9						
52	126	565.7						
50	122	582.0	532.4					
48	118	599.7	545.6					
46	115	614.6	560.0	517.7				
44	111	629.4	574.6	530.5				
42	108	643.4	591.0	543.1	502.2			
40	104	658.6	605.2	555.9	513.0			
38	100	673.4	619.3	568.7	523.8	465.8		
36	97	688.3	631.7	579.9	532.9	475.3	447.4	
34	93	702.4	643.9	592.7	541.7	484.7	456.3	436.0
32	90	707.0	656.1	603.7	549.6	492.7	465.2	444.8
30	86	707.3	667.7	614.5	558.3	500.1	473.1	453.5
28	82	707.6	678.0	624.1	567.1	507.3	480.1	460.5
26	79	707.8	678.2	631.5	577.1	514.5	487.0	467.2
24	75	708.1	678.4	637.0	586.9	522.6	493.7	473.7
22	72	708.4	678.5	639.3	593.4	530.7	501.2	480.4
20	68	708.7	678.6	639.4	597.4	537.6	508.7	487.9
18	64	708.9	678.8	639.5	601.4	542.4	515.6	494.9
16	61	709.2	679.0	639.6	601.5	545.7	520.2	501.5
14	57	709.4	679.1	639.6	601.6	548.8	523.2	505.2
12	54	709.7	679.3	639.7	601.7	548.9	525.8	507.9
10	50	709.9	679.4	639.8	601.7	549.0	525.9	509.8
8	46	710.1	679.6	639.8	601.7	549.0	526.0	509.9
6	43	710.3	679.7	639.9	601.7	549.0	526.0	509.9
4	40	710.4	679.8	640.0	601.6	548.9	525.9	503.1
2	36	710.5	679.9	640.1	601.7	548.9	525.8	503.2
0	32	710.6	679.9	640.2	601.8	548.8	525.8	503.2
-40	-40	711.1	680.1	640.5	602.2	549.4	526.3	503.3

With engine bleed for packs off, increase weight 2600 lb.
With engine and wing anti-ice on, decrease weight by 4700 lb.
When operating in icing conditions during any part of the flight when forecast landing temperature is below 10°C, decrease weight by 64300 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Sea Level, 33°C & Below, Zero Wind

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off or Auto

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)								
	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	644.4								
50	598.7	650.9							
100	559.9	611.4	647.2						
150	530.4	580.6	617.9	644.9					
200	506.2	555.5	593.1	621.7	643.4	659.5			
250		534.0	571.7	601.1	624.1	642.2	656.3		
300		515.1	552.9	582.8	606.7	625.8	641.3	653.7	659.4
350			535.9	566.1	590.6	610.6	626.9	640.5	651.7
400			520.5	551.0	575.9	596.4	613.5	627.7	639.8
450			506.4	537.0	562.2	583.2	600.8	615.7	628.3
500			493.3	524.0	549.5	570.8	588.9	604.3	617.4
550			481.1	511.8	537.5	559.2	577.6	593.4	607.0
600			469.7	500.5	526.3	548.2	566.9	583.0	597.0
650			458.9	489.7	515.7	537.8	556.8	573.2	587.4
700			448.9	479.6	505.6	527.9	547.1	563.7	578.3
750				470.0	496.1	518.5	537.9	554.7	569.5
800				460.8	487.0	509.5	529.0	546.1	561.1
850				452.2	478.3	500.9	520.5	537.8	553.0
900				443.9	470.0	492.6	512.4	529.8	545.1
950				436.0	462.0	484.7	504.6	522.1	537.6
1000				428.5	454.4	477.1	497.0	514.6	530.2

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustment

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)							
	400	440	480	520	560	600	640	680
33 & BELOW	0	0	0	0	0	0	0	0
34	-2.7	-3.0	-3.3	-3.6	-3.9	-4.2	-4.5	-4.9
36	-10.2	-11.4	-12.7	-13.9	-15.1	-16.3	-17.5	-18.7
38	-17.8	-19.9	-22.0	-24.1	-26.3	-28.4	-30.5	-32.6
40	-25.4	-28.4	-31.4	-34.4	-37.4	-40.5	-43.5	-46.5
42	-32.8	-36.5	-40.3	-44.1	-47.8	-51.6	-55.4	-59.2
44	-40.1	-44.7	-49.2	-53.7	-58.2	-62.8	-67.3	-71.8
46	-47.5	-52.8	-58.1	-63.4	-68.6	-73.9	-79.2	-84.5
48	-54.9	-60.9	-67.0	-73.0	-79.0	-85.1	-91.1	-97.2
50	-62.3	-69.1	-75.9	-82.6	-89.4	-96.2	-103.0	-109.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 15

Pressure Altitude Adjustment

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	400	440	480	520	560	600	640	680
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-16.2	-17.6	-19.1	-20.5	-22.0	-23.4	-24.9	-26.3
2000	-32.4	-35.3	-38.2	-41.0	-43.9	-46.8	-49.7	-52.6
3000	-46.7	-51.0	-55.3	-59.6	-63.9	-68.3	-72.6	-76.9
4000	-61.0	-66.7	-72.5	-78.2	-83.9	-89.7	-95.4	-101.2
5000	-75.6	-82.9	-90.1	-97.3	-104.5	-111.8	-119.0	-126.2
6000	-90.3	-99.0	-107.7	-116.4	-125.1	-133.8	-142.5	-151.2
7000	-105.9	-116.3	-126.8	-137.2	-147.6	-158.0	-168.4	-178.8
8000	-121.5	-133.7	-145.8	-157.9	-170.1	-182.2	-194.3	-206.4
9000	-134.7	-148.8	-162.9	-177.1	-191.2	-205.3	-219.4	-233.5
9800	-145.3	-160.9	-176.6	-192.5	-208.1	-223.8	-239.5	-255.2

Wind Adjustment

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	400	440	480	520	560	600	640	680
15 TW	-28.0	-34.0	-40.0	-46.0	-52.0	-58.0	-64.0	-36.0
10 TW	-18.7	-22.7	-26.7	-30.7	-34.7	-38.7	-42.7	-24.0
5 TW	-9.3	-11.3	-13.3	-15.3	-17.3	-19.3	-21.3	-12.0
0	0	0	0	0	0	0	0	0
10 HW	7.0	6.5	6.0	5.5	5.0	4.5	4.0	3.5
20 HW	14.0	13.0	12.0	11.0	10.0	9.0	8.0	7.0
30 HW	25.3	23.2	21.0	18.8	16.7	14.5	12.3	10.2
40 HW	36.7	33.3	30.0	26.7	23.3	20.0	16.7	13.3

With engine bleed for packs off, increase weight by 2000 lb.
With engine and wing anti-ice on, decrease weight by 6500 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18900	17100	14600
760	19500	17700	15200
740	20000	18200	15800
720	21000	19300	16700
700	21900	20400	18000
680	22900	21400	19200
660	23900	22400	20400
640	25000	23500	21700
620	25900	24500	22900
600	26900	25600	24000
580	27900	26800	25200
560	28900	28100	26500
540	30000	29300	27800
520	30700	30300	29100
500	31500	31100	30300
480	32200	31900	31300
460	32900	32700	32100
440	33500	33300	32800
420	34000	33800	33400
400	34500	34400	34000
380	35100	35000	34600
360	35600	35500	35100

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
326	291	261	237	217	200	188	177	167	158	150
488	436	391	355	326	300	282	266	251	238	227
649	580	521	473	434	400	376	354	335	318	303
809	724	650	591	543	500	470	443	419	398	380
968	867	779	709	651	600	565	533	504	479	456
1127	1009	908	826	759	700	659	622	589	559	533
1285	1152	1036	944	867	800	754	712	673	639	609
1442	1293	1165	1061	975	900	848	801	758	720	686
1599	1435	1293	1178	1083	1000	943	890	843	800	763
1755	1576	1421	1295	1191	1100	1037	980	928	881	840
1910	1716	1548	1412	1299	1200	1131	1069	1012	962	917
2065	1856	1675	1529	1407	1300	1226	1158	1097	1042	994
2219	1996	1802	1646	1515	1400	1320	1248	1182	1123	1072
2373	2135	1929	1762	1623	1500	1415	1337	1267	1204	1149
2526	2274	2056	1878	1730	1600	1509	1427	1352	1285	1226
2679	2413	2182	1994	1838	1700	1604	1516	1437	1366	1304
2831	2551	2308	2110	1945	1800	1699	1606	1522	1447	1382
2982	2689	2434	2226	2053	1900	1793	1696	1608	1529	1459
3133	2826	2559	2342	2160	2000	1888	1786	1693	1610	1537

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	16.3	0:52	15.6	0:49	15.1	0:47	14.8	0:46	14.5	0:44
300	23.9	1:16	22.7	1:12	21.8	1:09	21.0	1:06	20.5	1:03
400	31.4	1:39	29.8	1:34	28.5	1:30	27.3	1:25	26.5	1:21
500	39.0	2:03	36.9	1:57	35.1	1:51	33.6	1:45	32.5	1:40
600	46.8	2:26	44.2	2:19	42.0	2:12	40.1	2:05	38.6	1:59
700	54.7	2:49	51.5	2:41	48.9	2:33	46.5	2:25	44.7	2:17
800	62.5	3:12	58.9	3:02	55.8	2:53	53.0	2:45	50.8	2:36
900	70.4	3:35	66.2	3:24	62.7	3:14	59.4	3:04	57.0	2:55
1000	78.2	3:58	73.5	3:46	69.5	3:35	65.9	3:24	63.1	3:13
1100	86.4	4:20	81.2	4:07	76.7	3:55	72.6	3:43	69.4	3:32
1200	94.7	4:42	88.8	4:28	83.9	4:15	79.4	4:03	75.8	3:50
1300	102.9	5:04	96.5	4:49	91.1	4:35	86.1	4:22	82.2	4:09
1400	111.1	5:27	104.2	5:11	98.3	4:55	92.8	4:41	88.5	4:27
1500	119.3	5:49	111.9	5:32	105.5	5:15	99.6	5:00	94.9	4:45
1600	128.0	6:10	119.9	5:52	113.0	5:35	106.6	5:19	101.6	5:03
1700	136.6	6:31	127.9	6:12	120.5	5:55	113.7	5:38	108.2	5:21
1800	145.2	6:53	135.9	6:33	128.0	6:14	120.7	5:57	114.9	5:39
1900	153.8	7:14	143.9	6:53	135.5	6:34	127.7	6:15	121.5	5:57
2000	162.4	7:36	152.0	7:14	143.0	6:53	134.8	6:34	128.2	6:15

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	300	350	400	450	500
10	-0.7	-0.3	0.0	0.6	1.4
20	-1.5	-0.8	0.0	1.2	2.7
30	-2.3	-1.3	0.0	1.9	4.1
40	-3.2	-1.9	0.0	2.5	5.6
50	-4.1	-2.4	0.0	3.2	7.2
60	-5.1	-2.9	0.0	3.9	8.8
70	-6.0	-3.5	0.0	4.6	10.4
80	-7.0	-4.1	0.0	5.4	12.2
90	-8.1	-4.7	0.0	6.2	14.0
100	-9.2	-5.3	0.0	7.1	15.8
110	-10.3	-6.0	0.0	8.0	17.7
120	-11.5	-6.6	0.0	8.9	19.7
130	-12.7	-7.2	0.0	9.8	21.8
140	-14.0	-7.9	0.0	10.8	23.9
150	-15.2	-8.5	0.0	11.8	26.1
160	-16.6	-9.2	0.0	12.8	28.3
170	-17.9	-9.9	0.0	13.9	30.7

Based on VREF+80 climb, Long Range Cruise and VREF+80 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
101	84	72	63	56	50	45	42	38	36	33
171	150	133	120	109	100	92	86	80	75	71
242	215	194	177	162	150	139	130	122	115	109
311	280	255	233	215	200	187	175	165	156	147
380	344	315	290	268	250	234	220	207	196	186
448	408	374	346	321	300	281	265	250	237	225
517	472	434	402	374	350	329	310	293	278	265
586	536	494	458	427	400	376	355	336	319	304
655	600	554	514	480	450	423	400	379	360	343
726	666	615	571	533	500	471	445	421	400	381

Trip Fuel and Time

AIR DISTANCE (NM)		LANDING WEIGHT (1000 LB)					TIME (HRS:MIN)
		340	380	420	460	500	
50	FUEL (1000 LB)	4.8	5.1	5.3	5.5	5.8	0:15
	ALT (FT)	13000	11000	11000	11000	11000	
100	FUEL (1000 LB)	8.0	8.3	8.7	9.2	9.7	0:25
	ALT (FT)	23000	21000	21000	21000	19000	
150	FUEL (1000 LB)	10.8	11.3	11.8	12.4	13.2	0:34
	ALT (FT)	29000	27000	25000	25000	25000	
200	FUEL (1000 LB)	13.4	14.1	14.8	15.6	16.5	0:43
	ALT (FT)	31000	31000	29000	27000	27000	
250	FUEL (1000 LB)	16.0	16.8	17.7	18.7	19.9	0:51
	ALT (FT)	33000	31000	31000	29000	27000	
300	FUEL (1000 LB)	18.6	19.6	20.6	21.8	23.2	0:59
	ALT (FT)	33000	33000	31000	29000	29000	
350	FUEL (1000 LB)	21.3	22.3	23.5	24.9	26.5	1:08
	ALT (FT)	33000	33000	31000	31000	29000	
400	FUEL (1000 LB)	23.9	25.0	26.4	28.0	29.9	1:16
	ALT (FT)	33000	33000	31000	31000	29000	
450	FUEL (1000 LB)	26.5	27.8	29.3	31.1	33.3	1:24
	ALT (FT)	33000	33000	31000	31000	29000	
500	FUEL (1000 LB)	29.1	30.5	32.3	34.2	36.7	1:33
	ALT (FT)	33000	33000	31000	31000	29000	

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR) PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
780	33630	33660					
740	32030	31990					
700	30130	30040					
660	28070	28000	27870				
620	26430	26380	26210				
580	24640	24600	24420	24530			
540	23100	23040	22870	22920			
500	21700	21590	21420	21420	21620		
460	20630	20490	20290	20260	20420	20710	
420	19970	19810	19590	19540	19680	19900	20420
380	19380	19200	18960	18900	19010	19200	19620
340	18880	18680	18420	18330	18400	18570	18960

Flaps 1

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR) PRESSURE ALTITUDE (FT)				
	1500	5000	10000	15000	20000
780	33200	33350	33300	33810	35360
740	31460	31530	31490	31900	33060
700	29610	29620	29600	29870	30740
660	27590	27590	27560	27810	28370
620	25850	25840	25760	26020	26480
580	24030	23990	23870	24130	24440
540	22400	22310	22180	22370	22620
500	20870	20740	20590	20700	20940
460	19620	19440	19260	19320	19520
420	18720	18520	18310	18340	18480
380	17960	17750	17500	17500	17570
340	17340	17120	16840	16810	16830

These tables include 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
20	378.0	378.0	367.5
18	401.2	396.8	387.5
16	428.1	424.3	415.3
14	457.0	455.4	443.5
12	492.5	487.6	472.8
10	528.0	522.0	506.6
8	565.4	557.1	542.7
6	608.0	592.3	570.5
4	645.0	621.0	592.6
2	675.0	646.1	615.7
0	701.9	669.5	636.9

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)										
	PRESSURE ALTITUDE (1000 FT)										
	0	2	4	6	8	10	12	14	16	18	20
ENGINE ONLY	0.0	-1.6	-2.7	-2.7	-2.5	-2.0	-1.6	-0.5	0.0	0.0	0.0
ENGINE AND WING	-5.1	-6.7	-6.7	-7.1	-6.0	-5.3	-4.2	-3.6	-2.9	-2.2	-1.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Tire Speed, and Obstacle Limit Weights as determined from the following tables. Brake Energy Limit is not shown as it is not limiting for the range of conditions shown in this chapter. When determining a maximum weight for a wet runway, the dry runway limit weight must also be checked and the lower of the two weights used.

Field Limit Weight - Slope and Wind Corrections

These tables for wet and dry runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the Slope Correction table with the available field length and runway slope to determine the slope corrected field length. Now enter the Wind Correction table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway condition and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude.

When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Obstacle Limit Weight

This table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the correction tables to correct the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Maximum tire speed limited weights are presented for 235 MPH tires. To determine the tire speed limit weight, enter the table with OAT, move to airport pressure altitude and read the tire speed limit weight. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Takeoff Speeds

The speeds presented in the Takeoff Speeds table can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy, or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. The FMC computes takeoff speeds consistent with the Takeoff Speeds tables described above, however, the FMC takeoff speeds should not be used for takeoff weight lower than 340,000 lb (154,221 kg) as stated in the Airplane Flight Manual. To obtain speeds for the takeoff in these situations, use available performance software.

Normal takeoff speeds, V1, VR, and V2 are read from either the wet or dry table by entering with takeoff flap setting and brake release weight. Use the tables provided to correct takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind corrections to V1 are obtained by entering the Slope and Wind V1 Adjustment Table.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Minimum V2

Minimum takeoff safety speeds (V2) are provided to ensure an adequate margin between the normal operating speed and the in-air minimum control speed is maintained for directional control with high thrust asymmetry during a light weight takeoff.

Data are presented as a function of airport pressure altitude and are valid for all temperatures. To obtain the proper V2 speed for takeoff, first determine the normal takeoff V2 using the takeoff speeds tables provided, adjusted for pressure altitude, temperature, and VR correction (if applicable). Compare this V2 with the minimum V2. If the calculated V2 is less than the minimum V2, set V2 equal to minimum V2 and determine a new VR by adding the difference between calculated V2 and minimum V2 to the original VR obtained from the V1, VR, V2 Adjustments table or Minimum VR table (if applicable).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Brakes Deactivated

When operating with brakes deactivated, the runway/obstacle limit weight and the V1 must be reduced to allow for reduced braking capability. A simplified method which conservatively accounts for the reduced braking capability of one brake deactivated is to reduce the normal runway/obstacle limited weight by 8900 lb for a dry runway or 5600 lb for a wet runway and the V1 associated with the reduced weight by 2 knots. With two brakes deactivated, reduce the normal runway/obstacle limited weight by 18300 lb for a dry runway or 11700 lb for a wet runway and the V1 associated with the reduced weight by 5 knots for a dry runway or 3 knots for a wet runway. If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate stop distance available corrected for wind and slope exceeds approximately 5900 ft for one brake deactivated or 6200 ft for two brakes deactivated. For wet runways, the corrected accelerate stop distance should exceed approximately 7700 ft for one brake deactivated or 8100 ft for two brakes deactivated.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

One Thrust Reverser Inoperative

Wet runway takeoff performance presented for all brakes operating is based on the use of one thrust reverser during deceleration. When operating with a thrust reverser inoperative, the runway/obstacle limited takeoff weight and V1 speed must be reduced to account for the reduced deceleration capability. A simplified method which conservatively accounts for this is to reduce the normal wet runway/obstacle limited weight by 11200 lb and the V1 associated with the reduced weight by 3 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate stop distance available corrected for wind and slope exceeds approximately 7900 ft.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination. Data is based on economy climb and descent speeds, and Long Range Cruise with normal engine bleed for air conditioning. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time Table with air distance from the Ground to Air Miles Conversion Table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment Table with the Reference Fuel and the planned landing weight to obtain fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

These tables are provided to determine trip fuel and time required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time required with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. The data considers the use of the FMC short trip optimum altitude. Obtain air distance from upper table using the ground distance and wind component to the alternate. Enter Trip Fuel and Time table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

These tables provide total fuel flow information necessary for planning Flaps Up and Flaps 1 holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Oxygen Requirements

Flight Crew System

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck.

For freighter airplanes, regulations also require that sufficient oxygen be provided to the flight crew in case of a main deck cargo fire, which requires cabin depressurization, intermediate level off at 25000 ft altitude, and landing at the nearest suitable airport.

Data are provided to determine the flight crew oxygen dispatch requirements. Table 1 shows the dispatch pressure required for NORMAL regulator setting. Table 2, which can be used if oxygen dispatch requirements are scheduled based on pure oxygen availability, shows the dispatch pressure required for 100% regulator setting.

To determine the flight crew oxygen dispatch requirements, enter the appropriate table with number of crew plus observers using oxygen and total time, which should include maximum diversion time from the intended route to the nearest suitable airport, and read the minimum oxygen system dispatch pressure.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

An additional quantity of oxygen is required when flight altitudes above 41000 ft are planned. Regulations require that one active duty pilot must don the oxygen mask and breathe diluted oxygen for the duration of the flight above 41000 ft. The additional quantity of oxygen required is 0.5 psi/person/minute for NORMAL regulator setting or 2.7 psi/person/minute for 100% regulator setting.

For ambient temperatures above or below 21°C, adjust the required dispatch pressure by the appropriate correction from Table 3.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for Flaps 30.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight or maximum certified landing weight.

Landing Field Limit Weight

Obtain wind corrected field length by entering upper table with field length available and wind component along the runway. Now enter table with wind corrected field length and pressure altitude to read field limit weight for the expected runway condition.

Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Go-Around Climb Gradient

Enter the Reference Go-around Gradient table with airport OAT and pressure altitude to determine the reference Go-Around Gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted Go-Around Gradient. Apply the necessary engine bleed corrections as noted. Note that data is for one engine inoperative.

Quick Turnaround Limit Weight

Enter table with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff, or ensure the brake temperature is within limits using the alternate procedure described on the page.

Gear Down

This section provides flight planning data for revenue operation with gear down.

Takeoff/Approach or Landing Climb Limited Weight

Enter table with airport OAT and pressure altitude to determine Takeoff Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

The remaining gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777-200ER PW4090 LB FT FAA TO1-10 TO2-20 TALPA - PI.10.1

777-300 PW4090 LB FT FAA TO1-10 TO2-20 TALPA - PI.20.1

777-300ER GE90-115BL LB C FT FAA TO1-10 TO2-20 HIGH_ALT TALPA - PI.30.1

777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA - PI.40.1

777F GE90-110B1L LB FT FAA TO1-10 TO2-20 CREW3 TALPA HIGH_ALT - PI.50.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777-200ER PW4090 LB FT FAA TO1-10 TO2-20 TALPA

Pkg Model Identification PI.ModID.10.1

General PI.10.1

VREF PI.10.1
Flap Maneuver Speed PI.10.2
Slush/Standing Water Takeoff. PI.10.3
Slippery Runway Takeoff PI.10.7
TO1 Slush/Standing Water Takeoff PI.10.11
TO1 Slippery Runway Takeoff. PI.10.15
TO2 Slush/Standing Water Takeoff PI.10.19
TO2 Slippery Runway Takeoff. PI.10.23
Minimum Control Speeds. PI.10.27
Go-around EPR. PI.10.28
Max Climb EPR PI.10.29
Flight With Unreliable Airspeed / Turbulent Air Penetration PI.10.30

All Engine PI.11.1

Long Range Cruise Maximum Operating Altitude. PI.11.1
Long Range Cruise Control PI.11.3
Long Range Cruise Enroute Fuel and Time - Low Altitudes . PI.11.4
Long Range Cruise Enroute Fuel and Time - High Altitudes. PI.11.6
Long Range Cruise Wind-Altitude Trade PI.11.8
Descent at .84/310/250 . . . . . PI.11.8
Holding PI.11.9

Advisory Information. PI.12.1

Runway Surface Condition Correlation PI.12.1
Normal Configuration Landing Distance PI.12.2
Non-Normal Configuration Landing Distance PI.12.8
ADIRU/GPS DISAGREE (Flaps 25) PI.12.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADIRU/GPS DISAGREE (Flaps 30) PI.12.9
AIR DATA SYS (Flaps 20) PI.12.10
Airspeed Unreliable (Flaps 20) PI.12.11
ANTISKID (Flaps 25) PI.12.12
ANTISKID (Flaps 30) PI.12.13
ENG SHUTDOWN L, R (Flaps 20) PI.12.14
ENG SHUTDOWN L, R (Flaps 30) PI.12.15
FLAP / SLAT CONTROL (Flaps 20) PI.12.16
FLAPS DRIVE (Flaps ≤ 5) PI.12.17
FLAPS DRIVE (5 < Flaps < 20) PI.12.18
FLAPS DRIVE (Flaps ≥ 20) PI.12.19
FLAPS PRIMARY FAIL (Flaps 20) PI.12.20
FLIGHT CONTROL MODE (Flaps 20) PI.12.21
FLIGHT CONTROLS (Flaps 20) PI.12.22
HYD PRESS SYS C (Flaps 20). PI.12.23
HYD PRESS SYS L (Flaps 25) PI.12.24
HYD PRESS SYS L (Flaps 30) PI.12.25
HYD PRESS SYS L+C (Flaps 20) PI.12.26
HYD PRESS SYS L+R (Flaps 20) PI.12.27
HYD PRESS SYS R (Flaps 25). PI.12.28
HYD PRESS SYS R (Flaps 30). PI.12.29
HYD PRESS SYS R+C (Flaps 20) PI.12.30
NAV AIR DATA SYS (Flaps 20). PI.12.31
PITCH DOWN AUTHORITY (Flaps 25) PI.12.32
PITCH DOWN AUTHORITY (Flaps 30) PI.12.33
PITCH UP AUTHORITY (Flaps ≤ 15) PI.12.34
PITCH UP AUTHORITY (Flaps ≥ 20) PI.12.35
PRI FLIGHT COMPUTERS (Flaps 20) PI.12.36
SLATS DRIVE (Flaps 20) PI.12.37
SPOILERS (Flaps 25) PI.12.38
SPOILERS (Flaps 30) PI.12.39
STABILIZER (Flaps 20) PI.12.40
Approach or Landing Climb Limited Weight PI.12.41
Recommended Brake Cooling Schedule. PI.12.42

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Inoperative PI.13.1

Initial Max Continuous EPR. PI.13.1
Max Continuous EPR PI.13.2
Driftdown Speed/Level Off Altitude PI.13.6
Driftdown/LRC Cruise Range Capability PI.13.7
Long Range Cruise Altitude Capability PI.13.8
Long Range Cruise Control PI.13.9
Long Range Cruise Diversion Fuel and Time PI.13.10
Holding PI.13.11
Gear Down Landing Rate of Climb Available PI.13.12

Alternate Mode EEC PI.14.1

Limit Weight PI.14.1
Max Takeoff %N1 . . . . . PI.14.2
Max Climb %N1. . . . . PI.14.3
Max Cruise %N1 . . . . . PI.14.4
Go-Around %N1. . . . . PI.14.5

Alternate Mode EEC, Engine Inoperative PI.15.1

Initial Max Continuous %N1 . . . . . PI.15.1
Max Continuous %N1 . . . . . PI.15.2

Gear Down PI.16.1

220 KIAS Max Climb EPR PI.16.1
Long Range Cruise Altitude Capability PI.16.2
Long Range Cruise Control PI.16.3
Long Range Cruise Enroute Fuel and Time PI.16.4
Descent at VREF30 + 80 KIAS PI.16.5
Holding PI.16.6

Gear Down, Engine Inoperative PI.17.1

Driftdown Speed/Level Off Altitude PI.17.1
Long Range Cruise Altitude Capability PI.17.2
Long Range Cruise Control PI.17.3

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Diversion Fuel and Time PI.17.4
Holding PI.17.5

Text PI.18.1

Introduction PI.18.1
General PI.18.1
All Engines PI.18.4
Advisory Information PI.18.6
Engine Inoperative PI.18.8
Alternate Mode EEC PI.18.11
Alternate Mode EEC, Engine Inoperative PI.18.12
Gear Down PI.18.12

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
101	HL7574	28444	WB134
102	HL7575	28445	WB135
103	HL7598	27949	WB136
107	HL7733	34206	WB140
108	HL7734	34207	WB141
109	HL7743	34208	WB142
110	HL7750	34209	WB143
111	HL7751	34210	WB144
112	HL7752	34211	WB145

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airplane Number	Registry Number	Serial Number	Tabulation Number
113	HL7764	34214	WB146
114	HL7765	34212	WB147
115	HL7766	34213	WB148

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

VREF

Flaps 30

WEIGHT (1000 LB)	VREF (KIAS) PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
680	167	167	167	168	167	169
640	162	162	162	162	163	164
600	157	157	157	157	158	158
560	152	152	153	153	153	153
520	147	147	147	147	147	147
480	141	141	141	141	141	141
440	135	135	135	135	135	135
400	129	129	129	129	129	129
360	123	122	122	122	122	122
320	123	121	118	116	115	115

Flaps 25

WEIGHT (1000 LB)	VREF (KIAS) PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
680	175	175	175	174	176	175
640	170	170	170	170	170	170
600	165	165	165	165	165	165
560	160	160	160	160	160	161
520	154	154	154	154	154	155
480	148	148	148	148	148	148
440	142	142	142	142	142	142
400	135	135	135	135	135	135
360	128	128	128	128	128	128
320	123	121	121	121	121	121

Flaps 20

WEIGHT (1000 LB)	VREF (KIAS) PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
680	181	180	181	182	182	183
640	176	176	176	176	177	178
600	171	171	171	171	171	172
560	165	166	166	166	166	166
520	159	159	160	160	160	160
480	153	153	153	153	153	154
440	147	147	147	147	147	147
400	140	140	140	140	140	140
360	132	132	132	133	133	133
320	125	125	125	125	125	125

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS 0	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-71.7	-83.3	-94.9	-84.2	-95.8	-107.4	-111.5	-123.1	-134.7
660	-68.4	-80.0	-91.6	-79.3	-90.9	-102.5	-102.9	-114.5	-126.1
620	-64.4	-76.0	-87.6	-73.8	-85.4	-97.0	-94.0	-105.6	-117.2
580	-59.7	-71.3	-82.9	-67.7	-79.3	-90.9	-84.7	-96.3	-107.9
540	-54.3	-65.9	-77.5	-61.0	-72.6	-84.2	-75.1	-86.7	-98.3
500	-48.3	-59.9	-71.5	-53.7	-65.3	-76.9	-65.1	-76.7	-88.3
460	-41.6	-53.2	-64.8	-45.8	-57.4	-69.0	-54.8	-66.4	-78.0
420	-34.3	-45.9	-57.5	-37.4	-49.0	-60.6	-44.1	-55.7	-67.3
380	-26.3	-37.9	-49.5	-28.3	-39.9	-51.5	-33.1	-44.7	-56.3
340	-17.7	-29.3	-40.9	-18.7	-30.3	-41.9	-21.8	-33.4	-45.0
300	-8.9	-20.5	-32.1	-9.0	-20.6	-32.2	-10.4	-22.0	-33.6

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800							225.3		
6200				221.3			283.7		
6600	245.2			280.5			342.2	248.6	
7000	304.2			339.6	245.0		401.1	307.1	
7400	363.4	268.8		399.4	304.1		461.8	365.6	272.0
7800	424.0	327.8	233.3	461.3	363.3	268.6	524.5	425.2	330.5
8200	487.3	387.4	292.4	525.8	423.8	327.8	589.4	486.7	389.2
8600	553.8	449.0	351.5	593.1	486.8	387.3	656.7	550.2	449.5
9000	623.8	513.5	411.7	663.8	552.3	448.7	726.3	616.0	511.8
9400	698.0	581.3	474.4	737.6	621.0	512.7		684.3	576.2
9800	774.6	653.0	540.2		693.1	579.4		754.4	643.0
10200		728.6	609.5		767.3	649.4			712.3
10600			682.8			722.8			
11000			759.3						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -160 ft/+150 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-19	-15	-11	-14	-10	-6	-4	0	0
620	-21	-17	-13	-16	-12	-8	-5	-1	0
580	-22	-18	-14	-18	-14	-10	-7	-3	0
540	-24	-20	-16	-20	-16	-12	-10	-6	-2
500	-26	-22	-18	-22	-18	-14	-14	-10	-6
460	-27	-23	-19	-24	-20	-16	-17	-13	-9
420	-28	-24	-20	-25	-21	-17	-20	-16	-12
380	-28	-24	-20	-26	-22	-18	-21	-17	-13
340	-27	-23	-19	-25	-21	-17	-21	-17	-13
300	-26	-22	-18	-24	-20	-16	-21	-17	-13

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0. 12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-100.8	-114.8	-128.8	-115.0	-129.0	-143.0	-145.0	-159.0	-173.0
660	-94.6	-108.6	-122.6	-106.6	-120.6	-134.6	-132.2	-146.2	-160.2
620	-88.0	-102.0	-116.0	-98.0	-112.0	-126.0	-119.6	-133.6	-147.6
580	-81.2	-95.2	-109.2	-89.4	-103.4	-117.4	-107.2	-121.2	-135.2
540	-74.0	-88.0	-102.0	-80.7	-94.7	-108.7	-95.1	-109.1	-123.1
500	-66.4	-80.4	-94.4	-71.9	-85.9	-99.9	-83.2	-97.2	-111.2
460	-58.6	-72.6	-86.6	-63.0	-77.0	-91.0	-71.5	-85.5	-99.5
420	-50.4	-64.4	-78.4	-54.0	-68.0	-82.0	-60.1	-74.1	-88.1
380	-41.9	-55.9	-69.9	-44.9	-58.9	-72.9	-48.9	-62.9	-76.9
340	-33.1	-47.1	-61.1	-35.7	-49.7	-63.7	-37.9	-51.9	-65.9
300	-24.2	-38.2	-52.2	-26.6	-40.6	-54.6	-27.0	-41.0	-55.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0. 12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
8600							232.0		
9000							297.6		
9400							363.2	251.7	
9800				238.5			431.6	317.3	
10200				311.0			505.3	383.3	271.4
10600	262.7			383.9	260.3		585.8	453.1	337.0
11000	337.2			462.7	332.7		675.2	528.7	403.7
11400	414.3	284.8		550.9	406.7	282.0	772.7	611.5	475.2
11800	499.5	360.0	233.4	653.0	488.0	354.5		704.3	552.7
12200	599.3	438.6	307.1	772.0	579.8	430.2			638.1
12600	717.6	527.8	383.0		687.5	514.3			733.6
13000		632.2	463.9			610.0			
13400		759.8	557.6			723.7			
13800			667.1						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water adjustment.**
2. **Adjust field length available by -240 ft/+230 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0. 12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-32	-26	-20	-25	-19	-13	-8	-2	0
620	-34	-28	-22	-27	-21	-15	-11	-5	0
580	-36	-30	-24	-30	-24	-18	-15	-9	-3
540	-39	-33	-27	-34	-28	-22	-20	-14	-8
500	-41	-35	-29	-37	-31	-25	-26	-20	-14
460	-44	-38	-32	-40	-34	-28	-31	-25	-19
420	-45	-39	-33	-43	-37	-31	-36	-30	-24
380	-47	-41	-35	-44	-38	-32	-39	-33	-27
340	-47	-41	-35	-45	-39	-33	-41	-35	-29
300	-47	-41	-35	-45	-39	-33	-42	-36	-30

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	-3.6	-7.2	-31.7	-35.3	-38.9	-68.2	-71.8	-75.4
660	0.0	-3.6	-7.2	-35.2	-38.8	-42.4	-68.3	-71.9	-75.5
620	0.0	-3.6	-7.2	-37.3	-40.9	-44.5	-67.3	-70.9	-74.5
580	-3.2	-6.8	-10.4	-38.2	-41.8	-45.4	-65.1	-68.7	-72.3
540	-5.6	-9.2	-12.8	-37.8	-41.4	-45.0	-61.8	-65.4	-69.0
500	-7.0	-10.6	-14.2	-36.1	-39.7	-43.3	-57.3	-60.9	-64.5
460	-7.1	-10.7	-14.3	-33.1	-36.7	-40.3	-51.7	-55.3	-58.9
420	-6.2	-9.8	-13.4	-28.8	-32.4	-36.0	-44.9	-48.5	-52.1
380	-4.1	-7.7	-11.3	-23.3	-26.9	-30.5	-36.9	-40.5	-44.1
340	-0.9	-4.5	-8.1	-16.5	-20.1	-23.7	-27.8	-31.4	-35.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4600	232.9								
5000	372.2	246.8	121.4						
5400	504.0	385.9	260.8						
5800	625.6	516.5	399.5						
6200	739.6	637.2	529.0						
6600		750.8	648.9	346.3					
7000			762.1	434.3	320.3				
7400				525.0	407.6	294.2			
7800				618.9	497.5	381.2			
8200				716.2	590.4	470.2			
8600					686.7	562.2	345.3		
9000						657.4	396.4		
9400							449.7	345.3	
9800							505.5	396.4	
10200							564.2	449.7	345.3
10600							626.4	505.5	396.4
11000							692.8	564.2	449.7
11400								626.4	505.5
11800								692.8	564.2
12200									626.4
12600									692.8

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -120 ft/+110 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
640	-5	-3	-1	-15	-13	-11	-29	-27	-25
600	-6	-4	-2	-18	-16	-14	-32	-30	-28
560	-8	-6	-4	-20	-18	-16	-35	-33	-31
520	-9	-7	-5	-22	-20	-18	-38	-36	-34
480	-10	-8	-6	-24	-22	-20	-40	-38	-36
440	-11	-9	-7	-26	-24	-22	-43	-41	-39
400	-12	-10	-8	-27	-25	-23	-45	-43	-41
360	-12	-10	-8	-28	-26	-24	-46	-44	-42
320	-13	-11	-9	-29	-27	-25	-47	-45	-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). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-3.0	-6.2	-9.4	-55.6	-58.8	-62.0	-98.0	-101.2	-104.4
660	-9.3	-12.5	-15.7	-57.9	-61.1	-64.3	-95.2	-98.4	-101.6
620	-14.3	-17.5	-20.7	-59.0	-62.2	-65.4	-91.5	-94.7	-97.9
580	-18.0	-21.2	-24.4	-58.7	-61.9	-65.1	-86.8	-90.0	-93.2
540	-20.5	-23.7	-26.9	-57.3	-60.5	-63.7	-81.3	-84.5	-87.7
500	-21.7	-24.9	-28.1	-54.6	-57.8	-61.0	-74.8	-78.0	-81.2
460	-21.5	-24.7	-27.9	-50.6	-53.8	-57.0	-67.5	-70.7	-73.9
420	-20.1	-23.3	-26.5	-45.4	-48.6	-51.8	-59.2	-62.4	-65.6
380	-17.5	-20.7	-23.9	-38.9	-42.1	-45.3	-50.0	-53.2	-56.4
340	-13.6	-16.8	-20.0	-31.3	-34.5	-37.7	-39.9	-43.1	-46.3
300	-9.5	-12.7	-15.9	-23.4	-26.6	-29.8	-29.7	-32.9	-36.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
6200	510.0								
6600	685.2	485.7							
7000		670.9	458.9						
7400			656.1						
9000				398.9					
9400				610.3	316.7				
9800				775.4	554.1	232.4			
10200					727.3	492.6			
10600						678.9			
13000							284.6		
13400							381.8		
13800							484.5	284.6	
14200							596.3	381.8	
14600							719.8	484.5	284.6
15000								596.3	381.8
15400								719.8	484.5
15800									596.3
16200									719.8

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -150 ft/+140 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -230 ft/+220 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-7	-1	0	-22	-16	-10	-44	-38	-32
620	-9	-3	0	-25	-19	-13	-48	-42	-36
580	-11	-5	0	-28	-22	-16	-52	-46	-40
540	-13	-7	-1	-32	-26	-20	-57	-51	-45
500	-15	-9	-3	-35	-29	-23	-62	-56	-50
460	-17	-11	-5	-39	-33	-27	-66	-60	-54
420	-20	-14	-8	-42	-36	-30	-71	-65	-59
380	-21	-15	-9	-45	-39	-33	-76	-70	-64
340	-23	-17	-11	-48	-42	-36	-81	-75	-69
300	-25	-19	-13	-51	-45	-39	-86	-80	-74

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-69.7	-81.3	-92.9	-82.9	-94.5	-106.1	-112.1	-123.7	-135.3
660	-66.7	-78.3	-89.9	-78.3	-89.9	-101.5	-103.8	-115.4	-127.0
620	-63.4	-75.0	-86.6	-73.5	-85.1	-96.7	-95.4	-107.0	-118.6
580	-59.4	-71.0	-82.6	-68.1	-79.7	-91.3	-86.6	-98.2	-109.8
540	-54.8	-66.4	-78.0	-62.0	-73.6	-85.2	-77.4	-89.0	-100.6
500	-49.4	-61.0	-72.6	-55.3	-66.9	-78.5	-67.8	-79.4	-91.0
460	-43.3	-54.9	-66.5	-47.9	-59.5	-71.1	-57.8	-69.4	-81.0
420	-36.4	-48.0	-59.6	-39.9	-51.5	-63.1	-47.5	-59.1	-70.7
380	-28.8	-40.4	-52.0	-31.3	-42.9	-54.5	-36.8	-48.4	-60.0
340	-20.5	-32.1	-43.7	-22.0	-33.6	-45.2	-25.6	-37.2	-48.8
300	-11.8	-23.4	-35.0	-12.2	-23.8	-35.4	-14.2	-25.8	-37.4

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400							224.0		
5800				225.2			287.5		
6200	254.3			289.6			351.2	249.4	
6600	318.8			354.3	250.9		416.0	313.0	
7000	384.0	280.1		420.4	315.5		483.2	376.8	274.8
7400	451.8	344.8	241.4	489.6	380.4	276.7	553.0	442.6	338.4
7800	523.3	410.7	305.9	562.3	447.7	341.3	625.9	510.8	402.8
8200	599.1	479.9	370.8	639.0	518.2	406.9	702.1	581.8	469.5
8600	680.1	553.0	438.0	720.2	592.4	475.5	779.9	655.9	538.8
9000	765.3	630.9	508.7		670.9	547.4		733.2	611.1
9400		714.0	583.6		753.1	623.3			686.6
9800			663.5			703.7			764.4
10200			748.2						

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -160 ft/+150 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-17	-13	-9	-11	-7	-3	0	0	0
620	-18	-14	-10	-13	-9	-5	-2	0	0
580	-20	-16	-12	-15	-11	-7	-4	0	0
540	-22	-18	-14	-18	-14	-10	-7	-3	0
500	-24	-20	-16	-20	-16	-12	-11	-7	-3
460	-25	-21	-17	-22	-18	-14	-14	-10	-6
420	-26	-22	-18	-23	-19	-15	-17	-13	-9
380	-26	-22	-18	-24	-20	-16	-19	-15	-11
340	-25	-21	-17	-23	-19	-15	-19	-15	-11
300	-24	-20	-16	-22	-18	-14	-19	-15	-11

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-99.5	-113.5	-127.5	-115.2	-129.2	-143.2	-147.9	-161.9	-175.9
660	-93.5	-107.5	-121.5	-106.9	-120.9	-134.9	-135.2	-149.2	-163.2
620	-87.6	-101.6	-115.6	-98.7	-112.7	-126.7	-122.6	-136.6	-150.6
580	-81.2	-95.2	-109.2	-90.4	-104.4	-118.4	-110.2	-124.2	-138.2
540	-74.5	-88.5	-102.5	-81.9	-95.9	-109.9	-98.1	-112.1	-126.1
500	-67.4	-81.4	-95.4	-73.4	-87.4	-101.4	-86.2	-100.2	-114.2
460	-59.9	-73.9	-87.9	-64.7	-78.7	-92.7	-74.5	-88.5	-102.5
420	-52.1	-66.1	-80.1	-55.9	-69.9	-83.9	-63.1	-77.1	-91.1
380	-43.9	-57.9	-71.9	-47.0	-61.0	-75.0	-51.8	-65.8	-79.8
340	-35.3	-49.3	-63.3	-38.0	-52.0	-66.0	-40.8	-54.8	-68.8
300	-26.4	-40.4	-54.4	-28.8	-42.8	-56.8	-29.9	-43.9	-57.9

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
8200							275.0		
8600							348.5	224.4	
9000				232.6			425.9	296.9	
9400				317.3			512.0	370.9	246.0
9800	283.4			405.4	257.8		609.9	450.7	318.9
10200	375.7	221.9		505.9	343.0		724.3	539.9	394.0
10600	477.8	310.5		626.8	433.9	283.2		642.2	476.4
11000	604.3	404.6	248.0	777.6	539.4	369.1		760.7	569.1
11400	769.9	512.7	338.1		668.9	463.7			676.4
11800		648.2	434.8			575.2			
12200			550.3			714.9			
12600			696.2						

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -240 ft/+230 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-26	-20	-14	-18	-12	-6	0	0	0
620	-28	-22	-16	-21	-15	-9	-3	0	0
580	-31	-25	-19	-24	-18	-12	-7	-1	0
540	-33	-27	-21	-28	-22	-16	-13	-7	-1
500	-36	-30	-24	-31	-25	-19	-19	-13	-7
460	-39	-33	-27	-35	-29	-23	-25	-19	-13
420	-41	-35	-29	-38	-32	-26	-30	-24	-18
380	-42	-36	-30	-39	-33	-27	-34	-28	-22
340	-42	-36	-30	-40	-34	-28	-36	-30	-24
300	-43	-37	-31	-40	-34	-28	-38	-32	-26

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	-3.6	-7.2	-26.2	-29.8	-33.4	-63.8	-67.4	-71.0
660	0.0	-3.6	-7.2	-30.1	-33.7	-37.3	-64.3	-67.9	-71.5
620	0.0	-3.6	-7.2	-33.4	-37.0	-40.6	-64.4	-68.0	-71.6
580	-0.4	-4.0	-7.6	-35.4	-39.0	-42.6	-63.2	-66.8	-70.4
540	-3.6	-7.2	-10.8	-36.0	-39.6	-43.2	-60.8	-64.4	-68.0
500	-5.8	-9.4	-13.0	-35.3	-38.9	-42.5	-57.2	-60.8	-64.4
460	-6.7	-10.3	-13.9	-33.2	-36.8	-40.4	-52.3	-55.9	-59.5
420	-6.5	-10.1	-13.7	-29.7	-33.3	-36.9	-46.2	-49.8	-53.4
380	-5.0	-8.6	-12.2	-24.9	-28.5	-32.1	-38.9	-42.5	-46.1
340	-2.4	-6.0	-9.6	-18.7	-22.3	-25.9	-30.3	-33.9	-37.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4400	256.4								
4800	402.9	271.1							
5200	539.2	417.1	285.8						
5600	665.0	552.3	431.2						
6000		677.1	565.2	294.1					
6400			689.1	386.2	266.5				
6800				480.7	358.4				
7200				578.6	452.0	330.8			
7600				680.4	548.9	423.6			
8000					649.4	519.5	329.9		
8400					753.4	618.9	383.8		
8800						722.1	439.8	329.9	
9200							498.6	383.8	
9600							560.8	439.8	329.9
10000							626.8	498.6	383.8
10400							697.5	560.8	439.8
10800								626.8	498.6
11200								697.5	560.8
11600									626.8
12000									697.5

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -120 ft/+110 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
640	-1	1	3	-10	-8	-6	-21	-19	-17
600	-2	0	2	-11	-9	-7	-24	-22	-20
560	-3	-1	1	-13	-11	-9	-27	-25	-23
520	-4	-2	0	-15	-13	-11	-30	-28	-26
480	-5	-3	-1	-17	-15	-13	-32	-30	-28
440	-6	-4	-2	-19	-17	-15	-34	-32	-30
400	-7	-5	-3	-20	-18	-16	-36	-34	-32
360	-7	-5	-3	-21	-19	-17	-38	-36	-34
320	-7	-5	-3	-21	-19	-17	-38	-36	-34

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	0.0	-2.5	-49.6	-52.8	-56.0	-94.7	-97.9	-101.1
660	-2.9	-6.1	-9.3	-52.4	-55.6	-58.8	-92.2	-95.4	-98.6
620	-9.2	-12.4	-15.6	-54.6	-57.8	-61.0	-89.3	-92.5	-95.7
580	-14.0	-17.2	-20.4	-55.5	-58.7	-61.9	-85.5	-88.7	-91.9
540	-17.5	-20.7	-23.9	-55.1	-58.3	-61.5	-80.6	-83.8	-87.0
500	-19.7	-22.9	-26.1	-53.3	-56.5	-59.7	-74.9	-78.1	-81.3
460	-20.4	-23.6	-26.8	-50.2	-53.4	-56.6	-68.1	-71.3	-74.5
420	-19.9	-23.1	-26.3	-45.7	-48.9	-52.1	-60.4	-63.6	-66.8
380	-17.9	-21.1	-24.3	-40.0	-43.2	-46.4	-51.7	-54.9	-58.1
340	-14.6	-17.8	-21.0	-32.9	-36.1	-39.3	-42.0	-45.2	-48.4
300	-10.5	-13.7	-16.9	-25.0	-28.2	-31.4	-31.8	-35.0	-38.2

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESSURE ALTITUDE (FT)			PRESSURE ALTITUDE (FT)			PRESSURE ALTITUDE (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800	514.2								
6200	698.0	488.6							
6600		683.0	460.0						
7000			667.5						
8200				246.9					
8600				518.5					
9000				710.0	448.1				
9400					657.6	367.2			
9800						601.4			
10200						778.8			
12200							298.3		
12600							402.5		
13000							514.3	298.3	
13400							637.0	402.5	
13800							772.0	514.3	298.3
14200								637.0	402.5
14600								772.0	514.3
15000									637.0
15400									772.0

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -150 ft/+140 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -230 ft/+220 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff
10% Thrust Reduction
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-8	-2	0	-20	-14	-8	-39	-33	-27
620	-9	-3	0	-22	-16	-10	-43	-37	-31
580	-11	-5	0	-25	-19	-13	-47	-41	-35
540	-13	-7	-1	-28	-22	-16	-51	-45	-39
500	-14	-8	-2	-31	-25	-19	-56	-50	-44
460	-16	-10	-4	-35	-29	-23	-61	-55	-49
420	-18	-12	-6	-38	-32	-26	-66	-60	-54
380	-20	-14	-8	-41	-35	-29	-71	-65	-59
340	-21	-15	-9	-43	-37	-31	-75	-69	-63
300	-23	-17	-11	-46	-40	-34	-80	-74	-68

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-65.5	-77.1	-88.7	-79.3	-90.9	-102.5	-110.0	-121.6	-133.2
660	-62.4	-74.0	-85.6	-74.6	-86.2	-97.8	-101.7	-113.3	-124.9
620	-59.4	-71.0	-82.6	-70.2	-81.8	-93.4	-93.8	-105.4	-117.0
580	-56.8	-68.4	-80.0	-66.1	-77.7	-89.3	-86.3	-97.9	-109.5
540	-53.6	-65.2	-76.8	-61.5	-73.1	-84.7	-78.4	-90.0	-101.6
500	-49.5	-61.1	-72.7	-56.0	-67.6	-79.2	-69.9	-81.5	-93.1
460	-44.5	-56.1	-67.7	-49.8	-61.4	-73.0	-60.9	-72.5	-84.1
420	-38.6	-50.2	-61.8	-42.7	-54.3	-65.9	-51.4	-63.0	-74.6
380	-31.9	-43.5	-55.1	-34.8	-46.4	-58.0	-41.3	-52.9	-64.5
340	-24.3	-35.9	-47.5	-26.2	-37.8	-49.4	-30.7	-42.3	-53.9
300	-15.7	-27.3	-38.9	-16.6	-28.2	-39.8	-19.4	-31.0	-42.6

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400				222.6			285.0		
5800	262.7			298.0			359.5	239.9	
6200	337.0			372.5	253.0		434.6	315.0	
6600	411.5	292.6		448.5	328.0		511.6	389.4	270.1
7000	488.8	366.7	247.7	527.3	402.7	283.1	590.9	465.2	344.7
7400	569.9	442.1	322.2	609.4	479.7	357.7	672.8	543.1	419.4
7800	655.4	520.8	396.4	695.5	559.7	433.1	756.6	623.4	496.1
8200	745.2	603.5	473.1		643.4	511.3		706.4	574.9
8600		690.9	553.4		730.8	592.7			656.3
9000			637.9			678.0			740.0
9400			727.2			765.9			

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -160 ft/+150 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-12	-8	-4	-6	-2	0	0	0	0
620	-14	-10	-6	-8	-4	0	0	0	0
580	-16	-12	-8	-10	-6	-2	0	0	0
540	-18	-14	-10	-13	-9	-5	-1	0	0
500	-20	-16	-12	-15	-11	-7	-5	-1	0
460	-21	-17	-13	-18	-14	-10	-9	-5	-1
420	-22	-18	-14	-19	-15	-11	-12	-8	-4
380	-22	-18	-14	-19	-15	-11	-14	-10	-6
340	-21	-17	-13	-19	-15	-11	-14	-10	-6
300	-20	-16	-12	-18	-14	-10	-14	-10	-6

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-98.6	-112.6	-126.6	-116.0	-130.0	-144.0	-151.6	-165.6	-179.6
660	-92.6	-106.6	-120.6	-107.7	-121.7	-135.7	-138.9	-152.9	-166.9
620	-86.7	-100.7	-114.7	-99.4	-113.4	-127.4	-126.2	-140.2	-154.2
580	-80.8	-94.8	-108.8	-91.3	-105.3	-119.3	-113.7	-127.7	-141.7
540	-74.6	-88.6	-102.6	-83.0	-97.0	-111.0	-101.3	-115.3	-129.3
500	-67.9	-81.9	-95.9	-74.6	-88.6	-102.6	-89.3	-103.3	-117.3
460	-60.8	-74.8	-88.8	-66.1	-80.1	-94.1	-77.4	-91.4	-105.4
420	-53.3	-67.3	-81.3	-57.4	-71.4	-85.4	-65.8	-79.8	-93.8
380	-45.4	-59.4	-73.4	-48.6	-62.6	-76.6	-54.5	-68.5	-82.5
340	-37.0	-51.0	-65.0	-39.7	-53.7	-67.7	-43.4	-57.4	-71.4
300	-28.3	-42.3	-56.3	-30.6	-44.6	-58.6	-32.5	-46.5	-60.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7400							245.7		
7800							331.7		
8200				229.8			423.2	271.2	
8600				332.4			528.3	358.1	
9000	319.9			444.0	260.1		653.8	453.0	296.9
9400	440.1	243.0		581.6	364.0			563.4	385.3
9800	593.8	354.4		765.8	481.8	290.9		697.1	484.3
10200		481.3	275.4		631.0	397.0			600.5
10600		650.0	390.1			522.4			742.5
11000			526.5			685.8			
11400			713.7						

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -240 ft/+230 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-19	-13	-7	-9	-3	0	0	0	0
620	-21	-15	-9	-12	-6	0	0	0	0
580	-24	-18	-12	-16	-10	-4	0	0	0
540	-27	-21	-15	-20	-14	-8	-3	0	0
500	-30	-24	-18	-25	-19	-13	-10	-4	0
460	-33	-27	-21	-29	-23	-17	-17	-11	-5
420	-36	-30	-24	-32	-26	-20	-23	-17	-11
380	-37	-31	-25	-34	-28	-22	-27	-21	-15
340	-38	-32	-26	-35	-29	-23	-30	-24	-18
300	-38	-32	-26	-35	-29	-23	-32	-26	-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). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	-3.6	-7.2	-19.7	-23.3	-26.9	-58.0	-61.6	-65.2
660	0.0	-3.6	-7.2	-23.6	-27.2	-30.8	-58.6	-62.2	-65.8
620	0.0	-3.6	-7.2	-27.5	-31.1	-34.7	-59.3	-62.9	-66.5
580	0.0	-3.6	-7.2	-31.0	-34.6	-38.2	-59.6	-63.2	-66.8
540	-0.7	-4.3	-7.9	-33.0	-36.6	-40.2	-58.6	-62.2	-65.8
500	-3.8	-7.4	-11.0	-33.6	-37.2	-40.8	-56.3	-59.9	-63.5
460	-5.7	-9.3	-12.9	-32.7	-36.3	-39.9	-52.6	-56.2	-59.8
420	-6.4	-10.0	-13.6	-30.3	-33.9	-37.5	-47.6	-51.2	-54.8
380	-5.7	-9.3	-12.9	-26.5	-30.1	-33.7	-41.2	-44.8	-48.4
340	-3.8	-7.4	-11.0	-21.2	-24.8	-28.4	-33.5	-37.1	-40.7

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4400	354.0								
4800	502.9	369.6	228.8						
5200	639.1	517.0	385.0						
5600	766.7	652.1	531.0	280.4					
6000			665.0	378.3					
6400				478.8	348.9				
6800				583.1	448.2	319.5			
7200				691.9	551.4	418.0			
7600					658.8	520.0	339.4		
8000						626.1	397.2		
8400						736.4	457.9	339.4	
8800							521.9	397.2	
9200							589.9	457.9	339.4
9600							662.9	521.9	397.2
10000								589.9	457.9
10400								662.9	521.9
10800									589.9
11200									662.9

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -120 ft/+110 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
640	4	6	8	-4	-2	0	-14	-12	-10
600	3	5	7	-5	-3	-1	-16	-14	-12
560	2	4	6	-7	-5	-3	-19	-17	-15
520	1	3	5	-8	-6	-4	-21	-19	-17
480	0	2	4	-10	-8	-6	-23	-21	-19
440	0	2	4	-11	-9	-7	-25	-23	-21
400	-1	1	3	-12	-10	-8	-27	-25	-23
360	-1	1	3	-13	-11	-9	-28	-26	-24
320	-1	1	3	-13	-11	-9	-29	-27	-25

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	0.0	0.0	-42.7	-45.9	-49.1	-90.4	-93.6	-96.8
660	0.0	0.0	-1.8	-45.5	-48.7	-51.9	-87.9	-91.1	-94.3
620	-2.2	-5.4	-8.6	-48.3	-51.5	-54.7	-85.5	-88.7	-91.9
580	-8.5	-11.7	-14.9	-50.6	-53.8	-57.0	-82.8	-86.0	-89.2
540	-13.3	-16.5	-19.7	-51.6	-54.8	-58.0	-79.1	-82.3	-85.5
500	-16.7	-19.9	-23.1	-51.1	-54.3	-57.5	-74.3	-77.5	-80.7
460	-18.6	-21.8	-25.0	-49.1	-52.3	-55.5	-68.5	-71.7	-74.9
420	-19.1	-22.3	-25.5	-45.7	-48.9	-52.1	-61.5	-64.7	-67.9
380	-18.0	-21.2	-24.4	-40.9	-44.1	-47.3	-53.6	-56.8	-60.0
340	-15.5	-18.7	-21.9	-34.7	-37.9	-41.1	-44.6	-47.8	-51.0
300	-11.7	-14.9	-18.1	-27.1	-30.3	-33.5	-34.6	-37.8	-41.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400	505.2								
5800	705.0	476.2							
6200		688.9	443.3						
6600			672.3						
7800				383.1					
8200				627.2	286.4				
8600					563.5				
9000					760.0	493.0			
9400						704.3			
11400							313.8		
11800							426.8		
12200							549.5	313.8	
12600							686.0	426.8	
13000								549.5	313.8
13400								686.0	426.8
13800									549.5
14200									686.0

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -150 ft/+140 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -230 ft/+220 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff
20% Thrust Reduction
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-7	-1	0	-17	-11	-5	-33	-27	-21
620	-8	-2	0	-19	-13	-7	-37	-31	-25
580	-9	-3	0	-21	-15	-9	-41	-35	-29
540	-11	-5	0	-24	-18	-12	-44	-38	-32
500	-12	-6	0	-27	-21	-15	-49	-43	-37
460	-14	-8	-2	-29	-23	-17	-53	-47	-41
420	-15	-9	-3	-32	-26	-20	-58	-52	-46
380	-16	-10	-4	-35	-29	-23	-62	-56	-50
340	-18	-12	-6	-37	-31	-25	-67	-61	-55
300	-19	-13	-7	-39	-33	-27	-72	-66	-60

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Minimum Control Speeds

V1(MCG), Minimum VR
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	108	115	104	111	103	109	101	108				
50	122	111	118	107	114	103	110	101	108	99	106	98	104
40	104	117	123	113	119	109	115	105	111	101	107	98	104
30	86	117	124	117	124	113	119	109	115	104	111	100	107
20	68	118	124	117	124	114	120	110	117	106	112	101	108
-60	-76	119	124	118	124	115	121	111	117	107	113	104	110

TO1 V1(MCG), Minimum VR
10% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	103	110	100	106	98	104	96	103				
50	122	106	112	102	108	98	105	96	103	95	101	93	99
40	104	111	118	107	114	103	110	100	106	96	102	93	99
30	86	112	118	112	118	107	114	103	110	99	106	95	102
20	68	112	118	112	118	108	115	105	111	101	107	97	103
-60	-76	113	118	113	118	109	115	106	112	102	108	99	105

TO2 V1(MCG), Minimum VR
20% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	98	105	95	101	93	100	92	98				
50	122	101	107	97	104	94	100	92	98	90	96	88	94
40	104	105	112	102	108	98	104	94	101	91	97	88	94
30	86	106	112	106	112	102	108	98	104	94	101	91	97
20	68	106	112	106	112	103	109	99	106	95	102	92	98
-60	-76	107	113	107	112	104	109	100	106	97	103	94	100

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Go-around EPR

Based on engine bleed for packs on and anti-ice off

REPORTED OAT		TAT	AIRPORT PRESSURE ALTITUDE (FT)										
°C	°F	°C	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
56	133	60	1.276	1.274	1.275	1.276	1.278	1.279	1.281	1.283	1.284	1.286	1.289
51	124	55	1.309	1.306	1.306	1.303	1.305	1.308	1.310	1.313	1.315	1.318	1.322
46	115	50	1.346	1.345	1.344	1.341	1.341	1.339	1.340	1.343	1.345	1.350	1.355
41	106	45	1.387	1.387	1.387	1.385	1.383	1.382	1.381	1.380	1.377	1.382	1.388
36	97	40	1.401	1.433	1.430	1.430	1.429	1.426	1.430	1.427	1.427	1.426	1.421
31	88	35	1.401	1.472	1.471	1.470	1.468	1.470	1.469	1.467	1.468	1.459	1.454
26	79	30	1.401	1.481	1.494	1.500	1.495	1.496	1.493	1.492	1.490	1.481	1.472
21	70	25	1.401	1.481	1.494	1.507	1.514	1.512	1.510	1.508	1.506	1.499	1.492
16	61	20	1.401	1.481	1.494	1.507	1.517	1.527	1.526	1.524	1.522	1.515	1.507
11	52	15	1.401	1.481	1.494	1.507	1.517	1.527	1.533	1.539	1.538	1.531	1.524
7	45	10	1.401	1.481	1.494	1.507	1.517	1.527	1.533	1.539	1.545	1.546	1.541
2 & BELOW	36 & BELOW	5 & BELOW	1.401	1.481	1.494	1.507	1.517	1.527	1.533	1.539	1.545	1.546	1.546

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	10000
PACKS OFF	0.013	0.013	0.014	0.016	0.017	0.018	0.020
2 PACKS ON - 2 BLEED SOURCES	0	0	0	0	0	0	0
2 PACKS ON - 1 BLEED SOURCE	-0.013	-0.014	-0.015	-0.016	-0.016	-0.018	-0.020
1 PACK ON - 2 BLEED SOURCES	-0.013	-0.014	-0.015	-0.016	-0.016	-0.018	-0.020
1 PACK ON - 1 BLEED SOURCE	-0.013	-0.014	-0.015	-0.016	-0.016	-0.018	-0.020
WING ANTI-ICE ON	-0.006	-0.006	-0.008	-0.008	-0.008	-0.009	-0.010

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb EPR

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (IAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	.84	.84	.84
60	1.148	1.134	1.141	1.151	1.154	1.104	1.100	1.171	1.186	1.201
50	1.186	1.171	1.158	1.151	1.154	1.104	1.100	1.171	1.186	1.201
40	1.210	1.212	1.198	1.186	1.161	1.104	1.100	1.171	1.186	1.201
30	1.210	1.234	1.252	1.241	1.209	1.153	1.113	1.171	1.186	1.201
20	1.210	1.234	1.264	1.301	1.277	1.248	1.223	1.193	1.186	1.201
10	1.210	1.234	1.264	1.301	1.330	1.382	1.338	1.294	1.281	1.289
0	1.210	1.234	1.264	1.301	1.330	1.410	1.441	1.401	1.384	1.384
-10	1.210	1.234	1.264	1.301	1.330	1.410	1.458	1.487	1.474	1.472
-15 & BELOW	1.210	1.234	1.264	1.301	1.330	1.410	1.458	1.503	1.505	1.504

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	40	43
ENGINE ONLY	-0.016	-0.015	-0.017	-0.019	-0.019	-0.021
ENGINE & WING*	-0.022	-0.025	-0.030	-0.034	-0.038	-0.042
ENGINE & WING**	-0.029	-0.035	-0.043	-0.048	-0.056	-0.063

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off, 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		350	450	550	650
40000 (.82M)	**PITCH ATT**	**3.5**	**3.5**		
	V/S (FT/MIN)	1300	500		
30000 (280 KIAS)	**PITCH ATT**	**4.5**	**4.0**	**4.0**	**4.5**
	V/S (FT/MIN)	2300	1500	1000	500
20000 (270 KIAS)	**PITCH ATT**	**7.0**	**6.5**	**6.0**	**6.5**
	V/S (FT/MIN)	3500	2500	1800	1200
10000 (270 KIAS)	**PITCH ATT**	**10.0**	**8.5**	**8.0**	**8.0**
	V/S (FT/MIN)	4600	3400	2600	2000
SEA LEVEL (270 KIAS)	**PITCH ATT**	**13.0**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	5500	4100	3200	2500

Cruise

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		350	450	550	650
40000 (.82M)	**PITCH ATT**	**2.0**	**2.5**		
	EPR	1.115	1.291		
	(Alt Mode %N1)	(80.2)	(86.4)		
35000 (280 KIAS)	**PITCH ATT**	**1.5**	**2.0**	**2.5**	
	EPR	1.044	1.113	1.240	
	(Alt Mode %N1)	(77.7)	(80.4)	(85.0)	
30000 (280 KIAS)	**PITCH ATT**	**1.5**	**2.0**	**3.0**	**3.5**
	EPR	0.993	1.042	1.112	1.229
	(Alt Mode %N1)	(74.2)	(76.9)	(80.2)	(85.1)
25000 (280 KIAS)	**PITCH ATT**	**1.5**	**2.5**	**3.0**	**4.0**
	EPR	0.967	0.999	1.046	1.117
	(Alt Mode %N1)	(70.7)	(73.1)	(76.4)	(80.2)
20000 (270 KIAS)	**PITCH ATT**	**1.5**	**2.5**	**3.5**	**4.5**
	EPR	0.963	0.985	1.021	1.074
	(Alt Mode %N1)	(66.5)	(68.7)	(72.0)	(76.4)
15000 (270 KIAS)	**PITCH ATT**	**1.5**	**2.5**	**3.5**	**4.5**
	EPR	0.962	0.978	1.002	1.039
	(Alt Mode %N1)	(63.7)	(65.5)	(68.3)	(71.9)

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		350	450	550	650
40000 (.82M)	**PITCH ATT**	**-1.0**	**-0.5**		
	V/S (FT/MIN)	-2600	-2500		
30000 (280 KIAS)	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.0**
	V/S (FT/MIN)	-2200	-1900	-1800	-1900
20000 (270 KIAS)	**PITCH ATT**	**-1.0**	**0.0**	**1.0**	**2.0**
	V/S (FT/MIN)	-1800	-1600	-1600	-1600
10000 (270 KIAS)	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.5**
	V/S (FT/MIN)	-1800	-1500	-1500	-1500
SEA LEVEL (270 KIAS)	**PITCH ATT**	**-2.0**	**-0.5**	**0.5**	**1.5**
	V/S (FT/MIN)	-1600	-1400	-1300	-1300

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		350	450	550	650
10000	**PITCH ATT**	**4.0**	**5.0**	**5.0**	**5.0**
	EPR	0.997	1.009	1.018	1.029
	(Alt Mode %N1)	(51.9)	(58.6)	(63.8)	(68.3)
	KIAS	200	217	238	259
5000	**PITCH ATT**	**4.0**	**4.5**	**5.0**	**5.0**
	EPR	0.995	1.004	1.010	1.017
	(Alt Mode %N1)	(48.2)	(54.1)	(59.8)	(64.3)
	KIAS	200	217	237	258

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)			
		350	450	550	650
FLAPS UP GEAR UP (VREF30+80)	**PITCH ATT**	**4.0**	**5.0**	**5.5**	**6.0**
	EPR	0.991	1.001	1.013	1.026
	(Alt Mode %N1)	(48.2)	(53.9)	(59.5)	(64.3)
	KIAS	203	216	231	245
FLAPS 1 GEAR UP (VREF30+60)	**PITCH ATT**	**5.5**	**6.5**	**7.0**	**7.5**
	EPR	1.005	1.017	1.031	1.049
	(Alt Mode %N1)	(48.6)	(54.6)	(60.5)	(65.7)
	KIAS	183	196	211	225
FLAPS 5 GEAR UP (VREF30+40)	**PITCH ATT**	**4.5**	**5.5**	**6.0**	**6.0**
	EPR	1.018	1.034	1.051	1.072
	(Alt Mode %N1)	(49.3)	(55.9)	(62.1)	(67.0)
	KIAS	163	176	191	205
FLAPS 15 GEAR UP (VREF30+20)	**PITCH ATT**	**5.5**	**6.5**	**6.5**	**7.0**
	EPR	1.033	1.053	1.077	1.102
	(Alt Mode %N1)	(51.3)	(58.7)	(64.4)	(69.5)
	KIAS	143	156	171	185
FLAPS 20 GEAR DOWN (VREF30+20)	**PITCH ATT**	**4.0**	**4.5**	**5.0**	**5.0**
	EPR	1.056	1.085	1.118	1.154
	(Alt Mode %N1)	(57.9)	(64.7)	(70.4)	(75.4)
	KIAS	143	156	171	185

Final Approach (1500 FT)

Gear Down, Set Thrust for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)			
		350	450	550	650
FLAPS 20 (VREF20+10)	**PITCH ATT**	**1.0**	**1.5**	**1.5**	**1.5**
	EPR	1.002	1.006	1.010	1.015
	(Alt Mode %N1)	(38.8)	(43.3)	(47.6)	(51.3)
	KIAS	140	158	174	188
FLAPS 25 (VREF25+10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**
	EPR	1.030	1.039	1.050	1.064
	(Alt Mode %N1)	(48.3)	(53.9)	(58.7)	(62.9)
	KIAS	136	153	169	182
FLAPS 30 (VREF30+10)	**PITCH ATT**	**0.5**	**1.0**	**1.0**	**1.0**
	EPR	1.048	1.060	1.079	1.101
	(Alt Mode %N1)	(54.0)	(58.7)	(63.8)	(68.6)
	KIAS	133	146	161	175

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

Normal Mode

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		350	450	550	650
10000	**PITCH ATT**	**16.0**	**12.5**	**10.5**	**9.0**
	V/S (FT/MIN)	3500	2600	1900	1500
	KIAS	140	157	171	185
5000	**PITCH ATT**	**19.5**	**15.5**	**12.5**	**10.5**
	V/S (FT/MIN)	4200	3200	2500	2000
	KIAS	140	157	171	185
SEA LEVEL	**PITCH ATT**	**22.5**	**18.0**	**14.5**	**12.5**
	V/S (FT/MIN)	4900	3800	3000	2500
	KIAS	143	156	171	185

Alternate Mode EEC

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		350	450	550	650
10000	**PITCH ATT**	**15.5**	**12.0**	**10.0**	**8.5**
	V/S (FT/MIN)	3400	2500	1800	1400
	KIAS	140	157	171	185
5000	**PITCH ATT**	**19.0**	**15.0**	**12.5**	**10.5**
	V/S (FT/MIN)	4100	3100	2400	1900
	KIAS	140	157	171	185
SEA LEVEL	**PITCH ATT**	**22.0**	**17.5**	**14.0**	**12.0**
	V/S (FT/MIN)	4700	3600	2900	2300
	KIAS	143	156	171	185

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29600	0	33100*	33100*	33100*	33100*	32000
640	30200	-1	33900*	33900*	33900*	33900*	32600
620	30900	-3	34700*	34700*	34700*	34700	33300
600	31600	-4	35400*	35400*	35400*	35400	34000
580	32400	-6	36100*	36100*	36100*	36100	34700
560	33100	-8	36700*	36700*	36700*	36700*	35500
540	33900	-9	37500*	37500*	37500*	37500*	36200
520	34700	-11	38200*	38200*	38200*	38200*	37000
500	35500	-13	39100*	39100*	39100*	39100*	37800
480	36400	-14	39900*	39900*	39900*	39900*	38700
460	37300	-14	40800*	40800*	40800*	40800*	39600
440	38200	-14	41700*	41700*	41700*	41700*	40500
420	39200	-14	42600*	42600*	42600*	42600*	41500
400	40200	-14	43100	43100	43100	43100	42500
380	41200	-14	43100	43100	43100	43100	43100
360	42400	-14	43100	43100	43100	43100	43100
340	43100	-14	43100	43100	43100	43100	43100

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29600	6	32200*	32200*	32200*	32200*	32000
640	30200	5	33000*	33000*	33000*	33000*	32600
620	30900	3	33800*	33800*	33800*	33800*	33300
600	31600	1	34700*	34700*	34700*	34700*	34000
580	32400	0	35500*	35500*	35500*	35500*	34700
560	33100	-2	36100*	36100*	36100*	36100*	35500
540	33900	-4	36800*	36800*	36800*	36800*	36200
520	34700	-6	37600*	37600*	37600*	37600*	37000
500	35500	-7	38500*	38500*	38500*	38500*	37800
480	36400	-9	39300*	39300*	39300*	39300*	38700
460	37300	-9	40200*	40200*	40200*	40200*	39600
440	38200	-9	41100*	41100*	41100*	41100*	40500
420	39200	-9	42000*	42000*	42000*	42000*	41500
400	40200	-9	43000*	43000*	43000*	43000*	42500
380	41200	-9	43100	43100	43100	43100	43100
360	42400	-9	43100	43100	43100	43100	43100
340	43100	-9	43100	43100	43100	43100	43100

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29600	12	30800*	30800*	30800*	30800*	30800*
640	30200	10	31700*	31700*	31700*	31700*	31700*
620	30900	9	32700*	32700*	32700*	32700*	32700*
600	31600	7	33600*	33600*	33600*	33600*	33600*
580	32400	5	34500*	34500*	34500*	34500*	34500*
560	33100	4	35400*	35400*	35400*	35400*	35400*
540	33900	2	36100*	36100*	36100*	36100*	36100*
520	34700	0	36800*	36800*	36800*	36800*	36800*
500	35500	-2	37600*	37600*	37600*	37600*	37600*
480	36400	-3	38400*	38400*	38400*	38400*	38400*
460	37300	-3	39300*	39300*	39300*	39300*	39300*
440	38200	-3	40200*	40200*	40200*	40200*	40200*
420	39200	-3	41100*	41100*	41100*	41100*	41100*
400	40200	-3	42100*	42100*	42100*	42100*	42100*
380	41200	-3	43100	43100	43100	43100	43100
360	42400	-3	43100	43100	43100	43100	43100
340	43100	-3	43100	43100	43100	43100	43100

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		25	27	29	31	33	35	37	39	41	43
660	EPR	1.086	1.119	1.161	1.240	1.365					
	MACH	.772	.802	.834	.841	.835					
	KIAS	325	325	325	314	299					
	FF/ENG	9579	9655	9851	10001	10440					
620	EPR	1.065	1.093	1.127	1.186	1.273	1.423				
	MACH	.772	.802	.834	.842	.840	.832				
	KIAS	325	325	325	314	300	284				
	FF/ENG	9175	9226	9347	9337	9404	10053				
580	EPR	1.046	1.070	1.099	1.143	1.207	1.309				
	MACH	.772	.802	.832	.841	.841	.838				
	KIAS	325	325	324	314	301	286				
	FF/ENG	8821	8856	8913	8764	8672	8845				
540	EPR	1.029	1.051	1.076	1.108	1.156	1.228	1.349			
	MACH	.770	.794	.817	.835	.841	.841	.836			
	KIAS	324	321	318	312	301	287	273			
	FF/ENG	8468	8408	8339	8231	8088	8035	8374			
500	EPR	1.012	1.033	1.055	1.081	1.116	1.169	1.249	1.384		
	MACH	.744	.773	.797	.820	.837	.841	.841	.835		
	KIAS	312	312	309	306	299	288	274	260		
	FF/ENG	7832	7811	7745	7676	7560	7432	7464	7940		
460	EPR	0.998	1.014	1.036	1.059	1.085	1.123	1.179	1.265	1.409	
	MACH	.715	.746	.775	.799	.823	.838	.842	.840	.833	
	KIAS	299	300	300	297	293	286	275	262	248	
	FF/ENG	7191	7183	7169	7092	7024	6908	6838	6940	7454	
420	EPR	0.987	0.998	1.015	1.037	1.061	1.088	1.127	1.186	1.274	1.422
	MACH	.681	.714	.745	.775	.800	.823	.838	.842	.840	.833
	KIAS	284	286	287	287	284	281	274	262	250	236
	FF/ENG	6542	6549	6544	6530	6449	6384	6312	6293	6396	6897
380	EPR	0.979	0.987	0.998	1.014	1.037	1.061	1.089	1.129	1.187	1.274
	MACH	.647	.677	.710	.742	.773	.798	.822	.838	.842	.840
	KIAS	269	271	273	274	274	271	268	261	251	239
	FF/ENG	6033	5906	5912	5908	5893	5832	5792	5765	5745	5831
340	EPR	0.974	0.978	0.986	0.996	1.012	1.034	1.059	1.088	1.126	1.181
	MACH	.612	.639	.669	.702	.736	.767	.794	.819	.837	.841
	KIAS	254	255	256	258	260	260	258	254	249	239
	FF/ENG	5422	5397	5384	5277	5274	5265	5243	5240	5221	5195
300	EPR	0.971	0.974	0.977	0.984	0.994	1.008	1.030	1.054	1.083	1.117
	MACH	.578	.601	.628	.658	.690	.725	.758	.787	.812	.833
	KIAS	239	239	239	240	242	244	245	243	241	236
	FF/ENG	4837	4793	4765	4752	4743	4643	4667	4688	4684	4675

Shaded area approximates optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
281	260	241	226	212	200	191	183	175	168	162
422	390	363	339	319	300	287	275	263	254	245
562	521	484	452	425	400	383	366	352	339	327
702	651	605	565	531	500	479	459	441	424	409
843	781	726	679	637	600	575	551	529	509	491
985	912	847	792	743	700	670	643	617	594	573
1126	1043	969	905	850	800	766	735	706	679	655
1267	1174	1091	1019	956	900	862	827	795	765	738
1409	1305	1212	1132	1063	1000	958	919	883	850	820
1551	1436	1333	1246	1169	1100	1054	1011	972	935	902
1694	1568	1455	1359	1275	1200	1150	1103	1060	1020	984
1837	1700	1578	1473	1382	1300	1246	1195	1148	1105	1065
1980	1832	1700	1587	1489	1400	1341	1287	1236	1190	1147
2123	1964	1822	1701	1595	1500	1437	1379	1324	1275	1229
2267	2097	1945	1815	1702	1600	1533	1470	1413	1360	1311
2411	2229	2068	1929	1808	1700	1629	1562	1501	1444	1392
2555	2362	2190	2043	1915	1800	1725	1654	1589	1529	1474
2700	2495	2313	2157	2022	1900	1820	1746	1677	1614	1556
2845	2628	2435	2271	2128	2000	1916	1838	1766	1699	1638

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	8.3	0:38	7.0	0:37	5.7	0:35	5.0	0:34	4.3	0:33
300	13.0	0:55	11.4	0:53	9.5	0:50	8.5	0:47	7.6	0:46
400	17.7	1:13	15.8	1:09	13.3	1:04	12.0	1:01	11.0	0:59
500	22.3	1:30	20.1	1:26	17.0	1:19	15.5	1:15	14.2	1:12
600	26.9	1:47	24.4	1:42	20.8	1:34	19.0	1:29	17.5	1:25
700	31.6	2:05	28.7	1:59	24.5	1:49	22.5	1:43	20.8	1:38
800	36.3	2:22	33.0	2:15	28.2	2:04	26.0	1:57	24.1	1:51
900	40.9	2:40	37.3	2:32	32.0	2:19	29.5	2:11	27.3	2:04
1000	45.5	2:58	41.5	2:49	35.8	2:34	32.9	2:25	30.5	2:17
1100	50.1	3:16	45.8	3:06	39.5	2:50	36.3	2:39	33.7	2:30
1200	54.7	3:33	50.0	3:22	43.2	3:05	39.8	2:53	37.0	2:43
1300	59.2	3:52	54.2	3:39	46.9	3:20	43.2	3:07	40.1	2:56
1400	63.8	4:10	58.4	3:56	50.6	3:36	46.6	3:21	43.3	3:10
1500	68.3	4:28	62.5	4:13	54.3	3:51	50.0	3:36	46.5	3:23
1600	72.8	4:46	66.7	4:30	58.0	4:07	53.3	3:50	49.7	3:36
1700	77.3	5:04	70.8	4:48	61.6	4:22	56.7	4:04	52.8	3:50
1800	81.7	5:23	74.9	5:05	65.3	4:38	60.0	4:19	55.9	4:03
1900	86.1	5:41	79.0	5:22	68.9	4:54	63.4	4:33	59.0	4:17
2000	90.6	6:00	83.1	5:40	72.5	5:09	66.7	4:48	62.2	4:30

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - Low Altitudes
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	300	400	500	600	700
10	-1.4	-0.7	0.0	1.0	2.2
20	-3.6	-1.5	0.0	2.2	4.9
30	-5.6	-2.5	0.0	3.4	7.4
40	-7.7	-3.4	0.0	4.6	10.0
50	-9.8	-4.4	0.0	5.8	12.5
60	-12.0	-5.4	0.0	7.0	14.9
70	-14.2	-6.4	0.0	8.2	17.3
80	-16.5	-7.5	0.0	9.3	19.6
90	-18.7	-8.6	0.0	10.5	21.9
100	-21.1	-9.7	0.0	11.7	24.1
110	-23.4	-10.8	0.0	12.8	26.3
120	-25.5	-12.0	0.0	13.9	28.5

Based on Long Range Cruise and .84/310/250 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
519	490	463	440	419	400	384	368	353	339	326
1027	972	922	877	837	800	768	737	709	682	658
1537	1456	1382	1315	1255	1200	1152	1107	1065	1026	990
2049	1941	1842	1754	1674	1600	1536	1476	1420	1369	1322
2562	2427	2304	2193	2093	2000	1920	1845	1776	1712	1653
3077	2914	2766	2632	2511	2400	2304	2215	2132	2055	1984
3594	3403	3229	3072	2931	2800	2688	2584	2487	2398	2315
4113	3893	3692	3513	3350	3200	3073	2954	2843	2741	2647
4634	4385	4157	3954	3770	3600	3457	3323	3199	3084	2979
5157	4879	4624	4396	4190	4000	3841	3692	3554	3427	3310
5683	5374	5091	4838	4610	4400	4225	4062	3910	3770	3641
6211	5871	5560	5282	5031	4800	4609	4431	4266	4112	3972
6742	6370	6029	5726	5452	5200	4994	4801	4621	4455	4303
7275	6870	6500	6171	5873	5600	5378	5170	4976	4798	4634
7812	7373	6973	6616	6295	6000	5761	5539	5331	5140	4964
8351	7878	7447	7063	6717	6400	6145	5907	5686	5481	5293
8894	8386	7922	7510	7140	6800	6529	6275	6040	5822	5623
9441	8896	8399	7959	7563	7200	6912	6644	6394	6163	5951
9990	9408	8878	8408	7987	7600	7296	7012	6748	6504	6280
10543	9923	9358	8859	8410	8000	7679	7380	7101	6844	6608

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
400	11.3	0:57	10.8	0:56	10.4	0:56	10.3	0:57	10.3	0:57
800	23.8	1:49	22.9	1:48	22.2	1:46	21.7	1:47	21.7	1:47
1200	36.2	2:42	35.0	2:39	33.9	2:37	33.2	2:36	33.1	2:37
1600	48.7	3:34	47.1	3:30	45.7	3:27	44.7	3:26	44.4	3:27
2000	61.1	4:27	59.2	4:21	57.4	4:17	56.1	4:16	55.8	4:16
2400	73.1	5:21	70.8	5:14	68.7	5:08	67.1	5:06	66.5	5:06
2800	85.1	6:15	82.4	6:06	80.0	5:59	78.1	5:56	77.3	5:56
3200	96.9	7:10	93.8	6:59	91.1	6:51	88.8	6:47	87.8	6:46
3600	108.4	8:06	105.0	7:53	101.9	7:43	99.4	7:38	98.1	7:36
4000	119.9	9:02	116.2	8:47	112.8	8:36	110.0	8:29	108.4	8:26
4400	131.0	10:00	127.0	9:43	123.2	9:29	120.1	9:21	118.3	9:17
4800	142.1	10:58	137.7	10:38	133.7	10:23	130.2	10:13	128.1	10:08
5200	153.1	11:58	148.3	11:35	143.9	11:17	140.2	11:06	137.8	10:59
5600	163.9	12:58	158.6	12:33	154.0	12:13	150.0	11:59	147.3	11:51
6000	174.7	13:59	169.0	13:31	164.0	13:08	159.7	12:53	156.8	12:43
6400	185.2	15:02	179.1	14:31	173.7	14:05	169.1	13:48	165.9	13:36
6800	195.7	16:05	189.2	15:31	183.3	15:03	178.5	14:43	175.0	14:28
7200	206.0	17:10	199.2	16:32	192.9	16:01	187.7	15:38	184.0	15:22
7600	216.1	18:15	209.0	17:35	202.4	17:01	196.7	16:35	192.8	16:17
8000	226.2	19:21	218.8	18:38	211.8	18:00	205.8	17:32	201.6	17:11

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitudes

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	300	400	500	600	700
10	-1.8	-1.6	0.0	10.3	37.0
20	-3.8	-2.5	0.0	13.8	45.6
30	-5.9	-3.5	0.0	17.1	53.7
40	-8.0	-4.4	0.0	20.3	61.4
50	-10.1	-5.4	0.0	23.2	68.5
60	-12.3	-6.4	0.0	26.1	75.2
70	-14.5	-7.4	0.0	28.7	81.4
80	-16.7	-8.4	0.0	31.2	87.1
90	-18.9	-9.5	0.0	33.5	92.3
100	-21.2	-10.5	0.0	35.6	97.0
110	-23.5	-11.6	0.0	37.5	101.2
120	-25.8	-12.6	0.0	39.3	104.9
130	-28.1	-13.7	0.0	40.9	108.2
140	-30.5	-14.8	0.0	42.3	110.9
150	-32.9	-15.9	0.0	43.6	113.2
160	-35.3	-17.0	0.0	44.7	115.0
170	-37.8	-18.2	0.0	45.6	116.2
180	-40.3	-19.3	0.0	46.3	117.0
190	-42.8	-20.5	0.0	46.9	117.4
200	-45.3	-21.6	0.0	47.3	117.2
210	-47.9	-22.8	0.0	47.5	116.5
220	-50.5	-24.0	0.0	47.5	115.3
230	-53.1	-25.2	0.0	47.4	113.7
240	-55.8	-26.5	0.0	47.1	111.6

Based on Long Range Cruise and .84/310/250 descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)									
	660	620	580	540	500	460	420	380	340	300
43						116	48	11	0	8
41					104	45	12	0	5	22
39				87	39	10	0	3	17	39
37			69	30	8	0	3	15	34	57
35	95	51	21	5	0	3	14	31	52	74
33	35	13	2	0	4	15	30	49	69	90
31	7	0	0	6	16	30	47	66	85	103
29	0	1	8	18	32	47	64	81	98	114
27	4	11	21	34	48	64	80	95	110	124
25	15	25	37	50	65	79	93	107	120	131

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent at .84/310/250

PRESSURE ALT (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	95	102	109	116	122	127	132	138	144	150
TIME (MINUTES)	19	20	21	22	23	23	24	25	26	26

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
660	EPR	1.012	1.018	1.030	1.036	1.041	1.097	1.196			
	KIAS	259	260	261	277	302	306	310			
	FF/ENG	9680	9510	9390	9240	9440	9630	10080			
620	EPR	1.010	1.015	1.025	1.035	1.036	1.078	1.162	1.413		
	KIAS	251	252	253	262	287	296	300	279		
	FF/ENG	9050	8940	8800	8620	8720	8940	9250	10290		
580	EPR	1.008	1.012	1.021	1.034	1.036	1.061	1.133	1.303		
	KIAS	243	244	245	248	269	285	289	279		
	FF/ENG	8590	8500	8350	8150	7990	8280	8500	9020		
540	EPR	1.006	1.009	1.017	1.030	1.036	1.045	1.105	1.223		
	KIAS	234	235	236	237	252	275	278	279		
	FF/ENG	8020	7900	7790	7580	7460	7630	7790	8160		
500	EPR	1.004	1.007	1.013	1.024	1.035	1.037	1.081	1.173		
	KIAS	226	226	227	228	235	259	267	271		
	FF/ENG	7470	7320	7230	7020	6840	6960	7130	7370		
460	EPR	1.002	1.005	1.010	1.019	1.034	1.037	1.060	1.135	1.320	
	KIAS	218	218	218	219	220	238	255	259	249	
	FF/ENG	6910	6770	6650	6470	6300	6400	6490	6640	7260	
420	EPR	0.998	1.001	1.005	1.012	1.024	1.036	1.041	1.101	1.219	1.412
	KIAS	212	212	212	212	212	220	243	246	249	232
	FF/ENG	6370	6230	6080	5930	5800	5770	5860	5960	6400	7050
380	EPR	0.995	0.997	1.000	1.005	1.014	1.030	1.038	1.072	1.162	1.267
	KIAS	205	205	205	205	205	205	221	233	237	232
	FF/ENG	5830	5700	5560	5410	5310	5190	5290	5350	5620	5920
340	EPR	0.991	0.992	0.994	0.996	1.001	1.011	1.031	1.047	1.115	1.182
	KIAS	203	203	203	203	203	203	203	219	223	225
	FF/ENG	5380	5240	5100	4950	4860	4730	4690	4860	4920	5140
300	EPR	0.986	0.986	0.987	0.988	0.989	0.995	1.005	1.030	1.077	1.126
	KIAS	203	203	203	203	203	203	203	203	208	210
	FF/ENG	5040	4900	4730	4590	4490	4340	4280	4240	4390	4510

This table includes 5% additional fuel for holding in a race track pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
660	EPR	1.041	1.054	1.078	1.115	1.169
	KIAS	224	224	224	224	224
	FF/ENG	9950	9830	9750	9520	9610
620	EPR	1.035	1.046	1.067	1.098	1.147
	KIAS	219	219	219	219	219
	FF/ENG	9310	9200	9140	8890	8880
580	EPR	1.029	1.037	1.056	1.082	1.125
	KIAS	215	215	215	215	215
	FF/ENG	8840	8720	8630	8410	8180
540	EPR	1.024	1.031	1.047	1.069	1.105
	KIAS	210	210	210	210	210
	FF/ENG	8240	8110	8020	7820	7700
500	EPR	1.019	1.025	1.038	1.058	1.087
	KIAS	204	204	204	204	204
	FF/ENG	7650	7520	7430	7260	7120
460	EPR	1.014	1.020	1.030	1.046	1.071
	KIAS	198	198	198	198	198
	FF/ENG	7050	6940	6830	6690	6570
420	EPR	1.010	1.015	1.023	1.036	1.056
	KIAS	192	192	192	192	192
	FF/ENG	6470	6360	6260	6130	6030
380	EPR	1.006	1.010	1.017	1.027	1.043
	KIAS	185	185	185	185	185
	FF/ENG	5890	5790	5700	5590	5510
340	EPR	1.001	1.004	1.009	1.016	1.027
	KIAS	183	183	183	183	183
	FF/ENG	5400	5290	5200	5090	5040
300	EPR	0.996	0.998	1.002	1.007	1.014
	KIAS	183	183	183	183	183
	FF/ENG	5030	4910	4810	4680	4660

This table includes 5% additional fuel for holding in a race track pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	3880	80/-30	70	-140/470	30/-30	70/-70	130	60	140
AUTOBRAKE MAX	5010	70/-50	100	-200/660	0/0	100/-100	240	0	0
AUTOBRAKE 4	6050	90/-60	140	-260/920	0/-20	150/-150	300	0	0
AUTOBRAKE 3	7120	120/-80	170	-330/1150	30/-50	180/-180	350	0	0
AUTOBRAKE 2	7770	140/-100	220	-380/1320	90/-140	210/-200	320	140	140
AUTOBRAKE 1	8250	150/-130	240	-430/1470	160/-200	220/-220	320	490	530

Good Reported Braking Action

MAX MANUAL	5080	70/-60	120	-220/790	120/-90	100/-100	180	240	560
AUTOBRAKE MAX	5410	80/-60	130	-230/830	90/-70	120/-120	230	250	580
AUTOBRAKE 4	6070	90/-60	140	-260/940	30/-20	150/-150	300	20	90
AUTOBRAKE 3	7120	120/-80	170	-330/1150	30/-50	180/-180	350	0	0
AUTOBRAKE 2	7770	140/-100	220	-380/1320	90/-140	210/-200	320	140	140
AUTOBRAKE 1	8250	150/-130	240	-430/1470	160/-200	220/-220	320	490	530

Good To Medium Reported Braking Action

MAX MANUAL	5850	90/-70	150	-280/1050	200/-160	130/-130	210	450	1100
AUTOBRAKE MAX	6030	100/-70	160	-290/1070	180/-130	140/-140	250	440	1090
AUTOBRAKE 4	6430	100/-70	160	-310/1130	140/-100	160/-160	290	320	860
AUTOBRAKE 3	7270	120/-90	180	-360/1280	110/-90	180/-180	350	150	550
AUTOBRAKE 2	7860	140/-110	220	-400/1410	150/-170	210/-200	320	220	470
AUTOBRAKE 1	8290	150/-130	240	-430/1520	210/-220	220/-220	320	530	720

Medium Reported Braking Action

MAX MANUAL	6610	120/-90	180	-350/1300	280/-220	160/-150	230	660	1630
AUTOBRAKE MAX	6660	120/-80	180	-360/1310	260/-180	160/-160	280	620	1600
AUTOBRAKE 4	6790	120/-80	180	-360/1320	250/-170	160/-160	290	620	1620
AUTOBRAKE 3	7430	120/-90	200	-390/1410	180/-130	180/-180	350	300	1090
AUTOBRAKE 2	7950	140/-120	220	-410/1500	210/-200	210/-210	320	300	810
AUTOBRAKE 1	8330	150/-130	240	-440/1580	250/-240	220/-220	320	580	910

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	7450	140/-110	220	-430/1670	450/-320	180/-180	250	1020	2730
AUTOBRAKE MAX	7490	140/-100	220	-440/1670	450/-300	180/-180	280	1010	2710
AUTOBRAKE 4	7570	140/-100	220	-440/1680	440/-300	190/-180	280	1010	2740
AUTOBRAKE 3	7980	140/-110	220	-460/1740	390/-250	200/-200	340	790	2420
AUTOBRAKE 2	8380	160/-130	240	-480/1800	400/-290	220/-210	320	700	2130
AUTOBRAKE 1	8670	160/-130	260	-490/1860	420/-320	220/-220	320	900	2090
Poor Reported Braking Action									
MAX MANUAL	8290	160/-130	250	-520/2040	630/-410	210/-210	260	1380	3820
AUTOBRAKE MAX	8310	160/-130	250	-520/2040	640/-430	210/-210	280	1390	3830
AUTOBRAKE 4	8360	160/-130	250	-520/2050	630/-430	220/-210	260	1400	3860
AUTOBRAKE 3	8530	160/-130	250	-530/2070	600/-370	220/-220	330	1280	3750
AUTOBRAKE 2	8810	170/-140	260	-540/2100	590/-390	230/-220	310	1100	3450
AUTOBRAKE 1	9020	170/-140	280	-550/2140	590/-400	230/-230	320	1230	3280

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 220 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 180 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4030	90/-50	70	-140/480	50/-30	70/-70	130	70	160
AUTOBRAKE MAX	5310	70/-70	120	-210/690	0/0	120/-120	240	0	0
AUTOBRAKE 4	6470	90/-90	160	-280/950	10/-20	160/-160	310	0	0
AUTOBRAKE 3	7620	130/-130	200	-350/1200	50/-80	200/-200	330	10	10
AUTOBRAKE 2	8260	150/-150	240	-400/1370	130/-160	220/-220	320	280	280
AUTOBRAKE 1	8690	170/-160	260	-440/1520	200/-220	240/-230	320	680	780
Good Reported Braking Action									
MAX MANUAL	5310	80/-80	130	-230/820	120/-100	120/-120	180	290	660
AUTOBRAKE MAX	5670	80/-80	130	-240/850	90/-60	130/-130	240	280	670
AUTOBRAKE 4	6490	100/-90	160	-290/980	30/-20	160/-160	310	20	90
AUTOBRAKE 3	7620	130/-130	200	-350/1200	50/-80	200/-200	330	10	10
AUTOBRAKE 2	8260	150/-150	240	-400/1370	130/-160	220/-220	320	280	280
AUTOBRAKE 1	8690	170/-160	260	-440/1520	200/-220	240/-230	320	680	780
Good To Medium Reported Braking Action									
MAX MANUAL	6110	100/-100	160	-290/1070	200/-160	140/-140	210	520	1280
AUTOBRAKE MAX	6330	100/-100	160	-300/1090	180/-130	150/-140	260	500	1270
AUTOBRAKE 4	6830	120/-100	180	-330/1170	130/-100	170/-170	300	330	960
AUTOBRAKE 3	7790	130/-130	200	-370/1330	120/-120	200/-200	330	160	600
AUTOBRAKE 2	8340	150/-150	240	-410/1450	180/-190	220/-220	320	350	630
AUTOBRAKE 1	8740	170/-170	260	-440/1560	240/-240	240/-230	320	720	980
Medium Reported Braking Action									
MAX MANUAL	6910	130/-120	200	-360/1320	280/-220	160/-160	230	750	1910
AUTOBRAKE MAX	6980	130/-120	200	-360/1330	260/-200	170/-160	280	720	1860
AUTOBRAKE 4	7160	130/-120	200	-370/1360	230/-170	170/-170	300	630	1830
AUTOBRAKE 3	7950	130/-130	210	-400/1460	180/-160	210/-200	330	310	1200
AUTOBRAKE 2	8430	150/-150	240	-430/1540	240/-220	220/-220	320	430	990
AUTOBRAKE 1	8790	170/-170	260	-450/1610	290/-260	240/-230	320	770	1180

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	7770	150/-140	230	-440/1700	450/-320	190/-180	250	1150	3170
AUTOBRAKE MAX	7820	150/-140	240	-440/1700	450/-310	200/-190	280	1140	3150
AUTOBRAKE 4	7940	150/-140	240	-450/1710	440/-300	200/-200	290	1100	3150
AUTOBRAKE 3	8470	150/-140	240	-470/1780	390/-270	220/-210	330	830	2730
AUTOBRAKE 2	8840	170/-160	260	-490/1840	420/-310	230/-220	320	850	2480
AUTOBRAKE 1	9130	180/-180	280	-510/1900	440/-350	250/-240	320	1100	2500
Poor Reported Braking Action									
MAX MANUAL	8640	170/-160	260	-530/2070	630/-430	220/-210	260	1550	4430
AUTOBRAKE MAX	8660	170/-160	280	-530/2070	640/-430	220/-220	280	1560	4440
AUTOBRAKE 4	8720	170/-160	280	-530/2070	640/-430	220/-220	280	1580	4470
AUTOBRAKE 3	8990	170/-160	260	-540/2100	590/-380	230/-230	320	1350	4260
AUTOBRAKE 2	9260	180/-170	290	-550/2140	600/-400	240/-230	310	1280	3970
AUTOBRAKE 1	9480	180/-180	300	-560/2190	600/-430	250/-240	320	1430	3820

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 230 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4160	90/-50	80	-140/490	50/-30	80/-80	140	80	180
AUTOBRAKE MAX	5540	80/-80	120	-210/700	0/0	130/-130	240	0	0
AUTOBRAKE 4	6800	100/-120	160	-290/990	0/-10	170/-170	330	0	0
AUTOBRAKE 3	8070	130/-140	210	-370/1240	30/-80	210/-210	360	10	10
AUTOBRAKE 2	8770	160/-170	250	-410/1410	120/-170	240/-230	350	250	250
AUTOBRAKE 1	9270	180/-180	290	-460/1580	200/-230	250/-250	350	710	770
Good Reported Braking Action									
MAX MANUAL	5550	80/-80	140	-240/840	130/-100	130/-130	200	320	750
AUTOBRAKE MAX	5900	90/-90	140	-250/870	90/-70	140/-130	250	310	760
AUTOBRAKE 4	6820	100/-120	160	-300/1010	20/-20	170/-170	330	20	100
AUTOBRAKE 3	8070	130/-140	210	-370/1240	30/-80	210/-210	360	10	10
AUTOBRAKE 2	8770	160/-170	250	-410/1410	120/-170	240/-230	350	250	250
AUTOBRAKE 1	9270	180/-180	290	-460/1580	200/-230	250/-250	350	710	770
Good To Medium Reported Braking Action									
MAX MANUAL	6420	100/-100	170	-300/1100	210/-170	160/-150	220	590	1480
AUTOBRAKE MAX	6620	120/-110	170	-310/1120	190/-140	160/-150	260	560	1450
AUTOBRAKE 4	7180	120/-120	180	-340/1200	140/-100	180/-180	330	390	1120
AUTOBRAKE 3	8230	130/-140	210	-390/1370	110/-120	210/-210	360	180	710
AUTOBRAKE 2	8870	160/-170	260	-430/1500	170/-200	240/-240	350	330	680
AUTOBRAKE 1	9320	180/-190	290	-470/1620	240/-250	260/-250	350	760	1000
Medium Reported Braking Action									
MAX MANUAL	7290	130/-130	210	-370/1370	300/-240	180/-170	240	850	2210
AUTOBRAKE MAX	7340	140/-130	210	-370/1370	290/-210	180/-170	280	820	2150
AUTOBRAKE 4	7540	130/-130	210	-380/1390	250/-170	180/-180	320	750	2130
AUTOBRAKE 3	8400	140/-150	220	-410/1510	180/-160	220/-220	360	350	1410
AUTOBRAKE 2	8960	160/-170	260	-450/1590	230/-220	240/-240	350	410	1100
AUTOBRAKE 1	9360	180/-200	290	-470/1670	290/-280	260/-250	350	810	1230

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	8230	160/-160	250	-460/1750	490/-350	210/-200	260	1320	3690
AUTOBRAKE MAX	8260	160/-160	250	-460/1750	490/-330	210/-200	280	1300	3670
AUTOBRAKE 4	8400	160/-160	250	-470/1770	470/-320	210/-210	310	1270	3670
AUTOBRAKE 3	8960	160/-170	250	-490/1830	400/-290	240/-230	350	950	3210
AUTOBRAKE 2	9400	180/-180	290	-510/1900	430/-320	250/-250	340	910	2900
AUTOBRAKE 1	9720	200/-200	300	-530/1960	470/-360	270/-260	350	1180	2830
Poor Reported Braking Action									
MAX MANUAL	9170	180/-180	300	-550/2130	680/-460	240/-230	290	1780	5180
AUTOBRAKE MAX	9190	180/-180	300	-550/2130	690/-460	240/-230	290	1780	5190
AUTOBRAKE 4	9250	200/-180	300	-550/2140	680/-460	240/-230	300	1790	5220
AUTOBRAKE 3	9530	180/-180	290	-560/2160	620/-410	250/-240	350	1560	5010
AUTOBRAKE 2	9830	200/-200	310	-580/2210	630/-430	260/-250	330	1410	4690
AUTOBRAKE 1	10070	210/-210	320	-590/2250	640/-450	280/-260	350	1560	4430

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 240 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4160	100/-50	90	-170/580	70/-60	80/-80	140	160	350
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5460	90/-90	140	-270/960	170/-140	130/-120	190	470	1150
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	6120	110/-100	170	-320/1210	270/-210	150/-140	200	720	1880
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	6780	130/-120	200	-380/1460	370/-270	170/-160	220	980	2620
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	7700	160/-140	240	-490/1940	740/-410	200/-190	230	1530	4620
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	8620	180/-170	280	-590/2430	1100/-550	220/-210	250	2090	6620
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3990	90/-40	80	-160/570	70/-60	80/-80	140	130	300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5220	80/-60	130	-260/950	170/-140	120/-120	190	410	980
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	5860	100/-80	160	-320/1190	270/-200	140/-140	200	630	1610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	6490	120/-90	190	-380/1430	360/-270	160/-160	220	860	2250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	7390	150/-120	230	-480/1920	730/-410	190/-180	230	1370	4000
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	8290	170/-140	260	-580/2400	1090/-550	210/-210	250	1880	5760
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4080	80/-50	80	-140/480	50/-40	80/-80	150	100	210
AUTOBRAKE MAX	4820	70/-70	100	-180/610	0/0	110/-110	210	0	0
AUTOBRAKE 2	7880	130/-150	210	-370/1260	10/-70	220/-220	400	10	10
Good Reported Braking Action									
MAX MANUAL	5420	80/-90	140	-230/800	130/-110	120/-120	210	370	870
AUTOBRAKE MAX	5400	90/-90	140	-230/800	120/-100	120/-120	230	350	840
AUTOBRAKE 2	7880	130/-150	210	-370/1260	10/-70	220/-220	400	10	10
Good To Medium Reported Braking Action									
MAX MANUAL	6240	110/-110	180	-290/1040	220/-180	150/-150	240	670	1720
AUTOBRAKE MAX	6210	110/-110	180	-290/1040	230/-180	150/-150	250	650	1700
AUTOBRAKE 2	7990	140/-150	220	-390/1340	90/-110	220/-220	390	120	790
Medium Reported Braking Action									
MAX MANUAL	7060	130/-130	210	-350/1280	310/-240	180/-170	270	960	2570
AUTOBRAKE MAX	7020	130/-130	210	-350/1280	330/-260	180/-170	270	950	2550
AUTOBRAKE 3	7470	130/-130	200	-370/1330	220/-100	190/-190	370	590	2220
Medium To Poor Reported Braking Action									
MAX MANUAL	7940	160/-160	250	-440/1630	500/-350	210/-200	290	1460	4330
AUTOBRAKE MAX	7930	160/-160	260	-440/1630	530/-370	210/-200	290	1460	4330
AUTOBRAKE 3	8180	160/-150	250	-450/1650	460/-260	220/-210	360	1270	4150
Poor Reported Braking Action									
MAX MANUAL	8820	190/-180	290	-520/1970	690/-460	230/-220	310	1960	6090
AUTOBRAKE MAX	8840	190/-180	300	-520/1970	720/-480	240/-220	310	1970	6100
AUTOBRAKE 3	8880	190/-170	300	-520/1970	700/-410	240/-230	350	1940	6080

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4390	80/-60	90	-150/500	50/-50	90/-90	N/A	120	260
AUTOBRAKE MAX	5250	70/-80	120	-190/650	0/0	120/-120	N/A	0	0
AUTOBRAKE 2	8680	150/-160	250	-390/1330	50/-120	240/-240	N/A	100	100
Good Reported Braking Action									
MAX MANUAL	5840	90/-90	150	-240/830	140/-120	140/-130	N/A	430	1020
AUTOBRAKE MAX	5860	90/-90	150	-240/840	130/-110	140/-140	N/A	420	990
AUTOBRAKE 2	8680	150/-160	250	-390/1330	50/-120	240/-240	N/A	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	6720	110/-120	190	-310/1080	240/-190	170/-160	N/A	750	1950
AUTOBRAKE MAX	6710	110/-120	190	-300/1080	240/-200	170/-160	N/A	740	1930
AUTOBRAKE 2	8770	150/-160	250	-410/1410	130/-150	240/-240	N/A	210	890
Medium Reported Braking Action									
MAX MANUAL	7590	140/-140	230	-370/1330	330/-260	200/-190	N/A	1080	2880
AUTOBRAKE MAX	7560	140/-140	240	-370/1320	350/-280	200/-190	N/A	1070	2860
AUTOBRAKE 3	8200	140/-140	230	-390/1400	210/-120	220/-220	N/A	570	2370
Medium To Poor Reported Braking Action									
MAX MANUAL	8520	170/-160	280	-450/1670	520/-370	220/-220	N/A	1600	4730
AUTOBRAKE MAX	8510	170/-160	280	-450/1670	550/-390	230/-220	N/A	1600	4730
AUTOBRAKE 3	8890	160/-160	270	-470/1710	450/-270	240/-230	N/A	1310	4450
Poor Reported Braking Action									
MAX MANUAL	9440	200/-190	320	-530/2020	720/-480	250/-240	N/A	2130	6590
AUTOBRAKE MAX	9450	200/-190	330	-530/2020	740/-500	260/-250	N/A	2130	6600
AUTOBRAKE 3	9580	190/-190	320	-540/2030	690/-430	260/-250	N/A	2050	6530

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6010	110/-100	170	-310/1150	240/-190	140/-140	200	650	1660
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6010	110/-100	170	-310/1150	240/-190	140/-140	200	650	1660
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	6760	130/-120	200	-390/1480	400/-280	170/-160	220	1000	2760
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7510	150/-140	230	-460/1800	550/-370	190/-180	230	1350	3850
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8790	190/-180	280	-630/2670	1240/-630	230/-220	250	2470	9930
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10060	220/-210	330	-790/3530	1920/-880	260/-250	260	3580	16010
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5750	100/-80	160	-300/1130	240/-190	140/-130	200	570	1420
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5750	100/-80	160	-300/1130	240/-190	140/-130	200	570	1420
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	6480	120/-100	190	-380/1450	400/-280	160/-160	220	890	2370
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7210	140/-110	220	-450/1770	550/-360	180/-180	230	1200	3320
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8450	180/-150	270	-620/2630	1220/-620	220/-210	250	2240	8790
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9690	210/-180	310	-780/3490	1880/-870	250/-240	260	3280	14260
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3670	90/-50	70	-130/440	40/-40	70/-70	120	0	80
AUTOBRAKE MAX	4820	70/-70	100	-180/610	0/0	110/-110	210	0	0
AUTOBRAKE 2	7830	130/-140	210	-370/1250	30/-50	220/-220	400	0	0
Good Reported Braking Action									
MAX MANUAL	5050	80/-80	120	-220/770	130/-110	120/-120	180	0	360
AUTOBRAKE MAX	5360	80/-80	130	-230/800	110/-90	120/-120	220	0	370
AUTOBRAKE 2	7830	130/-140	210	-370/1250	30/-50	220/-220	400	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6000	100/-110	160	-290/1040	240/-190	150/-150	220	0	730
AUTOBRAKE MAX	6160	110/-110	170	-300/1060	230/-170	150/-150	250	0	730
AUTOBRAKE 2	7950	140/-150	220	-390/1350	120/-90	220/-220	400	0	260
Medium Reported Braking Action									
MAX MANUAL	6940	120/-130	200	-360/1310	340/-270	180/-180	250	0	1100
AUTOBRAKE MAX	6950	130/-130	200	-360/1310	340/-240	180/-180	280	0	1080
AUTOBRAKE 3	7490	130/-130	210	-380/1370	260/-160	200/-200	340	0	830
Medium To Poor Reported Braking Action									
MAX MANUAL	8060	160/-160	250	-460/1710	610/-420	220/-220	280	0	1890
AUTOBRAKE MAX	8080	160/-160	250	-460/1710	620/-410	220/-220	290	0	1880
AUTOBRAKE 3	8400	160/-160	260	-470/1750	580/-360	230/-230	330	0	1770
Poor Reported Braking Action									
MAX MANUAL	9180	190/-180	290	-560/2110	870/-560	250/-250	300	0	2670
AUTOBRAKE MAX	9200	190/-190	290	-560/2110	890/-570	260/-250	300	0	2670
AUTOBRAKE 3	9310	190/-190	300	-560/2120	890/-550	260/-250	310	0	2710

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3400	70/-30	60	-120/410	40/-30	60/-60	120	0	60
AUTOBRAKE MAX	4360	60/-40	90	-170/570	0/0	90/-90	200	0	0
AUTOBRAKE 2	6860	110/-80	180	-340/1160	30/-40	180/-180	360	0	0
Good Reported Braking Action									
MAX MANUAL	4580	70/-50	100	-200/730	110/-100	100/-100	170	0	260
AUTOBRAKE MAX	4870	70/-50	110	-220/760	100/-80	110/-110	210	0	270
AUTOBRAKE 2	6860	110/-80	180	-340/1160	30/-40	180/-180	360	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	5390	90/-70	140	-270/980	210/-170	130/-130	200	0	530
AUTOBRAKE MAX	5550	90/-70	140	-280/1000	200/-140	140/-140	240	0	530
AUTOBRAKE 2	6980	120/-80	190	-360/1260	110/-80	190/-190	360	0	190
Medium Reported Braking Action									
MAX MANUAL	6190	110/-80	170	-330/1230	300/-230	150/-150	230	0	790
AUTOBRAKE MAX	6220	110/-80	170	-340/1230	290/-200	160/-160	270	0	780
AUTOBRAKE 3	6620	110/-80	180	-350/1280	250/-150	170/-170	310	0	610
Medium To Poor Reported Braking Action									
MAX MANUAL	7150	140/-110	210	-430/1610	540/-360	190/-180	250	0	1350
AUTOBRAKE MAX	7170	140/-110	210	-430/1610	540/-350	190/-190	270	0	1340
AUTOBRAKE 3	7420	140/-110	220	-440/1640	520/-320	200/-200	300	0	1270
Poor Reported Braking Action									
MAX MANUAL	8100	160/-130	240	-520/1990	770/-490	220/-210	270	0	1900
AUTOBRAKE MAX	8120	160/-130	250	-520/1990	780/-500	220/-220	270	0	1900
AUTOBRAKE 3	8210	160/-130	250	-520/2000	780/-480	220/-220	280	0	1930

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAP / SLAT CONTROL (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3600	80/-40	70	-120/420	40/-30	70/-70	110	70	150
AUTOBRAKE MAX	4820	70/-70	100	-180/610	0/0	110/-110	210	0	0
AUTOBRAKE 2	7560	140/-150	220	-360/1220	120/-150	200/-200	290	270	270
Good Reported Braking Action									
MAX MANUAL	4790	70/-70	110	-200/720	100/-90	110/-100	160	270	630
AUTOBRAKE MAX	5120	80/-80	120	-220/760	70/-50	110/-110	220	250	630
AUTOBRAKE 2	7560	140/-150	220	-360/1220	120/-150	200/-200	290	270	270
Good To Medium Reported Braking Action									
MAX MANUAL	5530	90/-90	150	-260/950	180/-150	130/-130	190	500	1230
AUTOBRAKE MAX	5720	100/-100	150	-270/970	160/-120	140/-130	230	470	1210
AUTOBRAKE 2	7640	140/-150	220	-380/1300	170/-180	210/-200	290	340	610
Medium Reported Braking Action									
MAX MANUAL	6260	110/-110	180	-320/1180	250/-200	150/-150	210	720	1830
AUTOBRAKE MAX	6320	110/-110	180	-320/1180	240/-180	160/-150	240	690	1780
AUTOBRAKE 3	7250	120/-130	190	-360/1300	160/-140	190/-190	300	290	1130
Medium To Poor Reported Braking Action									
MAX MANUAL	7060	140/-130	220	-400/1510	420/-300	180/-180	230	1100	3050
AUTOBRAKE MAX	7100	140/-130	220	-400/1510	420/-290	190/-180	240	1090	3030
AUTOBRAKE 3	7730	140/-150	220	-420/1590	350/-250	210/-200	300	780	2620
Poor Reported Braking Action									
MAX MANUAL	7860	160/-150	250	-470/1830	580/-390	200/-200	240	1480	4270
AUTOBRAKE MAX	7880	160/-150	250	-470/1840	590/-390	210/-200	240	1490	4280
AUTOBRAKE 3	8200	160/-160	250	-480/1870	530/-350	220/-210	290	1270	4100

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≤ 5)
VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4290	120/-50	90	-140/490	50/-40	90/-90	130	130	300
AUTOBRAKE MAX	6100	80/-50	140	-210/710	0/0	150/-150	250	0	0
AUTOBRAKE 2	9680	170/-150	320	-420/1400	180/-230	280/-270	320	820	820
Good Reported Braking Action									
MAX MANUAL	5620	80/-60	150	-220/780	120/-100	130/-130	160	410	990
AUTOBRAKE MAX	6320	80/-50	160	-240/850	50/-40	150/-150	250	240	800
AUTOBRAKE 2	9680	170/-150	320	-420/1400	180/-230	280/-270	320	820	820
Good To Medium Reported Braking Action									
MAX MANUAL	6560	110/-80	190	-290/1030	200/-170	160/-160	190	760	1990
AUTOBRAKE MAX	6970	110/-80	200	-300/1070	160/-120	180/-170	250	660	1870
AUTOBRAKE 2	9760	180/-150	320	-430/1480	230/-260	280/-270	320	890	1280
Medium Reported Braking Action									
MAX MANUAL	7490	130/-100	230	-350/1270	280/-230	190/-190	210	1100	2990
AUTOBRAKE MAX	7610	130/-100	240	-350/1280	260/-200	200/-190	240	1080	2930
AUTOBRAKE 3	9340	150/-130	280	-420/1470	190/-210	260/-250	320	520	1740
Medium To Poor Reported Braking Action									
MAX MANUAL	8490	160/-130	280	-440/1620	460/-340	230/-220	240	1690	5120
AUTOBRAKE MAX	8570	160/-130	290	-440/1630	460/-320	230/-220	250	1680	5100
AUTOBRAKE 3	9790	170/-150	310	-480/1760	390/-310	270/-260	320	1170	4270
Poor Reported Braking Action									
MAX MANUAL	9490	190/-150	330	-520/1970	640/-440	260/-240	260	2270	7240
AUTOBRAKE MAX	9530	190/-150	330	-520/1970	650/-440	260/-250	260	2270	7260
AUTOBRAKE 3	10230	190/-160	340	-540/2040	580/-400	280/-270	320	1820	6800

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (5 < Flaps < 20)

VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3790	90/-30	70	-130/440	40/-40	70/-70	120	90	200
AUTOBRAKE MAX	5180	70/-40	110	-190/640	0/0	120/-120	220	0	0
AUTOBRAKE 2	8220	150/-120	250	-380/1280	120/-180	230/-220	310	400	400
Good Reported Braking Action									
MAX MANUAL	5080	70/-60	130	-210/750	110/-100	110/-110	170	340	820
AUTOBRAKE MAX	5440	80/-50	130	-220/780	70/-50	130/-120	220	300	800
AUTOBRAKE 2	8220	150/-120	250	-380/1280	120/-180	230/-220	310	400	400
Good To Medium Reported Braking Action									
MAX MANUAL	5880	100/-80	170	-270/980	190/-160	140/-140	200	630	1630
AUTOBRAKE MAX	6090	100/-70	170	-280/1000	170/-130	150/-140	230	590	1600
AUTOBRAKE 2	8300	150/-130	260	-400/1360	170/-200	230/-220	310	470	850
Medium Reported Braking Action									
MAX MANUAL	6670	120/-90	200	-330/1210	260/-210	170/-160	220	910	2440
AUTOBRAKE MAX	6730	120/-90	200	-330/1220	260/-200	170/-160	230	870	2400
AUTOBRAKE 3	7900	130/-100	220	-380/1360	150/-160	210/-210	310	350	1560
Medium To Poor Reported Braking Action									
MAX MANUAL	7520	150/-110	240	-410/1550	430/-310	200/-190	240	1380	4100
AUTOBRAKE MAX	7580	150/-110	240	-410/1550	440/-310	200/-190	250	1370	4100
AUTOBRAKE 3	8370	150/-120	250	-440/1650	350/-270	220/-220	310	960	3550
Poor Reported Braking Action									
MAX MANUAL	8370	170/-130	280	-490/1880	600/-400	220/-210	250	1850	5750
AUTOBRAKE MAX	8420	170/-130	280	-490/1880	610/-410	220/-210	260	1860	5790
AUTOBRAKE 3	8830	170/-130	280	-500/1930	540/-370	230/-230	300	1570	5540

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≥ 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3620	80/-40	70	-120/430	40/-30	70/-70	120	70	160
AUTOBRAKE MAX	4820	70/-70	100	-180/610	0/0	110/-110	210	0	0
AUTOBRAKE 2	7630	140/-150	220	-360/1230	100/-150	210/-200	300	220	220
Good Reported Braking Action									
MAX MANUAL	4830	70/-70	120	-210/730	110/-90	110/-110	170	280	650
AUTOBRAKE MAX	5130	80/-80	120	-220/760	80/-60	120/-110	220	270	660
AUTOBRAKE 2	7630	140/-150	220	-360/1230	100/-150	210/-200	300	220	220
Good To Medium Reported Braking Action									
MAX MANUAL	5590	90/-90	150	-270/960	190/-150	140/-130	190	510	1290
AUTOBRAKE MAX	5760	100/-100	150	-270/980	170/-120	140/-130	230	490	1270
AUTOBRAKE 2	7710	140/-150	230	-380/1310	150/-170	210/-210	300	290	590
Medium Reported Braking Action									
MAX MANUAL	6340	110/-110	180	-320/1190	260/-210	160/-150	210	740	1920
AUTOBRAKE MAX	6380	120/-110	180	-320/1190	250/-180	160/-150	240	710	1870
AUTOBRAKE 3	7300	120/-130	190	-360/1310	160/-140	190/-190	310	300	1230
Medium To Poor Reported Braking Action									
MAX MANUAL	7160	140/-140	220	-400/1520	430/-310	190/-180	230	1150	3210
AUTOBRAKE MAX	7190	140/-140	220	-400/1520	430/-290	190/-180	250	1130	3190
AUTOBRAKE 3	7800	140/-150	220	-430/1600	350/-250	210/-200	310	830	2800
Poor Reported Braking Action									
MAX MANUAL	7970	160/-160	260	-480/1850	590/-400	210/-200	250	1550	4500
AUTOBRAKE MAX	7990	160/-160	260	-480/1850	600/-400	210/-200	250	1550	4510
AUTOBRAKE 3	8290	160/-160	250	-490/1880	540/-360	220/-210	300	1360	4360

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS PRIMARY FAIL (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4000	80/-50	80	-140/470	40/-40	80/-80	140	90	190
AUTOBRAKE MAX	4820	70/-70	100	-180/610	0/0	110/-110	210	0	0
AUTOBRAKE 2	7830	140/-150	220	-370/1250	30/-100	210/-210	360	70	70
Good Reported Braking Action									
MAX MANUAL	5280	80/-80	130	-220/780	120/-100	120/-120	200	330	780
AUTOBRAKE MAX	5320	80/-80	130	-230/790	110/-100	120/-120	220	330	770
AUTOBRAKE 2	7830	140/-150	220	-370/1250	30/-100	210/-210	360	70	70
Good To Medium Reported Braking Action									
MAX MANUAL	6070	100/-100	170	-280/1020	210/-170	150/-140	230	600	1530
AUTOBRAKE MAX	6070	110/-100	170	-290/1020	210/-170	150/-150	240	600	1520
AUTOBRAKE 2	7920	140/-150	220	-390/1330	110/-130	220/-210	360	160	640
Medium Reported Braking Action									
MAX MANUAL	6850	120/-120	200	-340/1250	290/-230	170/-160	250	870	2280
AUTOBRAKE MAX	6810	130/-120	200	-340/1250	310/-240	170/-170	250	860	2260
AUTOBRAKE 3	7410	130/-130	200	-370/1320	190/-110	190/-190	360	430	1810
Medium To Poor Reported Braking Action									
MAX MANUAL	7700	150/-150	240	-420/1590	470/-330	200/-190	270	1320	3800
AUTOBRAKE MAX	7680	160/-150	240	-420/1590	490/-350	200/-200	270	1320	3800
AUTOBRAKE 3	8040	160/-150	240	-440/1630	410/-250	210/-210	350	1070	3550
Poor Reported Braking Action									
MAX MANUAL	8540	180/-170	280	-500/1930	650/-430	220/-210	280	1770	5320
AUTOBRAKE MAX	8550	180/-170	280	-500/1930	670/-450	230/-220	280	1770	5330
AUTOBRAKE 3	8670	180/-170	280	-510/1940	620/-390	230/-220	340	1700	5280

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROL MODE (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4080	80/-50	80	-140/480	50/-40	80/-80	150	100	210
AUTOBRAKE MAX	4820	70/-70	100	-180/610	0/0	110/-110	210	0	0
AUTOBRAKE 2	7880	130/-150	210	-370/1260	10/-70	220/-220	400	10	10
Good Reported Braking Action									
MAX MANUAL	5420	80/-90	140	-230/800	130/-110	120/-120	210	370	870
AUTOBRAKE MAX	5400	90/-90	140	-230/800	120/-100	120/-120	230	350	840
AUTOBRAKE 2	7880	130/-150	210	-370/1260	10/-70	220/-220	400	10	10
Good To Medium Reported Braking Action									
MAX MANUAL	6240	110/-110	180	-290/1040	220/-180	150/-150	240	670	1720
AUTOBRAKE MAX	6210	110/-110	180	-290/1040	230/-180	150/-150	250	650	1700
AUTOBRAKE 2	7990	140/-150	220	-390/1340	90/-110	220/-220	390	120	790
Medium Reported Braking Action									
MAX MANUAL	7060	130/-130	210	-350/1280	310/-240	180/-170	270	960	2570
AUTOBRAKE MAX	7020	130/-130	210	-350/1280	330/-260	180/-170	270	950	2550
AUTOBRAKE 3	7470	130/-130	200	-370/1330	220/-100	190/-190	370	590	2220
Medium To Poor Reported Braking Action									
MAX MANUAL	7940	160/-160	250	-440/1630	500/-350	210/-200	290	1460	4330
AUTOBRAKE MAX	7930	160/-160	260	-440/1630	530/-370	210/-200	290	1460	4330
AUTOBRAKE 3	8180	160/-150	250	-450/1650	460/-260	220/-210	360	1270	4150
Poor Reported Braking Action									
MAX MANUAL	8820	190/-180	290	-520/1970	690/-460	230/-220	310	1960	6090
AUTOBRAKE MAX	8840	190/-180	300	-520/1970	720/-480	240/-220	310	1970	6100
AUTOBRAKE 3	8880	190/-170	300	-520/1970	700/-410	240/-230	350	1940	6080

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROLS (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4420	70/-30	100	-150/510	70/-60	90/-90	200	160	370
AUTOBRAKE MAX	5180	70/-40	110	-190/640	0/0	120/-120	220	0	30
AUTOBRAKE 2	8580	140/-110	240	-390/1320	30/-100	240/-240	400	60	60
Good Reported Braking Action									
MAX MANUAL	5940	90/-60	160	-250/850	170/-150	140/-140	260	530	1320
AUTOBRAKE MAX	5940	90/-60	160	-250/850	160/-140	150/-140	260	490	1260
AUTOBRAKE 2	8580	140/-110	240	-390/1320	30/-100	240/-240	400	60	60
Good To Medium Reported Braking Action									
MAX MANUAL	6820	120/-90	200	-310/1100	270/-220	170/-170	280	900	2410
AUTOBRAKE MAX	6820	120/-90	210	-310/1100	270/-220	180/-170	280	880	2380
AUTOBRAKE 2	8690	140/-110	250	-410/1410	100/-140	240/-240	400	230	1290
Medium Reported Braking Action									
MAX MANUAL	7700	150/-110	250	-380/1350	370/-290	200/-200	300	1260	3510
AUTOBRAKE MAX	7700	150/-110	250	-380/1350	380/-300	210/-200	300	1260	3510
AUTOBRAKE 3	8120	140/-90	230	-390/1400	240/-120	220/-210	390	930	3210
Medium To Poor Reported Braking Action									
MAX MANUAL	8610	170/-130	290	-460/1700	570/-400	230/-220	320	1820	5580
AUTOBRAKE MAX	8620	180/-130	290	-460/1700	580/-420	230/-220	320	1830	5590
AUTOBRAKE 3	8850	170/-120	280	-470/1720	510/-280	240/-230	380	1650	5430
Poor Reported Braking Action									
MAX MANUAL	9520	200/-160	340	-540/2040	770/-520	260/-250	330	2380	7650
AUTOBRAKE MAX	9540	210/-160	340	-540/2050	790/-530	260/-250	330	2390	7670
AUTOBRAKE 3	9570	200/-140	340	-540/2050	770/-440	260/-250	370	2360	7650

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS C (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4000	80/-50	80	-140/470	40/-40	80/-80	140	90	190
AUTOBRAKE MAX	4820	70/-70	100	-180/610	0/0	110/-110	210	0	0
AUTOBRAKE 2	7830	140/-150	220	-370/1250	30/-100	210/-210	360	70	70
Good Reported Braking Action									
MAX MANUAL	5280	80/-80	130	-220/780	120/-100	120/-120	200	330	780
AUTOBRAKE MAX	5320	80/-80	130	-230/790	110/-100	120/-120	220	330	770
AUTOBRAKE 2	7830	140/-150	220	-370/1250	30/-100	210/-210	360	70	70
Good To Medium Reported Braking Action									
MAX MANUAL	6070	100/-100	170	-280/1020	210/-170	150/-140	230	600	1530
AUTOBRAKE MAX	6070	110/-100	170	-290/1020	210/-170	150/-150	240	600	1520
AUTOBRAKE 2	7920	140/-150	220	-390/1330	110/-130	220/-210	360	160	640
Medium Reported Braking Action									
MAX MANUAL	6850	120/-120	200	-340/1250	290/-230	170/-160	250	870	2280
AUTOBRAKE MAX	6810	130/-120	200	-340/1250	310/-240	170/-170	250	860	2260
AUTOBRAKE 3	7410	130/-130	200	-370/1320	190/-110	190/-190	360	430	1810
Medium To Poor Reported Braking Action									
MAX MANUAL	7700	150/-150	240	-420/1590	470/-330	200/-190	270	1320	3800
AUTOBRAKE MAX	7680	160/-150	240	-420/1590	490/-350	200/-200	270	1320	3800
AUTOBRAKE 3	8040	160/-150	240	-440/1630	410/-250	210/-210	350	1070	3550
Poor Reported Braking Action									
MAX MANUAL	8540	180/-170	280	-500/1930	650/-430	220/-210	280	1770	5320
AUTOBRAKE MAX	8550	180/-170	280	-500/1930	670/-450	230/-220	280	1770	5330
AUTOBRAKE 3	8670	180/-170	280	-510/1940	620/-390	230/-220	340	1700	5280

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3710	80/-40	70	-130/450	50/-40	70/-70	140	0	90
AUTOBRAKE MAX	4620	60/-60	100	-180/600	0/0	100/-100	210	0	0
AUTOBRAKE 2	7480	120/-120	200	-360/1220	10/-30	200/-200	400	0	0
Good Reported Braking Action									
MAX MANUAL	5110	80/-70	130	-230/800	140/-120	120/-120	200	0	390
AUTOBRAKE MAX	5320	80/-80	130	-230/820	120/-100	120/-120	230	0	400
AUTOBRAKE 2	7480	120/-120	200	-360/1220	10/-30	200/-200	400	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6080	100/-100	170	-310/1090	260/-210	150/-150	240	0	810
AUTOBRAKE MAX	6190	100/-100	170	-310/1100	260/-200	160/-150	250	0	810
AUTOBRAKE 2	7650	130/-130	210	-390/1340	120/-90	210/-210	400	0	370
Medium Reported Braking Action									
MAX MANUAL	7050	120/-120	210	-380/1370	380/-290	180/-180	270	0	1220
AUTOBRAKE MAX	7050	120/-120	210	-380/1370	390/-300	190/-180	270	0	1220
AUTOBRAKE 3	7370	130/-120	210	-390/1400	330/-210	190/-190	330	0	1150
Medium To Poor Reported Braking Action									
MAX MANUAL	8250	150/-150	270	-490/1830	710/-460	220/-220	300	0	2130
AUTOBRAKE MAX	8260	150/-150	270	-490/1830	730/-470	230/-220	300	0	2130
AUTOBRAKE 3	8470	160/-150	270	-500/1850	680/-430	230/-230	330	0	2110
Poor Reported Braking Action									
MAX MANUAL	9440	180/-170	320	-600/2290	1040/-630	260/-250	320	0	3030
AUTOBRAKE MAX	9460	180/-170	320	-600/2290	1060/-640	260/-260	320	0	3040
AUTOBRAKE 3	9560	190/-180	320	-600/2300	1030/-640	270/-260	320	0	3070

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3560	70/-30	70	-130/440	40/-40	70/-70	140	0	80
AUTOBRAKE MAX	4360	60/-40	90	-170/570	0/0	90/-90	210	0	0
AUTOBRAKE 2	6950	110/-80	180	-340/1170	0/-30	180/-180	380	0	0
Good Reported Braking Action									
MAX MANUAL	4880	70/-50	120	-220/780	140/-120	110/-110	200	0	340
AUTOBRAKE MAX	5050	70/-50	120	-230/800	110/-100	120/-120	230	0	330
AUTOBRAKE 2	6950	110/-80	180	-340/1170	0/-30	180/-180	380	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	5810	100/-70	160	-300/1060	260/-210	140/-140	240	0	700
AUTOBRAKE MAX	5900	100/-70	160	-300/1070	250/-200	150/-150	250	0	690
AUTOBRAKE 2	7130	120/-80	190	-370/1290	120/-90	190/-190	380	0	360
Medium Reported Braking Action									
MAX MANUAL	6740	120/-90	190	-370/1340	380/-290	170/-170	270	0	1050
AUTOBRAKE MAX	6740	120/-90	200	-370/1340	390/-290	180/-170	270	0	1050
AUTOBRAKE 3	6960	120/-80	200	-380/1370	350/-220	180/-180	320	0	1060
Medium To Poor Reported Braking Action									
MAX MANUAL	7890	150/-120	250	-480/1800	710/-450	210/-210	300	0	1850
AUTOBRAKE MAX	7910	150/-120	250	-480/1800	720/-460	220/-210	300	0	1850
AUTOBRAKE 3	8060	150/-110	250	-490/1820	690/-430	220/-220	320	0	1870
Poor Reported Braking Action									
MAX MANUAL	9040	170/-140	300	-590/2260	1030/-610	250/-240	320	0	2640
AUTOBRAKE MAX	9070	170/-140	300	-590/2260	1050/-630	250/-240	320	0	2650
AUTOBRAKE 3	9160	180/-140	300	-590/2270	1020/-630	250/-250	320	0	2680

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4530	80/-30	100	-160/530	60/-60	90/-90	180	0	150
AUTOBRAKE MAX	5180	70/-40	110	-190/640	0/0	120/-120	220	0	0
AUTOBRAKE 2	8630	140/-90	240	-390/1330	0/0	240/-240	460	0	0
Good Reported Braking Action									
MAX MANUAL	6310	90/-60	170	-270/920	190/-160	150/-150	260	0	620
AUTOBRAKE MAX	6260	90/-60	170	-270/920	180/-150	160/-160	280	0	590
AUTOBRAKE 2	8630	140/-90	240	-390/1330	0/0	240/-240	460	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	7520	120/-90	220	-360/1240	350/-280	200/-190	300	0	1260
AUTOBRAKE MAX	7480	120/-90	230	-360/1240	360/-280	200/-200	320	0	1240
AUTOBRAKE 2	8860	150/-100	260	-420/1460	200/-80	250/-250	460	0	790
Medium Reported Braking Action									
MAX MANUAL	8730	150/-110	270	-440/1550	510/-390	240/-230	340	0	1890
AUTOBRAKE MAX	8700	150/-110	280	-440/1550	540/-410	240/-230	350	0	1880
AUTOBRAKE 3	8790	160/-110	280	-440/1560	520/-310	240/-240	370	0	1910
Medium To Poor Reported Braking Action									
MAX MANUAL	10200	190/-150	340	-570/2060	920/-600	290/-280	380	0	3290
AUTOBRAKE MAX	10200	190/-150	350	-570/2060	960/-630	290/-280	380	0	3290
AUTOBRAKE 3	10250	200/-150	350	-570/2060	940/-570	290/-290	400	0	3310
Poor Reported Braking Action									
MAX MANUAL	11670	230/-180	410	-690/2560	1330/-810	330/-320	410	0	4690
AUTOBRAKE MAX	11690	230/-180	420	-690/2560	1370/-840	340/-330	410	0	4700
AUTOBRAKE 3	11710	230/-180	420	-690/2560	1360/-820	340/-330	420	0	4710

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+R (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4890	70/-40	110	-190/630	100/-90	110/-110	210	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	7390	110/-70	200	-340/1170	350/-280	200/-200	320	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	9370	150/-100	280	-480/1670	760/-530	270/-270	390	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	11340	180/-130	360	-610/2170	1170/-770	330/-330	450	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	14320	230/-170	500	-860/3150	3050/-1370	440/-440	500	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	17290	270/-200	630	-1110/4120	4920/-1960	540/-540	550	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4030	60/-50	80	-150/530	60/-60	80/-80	150	0	140
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5560	90/-80	140	-260/920	180/-150	130/-130	220	0	540
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	6570	120/-110	190	-340/1240	340/-260	170/-170	250	0	1040
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7580	140/-130	230	-420/1560	490/-360	200/-200	280	0	1530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8790	170/-160	290	-540/2080	930/-550	240/-240	300	0	2570
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9990	200/-190	340	-660/2600	1370/-730	280/-270	320	0	3610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3850	50/-30	80	-150/510	60/-50	80/-80	150	0	120
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5250	80/-60	130	-250/890	170/-140	120/-120	210	0	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	6190	100/-80	170	-330/1200	320/-240	160/-150	240	0	850
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7120	120/-100	210	-410/1510	460/-330	190/-180	270	0	1250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8240	150/-120	260	-530/2020	880/-510	230/-220	290	0	2100
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9360	180/-140	310	-640/2530	1300/-690	260/-250	310	0	2940
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5500	70/-50	130	-210/720	120/-110	130/-130	240	0	360
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	7640	120/-90	220	-350/1230	340/-270	200/-200	320	0	1230
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	9000	160/-120	290	-460/1630	600/-430	250/-240	360	0	2240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	10360	190/-150	350	-560/2030	860/-590	290/-280	390	0	3250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	11920	230/-180	430	-710/2680	1670/-870	340/-330	420	0	5300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	13470	270/-210	510	-860/3320	2480/-1150	390/-380	440	0	7340
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
NAV AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4080	80/-50	80	-140/480	50/-40	80/-80	150	100	210
AUTOBRAKE MAX	4820	70/-70	100	-180/610	0/0	110/-110	210	0	0
AUTOBRAKE 2	7880	130/-150	210	-370/1260	10/-70	220/-220	400	10	10
Good Reported Braking Action									
MAX MANUAL	5420	80/-90	140	-230/800	130/-110	120/-120	210	370	870
AUTOBRAKE MAX	5400	90/-90	140	-230/800	120/-100	120/-120	230	350	840
AUTOBRAKE 2	7880	130/-150	210	-370/1260	10/-70	220/-220	400	10	10
Good To Medium Reported Braking Action									
MAX MANUAL	6240	110/-110	180	-290/1040	220/-180	150/-150	240	670	1720
AUTOBRAKE MAX	6210	110/-110	180	-290/1040	230/-180	150/-150	250	650	1700
AUTOBRAKE 2	7990	140/-150	220	-390/1340	90/-110	220/-220	390	120	790
Medium Reported Braking Action									
MAX MANUAL	7060	130/-130	210	-350/1280	310/-240	180/-170	270	960	2570
AUTOBRAKE MAX	7020	130/-130	210	-350/1280	330/-260	180/-170	270	950	2550
AUTOBRAKE 3	7470	130/-130	200	-370/1330	220/-100	190/-190	370	590	2220
Medium To Poor Reported Braking Action									
MAX MANUAL	7940	160/-160	250	-440/1630	500/-350	210/-200	290	1460	4330
AUTOBRAKE MAX	7930	160/-160	260	-440/1630	530/-370	210/-200	290	1460	4330
AUTOBRAKE 3	8180	160/-150	250	-450/1650	460/-260	220/-210	360	1270	4150
Poor Reported Braking Action									
MAX MANUAL	8820	190/-180	290	-520/1970	690/-460	230/-220	310	1960	6090
AUTOBRAKE MAX	8840	190/-180	300	-520/1970	720/-480	240/-220	310	1970	6100
AUTOBRAKE 3	8880	190/-170	300	-520/1970	700/-410	240/-230	350	1940	6080

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3980	80/-40	70	-140/470	40/-40	70/-70	140	50	110
AUTOBRAKE MAX	4620	70/-60	100	-180/600	0/0	100/-100	210	0	0
AUTOBRAKE 2	7390	130/-130	210	-350/1210	50/-90	200/-190	330	110	110
Good Reported Braking Action									
MAX MANUAL	5110	70/-70	120	-220/760	110/-90	110/-110	190	220	510
AUTOBRAKE MAX	5150	70/-70	120	-220/770	110/-100	110/-110	210	230	520
AUTOBRAKE 2	7410	130/-130	210	-350/1210	60/-100	200/-190	340	110	110
Good To Medium Reported Braking Action									
MAX MANUAL	5810	90/-90	140	-270/980	180/-150	130/-130	200	420	1030
AUTOBRAKE MAX	5820	90/-90	150	-270/980	190/-150	130/-130	220	420	1040
AUTOBRAKE 2	7520	130/-130	210	-370/1290	130/-130	200/-200	330	180	430
Medium Reported Braking Action									
MAX MANUAL	6510	110/-100	170	-330/1210	250/-200	150/-150	220	620	1560
AUTOBRAKE MAX	6490	110/-110	180	-330/1200	270/-210	160/-150	240	620	1560
AUTOBRAKE 3	7070	110/-110	180	-360/1280	170/-100	180/-180	350	260	1020
Medium To Poor Reported Braking Action									
MAX MANUAL	7260	130/-120	210	-400/1530	410/-290	180/-170	240	960	2640
AUTOBRAKE MAX	7270	130/-120	210	-400/1530	430/-300	180/-170	250	960	2640
AUTOBRAKE 3	7630	130/-130	210	-420/1580	360/-230	190/-190	330	710	2300
Poor Reported Braking Action									
MAX MANUAL	8020	150/-140	240	-480/1850	570/-380	200/-190	250	1310	3720
AUTOBRAKE MAX	8040	150/-140	240	-480/1850	590/-400	200/-200	250	1310	3730
AUTOBRAKE 3	8190	150/-140	240	-480/1870	550/-350	210/-210	310	1170	3580

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3820	70/-30	70	-130/460	40/-40	70/-70	140	40	90
AUTOBRAKE MAX	4360	60/-40	90	-170/570	10/0	90/-90	210	0	0
AUTOBRAKE 2	6930	120/-90	180	-340/1170	20/-60	180/-180	340	30	30
Good Reported Braking Action									
MAX MANUAL	4880	70/-50	110	-210/740	100/-90	100/-100	190	190	430
AUTOBRAKE MAX	4920	70/-50	110	-210/750	110/-100	100/-100	210	190	440
AUTOBRAKE 2	6950	120/-80	190	-340/1170	30/-70	180/-180	350	30	30
Good To Medium Reported Braking Action									
MAX MANUAL	5550	80/-60	130	-270/960	180/-140	120/-120	200	360	880
AUTOBRAKE MAX	5560	90/-60	140	-270/970	190/-150	130/-120	220	360	880
AUTOBRAKE 2	7050	120/-90	190	-350/1250	100/-110	180/-180	340	100	330
Medium Reported Braking Action									
MAX MANUAL	6210	100/-80	160	-320/1180	250/-200	140/-140	220	540	1330
AUTOBRAKE MAX	6200	100/-80	160	-320/1180	260/-200	150/-140	240	530	1320
AUTOBRAKE 3	6600	110/-70	170	-340/1240	180/-90	170/-160	350	260	950
Medium To Poor Reported Braking Action									
MAX MANUAL	6940	120/-90	190	-400/1500	400/-280	170/-160	240	850	2260
AUTOBRAKE MAX	6950	120/-90	200	-390/1500	420/-300	170/-160	240	850	2260
AUTOBRAKE 3	7180	120/-90	200	-410/1540	370/-220	180/-180	330	680	2050
Poor Reported Braking Action									
MAX MANUAL	7670	140/-110	220	-470/1820	560/-370	190/-180	250	1160	3200
AUTOBRAKE MAX	7690	140/-110	230	-470/1820	580/-390	190/-190	250	1160	3200
AUTOBRAKE 3	7750	140/-100	230	-470/1830	560/-350	200/-190	300	1100	3150

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4210	110/-40	90	-140/480	40/-40	90/-90	120	120	260
AUTOBRAKE MAX	6100	80/-50	140	-210/710	0/0	150/-150	250	0	0
AUTOBRAKE 2	9210	170/-140	300	-400/1350	210/-220	260/-250	270	920	1130
Good Reported Braking Action									
MAX MANUAL	5550	80/-60	140	-220/780	110/-100	130/-130	150	380	900
AUTOBRAKE MAX	6340	80/-50	160	-250/850	60/-50	150/-150	250	210	700
AUTOBRAKE 2	9210	170/-140	300	-400/1350	210/-220	260/-250	270	920	1130
Good To Medium Reported Braking Action									
MAX MANUAL	6420	100/-80	180	-280/1020	190/-160	160/-160	180	680	1730
AUTOBRAKE MAX	6940	110/-80	200	-300/1060	150/-130	170/-170	240	590	1630
AUTOBRAKE 2	9290	170/-150	300	-420/1430	250/-250	260/-260	270	990	1490
Medium Reported Braking Action									
MAX MANUAL	7280	120/-100	220	-340/1250	270/-220	190/-180	200	970	2550
AUTOBRAKE MAX	7530	130/-100	230	-350/1270	240/-200	190/-190	230	970	2560
AUTOBRAKE 3	8970	150/-130	270	-410/1440	240/-220	250/-240	270	680	1610
Medium To Poor Reported Braking Action									
MAX MANUAL	8190	150/-120	260	-420/1590	440/-320	220/-210	220	1450	4170
AUTOBRAKE MAX	8360	160/-120	270	-430/1600	420/-300	220/-220	240	1430	4170
AUTOBRAKE 3	9390	170/-140	300	-470/1720	410/-310	260/-250	270	1180	3470
Poor Reported Braking Action									
MAX MANUAL	9090	180/-140	300	-500/1920	600/-410	240/-230	230	1920	5790
AUTOBRAKE MAX	9180	180/-140	310	-500/1930	600/-400	250/-240	250	1890	5780
AUTOBRAKE 3	9810	180/-150	320	-520/1990	580/-400	270/-260	270	1680	5330

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH UP AUTHORITY (Flaps ≥ 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3720	90/-30	70	-120/430	40/-30	70/-70	120	70	160
AUTOBRAKE MAX	5180	70/-40	110	-190/640	0/0	120/-120	220	0	0
AUTOBRAKE 2	8000	140/-120	240	-370/1260	150/-170	220/-210	270	470	490
Good Reported Braking Action									
MAX MANUAL	4960	70/-50	120	-210/730	100/-90	110/-110	150	280	640
AUTOBRAKE MAX	5460	80/-50	130	-220/780	70/-50	130/-120	230	200	590
AUTOBRAKE 2	8000	140/-120	240	-370/1260	150/-170	220/-210	270	470	490
Good To Medium Reported Braking Action									
MAX MANUAL	5740	90/-70	160	-270/960	180/-150	140/-140	180	510	1260
AUTOBRAKE MAX	6060	100/-70	160	-280/1000	150/-120	150/-140	230	460	1220
AUTOBRAKE 2	8080	150/-120	240	-390/1340	200/-200	220/-220	270	540	800
Medium Reported Braking Action									
MAX MANUAL	6510	110/-90	190	-330/1190	250/-200	160/-160	200	730	1870
AUTOBRAKE MAX	6660	120/-90	190	-330/1210	230/-180	170/-160	230	720	1840
AUTOBRAKE 3	7730	130/-100	220	-370/1340	190/-170	200/-200	280	350	1090
Medium To Poor Reported Braking Action									
MAX MANUAL	7340	140/-110	230	-410/1520	420/-300	190/-190	220	1130	3100
AUTOBRAKE MAX	7430	140/-110	230	-410/1540	410/-280	200/-190	240	1120	3080
AUTOBRAKE 3	8190	150/-120	250	-440/1620	370/-270	220/-210	280	800	2560
Poor Reported Braking Action									
MAX MANUAL	8170	160/-130	260	-480/1850	580/-390	210/-210	230	1520	4320
AUTOBRAKE MAX	8200	160/-130	260	-480/1860	580/-380	220/-210	250	1510	4320
AUTOBRAKE 3	8640	160/-130	270	-500/1900	540/-370	230/-220	280	1240	4030

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PRI FLIGHT COMPUTERS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4080	80/-50	80	-140/480	50/-40	80/-80	150	100	210
AUTOBRAKE MAX	4820	70/-70	100	-180/610	0/0	110/-110	210	0	0
AUTOBRAKE 2	7880	130/-150	210	-370/1260	10/-70	220/-220	400	10	10
Good Reported Braking Action									
MAX MANUAL	5420	80/-90	140	-230/800	130/-110	120/-120	210	370	870
AUTOBRAKE MAX	5400	90/-90	140	-230/800	120/-100	120/-120	230	350	840
AUTOBRAKE 2	7880	130/-150	210	-370/1260	10/-70	220/-220	400	10	10
Good To Medium Reported Braking Action									
MAX MANUAL	6240	110/-110	180	-290/1040	220/-180	150/-150	240	670	1720
AUTOBRAKE MAX	6210	110/-110	180	-290/1040	230/-180	150/-150	250	650	1700
AUTOBRAKE 2	7990	140/-150	220	-390/1340	90/-110	220/-220	390	120	790
Medium Reported Braking Action									
MAX MANUAL	7060	130/-130	210	-350/1280	310/-240	180/-170	270	960	2570
AUTOBRAKE MAX	7020	130/-130	210	-350/1280	330/-260	180/-170	270	950	2550
AUTOBRAKE 3	7470	130/-130	200	-370/1330	220/-100	190/-190	370	590	2220
Medium To Poor Reported Braking Action									
MAX MANUAL	7940	160/-160	250	-440/1630	500/-350	210/-200	290	1460	4330
AUTOBRAKE MAX	7930	160/-160	260	-440/1630	530/-370	210/-200	290	1460	4330
AUTOBRAKE 3	8180	160/-150	250	-450/1650	460/-260	220/-210	360	1270	4150
Poor Reported Braking Action									
MAX MANUAL	8820	190/-180	290	-520/1970	690/-460	230/-220	310	1960	6090
AUTOBRAKE MAX	8840	190/-180	300	-520/1970	720/-480	240/-220	310	1970	6100
AUTOBRAKE 3	8880	190/-170	300	-520/1970	700/-410	240/-230	350	1940	6080

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SLATS DRIVE (Flaps 20)
VREF30 + 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4100	90/-30	80	-140/470	50/-40	80/-80	120	100	220
AUTOBRAKE MAX	5630	70/-40	130	-200/680	10/0	130/-130	250	0	0
AUTOBRAKE 2	8760	150/-130	270	-390/1320	170/-190	250/-240	280	590	640
Good Reported Braking Action									
MAX MANUAL	5500	80/-60	140	-220/790	120/-110	130/-130	170	360	840
AUTOBRAKE MAX	5960	80/-50	150	-240/830	80/-60	140/-140	240	300	810
AUTOBRAKE 2	8760	150/-130	270	-390/1320	170/-190	250/-240	280	590	640
Good To Medium Reported Braking Action									
MAX MANUAL	6350	110/-80	180	-290/1030	210/-170	160/-160	200	630	1580
AUTOBRAKE MAX	6640	110/-80	190	-300/1050	170/-140	170/-160	250	590	1540
AUTOBRAKE 2	8840	160/-130	270	-410/1400	220/-220	250/-240	280	670	1030
Medium Reported Braking Action									
MAX MANUAL	7190	130/-100	220	-350/1260	290/-230	190/-180	220	900	2320
AUTOBRAKE MAX	7310	130/-100	220	-350/1270	260/-210	190/-180	250	880	2270
AUTOBRAKE 3	8460	140/-110	240	-400/1410	220/-190	230/-220	290	470	1440
Medium To Poor Reported Braking Action									
MAX MANUAL	8070	160/-120	260	-430/1600	460/-330	220/-210	240	1340	3750
AUTOBRAKE MAX	8150	160/-120	260	-430/1610	450/-320	220/-210	260	1330	3720
AUTOBRAKE 3	8950	160/-130	280	-460/1700	410/-300	250/-240	290	980	3150
Poor Reported Braking Action									
MAX MANUAL	8950	180/-140	300	-510/1930	630/-430	240/-230	250	1780	5170
AUTOBRAKE MAX	8980	180/-140	300	-510/1940	640/-430	240/-230	260	1780	5170
AUTOBRAKE 3	9440	180/-140	310	-520/1980	600/-400	260/-250	290	1490	4850

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3600	70/-40	70	-120/430	40/-40	70/-70	130	70	160
AUTOBRAKE MAX	4620	60/-60	100	-180/600	0/0	100/-100	210	0	0
AUTOBRAKE 2	7300	130/-130	210	-350/1200	80/-130	200/-190	300	160	160
Good Reported Braking Action									
MAX MANUAL	4770	70/-70	120	-210/730	110/-90	110/-100	180	280	660
AUTOBRAKE MAX	5000	80/-70	120	-210/750	90/-70	110/-110	210	280	670
AUTOBRAKE 2	7300	130/-130	210	-350/1200	80/-130	200/-190	300	160	160
Good To Medium Reported Braking Action									
MAX MANUAL	5490	90/-90	150	-260/960	180/-150	130/-130	200	500	1270
AUTOBRAKE MAX	5610	90/-90	150	-270/970	170/-140	130/-130	220	500	1260
AUTOBRAKE 2	7380	130/-130	210	-360/1280	130/-160	200/-190	300	240	560
Medium Reported Braking Action									
MAX MANUAL	6210	110/-110	180	-320/1180	260/-210	150/-150	220	730	1880
AUTOBRAKE MAX	6230	110/-110	180	-320/1190	260/-200	150/-150	230	710	1860
AUTOBRAKE 3	6980	120/-110	180	-350/1280	160/-130	180/-180	310	320	1350
Medium To Poor Reported Braking Action									
MAX MANUAL	6980	130/-130	210	-400/1510	420/-300	180/-170	240	1110	3110
AUTOBRAKE MAX	7000	140/-130	210	-400/1510	430/-300	180/-170	240	1100	3100
AUTOBRAKE 3	7490	140/-130	210	-420/1570	350/-240	190/-190	310	850	2800
Poor Reported Braking Action									
MAX MANUAL	7760	160/-150	250	-470/1830	590/-390	200/-190	250	1490	4330
AUTOBRAKE MAX	7770	160/-150	250	-470/1840	600/-400	200/-190	250	1500	4340
AUTOBRAKE 3	7990	160/-150	240	-480/1860	540/-350	210/-200	300	1370	4250

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3470	60/-30	60	-120/420	40/-40	60/-60	130	60	140
AUTOBRAKE MAX	4360	60/-40	90	-170/570	10/0	90/-90	210	0	0
AUTOBRAKE 2	6860	120/-90	190	-340/1160	50/-110	180/-180	310	60	60
Good Reported Braking Action									
MAX MANUAL	4570	70/-50	110	-200/710	110/-90	100/-100	180	240	560
AUTOBRAKE MAX	4770	70/-50	110	-210/740	90/-80	100/-100	200	240	560
AUTOBRAKE 2	6860	120/-90	190	-340/1160	50/-110	180/-180	310	60	60
Good To Medium Reported Braking Action									
MAX MANUAL	5250	90/-60	140	-260/940	180/-150	120/-120	200	440	1080
AUTOBRAKE MAX	5360	90/-60	140	-260/950	170/-140	120/-120	220	430	1080
AUTOBRAKE 2	6940	120/-90	190	-350/1240	100/-130	180/-180	310	140	440
Medium Reported Braking Action									
MAX MANUAL	5940	100/-80	170	-310/1160	260/-200	140/-140	220	640	1610
AUTOBRAKE MAX	5950	100/-80	170	-320/1160	260/-200	150/-140	230	630	1600
AUTOBRAKE 3	6530	110/-80	170	-340/1240	170/-110	160/-160	320	330	1240
Medium To Poor Reported Braking Action									
MAX MANUAL	6690	130/-100	200	-390/1490	420/-290	170/-160	240	980	2660
AUTOBRAKE MAX	6710	130/-100	200	-390/1490	430/-290	170/-160	240	980	2660
AUTOBRAKE 3	7060	130/-90	200	-400/1530	360/-230	180/-180	310	800	2480
Poor Reported Braking Action									
MAX MANUAL	7440	150/-120	230	-460/1810	580/-380	190/-180	250	1320	3720
AUTOBRAKE MAX	7460	150/-120	230	-460/1810	590/-390	190/-190	250	1330	3730
AUTOBRAKE 3	7590	150/-110	230	-470/1830	560/-350	200/-190	300	1280	3710

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
STABILIZER (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	440000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 440000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3850	90/-30	80	-130/450	40/-40	70/-70	120	90	190
AUTOBRAKE MAX	5180	70/-40	110	-190/640	0/0	120/-120	220	0	0
AUTOBRAKE 2	8140	140/-120	240	-370/1270	140/-170	220/-220	290	390	390
Good Reported Braking Action									
MAX MANUAL	5150	80/-60	130	-220/760	110/-100	120/-120	170	320	740
AUTOBRAKE MAX	5500	80/-50	130	-230/790	80/-60	130/-130	230	300	740
AUTOBRAKE 2	8140	140/-120	240	-370/1270	140/-170	220/-220	290	390	390
Good To Medium Reported Braking Action									
MAX MANUAL	5940	100/-80	170	-280/990	190/-160	150/-140	190	570	1430
AUTOBRAKE MAX	6150	100/-70	170	-290/1010	170/-130	150/-150	240	550	1400
AUTOBRAKE 2	8220	150/-120	250	-390/1350	190/-200	230/-220	290	470	780
Medium Reported Braking Action									
MAX MANUAL	6730	120/-90	200	-330/1220	270/-220	170/-160	210	820	2110
AUTOBRAKE MAX	6800	120/-90	200	-340/1230	260/-190	170/-170	250	790	2060
AUTOBRAKE 3	7830	130/-100	220	-380/1350	190/-160	210/-200	300	360	1320
Medium To Poor Reported Braking Action									
MAX MANUAL	7570	150/-110	240	-410/1560	440/-320	200/-190	230	1240	3460
AUTOBRAKE MAX	7620	150/-110	240	-420/1560	440/-300	200/-200	250	1220	3440
AUTOBRAKE 3	8320	150/-120	250	-440/1640	380/-270	230/-220	300	880	2950
Poor Reported Braking Action									
MAX MANUAL	8410	170/-130	270	-490/1890	610/-410	220/-210	250	1650	4800
AUTOBRAKE MAX	8430	170/-130	280	-490/1890	620/-410	220/-220	250	1650	4810
AUTOBRAKE 3	8800	170/-130	280	-500/1930	570/-380	240/-230	290	1390	4570

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	549.5	508.8				
52	126	565.6	523.4				
50	122	581.1	537.6	496.9			
48	118	597.7	553.7	511.6			
46	115	614.6	569.1	525.4	485.5		
44	111	630.1	584.0	540.3	498.8		
42	108	646.1	599.2	554.1	511.3	472.8	
40	104	661.2	613.5	567.1	523.6	485.0	
38	100	665.4	626.7	578.8	534.9	495.8	467.9
36	97	665.7	639.5	590.3	546.1	506.3	472.3
34	93	665.9	651.0	600.9	556.0	515.5	476.8
32	90	666.0	660.0	609.8	563.9	522.1	481.2
30	86	666.2	669.1	618.6	571.8	528.8	485.6
28	82	666.4	669.2	624.3	577.6	534.1	489.1
26	79	666.5	669.3	628.7	581.2	536.9	492.8
24	75	666.7	669.4	632.6	584.7	539.7	496.3
22	72	666.8	669.5	632.7	587.7	542.3	498.6
20	68	666.9	669.6	632.8	590.7	544.9	500.9
18	64	667.0	669.7	632.9	593.6	547.5	503.3
16	61	667.1	669.8	633.0	595.7	550.2	505.6
14	57	667.2	669.9	633.1	595.8	552.9	507.9
12	54	667.4	670.1	633.2	595.9	555.5	510.4
10	50	667.6	670.2	633.3	596.0	555.8	512.9
-40	-40	669.9	672.2	635.3	597.9	557.6	518.2

Based on engine bleed for 2 packs on and engine anti-ice off and wing anti-ice off.
With engine bleed for packs off, increase weight by 5000 lb.
With engine anti-ice on, decrease weight by 600 lb.
With engine and wing anti-ice on, decrease weight by 4400 lb.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease weight by 43900 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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	OAT	PRESSURE ALTITUDE (1000 FT)																	
(1000 LB)	(°C)	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8
640	0	18.5	20.1	21.9	27.4	30.2	33.3	37.7	41.8	46.6	49.1	54.9	61.5	61.4	68.9	77.4	74.0	83.0	92.9
	10	19.0	20.6	22.5	28.2	31.0	34.3	38.8	43.1	48.1	50.6	56.6	63.4	63.4	71.0	79.8	76.3	85.5	95.7
	15	19.4	21.0	22.9	28.7	31.6	35.0	39.5	43.9	48.9	51.5	57.6	64.5	64.5	72.2	81.1	77.6	86.8	97.3
	20	19.7	21.4	23.3	29.2	32.2	35.6	40.2	44.7	49.8	52.4	58.6	65.6	65.6	73.4	82.4	78.8	88.2	98.8
	30	20.1	21.9	23.9	30.0	33.0	36.5	41.3	45.9	51.1	53.9	60.2	67.4	67.4	75.5	84.6	81.0	90.6	101.5
	40	20.2	22.0	24.0	30.3	33.4	37.0	41.9	46.6	52.0	54.8	61.3	68.7	68.7	77.0	86.3	82.6	92.4	103.4
600	0	17.7	19.1	20.8	26.1	28.7	31.6	35.8	39.7	44.1	46.5	51.9	58.1	58.2	65.2	73.2	70.2	78.7	88.5
	10	18.1	19.6	21.4	26.8	29.5	32.6	36.8	40.9	45.5	48.0	53.6	60.0	60.0	67.3	75.5	72.4	81.1	91.1
	15	18.5	20.0	21.8	27.3	30.0	33.1	37.5	41.6	46.3	48.9	54.5	61.0	61.1	68.4	76.8	73.6	82.5	92.5
	20	18.8	20.3	22.2	27.8	30.6	33.7	38.2	42.4	47.2	49.7	55.5	62.1	62.1	69.6	78.0	74.8	83.8	93.9
	30	19.2	20.8	22.7	28.5	31.3	34.6	39.2	43.5	48.4	51.1	57.0	63.8	63.9	71.5	80.2	76.9	86.1	96.4
	40	19.3	20.9	22.8	28.8	31.7	35.0	39.7	44.1	49.2	51.9	58.0	65.0	65.1	72.9	81.8	78.5	87.8	98.3
560	0	16.8	18.2	19.7	24.8	27.1	29.9	33.8	37.5	41.6	43.9	49.0	54.8	54.9	61.5	69.0	66.3	74.3	83.5
	10	17.3	18.7	20.3	25.5	27.9	30.8	34.9	38.6	42.9	45.3	50.5	56.5	56.6	63.4	71.1	68.3	76.6	86.0
	15	17.6	19.0	20.7	25.9	28.4	31.3	35.5	39.3	43.7	46.1	51.4	57.5	57.6	64.5	72.4	69.5	77.9	87.4
	20	17.9	19.3	21.0	26.4	28.9	31.9	36.1	40.0	44.5	46.9	52.3	58.5	58.6	65.6	73.6	70.7	79.2	88.8
	30	18.3	19.8	21.5	27.0	29.6	32.7	37.1	41.1	45.7	48.2	53.8	60.1	60.3	67.4	75.6	72.7	81.3	91.2
	40	18.3	19.8	21.6	27.3	30.0	33.1	37.5	41.6	46.4	49.0	54.7	61.2	61.4	68.7	77.1	74.1	83.0	93.0
520	0	16.0	17.2	18.7	23.4	25.6	28.2	31.9	35.3	39.1	41.3	46.0	51.4	51.5	57.6	64.6	62.2	69.8	78.4
	10	16.4	17.7	19.2	24.1	26.4	29.0	32.9	36.3	40.3	42.6	47.4	53.0	53.2	59.5	66.7	64.2	71.9	80.8
	15	16.7	18.0	19.5	24.5	26.8	29.5	33.5	37.0	41.1	43.4	48.3	53.9	54.1	60.5	67.8	65.3	73.2	82.1
	20	17.0	18.3	19.9	25.0	27.3	30.1	34.1	37.7	41.8	44.1	49.1	54.9	55.1	61.6	69.0	66.4	74.4	83.4
	30	17.4	18.7	20.3	25.5	28.0	30.8	34.9	38.6	42.9	45.3	50.5	56.4	56.6	63.3	70.9	68.2	76.4	85.7
	40	17.4	18.8	20.4	25.8	28.2	31.1	35.4	39.2	43.5	46.0	51.3	57.4	57.6	64.4	72.3	69.6	78.0	87.4
480	0	15.2	16.3	17.6	22.1	24.1	26.5	30.0	33.1	36.6	38.7	43.0	47.9	48.1	53.7	60.2	58.0	65.0	73.0
	10	15.6	16.7	18.1	22.7	24.8	27.2	30.8	34.0	37.7	39.8	44.3	49.4	49.6	55.4	62.1	59.9	67.1	75.3
	15	15.8	17.0	18.5	23.1	25.3	27.7	31.4	34.7	38.4	40.6	45.1	50.3	50.5	56.4	63.2	60.9	68.2	76.5
	20	16.1	17.3	18.8	23.5	25.7	28.2	32.0	35.3	39.1	41.3	45.9	51.2	51.4	57.4	64.3	62.0	69.4	77.8
	30	16.5	17.7	19.2	24.1	26.3	28.9	32.8	36.2	40.1	42.4	47.1	52.6	52.8	59.0	66.0	63.7	71.3	79.9
	40	16.5	17.8	19.3	24.3	26.5	29.2	33.1	36.6	40.7	43.0	47.9	53.5	53.7	60.0	67.3	64.9	72.7	81.6
440	0	14.4	15.4	16.6	20.8	22.6	24.8	28.0	30.8	34.1	36.0	39.9	44.4	44.6	49.7	55.6	53.7	60.1	67.4
	10	14.7	15.8	17.1	21.3	23.3	25.5	28.8	31.7	35.1	37.1	41.1	45.8	46.0	51.3	57.4	55.4	62.0	69.5
	15	15.0	16.1	17.4	21.7	23.7	25.9	29.3	32.3	35.7	37.7	41.9	46.6	46.8	52.2	58.4	56.4	63.1	70.7
	20	15.3	16.4	17.7	22.1	24.1	26.4	29.9	32.9	36.4	38.4	42.6	47.4	47.6	53.1	59.4	57.4	64.2	71.9
	30	15.6	16.7	18.1	22.6	24.7	27.0	30.6	33.7	37.3	39.4	43.7	48.7	48.9	54.6	61.0	58.9	65.9	73.9
	40	15.6	16.7	18.1	22.8	24.9	27.3	30.9	34.1	37.8	39.9	44.4	49.5	49.7	55.5	62.2	60.0	67.2	75.4
400	0	13.6	14.5	15.6	19.4	21.1	23.1	26.0	28.6	31.5	33.2	36.8	40.9	41.0	45.7	51.0	49.2	55.0	61.7
	10	13.9	14.9	16.0	20.0	21.7	23.7	26.8	29.4	32.5	34.2	37.9	42.1	42.3	47.1	52.6	50.8	56.8	63.6
	15	14.2	15.2	16.3	20.3	22.1	24.1	27.3	29.9	33.1	34.9	38.6	42.9	43.1	47.9	53.5	51.7	57.8	64.7
	20	14.4	15.4	16.6	20.7	22.5	24.6	27.7	30.5	33.6	35.5	39.3	43.6	43.8	48.8	54.5	52.6	58.8	65.8
	30	14.7	15.7	17.0	21.1	23.0	25.1	28.4	31.2	34.5	36.4	40.3	44.8	45.0	50.1	55.9	54.0	60.4	67.6
	40	14.7	15.8	17.0	21.3	23.2	25.4	28.7	31.6	34.9	36.8	40.9	45.5	45.7	50.9	56.9	55.0	61.5	69.0

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.
If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Event Adjusted Brake Energy (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	4.5	13.8	22.9	32.0	41.0	50.0	59.2	68.4	77.8
	MAX AUTO	4.5	12.8	21.1	29.4	38.0	46.7	55.7	65.1	74.8
	AUTOBRAKE 4	4.4	12.1	19.8	27.5	35.3	43.4	51.8	60.7	70.1
	AUTOBRAKE 3	4.1	11.4	18.4	25.5	32.7	40.0	47.7	55.9	64.6
	AUTOBRAKE 2	3.9	10.6	17.2	23.6	30.1	36.8	43.7	51.1	59.0
	AUTOBRAKE 1	3.8	10.0	16.0	21.8	27.8	33.8	40.2	46.9	54.0

Two Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	3.9	12.6	21.2	29.5	37.7	45.9	54.0	62.3	70.7
	MAX AUTO	2.1	9.2	16.3	23.5	30.8	38.4	46.3	54.6	63.5
	AUTOBRAKE 4	1.6	7.1	12.7	18.5	24.5	30.9	37.7	45.1	53.1
	AUTOBRAKE 3	0.9	4.9	9.1	13.5	18.2	23.3	28.9	34.9	41.6
	AUTOBRAKE 2	0.2	3.1	6.2	9.5	13.0	16.9	21.2	25.9	31.1
	AUTOBRAKE 1		2.3	4.7	7.2	9.8	12.7	16.0	19.7	23.9

Cooling Time (Minutes)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)										
	16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE
GROUND		11	18	26	42	55	66	73		
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds for each taxi mile.
For one brake deactivated, increase brake energy by 10 percent.
For two brakes deactivated, increase brake energy by 20 percent.
When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 8 minutes.
When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.
Brake temperature monitor system (BTMS) indication on EICAS may be used 12 to 15 minutes after airplane has come to a complete stop, or inflight with gear retracted, to determine recommended cooling schedule. (Inflight gear extended, the BTMS indications may vary between individual brakes, due to airstream effects, gear tilt, and position of the gear temperature probes.)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Initial Max Continuous EPR

Based on .84M, engine bleed for packs on and anti-ice off

TAT	PRESSURE ALTITUDE (1000 FT)								
(°C)	27	29	31	33	35	37	39	41	43
20	1.260	1.236	1.217	1.204	1.193	1.176	1.182	1.192	1.203
15	1.320	1.295	1.272	1.256	1.244	1.224	1.229	1.237	1.245
10	1.376	1.351	1.328	1.311	1.295	1.275	1.280	1.285	1.290
5	1.378	1.404	1.382	1.365	1.352	1.329	1.333	1.335	1.337
0	1.378	1.420	1.431	1.415	1.402	1.381	1.385	1.385	1.384
-5	1.378	1.420	1.460	1.460	1.448	1.429	1.433	1.431	1.430
-10	1.378	1.420	1.460	1.482	1.488	1.472	1.475	1.473	1.472
-15	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-20	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-25	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-30	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-35	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-40	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous EPR

Based on engine bleed for packs on or off and anti-ice off

37000 FT to 31000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150	.48	1.480	1.480	1.480	1.477	1.464	1.445	1.421	1.392	1.359	1.326	1.324	1.324
200	.63	1.495	1.495	1.495	1.495	1.495	1.480	1.453	1.419	1.379	1.336	1.292	1.258
250	.77	1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.499	1.460	1.416	1.367	1.316
300	.91	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.434	1.393	1.346
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150	.46	1.479	1.479	1.479	1.479	1.464	1.445	1.421	1.392	1.362	1.332	1.323	1.323
200	.60	1.484	1.484	1.484	1.484	1.484	1.473	1.451	1.421	1.385	1.350	1.315	1.283
250	.74	1.528	1.528	1.528	1.528	1.528	1.528	1.528	1.498	1.459	1.413	1.360	1.303
300	.87	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.448	1.404	1.355
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150	.44	1.486	1.486	1.486	1.486	1.480	1.460	1.435	1.407	1.375	1.345	1.317	1.317
200	.58	1.493	1.493	1.493	1.493	1.493	1.493	1.471	1.444	1.409	1.372	1.336	1.299
250	.71	1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.516	1.478	1.430	1.370	1.301
300	.84	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.460	1.415	1.365
330	.91	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.426	1.383
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
150	.42	1.492	1.492	1.492	1.492	1.478	1.453	1.425	1.393	1.362	1.333	1.315	1.315
200	.55	1.506	1.506	1.506	1.506	1.506	1.497	1.470	1.438	1.400	1.361	1.322	1.284
250	.68	1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.498	1.454	1.395	1.326	1.262
300	.81	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.477	1.435	1.386	1.334
330	.88	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.385	1.335

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	37	35	33	31
ENGINE ONLY	-0.017	-0.016	-0.017	-0.018
ENGINE & WING*	-0.034	-0.032	-0.032	-0.033
ENGINE & WING**	-0.051	-0.048	-0.047	-0.048

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous EPR

Based on engine bleed for packs on or off and anti-ice off
29000 FT to 24000 FT Pressure Altitudes

29000 FT PRESSURE ALTITUDE		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
150	.40	1.504	1.504	1.504	1.504	1.488	1.459	1.429	1.394	1.363	1.334	1.326	1.326
200	.53	1.509	1.509	1.509	1.509	1.509	1.497	1.464	1.427	1.388	1.350	1.313	1.293
250	.65	1.504	1.504	1.504	1.504	1.504	1.504	1.504	1.457	1.405	1.350	1.294	1.251
300	.78	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.450	1.397	1.340	1.281
330	.85	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.406	1.354	1.298
27000 FT PRESSURE ALTITUDE		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
150	.38	1.523	1.523	1.523	1.523	1.523	1.505	1.473	1.440	1.404	1.372	1.343	1.343
200	.51	1.512	1.512	1.512	1.512	1.512	1.512	1.496	1.458	1.416	1.376	1.341	1.306
250	.63	1.479	1.479	1.479	1.479	1.479	1.479	1.479	1.474	1.423	1.372	1.325	1.285
300	.75	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.417	1.350	1.288
330	.81	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.370	1.311
25000 FT PRESSURE ALTITUDE		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
150	.37	1.540	1.540	1.540	1.540	1.540	1.522	1.488	1.451	1.415	1.380	1.360	1.360
200	.49	1.511	1.511	1.511	1.511	1.511	1.511	1.490	1.447	1.404	1.366	1.332	1.307
250	.60	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.451	1.400	1.354	1.315	1.282
300	.72	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.371	1.302	1.248
330	.78	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.327	1.260
24000 FT PRESSURE ALTITUDE		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
150	.36	1.536	1.536	1.536	1.536	1.536	1.530	1.494	1.459	1.421	1.387	1.355	1.355
200	.48	1.507	1.507	1.507	1.507	1.507	1.507	1.497	1.455	1.412	1.372	1.339	1.307
250	.59	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.453	1.408	1.363	1.324	1.289
300	.70	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.424	1.381	1.310	1.257
330	.77	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.375	1.336	1.270

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	29	27	25	24
ENGINE ONLY	-0.020	-0.021	-0.023	-0.022
ENGINE & WING*	-0.035	-0.036	-0.038	-0.037
ENGINE & WING**	-0.050	-0.051	-0.053	-0.051

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous EPR

Based on engine bleed for packs on or off and anti-ice off
22000 FT to 16000 FT Pressure Altitudes

22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
150	.35	1.529	1.529	1.529	1.529	1.529	1.511	1.474	1.435	1.399	1.367	1.346	1.346
200	.46	1.500	1.500	1.500	1.500	1.500	1.496	1.470	1.428	1.389	1.353	1.322	1.301
250	.57	1.466	1.466	1.466	1.466	1.466	1.466	1.455	1.423	1.380	1.339	1.302	1.270
300	.68	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.424	1.387	1.325	1.273	1.234
330	.74	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.386	1.347	1.283	1.228
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
150	.33	1.523	1.523	1.523	1.523	1.523	1.523	1.493	1.453	1.412	1.378	1.347	1.336
200	.44	1.492	1.492	1.492	1.492	1.492	1.492	1.484	1.444	1.404	1.365	1.334	1.305
250	.55	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.435	1.395	1.355	1.317	1.285
300	.65	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.393	1.338	1.291	1.250
330	.71	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.351	1.291	1.238
18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
150	.32	1.496	1.496	1.496	1.496	1.496	1.494	1.455	1.415	1.380	1.351	1.322	1.321
200	.42	1.474	1.474	1.474	1.474	1.474	1.471	1.452	1.409	1.369	1.336	1.309	1.283
250	.53	1.498	1.498	1.498	1.498	1.498	1.498	1.485	1.429	1.373	1.325	1.288	1.260
300	.63	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.398	1.337	1.285	1.238
330	.69	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.415	1.352	1.293	1.240
16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
150	.31	1.473	1.473	1.473	1.473	1.473	1.472	1.456	1.418	1.383	1.353	1.326	1.306
200	.41	1.454	1.454	1.454	1.454	1.454	1.454	1.442	1.412	1.375	1.342	1.314	1.288
250	.51	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.465	1.408	1.354	1.309	1.273
300	.60	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.436	1.375	1.318	1.271
330	.66	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.381	1.321	1.267

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	22	20	18	16
ENGINE ONLY	-0.020	-0.018	-0.014	-0.011
ENGINE & WING*	-0.034	-0.031	-0.026	-0.022
ENGINE & WING**	-0.047	-0.044	-0.038	-0.033

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous EPR

Based on engine bleed for packs on or off and anti-ice off
14000 FT to 5000 FT Pressure Altitudes

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
150	.29	1.446	1.446	1.446	1.446	1.446	1.443	1.417	1.381	1.351	1.325	1.301	1.290
200	.39	1.437	1.437	1.437	1.437	1.437	1.437	1.407	1.372	1.341	1.315	1.291	1.267
250	.49	1.490	1.490	1.490	1.490	1.490	1.490	1.490	1.435	1.379	1.329	1.286	1.252
300	.58	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.410	1.350	1.300	1.256
330	.64	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.416	1.354	1.298	1.250
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
150	.28	1.444	1.444	1.444	1.444	1.444	1.431	1.415	1.388	1.351	1.317	1.285	1.278
200	.38	1.433	1.433	1.433	1.433	1.433	1.430	1.415	1.397	1.367	1.325	1.285	1.247
250	.47	1.478	1.478	1.478	1.478	1.478	1.478	1.462	1.416	1.371	1.329	1.289	1.252
300	.56	1.471	1.471	1.471	1.471	1.471	1.471	1.471	1.453	1.393	1.338	1.293	1.254
330	.62	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.403	1.344	1.294	1.251
10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
150	.27	1.425	1.425	1.425	1.425	1.425	1.422	1.403	1.384	1.355	1.320	1.299	1.280
200	.36	1.401	1.401	1.401	1.401	1.401	1.401	1.394	1.380	1.358	1.323	1.291	1.270
250	.45	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.387	1.353	1.318	1.282	1.252
300	.54	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.372	1.323	1.282	1.247
330	.59	1.383	1.383	1.383	1.383	1.383	1.383	1.383	1.383	1.382	1.327	1.285	1.246
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
150	.25	1.385	1.385	1.385	1.385	1.385	1.385	1.377	1.348	1.323	1.302	1.281	1.260
200	.33	1.367	1.367	1.367	1.367	1.367	1.367	1.367	1.353	1.336	1.316	1.291	1.265
250	.41	1.341	1.341	1.341	1.341	1.341	1.341	1.341	1.341	1.326	1.311	1.287	1.253
300	.49	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.327	1.289	1.254	1.221
330	.54	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.289	1.252	1.218

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	14	12	10	5
ENGINE ONLY	-0.010	-0.013	-0.015	-0.015
ENGINE & WING*	-0.020	-0.023	-0.025	-0.023
ENGINE & WING*	-0.030	-0.033	-0.035	-0.031

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	639	281	16400	14900	13300
620	602	273	18000	16600	14900
580	562	264	19300	18300	16800
540	522	255	20900	19900	18800
500	483	246	22800	22300	21000
460	445	236	24800	24700	23500
420	406	226	27100	26800	25800
380	367	215	29400	29000	28200
340	329	204	31800	31300	30700

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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
133	125	118	111	105	100	95	91	87	83	80
273	255	238	224	211	200	190	181	172	165	158
412	384	359	337	317	300	285	271	258	246	236
550	512	478	449	423	400	379	361	344	328	314
687	639	597	561	529	500	474	451	430	411	393
822	766	716	673	634	600	569	541	516	493	472
958	892	835	784	740	700	664	632	603	576	552
1092	1018	953	896	845	800	759	723	689	659	631
1227	1144	1071	1007	951	900	854	813	776	742	711
1361	1269	1189	1119	1056	1000	950	904	863	825	790
1495	1395	1307	1230	1161	1100	1045	995	949	908	870
1629	1520	1425	1341	1267	1200	1140	1086	1036	991	950
1764	1646	1543	1453	1372	1300	1235	1176	1123	1074	1029
1899	1772	1662	1564	1478	1400	1330	1267	1209	1157	1109
2034	1899	1781	1676	1583	1500	1425	1357	1296	1240	1188
2171	2026	1900	1788	1689	1600	1520	1448	1382	1322	1267
2308	2154	2019	1900	1795	1700	1615	1538	1468	1404	1346
2446	2282	2139	2013	1900	1800	1710	1628	1554	1486	1424

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)									TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)									
	340	380	420	460	500	540	580	620	660	
100	2.1	2.3	2.5	2.7	2.9	3.1	3.2	3.4	3.6	0:15
200	4.7	5.2	5.7	6.2	6.7	7.1	7.4	7.9	8.5	0:32
300	7.7	8.5	9.3	10.1	10.9	11.7	12.3	13.2	14.2	0:49
400	10.8	11.9	13.0	14.1	15.2	16.4	17.4	18.7	20.0	1:05
500	13.7	15.2	16.6	18.0	19.5	21.0	22.2	23.8	25.5	1:22
600	16.7	18.4	20.1	21.8	23.5	25.4	26.9	28.8	30.8	1:37
700	19.5	21.6	23.5	25.5	27.5	29.7	31.6	33.8	36.1	1:53
800	22.3	24.7	26.9	29.2	31.5	34.0	36.2	38.8	41.3	2:08
900	25.1	27.8	30.3	32.8	35.5	38.3	40.7	43.7	46.5	2:24
1000	27.8	30.8	33.6	36.4	39.4	42.4	45.3	48.5	51.7	2:39
1100	30.5	33.8	36.9	40.0	43.2	46.6	49.7	53.3	56.8	2:54
1200	33.2	36.7	40.1	43.5	47.1	50.7	54.1	58.0	61.8	3:10
1300	35.8	39.6	43.3	47.0	50.8	54.8	58.5	62.7	66.8	3:25
1400	38.4	42.5	46.5	50.4	54.6	58.8	62.8	67.3	71.7	3:41
1500	41.0	45.4	49.6	53.9	58.3	62.8	67.1	71.9	76.5	3:56
1600	43.5	48.2	52.7	57.2	61.9	66.7	71.3	76.4	81.4	4:12
1700	46.0	51.0	55.8	60.6	65.5	70.6	75.5	80.9	86.1	4:29
1800	48.5	53.7	58.8	63.9	69.1	74.5	79.7	85.4	90.9	4:45

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	13600	12100	8100
620	15000	13700	12400
580	16800	15500	14000
540	18500	17400	15900
500	20100	19100	18000
460	22100	21300	20100
420	24300	24100	22800
380	26900	26600	25500
340	29700	29100	28200

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
660	EPR	1.260	1.430								
	MACH	.583	.641								
	KIAS	324	325								
	FF/ENG	20263	21796								
620	EPR	1.231	1.366								
	MACH	.572	.625								
	KIAS	318	317								
	FF/ENG	18942	19834								
580	EPR	1.205	1.304	1.385							
	MACH	.560	.600	.632							
	KIAS	311	304	308							
	FF/ENG	17664	17746	18696							
540	EPR	1.182	1.260	1.312	1.401						
	MACH	.547	.582	.603	.637						
	KIAS	304	294	294	299						
	FF/ENG	16446	16193	16492	17509						
500	EPR	1.161	1.226	1.263	1.318	1.412					
	MACH	.534	.569	.583	.605	.641					
	KIAS	296	287	283	283	289					
	FF/ENG	15254	14972	14904	15203	16246					
460	EPR	1.143	1.196	1.226	1.264	1.320	1.417				
	MACH	.519	.554	.569	.583	.605	.642				
	KIAS	288	280	276	272	272	278				
	FF/ENG	14101	13775	13681	13586	13882	14872				
420	EPR	1.124	1.169	1.194	1.224	1.261	1.317	1.413			
	MACH	.503	.538	.552	.567	.581	.603	.640			
	KIAS	278	271	268	265	261	261	266			
	FF/ENG	12956	12626	12465	12359	12260	12536	13427			
380	EPR	1.107	1.146	1.166	1.189	1.219	1.256	1.309	1.400		
	MACH	.485	.520	.534	.549	.564	.579	.599	.634		
	KIAS	268	262	259	256	253	249	248	252		
	FF/ENG	11915	11515	11302	11167	11040	10960	11162	11910		
340	EPR	1.090	1.124	1.141	1.160	1.183	1.211	1.246	1.295	1.376	1.514
	MACH	.464	.500	.515	.529	.544	.559	.575	.592	.624	.676
	KIAS	257	252	249	247	244	241	237	235	237	247
	FF/ENG	10930	10392	10191	10042	9913	9782	9711	9783	10365	11832
300	EPR	1.073	1.103	1.117	1.133	1.152	1.173	1.199	1.232	1.275	1.343
	MACH	.439	.478	.493	.507	.522	.537	.552	.568	.584	.610
	KIAS	243	240	238	236	234	231	228	225	221	222
	FF/ENG	9851	9322	9078	8958	8853	8720	8612	8519	8500	8878

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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
283	262	243	226	213	200	190	180	172	164	158
567	524	486	454	425	400	379	361	344	328	315
852	788	730	681	638	600	569	541	515	492	471
1138	1051	974	908	851	800	759	721	686	655	628
1424	1315	1218	1136	1064	1000	948	901	858	819	784
1711	1580	1463	1364	1277	1200	1138	1081	1029	982	940
1999	1845	1708	1592	1491	1400	1327	1260	1199	1145	1096
2288	2111	1954	1820	1704	1600	1517	1441	1371	1308	1252
2577	2377	2199	2048	1918	1800	1706	1620	1542	1471	1408

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	10		14		18	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	8.1	0:39	7.1	0:38	6.4	0:37
300	12.6	0:57	11.4	0:55	10.5	0:53
400	17.1	1:14	15.7	1:12	14.6	1:10
500	21.5	1:32	19.9	1:29	18.6	1:26
600	26.0	1:50	24.1	1:46	22.7	1:43
700	30.4	2:08	28.3	2:04	26.6	2:00
800	34.8	2:26	32.5	2:21	30.6	2:16
900	39.2	2:44	36.6	2:38	34.6	2:33
1000	43.5	3:02	40.8	2:56	38.5	2:50
1100	47.9	3:20	44.9	3:13	42.4	3:07
1200	52.2	3:39	49.0	3:31	46.3	3:24
1300	56.4	3:57	53.0	3:48	50.1	3:41
1400	60.7	4:15	57.1	4:06	54.0	3:57
1500	64.9	4:34	61.1	4:24	57.8	4:15
1600	69.2	4:52	65.1	4:41	61.6	4:32
1700	73.3	5:11	69.0	4:59	65.4	4:49
1800	77.5	5:29	73.0	5:17	69.1	5:06

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	300	400	500	600	700
5	-0.7	-0.4	0.0	1.0	3.7
15	-2.7	-1.6	0.0	3.2	10.6
25	-4.7	-2.7	0.0	5.3	16.8
35	-6.7	-3.8	0.0	7.3	22.3
45	-8.7	-4.8	0.0	9.1	27.2
55	-10.7	-5.9	0.0	10.8	31.3
65	-12.7	-6.9	0.0	12.3	34.8
75	-14.7	-7.8	0.0	13.7	37.6
85	-16.8	-8.8	0.0	14.9	39.7
95	-18.8	-9.7	0.0	16.1	41.1

APU fuel included.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
660	EPR	1.154	1.190	1.258	1.379		
	KIAS	259	260	261	277		
	FF/ENG	17960	17800	18010	19400		
620	EPR	1.139	1.172	1.232	1.328		
	KIAS	251	252	253	262		
	FF/ENG	16750	16580	16690	17410		
580	EPR	1.124	1.154	1.209	1.290		
	KIAS	243	244	245	248		
	FF/ENG	15660	15390	15460	15740		
540	EPR	1.110	1.137	1.186	1.256	1.384	
	KIAS	234	235	236	237	252	
	FF/ENG	14580	14240	14290	14340	15680	
500	EPR	1.097	1.120	1.165	1.226	1.322	
	KIAS	226	226	227	228	235	
	FF/ENG	13520	13170	13120	13090	13750	
460	EPR	1.085	1.104	1.144	1.198	1.277	1.443
	KIAS	218	218	218	219	220	238
	FF/ENG	12470	12200	12010	11920	12120	13720
420	EPR	1.073	1.089	1.122	1.170	1.236	1.351
	KIAS	212	212	212	212	212	220
	FF/ENG	11460	11260	11030	10850	10850	11590
380	EPR	1.061	1.076	1.103	1.143	1.200	1.287
	KIAS	205	205	205	205	205	205
	FF/ENG	10490	10290	10110	9810	9760	9990
340	EPR	1.049	1.062	1.084	1.117	1.165	1.235
	KIAS	203	203	203	203	203	203
	FF/ENG	9660	9460	9320	8970	8870	8960
300	EPR	1.039	1.048	1.068	1.093	1.133	1.189
	KIAS	203	203	203	203	203	203
	FF/ENG	9140	8750	8740	8370	8070	8110

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 20

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	410	290				
50	470	340	200			
48	520	390	250			
46	570	440	300	170		
44	620	480	350	210		
42	650	530	390	250	110	
40	660	580	430	290	150	
38	660	620	470	320	180	30
36	660	650	500	360	210	40
34	660	680	530	380	230	50
32	670	690	550	400	240	60
30	670	690	570	420	250	80
20	680	710	590	470	300	120
10	700	720	600	480	330	170
0	710	730	620	490	340	170
-20	740	760	640	510	350	180
-40	780	800	670	530	370	190

Rate of climb capability shown is valid for 440000 lb, gear down at VREF20 + 5.
Decrease rate of climb 40 ft/min per 10000 lb greater than 440000 lb.
Increase rate of climb 50 ft/min per 10000 lb less than 44‘0000 lb.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-80	-210				
50	-30	-160	-290			
48	20	-120	-250			
46	60	-70	-210	-340		
44	110	-30	-170	-310		
42	150	10	-130	-270	-410	
40	150	50	-90	-240	-380	
38	150	90	-60	-200	-350	-500
36	150	120	-30	-170	-320	-490
34	150	150	0	-150	-310	-480
32	150	160	10	-130	-290	-470
30	150	160	30	-120	-280	-460
20	160	170	50	-80	-240	-420
10	160	170	50	-80	-220	-390
0	170	180	50	-80	-230	-390
-20	180	180	60	-80	-230	-410
-40	180	190	60	-80	-240	-420

Rate of climb capability shown is valid for 440000 lb, gear down at VREF30 + 5.
Decrease rate of climb 40 ft/min per 10000 lb greater than 440000 lb.
Increase rate of climb 50 ft/min per 10000 lb less than 440000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Limit Weight

PERFORMANCE LIMIT	ALTERNATE MODE EEC LIMIT WEIGHT (1000 LB)							
	PRIMARY MODE PERFORMANCE LIMIT WEIGHT (1000 LB)							
	350	400	450	500	550	600	650	700
FIELD	318.5	364.6	410.8	456.9	503.1	549.2	595.4	641.5
CLIMB	300.8	346.9	393.0	439.1	485.2	531.2	577.3	623.4
OBSTACLE	308.7	352.1	395.5	438.9	482.4	525.8	569.2	612.6
NET LEVEL OFF WEIGHT	313.1	356.2	399.4	442.5	485.6	528.7	571.9	615.0
APPROACH OR LANDING CLIMB			388.1	433.4	478.7	574.1	569.4	614.7

Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
V1	+2
VR	+1
V2	0

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	131	88.6	88.5	88.5	88.7	88.7	88.8	88.9	89.0	89.0	89.0	89.3	89.5
50	122	90.3	90.3	90.1	90.1	90.1	90.2	90.3	90.5	90.5	90.6	90.9	91.2
45	113	92.2	92.2	92.1	92.0	92.0	91.9	91.8	91.9	92.0	92.2	92.6	92.9
40	104	94.1	94.1	94.2	94.2	94.1	94.0	93.8	93.9	93.7	93.7	94.1	94.6
35	95	94.4	96.8	96.4	96.5	96.4	96.2	96.7	96.3	96.1	96.0	95.6	96.0
30	86	94.3	98.5	98.2	98.2	97.8	97.8	97.8	97.6	97.6	97.1	96.6	96.3
25	77	93.7	98.5	98.8	98.8	98.4	98.2	98.0	97.9	97.8	97.4	96.9	96.5
20	68	92.9	98.4	98.8	98.8	98.8	98.4	98.2	98.1	98.0	97.5	97.1	96.6
15	59	92.1	97.6	98.2	98.8	98.6	98.5	98.4	98.3	98.2	97.7	97.3	96.8
10	50	91.3	96.7	97.3	97.9	98.4	98.5	98.5	98.4	98.4	97.9	97.5	97.0
5	41	90.5	95.9	96.5	97.1	97.5	98.0	98.4	98.4	98.4	98.1	97.7	97.2
0	32	89.7	95.0	95.6	96.2	96.7	97.1	97.5	97.9	98.2	98.1	97.7	97.3
-10	14	88.0	93.2	93.8	94.4	94.9	95.3	95.7	96.0	96.4	96.5	96.5	96.6
-20	-4	86.4	91.5	92.0	92.6	93.0	93.5	93.9	94.2	94.6	94.6	94.7	94.7
-30	-22	84.6	89.6	90.2	90.7	91.2	91.6	92.0	92.3	92.7	92.7	92.8	92.8
-40	-40	82.9	87.8	88.3	88.9	89.3	89.7	90.1	90.4	90.8	90.8	90.8	90.9
-50	-58	81.1	85.9	86.4	86.9	87.4	87.8	88.1	88.4	88.8	88.8	88.9	88.9

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1
WING ANTI-ICE ON	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	85.1	85.5	87.4	89.5	90.9	89.6	90.6	93.8	94.5	95.1
50	86.3	86.6	87.1	88.1	89.6	88.3	89.3	92.4	93.0	93.6
40	86.6	87.6	88.0	88.6	88.5	86.9	87.9	91.0	91.6	92.2
30	85.2	87.5	89.4	89.9	89.4	87.8	87.0	89.5	90.1	90.7
20	83.7	86.0	88.6	91.4	91.0	90.4	89.9	88.8	88.6	89.2
15	83.0	85.3	87.8	90.7	92.2	92.0	91.3	90.0	89.6	90.0
10	82.3	84.5	87.1	89.9	91.7	94.0	92.7	91.1	90.6	90.9
5	81.6	83.8	86.3	89.1	90.8	94.3	93.8	92.3	91.7	91.8
0	80.8	83.0	85.5	88.3	90.0	93.5	95.0	93.3	92.7	92.6
-5	80.1	82.3	84.7	87.5	89.2	92.6	94.8	94.4	93.7	93.6
-10	79.3	81.5	83.9	86.6	88.4	91.8	93.9	95.2	94.6	94.5
-15	78.6	80.7	83.1	85.8	87.5	90.9	93.0	94.9	95.0	95.0
-20	77.8	79.9	82.3	85.0	86.7	90.0	92.1	94.0	94.1	94.0
-25	77.0	79.1	81.5	84.1	85.8	89.1	91.2	93.1	93.2	93.1
-30	76.3	78.3	80.7	83.3	84.9	88.2	90.3	92.1	92.2	92.2
-35	75.5	77.5	79.8	82.4	84.1	87.3	89.3	91.2	91.3	91.2
-40	74.7	76.7	79.0	81.5	83.2	86.4	88.4	90.2	90.3	90.2

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
ENGINE ANTI-ICE ON	-1.0	-0.9	-0.8	-0.4	-0.7	-0.8	-0.8	-0.7	-0.8	-0.9
ENGINE & WING ANTI-ICE ON	-1.4	-1.3	-1.3	-1.0	-1.3	-1.4	-1.5	-1.3	-1.6	-1.7

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Max Cruise %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)									
	25	27	29	31	33	35	37	39	41	43
25	87.0	86.7	86.9	86.7	86.3	86.9	87.1	87.3	87.6	87.9
20	88.2	88.0	88.1	87.6	87.3	86.9	86.3	86.5	86.9	87.2
15	89.4	89.3	89.3	88.6	88.1	87.7	87.1	87.3	87.5	87.7
10	91.0	90.4	90.2	89.6	89.1	88.6	87.9	88.1	88.3	88.4
5	91.1	91.6	91.1	90.5	90.0	89.6	88.8	89.0	89.0	89.1
0	90.3	91.1	91.8	91.3	90.7	90.3	89.7	89.8	89.8	89.8
-5	89.5	90.3	91.0	91.4	91.4	91.0	90.4	90.5	90.4	90.4
-10	88.6	89.4	90.1	90.5	91.3	91.5	90.9	91.0	91.0	90.9
-15	87.8	88.6	89.2	89.7	90.4	91.2	91.3	91.4	91.3	91.3
-20	86.9	87.7	88.4	88.8	89.5	90.3	90.4	90.5	90.4	90.4
-25	86.1	86.8	87.5	87.9	88.6	89.4	89.5	89.6	89.5	89.5
-30	85.2	85.9	86.6	87.0	87.7	88.5	88.6	88.7	88.6	88.6
-35	84.3	85.1	85.7	86.1	86.8	87.6	87.7	87.7	87.7	87.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	25	27	29	31	33	35	37	39	41	43
ENGINE ANTI-ICE ON	-0.7	-0.6	-0.6	-0.6	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6
ENGINE & WING ANTI-ICE ON	-1.1	-1.1	-1.0	-1.0	-1.0	-1.0	-1.0	-1.1	-1.2	-1.3

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Go-Around %N1

Based on engine bleed for packs on, engine anti-ice on or off, wing anti-ice off

AIRPORT OAT		TAT(°C)	PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
51	124	55	90.4	90.2	90.2	90.0	90.2	90.3	90.5	90.7	90.8	91.0	91.3	91.4
46	115	50	92.1	92.1	92.0	91.8	91.8	91.7	91.7	91.9	92.1	92.4	92.7	92.9
41	106	45	94.0	94.0	94.0	93.9	93.8	93.7	93.7	93.6	93.4	93.7	94.1	94.4
36	97	40	94.7	96.2	96.0	96.0	95.9	95.7	96.0	95.8	95.8	95.7	95.4	95.7
31	88	35	94.6	97.8	97.7	97.7	97.5	97.7	97.6	97.5	97.5	97.0	96.7	96.4
26	79	30	94.1	98.1	98.6	98.7	98.4	98.5	98.3	98.2	98.1	97.5	97.0	96.6
21	70	25	93.4	98.0	98.5	98.8	98.9	98.7	98.5	98.4	98.2	97.8	97.4	96.9
16	61	20	92.6	97.3	98.1	98.8	98.8	98.9	98.8	98.6	98.5	98.0	97.5	97.1
11	52	15	91.8	96.4	97.3	98.1	98.7	98.9	98.9	98.9	98.7	98.2	97.8	97.3
7	45	10	91.0	95.6	96.4	97.3	97.9	98.6	98.8	98.8	98.8	98.5	98.0	97.5
2	36	5	90.2	94.7	95.6	96.4	97.1	97.7	98.1	98.5	98.8	98.4	98.1	97.7
-3	27	0	89.4	93.9	94.7	95.5	96.2	96.9	97.2	97.6	98.0	98.0	98.0	97.7
-13	9	-10	87.7	92.1	93.0	93.8	94.4	95.1	95.4	95.8	96.2	96.2	96.3	96.3
-23	-9	-20	86.0	90.4	91.2	92.0	92.6	93.3	93.6	94.0	94.4	94.4	94.4	94.5
-33	-27	-30	84.3	88.6	89.4	90.1	90.8	91.4	91.7	92.1	92.5	92.5	92.5	92.6
-43	-45	-40	82.6	86.7	87.5	88.3	88.9	89.5	89.8	90.2	90.6	90.6	90.6	90.7
-53	-63	-50	80.8	84.9	85.6	86.4	86.9	87.6	87.9	88.2	88.6	88.6	88.7	88.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1
WING ANTI-ICE ON	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC
ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	91.4	90.5	89.8	89.3	88.9	88.2	88.4	88.8	89.2
15	92.9	91.9	91.1	90.5	90.0	89.3	89.5	89.8	90.1
10	94.1	93.2	92.3	91.7	91.1	90.4	90.6	90.8	90.9
5	93.3	94.2	93.4	92.8	92.3	91.5	91.7	91.7	91.8
0	92.4	94.1	94.6	93.9	93.3	92.5	92.7	92.7	92.7
-5	91.6	93.2	94.9	94.9	94.4	93.6	93.7	93.7	93.6
-10	90.7	92.3	94.0	95.0	95.2	94.5	94.7	94.6	94.5
-15	89.9	91.5	93.1	94.0	95.0	95.0	95.1	95.0	95.0
-20	89.0	90.6	92.2	93.1	94.0	94.1	94.1	94.1	94.0
-25	88.1	89.7	91.3	92.2	93.1	93.2	93.2	93.2	93.1
-30	87.2	88.8	90.4	91.3	92.2	92.2	92.3	92.2	92.2
-35	86.3	87.8	89.5	90.3	91.2	91.3	91.3	91.3	91.2
-40	85.4	86.9	88.5	89.4	90.2	90.3	90.3	90.3	90.3

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
ENGINE ONLY	-0.7	-0.9	-0.8	-0.7	-0.6	-0.6	-0.6	-0.7	-0.7
ENGINE & WING*	-1.2	-1.4	-1.4	-1.2	-1.2	-1.2	-1.2	-1.4	-1.4
ENGINE & WING**	-1.7	-1.9	-1.9	-1.8	-1.7	-1.8	-1.9	-2.1	-2.2

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC
ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on and anti-ice off

320 KIAS

TAT(°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	92.3	93.5	94.8	93.0	91.7	90.6	89.3									
25	91.5	95.2	96.6	94.7	93.3	92.3	90.2	90.0	89.5	89.1						
20	90.8	95.0	98.1	96.6	95.0	93.9	91.6	91.4	91.0	90.7	90.6	90.2				
15	90.0	94.2	97.3	96.9	96.8	95.7	93.1	93.1	92.8	92.5	92.2	91.7	91.3	91.3	91.6	92.0
10	89.2	93.4	96.5	96.0	96.0	96.1	94.8	94.2	94.2	94.4	93.6	93.0	92.5	92.2	92.5	92.9
5	88.4	92.6	95.6	95.2	95.1	95.3	93.9	94.0	93.8	93.7	94.7	94.1	93.5	93.1	93.4	93.7
0	87.6	91.7	94.7	94.3	94.2	94.4	93.1	93.2	93.0	92.8	93.8	94.6	94.6	93.9	94.3	94.6
-5	86.8	90.9	93.9	93.5	93.4	93.6	92.2	92.3	92.1	92.0	92.9	93.7	94.5	94.4	94.9	95.1
-10	86.0	90.0	93.0	92.6	92.5	92.7	91.4	91.5	91.3	91.1	92.1	92.8	93.6	93.5	94.1	94.2
-15	85.2	89.2	92.1	91.7	91.6	91.8	90.5	90.6	90.4	90.2	91.2	91.9	92.7	92.6	93.2	93.3
-20	84.3	88.3	91.2	90.8	90.7	90.9	89.6	89.7	89.5	89.4	90.3	91.0	91.8	91.7	92.3	92.4
-25	83.5	87.4	90.3	89.9	89.8	90.0	88.7	88.8	88.6	88.5	89.4	90.1	90.9	90.8	91.4	91.4
-30	82.7	86.6	89.4	89.0	88.9	89.1	87.8	87.9	87.7	87.6	88.5	89.2	89.9	89.9	90.5	90.5
-35	81.8	85.7	88.5	88.1	88.0	88.2	86.9	87.0	86.8	86.7	87.6	88.3	89.0	88.9	89.5	89.6
-40	80.9	84.8	87.5	87.1	87.1	87.2	86.0	86.1	85.9	85.7	86.7	87.4	88.1	88.0	88.6	88.6

280 KIAS

TAT(°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	91.2	91.9	93.0	91.3	90.5	89.7	89.8									
25	91.3	93.6	94.7	92.9	91.9	90.9	90.6	90.0	89.6	89.3						
20	90.5	95.5	96.8	94.9	93.5	92.4	91.6	90.9	90.3	90.0	89.2	88.4				
15	89.7	95.0	98.2	97.0	95.5	94.2	92.6	92.0	91.4	91.2	90.5	89.7	89.7	90.4	90.0	89.5
10	88.9	94.2	97.3	97.2	97.3	96.1	93.5	93.3	92.7	92.5	92.1	91.6	91.4	91.6	91.2	90.5
5	88.1	93.4	96.5	96.3	96.4	96.7	95.1	94.3	94.7	94.6	93.7	93.2	92.9	92.8	92.3	91.6
0	87.3	92.5	95.6	95.4	95.6	95.8	94.4	94.4	94.6	94.9	96.2	94.9	94.3	93.9	93.3	92.6
-5	86.5	91.7	94.7	94.5	94.7	94.9	93.6	93.6	93.8	94.0	95.8	96.4	95.5	94.9	94.4	93.6
-10	85.7	90.8	93.8	93.7	93.8	94.1	92.7	92.7	92.9	93.2	94.9	95.5	96.0	95.7	95.3	94.5
-15	84.9	90.0	92.9	92.8	92.9	93.2	91.8	91.8	92.0	92.3	94.0	94.6	95.1	95.2	95.4	94.6
-20	84.1	89.1	92.0	91.9	92.0	92.2	90.9	90.9	91.2	91.4	93.1	93.7	94.2	94.3	94.5	93.6
-25	83.3	88.2	91.1	91.0	91.1	91.3	90.0	90.0	90.2	90.5	92.2	92.8	93.2	93.3	93.6	92.7
-30	82.4	87.3	90.2	90.0	90.2	90.4	89.1	89.1	89.3	89.5	91.3	91.8	92.3	92.4	92.6	91.8
-35	81.6	86.4	89.3	89.1	89.2	89.5	88.2	88.2	88.4	88.6	90.3	90.9	91.3	91.4	91.7	90.8
-40	80.7	85.5	88.3	88.2	88.3	88.5	87.2	87.2	87.5	87.7	89.4	89.9	90.4	90.5	90.7	89.9

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.6	-0.7	-0.8	-0.8	-0.7	-0.9	-0.8	-0.7	-0.6	-0.6
ENGINE & WING*	-0.9	-0.9	-0.9	-0.8	-0.8	-0.9	-1.1	-1.2	-1.3	-1.3	-1.2	-1.4	-1.4	-1.2	-1.2	-1.2
ENGINE & WING**	-1.2	-1.2	-1.2	-1.2	-1.2	-1.4	-1.5	-1.7	-1.9	-1.9	-1.7	-1.9	-1.9	-1.8	-1.7	-1.8

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC
ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on and anti-ice off

240 KIAS

TAT(°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	90.5	90.6	91.4	89.3	89.1	89.0	89.1									
25	90.5	91.6	92.8	90.6	90.2	89.8	90.0	89.6	89.3	89.4						
20	89.8	92.4	94.1	92.1	91.5	90.7	90.8	90.5	90.2	90.1	89.2	88.0				
15	89.1	92.9	95.3	94.0	93.3	92.2	91.8	91.4	91.0	90.9	90.2	88.8	87.1	86.0	86.5	88.0
10	88.3	92.1	95.5	95.9	95.2	94.0	92.9	92.5	92.0	91.8	91.0	89.9	88.6	87.5	86.9	88.2
5	87.5	91.3	94.6	95.5	96.5	95.9	94.1	93.7	93.2	93.0	92.0	91.1	90.1	89.2	88.8	89.7
0	86.7	90.4	93.8	94.6	95.6	96.2	94.7	94.4	94.5	94.3	93.1	92.3	91.8	90.9	90.5	91.0
-5	85.9	89.6	92.9	93.7	94.7	95.3	93.9	94.2	94.3	94.4	94.2	93.5	93.4	92.5	91.8	92.1
-10	85.1	88.8	92.1	92.9	93.8	94.4	93.0	93.4	93.5	93.6	94.1	94.5	94.4	93.8	93.2	93.3
-15	84.3	87.9	91.2	92.0	92.9	93.5	92.1	92.5	92.6	92.7	93.2	94.2	95.0	94.7	94.1	94.1
-20	83.5	87.1	90.3	91.1	92.0	92.6	91.2	91.6	91.7	91.8	92.3	93.2	94.4	94.8	94.7	94.7
-25	82.7	86.2	89.4	90.2	91.1	91.7	90.3	90.7	90.8	90.9	91.3	92.3	93.4	93.8	94.0	94.1
-30	81.8	85.3	88.5	89.3	90.2	90.8	89.4	89.7	89.9	89.9	90.4	91.4	92.5	92.9	93.0	93.1
-35	81.0	84.4	87.6	88.3	89.3	89.8	88.5	88.8	89.0	89.0	89.5	90.4	91.5	91.9	92.1	92.2
-40	80.1	83.6	86.6	87.4	88.3	88.9	87.6	87.9	88.0	88.1	88.5	89.5	90.6	91.0	91.1	91.2

200 KIAS

TAT(°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	89.8	89.6	89.9	88.2	88.3	88.3	89.4									
25	90.1	90.8	91.6	88.9	89.1	89.1	89.2	89.3	89.9	90.2						
20	90.1	91.4	92.6	89.6	89.9	89.9	90.0	89.6	89.2	89.4	89.5	89.5				
15	89.4	91.4	92.8	90.6	91.0	90.9	90.9	90.5	90.1	89.9	89.0	88.7	88.7	89.2	89.7	88.8
10	88.6	91.0	92.8	91.7	92.2	92.2	92.2	91.6	91.0	90.8	89.9	89.0	88.0	88.4	88.9	88.0
5	87.8	90.2	92.1	92.5	93.0	93.7	93.4	92.8	92.2	91.9	90.8	89.9	89.0	88.4	88.1	87.2
0	87.0	89.4	91.3	91.7	92.8	93.8	94.7	94.1	93.5	93.2	91.9	90.9	90.0	89.2	88.7	88.0
-5	86.2	88.6	90.4	90.8	91.9	93.1	94.2	94.5	94.7	94.5	93.1	91.9	90.9	90.0	89.4	89.1
-10	85.4	87.7	89.6	90.0	91.1	92.3	93.3	93.9	94.3	94.6	94.1	92.8	91.8	90.8	90.1	90.0
-15	84.6	86.9	88.7	89.1	90.2	91.4	92.4	93.0	93.5	93.7	93.9	93.4	92.4	91.5	90.7	90.8
-20	83.8	86.0	87.9	88.2	89.3	90.5	91.5	92.1	92.6	92.8	93.0	93.0	92.7	91.7	91.1	91.4
-25	82.9	85.2	87.0	87.4	88.4	89.6	90.6	91.1	91.6	91.9	92.1	92.1	92.2	91.8	91.1	91.6
-30	82.1	84.3	86.1	86.5	87.5	88.7	89.7	90.2	90.7	91.0	91.2	91.2	91.2	90.8	90.7	91.3
-35	81.2	83.5	85.2	85.6	86.6	87.8	88.8	89.3	89.8	90.0	90.2	90.2	90.3	89.9	89.7	90.4
-40	80.4	82.6	84.3	84.7	85.7	86.8	87.8	88.3	88.8	89.1	89.3	89.3	89.3	89.0	88.8	89.4

%N1 Adjustment for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	-0.6	-0.5	-.05	-0.4	-0.4	-0.5	-0.6	-0.7	-0.8	-0.8	-0.7	-0.9	-0.8	-0.7	-0.6	-0.6
ENGINE & WING*	-0.9	-0.9	-0.9	-0.8	-0.8	-0.9	-1.1	-1.2	-1.3	-1.3	-1.2	-1.4	-1.4	-1.2	-1.2	-1.2
ENGINE & WING**	-1.2	-1.2	-1.2	-1.2	-1.2	-1.4	-1.5	-1.7	-1.9	-1.9	-1.7	-1.9	-1.9	-1.8	-1.7	-1.8

***Wing anti-ice on, packs on**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

220 KIAS Max Climb EPR

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	0	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35
55	1.204	1.203	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
50	1.221	1.215	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
45	1.239	1.232	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
40	1.258	1.250	1.242	1.239	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
35	1.271	1.270	1.260	1.260	1.257	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
30	1.271	1.293	1.284	1.283	1.282	1.278	1.273	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
25	1.271	1.303	1.311	1.309	1.307	1.304	1.301	1.299	1.284	1.281	1.282	1.274	1.265	1.252	1.238	1.219
20	1.271	1.303	1.339	1.337	1.335	1.334	1.331	1.329	1.316	1.300	1.291	1.274	1.265	1.252	1.238	1.219
15	1.271	1.303	1.343	1.361	1.367	1.368	1.365	1.363	1.348	1.333	1.325	1.299	1.271	1.252	1.238	1.219
10	1.271	1.303	1.343	1.361	1.385	1.404	1.403	1.402	1.386	1.369	1.360	1.334	1.308	1.277	1.243	1.219
5	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.444	1.429	1.410	1.400	1.372	1.345	1.317	1.288	1.253
0	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.471	1.455	1.447	1.413	1.385	1.359	1.332	1.306
-5	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.456	1.426	1.402	1.380	1.359
-10	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.464	1.441	1.426	1.407
-15	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.495	1.475	1.463	1.450
-20	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.495	1.499	1.493	1.484

Anti-ice Adjustment

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
ENGINE ONLY	-0.016	-0.015	-0.015	-0.009	-0.017	-0.023	-0.019	-0.016
ENGINE AND WING*	-0.022	-0.023	-0.020	-0.020	-0.030	-0.038	-0.034	-0.032
ENGINE AND WING**	-0.029	-0.031	-0.030	-0.030	-0.043	-0.053	-0.048	-0.048

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off, 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	13700	13600	11100
640	15100	15000	12700
620	16600	16500	14300
600	18000	17900	15900
580	19500	19400	17400
560	20700	20600	18900
540	21800	21800	20300
520	23000	22900	21500
500	24100	24100	22700
480	25300	25200	23900
460	26300	26100	25200
440	27300	27100	26200
420	28400	28100	27300
400	29600	29200	28400
380	30700	30300	29500
360	31600	31300	30700
340	32300	32000	31600
320	33100	32800	32500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
660	EPR	1.213	1.300								
	MACH	.487	.519								
	KIAS	269	262								
	FF/ENG	15836	15777								
620	EPR	1.192	1.267	1.311							
	MACH	.475	.510	.522							
	KIAS	263	257	253							
	FF/ENG	14816	14701	14794							
580	EPR	1.173	1.239	1.274	1.320						
	MACH	.463	.499	.512	.524						
	KIAS	256	251	248	244						
	FF/ENG	13831	13653	13688	13768						
540	EPR	1.155	1.212	1.242	1.280	1.328					
	MACH	.451	.486	.500	.514	.526					
	KIAS	249	245	242	239	235					
	FF/ENG	12868	12637	12613	12650	12716					
500	EPR	1.136	1.187	1.213	1.245	1.283	1.334				
	MACH	.437	.472	.487	.501	.515	.527				
	KIAS	241	237	236	233	230	226				
	FF/ENG	11905	11651	11571	11576	11606	11678				
460	EPR	1.119	1.164	1.186	1.213	1.245	1.285	1.341			
	MACH	.422	.457	.472	.487	.501	.515	.533			
	KIAS	233	230	228	226	224	221	219			
	FF/ENG	11018	10704	10584	10557	10547	10583	10804			
420	EPR	1.102	1.142	1.162	1.184	1.211	1.243	1.286	1.348		
	MACH	.405	.441	.456	.470	.485	.500	.518	.540		
	KIAS	224	221	220	218	217	214	213	213		
	FF/ENG	10124	9763	9648	9589	9578	9553	9649	9994		
380	EPR	1.086	1.120	1.138	1.158	1.180	1.206	1.241	1.287	1.352	
	MACH	.388	.423	.438	.452	.467	.483	.503	.524	.547	
	KIAS	214	212	211	210	208	207	207	207	207	
	FF/ENG	9248	8845	8720	8670	8641	8620	8696	8832	9171	
340	EPR	1.072	1.100	1.115	1.132	1.152	1.175	1.203	1.239	1.285	1.350
	MACH	.369	.403	.417	.432	.449	.467	.487	.507	.529	.552
	KIAS	204	202	201	200	200	200	200	200	200	200
	FF/ENG	8471	8091	7962	7762	7763	7805	7850	7911	8034	8353
300	EPR	1.059	1.082	1.095	1.110	1.127	1.148	1.171	1.198	1.233	1.278
	MACH	.349	.384	.399	.416	.433	.451	.469	.489	.511	.533
	KIAS	192	192	192	192	192	192	192	192	192	192
	FF/ENG	7552	7312	7203	7175	7147	7019	7058	7093	7134	7257

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
327	291	260	236	217	200	188	177	167	159	153
662	589	526	476	435	400	376	355	336	319	305
1003	889	793	716	654	600	565	533	505	479	457
1348	1193	1061	957	873	800	753	711	673	639	609
1697	1500	1331	1199	1093	1000	942	889	841	798	760
2052	1810	1603	1442	1312	1200	1130	1066	1008	956	911
2411	2122	1877	1686	1533	1400	1318	1243	1175	1115	1062
2774	2438	2152	1931	1753	1600	1505	1419	1342	1273	1212
3141	2756	2429	2176	1974	1800	1693	1596	1508	1430	1362
3513	3077	2708	2423	2196	2000	1881	1772	1675	1588	1512
3888	3400	2987	2670	2417	2200	2068	1948	1840	1745	1661
4268	3726	3269	2918	2640	2400	2255	2124	2006	1902	1810
4653	4055	3552	3167	2862	2600	2443	2300	2172	2058	1959
5042	4388	3836	3416	3085	2800	2630	2475	2337	2214	2107
5436	4723	4123	3667	3308	3000	2817	2651	2502	2370	2255
5835	5061	4411	3918	3532	3200	3004	2826	2666	2525	2403
6238	5402	4701	4170	3755	3400	3191	3001	2831	2680	2550
6646	5747	4992	4423	3980	3600	3377	3176	2995	2835	2696
7059	6094	5285	4677	4204	3800	3564	3350	3159	2990	2843
7477	6444	5580	4932	4429	4000	3751	3525	3323	3144	2989

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	14.6	0:47	13.0	0:45	11.4	0:43	10.4	0:42	10.1	0:41
400	29.0	1:38	26.2	1:33	23.2	1:27	21.7	1:23	20.9	1:19
600	43.4	2:28	39.4	2:21	35.0	2:11	32.9	2:05	31.7	1:57
800	57.8	3:19	52.6	3:08	46.8	2:54	44.2	2:46	42.6	2:36
1000	72.2	4:09	65.8	3:56	58.6	3:38	55.4	3:27	53.4	3:14
1200	85.7	5:03	78.3	4:46	69.8	4:23	65.9	4:09	63.4	3:54
1400	99.2	5:58	90.9	5:37	81.0	5:09	76.4	4:52	73.4	4:34
1600	112.7	6:52	103.4	6:27	92.3	5:55	86.9	5:34	83.4	5:13
1800	126.1	7:46	115.9	7:18	103.5	6:40	97.4	6:17	93.4	5:53
2000	139.6	8:40	128.4	8:08	114.7	7:26	107.9	6:59	103.4	6:33
2200	152.0	9:38	139.9	9:02	125.1	8:14	117.5	7:44	112.6	7:14
2400	164.3	10:36	151.5	9:56	135.6	9:02	127.2	8:28	121.7	7:56
2600	176.7	11:34	163.0	10:49	146.0	9:50	136.9	9:13	130.9	8:37
2800	189.0	12:32	174.6	11:43	156.4	10:38	146.5	9:58	140.0	9:19
3000	201.3	13:29	186.1	12:37	166.9	11:26	156.2	10:42	149.2	10:00
3200	212.7	14:31	196.8	13:34	176.6	12:16	165.2	11:29	157.7	10:44
3400	224.0	15:33	207.5	14:31	186.4	13:07	174.1	12:16	166.2	11:27
3600	235.4	16:35	218.1	15:28	196.2	13:58	183.1	13:03	174.7	12:10
3800	246.7	17:37	228.8	16:25	205.9	14:48	192.1	13:49	183.2	12:54
4000	258.0	18:39	239.5	17:22	215.7	15:39	201.1	14:36	191.8	13:37

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	300	350	400	450	500
20	-2.1	-0.9	0.0	2.6	5.9
40	-4.4	-2.0	0.0	4.8	10.9
60	-6.7	-3.2	0.0	6.9	15.4
80	-9.0	-4.4	0.0	8.8	19.6
100	-11.3	-5.5	0.0	10.6	23.4
120	-13.6	-6.7	0.0	12.2	26.8
140	-15.9	-7.8	0.0	13.6	29.8
160	-18.1	-9.0	0.0	14.8	32.4
180	-20.3	-10.1	0.0	15.9	34.7
200	-22.5	-11.2	0.0	16.8	36.6
220	-24.7	-12.3	0.0	17.6	38.0
240	-26.9	-13.4	0.0	18.2	39.1
260	-29.1	-14.5	0.0	18.6	39.8
280	-31.2	-15.6	0.0	18.9	40.2
300	-33.4	-16.7	0.0	19.0	40.1

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30 + 80 KIAS

PRESSURE ALT (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	40	44	48	52	56	60	64	69	73	77
TIME (MINUTES)	11	12	13	14	14	15	16	17	17	18

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
660	EPR	1.114	1.143	1.197	1.280			
	KIAS	244	244	244	244			
	FF/ENG	15100	14810	14940	15260			
620	EPR	1.103	1.128	1.178	1.251			
	KIAS	239	239	239	239			
	FF/ENG	14300	13980	14040	14210			
580	EPR	1.092	1.115	1.160	1.224	1.336		
	KIAS	235	235	235	235	235		
	FF/ENG	13540	13210	13180	13260	13990		
540	EPR	1.082	1.102	1.142	1.199	1.291		
	KIAS	230	230	230	230	230		
	FF/ENG	12720	12440	12310	12300	12750		
500	EPR	1.073	1.090	1.125	1.176	1.253		
	KIAS	224	224	224	224	224		
	FF/ENG	11900	11700	11500	11400	11620		
460	EPR	1.064	1.079	1.109	1.155	1.220	1.338	
	KIAS	218	218	218	218	218	218	
	FF/ENG	11090	10930	10730	10540	10630	11240	
420	EPR	1.055	1.069	1.095	1.134	1.191	1.283	
	KIAS	212	212	212	212	212	212	
	FF/ENG	10310	10130	9980	9690	9720	10040	
380	EPR	1.047	1.059	1.082	1.115	1.165	1.239	1.391
	KIAS	205	205	205	205	205	205	205
	FF/ENG	9540	9360	9240	8910	8870	9050	9750
340	EPR	1.041	1.051	1.072	1.101	1.145	1.209	1.326
	KIAS	203	203	203	203	203	203	203
	FF/ENG	9060	8880	8870	8570	8330	8440	8840
300	EPR	1.037	1.046	1.065	1.091	1.131	1.188	1.286
	KIAS	203	203	203	203	203	203	203
	FF/ENG	8920	8740	8570	8280	8120	8050	8260

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
660	EPR	1.114	1.142	1.197	1.278	
	KIAS	224	224	224	224	
	FF/ENG	14330	14050	14210	14430	
620	EPR	1.102	1.128	1.178	1.249	1.376
	KIAS	219	219	219	219	219
	FF/ENG	13530	13250	13300	13420	14290
580	EPR	1.092	1.114	1.159	1.222	1.325
	KIAS	215	215	215	215	215
	FF/ENG	12730	12510	12440	12510	13030
540	EPR	1.082	1.101	1.141	1.197	1.283
	KIAS	210	210	210	210	210
	FF/ENG	11900	11750	11600	11590	11850
500	EPR	1.072	1.090	1.124	1.174	1.248
	KIAS	204	204	204	204	204
	FF/ENG	11090	10950	10810	10700	10800
460	EPR	1.063	1.078	1.108	1.152	1.216
	KIAS	198	198	198	198	198
	FF/ENG	10290	10140	10040	9810	9870
420	EPR	1.054	1.068	1.093	1.131	1.186
	KIAS	192	192	192	192	192
	FF/ENG	9500	9350	9270	8980	8990
380	EPR	1.046	1.057	1.080	1.111	1.159
	KIAS	185	185	185	185	185
	FF/ENG	8880	8740	8620	8360	8170
340	EPR	1.040	1.049	1.069	1.097	1.138
	KIAS	183	183	183	183	183
	FF/ENG	8360	8230	8090	7860	7750
300	EPR	1.035	1.044	1.062	1.086	1.123
	KIAS	183	183	183	183	183
	FF/ENG	8030	7900	7760	7530	7400

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		VREF30 + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
500	476	223	4500	3300	400
460	438	217	7100	6300	5400
420	399	211	9700	9000	8200
380	364	205	12700	12100	11400
340	325	198	15100	14200	13300

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
500	2700		
480	4200	2700	
460	5700	4600	1400
440	7000	6200	5200
420	8300	7600	6800
400	9700	9100	8300
380	11600	10700	9800
360	12900	12400	11800
340	14100	13300	12700
320	15500	14600	13500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)					
		5	7	9	11	13	15
480	EPR	1.337					
	MACH	.367					
	KIAS	222					
	FF/ENG	22003					
440	EPR	1.297	1.340				
	MACH	.357	.371				
	KIAS	216	216				
	FF/ENG	19984	20407				
400	EPR	1.262	1.297	1.340	1.399		
	MACH	.347	.360	.374	.388		
	KIAS	210	210	210	210		
	FF/ENG	18239	18411	18820	19442		
360	EPR	1.230	1.260	1.294	1.337	1.396	
	MACH	.336	.349	.362	.376	.390	
	KIAS	203	203	203	203	203	
	FF/ENG	16599	16685	16854	17185	17705	
320	EPR	1.199	1.225	1.254	1.288	1.330	1.388
	MACH	.324	.336	.349	.363	.377	.391
	KIAS	196	196	196	196	196	196
	FF/ENG	15036	15071	15169	15282	15527	15959

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
349	305	269	241	219	200	187	174	164	155	147
529	462	406	363	329	300	279	261	245	231	219
709	619	543	485	439	400	372	347	325	306	290
891	777	681	607	550	500	465	434	406	382	361
1073	935	819	730	660	600	558	520	486	457	433
1257	1094	957	853	771	700	650	606	567	533	504
1441	1254	1096	976	881	800	743	692	647	608	575
1626	1414	1235	1099	992	900	836	778	728	683	646
1813	1575	1374	1222	1102	1000	928	864	808	759	717

Reference Fuel and Time Required at Check Point

AIR DIST(NM)	PRESSURE ALTITUDE (1000 FT)							
	6		8		10		12	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	15.2	0:54	14.7	0:53	14.4	0:51	14.2	0:50
300	23.1	1:21	22.4	1:19	22.1	1:17	21.8	1:14
400	30.9	1:47	30.2	1:45	29.7	1:42	29.5	1:39
500	38.6	2:15	37.7	2:11	37.1	2:07	36.9	2:04
600	46.3	2:42	45.2	2:37	44.5	2:33	44.2	2:28
700	53.8	3:09	52.6	3:04	51.7	2:58	51.4	2:53
800	61.3	3:36	59.9	3:30	58.9	3:24	58.5	3:18
900	68.7	4:04	67.1	3:57	66.0	3:50	65.5	3:44
1000	76.0	4:32	74.3	4:24	73.0	4:16	72.4	4:09

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	300	350	400	450	500
10	-1.3	-0.7	0.0	1.3	2.4
15	-2.0	-1.1	0.0	2.0	3.9
20	-2.8	-1.4	0.0	2.8	5.4
25	-3.5	-1.8	0.0	3.6	6.8
30	-4.2	-2.1	0.0	4.3	8.3
35	-4.9	-2.5	0.0	5.0	9.7
40	-5.6	-2.9	0.0	5.7	11.1
45	-6.3	-3.2	0.0	6.4	12.5
50	-7.0	-3.6	0.0	7.1	13.9
55	-7.6	-3.9	0.0	7.7	15.3
60	-8.3	-4.3	0.0	8.4	16.7
65	-9.0	-4.6	0.0	9.0	18.1
70	-9.6	-5.0	0.0	9.6	19.4
75	-10.3	-5.3	0.0	10.1	20.8
80	-10.9	-5.7	0.0	10.7	22.1

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
540	EPR	1.316			
	KIAS	230			
	FF/ENG	25350			
500	EPR	1.283			
	KIAS	224			
	FF/ENG	23400			
460	EPR	1.253	1.313		
	KIAS	218	218		
	FF/ENG	21600	21770		
420	EPR	1.225	1.276	1.392	
	KIAS	212	212	212	
	FF/ENG	19890	19850	21040	
380	EPR	1.198	1.243	1.334	
	KIAS	205	205	205	
	FF/ENG	18230	18090	18670	
340	EPR	1.180	1.222	1.302	
	KIAS	203	203	203	
	FF/ENG	17180	17050	17380	
300	EPR	1.167	1.207	1.280	1.408
	KIAS	203	203	203	203
	FF/ENG	16500	16340	16580	17520

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

General

FMC Takeoff Speeds

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight is determined as follows:

(1) Determine the dry field/obstacle limit weight for the takeoff flap setting.

(2) Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.

(3) Adjust field length available for temperature by amount shown on chart.

(4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff speed determination:

(1) Determine takeoff speeds V1, VR and V2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on reversers operating and a 15 ft. screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around EPR

To find Go-Around EPR based on normal engine bleed for packs on and anti-ice off, enter the Go-Around EPR table with airport pressure altitude and reported OAT or TAT and read EPR. EPR adjustments are shown for engine bleeds for various conditions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb EPR

This table shows Max Climb EPR for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read EPR. EPR adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body attitude and average EPR information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Control

These tables provide target EPR, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude, .84 Mach approximates the Long Range Cruise Mach schedule.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing Flaps 30 at the outer marker.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding

Target EPR, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed for the selected flap setting. Flaps 1 is based on VREF30+60 speed schedule. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read EPR, IAS and fuel flow per engine.

Advisory Information

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

The table "Approach or Landing Climb Limited Weight" presents the data which are the more limiting of Approach Climb Limit Weight and Landing Climb Limit Weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind, at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

Engine Inoperative

Initial Max Continuous EPR

The Initial Max Continuous EPR setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target EPR setting at the start of driftdown. Once driftdown is established, the Max Continuous EPR table should be used to determine EPR for the given conditions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Continuous EPR

Power setting is based on one engine operating with one bleed source for pack(s) operating and all anti-ice bleeds off. Enter the table for appropriate pressure altitude with IAS or Mach and TAT to read Max Continuous EPR. Apply the anti-ice corrections below the table as required.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Control

The table provides target EPR, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (LB/HR)				
	GROSS WEIGHT (1000 LB)				
	700	600	500	400	300
43				360	310
39			420	360	310
35		470	420	380	300
31	520	500	450	370	310
25	510	490	440	380	340
20	520	520	460	410	360
15	520	520	480	440	400
10	540	520	510	490	440
5	590	590	570	530	480

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing is planned. The tables show gear down rate of climb available for Flaps 20 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in the ALTERNATE mode is to reduce the PRIMARY mode (normal) performance limited weights. The Limit Weight table provides takeoff field, climb, obstacle, net level off and approach or landing climb weights. To determine limit weights for operations with the EEC in the ALTERNATE mode, enter the table with the limit weights for PRIMARY mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. The ALTERNATE Mode EEC Approach or Landing Climb limit must be compared to the Landing Field Length limit and the more limiting of the two must be used as the landing limit weight. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustments Table. The adjusted V1 should not exceed the adjusted VR.

NOTE: The FMC does incorporate ALTERNATE Mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule with anti-ice off. Enter the table with pressure altitude and TAT to read Max Climb %N1. Apply bleed adjustments as required.

Max Cruise %N1

Maximum Cruise %N1 is presented for .84M, which approximates Long Range Cruise speed. Enter the table with pressure altitude and TAT to read Max Cruise %N1. Appropriate bleed adjustments are shown.

Go-Around %N1

Go-Around power setting for ALTERNATE MODE EEC operation is presented for normal engine bleed for packs on. Go-Around %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Alternate Mode EEC, Engine Inoperative

Initial Max Continuous %N1

Initial Max Continuous %N1 settings for use following an engine failure are presented. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Appropriate bleed adjustments are shown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Max Continuous %N1 settings are presented as a function of pressure altitude and TAT for engine inoperative speeds of 320, 280, 240, and 200 KIAS. Power settings may be interpolated for intermediate airspeeds. Apply bleed adjustments as required.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777-300 PW4090 LB FT FAA TO1-10 TO2-20 TALPA

Pkg Model Identification PI.ModID.20.1

General PI.20.1

VREF PI.20.1
Flap Maneuver Speed PI.20.2
Slush/Standing Water Takeoff. PI.20.3
Slippery Runway Takeoff PI.20.5
TO1 Slush/Standing Water Takeoff PI.20.8
TO1 Slippery Runway Takeoff. PI.20.10
TO2 Slush/Standing Water Takeoff PI.20.14
TO2 Slippery Runway Takeoff. PI.20.16
Minimum Control Speeds. PI.20.20
Go-around EPR. PI.20.21
Max Climb EPR PI.20.22
Flight With Unreliable Airspeed / Turbulent Air Penetration PI.20.23

All Engine PI.21.1

Long Range Cruise Maximum Operating Altitude. PI.21.1
Long Range Cruise Control PI.21.3
Long Range Cruise Enroute Fuel and Time - Low Altitude. . PI.21.4
Long Range Cruise Enroute Fuel and Time - High Altitude . PI.21.6
Long Range Cruise Wind-Altitude Trade. PI.21.8
Descent at .84/310/250 . . . . . PI.21.8
Holding PI.21.9

Advisory Information. PI.22.1

Runway Surface Condition Correlation PI.22.1
Normal Configuration Landing Distance PI.22.2
Non-Normal Configuration Landing Distance PI.22.8
ADIRU/GPS DISAGREE (Flaps 25) PI.22.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADIRU/GPS DISAGREE (Flaps 30) PI.22.9
AIR DATA SYS (Flaps 20) PI.22.10
Airspeed Unreliable (Flaps 20) PI.22.11
ANTISKID (Flaps 25) PI.22.12
ANTISKID (Flaps 30) PI.22.13
ENG SHUTDOWN L, R (Flaps 20) PI.22.14
ENG SHUTDOWN L, R (Flaps 30) PI.22.15
FLAP / SLAT CONTROL (Flaps 20) PI.22.16
FLAPS DRIVE (Flaps ≤ 5) PI.22.17
FLAPS DRIVE (5 < Flaps < 20) PI.22.18
FLAPS DRIVE (Flaps ≥ 20) PI.22.19
FLAPS PRIMARY FAIL (Flaps 20) PI.22.20
FLIGHT CONTROL MODE (Flaps 20) PI.22.21
FLIGHT CONTROLS (Flaps 20) PI.22.22
HYD PRESS SYS C (Flaps 20). PI.22.23
HYD PRESS SYS L (Flaps 25) PI.22.24
HYD PRESS SYS L (Flaps 30) PI.22.25
HYD PRESS SYS L+C (Flaps 20) PI.22.26
HYD PRESS SYS L+R (Flaps 20) PI.22.27
HYD PRESS SYS R (Flaps 25). PI.22.28
HYD PRESS SYS R (Flaps 30). PI.22.29
HYD PRESS SYS R+C (Flaps 20) PI.22.30
NAV AIR DATA SYS (Flaps 20). PI.22.31
PITCH DOWN AUTHORITY (Flaps 25) PI.22.32
PITCH DOWN AUTHORITY (Flaps 30) PI.22.33
PITCH UP AUTHORITY (Flaps ≤ 15) PI.22.34
PITCH UP AUTHORITY (Flaps ≥ 20) PI.22.35
PRI FLIGHT COMPUTERS (Flaps 20) PI.22.36
SLATS DRIVE (Flaps 20) PI.22.37
SPOILERS (Flaps 25) PI.22.38
SPOILERS (Flaps 30) PI.22.39
STABILIZER (Flaps 20) PI.22.40
Approach or Landing Climb Limited Weight PI.22.41
Recommended Brake Cooling Schedule. PI.22.42

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Inoperative PI.23.1

Initial Max Continuous EPR. PI.23.1
Max Continuous EPR PI.23.2
Driftdown Speed/Level Off Altitude PI.23.6
Driftdown/LRC Cruise Range Capability PI.23.7
Long Range Cruise Altitude Capability PI.23.8
Long Range Cruise Control PI.23.9
Long Range Cruise Diversion Fuel and Time PI.23.10
Holding PI.23.12
Gear Down Landing Rate of Climb Available PI.23.13

Alternate Mode EEC PI.24.1

Limit Weight PI.24.1
Max Takeoff %N1 . . . . . PI.24.2
Max Climb %N1. . . . . PI.24.3
Max Cruise %N1 . . . . . PI.24.4
Go-Around %N1. . . . . PI.24.5

Alternate Mode EEC, Engine Inoperative PI.25.1

Initial Max Continuous %N1 . . . . . PI.25.1
Max Continuous %N1 . . . . . PI.25.2

Gear Down PI.26.1

220 KIAS Max Climb EPR PI.26.1
Long Range Cruise Altitude Capability PI.26.2
Long Range Cruise Control PI.26.3
Long Range Cruise Enroute Fuel and Time PI.26.4
Descent at VREF30+80 . . . . . PI.26.5
Holding PI.26.6

Gear Down, Engine Inoperative PI.27.1

Driftdown Speed/Level Off Altitude PI.27.1
Long Range Cruise Altitude Capability PI.27.2
Long Range Cruise Control PI.27.3

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Diversion Fuel and Time PI.27.4
Holding PI.27.5

Text PI.28.1

Introduction PI.28.1
General PI.28.1
All Engines PI.28.4
Advisory Information PI.28.6
Engine Inoperative PI.28.8
Alternate Mode EEC PI.28.11
Alternate Mode EEC, Engine Inoperative PI.28.12
Gear Down PI.28.12

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
005	HL7532	28371	WB552
006	HL7533	27948	WB553
004	HL7534	27950	WB551
007	HL7573	27952	WB554

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

VREF

WEIGHT (1000 LB)	VREF (KIAS) FLAPS 30	25	20
660	169	174	183
640	165	172	181
620	163	169	178
600	160	167	175
580	157	164	172
560	155	161	169
540	152	158	166
520	149	155	163
500	146	152	160
480	143	149	157
460	140	146	154
440	137	143	150
420	133	139	147
400	130	136	143
380	126	132	139
360	123	128	135
340	119	124	131

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS 0	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-73.7	-84.1	-94.5	-85.8	-96.2	-106.6	-112.4	-122.8	-133.2
660	-72.0	-82.4	-92.8	-83.4	-93.8	-104.2	-108.1	-118.5	-128.9
620	-69.1	-79.5	-89.9	-79.6	-90.0	-100.4	-102.3	-112.7	-123.1
580	-65.1	-75.5	-85.9	-74.5	-84.9	-95.3	-94.8	-105.2	-115.6
540	-59.8	-70.2	-80.6	-68.1	-78.5	-88.9	-85.9	-96.3	-106.7
500	-53.4	-63.8	-74.2	-60.4	-70.8	-81.2	-75.4	-85.8	-96.2
460	-45.7	-56.1	-66.5	-51.4	-61.8	-72.2	-63.3	-73.7	-84.1
420	-36.9	-47.3	-57.7	-41.0	-51.4	-61.8	-49.7	-60.1	-70.5
380	-26.9	-37.3	-47.7	-29.3	-39.7	-50.1	-34.5	-44.9	-55.3

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800							315.4		
6200				320.3			389.7	364.4	339.7
6600	359.2	332.9	306.7	399.0	372.3	346.0	469.8	442.1	415.3
7000	440.8	412.7	385.4	482.6	454.0	426.0	559.0	527.9	498.1
7400	529.9	499.1	469.3	572.8	541.7	511.6	661.0	625.0	590.9
7800	628.9	594.4	561.3	671.3	637.2	604.3	777.0	737.8	698.6
8200	740.6	702.2	664.4	777.2	741.7	706.1			
8600			778.5						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -125ft/+125ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-17	-13	-9	-12	-8	-4	-2	2	6
620	-19	-15	-11	-13	-9	-5	-3	1	5
580	-21	-17	-13	-15	-11	-7	-4	0	4
540	-23	-19	-15	-18	-14	-10	-7	-3	1
500	-25	-21	-17	-20	-16	-12	-10	-6	-2
460	-27	-23	-19	-23	-19	-15	-13	-9	-5
420	-28	-24	-20	-24	-20	-16	-16	-12	-8
380	-28	-24	-20	-25	-21	-17	-19	-15	-11
340	-28	-24	-20	-26	-22	-18	-21	-17	-13

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-103.0	-115.0	-127.0	-121.9	-133.9	-145.9	-154.2	-166.2	-178.2
660	-97.5	-109.5	-121.5	-114.7	-126.7	-138.7	-143.6	-155.6	-167.6
620	-91.4	-103.4	-115.4	-106.8	-118.8	-130.8	-132.2	-144.2	-156.2
580	-84.5	-96.5	-108.5	-98.2	-110.2	-122.2	-120.1	-132.1	-144.1
540	-77.0	-89.0	-101.0	-88.8	-100.8	-112.8	-107.2	-119.2	-131.2
500	-68.9	-80.9	-92.9	-78.6	-90.6	-102.6	-93.5	-105.5	-117.5
460	-60.0	-72.0	-84.0	-67.6	-79.6	-91.6	-79.1	-91.1	-103.1
420	-50.5	-62.5	-74.5	-55.9	-67.9	-79.9	-64.0	-76.0	-88.0
380	-40.3	-52.3	-64.3	-43.5	-55.5	-67.5	-48.1	-60.1	-72.1
340	-29.4	-41.4	-53.4	-30.3	-42.3	-54.3	-31.4	-43.4	-55.4

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
8200							268.7		
8600							377.1	268.7	
9000							492.1	377.1	268.7
9400				334.6			619.2	492.1	377.1
9800				476.5	334.6		761.0	619.2	492.1
10200	369.2			647.8	476.5	334.6		761.0	619.2
10600	624.9	369.2			647.8	476.5			761.0
11000		624.9	369.2			647.8			
11400			624.9						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water adjustment.**
2. **Adjust field length available by -190 ft/+180 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limited weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-30	-24	-18	-21	-15	-9	-7	-1	0
620	-33	-27	-21	-24	-18	-12	-9	-3	0
580	-36	-30	-24	-27	-21	-15	-12	-6	0
540	-39	-33	-27	-31	-25	-19	-15	-9	-3
500	-42	-36	-30	-35	-29	-23	-20	-14	-8
460	-45	-39	-33	-39	-33	-27	-25	-19	-13
420	-47	-41	-35	-43	-37	-31	-31	-25	-19
380	-49	-43	-37	-45	-39	-33	-36	-30	-24
340	-51	-45	-39	-47	-41	-35	-43	-37	-31

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	-4.0	-8.0	-31.1	-35.1	-39.1	-67.5	-71.5	-75.5
660	0.0	-4.0	-8.0	-35.8	-39.8	-43.8	-68.9	-72.9	-76.9
620	-1.9	-5.9	-9.9	-38.8	-42.8	-46.8	-68.8	-72.8	-76.8
580	-5.8	-9.8	-13.8	-40.3	-44.3	-48.3	-67.1	-71.1	-75.1
540	-8.4	-12.4	-16.4	-40.0	-44.0	-48.0	-63.9	-67.9	-71.9
500	-9.6	-13.6	-17.6	-38.2	-42.2	-46.2	-59.1	-63.1	-67.1
460	-9.3	-13.3	-17.3	-34.7	-38.7	-42.7	-52.8	-56.8	-60.8
420	-7.6	-11.6	-15.6	-29.6	-33.6	-37.6	-45.0	-49.0	-53.0
380	-4.6	-8.6	-12.6	-22.9	-26.9	-30.9	-35.7	-39.7	-43.7

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4600	424.1	304.8							
5000	590.2	494.7	386.0						
5400	730.2	648.4	559.5						
5800			703.3						
6200				397.2					
6600				517.4	397.2				
7000				642.2	517.4	397.2			
7400				771.0	642.2	517.4			
7800					771.0	642.2	321.8		
8200						771.0	383.8		
8600							449.5	340.2	
9000							520.4	403.0	
9400							598.0	470.1	358.7
9800							684.8	542.9	422.6
10200							778.6	623.0	491.3
10600								712.9	566.1
11000									648.8
11400									741.0

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -70ft/+70ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -100ft/+100ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -135ft/+135ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustments (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-3	-1	1	-12	-10	-8	-25	-23	-21
620	-4	-2	0	-15	-13	-11	-28	-26	-24
580	-6	-4	-2	-17	-15	-13	-31	-29	-27
540	-8	-6	-4	-20	-18	-16	-35	-33	-31
500	-9	-7	-5	-22	-20	-18	-38	-36	-34
460	-10	-8	-6	-25	-23	-21	-41	-39	-37
420	-11	-9	-7	-26	-24	-22	-44	-42	-40
380	-12	-10	-8	-28	-26	-24	-46	-44	-42
340	-12	-10	-8	-29	-27	-25	-48	-46	-44

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-7.4	-11.4	-15.4	-57.1	-61.1	-65.1	-100.6	-104.6	-108.6
660	-12.9	-16.9	-20.9	-60.0	-64.0	-68.0	-97.9	-101.9	-105.9
620	-17.1	-21.1	-25.1	-61.3	-65.3	-69.3	-94.4	-98.4	-102.4
580	-20.3	-24.3	-28.3	-61.2	-65.2	-69.2	-89.9	-93.9	-97.9
540	-22.2	-26.2	-30.2	-59.5	-63.5	-67.5	-84.5	-88.5	-92.5
500	-23.1	-27.1	-31.1	-56.2	-60.2	-64.2	-78.1	-82.1	-86.1
460	-22.7	-26.7	-30.7	-51.4	-55.4	-59.4	-70.9	-74.9	-78.9
420	-21.2	-25.2	-29.2	-45.1	-49.1	-53.1	-62.8	-66.8	-70.8
380	-18.6	-22.6	-26.6	-37.3	-41.3	-45.3	-53.7	-57.7	-61.7
340	-14.8	-18.8	-22.8	-28.0	-32.0	-36.0	-43.8	-47.8	-51.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800	686.4	601.9	452.4						
6200			722.1						
8600				716.0	531.6				
9000					772.9	632.7			
12600							409.4		
13000							621.4	275.1	
13400								496.1	
13800								701.9	364.9
14200									580.3

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -200 ft/+190 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limited weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-6	0	0	-19	-13	-7	-40	-34	-28
620	-8	-2	0	-23	-17	-11	-45	-39	-33
580	-10	-4	0	-26	-20	-14	-50	-44	-38
540	-12	-6	0	-30	-24	-18	-56	-50	-44
500	-15	-9	-3	-34	-28	-22	-61	-55	-49
460	-17	-11	-5	-38	-32	-26	-66	-60	-54
420	-19	-13	-7	-42	-36	-30	-72	-66	-60
380	-21	-15	-9	-46	-40	-34	-77	-71	-65
340	-24	-18	-12	-50	-44	-38	-81	-75	-69

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-63.3	-72.0	-80.6	-74.6	-83.3	-91.9	-99.8	-108.4	-116.8
660	-62.1	-70.7	-79.0	-72.6	-80.9	-89.1	-95.0	-103.3	-111.5
620	-59.5	-67.8	-76.0	-69.0	-77.2	-85.5	-89.6	-97.9	-106.1
580	-56.0	-64.2	-72.5	-64.6	-73.0	-81.5	-83.9	-92.5	-101.1
540	-53.2	-61.7	-70.3	-61.1	-69.7	-78.8	-78.9	-88.1	-97.4
500	-50.5	-59.8	-69.1	-57.9	-67.2	-76.4	-73.6	-83.2	-93.0
460	-46.6	-56.3	-66.1	-52.9	-62.6	-72.3	-66.2	-76.0	-85.7
420	-40.1	-49.8	-59.6	-44.8	-54.6	-64.3	-55.0	-64.7	-74.4
380	-30.8	-40.6	-50.3	-34.0	-43.7	-53.5	-40.8	-50.5	-60.2

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400							314.4		
5800				333.2			402.4	305.6	
6200	384.0			424.5	324.1		496.6	393.4	
6600	478.2	374.9		520.6	415.2	315.0	601.0	486.8	384.5
7000	580.1	468.4	365.9	623.0	510.7	406.0	721.1	590.0	477.1
7400	693.4	569.5	458.8	733.5	612.4	500.9		708.4	579.1
7800		681.4	559.0		722.3	601.9			695.8
8200			669.6			711.1			

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -125ft/+125ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-13	-9	-4	-8	-3	1	3	7	12
620	-15	-11	-7	-9	-5	-1	2	6	11
580	-17	-13	-9	-11	-7	-3	0	5	9
540	-20	-15	-11	-14	-10	-5	-2	2	6
500	-22	-18	-14	-17	-13	-8	-6	-1	3
460	-24	-20	-16	-20	-16	-12	-9	-5	-1
420	-26	-22	-17	-22	-18	-14	-13	-9	-4
380	-27	-23	-18	-24	-19	-15	-17	-12	-8
340	-27	-23	-19	-24	-20	-16	-20	-16	-11

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-102.5	-114.5	-126.5	-121.9	-133.9	-145.9	-155.8	-167.8	-179.8
660	-96.9	-108.9	-120.9	-114.6	-126.6	-138.6	-145.0	-157.0	-169.0
620	-91.0	-103.0	-115.0	-107.0	-119.0	-131.0	-133.8	-145.8	-157.8
580	-84.5	-96.5	-108.5	-98.7	-110.7	-122.7	-121.9	-133.9	-145.9
540	-77.2	-89.2	-101.2	-89.5	-101.5	-113.5	-109.3	-121.3	-133.3
500	-69.3	-81.3	-93.3	-79.6	-91.6	-103.6	-95.9	-107.9	-119.9
460	-60.6	-72.6	-84.6	-69.0	-81.0	-93.0	-81.8	-93.8	-105.8
420	-51.3	-63.3	-75.3	-57.5	-69.5	-81.5	-66.8	-78.8	-90.8
380	-41.3	-53.3	-65.3	-45.3	-57.3	-69.3	-51.1	-63.1	-75.1
340	-30.7	-42.7	-54.7	-32.4	-44.4	-56.4	-34.8	-46.8	-58.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7800							345.5		
8200							477.7	345.5	
8600				346.6			631.3	477.7	345.5
9000				531.0	346.6			631.3	477.7
9400	551.9				531.0	346.6			631.3
9800		551.9				531.0			
10200			551.9						

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water adjustment.**
2. **Adjust field length available by -190 ft/+180 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-24	-18	-12	-15	-9	-3	-1	0	0
620	-27	-21	-15	-18	-12	-6	-3	0	0
580	-30	-24	-18	-21	-15	-9	-6	0	0
540	-33	-27	-21	-25	-19	-13	-9	-3	0
500	-36	-30	-24	-29	-23	-17	-14	-8	-2
460	-39	-33	-27	-33	-27	-21	-19	-13	-7
420	-41	-35	-29	-37	-31	-25	-25	-19	-13
380	-43	-37	-31	-39	-33	-27	-31	-25	-19
340	-45	-39	-33	-41	-35	-29	-37	-31	-25

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	-3.7	-7.5	-23.9	-27.6	-31.4	-61.3	-65.1	-68.8
660	0.0	-3.7	-7.5	-29.1	-32.9	-36.6	-63.3	-67.0	-70.8
620	0.0	-3.7	-7.5	-33.7	-37.5	-41.2	-64.6	-68.3	-72.1
580	-2.3	-6.0	-9.8	-36.6	-40.4	-44.1	-64.3	-68.0	-71.8
540	-6.0	-9.8	-13.5	-37.8	-41.5	-45.3	-62.4	-66.1	-69.9
500	-8.3	-12.0	-15.8	-37.2	-40.9	-44.7	-58.8	-62.5	-66.3
460	-9.0	-12.7	-16.5	-34.9	-38.6	-42.4	-53.6	-57.3	-61.1
420	-8.2	-12.0	-15.7	-30.8	-34.6	-38.3	-46.8	-50.5	-54.2
380	-6.0	-9.7	-13.5	-25.0	-28.8	-32.5	-38.3	-42.0	-45.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4200	361.3								
4600	550.9	443.0	317.4						
5000	705.0	615.7	516.5						
5400		762.4	676.1						
5800				390.6					
6200				518.3	390.6				
6600				651.0	518.3	390.6			
7000					651.0	518.3			
7400						651.0	333.4		
7800							399.6		
8200							470.4	353.0	
8600							547.4	420.3	307.3
9000							632.6	492.8	372.7
9400							728.4	572.0	441.4
9800								660.1	515.8
10200								758.1	597.4
10600									688.9

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -70ft/+70ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -100ft/+100ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -135ft/+135ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff
10% Thrust Reduction
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-4	-2	0	-11	-10	-8	-22	-20	-18
620	-5	-3	-2	-13	-11	-10	-25	-23	-21
580	-6	-4	-3	-15	-14	-12	-28	-26	-24
540	-7	-6	-4	-17	-16	-14	-31	-29	-27
500	-9	-7	-6	-20	-18	-17	-34	-33	-31
460	-10	-9	-7	-22	-21	-19	-38	-36	-34
420	-12	-10	-8	-25	-23	-21	-41	-39	-37
380	-13	-11	-9	-26	-24	-23	-43	-41	-39
340	-13	-11	-10	-27	-25	-24	-45	-43	-41

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-1.1	-5.1	-9.1	-50.9	-54.9	-58.9	-98.0	-102.0	-106.0
660	-7.0	-11.0	-15.0	-54.2	-58.2	-62.2	-95.4	-99.4	-103.4
620	-12.4	-16.4	-20.4	-56.8	-60.8	-64.8	-92.3	-96.3	-100.3
580	-16.5	-20.5	-24.5	-57.8	-61.8	-65.8	-88.2	-92.2	-96.2
540	-19.4	-23.4	-27.4	-57.1	-61.1	-65.1	-83.3	-87.3	-91.3
500	-21.0	-25.0	-29.0	-54.9	-58.9	-62.9	-77.4	-81.4	-85.4
460	-21.5	-25.5	-29.5	-51.0	-55.0	-59.0	-70.5	-74.5	-78.5
420	-20.6	-24.6	-28.6	-45.5	-49.5	-53.5	-62.7	-66.7	-70.7
380	-18.5	-22.5	-26.5	-38.3	-42.3	-46.3	-53.9	-57.9	-61.9
340	-15.2	-19.2	-23.2	-29.6	-33.6	-37.6	-44.3	-48.3	-52.3

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400	683.1	588.7							
5800			721.8						
7800				594.3					
8200					674.4				
8600						736.4			
11800							450.2		
12200							672.8	307.8	
12600								541.4	
13000								757.8	403.5
13400									629.7

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -200 ft/+190 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limited weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff
10% Thrust Reduction
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-5	0	0	-16	-10	-4	-34	-28	-22
620	-7	-1	0	-19	-13	-7	-39	-33	-27
580	-9	-3	0	-23	-17	-11	-44	-38	-32
540	-11	-5	0	-26	-20	-14	-49	-43	-37
500	-13	-7	-1	-29	-23	-17	-54	-48	-42
460	-15	-9	-3	-33	-27	-21	-59	-53	-47
420	-17	-11	-5	-37	-31	-25	-64	-58	-52
380	-18	-12	-6	-40	-34	-28	-69	-63	-57
340	-20	-14	-8	-44	-38	-32	-74	-68	-62

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-53.0	-59.8	-66.7	-63.5	-70.4	-77.2	-87.2	-94.1	-101.0
660	-51.7	-58.6	-65.5	-61.5	-68.4	-75.3	-83.5	-90.4	-97.2
620	-50.5	-57.4	-64.2	-59.6	-66.5	-73.3	-79.8	-86.7	-93.4
580	-49.3	-55.8	-61.9	-57.1	-63.2	-69.3	-73.5	-79.6	-85.7
540	-44.0	-50.0	-56.1	-50.7	-56.8	-62.8	-65.4	-71.5	-78.2
500	-40.3	-47.1	-53.8	-46.9	-53.6	-60.3	-61.0	-68.5	-76.7
460	-41.5	-49.6	-57.7	-47.9	-56.0	-64.3	-61.6	-70.5	-79.6
420	-40.6	-49.6	-58.7	-46.1	-55.1	-64.2	-57.8	-66.8	-75.9
380	-34.3	-43.4	-52.4	-38.2	-47.3	-56.3	-46.5	-55.6	-64.6

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5000							312.9		
5400	311.7			351.0			420.3	301.9	
5800	417.0	300.9		458.3	340.3		532.6	409.5	
6200	525.7	406.4		568.6	447.5	329.4	656.1	521.0	398.7
6600	642.1	514.6	395.8	684.3	557.4	436.7		643.0	509.5
7000	767.5	630.0	503.5		672.4	546.2		778.2	630.1
7400		755.0	618.0			660.6			764.8
7800			742.5			779.0			

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -125ft/+125ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-8	-3	2	-2	3	8	11	15	20
620	-10	-5	-1	-4	1	6	9	14	19
580	-13	-8	-3	-6	-1	4	7	12	17
540	-15	-10	-6	-9	-4	1	5	10	14
500	-18	-13	-8	-12	-7	-2	1	6	11
460	-20	-15	-11	-16	-11	-6	-3	1	6
420	-23	-18	-13	-19	-14	-9	-8	-4	1
380	-24	-19	-14	-20	-15	-10	-12	-7	-2
340	-24	-19	-14	-21	-16	-11	-15	-10	-5

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	-98.7	-110.7	-122.7	-118.4	-130.4	-142.4	-153.8	-165.8	-177.8
660	-93.5	-105.5	-117.5	-111.6	-123.6	-135.6	-143.5	-155.5	-167.5
620	-88.2	-100.2	-112.2	-104.7	-116.7	-128.7	-133.2	-145.2	-157.2
580	-82.9	-94.9	-106.9	-97.8	-109.8	-121.8	-122.8	-134.8	-146.8
540	-76.9	-88.9	-100.9	-90.0	-102.0	-114.0	-111.6	-123.6	-135.6
500	-70.1	-82.1	-94.1	-81.4	-93.4	-105.4	-99.5	-111.5	-123.5
460	-62.5	-74.5	-86.5	-71.8	-83.8	-95.8	-86.5	-98.5	-110.5
420	-54.1	-66.1	-78.1	-61.4	-73.4	-85.4	-72.5	-84.5	-96.5
380	-44.9	-56.9	-68.9	-50.0	-62.0	-74.0	-57.7	-69.7	-81.7
340	-34.8	-46.8	-58.8	-37.7	-49.7	-61.7	-42.0	-54.0	-66.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7000							310.7		
7400							468.9	310.7	
7800				376.4			661.7	468.9	310.7
8200	336.9			632.5	376.4			661.7	468.9
8600	740.6	336.9			632.5	376.4			661.7
9000		740.6	336.9			632.5			
9400			740.6						

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water adjustment.**
2. **Adjust field length available by -190 ft/+180 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-15	-9	-3	-5	0	0	0	0	0
620	-19	-13	-7	-8	-2	0	0	0	0
580	-22	-16	-10	-13	-7	-1	0	0	0
540	-26	-20	-14	-17	-11	-5	0	0	0
500	-30	-24	-18	-22	-16	-10	-4	0	0
460	-33	-27	-21	-27	-21	-15	-10	-4	0
420	-36	-30	-24	-31	-25	-19	-16	-10	-4
380	-38	-32	-26	-34	-28	-22	-23	-17	-11
340	-40	-34	-28	-36	-30	-24	-31	-25	-19

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	-3.4	-6.8	-15.1	-18.5	-21.8	-52.9	-56.3	-59.6
660	0.0	-3.4	-6.8	-20.3	-23.7	-27.1	-54.8	-58.2	-61.6
620	0.0	-3.4	-6.8	-25.6	-29.0	-32.4	-57.0	-60.4	-63.8
580	0.0	-3.4	-6.8	-30.6	-34.0	-37.4	-58.9	-62.3	-65.8
540	-2.3	-5.8	-9.2	-33.7	-37.2	-40.6	-59.0	-62.5	-66.0
500	-6.0	-9.4	-12.9	-34.9	-38.4	-41.9	-57.3	-60.8	-64.3
460	-8.0	-11.5	-14.9	-34.3	-37.8	-41.3	-53.8	-57.3	-60.9
420	-8.3	-11.9	-15.4	-31.7	-35.2	-38.7	-48.5	-52.0	-55.6
380	-7.1	-10.7	-14.2	-27.2	-30.8	-34.3	-41.4	-44.9	-48.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4200	503.1	377.3							
4600	676.7	576.8	463.5						
5000		738.7	644.6						
5400				384.7					
5800				521.3	371.3				
6200				663.2	507.5	358.0			
6600					648.8	493.7			
7000						634.4	347.4		
7400						779.7	418.2		
7800							494.7	368.1	
8200							578.3	440.5	319.7
8600							671.8	518.9	389.3
9000							774.8	605.2	463.3
9400								702.5	543.8
9800									633.0
10200									733.5

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -70ft/+70ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -100ft/+100ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -135ft/+135ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff
20% Thrust Reduction
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-4	-3	-2	-10	-9	-7	-19	-17	-16
620	-5	-4	-2	-12	-10	-9	-21	-20	-18
580	-6	-5	-3	-13	-12	-11	-24	-22	-21
540	-7	-6	-4	-15	-14	-12	-27	-25	-23
500	-8	-7	-5	-17	-16	-14	-29	-28	-26
460	-9	-8	-7	-19	-18	-16	-33	-31	-29
420	-11	-10	-9	-22	-21	-19	-36	-35	-33
380	-12	-11	-9	-23	-22	-20	-38	-37	-35
340	-12	-11	-9	-24	-22	-21	-39	-38	-36

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
700	0.0	0.0	-2.1	-43.0	-47.0	-51.0	-93.5	-97.5	-101.5
660	0.0	-4.0	-8.0	-46.4	-50.4	-54.4	-91.1	-95.1	-99.1
620	-5.9	-9.9	-13.9	-49.8	-53.8	-57.8	-88.5	-92.5	-96.5
580	-11.3	-15.3	-19.3	-52.5	-56.5	-60.5	-85.5	-89.5	-93.5
540	-15.4	-19.4	-23.4	-53.5	-57.5	-61.5	-81.5	-85.5	-89.5
500	-18.2	-22.2	-26.2	-52.7	-56.7	-60.7	-76.5	-80.5	-84.5
460	-19.7	-23.7	-27.7	-50.2	-54.2	-58.2	-70.4	-74.4	-78.4
420	-19.8	-23.8	-27.8	-45.9	-49.9	-53.9	-63.4	-67.4	-71.4
380	-18.5	-22.5	-26.5	-39.9	-43.9	-47.9	-55.2	-59.2	-63.2
340	-16.0	-20.0	-24.0	-32.1	-36.1	-40.1	-46.1	-50.1	-54.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5000	668.1	554.0							
5400			711.3						
7400				708.9					
7800					775.3	604.2			
11000							495.5		
11400							730.9	344.1	
11800								592.0	
12200									445.9
12600									685.2

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -200 ft/+190 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limited weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff
20% Thrust Reduction
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
660	-6	0	0	-15	-9	-3	-30	-24	-18
620	-8	-2	0	-17	-11	-5	-34	-28	-22
580	-9	-3	0	-20	-14	-8	-38	-32	-26
540	-10	-4	0	-23	-17	-11	-42	-36	-30
500	-12	-6	0	-26	-20	-14	-47	-41	-35
460	-14	-8	-2	-29	-23	-17	-52	-46	-40
420	-15	-9	-3	-32	-26	-20	-56	-50	-44
380	-17	-11	-5	-35	-29	-23	-61	-55	-49
340	-18	-12	-6	-38	-32	-26	-65	-59	-53

1. **Obtain V1, VR and V2 for the actual weight.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Minimum Control Speeds

V1(MCG), Minimum VR
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)					
		0		4000		8000	
°C	°F	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR
60	140	97	103	95	100		
50	122	100	105	95	100	91	97
40	104	106	111	98	103	91	97
30	86	110	115	102	107	94	99
20	68	110	115	103	108	95	100
-60	-76	111	115	104	109	97	102

TO1 V1(MCG), Minimum VR
10% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)					
		0		4000		8000	
°C	°F	V1(MCG)	Min VR	V1(MCG)	Min VR	V1(MCG)	Min VR
60	140	93	98	90	95		
50	122	95	101	90	95	87	92
40	104	100	105	93	98	87	92
30	86	104	109	97	102	89	95
20	68	105	109	98	103	90	96
-60	-76	106	110	99	104	92	97

TO2 V1(MCG), Minimum VR
20% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)					
		0		4000		8000	
°C	°F	V1(MCG)	MinVR	V1(MCG)	MinVR	V1(MCG)	MinVR
60	140	89	94	86	91		
50	122	91	96	86	91	82	88
40	104	95	100	88	94	82	88
30	86	99	104	91	97	85	90
20	68	99	104	93	98	86	91
-60	-76	100	104	94	99	88	93

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Go-around EPR

Based on engine bleed for packs on and anti-ice off

REPORTED OAT		TAT	AIRPORT PRESSURE ALTITUDE (FT)										
°C	°F	°C	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
56	133	60	1.276	1.274	1.275	1.276	1.278	1.279	1.281	1.293	1.284	1.286	1.289
51	124	55	1.309	1.306	1.306	1.303	1.305	1.308	1.310	1.313	1.315	1.318	1.322
46	115	50	1.346	1.345	1.344	1.341	1.341	1.339	1.340	1.343	1.345	1.350	1.355
41	106	45	1.387	1.387	1.387	1.385	1.383	1.382	1.381	1.380	1.377	1.382	1.388
36	97	40	1.401	1.433	1.430	1.430	1.429	1.426	1.430	1.427	1.427	1.426	1.421
31	88	35	1.401	1.472	1.471	1.470	1.468	1.470	1.469	1.467	1.468	1.459	1.454
26	79	30	1.401	1.481	1.494	1.500	1.495	1.496	1.493	1.492	1.490	1.481	1.472
21	70	25	1.401	1.481	1.494	1.507	1.514	1.512	1.510	1.508	1.506	1.499	1.492
16	61	20	1.401	1.481	1.494	1.507	1.517	1.527	1.526	1.524	1.522	1.515	1.507
11	52	15	1.401	1.481	1.494	1.507	1.517	1.527	1.533	1.539	1.538	1.531	1.524
7	45	10	1.401	1.481	1.494	1.507	1.517	1.527	1.533	1.539	1.545	1.546	1.541
2 & BELOW	36 & BELOW	5 & BELOW	1.401	1.481	1.494	1.507	1.517	1.527	1.533	1.539	1.545	1.546	1.546

EPR Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	10000
PACKS OFF	0.013	0.013	0.014	0.016	0.017	0.018	0.020
2 PACK ON - 2 BLEED SOURCES	0	0	0	0	0	0	0
2 PACK ON - 1 BLEED SOURCES	-0.013	-0.014	-0.015	-0.016	-0.016	-0.018	-0.020
1 PACK ON - 2 BLEED SOURCE	-0.013	-0.014	-0.015	-0.016	-0.016	-0.018	-0.020
1 PACK ON - 1 BLEED SOURCE	-0.013	-0.014	-0.015	-0.016	-0.016	-0.018	-0.020
WING ANTI-ICE ON	0.006	0.006	0.008	0.008	0.008	0.009	0.010

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb EPR

Based on engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)/SPEED (IAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	1.148	1.134	1.141	1.151	1.154	1.104	1.100	1.171	1.186	1.201
50	1.186	1.171	1.158	1.151	1.154	1.104	1.100	1.171	1.186	1.201
40	1.210	1.212	1.198	1.186	1.161	1.104	1.100	1.171	1.186	1.201
30	1.210	1.234	1.252	1.241	1.209	1.153	1.113	1.171	1.186	1.201
20	1.210	1.234	1.264	1.301	1.277	1.248	1.223	1.193	1.186	1.201
10	1.210	1.234	1.264	1.301	1.330	1.382	1.338	1.294	1.281	1.289
0	1.210	1.234	1.264	1.301	1.330	1.410	1.441	1.401	1.384	1.384
-10	1.210	1.234	1.264	1.301	1.330	1.410	1.458	1.487	1.474	1.472
-15 & BELOW	1.210	1.234	1.264	1.301	1.330	1.410	1.458	1.503	1.505	1.504

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	40	43
ENGINE ONLY	-0.016	-0.015	-0.017	-0.019	-0.019	-0.021
ENGINE & WING*	-0.022	-0.025	-0.030	-0.034	-0.038	-0.042
ENGINE & WING**	-0.029	-0.035	-0.043	-0.048	-0.056	-0.063

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off, 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		400	500	600	700
40000 (.82M)	**PITCH ATT**	**3.5**			
	V/S (FT/MIN)	800			
30000 (280 KIAS)	**PITCH ATT**	**4.0**	**4.0**	**4.0**	
	V/S (FT/MIN)	1800	1200	700	
20000 (270 KIAS)	**PITCH ATT**	**6.5**	**6.0**	**6.0**	**6.5**
	V/S (FT/MIN)	2900	2100	1500	1000
10000 (270 KIAS)	**PITCH ATT**	**9.0**	**8.0**	**8.0**	**8.0**
	V/S (FT/MIN)	3900	2900	2200	1700
SEA LEVEL (270 KIAS)	**PITCH ATT**	**11.5**	**10.5**	**9.5**	**9.5**
	V/S (FT/MIN)	4700	3600	2800	2300

Cruise

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		400	500	600	700
40000 (.82M)	**PITCH ATT**	**2.5**			
	EPR	1.211			
	(Alt Mode %N1)	(83.6)			
35000 (280 KIAS)	**PITCH ATT**	**1.5**	**2.0**	**3.0**	
	EPR	1.092	1.18	1.370	
	(Alt Mode %N1)	(79.8)	(83.1)	(89.7)	
30000 (280 KIAS)	**PITCH ATT**	**2.0**	**2.5**	**3.0**	**4.0**
	EPR	1.027	1.082	1.168	1.336
	(Alt Mode %N1)	(76.3)	(79.0)	(82.8)	(89.2)
25000 (280 KIAS)	**PITCH ATT**	**2.0**	**2.5**	**3.5**	**4.0**
	EPR	0.988	1.024	1.084	1.162
	(Alt Mode %N1)	(72.5)	(75.2)	(78.6)	(82.4)
20000 (270 KIAS)	**PITCH ATT**	**2.0**	**3.0**	**4.0**	**5.0**
	EPR	0.973	1.001	1.042	1.101
	(Alt Mode %N1)	(68.0)	(70.6)	(74.5)	(78.5)
15000 (270 KIAS)	**PITCH ATT**	**2.0**	**3.0**	**4.0**	**5.0**
	EPR	0.969	0.988	1.018	1.057
	(Alt Mode %N1)	(64.9)	(67.3)	(70.2)	(74.1)

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)			
		400	500	600	700
40000 (.82M)	**PITCH ATT**	**-0.5**			
	V/S (FT/MIN)	-2500			
30000 (280 KIAS)	**PITCH ATT**	**-1.0**	**0.0**	**1.0**	
	V/S (FT/MIN)	-2100	-1900	-1900	
20000 (270 KIAS)	**PITCH ATT**	**-0.5**	**0.5**	**1.5**	**2.0**
	V/S (FT/MIN)	-1700	-1600	-1600	-1600
10000 (270 KIAS)	**PITCH ATT**	**-1.0**	**0.0**	**1.0**	**2.0**
	V/S (FT/MIN)	-1600	-1500	-1400	-1400
SEA LEVEL (270 KIAS)	**PITCH ATT**	**-1.5**	**-0.5**	**1.0**	**2.0**
	V/S (FT/MIN)	-1600	-1400	-1400	-1400

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		400	500	600	700
10000	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**4.5**
	EPR	1.002	1.012	1.019	1.028
	(Alt Mode %N1)	(55.8)	(61.5)	(66.3)	(70.0)
	KIAS	210	227	249	271
5000	**PITCH ATT**	**4.0**	**4.5**	**5.0**	**5.0**
	EPR	0.998	1.006	1.010	1.016
	(Alt Mode %N1)	(51.5)	(57.2)	(62.2)	(66.3)
	KIAS	210	226	248	268

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)			
		400	500	600	700
FLAPS UP (GEAR UP) (VREF30+80)	PITCH ATT	**4.5**	**5.0**	**5.5**	**5.5**
	EPR	0.997	1.007	1.020	1.034
	(Alt Mode %N1)	(51.3)	(57.2)	(62.2)	(66.7)
	KIAS	210	226	239	254
FLAPS 1 (GEAR UP) (VREF30+60)	**PITCH ATT**	**6.0**	**6.5**	**7.0**	**7.0**
	EPR	1.012	1.024	1.040	1.060
	(Alt Mode %N1)	(51.9)	(58.0)	(63.5)	(68.2)
	KIAS	190	206	219	234
FLAPS 5 (GEAR UP) (VREF30+40)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**
	EPR	1.027	1.043	1.063	1.084
	(Alt Mode %N1)	(53.1)	(59.5)	(65.0)	(69.5)
	KIAS	170	186	199	214
FLAPS 15 (GEAR UP) (VREF30+20)	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**
	EPR	1.043	1.062	1.088	1.112
	(Alt Mode %N1)	(55.0)	(61.4)	(66.9)	(71.3)
	KIAS	150	166	179	194
FLAPS 20 GEAR DOWN) (VREF30+20)	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**
	EPR	1.070	1.101	1.136	1.174
	(Alt Mode %N1)	(61.4)	(67.9)	(73.1)	(77.6)
	KIAS	150	166	179	194

Final Approach (1500 FT)

Gear Down, Set Thrust for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)			
		400	500	600	700
FLAPS 20 (VREF20+10)	**PITCH ATT**	**1.0**	**1.5**	**1.5**	**1.5**
	EPR	1.002	1.007	1.012	1.017
	(Alt Mode %N1)	41.0	45.6	49.6	53.1
	KIAS	153	170	184	198
FLAPS 25 (VREF25+10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**
	EPR	1.031	1.043	1.055	1.071
	(Alt Mode %N1)	50.2	55.8	60.7	64.7
	KIAS	145	162	176	189
FLAPS 30 (VREF30+10)	**PITCH ATT**	**0.5**	**0.5**	**0.5**	**0.5**
	EPR	1.050	1.066	1.085	1.108
	(Alt Mode %N1)	55.3	60.9	65.7	70.1
	KIAS	140	156	169	184

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

Normal Mode

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		400	500	600	700
10000	**PITCH ATT**	**14.0**	**11.0**	**9.5**	**7.5**
	V/S (FT/MIN)	3000	2300	1700	1300
	KIAS	150	166	180	197
5000	**PITCH ATT**	**17.0**	**13.5**	**11.5**	**9.5**
	V/S (FT/MIN)	3700	2900	2300	1800
	KIAS	150	166	180	195
SEA LEVEL	**PITCH ATT**	**20.0**	**16.0**	**13.0**	**11.0**
	V/S (FT/MIN)	4300	3400	2700	2200
	KIAS	150	166	179	194

Alternate Mode EEC

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)			
		350	450	550	650
10000	**PITCH ATT**	**13.5**	**10.5**	**9.0**	**7.5**
	V/S (FT/MIN)	2900	2100	1600	1200
	KIAS	150	166	180	197
5000	**PITCH ATT**	**16.5**	**13.0**	**11.0**	**9.0**
	V/S (FT/MIN)	3600	2800	2200	1700
	KIAS	150	166	180	195
SEA LEVEL	**PITCH ATT**	**19.0**	**15.0**	**12.5**	**10.5**
	V/S (FT/MIN)	4100	3200	2600	2100
	KIAS	150	166	179	194

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29500	0	32800*	32800*	32800*	32800*	32200
640	30100	-1	33600*	33600*	33600*	33600*	32900
620	30800	-3	34300*	34300*	34300*	34300*	33500
600	31500	-4	35100*	35100*	35100*	35100*	34200
580	32300	-6	35800*	35800*	35800*	35800*	35000
560	33000	-8	36300*	36300*	36300*	36300*	35700
540	33800	-9	37000*	37000*	37000*	37000*	36400
520	34600	-11	37800*	37800*	37800*	37800*	37200
500	35400	-13	38600*	38600*	38600*	38600*	38000
480	36300	-14	39400*	39400*	39400*	39400*	38900
460	37200	-14	40200*	40200*	40200*	40200*	39800
440	38100	-14	41100*	41100*	41100*	41100*	40700
420	39100	-14	42000*	42000*	42000*	42000*	41700
400	40100	-14	43000*	43000*	43000*	43000*	42700
380	41100	-14	43100	43100	43100	43100	43100
360	42300	-14	43100	43100	43100	43100	43100
340	43100	-14	43100	43100	43100	43100	43100

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29500	6	31800*	31800*	31800*	31800*	31800*
640	30100	5	32600*	32600*	32600*	32600*	32600*
620	30800	3	33400*	33400*	33400*	33400*	33400*
600	31500	1	34300*	34300*	34300*	34300*	34200
580	32300	0	35100*	35100*	35100*	35100*	35000
560	33000	-2	35800*	35800*	35800*	35800*	35700
540	33800	-4	36400*	36400*	36400*	36400*	36400
520	34600	-5	37200*	37200*	37200*	37200*	37200
500	35400	-7	38000*	38000*	38000*	38000*	38000
480	36300	-9	38800*	38800*	38800*	38800*	38800*
460	37200	-9	39600*	39600*	39600*	39600*	39600*
440	38100	-9	40500*	40500*	40500*	40500*	40500*
420	39100	-9	41400*	41400*	41400*	41400*	41400*
400	40100	-9	42300*	42300*	42300*	42300*	42300*
380	41100	-9	43100	43100	43100	43100	43100
360	42300	-9	43100	43100	43100	43100	43100
340	43100	-9	43100	43100	43100	43100	43100

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
660	29500	12	30300*	30300*	30300*	30300*	30300*
640	30100	10	31200*	31200*	31200*	31200*	31200*
620	30800	9	32100*	32100*	32100*	32100*	32100*
600	31500	7	33000*	33000*	33000*	33000*	33000*
580	32300	6	34000*	34000*	34000*	34000*	34000*
560	33000	4	34900*	34900*	34900*	34900*	34900*
540	33800	2	35600*	35600*	35600*	35600*	35600*
520	34600	0	36200*	36200*	36200*	36200*	36200*
500	35400	-2	37000*	37000*	37000*	37000*	37000*
480	36300	-3	37800*	37800*	37800*	37800*	37800*
460	37200	-3	38700*	38700*	38700*	38700*	38700*
440	38100	-3	39500*	39500*	39500*	39500*	39500*
420	39100	-3	40400*	40400*	40400*	40400*	40400*
400	40100	-3	41300*	41300*	41300*	41300*	41300*
380	41100	-3	42300*	42300*	42300*	42300*	42300*
360	42300	-3	43100	43100	43100	43100	43100
340	43100	-3	43100	43100	43100	43100	43100

***Denotes altitude thrust limited in level flight, 300 fpm residual rate of climb.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		25	27	29	31	33	35	37	39	41	43
660	EPR	1.090	1.125	1.172	1.250	1.370					
	MACH	.772	.802	.834	.841	.839					
	KIAS	325	325	325	314	300					
	FF/ENG	9724	9828	10065	10189	10650					
620	EPR	1.069	1.100	1.140	1.199	1.286					
	MACH	.772	.802	.834	.841	.841					
	KIAS	325	325	325	314	301					
	FF/ENG	9343	9405	9586	9535	9619					
580	EPR	1.052	1.079	1.111	1.157	1.224	1.325				
	MACH	.772	.802	.828	.838	.841	.840				
	KIAS	325	325	322	313	301	287				
	FF/ENG	9022	9054	9067	8966	8903	9099				
540	EPR	1.036	1.061	1.088	1.123	1.174	1.249	1.367			
	MACH	.754	.785	.813	.831	.839	.841	.839			
	KIAS	317	317	316	310	300	288	274			
	FF/ENG	8469	8495	8493	8410	8316	8291	8668			
500	EPR	1.021	1.041	1.067	1.095	1.134	1.189	1.273	1.408		
	MACH	.726	.758	.789	.816	.833	.840	.841	.838		
	KIAS	304	305	306	304	297	287	275	261		
	FF/ENG	7809	7842	7861	7848	7760	7673	7734	8277		
460	EPR	1.006	1.024	1.045	1.072	1.101	1.143	1.204	1.294		
	MACH	.699	.728	.760	.792	.818	.834	.840	.841		
	KIAS	292	292	294	294	292	285	274	262		
	FF/ENG	7189	7184	7218	7225	7205	7121	7087	7227		
420	EPR	.994	1.007	1.026	1.047	1.074	1.105	1.150	1.216	1.307	
	MACH	.672	.698	.727	.760	.792	.819	.835	.840	.841	
	KIAS	280	280	280	281	282	279	272	262	250	
	FF/ENG	6616	6566	6564	6590	6589	6571	6533	6548	6696	
380	EPR	.985	.994	1.007	1.026	1.047	1.073	1.108	1.155	1.219	1.310
	MACH	.645	.669	.695	.724	.757	.791	.818	.834	.840	.841
	KIAS	268	267	266	267	268	268	266	260	250	239
	FF/ENG	6060	5995	5947	5941	5960	5969	5979	5987	6000	6133
340	EPR	.977	.984	.993	1.006	1.023	1.044	1.072	1.108	1.153	1.216
	MACH	.615	.639	.663	.689	.718	.751	.785	.815	.832	.840
	KIAS	255	254	253	253	253	254	254	253	247	239
	FF/ENG	5608	5553	5380	5332	5314	5332	5371	5422	5433	5443

Shaded area approximates optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - Low Altitude

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
283	262	243	226	213	200	191	182	174	167	161
423	392	364	340	319	300	286	274	262	252	243
564	522	485	453	425	400	382	366	351	337	325
705	653	606	566	531	500	478	457	439	422	407
846	783	727	680	638	600	574	549	527	507	489
987	914	849	793	744	700	670	642	616	592	570
1128	1044	970	906	850	800	766	734	704	677	652
1271	1176	1092	1020	957	900	861	825	792	762	734
1413	1308	1214	1133	1063	1000	957	917	880	846	816
1555	1439	1335	1247	1170	1100	1053	1009	968	931	898
1698	1571	1458	1361	1276	1200	1148	1101	1056	1016	979
1841	1703	1580	1475	1383	1300	1244	1192	1145	1101	1061
1984	1835	1702	1589	1489	1400	1340	1284	1233	1185	1142
2128	1968	1825	1703	1596	1500	1436	1376	1321	1270	1224
2272	2100	1948	1817	1703	1600	1532	1468	1409	1355	1305
2417	2234	2070	1931	1809	1700	1627	1559	1497	1439	1387
2562	2367	2193	2045	1916	1800	1723	1651	1584	1524	1468
2707	2500	2316	2159	2023	1900	1818	1742	1672	1608	1549
2852	2634	2439	2274	2129	2000	1914	1834	1760	1692	1630

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	8.9	0:39	7.6	0:37	6.2	0:35	5.4	0:34	4.8	0:33
300	13.6	0:56	12.0	0:53	10.0	0:50	9.0	0:48	8.2	0:46
400	18.4	1:13	16.3	1:10	13.9	1:05	12.7	1:02	11.6	1:00
500	23.1	1:30	20.7	1:26	17.7	1:20	16.2	1:17	15.0	1:13
600	27.8	1:48	25.1	1:42	21.6	1:35	19.8	1:31	18.3	1:26
700	32.5	2:05	29.5	1:59	25.4	1:50	23.4	1:45	21.7	1:39
800	37.2	2:23	33.9	2:15	29.2	2:05	26.9	1:59	25.0	1:53
900	41.9	2:41	38.2	2:32	33.0	2:20	30.4	2:13	28.3	2:06
1000	46.6	2:58	42.5	2:48	36.7	2:36	34.0	2:28	31.7	2:19
1100	51.2	3:16	46.8	3:05	40.6	2:51	37.5	2:42	34.9	2:33
1200	55.9	3:34	51.1	3:22	44.4	3:06	41.0	2:57	38.2	2:46
1300	60.5	3:52	55.4	3:39	48.2	3:21	44.4	3:11	41.5	3:00
1400	65.1	4:11	59.7	3:56	52.0	3:37	47.9	3:26	44.8	3:13
1500	69.7	4:29	63.9	4:13	55.7	3:52	51.4	3:40	48.0	3:27
1600	74.3	4:47	68.1	4:30	59.5	4:08	54.8	3:55	51.2	3:41
1700	78.8	5:06	72.3	4:47	63.2	4:23	58.2	4:10	54.5	3:55
1800	83.3	5:24	76.5	5:04	66.9	4:39	61.7	4:24	57.7	4:08
1900	87.8	5:43	80.7	5:22	70.6	4:55	65.1	4:39	60.9	4:22
2000	92.3	6:02	84.9	5:39	74.3	5:10	68.5	4:54	64.0	4:36

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - Low Altitude

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	300	350	400	450	500	550	600	650
10	-1.3	-1.1	-0.6	-0.3	0.0	0.4	0.8	1.3
20	-3.4	-2.4	-1.5	-0.8	0.0	1.0	2.0	3.1
30	-5.5	-3.8	-2.4	-1.2	0.0	1.5	3.2	4.9
40	-7.6	-5.3	-3.3	-1.6	0.0	2.1	4.3	6.7
50	-9.6	-6.8	-4.2	-2.1	0.0	2.7	5.5	8.5
60	-11.8	-8.3	-5.2	-2.6	0.0	3.3	6.7	10.2
70	-13.9	-9.9	-6.2	-3.0	0.0	3.9	7.8	11.9
80	-16.1	-11.5	-7.3	-3.5	0.0	4.4	9.0	13.6
90	-18.3	-13.1	-8.4	-4.0	0.0	5.0	10.2	15.3
100	-20.4	-14.8	-9.5	-4.5	0.0	5.6	11.3	17.0

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitude

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
521	492	465	441	419	400	383	367	352	339	327
1032	976	925	879	838	800	767	736	708	682	658
1545	1462	1386	1318	1257	1200	1151	1106	1064	1025	990
2059	1949	1848	1758	1676	1600	1535	1475	1419	1368	1321
2576	2438	2311	2198	2095	2000	1920	1844	1775	1711	1652
3095	2928	2775	2638	2514	2400	2304	2214	2131	2054	1983
3616	3419	3239	3079	2934	2800	2688	2583	2486	2397	2315
4139	3912	3705	3520	3353	3200	3072	2953	2842	2739	2645
4664	4407	4172	3963	3774	3600	3456	3322	3197	3082	2976
5192	4904	4640	4406	4194	4000	3840	3691	3552	3424	3306
5721	5401	5109	4849	4615	4400	4224	4059	3906	3765	3636
6253	5901	5579	5294	5036	4800	4607	4428	4261	4107	3965
6787	6402	6051	5739	5458	5200	4991	4796	4615	4448	4295
7324	6905	6523	6185	5880	5600	5375	5164	4969	4789	4623
7863	7410	6997	6631	6302	6000	5758	5532	5322	5128	4951
8405	7917	7472	7078	6724	6400	6141	5899	5674	5467	5277
8950	8426	7949	7526	7147	6800	6523	6266	6026	5805	5603
9497	8936	8426	7975	7571	7200	6906	6632	6378	6143	5929
10048	9449	8905	8425	7994	7600	7289	6998	6729	6480	6253
10601	9964	9385	8875	8418	8000	7671	7364	7079	6817	6577

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37 & ABOVE	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
400	11.9	0:57	11.5	0:56	11.1	0:56	11.0	0:57	11.1	0:58
800	24.7	1:51	23.9	1:48	23.2	1:47	22.8	1:47	22.8	1:47
1200	37.5	2:44	36.3	2:40	35.3	2:37	34.7	2:37	34.6	2:37
1600	50.3	3:38	48.7	3:32	47.4	3:28	46.5	3:27	46.3	3:27
2000	63.0	4:32	61.1	4:24	59.5	4:18	58.4	4:17	58.1	4:17
2400	75.3	5:27	73.0	5:17	71.1	5:10	69.7	5:07	69.2	5:07
2800	87.6	6:23	85.0	6:11	82.7	6:02	81.0	5:58	80.4	5:56
3200	99.6	7:19	96.7	7:05	94.1	6:54	92.1	6:49	91.2	6:47
3600	111.4	8:17	108.2	8:00	105.2	7:48	102.9	7:40	101.9	7:37
4000	123.2	9:14	119.7	8:56	116.3	8:41	113.8	8:32	112.5	8:28
4400	134.6	10:14	130.7	9:53	127.1	9:36	124.2	9:25	122.6	9:19
4800	146.0	11:13	141.7	10:50	137.8	10:31	134.6	10:18	132.8	10:10
5200	157.2	12:13	152.5	11:49	148.3	11:27	144.9	11:12	142.8	11:02
5600	168.3	13:15	163.1	12:48	158.6	12:24	154.9	12:06	152.5	11:55
6000	179.3	14:16	173.7	13:47	168.9	13:21	164.9	13:01	162.3	12:47
6400	190.1	15:20	184.1	14:49	178.8	14:20	174.5	13:58	171.6	13:41
6800	200.8	16:24	194.4	15:50	188.7	15:19	184.2	14:55	181.0	14:35
7200	211.4	17:29	204.6	16:52	198.5	16:19	193.6	15:52	190.2	15:31
7600	221.7	18:35	214.7	17:56	208.2	17:20	202.9	16:51	199.2	16:27
8000	232.0	19:41	224.7	18:59	218.0	18:21	212.1	17:50	208.2	17:23

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitude
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	300	350	400	450	500	550	600	650
10	-1.9	-1.9	-1.4	-0.7	0.0	1.9	5.8	11.7
20	-3.8	-3.3	-2.5	-1.2	0.0	2.9	8.2	15.9
30	-5.8	-4.8	-3.5	-1.7	0.0	3.8	10.5	20.0
40	-7.8	-6.2	-4.4	-2.2	0.0	4.7	12.7	23.8
50	-9.9	-7.7	-5.4	-2.7	0.0	5.6	14.8	27.5
60	-11.9	-9.2	-6.3	-3.2	0.0	6.5	16.9	31.1
70	-14.1	-10.8	-7.3	-3.8	0.0	7.3	18.8	34.4
80	-16.2	-12.3	-8.3	-4.3	0.0	8.2	20.7	37.6
90	-18.4	-13.9	-9.3	-4.8	0.0	9.0	22.5	40.6
100	-20.6	-15.5	-10.3	-5.3	0.0	9.7	24.2	43.5
110	-22.9	-17.1	-11.4	-5.9	0.0	10.5	25.9	46.1
120	-25.2	-18.7	-12.4	-6.4	0.0	11.2	27.4	48.6
130	-27.5	-20.4	-13.5	-6.9	0.0	11.9	28.9	50.9
140	-29.8	-22.1	-14.5	-7.5	0.0	12.6	30.3	53.1
150	-32.2	-23.8	-15.6	-8.0	0.0	13.2	31.6	55.0
160	-34.6	-25.5	-16.7	-8.6	0.0	13.9	32.8	56.8
170	-37.1	-27.3	-17.8	-9.1	0.0	14.5	33.9	58.4
180	-39.6	-29.1	-19.0	-9.7	0.0	15.1	35.0	59.8
190	-42.1	-30.9	-20.1	-10.2	0.0	15.6	36.0	61.1
200	-44.7	-32.7	-21.3	-10.8	0.0	16.2	36.9	62.2
210	-47.3	-34.5	-22.4	-11.3	0.0	16.7	37.7	63.1
220	-49.9	-36.4	-23.6	-11.9	0.0	17.2	38.4	63.8
230	-52.6	-38.3	-24.8	-12.4	0.0	17.6	39.1	64.3
240	-55.2	-40.2	-26.0	-13.0	0.0	18.1	39.6	64.7

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)								
	660	620	580	540	500	460	420	380	340
43							44	10	0
41						42	11	0	3
39				80	36	10	0	2	14
37			64	28	8	0	2	12	29
35		47	20	5	0	2	12	26	44
33	33	13	2	0	3	12	25	42	59
31	7	0	0	5	13	26	40	56	73
29	0	1	7	15	27	40	55	70	85
27	3	9	18	29	41	55	69	82	96
25	12	21	32	43	56	68	81	93	104

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent at .84/310/250

PRESSURE ALT (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	97	104	111	119	125	130	135	141	147	152
TIME (MINUTES)	19	20	21	22	23	23	24	25	26	26

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
660	EPR	1.009	1.013	1.025	1.033	1.041	1.100	1.204			
	KIAS	259	260	261	277	302	306	310			
	FF/ENG	9660	9510	9380	9290	9550	9750	10250			
620	EPR	1.007	1.011	1.021	1.033	1.034	1.082	1.169			
	KIAS	251	252	253	262	287	296	300			
	FF/ENG	9060	8960	8820	8660	8830	9080	9430			
580	EPR	1.006	1.010	1.017	1.032	1.034	1.066	1.139	1.321		
	KIAS	243	244	245	248	269	285	289	279		
	FF/ENG	8610	8540	8390	8190	8100	8430	8670	9270		
540	EPR	1.005	1.008	1.014	1.027	1.034	1.049	1.113	1.241		
	KIAS	234	235	236	237	252	275	278	279		
	FF/ENG	8050	7950	7850	7630	7560	7790	7960	8400		
500	EPR	1.003	1.006	1.012	1.022	1.034	1.039	1.090	1.188		
	KIAS	226	226	227	228	235	259	267	271		
	FF/ENG	7500	7370	7300	7090	6930	7090	7290	7600		
460	EPR	1.000	1.003	1.008	1.016	1.032	1.039	1.068	1.147	1.350	
	KIAS	220	220	220	220	220	238	255	259	249	
	FF/ENG	6970	6830	6750	6560	6380	6400	6660	6850	7580	
420	EPR	.996	.999	1.004	1.010	1.021	1.037	1.047	1.112	1.248	
	KIAS	213	213	213	213	213	220	243	246	249	
	FF/ENG	6430	6310	6180	6040	5900	5880	6020	6150	6670	
380	EPR	.993	.996	1.000	1.005	1.012	1.031	1.041	1.081	1.182	1.302
	KIAS	206	206	206	206	206	206	221	233	237	232
	FF/ENG	5900	5790	5660	5530	5420	5310	5420	5510	5850	6220
340	EPR	.991	.993	.996	1.000	1.005	1.019	1.039	1.054	1.130	1.211
	KIAS	199	199	199	199	199	199	199	219	223	225
	FF/ENG	5400	5280	5160	5020	4960	4800	4770	4930	5110	5380

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
660	EPR	1.038	1.050	1.071	1.108	1.164
	KIAS	229	229	229	229	229
	FF/ENG	10050	9940	9850	9600	9690
620	EPR	1.034	1.044	1.063	1.094	1.143
	KIAS	222	222	222	222	222
	FF/ENG	9420	9320	9250	9000	8990
580	EPR	1.028	1.037	1.054	1.079	1.121
	KIAS	217	217	217	217	217
	FF/ENG	8950	8840	8740	8520	8290
540	EPR	1.023	1.030	1.045	1.065	1.099
	KIAS	212	212	212	212	212
	FF/ENG	8360	8230	8140	7930	7790
500	EPR	1.019	1.025	1.037	1.054	1.079
	KIAS	206	206	206	206	206
	FF/ENG	7760	7630	7540	7360	7220
460	EPR	1.014	1.020	1.030	1.044	1.062
	KIAS	200	200	200	200	200
	FF/ENG	7160	7050	6940	6790	6660
420	EPR	1.009	1.015	1.024	1.035	1.047
	KIAS	193	193	193	193	193
	FF/ENG	6570	6470	6360	6230	6120
380	EPR	1.005	1.010	1.018	1.027	1.035
	KIAS	186	186	186	186	186
	FF/ENG	5990	5890	5790	5670	5590
340	EPR	1.001	1.005	1.012	1.020	1.025
	KIAS	179	179	179	179	179
	FF/ENG	5420	5320	5240	5140	5080

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4400	90/-50	90	-150/530	60/-50	80/-80	140	80	180
AUTOBRAKE MAX	5640	70/-70	130	-210/710	10/0	130/-130	260	0	0
AUTOBRAKE 4	6900	90/-90	170	-290/1000	10/-20	170/-170	330	0	0
AUTOBRAKE 3	8180	120/-120	220	-370/1240	30/-60	220/-220	390	0	0
AUTOBRAKE 2	9000	140/-140	250	-430/1440	100/-150	240/-240	360	140	140
AUTOBRAKE 1	9630	160/-160	290	-470/1610	180/-230	260/-260	360	520	590
Good Reported Braking Action									
MAX MANUAL	5760	80/-80	140	-240/870	140/-120	130/-130	210	280	620
AUTOBRAKE MAX	6120	80/-80	150	-250/910	120/-90	140/-140	250	290	640
AUTOBRAKE 4	6920	90/-90	170	-300/1020	30/-30	170/-170	330	20	100
AUTOBRAKE 3	8180	120/-120	220	-370/1240	30/-60	220/-220	390	0	0
AUTOBRAKE 2	9000	140/-140	250	-430/1440	100/-150	240/-240	360	140	140
AUTOBRAKE 1	9630	160/-160	290	-470/1610	180/-230	260/-260	360	520	590
Good To Medium Reported Braking Action									
MAX MANUAL	6690	100/-100	180	-320/1150	240/-190	160/-160	230	510	1210
AUTOBRAKE MAX	6910	100/-100	180	-320/1170	220/-160	170/-170	280	500	1200
AUTOBRAKE 4	7370	100/-100	200	-350/1230	180/-130	180/-180	320	360	940
AUTOBRAKE 3	8370	120/-120	220	-400/1390	130/-100	220/-220	390	180	600
AUTOBRAKE 2	9110	140/-140	260	-440/1540	170/-180	250/-240	360	230	510
AUTOBRAKE 1	9680	160/-160	290	-480/1670	240/-250	270/-260	360	560	780
Medium Reported Braking Action									
MAX MANUAL	7620	120/-120	220	-390/1430	330/-260	200/-180	250	740	1790
AUTOBRAKE MAX	7690	130/-120	220	-390/1430	320/-230	200/-200	300	710	1760
AUTOBRAKE 4	7810	120/-120	220	-390/1440	320/-220	200/-200	310	700	1780
AUTOBRAKE 3	8560	130/-130	230	-430/1530	230/-150	230/-230	390	370	1200
AUTOBRAKE 2	9210	140/-150	260	-460/1630	240/-220	250/-240	360	320	870
AUTOBRAKE 1	9730	160/-160	290	-490/1730	300/-280	280/-260	360	610	980

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	8660	140/-140	260	-490/1830	560/-390	230/-220	280	1140	2970
AUTOBRAKE MAX	8710	150/-140	260	-490/1830	560/-370	230/-220	300	1140	2960
AUTOBRAKE 4	8790	140/-140	260	-490/1840	550/-370	230/-220	300	1140	2980
AUTOBRAKE 3	9260	150/-140	270	-510/1890	480/-300	250/-250	390	900	2630
AUTOBRAKE 2	9750	160/-160	290	-530/1970	480/-350	260/-260	360	790	2300
AUTOBRAKE 1	10140	170/-170	310	-560/2030	510/-390	280/-280	350	1010	2280
Poor Reported Braking Action									
MAX MANUAL	9690	170/-160	310	-590/2230	780/-520	260/-250	300	1550	4150
AUTOBRAKE MAX	9720	170/-160	310	-590/2230	790/-520	260/-250	300	1560	4160
AUTOBRAKE 4	9780	170/-160	310	-590/2240	780/-530	260/-250	300	1580	4190
AUTOBRAKE 3	9960	170/-160	310	-590/2250	740/-450	280/-260	380	1440	4070
AUTOBRAKE 2	10280	170/-170	320	-600/2300	720/-480	280/-280	360	1270	3730
AUTOBRAKE 1	10560	180/-180	330	-620/2330	720/-490	290/-290	350	1400	3580

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 230 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4600	90/-60	90	-160/550	60/-60	90/-90	150	100	220
AUTOBRAKE MAX	5930	80/-80	130	-220/740	10/0	140/-140	260	0	0
AUTOBRAKE 4	7330	100/-100	180	-310/1040	10/-20	180/-180	350	0	0
AUTOBRAKE 3	8690	130/-130	230	-380/1290	50/-80	230/-230	380	0	0
AUTOBRAKE 2	9510	150/-160	280	-440/1480	140/-180	260/-260	360	250	250
AUTOBRAKE 1	10110	170/-170	310	-480/1660	220/-250	290/-280	360	690	820
Good Reported Braking Action									
MAX MANUAL	5970	80/-80	150	-250/890	140/-120	140/-140	200	310	720
AUTOBRAKE MAX	6380	80/-80	160	-260/920	120/-80	150/-150	260	320	750
AUTOBRAKE 4	7350	100/-100	180	-310/1060	30/-30	180/-180	350	20	100
AUTOBRAKE 3	8690	130/-130	230	-380/1290	50/-80	230/-230	380	0	0
AUTOBRAKE 2	9510	150/-160	280	-440/1480	140/-180	260/-260	360	250	250
AUTOBRAKE 1	10110	170/-170	310	-480/1660	220/-250	290/-280	360	690	820
Good To Medium Reported Braking Action									
MAX MANUAL	6940	100/-100	190	-330/1170	240/-190	170/-170	220	580	1400
AUTOBRAKE MAX	7190	100/-100	200	-330/1180	220/-160	180/-180	280	570	1390
AUTOBRAKE 4	7760	120/-120	210	-360/1270	170/-120	200/-200	340	380	1050
AUTOBRAKE 3	8880	130/-130	240	-410/1430	130/-130	240/-240	380	180	650
AUTOBRAKE 2	9610	150/-160	280	-450/1580	200/-210	260/-260	360	350	650
AUTOBRAKE 1	10160	170/-170	320	-490/1710	270/-280	290/-280	360	740	1020
Medium Reported Braking Action									
MAX MANUAL	7910	130/-130	230	-400/1450	330/-260	210/-200	250	840	2080
AUTOBRAKE MAX	8000	130/-130	230	-400/1450	320/-240	210/-210	300	820	2040
AUTOBRAKE 4	8180	130/-130	230	-400/1470	300/-210	220/-210	330	740	2000
AUTOBRAKE 3	9070	140/-140	250	-440/1580	220/-170	240/-240	380	370	1300
AUTOBRAKE 2	9720	150/-160	290	-470/1670	260/-240	260/-260	360	440	1050
AUTOBRAKE 1	10210	170/-170	320	-510/1760	320/-310	290/-280	360	780	1230

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	8980	150/-150	280	-490/1850	560/-390	240/-230	280	1290	3440
AUTOBRAKE MAX	9040	150/-150	280	-490/1850	560/-390	240/-240	300	1280	3420
AUTOBRAKE 4	9150	150/-150	280	-490/1870	550/-370	250/-240	320	1250	3420
AUTOBRAKE 3	9750	160/-160	290	-520/1930	470/-320	260/-260	370	950	2960
AUTOBRAKE 2	10230	170/-170	320	-540/2000	500/-370	280/-280	360	940	2660
AUTOBRAKE 1	10620	180/-180	340	-570/2060	530/-410	290/-290	360	1180	2680
Poor Reported Braking Action									
MAX MANUAL	10040	170/-170	320	-590/2250	780/-520	280/-260	300	1750	4800
AUTOBRAKE MAX	10070	170/-170	330	-590/2250	790/-530	280/-260	300	1750	4810
AUTOBRAKE 4	10130	170/-170	330	-590/2270	790/-530	280/-260	300	1760	4840
AUTOBRAKE 3	10420	170/-170	330	-600/2290	720/-470	290/-280	370	1530	4610
AUTOBRAKE 2	10740	180/-180	350	-610/2330	740/-490	300/-290	360	1440	4270
AUTOBRAKE 1	11030	200/-200	360	-630/2370	740/-510	300/-300	360	1590	4130

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 240 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 210 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4900	100/-60	100	-170/590	60/-60	100/-100	160	130	260
AUTOBRAKE MAX	6340	80/-80	150	-230/770	0/0	150/-150	260	0	0
AUTOBRAKE 4	7900	100/-120	210	-320/1080	0/-20	210/-210	360	0	0
AUTOBRAKE 3	9440	140/-150	250	-400/1360	50/-90	260/-260	400	0	0
AUTOBRAKE 2	10350	160/-170	310	-460/1550	150/-200	290/-290	390	280	280
AUTOBRAKE 1	11020	180/-200	360	-520/1740	240/-280	320/-310	390	780	870
Good Reported Braking Action									
MAX MANUAL	6380	90/-90	160	-260/920	150/-130	150/-150	210	370	850
AUTOBRAKE MAX	6800	90/-90	170	-280/950	120/-80	160/-160	280	370	860
AUTOBRAKE 4	7920	100/-120	210	-320/1100	20/-30	210/-210	360	20	120
AUTOBRAKE 3	9440	140/-150	250	-400/1360	50/-90	260/-260	400	0	0
AUTOBRAKE 2	10350	160/-170	310	-460/1550	150/-200	290/-290	390	280	280
AUTOBRAKE 1	11020	180/-200	360	-520/1740	240/-280	320/-310	390	780	870
Good To Medium Reported Braking Action									
MAX MANUAL	7460	120/-120	210	-340/1210	260/-210	180/-180	240	680	1660
AUTOBRAKE MAX	7700	120/-120	220	-350/1230	240/-170	200/-190	290	660	1630
AUTOBRAKE 4	8370	120/-130	240	-370/1320	170/-130	220/-220	350	440	1240
AUTOBRAKE 3	9630	140/-150	260	-430/1500	140/-140	260/-260	400	210	780
AUTOBRAKE 2	10450	170/-170	310	-480/1650	210/-230	290/-290	390	370	740
AUTOBRAKE 1	11060	180/-200	360	-520/1790	290/-300	320/-310	390	830	1120
Medium Reported Braking Action									
MAX MANUAL	8530	140/-140	250	-410/1510	370/-300	220/-220	280	990	2460
AUTOBRAKE MAX	8600	140/-140	260	-410/1510	360/-260	230/-220	310	950	2400
AUTOBRAKE 4	8820	140/-140	260	-430/1530	320/-230	230/-230	350	850	2370
AUTOBRAKE 3	9820	150/-150	280	-460/1640	230/-180	260/-260	400	430	1560
AUTOBRAKE 2	10560	170/-170	310	-490/1750	280/-260	300/-290	390	470	1210
AUTOBRAKE 1	11110	180/-200	360	-530/1840	350/-320	320/-310	390	890	1370

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	9710	170/-160	310	-520/1930	610/-430	260/-250	300	1510	4080
AUTOBRAKE MAX	9750	170/-160	320	-520/1930	610/-420	260/-250	320	1500	4060
AUTOBRAKE 4	9900	170/-170	320	-520/1940	590/-400	260/-260	330	1450	4060
AUTOBRAKE 3	10550	170/-170	320	-550/2010	510/-350	290/-290	400	1110	3540
AUTOBRAKE 2	11100	190/-180	350	-570/2090	530/-400	310/-300	390	1060	3160
AUTOBRAKE 1	11530	200/-200	380	-590/2160	570/-430	330/-320	390	1360	3120
Poor Reported Braking Action									
MAX MANUAL	10880	200/-180	370	-620/2350	850/-560	300/-290	320	2040	5700
AUTOBRAKE MAX	10890	200/-180	370	-620/2350	860/-580	300/-290	320	2050	5720
AUTOBRAKE 4	10970	200/-200	370	-620/2350	850/-580	300/-290	320	2060	5750
AUTOBRAKE 3	11280	200/-200	370	-630/2380	780/-510	310/-310	390	1790	5510
AUTOBRAKE 2	11650	210/-200	380	-640/2430	790/-530	320/-310	380	1640	5120
AUTOBRAKE 1	11960	210/-210	400	-660/2470	790/-540	330/-320	380	1830	4880

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 250 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 220 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4830	120/-70	120	-190/690	90/-80	110/-110	160	210	470
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6210	90/-90	170	-290/1050	210/-180	150/-150	200	520	1250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7020	110/-110	210	-360/1320	330/-250	180/-180	220	810	2050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7830	130/-130	240	-430/1590	450/-330	210/-200	240	1090	2840
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8960	160/-150	290	-540/2120	900/-510	240/-230	260	1720	4950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10100	190/-180	340	-660/2660	1360/-680	280/-260	280	2340	7050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4600	110/-60	110	-190/650	90/-80	100/-100	160	170	380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5990	90/-90	160	-290/1030	210/-170	150/-140	200	460	1080
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	6770	110/-100	200	-350/1300	330/-250	170/-170	220	710	1770
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7550	130/-120	230	-420/1570	450/-330	200/-190	240	970	2460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8660	150/-150	280	-540/2100	900/-500	230/-220	260	1540	4300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9760	180/-170	330	-650/2630	1350/-670	270/-260	280	2110	6150
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4600	100/-50	100	-150/520	60/-50	100/-90	170	120	250
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10

Good Reported Braking Action

MAX MANUAL	6250	90/-90	170	-250/880	160/-140	150/-150	230	420	990
AUTOBRAKE MAX	6260	90/-90	170	-260/880	150/-130	150/-150	250	410	970
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10

Good To Medium Reported Braking Action

MAX MANUAL	7280	120/-110	220	-330/1150	280/-230	190/-180	270	770	1940
AUTOBRAKE MAX	7270	120/-120	220	-330/1150	280/-230	190/-190	280	760	1920
AUTOBRAKE 2	9420	140/-160	270	-430/1470	100/-110	270/-270	440	150	870

Medium Reported Braking Action

MAX MANUAL	8300	140/-130	260	-400/1410	390/-310	220/-210	300	1110	2890
AUTOBRAKE MAX	8280	140/-140	260	-400/1410	410/-330	220/-220	300	1110	2870
AUTOBRAKE 3	8770	140/-130	250	-410/1460	280/-140	240/-240	400	740	2540

Medium To Poor Reported Braking Action

MAX MANUAL	9410	170/-160	320	-490/1790	630/-450	260/-250	320	1690	4810
AUTOBRAKE MAX	9420	170/-170	320	-490/1790	660/-470	260/-250	320	1700	4820
AUTOBRAKE 3	9680	170/-160	310	-500/1820	580/-340	270/-270	390	1510	4650

Poor Reported Braking Action

MAX MANUAL	10520	190/-190	370	-580/2170	870/-580	290/-280	340	2270	6730
AUTOBRAKE MAX	10550	200/-190	370	-580/2170	900/-600	300/-280	340	2280	6760
AUTOBRAKE 3	10590	200/-180	370	-580/2180	880/-540	300/-290	380	2270	6760

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4940	110/-60	110	-160/550	70/-60	110/-110	N/A	140	300
AUTOBRAKE MAX	5980	70/-80	140	-210/700	0/0	140/-140	N/A	0	0
AUTOBRAKE 2	10200	150/-170	300	-430/1460	40/-130	300/-290	N/A	70	70
Good Reported Braking Action									
MAX MANUAL	6720	90/-100	180	-270/910	180/-150	170/-160	N/A	490	1140
AUTOBRAKE MAX	6770	90/-100	190	-270/920	160/-140	170/-170	N/A	480	1130
AUTOBRAKE 2	10200	150/-170	300	-430/1460	40/-130	300/-290	N/A	70	70
Good To Medium Reported Braking Action									
MAX MANUAL	7810	120/-120	230	-340/1180	300/-240	210/-200	N/A	860	2170
AUTOBRAKE MAX	7830	120/-130	240	-340/1190	300/-250	210/-210	N/A	860	2160
AUTOBRAKE 2	10300	160/-170	310	-450/1550	130/-170	300/-290	N/A	220	940
Medium Reported Braking Action									
MAX MANUAL	8890	140/-140	280	-410/1450	410/-330	240/-230	N/A	1230	3190
AUTOBRAKE MAX	8880	150/-150	290	-410/1450	440/-350	240/-240	N/A	1230	3190
AUTOBRAKE 3	9570	140/-150	280	-430/1520	280/-150	270/-260	N/A	710	2680
Medium To Poor Reported Braking Action									
MAX MANUAL	10050	170/-170	340	-510/1840	660/-470	280/-270	N/A	1840	5210
AUTOBRAKE MAX	10060	180/-180	350	-510/1840	690/-490	280/-280	N/A	1850	5230
AUTOBRAKE 3	10470	170/-170	340	-520/1880	580/-350	300/-290	N/A	1550	4950
Poor Reported Braking Action									
MAX MANUAL	11200	200/-200	400	-600/2220	900/-600	320/-300	N/A	2450	7230
AUTOBRAKE MAX	11240	210/-200	400	-600/2230	930/-630	320/-310	N/A	2460	7260
AUTOBRAKE 3	11360	200/-190	400	-600/2240	870/-540	330/-310	N/A	2390	7220

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6880	110/-110	200	-350/1260	290/-230	180/-170	220	730	1810
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6880	110/-110	200	-350/1260	290/-230	180/-170	220	730	1810
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7810	130/-130	240	-430/1610	490/-340	210/-200	240	1130	2990
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8730	150/-150	280	-510/1960	680/-450	240/-230	260	1520	4170
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10300	190/-190	350	-700/2920	1540/-770	280/-270	280	2730	9500
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11860	230/-220	410	-890/3880	2390/-1080	320/-310	290	3930	14830
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6630	100/-100	190	-340/1240	290/-230	170/-160	220	640	1560
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6630	100/-100	190	-340/1240	290/-230	170/-160	220	640	1560
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7530	130/-120	230	-430/1590	490/-340	200/-190	240	1000	2590
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8430	150/-140	270	-510/1940	680/-450	230/-220	260	1350	3610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9960	190/-180	330	-700/2900	1520/-760	270/-260	280	2480	8380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11490	220/-210	390	-880/3850	2350/-1070	310/-300	290	3600	13140
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4340	100/-60	90	-150/520	60/-50	90/-90	140	0	120
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9220	140/-150	260	-410/1380	40/-60	260/-260	440	0	0
Good Reported Braking Action									
MAX MANUAL	5810	80/-80	150	-240/850	160/-130	140/-140	200	0	400
AUTOBRAKE MAX	6180	80/-90	160	-260/880	140/-120	150/-150	230	0	420
AUTOBRAKE 2	9220	140/-150	260	-410/1380	40/-60	260/-260	440	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6980	110/-110	200	-320/1140	290/-230	180/-180	240	0	810
AUTOBRAKE MAX	7180	110/-110	200	-330/1160	270/-210	190/-190	270	0	810
AUTOBRAKE 2	9370	150/-150	270	-430/1480	150/-110	270/-270	440	0	290
Medium Reported Braking Action									
MAX MANUAL	8140	130/-130	240	-400/1430	420/-330	220/-220	270	0	1220
AUTOBRAKE MAX	8180	130/-130	240	-400/1440	400/-290	230/-220	310	0	1190
AUTOBRAKE 3	8800	140/-140	250	-420/1500	330/-200	250/-240	380	0	900
Medium To Poor Reported Braking Action									
MAX MANUAL	9530	160/-160	300	-520/1880	750/-510	270/-270	300	0	2080
AUTOBRAKE MAX	9550	160/-160	300	-520/1880	750/-500	280/-270	320	0	2070
AUTOBRAKE 3	9920	170/-170	310	-530/1920	710/-430	290/-280	370	0	1940
Poor Reported Braking Action									
MAX MANUAL	10910	190/-190	360	-630/2320	1070/-690	320/-310	330	0	2940
AUTOBRAKE MAX	10920	190/-190	360	-630/2320	1090/-700	320/-310	330	0	2940
AUTOBRAKE 3	11030	190/-190	360	-630/2330	1090/-660	320/-310	350	0	2980

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3880	80/-50	80	-140/470	50/-50	80/-80	130	0	80
AUTOBRAKE MAX	4900	60/-60	110	-180/620	10/0	110/-110	220	0	0
AUTOBRAKE 2	7940	120/-120	220	-370/1260	30/-50	220/-220	390	0	0
Good Reported Braking Action									
MAX MANUAL	5190	70/-70	130	-230/790	140/-120	120/-120	190	0	290
AUTOBRAKE MAX	5530	70/-70	130	-240/830	120/-100	130/-130	220	0	300
AUTOBRAKE 2	7940	120/-120	220	-370/1260	30/-50	220/-220	390	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6170	90/-90	170	-300/1070	260/-200	160/-160	220	0	580
AUTOBRAKE MAX	6370	90/-90	170	-310/1090	240/-180	160/-160	260	0	580
AUTOBRAKE 2	8080	130/-130	230	-390/1360	130/-100	230/-230	390	0	210
Medium Reported Braking Action									
MAX MANUAL	7140	110/-110	200	-370/1340	370/-280	190/-190	250	0	870
AUTOBRAKE MAX	7200	110/-110	200	-370/1350	350/-250	190/-190	290	0	850
AUTOBRAKE 3	7660	120/-120	210	-390/1390	300/-190	210/-210	340	0	660
Medium To Poor Reported Braking Action									
MAX MANUAL	8310	140/-140	250	-480/1760	660/-440	230/-230	280	0	1470
AUTOBRAKE MAX	8350	140/-140	250	-480/1760	650/-430	230/-230	300	0	1460
AUTOBRAKE 3	8630	150/-140	260	-490/1790	630/-390	240/-240	330	0	1380
Poor Reported Braking Action									
MAX MANUAL	9480	160/-160	300	-580/2170	940/-590	270/-260	300	0	2070
AUTOBRAKE MAX	9500	160/-160	300	-580/2170	950/-600	270/-260	300	0	2070
AUTOBRAKE 3	9600	170/-160	300	-580/2180	960/-580	270/-270	310	0	2100

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAP / SLAT CONTROL (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4250	90/-50	90	-150/510	50/-50	90/-90	130	110	230
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	8910	140/-150	270	-400/1340	140/-180	250/-250	320	300	300
Good Reported Braking Action									
MAX MANUAL	5490	70/-80	140	-230/790	130/-110	130/-130	180	310	710
AUTOBRAKE MAX	5890	80/-80	150	-240/830	90/-70	140/-140	240	290	710
AUTOBRAKE 2	8910	140/-150	270	-400/1340	140/-180	250/-250	320	300	300
Good To Medium Reported Braking Action									
MAX MANUAL	6410	100/-100	180	-300/1040	220/-180	160/-160	210	570	1380
AUTOBRAKE MAX	6650	100/-100	190	-300/1070	190/-150	170/-170	250	550	1350
AUTOBRAKE 2	9000	150/-150	270	-420/1430	200/-210	250/-250	320	380	680
Medium Reported Braking Action									
MAX MANUAL	7330	120/-120	220	-360/1290	310/-250	190/-190	230	820	2040
AUTOBRAKE MAX	7410	120/-120	220	-360/1300	290/-220	200/-190	260	800	1990
AUTOBRAKE 3	8480	130/-130	240	-400/1420	200/-170	230/-230	330	360	1250
Medium To Poor Reported Braking Action									
MAX MANUAL	8330	150/-140	270	-450/1660	520/-370	230/-220	250	1260	3380
AUTOBRAKE MAX	8370	150/-140	270	-450/1660	510/-350	230/-220	270	1250	3350
AUTOBRAKE 3	9090	150/-150	280	-470/1740	430/-300	250/-250	330	910	2870
Poor Reported Braking Action									
MAX MANUAL	9320	170/-160	310	-530/2020	720/-480	260/-250	270	1700	4710
AUTOBRAKE MAX	9330	170/-160	310	-530/2020	730/-480	260/-250	270	1700	4710
AUTOBRAKE 3	9700	170/-160	310	-540/2050	660/-430	270/-260	330	1450	4490

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≤ 5)
VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5150	140/-80	130	-180/640	70/-70	120/-120	160	210	470
AUTOBRAKE MAX	6770	90/-80	160	-230/770	10/0	170/-170	270	10	40
AUTOBRAKE 2	11180	170/-190	370	-460/1520	190/-250	330/-320	360	700	700
Good Reported Braking Action									
MAX MANUAL	6350	80/-80	170	-250/850	140/-120	160/-150	180	460	1080
AUTOBRAKE MAX	7040	80/-90	180	-260/910	70/-50	180/-180	260	280	890
AUTOBRAKE 2	11180	170/-190	370	-460/1520	190/-250	330/-320	360	700	700
Good To Medium Reported Braking Action									
MAX MANUAL	7500	110/-110	230	-320/1120	250/-200	200/-190	210	850	2170
AUTOBRAKE MAX	7880	110/-110	230	-330/1150	200/-150	210/-210	270	750	2040
AUTOBRAKE 2	11270	170/-190	370	-480/1610	240/-280	330/-320	360	780	1210
Medium Reported Braking Action									
MAX MANUAL	8640	130/-130	280	-390/1390	350/-280	240/-230	240	1240	3260
AUTOBRAKE MAX	8710	130/-130	280	-390/1390	320/-250	240/-230	270	1210	3180
AUTOBRAKE 3	10650	150/-160	320	-460/1590	210/-220	300/-300	370	510	1840
Medium To Poor Reported Braking Action									
MAX MANUAL	9870	160/-160	340	-490/1770	580/-410	280/-270	270	1910	5570
AUTOBRAKE MAX	9900	160/-160	340	-490/1770	560/-400	280/-270	290	1890	5520
AUTOBRAKE 3	11240	170/-180	360	-530/1910	460/-350	320/-320	370	1290	4610
Poor Reported Braking Action									
MAX MANUAL	11100	190/-190	400	-580/2150	800/-540	320/-300	290	2580	7870
AUTOBRAKE MAX	11090	190/-190	400	-580/2150	800/-540	320/-300	300	2570	7860
AUTOBRAKE 3	11820	190/-190	400	-600/2220	710/-480	340/-330	360	2060	7370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (5 < Flaps < 20)

VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4470	100/-60	100	-150/530	60/-50	90/-90	140	140	310
AUTOBRAKE MAX	5780	70/-70	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9510	150/-160	290	-410/1390	130/-190	270/-270	350	340	340
Good Reported Braking Action									
MAX MANUAL	5760	80/-80	150	-230/810	130/-120	140/-140	180	390	910
AUTOBRAKE MAX	6120	80/-80	160	-240/850	90/-70	150/-150	240	350	890
AUTOBRAKE 2	9510	150/-160	290	-410/1390	130/-190	270/-270	350	340	340
Good To Medium Reported Braking Action									
MAX MANUAL	6740	100/-100	200	-300/1070	230/-190	170/-170	210	710	1800
AUTOBRAKE MAX	6930	100/-100	200	-310/1090	210/-160	180/-180	250	670	1760
AUTOBRAKE 2	9600	150/-160	300	-430/1480	180/-220	270/-270	350	420	830
Medium Reported Braking Action									
MAX MANUAL	7720	120/-120	240	-370/1320	330/-260	200/-200	240	1030	2690
AUTOBRAKE MAX	7740	120/-120	240	-370/1330	320/-240	210/-200	260	990	2630
AUTOBRAKE 3	9030	130/-140	250	-420/1470	170/-170	250/-240	360	400	1700
Medium To Poor Reported Braking Action									
MAX MANUAL	8770	150/-150	290	-460/1690	540/-380	240/-230	260	1570	4490
AUTOBRAKE MAX	8780	150/-150	290	-460/1700	540/-380	240/-230	280	1550	4460
AUTOBRAKE 3	9640	150/-160	300	-490/1790	420/-310	270/-260	350	1120	3880
Poor Reported Braking Action									
MAX MANUAL	9820	170/-170	340	-540/2060	740/-500	270/-260	280	2110	6290
AUTOBRAKE MAX	9820	170/-170	340	-540/2060	750/-510	270/-260	290	2110	6290
AUTOBRAKE 3	10250	170/-170	340	-560/2100	660/-450	290/-280	340	1830	6050

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≥ 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4260	90/-50	90	-150/510	50/-50	90/-90	140	110	230
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9000	140/-150	270	-400/1350	130/-170	250/-250	330	240	240
Good Reported Braking Action									
MAX MANUAL	5550	80/-80	140	-230/800	130/-110	130/-130	180	320	740
AUTOBRAKE MAX	5910	80/-80	150	-240/830	100/-70	140/-140	240	320	750
AUTOBRAKE 2	9000	140/-150	270	-400/1350	130/-170	250/-250	330	240	240
Good To Medium Reported Braking Action									
MAX MANUAL	6490	100/-100	180	-300/1060	230/-190	160/-160	210	590	1440
AUTOBRAKE MAX	6700	100/-100	190	-300/1070	210/-150	170/-170	260	580	1420
AUTOBRAKE 2	9090	150/-150	270	-420/1440	190/-200	260/-250	330	330	650
Medium Reported Braking Action									
MAX MANUAL	7420	120/-120	220	-360/1310	320/-260	190/-190	230	860	2140
AUTOBRAKE MAX	7480	120/-120	230	-360/1310	310/-230	200/-190	270	830	2090
AUTOBRAKE 3	8540	130/-130	240	-400/1430	200/-160	230/-230	350	370	1360
Medium To Poor Reported Braking Action									
MAX MANUAL	8440	150/-140	270	-450/1680	530/-380	230/-220	260	1320	3550
AUTOBRAKE MAX	8480	150/-140	280	-450/1680	530/-370	230/-220	280	1310	3530
AUTOBRAKE 3	9180	150/-150	280	-480/1750	440/-300	250/-250	350	970	3080
Poor Reported Braking Action									
MAX MANUAL	9460	170/-160	320	-540/2040	740/-490	260/-250	280	1770	4960
AUTOBRAKE MAX	9470	170/-160	320	-540/2040	750/-500	260/-250	280	1780	4970
AUTOBRAKE 3	9810	170/-170	320	-550/2070	680/-440	270/-270	340	1560	4790

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS PRIMARY FAIL (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4520	100/-50	100	-150/510	60/-50	90/-90	140	110	230
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9250	140/-150	270	-410/1380	30/-120	260/-260	400	60	60
Good Reported Braking Action									
MAX MANUAL	6070	80/-90	160	-250/860	150/-130	140/-140	220	380	890
AUTOBRAKE MAX	6150	90/-90	160	-250/860	140/-120	150/-150	240	380	890
AUTOBRAKE 2	9250	140/-150	270	-410/1380	30/-120	260/-260	400	60	60
Good To Medium Reported Braking Action									
MAX MANUAL	7050	110/-110	210	-320/1120	260/-210	180/-170	250	690	1720
AUTOBRAKE MAX	7080	110/-110	210	-320/1120	260/-210	180/-180	260	690	1720
AUTOBRAKE 2	9350	150/-160	270	-430/1470	110/-150	260/-260	400	180	680
Medium Reported Braking Action									
MAX MANUAL	8020	130/-130	250	-390/1380	360/-290	210/-200	270	1000	2550
AUTOBRAKE MAX	8000	130/-130	250	-380/1370	380/-300	210/-210	280	990	2540
AUTOBRAKE 3	8690	130/-130	250	-410/1450	240/-130	240/-230	390	530	2040
Medium To Poor Reported Braking Action									
MAX MANUAL	9080	160/-160	300	-480/1750	590/-420	250/-240	300	1520	4210
AUTOBRAKE MAX	9090	160/-160	300	-480/1750	610/-430	250/-240	300	1520	4220
AUTOBRAKE 3	9500	160/-160	300	-490/1790	510/-320	270/-260	380	1260	3950
Poor Reported Braking Action									
MAX MANUAL	10130	180/-180	350	-570/2120	810/-540	280/-270	320	2040	5870
AUTOBRAKE MAX	10170	190/-180	350	-570/2120	840/-560	280/-270	320	2040	5900
AUTOBRAKE 3	10300	180/-180	350	-570/2130	780/-500	290/-280	370	1980	5860

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROL MODE (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4600	100/-50	100	-150/520	60/-50	100/-90	170	120	250
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10
Good Reported Braking Action									
MAX MANUAL	6250	90/-90	170	-250/880	160/-140	150/-150	230	420	990
AUTOBRAKE MAX	6260	90/-90	170	-260/880	150/-130	150/-150	250	410	970
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10
Good To Medium Reported Braking Action									
MAX MANUAL	7280	120/-110	220	-330/1150	280/-230	190/-180	270	770	1940
AUTOBRAKE MAX	7270	120/-120	220	-330/1150	280/-230	190/-190	280	760	1920
AUTOBRAKE 2	9420	140/-160	270	-430/1470	100/-110	270/-270	440	150	870
Medium Reported Braking Action									
MAX MANUAL	8300	140/-130	260	-400/1410	390/-310	220/-210	300	1110	2890
AUTOBRAKE MAX	8280	140/-140	260	-400/1410	410/-330	220/-220	300	1110	2870
AUTOBRAKE 3	8770	140/-130	250	-410/1460	280/-140	240/-240	400	740	2540
Medium To Poor Reported Braking Action									
MAX MANUAL	9410	170/-160	320	-490/1790	630/-450	260/-250	320	1690	4810
AUTOBRAKE MAX	9420	170/-170	320	-490/1790	660/-470	260/-250	320	1700	4820
AUTOBRAKE 3	9680	170/-160	310	-500/1820	580/-340	270/-270	390	1510	4650
Poor Reported Braking Action									
MAX MANUAL	10520	190/-190	370	-580/2170	870/-580	290/-280	340	2270	6730
AUTOBRAKE MAX	10550	200/-190	370	-580/2170	900/-600	300/-280	340	2280	6760
AUTOBRAKE 3	10590	200/-180	370	-580/2180	880/-540	300/-290	380	2270	6760

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROLS (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4930	80/-60	120	-170/560	80/-70	110/-110	210	180	400
AUTOBRAKE MAX	5780	70/-70	130	-210/690	0/0	140/-140	240	0	40
AUTOBRAKE 2	9850	140/-160	280	-430/1430	10/-90	280/-280	450	20	20
Good Reported Braking Action									
MAX MANUAL	6770	100/-100	190	-270/930	210/-180	170/-170	280	590	1440
AUTOBRAKE MAX	6760	100/-100	190	-270/930	200/-160	170/-170	290	550	1370
AUTOBRAKE 2	9850	140/-160	280	-430/1430	10/-90	280/-280	450	20	20
Good To Medium Reported Braking Action									
MAX MANUAL	7860	130/-130	250	-350/1210	340/-270	210/-210	310	1010	2630
AUTOBRAKE MAX	7850	130/-130	250	-350/1210	340/-270	210/-210	320	990	2590
AUTOBRAKE 2	9980	150/-160	290	-450/1520	110/-130	290/-290	450	250	1390
Medium Reported Braking Action									
MAX MANUAL	8950	150/-150	300	-420/1480	460/-360	250/-240	340	1420	3810
AUTOBRAKE MAX	8930	150/-150	300	-420/1480	470/-370	250/-240	340	1420	3800
AUTOBRAKE 3	9310	140/-140	280	-430/1510	330/-160	260/-260	420	1160	3580
Medium To Poor Reported Braking Action									
MAX MANUAL	10080	180/-180	360	-520/1860	710/-510	290/-280	360	2070	6050
AUTOBRAKE MAX	10080	180/-180	360	-520/1870	730/-520	290/-280	360	2070	6050
AUTOBRAKE 3	10270	180/-170	350	-520/1880	660/-370	300/-290	410	1940	5940
Poor Reported Braking Action									
MAX MANUAL	11210	210/-200	410	-610/2240	960/-650	320/-310	370	2710	8280
AUTOBRAKE MAX	11230	210/-200	410	-610/2250	980/-660	330/-310	370	2710	8300
AUTOBRAKE 3	11230	210/-190	410	-610/2250	980/-580	330/-310	400	2710	8290

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS C (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4520	100/-50	100	-150/510	60/-50	90/-90	140	110	230
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9250	140/-150	270	-410/1380	30/-120	260/-260	400	60	60
Good Reported Braking Action									
MAX MANUAL	6070	80/-90	160	-250/860	150/-130	140/-140	220	380	890
AUTOBRAKE MAX	6150	90/-90	160	-250/860	140/-120	150/-150	240	380	890
AUTOBRAKE 2	9250	140/-150	270	-410/1380	30/-120	260/-260	400	60	60
Good To Medium Reported Braking Action									
MAX MANUAL	7050	110/-110	210	-320/1120	260/-210	180/-170	250	690	1720
AUTOBRAKE MAX	7080	110/-110	210	-320/1120	260/-210	180/-180	260	690	1720
AUTOBRAKE 2	9350	150/-160	270	-430/1470	110/-150	260/-260	400	180	680
Medium Reported Braking Action									
MAX MANUAL	8020	130/-130	250	-390/1380	360/-290	210/-200	270	1000	2550
AUTOBRAKE MAX	8000	130/-130	250	-380/1370	380/-300	210/-210	280	990	2540
AUTOBRAKE 3	8690	130/-130	250	-410/1450	240/-130	240/-230	390	530	2040
Medium To Poor Reported Braking Action									
MAX MANUAL	9080	160/-160	300	-480/1750	590/-420	250/-240	300	1520	4210
AUTOBRAKE MAX	9090	160/-160	300	-480/1750	610/-430	250/-240	300	1520	4220
AUTOBRAKE 3	9500	160/-160	300	-490/1790	510/-320	270/-260	380	1260	3950
Poor Reported Braking Action									
MAX MANUAL	10130	180/-180	350	-570/2120	810/-540	280/-270	320	2040	5870
AUTOBRAKE MAX	10170	190/-180	350	-570/2120	840/-560	280/-270	320	2040	5900
AUTOBRAKE 3	10300	180/-180	350	-570/2130	780/-500	290/-280	370	1980	5860

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4140	90/-50	90	-150/490	60/-50	90/-90	140	0	110
AUTOBRAKE MAX	5160	70/-70	110	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8570	130/-130	240	-390/1320	10/-40	240/-240	430	0	0
Good Reported Braking Action									
MAX MANUAL	5770	80/-80	150	-250/860	170/-140	140/-140	220	0	430
AUTOBRAKE MAX	6000	80/-80	150	-260/880	140/-120	150/-150	250	0	430
AUTOBRAKE 2	8570	130/-130	240	-390/1320	10/-40	240/-240	430	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6930	100/-110	200	-330/1170	320/-250	180/-180	260	0	870
AUTOBRAKE MAX	7050	110/-110	200	-340/1180	310/-240	190/-190	280	0	870
AUTOBRAKE 2	8770	130/-140	250	-420/1450	150/-100	250/-250	430	0	390
Medium Reported Braking Action									
MAX MANUAL	8090	120/-130	250	-410/1480	460/-350	220/-220	290	0	1300
AUTOBRAKE MAX	8100	130/-130	250	-410/1480	470/-360	220/-220	300	0	1300
AUTOBRAKE 3	8440	130/-130	250	-420/1510	400/-250	230/-230	360	0	1220
Medium To Poor Reported Braking Action									
MAX MANUAL	9520	160/-160	320	-540/1970	850/-550	270/-270	320	0	2260
AUTOBRAKE MAX	9540	160/-160	320	-540/1970	860/-560	270/-270	330	0	2260
AUTOBRAKE 3	9770	160/-160	320	-540/1990	820/-510	280/-270	360	0	2240
Poor Reported Braking Action									
MAX MANUAL	10950	190/-180	380	-660/2460	1240/-750	320/-310	350	0	3210
AUTOBRAKE MAX	10980	190/-180	380	-660/2460	1250/-760	320/-310	350	0	3220
AUTOBRAKE 3	11090	190/-190	380	-660/2470	1230/-770	320/-310	350	0	3250

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3960	90/-40	80	-140/480	50/-50	80/-80	150	0	90
AUTOBRAKE MAX	4900	60/-60	110	-180/620	10/0	110/-110	220	0	0
AUTOBRAKE 2	8040	120/-120	220	-370/1270	10/-30	220/-220	410	0	0
Good Reported Braking Action									
MAX MANUAL	5550	80/-80	140	-240/850	160/-140	130/-130	220	0	370
AUTOBRAKE MAX	5760	80/-80	150	-250/870	140/-120	140/-140	250	0	370
AUTOBRAKE 2	8040	120/-120	220	-370/1270	10/-30	220/-220	410	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6670	100/-100	190	-330/1160	310/-250	170/-170	260	0	760
AUTOBRAKE MAX	6780	100/-100	200	-330/1170	310/-240	180/-180	280	0	760
AUTOBRAKE 2	8250	130/-130	230	-400/1400	160/-100	230/-230	410	0	380
Medium Reported Braking Action									
MAX MANUAL	7790	120/-120	230	-410/1460	460/-350	210/-210	290	0	1140
AUTOBRAKE MAX	7790	120/-120	240	-410/1460	470/-360	210/-210	300	0	1140
AUTOBRAKE 3	8050	120/-120	240	-410/1480	430/-260	220/-220	350	0	1140
Medium To Poor Reported Braking Action									
MAX MANUAL	9180	150/-150	300	-530/1950	850/-550	260/-260	320	0	1980
AUTOBRAKE MAX	9200	150/-150	300	-530/1950	860/-560	260/-260	330	0	1990
AUTOBRAKE 3	9380	150/-150	300	-530/1970	830/-510	270/-260	350	0	2000
Poor Reported Braking Action									
MAX MANUAL	10570	180/-180	360	-650/2440	1230/-740	300/-300	350	0	2820
AUTOBRAKE MAX	10600	180/-180	360	-650/2440	1250/-750	310/-300	350	0	2830
AUTOBRAKE 3	10700	180/-180	360	-650/2450	1220/-760	310/-300	350	0	2860

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5010	110/-60	110	-170/570	80/-70	110/-110	200	0	160
AUTOBRAKE MAX	5780	70/-70	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9870	140/-150	280	-430/1430	0/0	280/-280	500	0	0
Good Reported Braking Action									
MAX MANUAL	7110	90/-100	190	-290/990	230/-190	180/-180	290	0	660
AUTOBRAKE MAX	7100	90/-100	200	-290/990	210/-180	190/-180	310	0	640
AUTOBRAKE 2	9870	140/-150	280	-430/1430	0/0	280/-280	500	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	8570	120/-130	260	-390/1330	430/-330	230/-230	340	0	1340
AUTOBRAKE MAX	8560	120/-130	260	-390/1330	430/-340	240/-230	350	0	1330
AUTOBRAKE 2	10150	150/-160	300	-460/1570	250/-100	290/-290	500	0	850
Medium Reported Braking Action									
MAX MANUAL	10030	150/-160	320	-480/1670	620/-470	280/-280	380	0	2010
AUTOBRAKE MAX	10010	150/-160	320	-480/1670	650/-490	290/-280	380	0	2010
AUTOBRAKE 3	10120	160/-160	330	-480/1680	630/-400	290/-280	400	0	2040
Medium To Poor Reported Braking Action									
MAX MANUAL	11800	190/-200	410	-620/2210	1110/-720	340/-340	420	0	3480
AUTOBRAKE MAX	11820	190/-200	410	-620/2210	1150/-750	350/-340	420	0	3490
AUTOBRAKE 3	11880	200/-200	420	-620/2220	1130/-690	350/-340	430	0	3510
Poor Reported Braking Action									
MAX MANUAL	13570	230/-230	490	-750/2750	1600/-970	400/-390	450	0	4950
AUTOBRAKE MAX	13620	230/-230	500	-750/2750	1640/-1010	410/-400	450	0	4970
AUTOBRAKE 3	13640	230/-230	500	-750/2760	1630/-980	410/-400	460	0	4980

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+R (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5800	70/-70	140	-220/740	140/-130	140/-140	240	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8920	120/-120	260	-400/1370	480/-380	250/-250	370	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	11340	160/-160	350	-560/1940	1040/-700	340/-340	440	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	13750	190/-200	440	-720/2510	1600/-1020	420/-420	500	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	17270	240/-240	600	-1000/3590	4200/-1750	540/-540	560	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	20790	290/-280	760	-1270/4670	6800/-2480	660/-660	610	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4710	60/-60	110	-180/620	90/-80	100/-100	180	0	200
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6630	90/-100	180	-310/1080	250/-210	170/-170	250	0	690
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7880	120/-130	240	-410/1450	460/-350	220/-210	280	0	1290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	9130	150/-150	290	-500/1820	670/-480	260/-250	310	0	1880
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10600	180/-180	360	-640/2410	1290/-720	310/-300	340	0	3070
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	12060	210/-200	430	-770/2990	1910/-960	350/-340	360	0	4260
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4520	50/-50	100	-180/600	80/-80	100/-100	170	0	160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6300	90/-90	170	-300/1050	240/-200	160/-160	240	0	570
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7460	120/-120	220	-390/1410	440/-330	200/-200	270	0	1060
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8620	140/-140	270	-480/1770	640/-450	240/-230	300	0	1540
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9990	170/-170	330	-620/2350	1230/-680	290/-280	320	0	2520
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11350	200/-190	390	-750/2920	1820/-910	330/-320	340	0	3490
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6150	70/-80	150	-230/780	150/-130	150/-150	260	0	390
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8710	120/-130	260	-390/1320	410/-330	240/-230	350	0	1300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	10350	160/-170	340	-510/1760	730/-530	300/-290	390	0	2370
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	11980	190/-200	410	-620/2190	1040/-720	350/-340	430	0	3440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	13860	240/-240	510	-780/2880	1970/-1050	410/-400	460	0	5570
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	15730	280/-270	600	-940/3560	2900/-1380	470/-460	490	0	7690
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
NAV AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4600	100/-50	100	-150/520	60/-50	100/-90	170	120	250
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10
Good Reported Braking Action									
MAX MANUAL	6250	90/-90	170	-250/880	160/-140	150/-150	230	420	990
AUTOBRAKE MAX	6260	90/-90	170	-260/880	150/-130	150/-150	250	410	970
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10
Good To Medium Reported Braking Action									
MAX MANUAL	7280	120/-110	220	-330/1150	280/-230	190/-180	270	770	1940
AUTOBRAKE MAX	7270	120/-120	220	-330/1150	280/-230	190/-190	280	760	1920
AUTOBRAKE 2	9420	140/-160	270	-430/1470	100/-110	270/-270	440	150	870
Medium Reported Braking Action									
MAX MANUAL	8300	140/-130	260	-400/1410	390/-310	220/-210	300	1110	2890
AUTOBRAKE MAX	8280	140/-140	260	-400/1410	410/-330	220/-220	300	1110	2870
AUTOBRAKE 3	8770	140/-130	250	-410/1460	280/-140	240/-240	400	740	2540
Medium To Poor Reported Braking Action									
MAX MANUAL	9410	170/-160	320	-490/1790	630/-450	260/-250	320	1690	4810
AUTOBRAKE MAX	9420	170/-170	320	-490/1790	660/-470	260/-250	320	1700	4820
AUTOBRAKE 3	9680	170/-160	310	-500/1820	580/-340	270/-270	390	1510	4650
Poor Reported Braking Action									
MAX MANUAL	10520	190/-190	370	-580/2170	870/-580	290/-280	340	2270	6730
AUTOBRAKE MAX	10550	200/-190	370	-580/2170	900/-600	300/-280	340	2280	6760
AUTOBRAKE 3	10590	200/-180	370	-580/2180	880/-540	300/-290	380	2270	6760

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4510	90/-50	90	-160/530	60/-50	90/-90	160	70	160
AUTOBRAKE MAX	5160	70/-70	110	-190/640	20/0	120/-120	240	0	0
AUTOBRAKE 2	8500	130/-140	240	-390/1310	50/-100	230/-230	370	100	100
Good Reported Braking Action									
MAX MANUAL	5710	70/-70	140	-230/820	130/-110	130/-130	200	250	560
AUTOBRAKE MAX	5780	70/-80	140	-240/820	130/-120	130/-130	220	260	580
AUTOBRAKE 2	8520	130/-140	240	-390/1310	60/-110	230/-230	370	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	6560	90/-90	180	-300/1060	220/-180	160/-160	220	470	1130
AUTOBRAKE MAX	6600	90/-100	180	-300/1070	230/-190	160/-160	240	480	1150
AUTOBRAKE 2	8640	130/-140	250	-410/1400	140/-150	240/-240	370	180	450
Medium Reported Braking Action									
MAX MANUAL	7400	110/-110	210	-360/1300	300/-240	180/-180	240	690	1700
AUTOBRAKE MAX	7410	110/-110	210	-360/1310	320/-250	190/-180	260	690	1710
AUTOBRAKE 3	8060	120/-120	220	-390/1390	200/-100	210/-210	390	320	1130
Medium To Poor Reported Braking Action									
MAX MANUAL	8330	130/-130	250	-450/1660	500/-350	210/-210	260	1080	2860
AUTOBRAKE MAX	8360	140/-130	260	-450/1660	520/-370	220/-210	270	1080	2880
AUTOBRAKE 3	8750	140/-140	260	-460/1710	440/-260	230/-230	370	830	2520
Poor Reported Braking Action									
MAX MANUAL	9250	150/-150	290	-530/2010	690/-460	240/-230	280	1470	4020
AUTOBRAKE MAX	9300	160/-150	300	-530/2010	720/-480	250/-240	280	1470	4040
AUTOBRAKE 3	9430	150/-150	290	-530/2030	670/-420	250/-250	340	1340	3910

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4310	80/-50	80	-150/510	50/-50	80/-80	150	60	130
AUTOBRAKE MAX	4900	70/-60	110	-180/620	20/0	110/-110	240	0	0
AUTOBRAKE 2	8030	120/-130	220	-370/1270	20/-70	220/-220	370	30	30
Good Reported Braking Action									
MAX MANUAL	5490	70/-70	130	-230/800	130/-110	120/-120	200	210	480
AUTOBRAKE MAX	5560	70/-70	130	-230/810	130/-120	130/-120	220	220	500
AUTOBRAKE 2	8050	120/-130	220	-370/1270	30/-90	220/-220	380	30	30
Good To Medium Reported Braking Action									
MAX MANUAL	6300	90/-90	170	-300/1050	220/-180	150/-150	220	410	970
AUTOBRAKE MAX	6340	90/-90	170	-300/1050	230/-180	160/-150	240	420	990
AUTOBRAKE 2	8170	130/-130	230	-390/1360	110/-120	220/-220	380	120	360
Medium Reported Braking Action									
MAX MANUAL	7110	110/-100	200	-360/1290	300/-240	170/-170	240	600	1460
AUTOBRAKE MAX	7120	110/-110	200	-360/1290	320/-240	180/-170	260	610	1470
AUTOBRAKE 3	7600	110/-110	210	-380/1350	210/-100	200/-200	380	320	1040
Medium To Poor Reported Braking Action									
MAX MANUAL	8010	130/-120	240	-440/1640	500/-350	200/-200	260	950	2470
AUTOBRAKE MAX	8040	130/-130	240	-440/1640	520/-360	210/-200	270	960	2480
AUTOBRAKE 3	8310	130/-130	250	-450/1680	450/-260	220/-220	360	790	2240
Poor Reported Braking Action									
MAX MANUAL	8910	150/-140	270	-520/1990	690/-460	230/-230	270	1300	3470
AUTOBRAKE MAX	8950	150/-150	280	-520/1990	710/-480	240/-230	280	1310	3490
AUTOBRAKE 3	9010	150/-140	280	-520/2000	690/-420	240/-230	330	1250	3430

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH UP AUTHORITY (Flaps ≤ 15)
VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5030	130/-70	120	-170/590	70/-60	110/-110	150	180	400
AUTOBRAKE MAX	6770	80/-80	160	-230/760	10/0	170/-170	270	0	20
AUTOBRAKE 2	10630	160/-180	350	-440/1470	230/-250	310/-300	310	900	1080
Good Reported Braking Action									
MAX MANUAL	6260	80/-80	170	-240/840	140/-120	160/-150	170	420	980
AUTOBRAKE MAX	7070	80/-90	180	-270/910	80/-60	180/-180	270	250	770
AUTOBRAKE 2	10630	160/-180	350	-440/1470	230/-250	310/-300	310	900	1080
Good To Medium Reported Braking Action									
MAX MANUAL	7320	110/-110	220	-310/1100	240/-200	200/-190	200	750	1880
AUTOBRAKE MAX	7840	110/-110	230	-330/1150	190/-150	210/-210	270	670	1770
AUTOBRAKE 2	10720	170/-180	350	-460/1560	280/-280	310/-310	310	980	1480
Medium Reported Braking Action									
MAX MANUAL	8370	130/-130	260	-380/1360	330/-270	230/-220	220	1080	2780
AUTOBRAKE MAX	8600	130/-130	270	-390/1380	300/-240	230/-230	260	1080	2770
AUTOBRAKE 3	10250	150/-160	310	-440/1550	270/-240	290/-280	310	680	1680
Medium To Poor Reported Braking Action									
MAX MANUAL	9490	160/-160	320	-470/1730	540/-390	270/-250	240	1630	4540
AUTOBRAKE MAX	9620	160/-160	320	-480/1740	520/-370	270/-260	270	1610	4510
AUTOBRAKE 3	10800	170/-180	350	-510/1860	490/-360	310/-300	310	1270	3710
Poor Reported Braking Action									
MAX MANUAL	10600	180/-180	370	-560/2100	740/-500	300/-280	260	2170	6290
AUTOBRAKE MAX	10640	180/-180	370	-560/2100	740/-490	300/-290	280	2140	6250
AUTOBRAKE 3	11340	180/-190	390	-580/2160	710/-480	320/-310	310	1850	5740

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH UP AUTHORITY (Flaps ≥ 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4410	100/-60	100	-150/530	60/-50	90/-90	140	120	260
AUTOBRAKE MAX	5780	70/-70	130	-210/690	10/0	140/-140	250	0	0
AUTOBRAKE 2	9230	140/-150	280	-410/1370	160/-190	260/-260	310	460	470
Good Reported Braking Action									
MAX MANUAL	5590	70/-70	140	-230/800	120/-110	130/-130	170	310	700
AUTOBRAKE MAX	6130	80/-80	150	-240/850	80/-60	150/-150	240	230	650
AUTOBRAKE 2	9230	140/-150	280	-410/1370	160/-190	260/-260	310	460	470
Good To Medium Reported Braking Action									
MAX MANUAL	6530	90/-90	180	-300/1050	220/-180	170/-160	200	570	1370
AUTOBRAKE MAX	6890	100/-100	190	-300/1080	180/-140	180/-180	250	520	1330
AUTOBRAKE 2	9320	140/-150	290	-430/1450	220/-220	260/-260	310	540	810
Medium Reported Braking Action									
MAX MANUAL	7470	110/-110	220	-360/1300	310/-250	200/-190	220	820	2030
AUTOBRAKE MAX	7640	120/-120	230	-360/1310	280/-220	200/-200	260	810	2000
AUTOBRAKE 3	8840	130/-140	250	-410/1450	220/-190	240/-240	320	380	1180
Medium To Poor Reported Braking Action									
MAX MANUAL	8490	140/-140	270	-450/1670	510/-370	230/-220	240	1260	3350
AUTOBRAKE MAX	8590	140/-140	280	-450/1670	500/-350	230/-230	270	1250	3340
AUTOBRAKE 3	9430	150/-150	290	-480/1760	440/-320	260/-260	320	890	2760
Poor Reported Braking Action									
MAX MANUAL	9510	160/-160	320	-530/2030	710/-480	260/-250	260	1700	4670
AUTOBRAKE MAX	9530	160/-160	320	-530/2030	720/-470	260/-250	270	1690	4670
AUTOBRAKE 3	10020	170/-160	330	-550/2070	660/-440	280/-270	310	1390	4340

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PRI FLIGHT COMPUTERS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4600	100/-50	100	-150/520	60/-50	100/-90	170	120	250
AUTOBRAKE MAX	5510	70/-70	130	-200/670	0/0	130/-130	230	0	0
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10

Good Reported Braking Action

MAX MANUAL	6250	90/-90	170	-250/880	160/-140	150/-150	230	420	990
AUTOBRAKE MAX	6260	90/-90	170	-260/880	150/-130	150/-150	250	410	970
AUTOBRAKE 2	9310	140/-150	260	-410/1380	0/-70	270/-260	440	10	10

Good To Medium Reported Braking Action

MAX MANUAL	7280	120/-110	220	-330/1150	280/-230	190/-180	270	770	1940
AUTOBRAKE MAX	7270	120/-120	220	-330/1150	280/-230	190/-190	280	760	1920
AUTOBRAKE 2	9420	140/-160	270	-430/1470	100/-110	270/-270	440	150	870

Medium Reported Braking Action

MAX MANUAL	8300	140/-130	260	-400/1410	390/-310	220/-210	300	1110	2890
AUTOBRAKE MAX	8280	140/-140	260	-400/1410	410/-330	220/-220	300	1110	2870
AUTOBRAKE 3	8770	140/-130	250	-410/1460	280/-140	240/-240	400	740	2540

Medium To Poor Reported Braking Action

MAX MANUAL	9410	170/-160	320	-490/1790	630/-450	260/-250	320	1690	4810
AUTOBRAKE MAX	9420	170/-170	320	-490/1790	660/-470	260/-250	320	1700	4820
AUTOBRAKE 3	9680	170/-160	310	-500/1820	580/-340	270/-270	390	1510	4650

Poor Reported Braking Action

MAX MANUAL	10520	190/-190	370	-580/2170	870/-580	290/-280	340	2270	6730
AUTOBRAKE MAX	10550	200/-190	370	-580/2170	900/-600	300/-280	340	2280	6760
AUTOBRAKE 3	10590	200/-180	370	-580/2180	880/-540	300/-290	380	2270	6760

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SLATS DRIVE (Flaps 20)
VREF30 + 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4700	110/-60	110	-160/540	60/-60	100/-100	140	130	290
AUTOBRAKE MAX	6260	70/-80	150	-220/720	10/0	150/-150	260	0	0
AUTOBRAKE 2	10090	150/-160	310	-430/1440	190/-220	290/-290	320	570	600
Good Reported Braking Action									
MAX MANUAL	6200	80/-80	170	-250/850	150/-130	150/-150	190	390	910
AUTOBRAKE MAX	6690	80/-90	170	-260/890	100/-80	170/-170	260	340	890
AUTOBRAKE 2	10090	150/-160	310	-430/1440	190/-220	290/-290	320	570	600
Good To Medium Reported Braking Action									
MAX MANUAL	7230	110/-110	220	-320/1110	250/-210	190/-190	220	700	1710
AUTOBRAKE MAX	7540	110/-110	220	-330/1140	210/-170	200/-200	270	660	1680
AUTOBRAKE 2	10180	160/-170	320	-450/1520	250/-250	300/-290	320	660	1030
Medium Reported Braking Action									
MAX MANUAL	8250	130/-130	260	-380/1370	350/-280	220/-220	240	1000	2500
AUTOBRAKE MAX	8390	130/-130	260	-390/1380	320/-250	230/-220	280	980	2460
AUTOBRAKE 3	9660	140/-150	290	-430/1520	260/-210	270/-270	330	500	1540
Medium To Poor Reported Braking Action									
MAX MANUAL	9340	160/-160	310	-470/1740	570/-410	260/-250	260	1500	4040
AUTOBRAKE MAX	9420	160/-160	310	-480/1750	560/-390	270/-250	290	1490	4020
AUTOBRAKE 3	10300	160/-170	330	-510/1840	500/-350	290/-290	330	1090	3380
Poor Reported Braking Action									
MAX MANUAL	10420	180/-180	360	-560/2110	780/-530	290/-280	280	1990	5570
AUTOBRAKE MAX	10440	180/-180	360	-560/2110	790/-520	300/-280	290	1990	5570
AUTOBRAKE 3	10930	180/-180	370	-580/2160	730/-490	310/-300	320	1670	5220

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4030	90/-50	80	-140/470	50/-50	80/-80	130	90	200
AUTOBRAKE MAX	5160	60/-70	110	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8410	130/-140	240	-380/1300	90/-140	230/-230	340	130	130
Good Reported Braking Action									
MAX MANUAL	5380	70/-70	140	-230/790	130/-110	130/-120	190	310	720
AUTOBRAKE MAX	5640	80/-80	140	-230/820	110/-90	130/-130	220	320	730
AUTOBRAKE 2	8410	130/-140	240	-380/1300	90/-140	230/-230	340	130	130
Good To Medium Reported Braking Action									
MAX MANUAL	6260	90/-90	180	-300/1040	230/-180	160/-150	220	570	1390
AUTOBRAKE MAX	6400	100/-100	180	-300/1060	220/-170	160/-160	240	560	1380
AUTOBRAKE 2	8510	130/-140	250	-400/1390	150/-170	240/-230	340	220	570
Medium Reported Braking Action									
MAX MANUAL	7140	110/-110	210	-360/1290	320/-250	180/-180	240	820	2050
AUTOBRAKE MAX	7160	110/-110	220	-360/1290	320/-240	190/-180	260	790	2030
AUTOBRAKE 3	7960	120/-120	220	-390/1380	210/-140	210/-210	350	400	1480
Medium To Poor Reported Braking Action									
MAX MANUAL	8090	140/-130	260	-450/1650	530/-370	220/-210	260	1250	3370
AUTOBRAKE MAX	8110	140/-140	260	-450/1650	530/-370	220/-210	270	1240	3370
AUTOBRAKE 3	8620	140/-140	260	-460/1710	450/-290	230/-230	340	990	3060
Poor Reported Braking Action									
MAX MANUAL	9040	160/-150	300	-530/2000	730/-480	250/-240	280	1680	4690
AUTOBRAKE MAX	9060	160/-160	300	-530/2010	740/-490	250/-240	280	1680	4700
AUTOBRAKE 3	9270	160/-150	300	-530/2030	690/-430	250/-250	330	1580	4630

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3850	80/-40	80	-130/460	50/-40	70/-70	130	70	160
AUTOBRAKE MAX	4900	60/-60	110	-180/620	10/0	110/-110	220	0	0
AUTOBRAKE 2	7950	120/-130	220	-370/1260	60/-120	220/-220	340	60	60
Good Reported Braking Action									
MAX MANUAL	5190	70/-70	130	-220/780	130/-110	120/-120	190	270	620
AUTOBRAKE MAX	5430	70/-70	140	-230/800	110/-90	130/-120	220	270	630
AUTOBRAKE 2	7950	120/-130	220	-370/1260	60/-120	220/-220	340	60	60
Good To Medium Reported Braking Action									
MAX MANUAL	6030	90/-90	170	-290/1030	230/-180	150/-150	220	500	1200
AUTOBRAKE MAX	6160	90/-90	170	-290/1040	220/-170	160/-150	240	490	1190
AUTOBRAKE 2	8040	130/-130	230	-390/1350	130/-150	220/-220	340	160	470
Medium Reported Braking Action									
MAX MANUAL	6870	110/-110	200	-350/1270	320/-250	180/-170	240	720	1770
AUTOBRAKE MAX	6890	110/-110	200	-350/1270	320/-240	180/-170	260	710	1750
AUTOBRAKE 3	7520	120/-110	210	-370/1340	220/-130	200/-200	350	400	1360
Medium To Poor Reported Braking Action									
MAX MANUAL	7800	140/-130	240	-440/1630	520/-370	210/-200	260	1110	2910
AUTOBRAKE MAX	7820	140/-130	250	-440/1630	530/-370	210/-200	270	1110	2910
AUTOBRAKE 3	8200	140/-130	250	-450/1670	470/-280	220/-220	340	930	2710
Poor Reported Braking Action									
MAX MANUAL	8730	160/-150	280	-520/1980	720/-480	240/-230	280	1490	4050
AUTOBRAKE MAX	8750	160/-150	290	-520/1990	730/-490	240/-230	280	1500	4060
AUTOBRAKE 3	8880	160/-150	290	-520/2000	710/-430	240/-240	330	1460	4050

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
STABILIZER (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	520000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 520000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4420	100/-50	100	-150/520	60/-50	90/-90	140	120	250
AUTOBRAKE MAX	5780	70/-70	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9390	140/-150	290	-410/1380	150/-190	270/-260	330	360	360
Good Reported Braking Action									
MAX MANUAL	5810	80/-80	150	-240/820	140/-120	140/-140	190	350	810
AUTOBRAKE MAX	6190	80/-80	160	-250/860	110/-80	150/-150	240	340	820
AUTOBRAKE 2	9390	140/-150	290	-410/1380	150/-190	270/-260	330	360	360
Good To Medium Reported Braking Action									
MAX MANUAL	6780	100/-100	200	-310/1080	240/-200	180/-170	220	630	1550
AUTOBRAKE MAX	7010	100/-100	200	-310/1100	220/-160	180/-180	260	620	1530
AUTOBRAKE 2	9480	150/-160	290	-430/1470	210/-220	270/-270	330	450	780
Medium Reported Braking Action									
MAX MANUAL	7740	120/-120	240	-370/1330	330/-270	210/-200	240	910	2290
AUTOBRAKE MAX	7820	120/-120	240	-370/1340	320/-240	210/-200	270	890	2240
AUTOBRAKE 3	8950	130/-140	260	-410/1460	220/-180	250/-240	340	410	1430
Medium To Poor Reported Braking Action									
MAX MANUAL	8780	150/-150	290	-460/1700	540/-390	240/-230	260	1380	3740
AUTOBRAKE MAX	8830	150/-150	290	-460/1710	550/-380	250/-230	280	1380	3720
AUTOBRAKE 3	9590	150/-160	300	-490/1780	460/-320	270/-260	340	1000	3190
Poor Reported Braking Action									
MAX MANUAL	9820	170/-170	330	-550/2070	750/-510	270/-260	280	1850	5190
AUTOBRAKE MAX	9830	170/-170	340	-550/2070	770/-510	280/-260	280	1860	5190
AUTOBRAKE 3	10220	170/-170	340	-560/2100	700/-460	290/-280	330	1590	4950

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25 or 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)			
		AIRPORT PRESSURE ALTITUDE (FT)			
°C	°F	0	1000	2000	3000
54	129	509.5			
52	126	524.1	504.0		
50	122	539.1	519.0	497.5	
48	118	555.3	533.9	512.5	493.3
46	115	571.0	549.5	526.9	506.8
44	111	586.0	564.3	541.8	520.4
42	108	600.7	578.4	555.9	533.9
40	104	614.6	591.8	569.1	546.8
38	100	628.0	604.4	581.5	559.3
36	97	640.3	616.1	592.9	570.6
34	93	651.1	627.0	603.2	581.0
32	90	660.2	636.1	612.5	588.7
30	86	668.7	644.0	619.6	596.1
28	82	668.8	651.9	625.1	601.9
26	79	668.9	652.0	630.4	606.1
24	75	669.0	652.2	633.1	610.0
22	72	669.2	652.3	633.3	612.9
20	68	669.3	652.4	633.4	615.3
18	64	669.4	652.5	633.5	615.4
16	61	669.5	652.6	633.6	615.5
14	57	669.6	652.8	633.7	615.6
12	54	669.8	652.9	633.8	615.7
10 & BELOW	50 & BELOW	669.9	653.0	634.0	615.9

Based on engine bleed for 2 packs on and engine anti-ice off and wing anti-ice off.
With engine bleed for packs off, increase weight by 4800 lb.
With engine anti-ice on, decrease weight by 1100 lb.
With engine and wing anti-ice on, decrease weight by 4800 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 43300 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT	OAT	PRESSURE ALTITUDE (1000 FT)																	
(1000 LB)	(°C)	0	2	4	0	2	4	0	2	4	0	2	4	0	2	4	0	2	4
680	0	19.3	20.2	21.0	28.6	30.1	31.5	39.3	41.5	43.7	51.2	54.2	57.3	64.1	67.9	71.8	77.0	81.7	86.3
	10	19.8	20.7	21.6	29.4	31.0	32.5	40.5	42.8	45.0	52.8	55.9	59.1	66.1	70.1	74.1	79.4	84.1	88.9
	15	20.2	21.1	22.0	30.0	31.6	33.1	41.2	43.6	45.9	53.8	56.9	60.2	67.3	71.3	75.4	80.7	85.5	90.3
	20	20.6	21.5	22.4	30.5	32.1	33.6	41.9	44.3	46.7	54.7	57.9	61.2	68.4	72.5	76.6	82.0	86.8	91.7
	30	21.0	22.0	22.9	31.3	32.9	34.5	43.1	45.5	47.9	56.2	59.5	62.8	70.2	74.4	78.7	84.2	89.2	94.1
	40	21.2	22.1	23.1	31.6	33.3	34.9	43.7	46.2	48.7	57.2	60.6	64.0	71.6	75.9	80.2	85.9	91.0	96.0
640	0	18.5	19.3	20.1	27.3	28.7	30.0	37.4	39.5	41.6	48.7	51.6	54.4	60.9	64.6	68.3	73.4	77.8	82.3
	10	19.0	19.8	20.6	28.1	29.5	30.9	38.6	40.7	42.8	50.2	53.2	56.1	62.8	66.6	70.4	75.6	80.2	84.7
	15	19.3	20.2	21.0	28.6	30.1	31.5	39.3	41.5	43.6	51.1	54.2	57.1	63.9	67.8	71.6	76.9	81.5	86.1
	20	19.6	20.5	21.4	29.1	30.6	32.0	39.9	42.2	44.4	52.0	55.1	58.1	65.0	68.9	72.8	78.2	82.8	87.5
	30	20.1	21.0	21.8	29.8	31.3	32.8	41.0	43.3	45.6	53.4	56.6	59.7	66.8	70.8	74.8	80.3	85.1	89.8
	40	20.2	21.1	22.0	30.1	31.7	33.2	41.6	43.9	46.3	54.4	57.6	60.8	68.1	72.2	76.3	81.9	86.8	91.6
600	0	17.6	18.4	19.1	26.0	27.3	28.5	35.5	37.5	39.4	46.2	48.8	51.5	57.7	61.2	64.7	69.6	73.8	78.0
	10	18.1	18.9	19.6	26.7	28.0	29.4	36.6	38.6	40.6	47.6	50.4	53.1	59.5	63.1	66.7	71.8	76.1	80.4
	15	18.4	19.2	20.0	27.2	28.5	29.9	37.3	39.3	41.4	48.5	51.3	54.1	60.6	64.2	67.9	73.0	77.4	81.8
	20	18.7	19.5	20.3	27.7	29.0	30.4	37.9	40.0	42.1	49.3	52.2	55.0	61.6	65.3	69.0	74.2	78.6	83.1
	30	19.2	20.0	20.8	28.3	29.8	31.2	38.9	41.0	43.2	50.6	53.6	56.5	63.3	67.1	70.9	76.2	80.8	85.3
	40	19.2	20.1	20.9	28.6	30.1	31.5	39.4	41.6	43.8	51.5	54.5	57.6	64.5	68.4	72.3	77.8	82.4	87.1
560	0	16.8	17.5	18.2	24.6	25.8	27.0	33.6	35.4	37.2	43.6	46.1	48.6	54.4	57.7	60.9	65.7	69.7	73.7
	10	17.2	17.9	18.7	25.3	26.6	27.8	34.6	36.5	38.4	44.9	47.5	50.1	56.1	59.5	62.8	67.7	71.8	75.9
	15	17.5	18.3	19.0	25.8	27.1	28.3	35.3	37.2	39.1	45.8	48.4	51.0	57.1	60.6	63.9	68.9	73.1	77.2
	20	17.8	18.6	19.3	26.3	27.5	28.8	35.9	37.8	39.7	46.6	49.2	51.9	58.1	61.6	65.0	70.1	74.3	78.5
	30	18.2	19.0	19.8	26.9	28.2	29.5	36.8	38.8	40.8	47.8	50.6	53.3	59.7	63.3	66.8	72.0	76.3	80.6
	40	18.3	19.1	19.9	27.1	28.5	29.8	37.3	39.3	41.4	48.6	51.4	54.2	60.8	64.5	68.1	73.4	77.8	82.3
520	0	15.9	16.6	17.2	23.3	24.4	25.5	31.7	33.4	35.1	41.0	43.3	45.6	51.1	54.1	57.1	61.7	65.4	69.1
	10	16.4	17.0	17.7	24.0	25.1	26.3	32.6	34.4	36.1	42.3	44.7	47.1	52.7	55.8	58.9	63.6	67.4	71.3
	15	16.7	17.3	18.0	24.4	25.6	26.8	33.2	35.0	36.8	43.1	45.5	47.9	53.7	56.8	60.0	64.7	68.6	72.5
	20	17.0	17.6	18.3	24.8	26.0	27.2	33.8	35.6	37.4	43.8	46.3	48.7	54.6	57.8	61.0	65.8	69.8	73.7
	30	17.3	18.0	18.7	25.4	26.6	27.9	34.7	36.5	38.4	44.9	47.5	50.1	56.1	59.4	62.7	67.6	71.7	75.7
	40	17.4	18.1	18.8	25.6	26.9	28.2	35.1	37.0	38.9	45.6	48.3	50.9	57.1	60.5	63.9	68.9	73.1	77.2
480	0	15.1	15.7	16.3	22.0	23.0	24.0	29.8	31.3	32.9	38.4	40.5	42.6	47.7	50.5	53.3	57.5	61.0	64.4
	10	15.5	16.1	16.7	22.6	23.7	24.7	30.6	32.2	33.8	39.5	41.7	44.0	49.2	52.1	54.9	59.3	62.9	66.4
	15	15.8	16.4	17.0	23.0	24.1	25.2	31.2	32.8	34.5	40.3	42.5	44.8	50.1	53.0	55.9	60.4	64.0	67.6
	20	16.1	16.7	17.3	23.4	24.5	25.6	31.8	33.4	35.1	41.0	43.2	45.5	50.9	53.9	56.9	61.4	65.1	68.7
	30	16.4	17.1	17.7	24.0	25.1	26.2	32.5	34.2	36.0	42.0	44.4	46.7	52.3	55.4	58.4	63.1	66.9	70.6
	40	16.5	17.1	17.8	24.2	25.3	26.5	32.9	34.7	36.4	42.7	45.1	47.5	53.2	56.4	59.5	64.3	68.2	72.0
440	0	14.3	14.9	15.4	20.7	21.6	22.5	27.8	29.2	30.6	35.7	37.7	39.6	44.2	46.8	49.3	53.2	56.4	59.6
	10	14.7	15.2	15.8	21.2	22.2	23.2	28.6	30.1	31.6	36.8	38.8	40.8	45.6	48.2	50.9	54.9	58.2	61.4
	15	15.0	15.5	16.1	21.6	22.6	23.6	29.2	30.7	32.2	37.5	39.5	41.6	46.4	49.1	51.8	55.9	59.2	62.5
	20	15.2	15.8	16.4	22.0	23.0	24.0	29.7	31.2	32.7	38.1	40.2	42.3	47.2	49.9	52.7	56.8	60.2	63.6
	30	15.5	16.1	16.7	22.5	23.5	24.6	30.4	32.0	33.5	39.1	41.2	43.4	48.5	51.3	54.1	58.4	61.9	65.3
	40	15.6	16.2	16.8	22.7	23.7	24.8	30.7	32.3	33.9	39.6	41.9	44.1	49.3	52.2	55.1	59.5	63.0	66.6

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.
If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Event Adjusted Brake Energy (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
EVENT		10	20	30	40	50	60	70	80	90	100
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100
LANDING	MAX MAN	5.1	14.1	23.1	32.1	41.2	50.3	59.5	68.8	78.3	87.9
	MAX AUTO	5.1	13.1	21.2	29.6	38.1	46.9	56.0	65.5	75.3	85.6
	AUTOBRAKE 4	4.9	12.4	19.9	27.5	35.4	43.5	52.1	61.1	70.6	80.8
	AUTOBRAKE 3	4.6	11.6	18.5	25.5	32.7	40.1	47.9	56.2	65.0	74.5
	AUTOBRAKE 2	4.3	10.8	17.2	23.6	30.1	36.9	43.9	51.4	59.4	68.0
	AUTOBRAKE 1	4.2	10.1	15.9	21.8	27.7	33.8	40.3	47.1	54.5	62.4

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)									
EVENT		10	20	30	40	50	60	70	80	90	100
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100
LANDING	MAX MAN	4.4	13.0	21.4	29.7	37.9	46.1	54.3	62.6	71.1	79.7
	MAX AUTO	2.4	9.4	16.4	23.5	30.9	38.6	46.6	55.0	64.0	73.5
	AUTOBRAKE 4	1.9	7.2	12.7	18.4	24.5	31.0	37.9	45.5	53.6	62.5
	AUTOBRAKE 3	1.1	4.9	9.0	13.4	18.2	23.4	29.0	35.2	42.0	49.3
	AUTOBRAKE 2	0.3	3.1	6.1	9.4	13.0	16.9	21.3	26.1	31.4	37.2
	AUTOBRAKE 1	0.1	2.3	4.6	7.1	9.8	12.7	16.1	19.9	24.2	29.2

Cooling Time (Minutes)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
	16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
GEAR DOWN INFLIGHT	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE
GROUND		11	18	26	42	55	66	73		
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds for each taxi mile.
For one brake deactivated, increase brake energy by 10 percent.
For two brakes deactivated, increase brake energy by 20 percent.
When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 8 minutes.
When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.
Brake temperature monitor system (BTMS) indication on EICAS may be used 12 to 15 minutes after airplane has come to a complete stop, or inflight with gear retracted, to determine recommended cooling schedule. (Inflight gear extended, the BTMS indications may vary between individual brakes, due to airstream effects, gear tilt, and position of the gear temperature probes.)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Initial Max Continuous EPR

Based on .84M, engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	1.260	1.236	1.217	1.204	1.193	1.176	1.182	1.192	1.203
15	1.320	1.295	1.272	1.256	1.244	1.224	1.229	1.237	1.245
10	1.376	1.351	1.328	1.311	1.295	1.275	1.280	1.285	1.290
5	1.378	1.404	1.382	1.365	1.352	1.329	1.333	1.335	1.337
0	1.378	1.420	1.431	1.415	1.402	1.381	1.385	1.385	1.384
-5	1.378	1.420	1.460	1.460	1.488	1.429	1.433	1.431	1.430
-10	1.378	1.420	1.460	1.482	1.488	1.472	1.475	1.473	1.472
-15	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-20	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-25	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-30	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-35	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504
-40	1.378	1.420	1.460	1.482	1.504	1.505	1.506	1.505	1.504

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous EPR

37000 FT to 31000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150	0.48	1.480	1.480	1.480	1.477	1.464	1.445	1.421	1.392	1.359	1.326	1.324	1.324
200	0.63	1.495	1.495	1.495	1.495	1.495	1.480	1.453	1.419	1.379	1.336	1.292	1.258
250	0.77	1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.499	1.460	1.416	1.367	1.316
300	0.91	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.434	1.393	1.346
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150	0.46	1.479	1.479	1.479	1.479	1.464	1.445	1.421	1.392	1.362	1.332	1.323	1.323
200	0.60	1.484	1.484	1.484	1.484	1.484	1.473	1.451	1.421	1.385	1.350	1.315	1.283
250	0.74	1.528	1.528	1.528	1.528	1.528	1.528	1.528	1.498	1.459	1.413	1.360	1.303
300	0.87	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.480	1.448	1.404	1.355
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
150	0.44	1.486	1.486	1.486	1.486	1.480	1.460	1.435	1.407	1.375	1.345	1.317	1.317
200	0.58	1.493	1.493	1.493	1.493	1.493	1.493	1.471	1.444	1.409	1.372	1.336	1.299
250	0.71	1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.516	1.478	1.430	1.370	1.301
300	0.84	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.460	1.415	1.365
330	0.91	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.426	1.383
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
150	0.42	1.492	1.492	1.492	1.492	1.478	1.453	1.425	1.393	1.362	1.333	1.315	1.315
200	0.55	1.506	1.506	1.506	1.506	1.506	1.497	1.470	1.438	1.400	1.361	1.322	1.284
250	0.68	1.530	1.530	1.530	1.530	1.530	1.530	1.530	1.498	1.454	1.395	1.326	1.262
300	0.81	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.477	1.435	1.386	1.334
333	0.88	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.385	1.335

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	31	33	35	37
ENGINE ONLY	-0.018	-0.017	-0.016	-0.017
ENGINE & WING *	-0.033	-0.032	-0.032	-0.034
ENGINE & WING **	-0.048	-0.047	-0.048	-0.051

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous EPR

29000 FT to 24000 FT Pressure Altitudes

29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
150	0.40	1.504	1.504	1.504	1.504	1.488	1.459	1.429	1.394	1.363	1.334	1.326	1.326
200	0.53	1.509	1.509	1.509	1.509	1.509	1.497	1.464	1.427	1.388	1.350	1.313	1.293
250	0.65	1.504	1.504	1.504	1.504	1.504	1.504	1.504	1.457	1.405	1.350	1.294	1.251
300	0.78	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.450	1.397	1.340	1.281
330	0.85	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.417	1.406	1.354	1.298
27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
150	0.38	1.523	1.523	1.523	1.523	1.523	1.505	1.473	1.440	1.404	1.372	1.343	1.343
200	0.51	1.512	1.512	1.512	1.512	1.512	1.512	1.496	1.458	1.416	1.376	1.341	1.306
250	0.63	1.479	1.479	1.479	1.479	1.479	1.479	1.479	1.474	1.423	1.372	1.325	1.285
300	0.75	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.417	1.350	1.288
330	0.81	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.395	1.370	1.311
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
150	0.37	1.540	1.540	1.540	1.540	1.540	1.522	1.488	1.451	1.415	1.380	1.360	1.360
200	0.49	1.511	1.511	1.511	1.511	1.511	1.511	1.490	1.447	1.404	1.366	1.332	1.307
250	0.60	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.451	1.400	1.354	1.315	1.282
300	0.72	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.429	1.371	1.302	1.248
330	0.78	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.375	1.327	1.260
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
150	0.36	1.536	1.536	1.536	1.536	1.536	1.530	1.494	1.459	1.421	1.387	1.355	1.355
200	0.48	1.507	1.507	1.507	1.507	1.507	1.507	1.497	1.455	1.412	1.372	1.339	1.307
250	0.59	1.463	1.463	1.463	1.463	1.463	1.463	1.463	1.453	1.408	1.363	1.324	1.289
300	0.70	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.432	1.424	1.381	1.310	1.257
333	0.77	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.382	1.378	1.336	1.270

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	24	25	27	29
ENGINE ONLY	-0.022	-0.023	-0.021	-0.020
ENGINE & WING*	-0.037	-0.038	-0.036	-0.035
ENGINE & WING**	-0.051	-0.053	-0.051	-0.050

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous EPR
22000 FT to 16000 FT Pressure Altitudes

22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
150	0.35	1.529	1.529	1.529	1.529	1.529	1.511	1.474	1.399	1.399	1.367	1.346	1.346
200	0.46	1.500	1.500	1.500	1.500	1.500	1.496	1.470	1.428	1.389	1.353	1.322	1.301
250	0.57	1.466	1.466	1.466	1.466	1.466	1.466	1.455	1.423	1.380	1.339	1.302	1.270
300	0.68	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.424	1.387	1.325	1.273	1.234
330	0.74	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.392	1.386	1.347	1.283	1.228
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
150	0.33	1.523	1.523	1.523	1.523	1.523	1.523	1.493	1.453	1.412	1.378	1.347	1.336
200	0.44	1.492	1.492	1.492	1.492	1.492	1.492	1.484	1.444	1.404	1.365	1.334	1.305
250	0.55	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.435	1.395	1.355	1.317	1.285
300	0.65	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.393	1.338	1.291	1.250
330	0.71	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.394	1.351	1.291	1.238
18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
150	0.32	1.496	1.496	1.496	1.496	1.496	1.494	1.455	1.415	1.380	1.351	1.322	1.321
200	0.42	1.474	1.474	1.474	1.474	1.474	1.471	1.452	1.409	1.369	1.336	1.309	1.283
250	0.53	1.498	1.498	1.498	1.498	1.498	1.498	1.485	1.429	1.373	1.325	1.288	1.260
300	0.63	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.461	1.398	1.337	1.285	1.238
330	0.69	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.426	1.415	1.352	1.293	1.240
16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
150	0.31	1.473	1.473	1.473	1.473	1.473	1.472	1.456	1.418	1.383	1.353	1.326	1.306
200	0.41	1.454	1.454	1.454	1.454	1.454	1.454	1.442	1.412	1.375	1.342	1.314	1.288
250	0.51	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.465	1.408	1.354	1.309	1.273
300	0.60	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.465	1.436	1.375	1.318	1.271
330	0.66	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.423	1.381	1.321	1.267

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	16	18	20	22
ENGINE ONLY	-0.011	-0.014	-0.018	-0.020
ENGINE & WING*	-0.022	-0.026	-0.031	-0.034
ENGINE & WING**	-0.033	-0.038	-0.044	-0.047

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous EPR

14000 FT to 5000 FT Pressure Altitudes

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
150	0.29	1.446	1.446	1.446	1.446	1.446	1.443	1.417	1.381	1.351	1.325	1.301	1.290
200	0.39	1.437	1.437	1.437	1.437	1.437	1.437	1.407	1.372	1.341	1.315	1.291	1.267
250	0.49	1.490	1.490	1.490	1.490	1.490	1.490	1.490	1.435	1.379	1.329	1.286	1.252
300	0.58	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.466	1.410	1.350	1.300	1.256
330	0.64	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.416	1.354	1.298	1.250
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
150	0.28	1.444	1.444	1.444	1.444	1.444	1.431	1.415	1.388	1.351	1.317	1.285	1.278
200	0.38	1.433	1.433	1.433	1.433	1.433	1.430	1.415	1.397	1.367	1.325	1.285	1.247
250	0.47	1.478	1.478	1.478	1.478	1.478	1.478	1.462	1.416	1.371	1.329	1.289	1.252
300	0.56	1.471	1.471	1.471	1.471	1.471	1.471	1.471	1.453	1.393	1.338	1.293	1.254
330	0.62	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.439	1.403	1.344	1.294	1.251
10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	5	0	5	10	15	20	25	30	35	40
150	0.27	1.425	1.425	1.425	1.425	1.425	1.422	1.403	1.384	1.355	1.320	1.299	1.280
200	0.36	1.401	1.401	1.401	1.401	1.401	1.401	1.394	1.380	1.358	1.323	1.291	1.270
250	0.45	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.387	1.353	1.318	1.282	1.252
300	0.54	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.411	1.372	1.323	1.282	1.254
330	0.59	1.383	1.383	1.383	1.383	1.383	1.383	1.383	1.383	1.382	1.327	1.285	1.246
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
150	0.25	1.385	1.385	1.385	1.385	1.385	1.385	1.377	1.348	1.323	1.302	1.281	1.260
200	0.33	1.367	1.367	1.367	1.367	1.367	1.367	1.367	1.353	1.336	1.316	1.291	1.265
250	0.41	1.341	1.341	1.341	1.341	1.341	1.341	1.341	1.341	1.326	1.311	1.287	1.253
300	0.49	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.327	1.289	1.254	1.221
330	0.54	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.311	1.289	1.252	1.218

EPR Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	5	10	12	14
ENGINE ONLY	-0.015	-0.015	-0.013	-0.010
ENGINE & WING*	-0.023	-0.025	-0.023	-0.020
ENGINE & WING**	-0.031	-0.035	-0.033	-0.030

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	638	281	16200	14700	13100
620	600	273	17700	16300	14700
580	562	264	19000	18000	16400
540	522	255	20400	19600	18300
500	483	246	22300	21700	20500
460	444	236	24300	24100	22900
420	406	226	26400	26200	25300
380	367	215	28700	28300	27500
340	329	204	31200	30600	29900

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
134	125	118	111	105	100	95	91	87	83	80
274	255	239	224	211	200	190	181	172	165	158
413	384	359	337	317	300	284	270	258	246	236
551	512	479	449	423	400	379	360	343	328	314
688	640	598	561	529	500	474	451	429	410	393
825	768	717	674	635	600	569	541	516	492	471
961	895	836	785	740	700	664	631	602	575	550
1097	1021	955	897	846	800	759	722	688	658	629
1233	1148	1074	1009	951	900	854	812	775	740	709
1368	1274	1192	1121	1057	1000	949	903	861	823	788
1503	1401	1311	1232	1162	1100	1044	993	947	906	867
1639	1527	1430	1344	1268	1200	1139	1084	1034	988	947
1774	1654	1548	1456	1373	1300	1234	1174	1120	1071	1026
1910	1781	1667	1567	1479	1400	1329	1265	1207	1153	1105
2047	1908	1786	1679	1585	1500	1424	1355	1293	1236	1184
2184	2035	1906	1792	1690	1600	1519	1445	1379	1318	1263
2321	2163	2025	1904	1796	1700	1614	1536	1465	1400	1341
2460	2292	2145	2016	1902	1800	1708	1626	1550	1482	1419

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)									TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)									
	340	380	420	460	500	540	580	620	660	
100	2.1	2.3	2.5	2.8	3.0	3.2	3.2	3.4	3.6	0:15
200	4.9	5.4	5.8	6.3	6.8	7.2	7.5	8.0	8.6	0:32
300	8.0	8.8	9.5	10.3	11.1	11.9	12.5	13.4	14.2	0:49
400	11.2	12.3	13.4	14.5	15.6	16.7	17.7	18.9	20.1	1:06
500	14.2	15.7	17.1	18.5	20.0	21.4	22.6	24.2	25.8	1:22
600	17.2	19.0	20.7	22.4	24.1	25.9	27.4	29.3	31.2	1:38
700	20.2	22.2	24.2	26.2	28.3	30.4	32.2	34.4	36.5	1:54
800	23.1	25.4	27.7	30.0	32.4	34.8	36.9	39.4	41.8	2:10
900	26.0	28.6	31.2	33.8	36.4	39.1	41.6	44.4	47.1	2:26
1000	28.8	31.7	34.6	37.5	40.5	43.4	46.2	49.4	52.3	2:41
1100	31.6	34.8	38.0	41.2	44.4	47.7	50.8	54.2	57.5	2:57
1200	34.4	37.9	41.4	44.8	48.4	51.9	55.3	59.1	62.6	3:13
1300	37.1	40.9	44.7	48.4	52.2	56.1	59.8	63.8	67.7	3:29
1400	39.8	43.9	47.9	52.0	56.1	60.2	64.2	68.6	72.7	3:44
1500	42.5	46.9	51.2	55.5	59.9	64.3	68.6	73.3	77.6	4:00
1600	45.1	49.8	54.4	59.0	63.7	68.4	73.0	77.9	82.5	4:17
1700	47.8	52.7	57.6	62.5	67.4	72.4	77.3	82.5	87.4	4:33
1800	50.3	55.5	60.7	65.9	71.1	76.4	81.5	87.0	92.2	4:50

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	13200	12000	7600
640	14000	12800	9700
620	14800	13600	12200
600	15700	14400	13000
580	16500	15300	13800
560	17400	16200	14700
540	18300	17100	15600
520	19000	18000	16600
500	19700	18800	17600
480	20600	19600	18600
460	21600	20700	19700
440	22700	22000	20900
420	23700	23300	22200
400	24900	24800	23600
380	26100	25900	24900
360	27400	27100	26200
340	28800	28400	27500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	13	15	17	19	21	23	25	27	29
660	EPR	1.263	1.355								
	MACH	.577	.615								
	KIAS	321	323								
	FF/ENG	20270	21145								
620	EPR	1.235	1.302	1.379							
	MACH	.567	.591	.622							
	KIAS	315	310	315							
	FF/ENG	19027	19136	20113							
580	EPR	1.209	1.263	1.315	1.404						
	MACH	.555	.575	.595	.628						
	KIAS	308	302	301	306						
	FF/ENG	17754	17668	17936	19053						
540	EPR	1.185	1.233	1.270	1.327	1.426					
	MACH	.541	.564	.577	.599	.633					
	KIAS	300	296	292	292	297					
	FF/ENG	16495	16470	16382	16765	17916					
500	EPR	1.164	1.204	1.236	1.274	1.336					
	MACH	.526	.549	.564	.578	.601					
	KIAS	292	288	285	281	281					
	FF/ENG	15293	15222	15189	15142	15546					
460	EPR	1.145	1.179	1.205	1.235	1.274	1.342				
	MACH	.512	.532	.548	.564	.577	.601				
	KIAS	284	279	277	274	270	270				
	FF/ENG	14164	14013	13947	13934	13868	14271				
420	EPR	1.127	1.157	1.178	1.201	1.233	1.273	1.342	1.448		
	MACH	.497	.516	.530	.546	.563	.576	.599	.634		
	KIAS	275	270	267	265	263	259	258	263		
	FF/ENG	13077	12883	12744	12662	12641	12582	12936	13947		
380	EPR	1.110	1.136	1.154	1.172	1.198	1.231	1.274	1.333	1.440	
	MACH	.482	.499	.513	.527	.543	.559	.574	.594	.630	
	KIAS	267	261	258	255	253	251	247	246	250	
	FF/ENG	12119	11793	11631	11445	11375	11331	11311	11574	12465	
340	EPR	1.092	1.116	1.131	1.146	1.168	1.193	1.227	1.267	1.321	1.419
	MACH	.461	.483	.495	.508	.522	.537	.554	.570	.587	.620
	KIAS	255	253	249	246	243	240	238	235	233	236
	FF/ENG	11113	10789	10555	10335	10202	10115	10047	10033	10187	10906

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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
288	265	245	228	213	200	190	181	173	165	158
573	528	489	455	426	400	380	362	346	331	318
860	793	734	683	639	600	571	544	519	497	477
1147	1057	978	911	852	800	761	725	692	662	635
1435	1323	1224	1139	1066	1000	951	906	865	828	794
1724	1589	1469	1367	1279	1200	1141	1086	1037	992	952
2014	1856	1716	1596	1493	1400	1331	1268	1210	1157	1109
2305	2123	1962	1825	1706	1600	1521	1448	1381	1321	1266
2596	2391	2208	2054	1920	1800	1710	1628	1552	1484	1423

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		18		22	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	8.6	0:40	7.5	0:39	6.8	0:38	6.5	0:36
300	13.1	0:58	11.9	0:56	11.0	0:54	10.9	0:51
400	17.7	1:16	16.2	1:13	15.2	1:11	15.2	1:06
500	22.3	1:34	20.6	1:31	19.4	1:28	19.4	1:22
600	26.8	1:52	24.9	1:48	23.5	1:44	23.6	1:37
700	31.3	2:10	29.2	2:05	27.6	2:01	27.8	1:53
800	35.8	2:29	33.4	2:23	31.7	2:18	31.9	2:08
900	40.2	2:47	37.7	2:41	35.7	2:35	35.9	2:24
1000	44.6	3:05	41.9	2:58	39.8	2:52	40.0	2:40
1100	49.0	3:24	46.1	3:16	43.8	3:09	43.9	2:56
1200	53.4	3:42	50.2	3:34	47.8	3:26	47.9	3:12
1300	57.8	4:01	54.4	3:52	51.7	3:43	51.8	3:28
1400	62.1	4:19	58.5	4:09	55.7	4:00	55.7	3:44
1500	66.4	4:38	62.6	4:27	59.6	4:17	59.5	4:01
1600	70.7	4:57	66.7	4:45	63.5	4:34	63.3	4:17
1700	75.0	5:16	70.7	5:03	67.3	4:52	67.0	4:33
1800	79.2	5:35	74.8	5:22	71.2	5:09	70.8	4:50

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	300	350	400	450	500	550	600	650
5	-0.7	-0.6	-0.4	-0.2	0.0	0.5	0.8	1.2
10	-1.7	-1.4	-1.0	-0.5	0.0	1.3	2.3	3.1
15	-2.8	-2.2	-1.5	-0.8	0.0	2.1	3.7	5.1
20	-3.8	-3.0	-2.1	-1.1	0.0	2.8	5.2	7.0
25	-4.9	-3.8	-2.6	-1.3	0.0	3.6	6.6	9.0
30	-5.9	-4.6	-3.1	-1.6	0.0	4.3	8.0	10.9
35	-6.9	-5.3	-3.6	-1.9	0.0	5.1	9.3	12.9
40	-7.9	-6.1	-4.2	-2.1	0.0	5.8	10.7	14.8
45	-9.0	-6.9	-4.7	-2.4	0.0	6.5	12.0	16.7
50	-10.0	-7.6	-5.2	-2.7	0.0	7.1	13.4	18.7
55	-11.0	-8.4	-5.7	-2.9	0.0	7.8	14.7	20.6
60	-12.0	-9.1	-6.2	-3.2	0.0	8.5	16.0	22.5
65	-13.0	-9.9	-6.6	-3.4	0.0	9.1	17.2	24.4
70	-14.0	-10.6	-7.1	-3.7	0.0	9.7	18.5	26.4
75	-15.0	-11.3	-7.6	-3.9	0.0	10.3	19.7	28.3
80	-16.0	-12.0	-8.0	-4.2	0.0	10.9	20.9	30.2

APU fuel included

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
660	EPR	1.150	1.186	1.256	1.382		
	KIAS	259	260	261	277		
	FF/ENG	17910	17770	18030	19530		
620	EPR	1.136	1.168	1.231	1.333		
	KIAS	251	252	253	262		
	FF/ENG	16750	16610	16750	17560		
580	EPR	1.122	1.152	1.208	1.294		
	KIAS	243	244	245	248		
	FF/ENG	15690	15450	15560	15900		
540	EPR	1.109	1.136	1.186	1.261	1.400	
	KIAS	234	235	236	237	252	
	FF/ENG	14630	14330	14410	14510	16030	
500	EPR	1.097	1.120	1.165	1.229	1.334	
	KIAS	226	226	227	228	235	
	FF/ENG	13600	13270	13270	13280	14050	
460	EPR	1.085	1.105	1.144	1.199	1.283	1.470
	KIAS	220	220	220	220	220	238
	FF/ENG	12610	12350	12200	12140	12400	14260
420	EPR	1.073	1.090	1.124	1.171	1.241	1.371
	KIAS	213	213	213	213	213	220
	FF/ENG	11610	11430	11230	11090	11140	12000
380	EPR	1.061	1.076	1.105	1.145	1.201	1.303
	KIAS	206	206	206	206	206	206
	FF/ENG	10630	10450	10290	10050	10030	10340
340	EPR	1.051	1.063	1.087	1.121	1.164	1.252
	KIAS	199	199	199	199	199	199
	FF/ENG	9660	9480	9370	9050	9000	9150

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available
Flaps 20

TAT (°C)	RATE OF CLIMB (FT/MIN) PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	290	160				
50	340	210	70			
48	400	260	120			
46	450	310	170	30		
44	500	360	220	80		
42	550	410	270	130	-20	
40	600	460	310	170	20	
38	620	510	360	210	60	-100
36	620	550	400	250	100	-60
34	620	590	430	280	130	-20
32	620	620	460	320	160	-10
30	630	650	490	340	180	0
20	640	660	550	410	240	60
10	650	680	560	430	280	100
0	670	690	570	440	290	120
-20	700	720	600	460	300	130
-40	730	750	620	480	320	130

Rate of climb capability shown is valid for 450000 lb, gear down at VREF20 + 5.
Decrease rate of climb 40 ft/min per 10000 lb greater than 450000 lb.
Increase rate of climb 50 ft/min per 10000 lb less than 450000 lb.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN) PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-200	-330				
50	-150	-290	-420			
48	-100	-240	-380			
46	-50	-190	-330	-470		
44	-10	-150	-290	-430		
42	40	-110	-250	-390	-540	
40	80	-60	-210	-350	-500	
38	90	-20	-170	-320	-460	-620
36	90	20	-130	-280	-430	-590
34	90	50	-100	-250	-400	-560
32	90	80	-70	-220	-380	-550
30	90	110	-50	-200	-360	-540
20	100	110	-10	-150	-320	-500
10	100	110	-10	-140	-290	-460
0	110	110	-10	-140	-290	-460
-20	110	120	-10	-140	-300	-470
-40	120	130	0	-150	-310	-490

Rate of climb capability shown is valid for 450000 lb, gear down at VREF30 + 5.
Decrease rate of climb 40 ft/min per 10000 lb greater than 450000 lb.
Increase rate of climb 50 ft/min per 10000 lb less than 450000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Limit Weight

PERFORMANCE LIMIT	ALTERNATE MODE EEC LIMIT WEIGHT (1000 LB)							
	PRIMARY MODE PERFORMANCE LIMIT WEIGHT (1000 LB)							
	350	400	450	500	550	600	650	700
FIELD	322.5	368.5	416.5	462.0	508.5	555.5	584.5	653.0
CLIMB	301.5	344.5	387.0	431.0	474.5	517.5	562.0	605.0
OBSTACLE	312.0	356.0	398.5	441.0	485.5	528.0	572.0	615.0
NET LEVEL OFF WEIGHT		333.5	378.0	423.5	469.0	514.0	559.0	604.5
APPROACH OR LANDING CLIMB			404.5	454.5	503.5	553.0	603.0	655.0

Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
V1	+2
VR	+1
V2	0

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	131	88.6	88.5	88.5	88.7	88.7	88.8	88.9	89.0	89.0	89.0	89.3	89.5
50	122	90.3	90.3	90.1	90.1	90.1	90.2	90.3	90.5	90.5	90.6	90.9	91.2
45	113	92.2	92.2	92.1	92.0	92.0	91.9	91.8	91.9	92.0	92.2	92.6	92.9
40	104	94.1	94.1	94.2	94.2	94.1	94.0	93.8	93.9	93.7	93.7	94.1	94.6
35	95	94.4	96.8	96.4	96.5	96.4	96.2	96.7	96.3	96.1	96.0	95.6	96.0
30	86	94.3	98.5	98.2	98.2	97.8	97.8	97.8	97.6	97.6	97.1	96.6	96.3
25	77	93.7	98.5	98.8	98.8	98.4	98.2	98.0	97.9	97.8	97.4	96.9	96.5
20	68	92.9	98.4	98.8	98.8	98.8	98.4	98.2	98.1	98.0	97.5	97.1	96.6
15	59	92.1	97.6	98.2	98.8	98.6	98.5	98.4	98.3	98.2	97.7	97.3	96.8
10	50	91.3	96.7	97.3	97.9	98.4	98.5	98.5	98.4	98.4	97.9	97.5	97.0
5	41	90.5	95.9	96.5	97.1	97.5	98.0	98.4	98.4	98.4	98.1	97.7	97.2
0	32	89.7	95.0	95.6	96.2	96.7	97.1	97.5	97.9	98.2	98.1	97.7	97.3
-10	14	88.0	93.2	93.8	94.4	94.9	95.3	95.7	96.0	96.4	96.5	96.5	96.6
-20	-4	86.4	91.5	92.0	92.6	93.0	93.5	93.9	94.2	94.6	94.6	94.7	94.7
-30	-22	84.6	89.6	90.2	90.7	91.2	91.6	92.0	92.3	92.7	92.7	92.8	92.8
-40	-40	82.9	87.8	88.3	88.9	89.3	89.7	90.1	90.4	90.8	90.8	90.8	90.9
-50	-58	81.1	85.9	86.4	86.9	87.4	87.8	88.1	88.4	88.8	88.8	88.9	88.9

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	9000
PACKS OFF	0.8	0.8	0.9	1.0	1.0	1.1	1.1
WING ANTI-ICE ON	-0.4	-0.4	-0.5	-0.5	-0.5	-0.6	-0.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	85.1	85.5	87.4	89.5	90.9	89.6	90.6	93.8	94.5	95.1
50	86.3	86.6	87.1	88.1	89.6	88.3	89.3	92.4	93.0	93.6
40	86.6	87.6	88.0	88.6	88.5	86.9	87.9	91.0	91.6	92.2
30	85.2	87.5	89.4	89.9	89.4	87.8	87.0	89.5	90.1	90.7
20	83.7	86.0	88.6	91.4	91.0	90.4	89.9	88.8	88.6	89.2
15	83.0	85.3	87.8	90.7	92.2	92.0	91.3	90.0	89.6	90.0
10	82.3	84.5	87.1	89.9	91.7	94.0	92.7	91.1	90.6	90.9
5	81.6	83.8	86.3	89.1	90.8	94.3	93.8	92.3	91.7	91.8
0	80.8	83.0	85.5	88.3	90.0	93.5	95.0	93.3	92.7	92.6
-5	80.1	82.3	84.7	87.5	89.2	92.6	94.8	94.4	93.7	93.6
-10	79.3	81.5	83.9	86.6	88.4	91.8	93.9	95.2	94.6	94.5
-15	78.6	80.7	83.1	85.8	87.5	90.9	93.0	94.9	95.0	95.0
-20	77.8	79.9	82.3	85.0	86.7	90.0	92.1	94.0	94.1	94.0
-25	77.0	79.1	81.5	84.1	85.8	89.1	91.2	93.1	93.2	93.1
-30	76.3	78.3	80.7	83.3	84.9	88.2	90.3	92.1	92.2	92.2
-35	75.5	77.5	79.8	82.4	84.1	87.3	89.3	91.2	91.3	91.2
-40	74.7	76.7	79.0	81.5	83.2	86.4	88.4	90.2	90.3	90.2

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
ENGINE ANTI-ICE ON	-1.0	-0.9	-0.8	-0.4	-0.7	-0.8	-0.8	-0.7	-0.8	-0.9
ENGINE & WING ANTI-ICE ON	-1.4	-1.3	-1.3	-1.0	-1.3	-1.4	-1.5	-1.3	-1.6	-1.7

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Max Cruise %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)									
	25000	27000	29000	31000	33000	35000	37000	39000	41000	43000
25	87.0	86.7	86.9	86.7	86.3	86.9	87.1	87.3	87.6	87.9
20	88.2	88.0	88.1	87.6	87.3	86.9	86.3	86.5	86.9	87.2
15	89.4	89.3	89.3	88.6	88.1	87.7	87.1	87.3	87.5	87.7
10	91.0	90.4	90.2	89.6	89.1	88.6	87.9	88.1	88.3	88.4
5	91.1	91.6	91.1	90.5	90.0	89.6	88.8	89.0	89.0	89.1
0	90.3	91.1	91.8	91.3	90.7	90.3	89.7	89.8	89.8	89.8
-5	89.5	90.3	91.0	91.4	91.4	91.0	90.4	90.5	90.4	90.4
-10	88.6	89.4	90.1	90.5	91.3	91.5	90.9	91.0	91.0	90.9
-15	87.8	88.6	89.2	89.7	90.4	91.2	91.3	91.4	91.3	91.3
-20	86.9	87.7	88.4	88.8	89.5	90.3	90.4	90.5	90.4	90.4
-25	86.1	86.8	87.5	87.9	88.6	89.4	89.5	89.6	89.5	89.5
-30	85.2	85.9	86.6	87.0	87.7	88.5	88.6	88.7	88.6	88.6
-35	84.3	85.1	85.7	86.1	86.8	87.6	87.7	87.7	87.7	87.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)									
	25000	27000	29000	31000	33000	35000	37000	39000	41000	43000
ENGINE ANTI-ICE ON	-0.7	-0.6	-0.6	-0.6	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6
ENGINE & WING ANTI-ICE ON	-1.1	-1.1	-1.0	-1.0	-1.0	-1.0	-1.0	-1.1	-1.2	-1.3

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Go-Around %N1

Based on engine bleed for packs on, engine anti-ice on or off, wing anti-ice off

AIRPORT OAT		TAT (°C)	PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
51	124	55	90.4	90.2	90.2	90.0	90.2	90.3	90.5	90.7	90.8	91.0	91.3	91.4
46	115	50	92.1	92.1	92.0	91.8	91.8	91.7	91.7	91.9	92.1	92.4	92.7	92.9
41	106	45	94.0	94.0	94.0	93.9	93.8	93.7	93.7	93.6	93.4	93.7	94.1	94.4
36	97	40	94.7	96.2	96.0	96.0	95.9	95.7	96.0	95.8	95.8	95.7	95.4	95.7
31	88	35	94.6	97.8	97.7	97.7	97.5	97.7	97.6	97.5	97.5	97.0	96.7	96.4
26	79	30	94.1	98.1	98.6	98.7	98.4	98.5	98.3	98.2	98.1	97.5	97.0	96.6
21	70	25	93.4	98.0	98.5	98.8	98.9	98.7	98.5	98.4	98.2	97.8	97.4	96.9
16	61	20	92.6	97.3	98.1	98.8	98.8	98.9	98.8	98.6	98.5	98.0	97.5	97.1
11	52	15	91.8	96.4	97.3	98.1	98.7	98.9	98.9	98.9	98.7	98.2	97.8	97.3
7	45	10	91.0	95.6	96.4	97.3	97.9	98.6	98.8	98.8	98.8	98.5	98.0	97.5
2	36	5	90.2	94.7	95.6	96.4	97.1	97.7	98.1	98.5	98.8	98.4	98.1	97.7
-3	27	0	89.4	93.9	94.7	95.5	96.2	96.9	97.2	97.6	98.0	98.0	98.0	97.7
-13	9	-10	87.7	92.1	93.0	93.8	94.4	95.1	95.4	95.8	96.2	96.2	96.3	96.3
-23	-9	-20	86.0	90.4	91.2	92.0	92.6	93.3	93.6	94.0	94.4	94.4	94.4	94.5
-33	-27	-30	84.3	88.6	89.4	90.1	90.8	91.4	91.7	92.1	92.5	92.5	92.5	92.6
-43	-45	-40	82.6	86.7	87.5	88.3	88.9	89.5	89.8	90.2	90.6	90.6	90.6	90.7
-53	-63	-50	80.8	84.9	85.6	86.4	86.9	87.6	87.9	88.2	88.6	88.6	88.7	88.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)						
	-1000	0	2000	4000	6000	8000	9000
PACKS OFF	0.8	0.8	0.9	1.0	1.0	1.1	1.1
WING ANTI-ICE ON	-0.4	-0.4	-0.5	-0.5	-0.5	-0.6	-0.6

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	91.4	90.5	89.8	89.3	88.9	88.2	88.4	88.8	89.2
15	92.9	91.9	91.1	90.5	90.0	89.3	89.5	89.8	90.1
10	94.1	93.2	92.3	91.7	91.1	90.4	90.6	90.8	90.9
5	93.3	94.2	93.4	92.8	92.3	91.5	91.7	91.7	91.8
0	92.4	94.1	94.6	93.9	93.3	92.5	92.7	92.7	92.7
-5	91.6	93.2	94.9	94.9	94.4	93.6	93.7	93.7	93.6
-10	90.7	92.3	94.0	95.0	95.2	94.5	94.7	94.6	94.5
-15	89.9	91.5	93.1	94.0	95.0	95.0	95.1	95.0	95.0
-20	89.0	90.6	92.2	93.1	94.0	94.1	94.1	94.1	94.0
-25	88.1	89.7	91.3	92.2	93.1	93.2	93.2	93.2	93.1
-30	87.2	88.8	90.4	91.3	92.2	92.2	92.3	92.2	92.2
-35	86.3	87.8	89.5	90.3	91.2	91.3	91.3	91.3	91.2
-40	85.4	86.9	88.5	89.4	90.2	90.3	90.3	90.3	90.3

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
ENGINE ONLY	-0.7	-0.9	-0.8	-0.7	-0.6	-0.6	-0.6	-0.7	-0.7
ENGINE & WING*	-1.2	-1.4	-1.4	-1.2	-1.2	-1.2	-1.2	-1.4	-1.4
ENGINE & WING**	-1.7	-1.9	-1.9	-1.8	-1.7	-1.8	-1.9	-2.1	-2.2

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC
ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

320 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	92.3	93.5	94.8	93.0	91.7	90.6	89.3									
25	91.5	95.2	96.6	94.7	93.3	92.3	90.2	90.0	89.5	89.1						
20	90.8	95.0	98.1	96.6	95.0	93.9	91.6	91.4	91.0	90.7	90.6	90.2				
15	90.0	94.2	97.3	96.9	96.8	95.7	93.1	93.1	92.8	92.5	92.2	91.7	91.3	91.3	91.6	92.0
10	89.2	93.4	96.5	96.0	96.0	96.1	94.8	94.2	94.2	94.4	93.6	93.0	92.5	92.2	92.5	92.9
5	88.4	92.6	95.6	95.2	95.1	95.3	93.9	94.0	93.8	93.7	94.7	94.1	93.5	93.1	93.4	93.7
0	87.6	91.7	94.7	94.3	94.2	94.4	93.1	93.2	93.0	92.8	93.8	94.6	94.6	93.9	94.3	94.6
-5	86.8	90.9	93.9	93.5	93.4	93.6	92.2	92.3	92.1	92.0	92.9	93.7	94.5	94.4	94.9	95.1
-10	86.0	90.0	93.0	92.6	92.5	92.7	91.4	91.5	91.3	91.1	92.1	92.8	93.6	93.5	94.1	94.2
-15	85.2	89.2	92.1	91.7	91.6	91.8	90.5	90.6	90.4	90.2	91.2	91.9	92.7	92.6	93.2	93.3
-20	84.3	88.3	91.2	90.8	90.7	90.9	89.6	89.7	89.5	89.4	90.3	91.0	91.8	91.7	92.3	92.4
-25	83.5	87.4	90.3	89.9	89.8	90.0	88.7	88.8	88.6	88.5	89.4	90.1	90.9	90.8	91.4	91.4
-30	82.7	86.6	89.4	89.0	88.9	89.1	87.8	87.9	87.7	87.6	88.5	89.2	89.9	89.9	90.5	90.5
-35	81.8	85.7	88.5	88.1	88.0	88.2	86.9	87.0	86.8	86.7	87.6	88.3	89.0	88.9	89.5	89.6
-40	80.9	84.8	87.5	87.1	87.1	87.2	86.0	86.1	85.9	85.7	86.7	87.4	88.1	88.0	88.6	88.6

280 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	91.2	91.9	93.0	91.3	90.5	89.7	89.8									
25	91.3	93.6	94.7	92.9	91.9	90.9	90.6	90.0	89.6	89.3						
20	90.5	95.5	96.8	94.9	93.5	92.4	91.6	90.9	90.3	90.0	89.2	88.4				
15	89.7	95.0	98.2	97.0	95.5	94.2	92.6	92.0	91.4	91.2	90.5	89.7	89.7	90.4	90.0	89.5
10	88.9	94.2	97.3	97.2	97.3	96.1	93.5	93.3	92.7	92.5	92.1	91.6	91.4	91.6	91.2	90.5
5	88.1	93.4	96.5	96.3	96.4	96.7	95.1	94.3	94.7	94.6	93.7	93.2	92.9	92.8	92.3	91.6
0	87.3	92.5	95.6	95.4	95.6	95.8	94.4	94.4	94.6	94.9	96.2	94.9	94.3	93.9	93.3	92.6
-5	86.5	91.7	94.7	94.5	94.7	94.9	93.6	93.6	93.8	94.0	95.8	96.4	95.5	94.9	94.4	93.6
-10	85.7	90.8	93.8	93.7	93.8	94.1	92.7	92.7	92.9	93.2	94.9	95.5	96.0	95.7	95.3	94.5
-15	84.9	90.0	92.9	92.8	92.9	93.2	91.8	91.8	92.0	92.3	94.0	94.6	95.1	95.2	95.4	94.6
-20	84.1	89.1	92.0	91.9	92.0	92.2	90.9	90.9	91.2	91.4	93.1	93.7	94.2	94.3	94.5	93.6
-25	83.3	88.2	91.1	91.0	91.1	91.3	90.0	90.0	90.2	90.5	92.2	92.8	93.2	93.3	93.6	92.7
-30	82.4	87.3	90.2	90.0	90.2	90.4	89.1	89.1	89.3	89.5	91.3	91.8	92.3	92.4	92.6	91.8
-35	81.6	86.4	89.3	89.1	89.2	89.5	88.2	88.2	88.4	88.6	90.3	90.9	91.3	91.4	91.7	90.8
-40	80.7	85.5	88.3	88.2	88.3	88.5	87.2	87.2	87.5	87.7	89.4	89.9	90.4	90.5	90.7	89.9

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.6	-0.7	-0.8	-0.8	-0.7	-0.9	-0.8	-0.7	-0.6	-0.6
ENGINE & WING*	-0.9	-0.9	-0.9	-0.8	-0.8	-0.9	-1.1	-1.2	-1.3	-1.3	-1.2	-1.4	-1.4	-1.2	-1.2	-1.2
ENGINE & WING**	-1.2	-1.2	-1.2	-1.2	-1.2	-1.4	-1.5	-1.7	-1.9	-1.9	-1.7	-1.9	-1.9	-1.8	-1.7	-1.8

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC
ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

240 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	90.5	90.6	91.4	89.3	89.1	89.0	89.1									
25	90.5	91.6	92.8	90.6	90.2	89.8	90.0	89.6	89.3	89.4						
20	89.8	92.4	94.1	92.1	91.5	90.7	90.8	90.5	90.2	90.1	89.2	88.0				
15	89.1	92.9	95.3	94.0	93.3	92.2	91.8	91.4	91.0	90.9	90.2	88.8	87.1	86.0	86.5	88.0
10	88.3	92.1	95.5	95.9	95.2	94.0	92.9	92.5	92.0	91.8	91.0	89.9	88.6	87.5	86.9	88.2
5	87.5	91.3	94.6	95.5	96.5	95.9	94.1	93.7	93.2	93.0	92.0	91.1	90.1	89.2	88.8	89.7
0	86.7	90.4	93.8	94.6	95.6	96.2	94.7	94.4	94.5	94.3	93.1	92.3	91.8	90.9	90.5	91.0
-5	85.9	89.6	92.9	93.7	94.7	95.3	93.9	94.2	94.3	94.4	94.2	93.5	93.4	92.5	91.8	92.1
-10	85.1	88.8	92.1	92.9	93.8	94.4	93.0	93.4	93.5	93.6	94.1	94.5	94.4	93.8	93.2	93.3
-15	84.3	87.9	91.2	92.0	92.9	93.5	92.1	92.5	92.6	92.7	93.2	94.2	95.0	94.7	94.1	94.1
-20	83.5	87.1	90.3	91.1	92.0	92.6	91.2	91.6	91.7	91.8	92.3	93.2	94.4	94.8	94.7	94.7
-25	82.7	86.2	89.4	90.2	91.1	91.7	90.3	90.7	90.8	90.9	91.3	92.3	93.4	93.8	94.0	94.1
-30	81.8	85.3	88.5	89.3	90.2	90.8	89.4	89.7	89.9	89.9	90.4	91.4	92.5	92.9	93.0	93.1
-35	81.0	84.4	87.6	88.3	89.3	89.8	88.5	88.8	89.0	89.0	89.5	90.4	91.5	91.9	92.1	92.2
-40	80.1	83.6	86.6	87.4	88.3	88.9	87.6	87.9	88.0	88.1	88.5	89.5	90.6	91.0	91.1	91.2

200 KIAS

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
30	89.8	89.6	89.9	88.2	88.3	88.3	89.4									
25	90.1	90.8	91.6	88.9	89.1	89.1	89.2	89.3	89.9	90.2						
20	90.1	91.4	92.6	89.6	89.9	89.9	90.0	89.6	89.2	89.4	89.5	89.5				
15	89.4	91.4	92.8	90.6	91.0	90.9	90.9	90.5	90.1	89.9	89.0	88.7	88.7	89.2	89.7	88.8
10	88.6	91.0	92.8	91.7	92.2	92.2	92.2	91.6	91.0	90.8	89.9	89.0	88.0	88.4	88.9	88.0
5	87.8	90.2	92.1	92.5	93.0	93.7	93.4	92.8	92.2	91.9	90.8	89.9	89.0	88.4	88.1	87.2
0	87.0	89.4	91.3	91.7	92.8	93.8	94.7	94.1	93.5	93.2	91.9	90.9	90.0	89.2	88.7	88.0
-5	86.2	88.6	90.4	90.8	91.9	93.1	94.2	94.5	94.7	94.5	93.1	91.9	90.9	90.0	89.4	89.1
-10	85.4	87.7	89.6	90.0	91.1	92.3	93.3	93.9	94.3	94.6	94.1	92.8	91.8	90.8	90.1	90.0
-15	84.6	86.9	88.7	89.1	90.2	91.4	92.4	93.0	93.5	93.7	93.9	93.4	92.4	91.5	90.7	90.8
-20	83.8	86.0	87.9	88.2	89.3	90.5	91.5	92.1	92.6	92.8	93.0	93.0	92.7	91.7	91.1	91.4
-25	82.9	85.2	87.0	87.4	88.4	89.6	90.6	91.1	91.6	91.9	92.1	92.1	92.2	91.8	91.1	91.6
-30	82.1	84.3	86.1	86.5	87.5	88.7	89.7	90.2	90.7	91.0	91.2	91.2	91.2	90.8	90.7	91.3
-35	81.2	83.5	85.2	85.6	86.6	87.8	88.8	89.3	89.8	90.0	90.2	90.2	90.3	89.9	89.7	90.4
-40	80.4	82.6	84.3	84.7	85.7	86.8	87.8	88.3	88.8	89.1	89.3	89.3	89.3	89.0	88.8	89.4

%N1 Adjustments for Engine Bleed

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)															
	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35	37
ENGINE ONLY	-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.6	-0.7	-0.8	-0.8	-0.7	-0.9	-0.8	-0.7	-0.6	-0.6
ENGINE & WING*	-0.9	-0.9	-0.9	-0.8	-0.8	-0.9	-1.1	-1.2	-1.3	-1.3	-1.2	-1.4	-1.4	-1.2	-1.2	-1.2
ENGINE & WING**	-1.2	-1.2	-1.2	-1.2	-1.2	-1.4	-1.5	-1.7	-1.9	-1.9	-1.7	-1.9	-1.9	-1.8	-1.7	-1.8

***Wing anti-ice on, packs on.**
****Wing anti-ice on, packs off.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

220 KIAS Max Climb EPR

TAT (°C)	PRESSURE ALTITUDE (1000 FT)															
	0	5	10	12	14	16	18	20	22	24	25	27	29	31	33	35
55	1.204	1.203	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
50	1.221	1.215	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
45	1.239	1.232	1.223	1.231	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
40	1.258	1.250	1.242	1.239	1.241	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
35	1.271	1.270	1.260	1.260	1.257	1.252	1.262	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
30	1.271	1.293	1.284	1.283	1.282	1.278	1.273	1.276	1.279	1.281	1.282	1.274	1.265	1.252	1.238	1.219
25	1.271	1.303	1.311	1.309	1.307	1.304	1.301	1.299	1.284	1.281	1.282	1.274	1.265	1.252	1.238	1.219
20	1.271	1.303	1.339	1.337	1.335	1.334	1.331	1.329	1.316	1.300	1.291	1.274	1.265	1.252	1.238	1.219
15	1.271	1.303	1.343	1.361	1.367	1.368	1.365	1.363	1.348	1.333	1.325	1.299	1.271	1.252	1.238	1.219
10	1.271	1.303	1.343	1.361	1.385	1.404	1.403	1.402	1.386	1.369	1.360	1.334	1.308	1.277	1.243	1.219
5	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.444	1.429	1.410	1.400	1.372	1.345	1.317	1.288	1.253
0	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.471	1.455	1.447	1.413	1.385	1.359	1.332	1.306
-5	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.456	1.426	1.402	1.380	1.359
-10	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.464	1.441	1.426	1.407
-15	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.495	1.475	1.463	1.450
-20	1.271	1.303	1.343	1.361	1.385	1.410	1.435	1.464	1.475	1.486	1.492	1.494	1.495	1.499	1.493	1.484

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
ENGINE ONLY	-.016	-.015	-.015	-.009	-.017	-.023	-.019	-.016
ENGINE AND WING*	-.022	-.023	-.025	-.020	-.030	-.038	-.034	-.032
ENGINE AND WING**	-.029	-.031	-.035	-.030	-.043	-.053	-.048	-.048

***Wing anti-ice on, packs on, or packs off with 2 bleed sources.**
****Wing anti-ice on, packs off, 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
660	14400	14300	12000
640	15800	15700	13600
620	17100	17000	15100
600	18400	18300	16500
580	19700	19600	17900
560	20800	20700	19300
540	21900	21800	20500
520	23000	22900	21700
500	24200	24100	22800
480	25300	25200	24000
460	26300	26100	25100
440	27300	27100	26200
420	28300	28000	27200
400	29400	29100	28300
380	30600	30100	29400
360	31500	31200	30600
340	32200	31900	31500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)										
		10	13	15	17	19	21	23	25	27	29	31
660	EPR	1.204	1.253	1.291								
	MACH	.479	.499	.511								
	KIAS	265	261	258								
	FF/ENG	15529	15395	15416								
620	EPR	1.186	1.228	1.261	1.301							
	MACH	.469	.489	.501	.514							
	KIAS	259	256	252	249							
	FF/ENG	14589	14433	14371	14499							
580	EPR	1.167	1.205	1.234	1.266	1.312						
	MACH	.457	.478	.491	.504	.517						
	KIAS	253	250	247	244	241						
	FF/ENG	13649	13497	13400	13407	13541						
540	EPR	1.150	1.183	1.208	1.236	1.272	1.322					
	MACH	.444	.465	.479	.492	.505	.519					
	KIAS	245	243	241	238	235	232					
	FF/ENG	12713	12572	12457	12394	12420	12552					
500	EPR	1.132	1.162	1.184	1.208	1.239	1.277	1.336				
	MACH	.430	.452	.466	.480	.493	.507	.527				
	KIAS	238	236	234	232	229	226	226				
	FF/ENG	11769	11644	11535	11422	11399	11426	11779				
460	EPR	1.115	1.141	1.160	1.182	1.209	1.241	1.285	1.347			
	MACH	.415	.436	.451	.465	.480	.493	.513	.534			
	KIAS	229	228	226	225	223	220	220	220			
	FF/ENG	10894	10707	10614	10495	10443	10413	10634	10992			
420	EPR	1.099	1.121	1.138	1.157	1.178	1.208	1.246	1.291	1.357		
	MACH	.398	.420	.434	.449	.464	.478	.498	.519	.540		
	KIAS	220	219	218	217	215	213	213	213	213		
	FF/ENG	10010	9791	9683	9581	9527	9501	9605	9792	10171		
380	EPR	1.083	1.103	1.117	1.132	1.149	1.177	1.212	1.247	1.294	1.361	
	MACH	.381	.402	.416	.431	.446	.463	.482	.502	.523	.546	
	KIAS	210	209	209	208	207	206	206	206	206	206	
	FF/ENG	9133	8911	8771	8660	8625	8650	8724	8803	8956	9326	
340	EPR	1.070	1.086	1.098	1.110	1.121	1.147	1.180	1.209	1.245	1.293	1.360
	MACH	.362	.382	.397	.412	.429	.446	.465	.484	.505	.527	.549
	KIAS	199	199	199	199	199	199	199	199	199	199	199
	FF/ENG	8341	8164	8039	7946	7798	7838	7883	7931	7997	8134	8478

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
315	285	258	236	217	200	190	180	171	162	154
634	570	515	471	433	400	378	359	340	324	309
955	858	774	706	650	600	567	537	509	485	463
1280	1149	1035	943	867	800	756	715	679	646	617
1609	1441	1297	1180	1084	1000	944	894	848	807	771
1940	1736	1560	1419	1302	1200	1133	1072	1017	968	924
2276	2034	1825	1658	1520	1400	1322	1251	1186	1128	1077
2615	2334	2091	1898	1739	1600	1510	1429	1354	1288	1229
2959	2636	2359	2139	1958	1800	1699	1606	1523	1448	1382
3307	2942	2629	2381	2177	2000	1887	1784	1691	1607	1534
3660	3251	2901	2623	2397	2200	2075	1961	1859	1767	1685
4017	3563	3174	2867	2617	2400	2263	2139	2026	1925	1837
4378	3877	3449	3112	2838	2600	2451	2316	2193	2084	1987
4743	4194	3725	3357	3059	2800	2639	2493	2360	2242	2138
5112	4514	4003	3603	3280	3000	2827	2669	2527	2400	2288
5485	4835	4282	3850	3502	3200	3014	2845	2693	2557	2437
5862	5160	4563	4098	3724	3400	3202	3021	2858	2714	2587
6245	5488	4845	4346	3946	3600	3389	3197	3024	2870	2735
6632	5819	5129	4596	4169	3800	3577	3373	3190	3027	2884
7023	6152	5415	4846	4392	4000	3764	3549	3356	3183	3032

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		14		20		24	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	17.0	0:45	15.5	0:44	13.7	0:42	13.4	0:40
400	33.1	1:31	30.5	1:27	27.5	1:23	26.8	1:19
600	49.2	2:18	45.5	2:11	41.2	2:03	40.2	1:57
800	65.3	3:04	60.5	2:55	55.0	2:44	53.6	2:35
1000	81.4	3:50	75.5	3:38	68.7	3:24	67.0	3:13
1200	96.8	4:39	89.7	4:24	81.8	4:06	79.6	3:53
1400	112.2	5:27	104.0	5:09	94.9	4:48	92.2	4:32
1600	127.2	6:16	117.9	5:55	107.7	5:30	104.5	5:12
1800	142.0	7:07	131.6	6:43	120.1	6:13	116.4	5:52
2000	156.7	7:57	145.2	7:30	132.6	6:56	128.4	6:32
2200	170.9	8:50	158.4	8:19	144.5	7:40	139.8	7:13
2400	185.1	9:43	171.6	9:08	156.4	8:24	151.2	7:55
2600	198.9	10:37	184.5	9:58	168.1	9:09	162.3	8:36
2800	212.5	11:32	197.3	10:49	179.6	9:54	173.2	9:19
3000	226.0	12:27	210.0	11:40	191.1	10:40	184.0	10:01
3200	238.9	13:23	222.1	12:32	202.2	11:27	194.4	10:44
3400	251.8	14:20	234.3	13:25	213.3	12:13	204.8	11:28
3600	264.5	15:18	246.2	14:18	224.2	13:01	214.9	12:12
3800	276.8	16:17	257.9	15:12	234.9	13:49	224.8	12:56
4000	289.2	17:16	269.6	16:06	245.5	14:37	234.7	13:41

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Enroute Fuel and Time
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	300	350	400	450	500	550	600	650	700
20	-3.7	-2.9	-2.0	-1.1	0.0	2.6	5.2	8.0	10.9
40	-7.8	-5.9	-4.0	-2.0	0.0	5.4	11.1	17.1	23.5
60	-11.9	-8.9	-5.9	-3.0	0.0	8.0	16.5	25.6	35.2
80	-16.1	-12.0	-7.9	-4.0	0.0	10.4	21.5	33.4	46.1
100	-20.2	-15.0	-9.9	-5.0	0.0	12.6	26.2	40.7	56.1
120	-24.4	-18.1	-12.0	-6.1	0.0	14.6	30.4	47.2	65.2
140	-28.5	-21.2	-14.0	-7.1	0.0	16.5	34.2	53.2	73.5
160	-32.7	-24.3	-16.1	-8.1	0.0	18.1	37.6	58.6	81.0
180	-36.9	-27.4	-18.1	-9.1	0.0	19.5	40.6	63.3	87.6
200	-41.0	-30.6	-20.2	-10.2	0.0	20.7	43.2	67.4	93.4
220	-45.2	-33.7	-22.3	-11.2	0.0	21.8	45.4	70.9	98.3
240	-49.4	-36.9	-24.5	-12.3	0.0	22.6	47.2	73.8	102.3
260	-53.6	-40.1	-26.6	-13.3	0.0	23.2	48.6	76.0	105.5
280	-57.9	-43.3	-28.8	-14.4	0.0	23.7	49.5	77.6	107.9
300	-62.1	-46.5	-31.0	-15.5	0.0	23.9	50.1	78.6	109.4

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30+80

PRESSURE ALT (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	54	58	63	67	71	75	79	84	88	92
TIME (MINUTES)	13	14	15	16	16	17	17	18	19	19

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
660	EPR	1.111	1.139	1.194	1.281			
	KIAS	249	249	249	249			
	FF/ENG	15280	15000	15140	15520			
620	EPR	1.100	1.125	1.174	1.250			
	KIAS	242	242	242	242			
	FF/ENG	14400	14090	14160	14360			
580	EPR	1.090	1.113	1.157	1.223	1.339		
	KIAS	237	237	237	237	237		
	FF/ENG	13620	13290	13290	13370	14160		
540	EPR	1.081	1.101	1.140	1.199	1.292		
	KIAS	232	232	232	232	232		
	FF/ENG	12860	12580	12460	12470	12970		
500	EPR	1.072	1.090	1.125	1.175	1.255		
	KIAS	226	226	226	226	226		
	FF/ENG	12060	11860	11680	11600	11850		
460	EPR	1.063	1.079	1.110	1.154	1.222	1.347	
	KIAS	220	220	220	220	220	220	
	FF/ENG	11250	11110	10910	10750	10850	11540	
420	EPR	1.054	1.068	1.095	1.134	1.191	1.291	
	KIAS	213	213	213	213	213	213	
	FF/ENG	10450	10300	10150	9880	9920	10280	
380	EPR	1.047	1.059	1.081	1.115	1.161	1.247	1.408
	KIAS	206	206	206	206	206	206	206
	FF/ENG	9660	9490	9380	9080	9050	9240	10040
340	EPR	1.040	1.050	1.069	1.098	1.133	1.209	1.323
	KIAS	199	199	199	199	199	199	199
	FF/ENG	9020	8860	8720	8440	8210	8330	8700

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
660	EPR	1.115	1.143	1.198	1.284	
	KIAS	229	229	229	229	
	FF/ENG	14670	14390	14570	14830	
620	EPR	1.103	1.129	1.177	1.252	
	KIAS	222	222	222	222	
	FF/ENG	13770	13480	13560	13700	
580	EPR	1.093	1.115	1.159	1.223	1.332
	KIAS	217	217	217	217	217
	FF/ENG	12930	12690	12630	12720	13310
540	EPR	1.083	1.103	1.142	1.197	1.285
	KIAS	212	212	212	212	212
	FF/ENG	12130	11960	11820	11820	12130
500	EPR	1.073	1.091	1.125	1.174	1.247
	KIAS	206	206	206	206	206
	FF/ENG	11300	11160	11010	10920	11050
460	EPR	1.064	1.079	1.109	1.152	1.211
	KIAS	200	200	200	200	200
	FF/ENG	10490	10340	10230	10020	10080
420	EPR	1.054	1.068	1.094	1.131	1.177
	KIAS	193	193	193	193	193
	FF/ENG	9680	9520	9440	9150	9170
380	EPR	1.047	1.058	1.080	1.111	1.146
	KIAS	186	186	186	186	186
	FF/ENG	9010	8870	8750	8490	8310
340	EPR	1.039	1.049	1.067	1.093	1.115
	KIAS	179	179	179	179	179
	FF/ENG	8200	8080	7950	7730	7610

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		VREF30 + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
500	476	224	4100	2800	
460	438	218	6700	5900	5000
420	401	211	9300	8700	7900
380	364	204	12400	11900	11100
340	326	197	14900	14000	13200

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
500			
480	2100		
460	4000	2400	
440	5800	4800	3200
420	7500	6700	5800
400	9200	8500	7700
380	11200	10300	9500
360	12700	12200	11500
340	13900	13200	12600

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)					
		5	7	9	11	13	15
480	EPR						
	MACH						
	KIAS						
	FF/ENG						
440	EPR	1.312	1.361				
	MACH	.366	.379				
	KIAS	221	221				
	FF/ENG	20938	21487				
400	EPR	1.263	1.302	1.351	1.409		
	MACH	.349	.362	.375	.389		
	KIAS	211	211	211	210		
	FF/ENG	18577	18792	19254	19826		
360	EPR	1.227	1.257	1.294	1.342	1.403	
	MACH	.335	.347	.360	.374	.389	
	KIAS	202	203	203	203	203	
	FF/ENG	16667	16770	16958	17332	17890	
340	EPR	1.212	1.239	1.271	1.313	1.366	1.439
	MACH	.329	.341	.354	.367	.382	.397
	KIAS	199	199	199	199	199	199
	FF/ENG	15842	15909	16058	16265	16688	17379

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
353	309	271	242	220	200	186	174	163	153	145
533	465	408	364	330	300	279	260	244	229	217
714	622	545	486	440	400	372	347	324	305	288
897	781	684	609	550	500	464	433	404	380	360
1080	940	822	732	661	600	557	518	485	456	431
1265	1100	961	855	772	700	650	604	565	531	502
1450	1260	1100	978	882	800	742	690	645	606	573
1637	1420	1239	1101	993	900	835	777	725	681	643
1824	1582	1378	1224	1104	1000	927	863	805	756	714
2013	1744	1518	1348	1214	1100	1020	949	886	831	785
2202	1907	1659	1472	1325	1200	1113	1035	966	906	856

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 6		8		10		12	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	15.9	0:55	15.5	0:54	15.2	0:53	15.0	0:51
300	23.9	1:22	23.3	1:20	22.9	1:18	22.7	1:16
400	31.8	1:49	31.1	1:46	30.7	1:43	30.4	1:40
500	39.4	2:16	38.5	2:12	38.0	2:09	37.8	2:05
600	47.1	2:43	46.0	2:39	45.4	2:34	45.1	2:30
700	54.7	3:11	53.5	3:05	52.8	3:00	52.5	2:55
800	62.4	3:38	61.0	3:32	60.1	3:26	59.8	3:20
900	69.7	4:06	68.2	3:59	67.2	3:52	66.8	3:46
1000	77.1	4:34	75.5	4:26	74.3	4:18	73.7	4:11
1100	84.3	5:02	82.5	4:54	81.2	4:45	80.5	4:37
1200	91.5	5:31	89.5	5:21	88.1	5:12	87.3	5:03

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)					
	300	350	400	450	500	550
10	-1.4	-0.7	0.0	1.3	2.3	3.4
20	-2.8	-1.5	0.0	2.9	5.5	7.8
30	-4.3	-2.2	0.0	4.5	8.6	12.2
40	-5.7	-2.9	0.0	5.9	11.6	16.5
50	-7.1	-3.7	0.0	7.3	14.4	20.8
60	-8.5	-4.4	0.0	8.7	17.2	25.0
70	-9.8	-5.1	0.0	9.9	19.9	29.2
80	-11.2	-5.8	0.0	11.0	22.6	33.3
90	-12.5	-6.5	0.0	12.1	25.1	37.4
100	-13.8	-7.2	0.0	13.1	27.5	41.4

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
500	EPR	1.286			
	KIAS	226			
	FF/ENG	23810			
460	EPR	1.255	1.320		
	KIAS	220	220		
	FF/ENG	22000	22290		
420	EPR	1.227	1.278		
	KIAS	213	213		
	FF/ENG	20230	20240		
380	EPR	1.200	1.243	1.345	
	KIAS	206	206	206	
	FF/ENG	18490	18390	19110	
340	EPR	1.175	1.212	1.291	1.439
	KIAS	199	199	199	199
	FF/ENG	16750	16630	16950	18250

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

General

FMC Takeoff Speeds

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight is determined as follows:

(1) Determine the dry field/obstacle limit weight for the takeoff flap setting.

(2) Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.

(3) Adjust field length available for temperature by amount shown on chart.

(4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff speed determination:

(1) Determine takeoff speeds V1, VR and V2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on reversers operating and a 15 ft. screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around EPR

To find Go-Around EPR based on normal engine bleed for packs on and anti-ice off, enter the Go-Around EPR table with airport pressure altitude and reported OAT or TAT and read EPR. EPR adjustments are shown for engine bleeds for various conditions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb EPR

This table shows Max Climb EPR for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read EPR. EPR adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body attitude and average EPR information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of 1.5g (48° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Control

These tables provide target EPR, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude, .84 Mach approximates the Long Range Cruise Mach schedule.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing Flaps 30 at the outer marker.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding

Target EPR, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed for the selected flap setting. Flaps 1 is based on VREF30+60 speed schedule. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read EPR, IAS and fuel flow per engine.

Advisory Information

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind, at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

Engine Inoperative

Initial Max Continuous EPR

The Initial Max Continuous EPR setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target EPR setting at the start of driftdown. Once driftdown is established, the Max Continuous EPR table should be used to determine EPR for the given conditions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Continuous EPR

Power setting is based on one engine operating with one bleed source for pack(s) operating and all anti-ice bleeds off. Enter the table for appropriate pressure altitude with IAS or Mach and TAT to read Max Continuous EPR. Apply the anti-ice corrections below the table as required.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Control

The table provides target EPR, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (LB/HR)				
	GROSS WEIGHT (1000 LB)				
	700	600	500	400	300
43				360	310
39			420	360	310
35		470	420	380	300
31	520	500	450	370	310
25	510	490	440	380	340
20	520	520	460	410	360
15	520	520	480	440	400
10	540	520	510	490	440
5	590	590	570	530	480

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing is planned. The tables show gear down rate of climb available for Flaps 20 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in the ALTERNATE mode is to reduce the PRIMARY mode (normal) performance limited weights. The Limit Weight table provides takeoff field, climb, obstacle, net level off and approach or landing climb weights. To determine limit weights for operations with the EEC in the ALTERNATE mode, enter the table with the limit weights for PRIMARY mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. The ALTERNATE Mode EEC Approach or Landing Climb limit must be compared to the Landing Field Length limit and the more limiting of the two must be used as the landing limit weight. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustments Table. The adjusted V1 should not exceed the adjusted VR.

NOTE: The FMC does incorporate ALTERNATE Mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule with anti-ice off. Enter the table with pressure altitude and TAT to read Max Climb %N1. Apply bleed adjustments as required.

Max Cruise %N1

Maximum Cruise %N1 is presented for .84M, which approximates Long Range Cruise speed. Enter the table with pressure altitude and TAT to read Max Cruise %N1. Appropriate bleed adjustments are shown.

Go-Around %N1

Go-Around power setting for ALTERNATE MODE EEC operation is presented for normal engine bleed for packs on. Go-Around %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Alternate Mode EEC, Engine Inoperative

Initial Max Continuous %N1

Initial Max Continuous %N1 settings for use following an engine failure are presented. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Appropriate bleed adjustments are shown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Max Continuous %N1 settings are presented as a function of pressure altitude and TAT for engine inoperative speeds of 320, 280, 240, and 200 KIAS. Power settings may be interpolated for intermediate airspeeds. Apply bleed adjustments as required.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777-300ER GE90-115BL LB C FT FAA TO1-10 TO2-20 HIGH_ALT TALPA

Pkg Model Identification PI.ModID.30.1

General PI.30.1

VREF PI.30.1
Flap Maneuver Speed PI.30.2
Slush/Standing Water Takeoff. PI.30.3
Slippery Runway Takeoff PI.30.7
TO1 Slush/Standing Water Takeoff PI.30.11
TO1 Slippery Runway Takeoff. PI.30.15
TO2 Slush/Standing Water Takeoff PI.30.19
TO2 Slippery Runway Takeoff. PI.30.23
Minimum Control Speeds. PI.30.27
Go-Around %N1. . . . . PI.30.28
Max Climb %N1. . . . . PI.30.29
Flight With Unreliable Airspeed / Turbulent Air Penetration PI.30.30

All Engine PI.31.1

Long Range Cruise Maximum Operating Altitude. PI.31.1
Long Range Cruise Control PI.31.5
Long Range Cruise Enroute Fuel and Time - Low Altitudes . PI.31.6
Long Range Cruise Enroute Fuel and Time - High Altitudes. PI.31.7
Long Range Cruise Wind-Altitude Trade. PI.31.9
Descent at .84M/310/250 . . . . . PI.31.9
Holding PI.31.10

Advisory Information. PI.32.1

Runway Surface Condition Correlation PI.32.1
Normal Configuration Landing Distance PI.32.2
Non-Normal Configuration Landing Distance PI.32.8
ADIRU/GPS DISAGREE (Flaps 25) PI.32.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADIRU/GPS DISAGREE (Flaps 30) PI.32.9
AIR DATA SYS (Flaps 20) PI.32.10
Airspeed Unreliable (Flaps 20) PI.32.11
ANTISKID (Flaps 25) PI.32.12
ANTISKID (Flaps 30) PI.32.13
ENG SHUTDOWN L, R (Flaps 20) PI.32.14
ENG SHUTDOWN L, R (Flaps 30) PI.32.15
FLAP / SLAT CONTROL (Flaps 20) PI.32.16
FLAPS DRIVE (Flaps ≤ 5) PI.32.17
FLAPS DRIVE (5 < Flaps < 20) PI.32.18
FLAPS DRIVE (Flaps ≥ 20) PI.32.19
FLAPS PRIMARY FAIL (Flaps 20) PI.32.20
FLIGHT CONTROL MODE (Flaps 20) PI.32.21
FLIGHT CONTROLS (Flaps 20) PI.32.22
HYD PRESS SYS C (Flaps 20). PI.32.23
HYD PRESS SYS L (Flaps 25) PI.32.24
HYD PRESS SYS L (Flaps 30) PI.32.25
HYD PRESS SYS L+C (Flaps 20) PI.32.26
HYD PRESS SYS L+R (Flaps 20) PI.32.27
HYD PRESS SYS R (Flaps 25). PI.32.28
HYD PRESS SYS R (Flaps 30). PI.32.29
HYD PRESS SYS R+C (Flaps 20) PI.32.30
NAV AIR DATA SYS (Flaps 20). PI.32.31
PITCH DOWN AUTHORITY (Flaps 25) PI.32.32
PITCH DOWN AUTHORITY (Flaps 30) PI.32.33
PITCH UP AUTHORITY (Flaps ≤ 15) PI.32.34
PITCH UP AUTHORITY (Flaps ≥ 20) PI.32.35
PRI FLIGHT COMPUTERS (Flaps 20) PI.32.36
SLATS DRIVE (Flaps 20) PI.32.37
SPOILERS (Flaps 25) PI.32.38
SPOILERS (Flaps 30) PI.32.39
STABILIZER (Flaps 20) PI.32.40
Approach or Landing Climb Limited Weight PI.32.41
Recommended Brake Cooling Schedule. PI.32.43

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Inoperative PI.33.1

Initial Max Continuous %N1 . . . . . PI.33.1
Max Continuous %N1 . . . . . PI.33.2
Driftdown Speed/Level Off Altitude PI.33.5
Driftdown/LRC Cruise Range Capability PI.33.6
Long Range Cruise Altitude Capability PI.33.7
Long Range Cruise Control PI.33.8
Long Range Cruise Diversion Fuel and Time PI.33.9
Holding PI.33.10
Gear Down Landing Rate of Climb Available PI.33.11

Alternate Mode EEC PI.34.1

Alternate Mode EEC Max Takeoff %N1 . . . . . PI.34.1

Gear Down PI.35.1

220 KIAS Max Climb %N1 . . . . . PI.35.1
Long Range Cruise Altitude Capability PI.35.2
Long Range Cruise Control PI.35.3
Long Range Cruise Enroute Fuel and Time PI.35.4
Descent at VREF30+80 . . . . . PI.35.5
Holding PI.35.6

Gear Down, Engine Inoperative PI.36.1

Driftdown Speed/Level Off Altitude PI.36.1
Long Range Cruise Altitude Capability PI.36.2
Long Range Cruise Control PI.36.3
Long Range Cruise Diversion Fuel and Time PI.36.4
Holding PI.36.6

Text PI.37.1

Introduction PI.37.1
General PI.37.1
All Engines PI.37.4
Advisory Information PI.37.6
Engine Inoperative PI.37.9

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Mode EEC PI.37.12
Gear Down PI.37.12

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
221	HL7202	60377	WE479
222	HL7203	60378	WE480
223	HL7204	60380	WE481
224	HL7205	60379	WE482
219	HL8041	60375	WE477
220	HL8042	60376	WE478
225	HL8346	63434	WE483
226	HL8347	63435	WE484

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

VREF

WEIGHT (1000 LB)	VREF (KIAS) FLAPS 30	25	20
800	185	187	200
750	180	183	196
700	173	177	189
650	162	171	183
600	156	164	176
550	149	157	168
500	142	150	161
450	135	142	152
400	127	134	144
350	118	125	134

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	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.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-83.3	-97.3	-111.3	-98.7	-112.7	-126.7	-124.4	-138.4	-152.4
800	-80.4	-94.4	-108.4	-94.8	-108.8	-122.8	-118.5	-132.5	-146.5
760	-77.3	-91.3	-105.3	-90.6	-104.6	-118.6	-112.4	-126.4	-140.4
720	-73.5	-87.5	-101.5	-85.8	-99.8	-113.8	-105.5	-119.5	-133.5
680	-69.1	-83.1	-97.1	-80.2	-94.2	-108.2	-97.9	-111.9	-125.9
640	-63.9	-77.9	-91.9	-73.8	-87.8	-101.8	-89.5	-103.5	-117.5
600	-58.1	-72.1	-86.1	-66.8	-80.8	-94.8	-80.3	-94.3	-108.3
560	-51.6	-65.6	-79.6	-59.0	-73.0	-87.0	-70.3	-84.3	-98.3
520	-44.5	-58.5	-72.5	-50.5	-64.5	-78.5	-59.6	-73.6	-87.6
480	-36.6	-50.6	-64.6	-41.3	-55.3	-69.3	-48.1	-62.1	-76.1
440	-28.1	-42.1	-56.1	-31.4	-45.4	-59.4	-35.8	-49.8	-63.8
400	-19.1	-33.1	-47.1	-20.9	-34.9	-48.9	-22.9	-36.9	-50.9
360	-10.1	-24.1	-38.1	-10.4	-24.4	-38.4	-10.1	-24.1	-38.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
6200							310.2		
6600	289.9			317.3			364.9		
7000	343.3			371.4			419.6	289.7	
7400	396.8			425.4	297.0		475.2	344.4	
7800	450.6	323.3		480.7	351.1		532.2	399.1	
8200	506.2	376.7		537.5	405.1		590.6	454.2	323.9
8600	563.6	430.3	303.2	596.2	459.8	330.8	650.7	510.6	378.6
9000	623.2	485.1	356.7	656.9	516.0	384.9	712.6	568.5	433.4
9400	685.1	541.8	410.1	719.8	574.0	439.1	776.3	628.0	489.3
9800	749.7	600.6	464.3	785.2	633.9	494.7	841.6	689.1	546.6
10200	817.0	661.6	520.3	852.1	696.0	552.0	906.8	752.2	605.5
10600	884.9	725.1	578.3	919.0	760.4	611.2		817.1	666.0
11000		791.6	638.4		827.0	672.4		882.3	728.3
11400		859.4	701.0		893.9	735.9			792.6
11800			766.3			802.0			857.9
12200			834.0			868.9			
12600			901.8						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -170 ft/+170 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-23	-20	-18	-19	-16	-14	-12	-10	-7
800	-25	-23	-20	-21	-19	-16	-14	-11	-9
760	-27	-25	-22	-23	-21	-18	-15	-13	-10
720	-29	-27	-24	-25	-22	-20	-16	-14	-11
680	-30	-28	-25	-26	-24	-21	-18	-15	-13
640	-31	-28	-26	-27	-25	-22	-19	-17	-14
600	-31	-28	-26	-28	-25	-23	-20	-18	-15
560	-31	-28	-26	-28	-26	-23	-22	-19	-17
520	-31	-28	-26	-28	-26	-23	-23	-20	-18
480	-30	-27	-25	-28	-25	-23	-23	-21	-18
440	-29	-27	-24	-28	-25	-23	-24	-21	-19
400	-29	-26	-24	-27	-24	-22	-24	-21	-19
360	-28	-25	-23	-26	-24	-21	-24	-21	-19

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-115.4	-130.9	-146.4	-134.1	-149.6	-165.1	-164.7	-180.2	-195.7
800	-80.4	-94.4	-108.4	-94.8	-108.8	-122.8	-118.5	-132.5	-146.5
760	-77.3	-91.3	-105.3	-90.6	-104.6	-118.6	-112.4	-126.4	-140.4
720	-73.5	-87.5	-101.5	-85.8	-99.8	-113.8	-105.5	-119.5	-133.5
680	-69.1	-83.1	-97.1	-80.2	-94.2	-108.2	-97.9	-111.9	-125.9
640	-63.9	-77.9	-91.9	-73.8	-87.8	-101.8	-89.5	-103.5	-117.5
600	-58.1	-72.1	-86.1	-66.8	-80.8	-94.8	-80.3	-94.3	-108.3
560	-51.6	-65.6	-79.6	-59.0	-73.0	-87.0	-70.3	-84.3	-98.3
520	-44.5	-58.5	-72.5	-50.5	-64.5	-78.5	-59.6	-73.6	-87.6
480	-36.6	-50.6	-64.6	-41.3	-55.3	-69.3	-48.1	-62.1	-76.1
440	-28.1	-42.1	-56.1	-31.4	-45.4	-59.4	-35.8	-49.8	-63.8
400	-19.1	-33.1	-47.1	-20.9	-34.9	-48.9	-22.9	-36.9	-50.9
360	-10.1	-24.1	-38.1	-10.4	-24.4	-38.4	-10.1	-24.1	-38.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
9400							301.4		
9800							365.5		
10200							429.6	293.4	
10600				295.7			495.1	357.5	
11000				363.8			562.5	421.6	285.3
11400	293.1			431.9	287.2		632.0	486.9	349.4
11800	363.6			502.3	355.3		703.7	554.0	413.6
12200	434.3	284.3		575.7	423.3		778.0	623.2	478.6
12600	508.2	354.8		652.8	493.3	346.8	854.0	694.6	545.5
13000	586.7	425.4		734.1	566.3	414.8		768.6	614.4
13400	670.7	498.7	346.0	820.0	643.0	484.4		844.5	685.6
13800	761.9	576.6	416.4	907.0	723.7	557.1			759.2
14200	859.2	659.9	489.3		809.2	633.2			835.0
14600		750.0	566.6		896.1	713.4			910.9
15000		847.0	649.1			798.3			
15400			738.4			885.3			
15800			834.8						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -280 ft/+280 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-39	-34	-29	-33	-28	-23	-21	-16	-11
800	-41	-36	-31	-35	-30	-25	-23	-18	-13
760	-43	-38	-33	-37	-32	-27	-25	-20	-15
720	-45	-40	-35	-39	-34	-29	-27	-22	-17
680	-46	-41	-36	-41	-36	-31	-29	-24	-19
640	-47	-42	-37	-42	-37	-32	-32	-27	-22
600	-47	-42	-37	-43	-38	-33	-34	-29	-24
560	-47	-42	-37	-44	-39	-34	-36	-31	-26
520	-47	-42	-37	-44	-39	-34	-37	-32	-27
480	-47	-42	-37	-44	-39	-34	-39	-34	-29
440	-46	-41	-36	-44	-39	-34	-40	-35	-30
400	-46	-41	-36	-44	-39	-34	-40	-35	-30
360	-45	-40	-35	-44	-39	-34	-41	-36	-31

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	0.0	-4.0	-8.0	-45.4	-49.4	-53.4	-85.6	-89.6	-93.6
800	0.0	-4.0	-8.0	-46.4	-50.4	-54.4	-83.4	-87.4	-91.4
760	-2.4	-6.4	-10.4	-47.3	-51.3	-55.3	-81.1	-85.1	-89.1
720	-7.6	-11.6	-15.6	-47.7	-51.7	-55.7	-78.5	-82.5	-86.5
680	-11.3	-15.3	-19.3	-47.6	-51.6	-55.6	-75.7	-79.7	-83.7
640	-13.2	-17.2	-21.2	-47.0	-51.0	-55.0	-72.5	-76.5	-80.5
600	-13.9	-17.9	-21.9	-45.2	-49.2	-53.2	-68.3	-72.3	-76.3
560	-13.6	-17.6	-21.6	-42.2	-46.2	-50.2	-62.7	-66.7	-70.7
520	-12.4	-16.4	-20.4	-37.9	-41.9	-45.9	-55.7	-59.7	-63.7
480	-10.3	-14.3	-18.3	-32.1	-36.1	-40.1	-47.3	-51.3	-55.3
440	-7.2	-11.2	-15.2	-25.1	-29.1	-33.1	-37.5	-41.5	-45.5
400	-3.2	-7.2	-11.2	-16.8	-20.8	-24.8	-26.3	-30.3	-34.3
360	0.0	-2.2	-6.2	-7.1	-11.1	-15.1	-13.7	-17.7	-21.7

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5000	396.3								
5400	513.2	367.0							
5800	629.1	484.0	337.6						
6200	744.1	600.2	454.9	317.2					
6600	858.4	715.4	571.2	391.6					
7000		829.8	686.7	468.4	335.8				
7400			801.3	548.5	410.6	280.1			
7800			915.5	632.2	488.1	354.3	324.6		
8200				720.2	569.1	429.7	369.2		
8600				812.9	653.8	508.0	414.9	291.0	
9000				907.0	742.9	589.8	462.2	335.7	
9400					836.4	675.6	511.2	380.5	
9800						765.9	562.3	426.6	302.2
10200						859.9	615.7	474.3	346.9
10600							671.7	523.8	391.9
11000							730.6	575.4	438.3
11400							793.3	629.4	486.5
11800							857.6	686.1	536.5
12200								746.0	588.7
12600								809.4	643.3
13000								873.7	700.8
13400									761.5
13800									825.5
14200									889.8

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -130 ft/+130 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -190 ft/+190 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustments (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-4	-2	0	-15	-13	-10	-29	-27	-24
800	-7	-4	-2	-18	-16	-13	-32	-30	-27
760	-9	-6	-4	-21	-18	-16	-35	-32	-30
720	-10	-8	-5	-23	-20	-18	-37	-34	-32
680	-11	-9	-6	-24	-22	-19	-39	-36	-34
640	-12	-10	-7	-25	-23	-20	-40	-37	-35
600	-13	-10	-8	-26	-23	-21	-41	-38	-36
560	-13	-11	-8	-26	-24	-21	-41	-39	-36
520	-13	-11	-8	-27	-24	-22	-42	-39	-37
480	-14	-11	-9	-27	-25	-22	-42	-39	-37
440	-14	-11	-9	-27	-25	-22	-42	-39	-37
400	-14	-12	-9	-28	-25	-23	-42	-39	-37
360	-15	-12	-10	-29	-26	-24	-41	-39	-36

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-6.4	-6.4	-6.4	-74.5	-74.5	-74.5	-126.1	-126.1	-126.1
800	-11.5	-11.5	-11.5	-73.4	-73.4	-73.4	-120.9	-120.9	-120.9
760	-16.3	-16.3	-16.3	-72.4	-72.4	-72.4	-115.8	-115.8	-115.8
720	-20.5	-20.5	-20.5	-71.5	-71.5	-71.5	-111.2	-111.2	-111.2
680	-23.8	-23.8	-23.8	-70.8	-70.8	-70.8	-107.0	-107.0	-107.0
640	-26.4	-26.4	-26.4	-70.2	-70.2	-70.2	-103.2	-103.2	-103.2
600	-27.7	-27.7	-27.7	-68.3	-68.3	-68.3	-98.4	-98.4	-98.4
560	-27.6	-27.6	-27.6	-64.5	-64.5	-64.5	-92.0	-92.0	-92.0
520	-26.1	-26.1	-26.1	-58.9	-58.9	-58.9	-83.7	-83.7	-83.7
480	-23.2	-23.2	-23.2	-51.3	-51.3	-51.3	-73.8	-73.8	-73.8
440	-18.9	-18.9	-18.9	-42.0	-42.0	-42.0	-62.3	-62.3	-62.3
400	-13.2	-13.2	-13.2	-30.7	-30.7	-30.7	-49.0	-49.0	-49.0
360	-6.0	-6.0	-6.0	-17.5	-17.5	-17.5	-33.9	-33.9	-33.9

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
6200	502.7								
6600	678.3	502.7							
7000	820.6	678.3	502.7						
7400		820.6	678.3						
7800			820.6						
...									
9400				405.5					
9800				613.9	305.6				
10200				775.2	543.4				
10600				919.9	718.3	464.6			
11000					865.6	657.4			
11400						811.4			
...									
15400							324.8		
15800							570.0		
16200							738.4	492.3	
16600							879.7	680.3	399.4
17000								827.3	616.5
17400									774.8
17800									914.6

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -160 ft/+160 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -270 ft/+270 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-7	-2	0	-24	-19	-14	-49	-44	-39
800	-10	-5	0	-27	-22	-17	-52	-47	-42
760	-12	-7	-2	-30	-25	-20	-55	-50	-45
720	-14	-9	-4	-32	-27	-22	-58	-53	-48
680	-15	-10	-5	-35	-30	-25	-61	-56	-51
640	-17	-12	-7	-36	-31	-26	-64	-59	-54
600	-18	-13	-8	-38	-33	-28	-67	-62	-57
560	-18	-13	-8	-40	-35	-30	-69	-64	-59
520	-19	-14	-9	-41	-36	-31	-70	-65	-60
480	-20	-15	-10	-43	-38	-33	-71	-66	-61
440	-21	-16	-11	-44	-39	-34	-71	-66	-61
400	-22	-17	-12	-46	-41	-36	-71	-66	-61
360	-23	-18	-13	-48	-43	-38	-71	-66	-61

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-78.3	-92.3	-106.3	-93.6	-107.6	-121.6	-119.3	-133.3	-147.3
800	-75.4	-89.4	-103.4	-89.7	-103.7	-117.7	-113.6	-127.6	-141.6
760	-72.7	-86.7	-100.7	-86.1	-100.1	-114.1	-108.3	-122.3	-136.3
720	-70.3	-84.3	-98.3	-82.7	-96.7	-110.7	-103.1	-117.1	-131.1
680	-67.3	-81.3	-95.3	-78.7	-92.7	-106.7	-97.2	-111.2	-125.2
640	-63.5	-77.5	-91.5	-73.8	-87.8	-101.8	-90.3	-104.3	-118.3
600	-58.8	-72.8	-86.8	-68.0	-82.0	-96.0	-82.6	-96.6	-110.6
560	-53.4	-67.4	-81.4	-61.4	-75.4	-89.4	-73.8	-87.8	-101.8
520	-47.2	-61.2	-75.2	-53.9	-67.9	-81.9	-64.2	-78.2	-92.2
480	-40.2	-54.2	-68.2	-45.6	-59.6	-73.6	-53.7	-67.7	-81.7
440	-32.4	-46.4	-60.4	-36.5	-50.5	-64.5	-42.2	-56.2	-70.2
400	-23.8	-37.8	-51.8	-26.5	-40.5	-54.5	-29.9	-43.9	-57.9
360	-15.0	-29.0	-43.0	-16.1	-30.1	-44.1	-17.2	-31.2	-45.2

V1(MCG) Limit Weight (1000 LB)

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.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5800							313.5		
6200	298.1			325.6			373.3		
6600	356.6			384.7			433.3	291.1	
7000	415.2			444.3	303.4		494.7	350.9	
7400	475.2	334.6		505.8	362.5		558.0	410.7	
7800	537.5	393.2		569.5	421.8	281.3	623.5	471.4	328.5
8200	602.5	452.4	312.7	635.8	482.5	340.3	691.1	534.1	388.2
8600	670.4	513.8	371.2	704.9	545.3	399.5	761.3	598.7	448.4
9000	741.8	577.8	430.0	777.2	610.6	459.5	833.8	665.5	510.4
9400	816.8	644.6	490.5	851.9	678.7	521.5	906.6	734.7	574.2
9800	892.7	714.6	553.5		749.7	585.9		806.5	640.1
10200		788.4	619.2		823.9	652.8		879.3	708.4
10600		864.2	687.9		898.7	722.7			779.3
11000			760.2			795.9			851.9
11400			835.8			870.6			
11800			911.7						

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -170 ft/+170 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-19	-17	-14	-15	-13	-10	-8	-5	-3
800	-22	-19	-17	-17	-15	-12	-9	-7	-4
760	-24	-22	-19	-20	-17	-15	-11	-8	-6
720	-26	-24	-21	-21	-19	-16	-12	-10	-7
680	-27	-25	-22	-23	-20	-18	-14	-11	-9
640	-28	-25	-23	-24	-21	-19	-15	-13	-10
600	-28	-26	-23	-25	-22	-20	-17	-14	-12
560	-28	-26	-23	-25	-22	-20	-18	-15	-13
520	-28	-25	-23	-25	-23	-20	-19	-17	-14
480	-27	-25	-22	-25	-22	-20	-20	-17	-15
440	-26	-24	-21	-24	-22	-19	-20	-18	-15
400	-26	-23	-21	-24	-21	-19	-20	-18	-15
360	-25	-22	-20	-23	-21	-18	-20	-18	-15

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-111.3	-126.8	-142.3	-130.5	-146.0	-161.5	-162.7	-178.2	-193.7
800	-106.4	-121.9	-137.4	-124.1	-139.6	-155.1	-153.4	-168.9	-184.4
760	-101.6	-117.1	-132.6	-117.8	-133.3	-148.8	-144.3	-159.8	-175.3
720	-96.9	-112.4	-127.9	-111.7	-127.2	-142.7	-135.3	-150.8	-166.3
680	-91.7	-107.2	-122.7	-105.0	-120.5	-136.0	-125.8	-141.3	-156.8
640	-85.8	-101.3	-116.8	-97.7	-113.2	-128.7	-115.7	-131.2	-146.7
600	-79.3	-94.8	-110.3	-89.7	-105.2	-120.7	-105.0	-120.5	-136.0
560	-72.0	-87.5	-103.0	-80.9	-96.4	-111.9	-93.7	-109.2	-124.7
520	-64.1	-79.6	-95.1	-71.5	-87.0	-102.5	-81.8	-97.3	-112.8
480	-55.4	-70.9	-86.4	-61.5	-77.0	-92.5	-69.2	-84.7	-100.2
440	-46.1	-61.6	-77.1	-50.7	-66.2	-81.7	-56.1	-71.6	-87.1
400	-36.1	-51.6	-67.1	-39.3	-54.8	-70.3	-42.4	-57.9	-73.4
360	-25.8	-41.3	-56.8	-27.6	-43.1	-58.6	-28.3	-43.8	-59.3

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
8600							302.3		
9000							375.7		
9400							450.3	293.1	
9800				329.4			528.3	366.6	
10200				410.6			610.1	440.9	283.9
10600	356.7			495.2	319.4		696.5	518.3	357.4
11000	443.9			585.8	400.4		788.1	599.7	431.5
11400	537.9	345.9		683.6	484.3	309.3	883.3	685.5	508.4
11800	641.5	432.7		790.5	574.1	390.2		776.3	589.2
12200	757.9	525.7	335.1	903.3	671.0	473.5		871.3	674.4
12600	886.3	627.9	421.6		776.5	562.4			764.6
13000		742.4	513.5		889.1	658.4			859.3
13400		870.1	614.5			762.8			
13800			727.3			874.9			
14200			853.9						

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -280 ft/+280 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-34	-29	-24	-27	-22	-17	-13	-8	-3
800	-36	-31	-26	-29	-24	-19	-16	-11	-6
760	-39	-34	-29	-32	-27	-22	-18	-13	-8
720	-41	-36	-31	-34	-29	-24	-20	-15	-10
680	-42	-37	-32	-36	-31	-26	-23	-18	-13
640	-43	-38	-33	-37	-32	-27	-25	-20	-15
600	-43	-38	-33	-39	-34	-29	-28	-23	-18
560	-43	-38	-33	-39	-34	-29	-30	-25	-20
520	-43	-38	-33	-40	-35	-30	-32	-27	-22
480	-43	-38	-33	-40	-35	-30	-34	-29	-24
440	-42	-37	-32	-40	-35	-30	-35	-30	-25
400	-41	-36	-31	-39	-34	-29	-35	-30	-25
360	-41	-36	-31	-39	-34	-29	-36	-31	-26

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	0.0	-4.0	-8.0	-39.0	-43.0	-47.0	-79.4	-83.4	-87.4
800	0.0	-4.0	-8.0	-40.0	-44.0	-48.0	-77.2	-81.2	-85.2
760	0.0	-4.0	-8.0	-41.1	-45.1	-49.1	-75.3	-79.3	-83.3
720	-0.9	-4.9	-8.9	-42.4	-46.4	-50.4	-73.8	-77.8	-81.8
680	-6.4	-10.4	-14.4	-43.4	-47.4	-51.4	-72.0	-76.0	-80.0
640	-10.3	-14.3	-18.3	-43.8	-47.8	-51.8	-69.9	-73.9	-77.9
600	-12.3	-16.3	-20.3	-43.6	-47.6	-51.6	-67.4	-71.4	-75.4
560	-13.0	-17.0	-21.0	-42.1	-46.1	-50.1	-63.6	-67.6	-71.6
520	-12.7	-16.7	-20.7	-39.2	-43.2	-47.2	-58.2	-62.2	-66.2
480	-11.4	-15.4	-19.4	-34.8	-38.8	-42.8	-51.3	-55.3	-59.3
440	-9.1	-13.1	-17.1	-29.0	-33.0	-37.0	-42.9	-46.9	-50.9
400	-5.7	-9.7	-13.7	-21.7	-25.7	-29.7	-32.8	-36.8	-40.8
360	-1.5	-5.5	-9.5	-13.1	-17.1	-21.1	-21.3	-25.3	-29.3

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4600	364.9								
5000	488.8	333.7							
5400	611.7	457.9	302.6						
5800	733.7	581.1	427.0	310.5					
6200	855.0	703.3	550.4	389.4					
6600		824.7	672.9	470.9	330.2				
7000			794.4	556.1	409.5		284.0		
7400			915.6	645.6	491.8	349.9	331.5		
7800				740.0	578.1	429.7	379.1		
8200				839.5	668.7	513.0	428.1	295.9	
8600					764.5	600.3	479.0	343.4	
9000					864.5	692.2	532.1	391.2	
9400						789.4	587.5	440.6	307.8
9800						889.6	645.8	492.0	355.3
10200							707.4	545.7	403.4
10600							772.8	601.8	453.3
11000							841.4	660.9	505.3
11400							910.2	723.4	559.5
11800								789.9	616.3
12200								858.6	676.2
12600									739.6
13000									807.1
13400									875.8

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -130 ft/+130 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -190 ft/+190 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-4	-2	0	-14	-11	-9	-27	-24	-22
800	-6	-4	-1	-16	-14	-11	-29	-27	-24
760	-8	-5	-3	-19	-16	-14	-32	-29	-27
720	-9	-7	-4	-20	-18	-15	-34	-31	-29
680	-10	-8	-5	-22	-19	-17	-35	-33	-30
640	-11	-8	-6	-23	-20	-18	-37	-34	-32
600	-11	-9	-6	-23	-21	-18	-37	-35	-32
560	-12	-9	-7	-24	-21	-19	-38	-36	-33
520	-12	-10	-7	-24	-22	-19	-38	-36	-33
480	-12	-10	-7	-24	-22	-19	-38	-36	-33
440	-12	-10	-7	-25	-22	-20	-38	-36	-33
400	-13	-10	-8	-25	-23	-20	-38	-36	-33
360	-13	-11	-8	-26	-23	-21	-38	-36	-33

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	0.0	0.0	0.0	-68.2	-68.2	-68.2	-120.4	-120.4	-120.4
800	-3.6	-3.6	-3.6	-67.1	-67.1	-67.1	-115.5	-115.5	-115.5
760	-8.7	-8.7	-8.7	-66.3	-66.3	-66.3	-110.9	-110.9	-110.9
720	-13.7	-13.7	-13.7	-65.8	-65.8	-65.8	-106.5	-106.5	-106.5
680	-18.2	-18.2	-18.2	-65.5	-65.5	-65.5	-102.6	-102.6	-102.6
640	-21.8	-21.8	-21.8	-65.3	-65.3	-65.3	-99.2	-99.2	-99.2
600	-24.5	-24.5	-24.5	-65.2	-65.2	-65.2	-96.2	-96.2	-96.2
560	-25.9	-25.9	-25.9	-63.7	-63.7	-63.7	-91.9	-91.9	-91.9
520	-25.8	-25.8	-25.8	-60.1	-60.1	-60.1	-85.7	-85.7	-85.7
480	-24.2	-24.2	-24.2	-54.4	-54.4	-54.4	-77.7	-77.7	-77.7
440	-21.1	-21.1	-21.1	-46.7	-46.7	-46.7	-67.7	-67.7	-67.7
400	-16.4	-16.4	-16.4	-36.9	-36.9	-36.9	-55.8	-55.8	-55.8
360	-10.3	-10.3	-10.3	-25.0	-25.0	-25.0	-42.0	-42.0	-42.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5800	519.6								
6200	705.4	519.6							
6600	857.4	705.4	519.6						
7000		857.4	705.4						
7400			857.4						
8600				341.7					
9000				588.1					
9400				769.2	506.9				
9800					705.9	413.7			
10200					869.0	637.4			
10600						809.2			
...									
14200							401.0		
14600							637.8		
15000							808.0	560.9	
15400								748.6	471.6
15800								905.5	684.3
16200									847.0

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -160 ft/+160 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -270 ft/+270 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-6	-1	0	-21	-16	-11	-44	-39	-34
800	-9	-4	0	-24	-19	-14	-47	-42	-37
760	-11	-6	-1	-26	-21	-16	-50	-45	-40
720	-12	-7	-2	-29	-24	-19	-53	-48	-43
680	-14	-9	-4	-31	-26	-21	-56	-51	-46
640	-15	-10	-5	-32	-27	-22	-58	-53	-48
600	-16	-11	-6	-34	-29	-24	-61	-56	-51
560	-16	-11	-6	-35	-30	-25	-63	-58	-53
520	-17	-12	-7	-37	-32	-27	-64	-59	-54
480	-18	-13	-8	-38	-33	-28	-65	-60	-55
440	-18	-13	-8	-40	-35	-30	-65	-60	-55
400	-19	-14	-9	-41	-36	-31	-65	-60	-55
360	-20	-15	-10	-43	-38	-33	-65	-60	-55

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-74.8	-88.8	-102.8	-90.1	-104.1	-118.1	-116.1	-130.1	-144.1
800	-71.8	-85.8	-99.8	-86.1	-100.1	-114.1	-110.2	-124.2	-138.2
760	-68.9	-82.9	-96.9	-82.2	-96.2	-110.2	-104.5	-118.5	-132.5
720	-66.2	-80.2	-94.2	-78.6	-92.6	-106.6	-99.3	-113.3	-127.3
680	-64.0	-78.0	-92.0	-75.6	-89.6	-103.6	-94.6	-108.6	-122.6
640	-61.6	-75.6	-89.6	-72.2	-86.2	-100.2	-89.5	-103.5	-117.5
600	-58.3	-72.3	-86.3	-67.9	-81.9	-95.9	-83.2	-97.2	-111.2
560	-54.1	-68.1	-82.1	-62.5	-76.5	-90.5	-76.0	-90.0	-104.0
520	-48.9	-62.9	-76.9	-56.2	-70.2	-84.2	-67.5	-81.5	-95.5
480	-42.8	-56.8	-70.8	-48.8	-62.8	-76.8	-58.1	-72.1	-86.1
440	-35.8	-49.8	-63.8	-40.6	-54.6	-68.6	-47.6	-61.6	-75.6
400	-27.9	-41.9	-55.9	-31.3	-45.3	-59.3	-36.0	-50.0	-64.0
360	-19.5	-33.5	-47.5	-21.5	-35.5	-49.5	-23.8	-37.8	-51.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5400							315.6		
5800	306.4			334.0			381.9		
6200	371.3			399.6			448.5	290.8	
6600	436.5	282.2		466.1	309.5		517.2	357.0	
7000	504.0	346.9		535.2	375.0		588.3	423.3	
7400	574.5	411.9		607.3	440.9	285.0	662.0	491.2	332.2
7800	648.6	478.3	322.6	682.7	509.0	350.4	738.8	561.3	398.4
8200	726.6	547.7	387.5	761.9	579.9	416.0	818.6	634.0	465.5
8600	809.2	620.4	453.1	844.5	654.0	483.2	899.3	709.6	534.7
9000	893.4	696.8	521.3		731.7	553.0		788.4	606.5
9400		777.7	592.7		813.4	625.8		869.0	680.9
9800		861.8	667.7		896.3	702.1			758.5
10200			746.8			782.4			838.8
10600			830.3			865.2			919.5
11000			914.5						

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -170 ft/+170 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-17	-14	-12	-12	-10	-7	-4	-2	0
800	-20	-17	-15	-15	-12	-10	-6	-3	-1
760	-22	-20	-17	-17	-15	-12	-7	-5	-2
720	-24	-22	-19	-19	-17	-14	-9	-7	-4
680	-25	-23	-20	-21	-18	-16	-11	-8	-6
640	-26	-24	-21	-22	-19	-17	-12	-10	-7
600	-27	-24	-22	-23	-20	-18	-14	-11	-9
560	-26	-24	-21	-23	-20	-18	-15	-13	-10
520	-26	-23	-21	-23	-21	-18	-16	-14	-11
480	-25	-23	-20	-23	-20	-18	-17	-15	-12
440	-24	-22	-19	-22	-20	-17	-18	-15	-13
400	-24	-21	-19	-22	-19	-17	-18	-15	-13
360	-23	-20	-18	-21	-18	-16	-18	-15	-13

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-109.4	-124.9	-140.4	-129.3	-144.8	-160.3	-163.0	-178.5	-194.0
800	-104.3	-119.8	-135.3	-122.7	-138.2	-153.7	-153.5	-169.0	-184.5
760	-99.3	-114.8	-130.3	-116.2	-131.7	-147.2	-144.3	-159.8	-175.3
720	-94.5	-110.0	-125.5	-109.9	-125.4	-140.9	-135.2	-150.7	-166.2
680	-89.9	-105.4	-120.9	-103.8	-119.3	-134.8	-126.2	-141.7	-157.2
640	-85.0	-100.5	-116.0	-97.5	-113.0	-128.5	-117.0	-132.5	-148.0
600	-79.3	-94.8	-110.3	-90.3	-105.8	-121.3	-107.1	-122.6	-138.1
560	-72.8	-88.3	-103.8	-82.4	-97.9	-113.4	-96.5	-112.0	-127.5
520	-65.6	-81.1	-96.6	-73.7	-89.2	-104.7	-85.2	-100.7	-116.2
480	-57.6	-73.1	-88.6	-64.3	-79.8	-95.3	-73.3	-88.8	-104.3
440	-48.9	-64.4	-79.9	-54.1	-69.6	-85.1	-60.7	-76.2	-91.7
400	-39.4	-54.9	-70.4	-43.2	-58.7	-74.2	-47.4	-62.9	-78.4
360	-29.2	-44.8	-60.3	-31.7	-47.2	-62.7	-33.6	-49.1	-64.6

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
7800							295.8		
8200							383.1		
8600							473.0	284.9	
9000				370.5			569.3	372.2	
9400	333.9			472.2			673.2	461.6	
9800	441.8			583.6	358.1		786.0	556.8	361.3
10200	561.3	320.6		707.9	458.9		905.9	659.6	450.2
10600	699.2	427.9		848.1	569.0	345.9		771.3	544.6
11000	862.5	545.6	307.3		691.6	445.8		890.7	646.2
11400		680.8	414.1		830.0	554.6			756.7
11800		841.2	530.0			675.5			875.6
12200			662.8			812.1			
12600			819.9						

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -280 ft/+280 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-29	-24	-19	-21	-16	-11	-6	-1	0
800	-32	-27	-22	-24	-19	-14	-8	-3	0
760	-35	-30	-25	-27	-22	-17	-11	-6	-1
720	-37	-32	-27	-30	-25	-20	-13	-8	-3
680	-38	-33	-28	-32	-27	-22	-16	-11	-6
640	-39	-34	-29	-33	-28	-23	-19	-14	-9
600	-40	-35	-30	-35	-30	-25	-22	-17	-12
560	-40	-35	-30	-35	-30	-25	-25	-20	-15
520	-40	-35	-30	-36	-31	-26	-27	-22	-17
480	-39	-34	-29	-36	-31	-26	-29	-24	-19
440	-39	-34	-29	-36	-31	-26	-30	-25	-20
400	-38	-33	-28	-36	-31	-26	-31	-26	-21
360	-37	-32	-27	-35	-30	-25	-32	-27	-22

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	0.0	-4.0	-8.0	-34.0	-38.0	-42.0	-75.3	-79.3	-83.3
800	0.0	-4.0	-8.0	-35.0	-39.0	-43.0	-73.1	-77.1	-81.1
760	0.0	-4.0	-8.0	-36.0	-40.0	-44.0	-70.9	-74.9	-78.9
720	0.0	-4.0	-8.0	-37.0	-41.0	-45.0	-69.1	-73.1	-77.1
680	0.0	-4.0	-8.0	-38.6	-42.6	-46.6	-67.9	-71.9	-75.9
640	-5.6	-9.6	-13.6	-39.9	-43.9	-47.9	-66.6	-70.6	-74.6
600	-9.6	-13.6	-17.6	-40.6	-44.6	-48.6	-64.9	-68.9	-72.9
560	-11.5	-15.5	-19.5	-40.6	-44.6	-48.6	-62.8	-66.8	-70.8
520	-12.2	-16.2	-20.2	-39.2	-43.2	-47.2	-59.1	-63.1	-67.1
480	-11.8	-15.8	-19.8	-36.3	-40.3	-44.3	-53.8	-57.8	-61.8
440	-10.3	-14.3	-18.3	-31.7	-35.7	-39.7	-46.7	-50.7	-54.7
400	-7.7	-11.7	-15.7	-25.5	-29.5	-33.5	-37.9	-41.9	-45.9
360	-4.4	-8.4	-12.4	-18.1	-22.1	-26.1	-27.7	-31.7	-35.7

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4200	324.0								
4600	455.9	291.0							
5000	586.8	423.1							
5400	716.7	554.2	390.1	299.5					
5800	845.8	684.3	521.5	383.3					
6200		813.5	651.9	470.0	320.4				
6600			781.3	560.9	404.6		286.7		
7000			910.3	656.8	492.3	341.4	337.3		
7400				758.6	584.4	426.2	388.3		
7800				865.4	681.7	514.9	441.1	299.3	
8200					785.1	608.2	496.2	350.0	
8600					892.2	706.9	553.9	401.3	
9000						811.8	614.6	454.6	312.0
9400						919.0	678.8	510.3	362.7
9800							747.2	568.7	414.4
10200							820.2	630.3	468.3
10600							894.1	695.5	524.7
11000								765.1	583.8
11400								838.6	646.2
11800								912.6	712.4
12200									783.3
12600									857.1

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -130 ft/+130 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -190 ft/+190 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-5	-3	0	-14	-11	-9	-25	-23	-20
800	-7	-4	-2	-16	-13	-11	-28	-25	-23
760	-8	-6	-3	-18	-15	-13	-30	-27	-25
720	-10	-7	-5	-20	-17	-15	-32	-29	-27
680	-10	-8	-5	-21	-18	-16	-33	-31	-28
640	-11	-9	-6	-22	-19	-17	-34	-32	-29
600	-11	-9	-6	-22	-20	-17	-35	-33	-30
560	-12	-9	-7	-23	-20	-18	-36	-33	-31
520	-12	-10	-7	-23	-20	-18	-36	-34	-31
480	-12	-10	-7	-23	-21	-18	-36	-34	-31
440	-12	-10	-7	-24	-21	-19	-36	-34	-31
400	-13	-10	-8	-24	-21	-19	-36	-34	-31
360	-13	-11	-8	-24	-22	-19	-36	-33	-31

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	0.0	0.0	0.0	-64.0	-64.0	-64.0	-117.7	-117.7	-117.7
800	0.0	0.0	0.0	-63.0	-63.0	-63.0	-112.5	-112.5	-112.5
760	-1.6	-1.6	-1.6	-61.9	-61.9	-61.9	-107.6	-107.6	-107.6
720	-6.7	-6.7	-6.7	-61.0	-61.0	-61.0	-103.1	-103.1	-103.1
680	-11.8	-11.8	-11.8	-60.7	-60.7	-60.7	-99.0	-99.0	-99.0
640	-16.4	-16.4	-16.4	-60.6	-60.6	-60.6	-95.4	-95.4	-95.4
600	-20.2	-20.2	-20.2	-60.7	-60.7	-60.7	-92.4	-92.4	-92.4
560	-23.0	-23.0	-23.0	-60.9	-60.9	-60.9	-89.7	-89.7	-89.7
520	-24.4	-24.4	-24.4	-59.4	-59.4	-59.4	-85.6	-85.6	-85.6
480	-24.1	-24.1	-24.1	-55.6	-55.6	-55.6	-79.4	-79.4	-79.4
440	-22.2	-22.2	-22.2	-49.6	-49.6	-49.6	-71.1	-71.1	-71.1
400	-18.6	-18.6	-18.6	-41.4	-41.4	-41.4	-60.7	-60.7	-60.7
360	-13.8	-13.8	-13.8	-31.1	-31.1	-31.1	-48.3	-48.3	-48.3

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5400	522.5								
5800	723.4	522.5							
6200	888.7	723.4	522.5						
6600		888.7	723.4						
7000			888.7						
...									
8200				528.9					
8600				740.6	429.1				
9000				918.2	667.8	310.1			
9400					852.1	587.8			
9800						786.0			
...									
13000							416.2		
13400							669.3		
13800							852.7	587.4	
14200								787.2	492.0
14600									718.8
15000									896.4

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -100 ft/+100 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -160 ft/+160 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -270 ft/+270 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
840	-7	-2	0	-20	-15	-10	-40	-35	-30
800	-9	-4	0	-22	-17	-12	-43	-38	-33
760	-11	-6	-1	-24	-19	-14	-45	-40	-35
720	-12	-7	-2	-27	-22	-17	-48	-43	-38
680	-13	-8	-3	-28	-23	-18	-51	-46	-41
640	-14	-9	-4	-30	-25	-20	-53	-48	-43
600	-15	-10	-5	-31	-26	-21	-56	-51	-46
560	-16	-11	-6	-33	-28	-23	-57	-52	-47
520	-16	-11	-6	-34	-29	-24	-59	-54	-49
480	-17	-12	-7	-35	-30	-25	-59	-54	-49
440	-17	-12	-7	-36	-31	-26	-59	-54	-49
400	-18	-13	-8	-38	-33	-28	-59	-54	-49
360	-19	-14	-9	-39	-34	-29	-59	-54	-49

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Minimum Control Speeds

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111						
50	122	119	121	116	118	111	113	109	111	107	109	103	106	99	102
40	104	126	127	123	124	118	120	113	115	108	111	103	106	99	102
30	86	128	130	128	130	123	125	118	120	112	115	107	109	101	104
20	68	129	130	129	130	125	126	120	122	116	118	110	113	105	108
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114	107	110

TO1 V1(MCG), Minimum VR
10% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	110	112	107	110	105	107	103	106						
50	122	113	115	110	112	105	108	103	106	101	104	98	101	94	97
40	104	120	121	117	119	112	114	107	110	103	105	98	101	94	97
30	86	122	123	121	123	116	118	112	114	107	109	102	104	96	99
20	68	122	123	121	123	118	120	114	116	110	112	105	107	100	102
-60	-76	124	124	123	123	119	120	115	116	111	113	106	108	102	104

TO2 V1(MCG), Minimum VR
20% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	105	107	102	104	100	102	98	101						
50	122	107	109	105	107	100	103	98	101	96	99	93	96	89	92
40	104	113	115	111	113	106	108	102	104	97	100	93	96	89	92
30	86	115	117	115	117	110	112	106	108	101	104	96	99	91	94
20	68	115	117	115	117	112	114	108	110	104	106	99	102	94	97
-60	-76	117	117	116	117	113	114	109	111	105	107	101	103	97	99

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Go-Around %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

REPORTED OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (1000 FT)												
°C	°F		-2	-1	0	1	2	3	4	5	6	7	8	9	10
66	150	70	93.7	93.8	94.1	93.9	93.8	93.7	93.6	93.4	93.3	92.6	91.5	90.5	89.6
56	133	60	96.5	96.6	96.9	96.7	96.6	96.5	96.4	96.2	96.1	95.4	94.3	93.4	92.5
51	124	55	97.8	98.0	98.3	98.1	97.9	97.9	97.7	97.6	97.4	96.7	95.7	94.7	93.9
46	115	50	99.1	99.3	99.6	99.4	99.3	99.2	99.1	98.9	98.7	98.0	97.0	96.1	95.2
41	106	45	100.2	100.7	101.1	101.0	100.9	100.7	100.5	100.4	100.0	99.3	98.3	97.3	96.5
36	97	40	101.5	102.4	103.2	103.2	102.8	102.6	102.3	102.0	101.4	100.5	99.5	98.6	97.8
31	88	35	101.2	103.9	105.8	105.4	105.1	104.7	104.3	103.8	102.7	101.7	100.6	99.7	98.9
26	79	30	100.4	103.1	105.9	106.8	107.3	106.8	106.6	106.4	105.0	103.4	101.9	100.8	100.0
21	70	25	99.5	102.2	105.0	105.9	106.5	107.0	107.4	107.4	106.8	105.7	104.0	102.3	101.3
16	61	20	98.7	101.4	104.1	105.0	105.6	106.1	106.5	107.0	106.8	106.3	105.2	104.2	103.3
11	53	15	97.9	100.5	103.2	104.1	104.7	105.2	105.6	106.1	105.9	105.5	104.9	104.4	104.0
7	44	10	97.0	99.6	102.3	103.2	103.8	104.3	104.7	105.1	105.0	104.6	104.0	103.5	103.4
2	35	5	96.1	98.7	101.4	102.3	102.9	103.4	103.8	104.2	104.1	103.7	103.1	102.6	102.5
-3	26	0	95.3	97.8	100.5	101.4	102.0	102.4	102.8	103.3	103.1	102.7	102.2	101.7	101.6
-13	8	-10	93.5	96.0	98.6	99.5	100.1	100.5	100.9	101.4	101.2	100.8	100.3	99.8	99.7
-23	-10	-20	91.7	94.2	96.7	97.6	98.2	98.6	99.0	99.4	99.3	98.9	98.3	97.9	97.8
-33	-27	-30	89.9	92.3	94.8	95.6	96.2	96.6	97.0	97.4	97.3	96.9	96.4	95.9	95.8
-43	-45	-40	88.0	90.4	92.8	93.6	94.2	94.6	95.0	95.4	95.3	94.9	94.4	93.9	93.9
-53	-63	-50	86.1	88.4	90.8	91.6	92.2	92.6	93.0	93.3	93.2	92.9	92.3	91.9	91.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)												
	-2	-1	0	1	2	3	4	5	6	7	8	9	10
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
1 PACK ON	-0.2	-0.2	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

***Packs on or off with 2 bleed sources.**
****Packs off with 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	**PITCH ATT**	**4.5**	**4.0**			
	V/S (FT/MIN)	1100	700			
30000 (280 KIAS)	**PITCH ATT**	**5.5**	**5.0**	**5.0**	**4.5**	**4.0**
	V/S (FT/MIN)	2800	2100	1500	1100	800
20000 (270 KIAS)	**PITCH ATT**	**8.5**	**7.5**	**7.5**	**7.5**	**7.0**
	V/S (FT/MIN)	4100	3100	2400	1700	1300
10000 (270 KIAS)	**PITCH ATT**	**11.5**	**10.5**	**9.5**	**9.5**	**9.0**
	V/S (FT/MIN)	5400	4100	3300	2600	2100
SEA LEVEL (270 KIAS)	**PITCH ATT**	**15.0**	**13.0**	**12.0**	**11.5**	**11.0**
	V/S (FT/MIN)	6300	4900	3900	3200	2600

Cruise

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	**PITCH ATT**	**2.5**	**3.0**			
	%N1	82.1	87.2			
35000 (280 KIAS)	**PITCH ATT**	**1.5**	**2.5**	**3.0**	**3.5**	
	%N1	78.9	81.6	85.3	92.0	
30000 (280 KIAS)	**PITCH ATT**	**2.0**	**2.5**	**3.0**	**3.0**	**3.0**
	%N1	74.5	77.2	80.7	84.8	88.8
25000 (280 KIAS)	**PITCH ATT**	**2.0**	**2.5**	**3.5**	**3.5**	**3.5**
	%N1	70.6	73.0	76.1	80.0	83.7
20000 (270 KIAS)	**PITCH ATT**	**2.0**	**3.0**	**4.0**	**4.0**	**4.0**
	%N1	65.8	68.3	71.4	75.2	78.9
15000 (270 KIAS)	**PITCH ATT**	**2.0**	**3.0**	**4.0**	**4.5**	**4.5**
	%N1	61.8	64.4	67.2	70.4	74.3

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	**PITCH ATT**	**-1.0**	**0.0**			
	V/S (FT/MIN)	-2700	-2700			
30000 (280 KIAS)	**PITCH ATT**	**-1.0**	**0.0**	**1.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-2200	-2000	-1900	-2100	-2500
20000 (270 KIAS)	**PITCH ATT**	**-0.5**	**0.5**	**1.5**	**2.0**	**1.5**
	V/S (FT/MIN)	-1800	-1600	-1500	-1500	-1600
10000 (270 KIAS)	**PITCH ATT**	**-1.0**	**0.0**	**1.5**	**2.5**	**2.5**
	V/S (FT/MIN)	-1600	-1400	-1400	-1400	-1400
SEA LEVEL (270 KIAS)	**PITCH ATT**	**-1.0**	**0.0**	**1.0**	**2.0**	**2.5**
	V/S (FT/MIN)	-1400	-1300	-1200	-1200	-1300

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	52.8	57.5	62.0	66.1	69.7
	KIAS	207	222	238	258	276
5000	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	49.3	53.8	58.0	61.9	65.6
	KIAS	207	222	237	256	274

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS UP	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
GEAR UP	%N1	49.5	54.2	58.5	62.6	66.4
(VREF30+80)	KIAS	207	222	235	252	264
FLAPS 1	**PITCH ATT**	**6.5**	**7.0**	**7.5**	**7.5**	**8.0**
GEAR UP	%N1	50.4	55.4	60.0	64.3	68.0
(VREF30+60)	KIAS	187	202	215	232	244
FLAPS 5	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
GEAR UP	%N1	50.9	56.1	61.0	65.2	69.1
(VREF30+40)	KIAS	167	182	195	212	224
FLAPS 15	**PITCH ATT**	**6.5**	**7.0**	**7.0**	**7.0**	**7.0**
GEAR UP	%N1	52.1	57.7	62.7	66.9	71.2
(VREF30+20)	KIAS	147	162	175	192	204
FLAPS 20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**5.5**
GEAR DOWN	%N1	57.9	63.7	69.3	74.0	78.1
(VREF30+20)	KIAS	147	162	175	192	204

Final Approach (1500 FT)

Gear Down, Set Thrust for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS 20 (VREF20+10)	**PITCH ATT**	**1.0**	**1.0**	**1.5**	**1.5**	**2.0**
	%N1	39.7	43.9	47.9	51.1	53.8
	KIAS	153	170	185	199	209
FLAPS 25 (VREF25+10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	50.0	54.5	58.5	62.2	64.7
	KIAS	144	159	173	186	196
FLAPS 30 (VREF30+10)	**PITCH ATT**	**1.0**	**1.5**	**1.5**	**1.0**	**1.0**
	%N1	54.3	59.4	63.6	69.6	73.5
	KIAS	137	152	165	182	194

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	**PITCH ATT**	**18.0**	**14.5**	**12.5**	**10.5**	**9.0**
	V/S (FT/MIN)	4000	3100	2500	2000	1600
	KIAS	147	162	176	193	205
5000	**PITCH ATT**	**22.5**	**18.0**	**15.0**	**12.5**	**11.0**
	V/S (FT/MIN)	5000	4000	3300	2700	2200
	KIAS	147	162	176	192	205
SEA LEVEL	**PITCH ATT**	**27.0**	**21.5**	**18.0**	**15.0**	**13.0**
	V/S (FT/MIN)	5800	4700	3900	3300	2800
	KIAS	147	162	175	192	204

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	30800	29100	27600
760	28800	2	31300	29700	28200
740	29400	0	31800	30200	28700
720	30000	-1	32300	30700	29100
700	30700	-2	32800	31100	29600
680	31300	-4	33200	31600	30100
660	31900	-5	33700	32100	30600
640	32600	-7	34300	32700	31200
620	33300	-8	34800	33200	31700
600	34000	-10	35300	33800	32300
580	34700	-11	35900	34300	32900
560	35400	-13	36500	34900	33500
540	36200	-15	37100	35600	34100
520	37000	-15	37800	36200	34800
500	37800	-15	38400	36900	35500
480	38600	-15	39100	37600	36200
460	39500	-15	39900	38300	36900
440	40400	-15	40600	39100	37700
420	41400	-15	41400	39900	38600
400	42400	-15	42300	40800	39400
380	43100	-15	43100	41800	40500

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	30800	29100	27600
760	28800	8	31300	29700	28200
740	29400	6	31800	30200	28700
720	30000	5	32300	30700	29100
700	30700	3	32800	31100	29600
680	31300	2	33200	31600	30100
660	31900	1	33700	32100	30600
640	32600	-1	34300	32700	31200
620	33300	-2	34800	33200	31700
600	34000	-4	35300	33800	32300
580	34700	-6	35900	34300	32900
560	35400	-7	36500	34900	33500
540	36200	-9	37100	35600	34100
520	37000	-9	37800	36200	34800
500	37800	-9	38400	36900	35500
480	38600	-9	39100	37600	36200
460	39500	-9	39900	38300	36900
440	40400	-9	40600	39100	37700
420	41400	-9	41400	39900	38600
400	42400	-9	42300	40800	39400
380	43100	-9	43100	41800	40500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	30800	29100	27600
760	28800	13	31300	29700	28200
740	29400	12	31800	30200	28700
720	30000	11	32300	30700	29100
700	30700	9	32800	31100	29600
680	31300	8	33200	31600	30100
660	31900	6	33700	32100	30600
640	32600	5	34300	32700	31200
620	33300	3	34800	33200	31700
600	34000	2	35300	33800	32300
580	34700	0	35900	34300	32900
560	35400	-2	36500	34900	33500
540	36200	-3	37100	35600	34100
520	37000	-3	37800	36200	34800
500	37800	-3	38400	36900	35500
480	38600	-3	39100	37600	36200
460	39500	-3	39900	38300	36900
440	40400	-3	40600	39100	37700
420	41400	-3	41400	39900	38600
400	42400	-3	42300	40800	39400
380	43100	-3	43100	41800	40500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Mid C.G. (30% MAC)

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	31800	30200	28600
760	28800	2	32400	30700	29200
740	29400	0	32900	31300	29700
720	30000	-1	33300	31700	30200
700	30700	-2	33800	32200	30700
680	31300	-4	34300	32700	31200
660	31900	-5	34800	33200	31700
640	32600	-7	35300	33700	32200
620	33300	-8	35800	34200	32700
600	34000	-10	36300	34800	33300
580	34700	-11	36900	35300	33900
560	35400	-13	37500	35900	34500
540	36200	-15	38100	36600	35100
520	37000	-15	38800	37200	35800
500	37800	-15	39400	37900	36400
480	38600	-15	40100	38600	37100
460	39500	-15	40900	39300	37900
440	40400	-15	41600	40100	38700
420	41400	-15	42400	40900	39500
400	42400	-15	43100	41700	40300
380	43100	-15	43100	42800	41400

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	31800	30200	28600
760	28800	8	32400	30700	29200
740	29400	6	32900	31300	29700
720	30000	5	33300	31700	30200
700	30700	3	33800	32200	30700
680	31300	2	34300	32700	31200
660	31900	1	34800	33200	31700
640	32600	-1	35300	33700	32200
620	33300	-2	35800	34200	32700
600	34000	-4	36300	34800	33300
580	34700	-6	36900	35300	33900
560	35400	-7	37500	35900	34500
540	36200	-9	38100	36600	35100
520	37000	-9	38800	37200	35800
500	37800	-9	39400	37900	36400
480	38600	-9	40100	38600	37100
460	39500	-9	40900	39300	37900
440	40400	-9	41600	40100	38700
420	41400	-9	42400	40900	39500
400	42400	-9	43100	41700	40300
380	43100	-9	43100	42800	41400

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Mid C.G. (30% MAC)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	31800	30200	28600
760	28800	13	32400	30700	29200
740	29400	12	32900	31300	29700
720	30000	11	33300	31700	30200
700	30700	9	33800	32200	30700
680	31300	8	34300	32700	31200
660	31900	6	34800	33200	31700
640	32600	5	35300	33700	32200
620	33300	3	35800	34200	32700
600	34000	2	36300	34800	33300
580	34700	0	36900	35300	33900
560	35400	-2	37500	35900	34500
540	36200	-3	38100	36600	35100
520	37000	-3	38800	37200	35800
500	37800	-3	39400	37900	36400
480	38600	-3	40100	38600	37100
460	39500	-3	40900	39300	37900
440	40400	-3	41600	40100	38700
420	41400	-3	42400	40900	39500
400	42400	-3	43100	41700	40300
380	43100	-3	43100	42800	41400

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		25	27	29	31	33	35	37	39	41	43
780	%N1	84.2	85.9	87.1	89.6						
	MACH	.819	.840	.839	.838						
	KIAS	346	342	327	313						
	FF/ENG	11439	11411	11201	11537						
740	%N1	83.4	84.8	85.9	87.7	90.7					
	MACH	.819	.837	.840	.839	.837					
	KIAS	346	341	328	313	299					
	FF/ENG	11096	10974	10668	10708	11189					
700	%N1	82.5	83.7	84.9	86.1	88.3					
	MACH	.812	.831	.839	.840	.838					
	KIAS	343	338	327	314	300					
	FF/ENG	10640	10513	10229	10021	10265					
660	%N1	81.0	82.5	83.7	84.9	86.4	89.1				
	MACH	.795	.819	.835	.840	.839	.837				
	KIAS	335	332	325	314	300	286				
	FF/ENG	10011	9983	9794	9536	9480	9831				
620	%N1	79.4	81.1	82.5	83.8	84.9	86.7				
	MACH	.775	.803	.825	.838	.840	.839				
	KIAS	326	325	321	313	300	287				
	FF/ENG	9341	9384	9307	9103	8893	8984				
580	%N1	77.6	79.4	81.1	82.4	83.6	84.8	87.5			
	MACH	.751	.782	.809	.830	.839	.840	.838			
	KIAS	315	316	314	310	300	287	274			
	FF/ENG	8646	8743	8740	8651	8448	8289	8522			
540	%N1	75.9	77.5	79.3	81.0	82.3	83.4	85.2	88.6		
	MACH	.728	.757	.788	.814	.833	.840	.839	.837		
	KIAS	305	305	305	303	298	287	274	261		
	FF/ENG	8016	8060	8128	8113	8011	7814	7757	8113		
500	%N1	74.4	75.7	77.3	79.1	80.7	82.1	83.5	85.9		
	MACH	.709	.731	.761	.792	.818	.835	.840	.839		
	KIAS	296	294	294	294	292	285	274	262		
	FF/ENG	7478	7417	7468	7518	7504	7376	7226	7293		
460	%N1	72.8	74.0	75.3	77.0	78.9	80.4	82.1	84.0	86.5	
	MACH	.691	.710	.733	.764	.795	.821	.836	.840	.839	
	KIAS	288	285	282	283	283	280	273	262	250	
	FF/ENG	6982	6872	6822	6874	6918	6892	6790	6706	6803	
420	%N1	70.8	72.3	73.5	74.8	76.5	78.4	80.3	82.4	84.2	86.8
	MACH	.669	.690	.710	.733	.764	.796	.822	.837	.840	.839
	KIAS	278	276	273	270	271	271	268	261	250	238
	FF/ENG	6457	6375	6276	6235	6280	6311	6314	6265	6188	6260
380	%N1	68.5	70.1	71.6	72.8	74.2	75.9	78.2	80.4	82.5	84.3
	MACH	.639	.665	.688	.708	.731	.762	.795	.821	.836	.840
	KIAS	266	266	264	260	258	258	258	255	249	239
	FF/ENG	5889	5850	5779	5697	5655	5676	5727	5783	5742	5644
340	%N1	65.9	67.6	69.2	70.7	72.0	73.3	75.3	78.0	80.3	82.5
	MACH	.604	.632	.659	.683	.704	.726	.757	.790	.817	.835
	KIAS	250	251	252	251	247	244	244	245	242	237
	FF/ENG	5299	5296	5253	5205	5135	5071	5094	5184	5243	5194

Shaded area approximates optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
282	261	242	226	213	200	191	182	174	167	160
561	520	484	452	425	400	382	366	351	337	325
840	779	725	678	637	600	574	550	528	508	489
1120	1039	966	904	849	800	766	734	705	678	653
1401	1299	1208	1130	1062	1000	957	918	881	848	817
1683	1560	1451	1357	1274	1200	1149	1101	1057	1017	980
1966	1822	1694	1583	1487	1400	1340	1285	1234	1187	1144
2250	2085	1937	1811	1700	1600	1532	1469	1410	1356	1307
2535	2348	2181	2038	1913	1800	1723	1652	1586	1525	1470
2820	2611	2425	2265	2126	2000	1915	1835	1762	1695	1633

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	9.1	0:37	7.9	0:36	6.5	0:35	5.8	0:34	5.1	0:33
400	18.7	1:09	17.1	1:06	14.8	1:03	13.6	1:01	12.6	0:58
600	28.4	1:42	26.3	1:36	23.1	1:31	21.4	1:28	20.1	1:24
800	37.9	2:15	35.3	2:07	31.3	1:59	29.1	1:55	27.5	1:49
1000	47.3	2:48	44.3	2:38	39.4	2:27	36.8	2:22	34.8	2:15
1200	56.7	3:22	53.2	3:09	47.5	2:56	44.4	2:49	42.1	2:40
1400	66.1	3:55	62.1	3:41	55.5	3:24	51.9	3:17	49.3	3:06
1600	75.3	4:29	70.8	4:12	63.5	3:53	59.4	3:44	56.4	3:32
1800	84.5	5:04	79.5	4:44	71.4	4:22	66.8	4:12	63.5	3:58
2000	93.6	5:38	88.2	5:17	79.2	4:51	74.2	4:40	70.6	4:24

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB) 400	450	500	550	600	650	700	750	800
10	-1.4	-1.0	-0.7	-0.3	0.0	0.4	0.8	1.2	1.7
20	-2.9	-2.2	-1.5	-0.7	0.0	0.9	1.8	2.8	3.8
30	-4.5	-3.4	-2.3	-1.1	0.0	1.4	2.9	4.4	5.9
40	-6.1	-4.6	-3.1	-1.5	0.0	1.9	3.9	6.0	8.1
50	-7.6	-5.8	-3.9	-1.9	0.0	2.5	5.0	7.6	10.2
60	-9.2	-7.0	-4.7	-2.3	0.0	3.0	6.1	9.2	12.3
70	-10.7	-8.1	-5.5	-2.7	0.0	3.6	7.2	10.8	14.4
80	-12.3	-9.3	-6.3	-3.1	0.0	4.2	8.3	12.4	16.5
90	-13.8	-10.5	-7.1	-3.5	0.0	4.8	9.4	14.0	18.5
100	-15.3	-11.6	-7.8	-3.9	0.0	5.4	10.6	15.7	20.6
110	-16.9	-12.8	-8.6	-4.3	0.0	6.0	11.7	17.3	22.7
120	-18.4	-13.9	-9.4	-4.7	0.0	6.6	12.9	19.0	24.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1032	976	925	879	838	800	767	736	708	682	657
1543	1460	1385	1317	1256	1200	1151	1106	1063	1024	989
2056	1946	1846	1756	1675	1600	1535	1475	1419	1367	1320
2571	2433	2308	2195	2094	2000	1920	1845	1775	1710	1651
3088	2922	2771	2635	2513	2400	2304	2214	2131	2053	1982
3606	3412	3235	3076	2932	2800	2688	2583	2486	2396	2313
4126	3904	3699	3517	3352	3200	3072	2953	2842	2739	2645
4649	4396	4165	3959	3772	3600	3456	3322	3197	3082	2976
5172	4890	4631	4400	4192	4000	3840	3691	3552	3424	3307
5697	5384	5098	4843	4612	4400	4224	4060	3908	3767	3637
6223	5880	5565	5285	5033	4800	4608	4429	4263	4109	3967
6751	6376	6034	5729	5453	5200	4992	4798	4617	4450	4297
7281	6874	6503	6172	5874	5600	5375	5166	4971	4791	4626
7812	7373	6973	6616	6295	6000	5759	5534	5324	5131	4954
8345	7874	7444	7061	6716	6400	6142	5901	5678	5471	5282
8880	8376	7915	7506	7138	6800	6525	6269	6030	5811	5610
9418	8880	8388	7952	7560	7200	6908	6636	6383	6150	5936
9959	9385	8863	8399	7982	7600	7291	7002	6735	6488	6262
10502	9893	9338	8846	8405	8000	7674	7369	7086	6826	6587

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
800	27.2	1:48	26.3	1:47	25.5	1:47	25.3	1:48	26.2	1:48
1200	41.3	2:39	40.1	2:36	39.0	2:36	38.4	2:37	39.5	2:38
1600	55.4	3:30	53.9	3:26	52.4	3:25	51.6	3:27	52.7	3:28
2000	69.6	4:21	67.7	4:16	65.8	4:15	64.8	4:16	66.0	4:18
2400	83.1	5:13	80.9	5:07	78.8	5:05	77.4	5:06	78.5	5:07
2800	96.7	6:06	94.1	5:58	91.7	5:55	90.1	5:55	90.9	5:57
3200	109.9	6:59	107.1	6:50	104.4	6:45	102.4	6:45	103.0	6:47
3600	122.9	7:54	119.8	7:42	116.9	7:36	114.6	7:35	114.9	7:37
4000	135.9	8:48	132.6	8:34	129.3	8:27	126.7	8:25	126.7	8:27
4400	148.4	9:43	144.8	9:28	141.3	9:19	138.4	9:16	138.1	9:17
4800	160.8	10:39	157.0	10:22	153.2	10:10	150.1	10:07	149.5	10:07
5200	173.0	11:36	168.9	11:17	165.0	11:03	161.5	10:58	160.6	10:57
5600	185.0	12:33	180.6	12:12	176.4	11:57	172.8	11:50	171.6	11:47
6000	197.0	13:30	192.3	13:08	187.9	12:50	184.0	12:41	182.5	12:38
6400	208.5	14:28	203.5	14:05	198.9	13:45	194.8	13:34	193.0	13:29
6800	220.0	15:27	214.8	15:02	209.9	14:41	205.5	14:27	203.5	14:21
7200	231.4	16:26	225.8	16:00	220.7	15:37	216.1	15:21	213.8	15:13
7600	242.5	17:26	236.6	16:58	231.2	16:33	226.4	16:16	223.9	16:05
8000	253.6	18:26	247.4	17:56	241.8	17:30	236.7	17:11	234.0	16:58

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitudes
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	400	450	500	550	600	650	700	750	800
20	-3.7	-2.7	-1.7	-0.8	0.0	2.7	8.7	17.9	30.3
40	-8.1	-6.1	-4.1	-2.0	0.0	4.9	13.5	26.0	42.2
60	-12.3	-9.4	-6.4	-3.2	0.0	6.8	17.9	33.3	53.0
80	-16.5	-12.7	-8.7	-4.3	0.0	8.6	22.0	40.0	62.6
100	-20.6	-15.9	-10.9	-5.4	0.0	10.3	25.6	45.9	71.2
120	-24.5	-19.0	-13.1	-6.5	0.0	11.8	28.9	51.1	78.6
140	-28.4	-22.0	-15.1	-7.5	0.0	13.2	31.8	55.7	84.9
160	-32.2	-24.9	-17.1	-8.6	0.0	14.5	34.3	59.5	90.0
180	-35.9	-27.8	-19.1	-9.6	0.0	15.5	36.4	62.6	94.1
200	-39.5	-30.5	-21.0	-10.6	0.0	16.5	38.1	65.0	97.0
220	-43.0	-33.2	-22.8	-11.5	0.0	17.3	39.5	66.7	98.9
240	-46.4	-35.8	-24.6	-12.4	0.0	17.9	40.4	67.7	99.6
260	-49.7	-38.3	-26.3	-13.3	0.0	18.4	41.0	68.0	99.2
280	-52.9	-40.8	-27.9	-14.2	0.0	18.7	41.2	67.5	97.6
300	-56.0	-43.1	-29.5	-15.1	0.0	18.9	41.1	66.4	95.0
320	-59.0	-45.4	-31.0	-15.9	0.0	19.0	40.5	64.6	91.2
340	-61.9	-47.5	-32.4	-16.7	0.0	18.9	39.5	62.0	86.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)										
	780	740	700	660	620	580	540	500	460	420	380
43							188	94	35	6	0
41						153	77	29	6	0	8
39					117	58	22	4	0	8	23
37			147	84	40	14	2	1	9	22	38
35		101	56	25	7	0	2	10	23	37	52
33	66	34	14	3	0	4	13	24	38	52	64
31	18	6	0	1	7	16	27	39	52	63	72
29	1	0	4	10	19	30	42	53	63	71	76
27	2	7	15	24	34	44	55	64	71	76	77
25	12	20	29	38	48	57	65	71	75	77	76

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent at .84M/310/250

PRESSURE ALTITUDE (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	96	104	111	118	124	129	135	140	145	150
TIME (MINUTES)	20	21	22	23	24	24	25	26	26	27

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
800	%N1	62.7	65.6	69.7	74.5	79.1	83.7	88.8			
	KIAS	273	275	276	301	314	318	312			
	FF/ENG	10540	10420	10330	10690	11040	11440	12000			
760	%N1	61.3	64.2	68.3	72.8	77.7	82.4	87.0			
	KIAS	266	268	269	285	306	309	312			
	FF/ENG	10010	9920	9800	9990	10430	10760	11180			
720	%N1	59.9	62.7	66.8	71.0	76.2	80.9	85.5			
	KIAS	259	260	261	271	297	300	305			
	FF/ENG	9490	9400	9280	9340	9830	10070	10400			
680	%N1	58.5	61.2	65.4	69.3	74.6	79.3	84.0			
	KIAS	252	253	254	256	286	291	296			
	FF/ENG	8980	8890	8760	8740	9200	9410	9720			
640	%N1	57.0	59.6	63.8	67.7	72.8	77.6	82.2			
	KIAS	245	245	246	248	267	282	286			
	FF/ENG	8470	8370	8250	8210	8480	8780	9070			
600	%N1	55.5	58.0	62.0	66.1	70.7	75.8	80.6	85.3		
	KIAS	236	237	238	239	251	273	276	279		
	FF/ENG	7980	7860	7740	7680	7800	8190	8420	8790		
560	%N1	53.9	56.4	60.2	64.4	68.7	74.0	78.7	83.5		
	KIAS	231	231	231	231	234	263	266	270		
	FF/ENG	7500	7370	7230	7170	7180	7600	7780	8020		
520	%N1	52.3	54.7	58.4	62.5	66.7	71.8	76.6	81.5		
	KIAS	225	225	225	225	225	243	256	259		
	FF/ENG	7060	6910	6740	6660	6650	6880	7150	7370		
480	%N1	50.7	53.0	56.6	60.5	64.7	69.3	74.5	79.3		
	KIAS	220	220	220	220	220	224	245	248		
	FF/ENG	6640	6470	6270	6190	6160	6210	6540	6720		
440	%N1	48.8	51.2	54.7	58.4	62.6	66.9	72.2	77.1	83.5	
	KIAS	213	213	213	213	213	213	232	237	240	
	FF/ENG	6240	6050	5840	5750	5680	5670	5920	6090	6440	
400	%N1	46.8	49.3	52.8	56.3	60.4	64.7	69.4	74.5	81.0	
	KIAS	207	207	207	207	207	207	209	225	228	
	FF/ENG	5850	5660	5430	5340	5250	5200	5230	5480	5760	
360	%N1	44.7	47.1	50.7	54.2	57.9	62.4	66.6	71.8	78.3	82.3
	KIAS	200	200	200	200	200	200	200	212	215	217
	FF/ENG	5590	5400	5170	5050	4940	4870	4840	4900	5110	5270

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
800	%N1	65.2	68.1	72.7	77.2	82.2
	KIAS	242	242	242	242	242
	FF/ENG	11530	11500	11450	11560	11820
760	%N1	63.7	66.5	70.9	75.4	80.5
	KIAS	242	242	242	242	242
	FF/ENG	10890	10840	10770	10840	11080
720	%N1	62.2	65.0	69.2	73.8	78.8
	KIAS	236	236	236	236	236
	FF/ENG	10290	10230	10160	10190	10400
680	%N1	60.6	63.5	67.6	72.2	77.1
	KIAS	228	228	228	228	228
	FF/ENG	9700	9640	9560	9570	9740
640	%N1	59.0	61.8	65.9	70.5	75.3
	KIAS	221	221	221	221	221
	FF/ENG	9130	9050	8960	8960	9090
600	%N1	57.3	60.0	64.1	68.4	73.2
	KIAS	216	216	216	216	216
	FF/ENG	8560	8480	8360	8360	8430
560	%N1	55.6	58.1	62.2	66.4	71.2
	KIAS	211	211	211	211	211
	FF/ENG	8010	7910	7790	7760	7810
520	%N1	53.9	56.3	60.2	64.3	68.9
	KIAS	205	205	205	205	205
	FF/ENG	7480	7350	7220	7180	7200
480	%N1	52.1	54.4	58.1	62.2	66.5
	KIAS	200	200	200	200	200
	FF/ENG	6990	6830	6670	6610	6600
440	%N1	50.1	52.4	56.0	59.9	64.1
	KIAS	193	193	193	193	193
	FF/ENG	6510	6330	6140	6050	6030
400	%N1	48.0	50.3	53.8	57.4	61.7
	KIAS	187	187	187	187	187
	FF/ENG	6050	5850	5650	5540	5490
360	%N1	45.5	48.1	51.5	54.9	59.0
	KIAS	180	180	180	180	180
	FF/ENG	5730	5530	5300	5180	5100

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4280	90/-50	80	-150/490	50/-50	80/-80	140	80	180
AUTOBRAKE MAX	5590	80/-70	130	-210/710	0/0	130/-130	250	0	0
AUTOBRAKE 4	7120	120/-90	170	-300/1010	0/0	180/-180	360	0	0
AUTOBRAKE 3	8340	140/-120	220	-370/1270	0/-50	220/-220	400	0	0
AUTOBRAKE 2	9190	160/-140	260	-430/1450	100/-200	240/-240	320	240	240
AUTOBRAKE 1	9940	180/-160	310	-490/1690	290/-300	260/-260	320	970	1210
Good Reported Braking Action									
MAX MANUAL	5810	80/-70	140	-240/860	130/-120	130/-130	200	350	810
AUTOBRAKE MAX	6010	90/-70	150	-250/890	120/-90	140/-140	230	370	850
AUTOBRAKE 4	7150	120/-90	170	-300/1040	30/-10	180/-180	360	20	140
AUTOBRAKE 3	8340	140/-120	220	-370/1270	10/-50	220/-220	400	0	0
AUTOBRAKE 2	9190	160/-140	260	-430/1450	100/-200	240/-240	320	240	240
AUTOBRAKE 1	9940	180/-160	310	-490/1690	290/-300	260/-260	320	970	1210
Good To Medium Reported Braking Action									
MAX MANUAL	6700	100/-90	180	-310/1130	220/-180	160/-160	220	630	1580
AUTOBRAKE MAX	6810	110/-90	180	-320/1140	210/-170	160/-160	250	640	1600
AUTOBRAKE 4	7500	130/-100	200	-350/1220	140/-80	190/-190	360	440	1230
AUTOBRAKE 3	8510	140/-120	220	-400/1390	80/-90	220/-220	400	200	790
AUTOBRAKE 2	9270	160/-140	260	-440/1540	160/-220	240/-240	320	350	740
AUTOBRAKE 1	9950	180/-160	320	-490/1710	320/-310	260/-270	320	1010	1410
Medium Reported Braking Action									
MAX MANUAL	7600	130/-100	220	-380/1390	310/-240	180/-180	250	920	2360
AUTOBRAKE MAX	7600	130/-100	220	-380/1390	310/-240	180/-180	260	910	2350
AUTOBRAKE 4	7840	140/-100	220	-390/1410	240/-150	200/-200	360	850	2320
AUTOBRAKE 3	8680	150/-130	230	-430/1520	150/-140	230/-230	400	390	1590
AUTOBRAKE 2	9360	160/-140	260	-460/1620	220/-250	240/-240	320	450	1230
AUTOBRAKE 1	9960	180/-160	320	-490/1740	360/-320	260/-280	320	1050	1610

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	8540	150/-130	260	-470/1750	490/-350	210/-210	270	1410	3980
AUTOBRAKE MAX	8550	150/-130	260	-470/1750	490/-360	210/-210	280	1410	3970
AUTOBRAKE 4	8670	160/-130	260	-470/1770	460/-290	220/-220	340	1380	3960
AUTOBRAKE 3	9240	170/-140	260	-490/1830	360/-250	240/-250	400	1050	3510
AUTOBRAKE 2	9780	170/-150	290	-520/1910	400/-350	250/-250	320	990	3160
AUTOBRAKE 1	10260	190/-170	330	-550/2000	510/-400	270/-280	320	1430	3250
Poor Reported Braking Action									
MAX MANUAL	9490	170/-150	310	-550/2120	670/-460	240/-240	290	1910	5600
AUTOBRAKE MAX	9500	170/-150	310	-550/2120	680/-470	240/-240	290	1910	5600
AUTOBRAKE 4	9500	180/-150	310	-550/2120	680/-440	240/-240	320	1910	5600
AUTOBRAKE 3	9800	180/-150	300	-560/2150	560/-370	250/-260	390	1710	5440
AUTOBRAKE 2	10200	180/-160	320	-580/2200	590/-450	260/-260	320	1530	5090
AUTOBRAKE 1	10560	200/-170	350	-600/2250	670/-480	280/-280	320	1810	4890

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 240 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4460	80/-50	90	-150/510	50/-50	80/-80	140	90	210
AUTOBRAKE MAX	5970	70/-70	140	-220/740	0/0	140/-140	260	0	0
AUTOBRAKE 4	7660	90/-100	200	-310/1060	0/0	200/-200	370	0	0
AUTOBRAKE 3	8990	120/-130	240	-390/1320	0/-80	240/-240	400	10	10
AUTOBRAKE 2	9830	140/-150	290	-450/1510	140/-220	260/-260	330	370	370
AUTOBRAKE 1	10600	170/-170	350	-520/1750	320/-330	290/-290	330	1140	1500
Good Reported Braking Action									
MAX MANUAL	6120	70/-80	150	-250/890	140/-120	140/-140	200	380	900
AUTOBRAKE MAX	6350	80/-80	160	-260/910	130/-70	150/-150	250	400	950
AUTOBRAKE 4	7690	90/-100	200	-320/1080	30/-10	200/-200	380	20	140
AUTOBRAKE 3	8990	120/-130	240	-390/1320	10/-80	240/-240	400	10	10
AUTOBRAKE 2	9830	140/-150	290	-450/1510	140/-220	260/-260	330	370	370
AUTOBRAKE 1	10600	170/-170	350	-520/1750	320/-330	290/-290	330	1140	1500
Good To Medium Reported Braking Action									
MAX MANUAL	7080	90/-100	200	-320/1160	230/-190	170/-170	220	700	1760
AUTOBRAKE MAX	7190	100/-100	200	-330/1170	230/-160	170/-170	260	710	1790
AUTOBRAKE 4	8040	100/-110	220	-360/1270	130/-80	210/-210	380	440	1330
AUTOBRAKE 3	9170	120/-130	250	-410/1450	90/-130	240/-250	400	220	850
AUTOBRAKE 2	9920	140/-150	290	-460/1590	200/-250	260/-260	330	480	890
AUTOBRAKE 1	10620	170/-170	350	-520/1780	360/-340	290/-290	330	1180	1710
Medium Reported Braking Action									
MAX MANUAL	8040	120/-120	240	-390/1430	320/-260	200/-200	250	1010	2620
AUTOBRAKE MAX	8040	120/-120	240	-390/1430	330/-240	200/-200	280	1010	2620
AUTOBRAKE 4	8400	120/-120	240	-400/1460	230/-150	220/-220	380	860	2520
AUTOBRAKE 3	9340	130/-140	250	-440/1580	160/-170	240/-250	390	430	1680
AUTOBRAKE 2	10020	140/-150	300	-470/1670	250/-280	260/-260	330	590	1410
AUTOBRAKE 1	10640	170/-170	350	-520/1810	390/-350	290/-290	330	1220	1920

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	9040	140/-140	290	-480/1790	510/-370	230/-230	270	1560	4430
AUTOBRAKE MAX	9050	140/-140	290	-480/1790	520/-370	230/-230	290	1560	4430
AUTOBRAKE 4	9230	140/-140	290	-480/1810	470/-300	240/-240	350	1480	4390
AUTOBRAKE 3	9910	140/-150	290	-510/1890	370/-290	260/-260	390	1120	3840
AUTOBRAKE 2	10440	160/-160	330	-530/1960	440/-370	280/-280	330	1160	3540
AUTOBRAKE 1	10940	180/-180	360	-570/2060	540/-430	290/-290	330	1620	3700
Poor Reported Braking Action									
MAX MANUAL	10040	160/-160	330	-560/2160	700/-480	260/-260	290	2100	6230
AUTOBRAKE MAX	10060	160/-160	330	-560/2160	710/-490	260/-260	300	2100	6240
AUTOBRAKE 4	10070	160/-160	330	-560/2160	700/-450	260/-260	320	2100	6260
AUTOBRAKE 3	10480	160/-160	330	-590/2210	580/-400	280/-280	390	1810	5990
AUTOBRAKE 2	10870	170/-170	360	-600/2250	630/-470	290/-290	330	1730	5660
AUTOBRAKE 1	11250	180/-180	370	-620/2320	690/-520	300/-300	330	2010	5490

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 250 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 220 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4800	100/-50	100	-160/530	60/-50	90/-90	150	120	240
AUTOBRAKE MAX	6540	80/-80	150	-230/780	0/0	160/-160	280	0	0
AUTOBRAKE 4	8490	100/-120	220	-330/1130	0/0	230/-230	400	0	0
AUTOBRAKE 3	9980	140/-150	280	-410/1400	10/-90	280/-280	430	30	30
AUTOBRAKE 2	10930	160/-170	330	-470/1600	160/-250	300/-300	360	490	490
AUTOBRAKE 1	11780	200/-200	400	-540/1850	360/-380	330/-330	360	1400	1830
Good Reported Braking Action									
MAX MANUAL	6660	80/-90	170	-260/930	150/-140	160/-160	210	460	1080
AUTOBRAKE MAX	6920	90/-90	180	-280/950	130/-70	160/-160	280	460	1120
AUTOBRAKE 4	8500	100/-120	220	-350/1150	30/-10	230/-230	400	20	160
AUTOBRAKE 3	9980	140/-150	280	-410/1400	10/-90	280/-280	430	30	30
AUTOBRAKE 2	10930	160/-170	330	-470/1600	160/-250	300/-300	360	490	490
AUTOBRAKE 1	11780	200/-200	400	-540/1850	360/-380	330/-330	360	1400	1830
Good To Medium Reported Braking Action									
MAX MANUAL	7730	100/-110	220	-340/1210	250/-210	190/-200	240	830	2110
AUTOBRAKE MAX	7870	110/-110	230	-350/1220	250/-170	200/-200	280	830	2120
AUTOBRAKE 4	8870	120/-130	250	-390/1340	140/-90	240/-240	400	490	1560
AUTOBRAKE 3	10160	140/-150	290	-440/1530	100/-140	280/-280	430	260	1020
AUTOBRAKE 2	11010	160/-170	340	-490/1680	220/-280	300/-300	360	610	1100
AUTOBRAKE 1	11790	200/-200	400	-550/1880	400/-390	330/-330	360	1440	2080
Medium Reported Braking Action									
MAX MANUAL	8810	130/-130	260	-410/1500	360/-290	220/-230	260	1210	3140
AUTOBRAKE MAX	8810	130/-130	280	-410/1500	370/-260	230/-230	290	1200	3130
AUTOBRAKE 4	9250	130/-140	280	-430/1530	250/-160	240/-240	400	970	2960
AUTOBRAKE 3	10340	140/-150	300	-470/1660	180/-180	280/-280	430	490	2000
AUTOBRAKE 2	11100	160/-170	350	-510/1760	280/-310	300/-300	360	720	1710
AUTOBRAKE 1	11810	200/-200	400	-550/1910	440/-390	330/-330	360	1480	2320

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	9930	160/-160	320	-510/1870	560/-410	250/-260	290	1840	5300
AUTOBRAKE MAX	9940	160/-160	330	-510/1880	570/-400	260/-260	300	1830	5300
AUTOBRAKE 4	10150	160/-160	330	-510/1900	510/-330	270/-270	380	1720	5210
AUTOBRAKE 3	10940	160/-170	340	-550/1980	410/-320	290/-290	420	1290	4560
AUTOBRAKE 2	11550	180/-180	370	-570/2060	480/-410	310/-310	350	1390	4240
AUTOBRAKE 1	12120	200/-200	410	-600/2170	600/-480	340/-340	360	1930	4430
Poor Reported Braking Action									
MAX MANUAL	11050	180/-180	380	-600/2250	760/-530	290/-290	310	2470	7450
AUTOBRAKE MAX	11060	180/-180	380	-600/2270	770/-540	300/-300	310	2470	7460
AUTOBRAKE 4	11060	180/-180	380	-600/2270	770/-490	300/-300	360	2470	7460
AUTOBRAKE 3	11550	180/-180	380	-620/2310	630/-450	310/-310	410	2090	7120
AUTOBRAKE 2	11990	200/-200	400	-630/2360	690/-520	320/-320	350	2050	6760
AUTOBRAKE 1	12420	210/-210	430	-660/2430	760/-560	350/-350	360	2380	6540

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 280 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 230 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4680	120/-50	110	-180/620	80/-70	100/-100	150	200	450
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6330	90/-90	180	-290/1040	210/-170	150/-150	200	630	1570
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7110	100/-100	210	-350/1290	310/-240	180/-180	220	980	2600
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7890	120/-120	250	-420/1550	420/-320	200/-200	240	1320	3630
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8920	150/-140	300	-520/2010	760/-460	230/-230	260	2070	6680
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9960	170/-170	350	-620/2480	1100/-610	260/-260	270	2820	9730
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4460	110/-50	100	-170/600	80/-70	90/-90	150	180	400
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6000	100/-80	160	-280/1010	200/-160	140/-140	200	570	1410
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	6730	110/-100	200	-340/1260	300/-230	160/-160	220	880	2330
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7460	130/-110	230	-400/1510	400/-300	190/-190	240	1190	3260
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8430	160/-130	280	-500/1970	730/-440	210/-210	250	1890	6010
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9400	180/-160	320	-600/2430	1060/-580	240/-240	270	2580	8750
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good Reported Braking Action									
MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130
Medium Reported Braking Action									
MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680
Poor Reported Braking Action									
MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5080	100/-60	110	-160/540	60/-60	110/-110	N/A	160	340
AUTOBRAKE MAX	6160	70/-70	150	-220/720	0/0	150/-150	N/A	0	0
AUTOBRAKE 2	10690	150/-170	330	-450/1490	110/-170	300/-300	N/A	260	260
Good Reported Braking Action									
MAX MANUAL	6980	90/-90	190	-270/920	170/-150	170/-170	N/A	580	1410
AUTOBRAKE MAX	6960	90/-90	190	-270/920	170/-150	170/-170	N/A	580	1410
AUTOBRAKE 2	10690	150/-170	330	-450/1490	110/-170	300/-300	N/A	260	260
Good To Medium Reported Braking Action									
MAX MANUAL	8040	110/-120	240	-340/1180	280/-230	210/-210	N/A	1010	2670
AUTOBRAKE MAX	8020	120/-120	240	-340/1180	290/-240	210/-210	N/A	1010	2670
AUTOBRAKE 2	10780	150/-170	330	-470/1570	190/-210	310/-310	N/A	410	1280
Medium Reported Braking Action									
MAX MANUAL	9090	130/-140	290	-410/1430	390/-310	240/-240	N/A	1440	3930
AUTOBRAKE MAX	9070	140/-140	290	-400/1430	410/-330	240/-240	N/A	1440	3920
AUTOBRAKE 3	10000	130/-140	290	-440/1530	210/-170	280/-280	N/A	670	3100
Medium To Poor Reported Braking Action									
MAX MANUAL	10160	160/-170	350	-490/1780	590/-430	270/-270	N/A	2130	6460
AUTOBRAKE MAX	10160	170/-170	350	-490/1780	610/-450	280/-280	N/A	2130	6460
AUTOBRAKE 3	10730	160/-160	340	-510/1840	480/-330	300/-300	N/A	1640	5950
Poor Reported Braking Action									
MAX MANUAL	11230	190/-190	400	-570/2130	790/-550	300/-300	N/A	2810	8990
AUTOBRAKE MAX	11240	190/-190	410	-570/2130	810/-570	310/-310	N/A	2820	9000
AUTOBRAKE 3	11450	180/-180	390	-580/2150	740/-480	320/-320	N/A	2610	8800

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6990	100/-100	210	-340/1240	280/-230	170/-170	220	880	2280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6990	100/-100	210	-340/1240	280/-230	170/-170	220	880	2280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7860	120/-120	250	-420/1560	450/-330	200/-200	240	1360	3850
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8730	140/-140	290	-490/1880	610/-420	230/-230	250	1830	5420
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10080	180/-170	350	-650/2670	2060/-670	270/-270	270	3320	7250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11430	210/-200	410	-810/3460	3500/-910	300/-300	280	4800	9070
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6610	110/-90	190	-330/1210	270/-210	160/-160	220	800	2050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6610	110/-90	190	-330/1210	270/-210	160/-160	220	800	2050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7430	130/-110	230	-410/1530	430/-310	190/-190	240	1230	3460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8250	150/-130	270	-480/1840	580/-400	210/-210	250	1660	4870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9530	190/-160	330	-630/2620	1980/-640	250/-250	270	3050	7290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10800	220/-190	380	-780/3390	3380/-870	280/-280	280	4430	9700
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4220	100/-50	90	-140/480	50/-50	90/-90	130	0	110
AUTOBRAKE MAX	5690	70/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9870	130/-140	280	-430/1430	40/-110	280/-280	430	0	0

Good Reported Braking Action

MAX MANUAL	6070	80/-80	160	-250/860	160/-140	150/-150	200	0	510
AUTOBRAKE MAX	6320	80/-80	160	-260/880	150/-130	150/-160	230	0	540
AUTOBRAKE 2	9870	130/-140	280	-430/1430	40/-110	280/-280	430	0	0

Good To Medium Reported Braking Action

MAX MANUAL	7260	100/-110	210	-330/1150	290/-240	190/-190	240	0	1030
AUTOBRAKE MAX	7390	110/-110	210	-340/1160	280/-220	190/-200	270	0	1050
AUTOBRAKE 2	10000	140/-150	290	-450/1530	140/-150	290/-290	430	0	360

Medium Reported Braking Action

MAX MANUAL	8440	120/-130	250	-410/1440	420/-330	230/-230	270	0	1550
AUTOBRAKE MAX	8460	130/-130	260	-410/1440	410/-310	230/-230	300	0	1550
AUTOBRAKE 3	9280	130/-140	270	-430/1520	270/-200	260/-260	390	0	1120

Medium To Poor Reported Braking Action

MAX MANUAL	9820	150/-160	310	-520/1870	720/-500	280/-280	300	0	2660
AUTOBRAKE MAX	9830	160/-160	320	-520/1870	720/-500	280/-280	320	0	2660
AUTOBRAKE 3	10310	160/-170	330	-530/1910	640/-410	290/-290	380	0	2470

Poor Reported Braking Action

MAX MANUAL	11190	180/-190	370	-620/2290	1020/-670	320/-320	330	0	3770
AUTOBRAKE MAX	11200	190/-190	380	-620/2290	1030/-680	320/-320	330	0	3770
AUTOBRAKE 3	11340	190/-190	380	-620/2300	1000/-620	320/-320	370	0	3820

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3750	80/-40	70	-130/440	40/-40	70/-70	120	0	80
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8140	140/-110	220	-380/1280	40/-70	220/-230	390	0	0
Good Reported Braking Action									
MAX MANUAL	5250	80/-60	130	-230/790	130/-120	120/-120	190	0	370
AUTOBRAKE MAX	5460	80/-70	130	-230/810	120/-110	130/-130	210	0	400
AUTOBRAKE 2	8140	140/-110	220	-380/1280	40/-70	220/-230	390	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6210	100/-80	170	-300/1060	240/-200	150/-160	220	0	760
AUTOBRAKE MAX	6320	100/-90	170	-300/1070	240/-180	160/-160	250	0	770
AUTOBRAKE 2	8260	150/-120	230	-400/1380	130/-110	230/-230	390	0	280
Medium Reported Braking Action									
MAX MANUAL	7170	120/-100	200	-370/1320	350/-280	180/-190	250	0	1140
AUTOBRAKE MAX	7180	120/-100	210	-370/1320	350/-250	190/-190	280	0	1140
AUTOBRAKE 3	7760	130/-110	220	-390/1390	240/-190	210/-210	350	0	880
Medium To Poor Reported Braking Action									
MAX MANUAL	8290	150/-130	250	-470/1720	610/-420	220/-230	270	0	1950
AUTOBRAKE MAX	8300	150/-130	260	-470/1720	620/-410	230/-230	290	0	1960
AUTOBRAKE 3	8650	160/-130	260	-480/1760	550/-370	240/-240	330	0	1840
Poor Reported Braking Action									
MAX MANUAL	9410	170/-150	300	-560/2110	860/-560	260/-260	290	0	2760
AUTOBRAKE MAX	9420	180/-150	300	-560/2110	880/-570	260/-260	290	0	2770
AUTOBRAKE 3	9540	180/-150	300	-560/2120	850/-550	260/-260	310	0	2800

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAP / SLAT CONTROL (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4170	90/-40	90	-140/460	50/-40	80/-80	130	100	210
AUTOBRAKE MAX	5690	70/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430
Good Reported Braking Action									
MAX MANUAL	5790	70/-80	150	-230/810	130/-120	140/-140	180	400	940
AUTOBRAKE MAX	6020	80/-80	160	-240/830	110/-60	140/-140	240	400	970
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430
Good To Medium Reported Braking Action									
MAX MANUAL	6730	90/-100	190	-300/1060	220/-190	170/-170	210	730	1840
AUTOBRAKE MAX	6840	100/-100	200	-300/1070	220/-150	170/-170	250	720	1850
AUTOBRAKE 2	9580	140/-150	300	-430/1460	190/-250	260/-260	310	530	960
Medium Reported Braking Action									
MAX MANUAL	7660	110/-110	230	-360/1300	310/-250	190/-200	230	1050	2730
AUTOBRAKE MAX	7660	110/-110	240	-360/1300	320/-230	200/-200	250	1040	2720
AUTOBRAKE 3	8990	120/-130	260	-410/1440	160/-160	240/-240	370	430	1740
Medium To Poor Reported Braking Action									
MAX MANUAL	8640	140/-140	280	-440/1630	490/-360	220/-230	250	1600	4610
AUTOBRAKE MAX	8640	140/-140	290	-440/1640	500/-350	230/-230	260	1600	4610
AUTOBRAKE 3	9520	140/-150	300	-480/1730	360/-280	260/-260	370	1130	3970
Poor Reported Braking Action									
MAX MANUAL	9610	160/-160	330	-520/1960	660/-460	250/-250	270	2150	6480
AUTOBRAKE MAX	9620	160/-160	330	-520/1970	670/-470	260/-260	270	2150	6490
AUTOBRAKE 3	10040	160/-160	330	-540/2010	550/-390	270/-270	360	1820	6190

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≤ 5)
VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4620	150/-50	130	-150/630	50/-50	120/-100	170	150	380
AUTOBRAKE MAX	6730	90/-70	170	-230/760	0/0	170/-170	270	0	0
AUTOBRAKE 2	11280	190/-180	370	-460/1520	200/-250	320/-320	360	880	880
Good Reported Braking Action									
MAX MANUAL	6450	90/-80	180	-250/850	140/-120	160/-160	180	530	1280
AUTOBRAKE MAX	6960	90/-80	180	-260/890	60/-40	180/-180	270	310	1090
AUTOBRAKE 2	11280	190/-180	370	-460/1520	200/-250	320/-320	360	880	880
Good To Medium Reported Braking Action									
MAX MANUAL	7570	120/-100	230	-320/1110	240/-200	200/-200	210	980	2610
AUTOBRAKE MAX	7800	120/-100	230	-320/1130	200/-150	210/-210	270	860	2500
AUTOBRAKE 2	11350	190/-180	380	-470/1600	240/-280	320/-320	360	970	1540
Medium Reported Braking Action									
MAX MANUAL	8680	140/-120	280	-380/1360	330/-270	230/-230	240	1430	3940
AUTOBRAKE MAX	8640	140/-120	280	-380/1360	330/-250	230/-230	260	1410	3900
AUTOBRAKE 3	10660	160/-150	320	-450/1560	180/-190	300/-300	380	580	2330
Medium To Poor Reported Braking Action									
MAX MANUAL	9830	170/-150	340	-470/1710	520/-390	260/-260	270	2190	6860
AUTOBRAKE MAX	9800	170/-150	340	-470/1710	520/-380	270/-270	280	2180	6830
AUTOBRAKE 3	11160	180/-170	360	-510/1840	390/-300	310/-310	380	1450	5750
Poor Reported Braking Action									
MAX MANUAL	10970	200/-170	400	-550/2050	700/-500	290/-290	290	2940	9780
AUTOBRAKE MAX	10960	200/-170	400	-550/2050	710/-510	300/-300	290	2940	9760
AUTOBRAKE 3	11650	200/-180	400	-570/2120	600/-410	320/-320	380	2320	9160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (5 < Flaps < 20)

VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4200	110/-40	90	-140/460	50/-40	80/-80	120	100	230
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9710	160/-150	300	-420/1410	120/-180	270/-270	370	360	360
Good Reported Braking Action									
MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	440	1040
AUTOBRAKE MAX	6040	90/-70	160	-240/830	110/-70	150/-150	240	430	1070
AUTOBRAKE 2	9710	160/-150	300	-420/1410	120/-180	270/-270	370	360	360
Good To Medium Reported Braking Action									
MAX MANUAL	6830	110/-90	200	-300/1060	220/-190	170/-170	210	810	2100
AUTOBRAKE MAX	6910	110/-90	200	-300/1070	220/-170	180/-180	240	800	2100
AUTOBRAKE 2	9780	170/-150	300	-440/1480	170/-210	270/-270	370	460	990
Medium Reported Braking Action									
MAX MANUAL	7800	130/-110	240	-360/1310	310/-250	200/-200	240	1170	3150
AUTOBRAKE MAX	7780	130/-110	240	-360/1300	320/-260	200/-200	240	1160	3130
AUTOBRAKE 3	9100	140/-130	260	-410/1450	140/-140	250/-250	390	430	2080
Medium To Poor Reported Braking Action									
MAX MANUAL	8810	160/-140	290	-450/1650	490/-360	230/-230	260	1790	5410
AUTOBRAKE MAX	8810	160/-140	290	-450/1640	510/-370	230/-230	260	1790	5400
AUTOBRAKE 3	9630	160/-140	300	-480/1740	370/-260	270/-270	390	1270	4730
Poor Reported Braking Action									
MAX MANUAL	9820	180/-160	340	-530/1980	670/-470	260/-260	280	2410	7670
AUTOBRAKE MAX	9830	180/-160	340	-530/1980	690/-480	260/-260	280	2410	7670
AUTOBRAKE 3	10160	180/-150	340	-540/2020	600/-370	280/-280	380	2100	7370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≥ 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4170	100/-40	90	-140/460	50/-40	80/-80	130	100	210
AUTOBRAKE MAX	5690	70/-70	130	-210/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430
Good Reported Braking Action									
MAX MANUAL	5790	70/-80	150	-230/810	130/-120	140/-140	180	400	940
AUTOBRAKE MAX	5990	80/-80	160	-240/830	110/-70	140/-140	240	400	970
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430
Good To Medium Reported Braking Action									
MAX MANUAL	6730	90/-90	190	-300/1050	220/-180	170/-170	210	720	1840
AUTOBRAKE MAX	6820	100/-100	200	-300/1060	210/-150	170/-170	250	720	1840
AUTOBRAKE 2	9570	140/-150	300	-430/1460	190/-240	260/-260	310	530	960
Medium Reported Braking Action									
MAX MANUAL	7660	110/-110	240	-360/1300	310/-250	200/-200	230	1050	2740
AUTOBRAKE MAX	7650	120/-110	240	-360/1300	320/-230	200/-200	250	1040	2720
AUTOBRAKE 3	8970	120/-130	260	-410/1440	160/-160	240/-240	370	430	1740
Medium To Poor Reported Braking Action									
MAX MANUAL	8640	140/-140	280	-440/1630	490/-360	220/-220	250	1600	4610
AUTOBRAKE MAX	8630	140/-140	280	-440/1630	490/-350	230/-230	260	1590	4600
AUTOBRAKE 3	9510	140/-150	290	-470/1720	350/-270	260/-260	360	1130	3960
Poor Reported Braking Action									
MAX MANUAL	9610	160/-160	330	-520/1970	660/-460	250/-250	270	2150	6480
AUTOBRAKE MAX	9620	160/-160	330	-520/1970	670/-470	260/-260	270	2150	6490
AUTOBRAKE 3	10050	160/-160	330	-540/2010	550/-390	270/-270	360	1820	6190

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS PRIMARY FAIL (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4690	80/-50	100	-150/510	60/-50	100/-100	160	120	270
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170
Good Reported Braking Action									
MAX MANUAL	6410	80/-80	170	-250/870	160/-140	150/-150	220	490	1170
AUTOBRAKE MAX	6390	80/-90	170	-250/870	150/-130	150/-150	240	490	1160
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170
Good To Medium Reported Braking Action									
MAX MANUAL	7380	110/-110	220	-320/1120	260/-210	180/-180	250	870	2260
AUTOBRAKE MAX	7360	110/-110	220	-320/1120	260/-220	190/-190	260	860	2240
AUTOBRAKE 2	9870	140/-160	300	-440/1500	150/-180	280/-280	400	300	1020
Medium Reported Braking Action									
MAX MANUAL	8350	130/-130	260	-390/1370	350/-280	210/-210	280	1240	3340
AUTOBRAKE MAX	8320	130/-130	260	-380/1370	370/-300	220/-220	280	1230	3320
AUTOBRAKE 3	9130	130/-130	260	-410/1460	200/-140	250/-250	410	580	2630
Medium To Poor Reported Braking Action									
MAX MANUAL	9350	160/-150	310	-470/1710	540/-400	240/-240	300	1860	5560
AUTOBRAKE MAX	9340	160/-150	310	-470/1710	570/-420	250/-250	300	1860	5560
AUTOBRAKE 3	9820	150/-150	310	-480/1770	450/-290	270/-270	400	1460	5140
Poor Reported Braking Action									
MAX MANUAL	10340	180/-170	360	-550/2050	730/-510	270/-270	310	2470	7780
AUTOBRAKE MAX	10360	180/-170	360	-550/2050	760/-530	280/-280	310	2480	7790
AUTOBRAKE 3	10500	170/-170	350	-550/2070	700/-440	290/-290	380	2330	7640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROL MODE (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good Reported Braking Action									
MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130
Medium Reported Braking Action									
MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680
Poor Reported Braking Action									
MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROLS (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4910	90/-50	110	-160/540	80/-70	110/-110	210	190	430
AUTOBRAKE MAX	5740	70/-60	130	-210/690	0/0	140/-140	240	0	30
AUTOBRAKE 2	10010	160/-150	290	-430/1440	30/-120	290/-290	440	60	60
Good Reported Braking Action									
MAX MANUAL	6820	100/-90	190	-270/920	200/-170	170/-170	280	680	1700
AUTOBRAKE MAX	6770	100/-90	190	-270/920	210/-180	170/-170	280	670	1660
AUTOBRAKE 2	10010	160/-150	290	-430/1440	30/-120	290/-290	440	60	60
Good To Medium Reported Braking Action									
MAX MANUAL	7870	130/-110	240	-340/1180	320/-260	200/-200	310	1160	3160
AUTOBRAKE MAX	7830	130/-110	250	-340/1180	330/-270	210/-210	310	1150	3130
AUTOBRAKE 2	10110	160/-150	300	-450/1520	120/-150	290/-290	440	290	1700
Medium Reported Braking Action									
MAX MANUAL	8910	150/-130	290	-410/1440	430/-340	230/-230	330	1630	4610
AUTOBRAKE MAX	8890	150/-130	300	-410/1440	440/-350	240/-240	330	1630	4600
AUTOBRAKE 3	9300	150/-120	280	-420/1480	310/-150	250/-260	410	1220	4190
Medium To Poor Reported Braking Action									
MAX MANUAL	9960	180/-160	350	-500/1790	640/-470	270/-270	350	2360	7490
AUTOBRAKE MAX	9950	180/-160	360	-500/1790	650/-480	270/-270	350	2370	7490
AUTOBRAKE 3	10170	180/-150	340	-500/1810	580/-340	280/-280	400	2140	7270
Poor Reported Braking Action									
MAX MANUAL	11000	210/-180	410	-580/2130	840/-590	300/-300	360	3090	10360
AUTOBRAKE MAX	11010	210/-180	410	-580/2130	860/-600	300/-300	360	3100	10380
AUTOBRAKE 3	11040	210/-170	400	-580/2140	840/-530	300/-300	390	3060	10340

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS C (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4690	80/-50	100	-150/510	60/-50	100/-100	160	120	270
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170
Good Reported Braking Action									
MAX MANUAL	6410	80/-80	170	-250/870	160/-140	150/-150	220	490	1170
AUTOBRAKE MAX	6390	80/-90	170	-250/870	150/-130	150/-150	240	490	1160
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170
Good To Medium Reported Braking Action									
MAX MANUAL	7380	110/-110	220	-320/1120	260/-210	180/-180	250	870	2260
AUTOBRAKE MAX	7360	110/-110	220	-320/1120	260/-220	190/-190	260	860	2240
AUTOBRAKE 2	9870	140/-160	300	-440/1500	150/-180	280/-280	400	300	1020
Medium Reported Braking Action									
MAX MANUAL	8350	130/-130	260	-390/1370	350/-280	210/-210	280	1240	3340
AUTOBRAKE MAX	8320	130/-130	260	-380/1370	370/-300	220/-220	280	1230	3320
AUTOBRAKE 3	9130	130/-130	260	-410/1460	200/-140	250/-250	410	580	2630
Medium To Poor Reported Braking Action									
MAX MANUAL	9350	160/-150	310	-470/1710	540/-400	240/-240	300	1860	5560
AUTOBRAKE MAX	9340	160/-150	310	-470/1710	570/-420	250/-250	300	1860	5560
AUTOBRAKE 3	9820	150/-150	310	-480/1770	450/-290	270/-270	400	1460	5140
Poor Reported Braking Action									
MAX MANUAL	10340	180/-170	360	-550/2050	730/-510	270/-270	310	2470	7780
AUTOBRAKE MAX	10360	180/-170	360	-550/2050	760/-530	280/-280	310	2480	7790
AUTOBRAKE 3	10500	170/-170	350	-550/2070	700/-440	290/-290	380	2330	7640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4150	80/-40	90	-140/480	50/-50	80/-90	150	0	120
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8900	120/-130	250	-400/1350	0/-10	250/-250	470	0	0
Good Reported Braking Action									
MAX MANUAL	5980	70/-80	150	-250/880	170/-150	150/-150	220	0	540
AUTOBRAKE MAX	6100	70/-80	160	-260/890	160/-130	150/-150	250	0	560
AUTOBRAKE 2	8900	120/-130	250	-400/1350	0/-10	250/-250	470	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	7190	100/-100	200	-340/1200	320/-260	190/-190	260	0	1120
AUTOBRAKE MAX	7240	100/-100	210	-340/1200	320/-250	190/-190	280	0	1130
AUTOBRAKE 2	9100	130/-130	260	-430/1480	140/-80	260/-260	470	0	550
Medium Reported Braking Action									
MAX MANUAL	8390	120/-120	250	-420/1510	470/-360	220/-220	300	0	1700
AUTOBRAKE MAX	8380	120/-120	260	-420/1510	480/-370	230/-230	300	0	1700
AUTOBRAKE 3	8640	120/-130	260	-430/1530	400/-220	240/-240	400	0	1640
Medium To Poor Reported Braking Action									
MAX MANUAL	9840	150/-150	320	-550/2010	860/-560	270/-270	330	0	3030
AUTOBRAKE MAX	9850	150/-150	330	-550/2010	870/-570	280/-280	330	0	3040
AUTOBRAKE 3	9980	150/-160	330	-550/2020	830/-480	280/-280	390	0	3010
Poor Reported Braking Action									
MAX MANUAL	11290	170/-180	380	-670/2510	1240/-760	320/-320	350	0	4360
AUTOBRAKE MAX	11320	180/-180	390	-670/2510	1260/-770	320/-320	350	0	4370
AUTOBRAKE 3	11320	180/-180	390	-670/2510	1260/-740	320/-320	380	0	4370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3970	80/-40	80	-140/470	50/-50	80/-80	150	0	100
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8220	140/-120	220	-380/1290	0/0	230/-230	450	0	0
Good Reported Braking Action									
MAX MANUAL	5680	90/-70	140	-250/860	170/-140	140/-140	220	0	490
AUTOBRAKE MAX	5770	90/-70	150	-250/870	150/-130	140/-140	240	0	500
AUTOBRAKE 2	8220	140/-120	220	-380/1290	0/0	230/-230	450	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6810	110/-90	190	-330/1170	310/-240	180/-180	260	0	1020
AUTOBRAKE MAX	6850	110/-90	200	-330/1170	310/-240	180/-180	270	0	1030
AUTOBRAKE 2	8420	150/-120	240	-410/1420	140/-70	240/-240	450	0	550
Medium Reported Braking Action									
MAX MANUAL	7940	130/-110	240	-410/1470	450/-340	210/-210	290	0	1550
AUTOBRAKE MAX	7930	130/-110	240	-410/1470	460/-350	210/-210	300	0	1550
AUTOBRAKE 3	8080	140/-120	240	-410/1480	420/-230	220/-220	370	0	1560
Medium To Poor Reported Braking Action									
MAX MANUAL	9320	160/-140	300	-530/1960	830/-540	260/-260	320	0	2770
AUTOBRAKE MAX	9320	160/-140	300	-530/1970	840/-550	260/-260	330	0	2780
AUTOBRAKE 3	9400	170/-140	300	-530/1970	820/-480	260/-260	370	0	2780
Poor Reported Braking Action									
MAX MANUAL	10690	190/-160	360	-650/2450	1200/-730	300/-300	350	0	3990
AUTOBRAKE MAX	10710	190/-160	360	-650/2460	1220/-740	300/-300	350	0	4000
AUTOBRAKE 3	10710	200/-160	360	-650/2460	1220/-720	300/-300	360	0	4000

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5110	100/-50	110	-170/570	80/-70	110/-110	210	0	190
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	10070	160/-140	280	-430/1450	0/0	290/-290	510	0	0
Good Reported Braking Action									
MAX MANUAL	7370	110/-90	200	-300/1010	240/-200	190/-190	300	0	850
AUTOBRAKE MAX	7240	110/-90	200	-290/1000	260/-190	190/-190	310	0	820
AUTOBRAKE 2	10070	160/-140	280	-430/1450	0/0	290/-290	510	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	8820	140/-120	260	-390/1350	430/-340	240/-240	340	0	1710
AUTOBRAKE MAX	8730	140/-120	270	-390/1350	460/-350	240/-240	350	0	1680
AUTOBRAKE 2	10360	170/-140	300	-470/1590	240/-100	300/-300	510	0	1120
Medium Reported Braking Action									
MAX MANUAL	10260	170/-140	320	-480/1690	620/-470	280/-280	380	0	2560
AUTOBRAKE MAX	10210	170/-140	330	-480/1690	650/-500	280/-280	380	0	2540
AUTOBRAKE 3	10240	170/-150	330	-480/1690	640/-420	290/-290	400	0	2550
Medium To Poor Reported Braking Action									
MAX MANUAL	11970	210/-180	400	-620/2230	1090/-710	340/-340	410	0	4460
AUTOBRAKE MAX	11950	210/-180	410	-620/2230	1130/-740	340/-340	410	0	4460
AUTOBRAKE 3	11970	210/-180	410	-620/2230	1120/-700	350/-350	420	0	4460
Poor Reported Braking Action									
MAX MANUAL	13670	240/-210	480	-750/2760	1560/-950	390/-390	440	0	6360
AUTOBRAKE MAX	13690	250/-210	490	-750/2760	1600/-980	400/-400	440	0	6370
AUTOBRAKE 3	13690	250/-210	490	-750/2760	1600/-980	400/-400	440	0	6370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+R (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5510	100/-60	130	-200/670	120/-100	130/-130	230	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8760	120/-100	240	-380/1300	440/-350	240/-240	370	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	11280	160/-140	330	-540/1880	980/-670	330/-330	440	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	13800	200/-170	410	-700/2450	1520/-990	420/-420	510	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	17750	250/-200	550	-1010/3660	4490/-1810	560/-560	570	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	21700	290/-230	680	-1310/4860	7450/-2620	690/-690	630	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4530	60/-50	100	-160/560	70/-70	100/-100	170	0	180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6520	80/-90	180	-290/1010	220/-190	160/-160	240	0	740
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7760	110/-110	230	-380/1360	410/-310	200/-200	280	0	1440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	9000	130/-130	280	-470/1700	590/-430	240/-240	310	0	2130
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10460	160/-160	350	-600/2260	1090/-660	290/-290	330	0	3670
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11910	190/-190	410	-730/2820	1590/-880	330/-330	350	0	5210
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4310	60/-50	90	-160/540	70/-60	90/-90	160	0	160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6110	90/-80	160	-280/970	210/-170	150/-150	230	0	640
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7240	120/-100	210	-370/1310	380/-290	190/-190	260	0	1240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8370	140/-120	250	-450/1640	540/-400	220/-220	290	0	1840
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9700	170/-150	310	-580/2180	1010/-610	260/-260	310	0	3160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11020	200/-170	370	-700/2720	1480/-810	300/-300	330	0	4470
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6200	80/-70	150	-230/770	140/-130	150/-150	260	0	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8890	140/-120	260	-390/1340	410/-330	240/-240	350	0	1610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	10490	180/-150	340	-500/1770	710/-520	290/-290	390	0	2950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	12090	210/-180	410	-610/2200	1010/-700	340/-340	420	0	4290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	13900	250/-220	500	-780/2890	1920/-1020	400/-400	450	0	7180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	15700	290/-250	580	-940/3570	2820/-1330	450/-450	470	0	10060
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
NAV AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good Reported Braking Action									
MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130
Medium Reported Braking Action									
MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680
Poor Reported Braking Action									
MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4410	80/-40	80	-150/490	50/-40	80/-80	150	60	140
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8760	120/-130	250	-390/1330	70/-130	240/-240	360	140	140
Good Reported Braking Action									
MAX MANUAL	5860	70/-70	140	-240/820	130/-110	130/-130	200	300	700
AUTOBRAKE MAX	5840	70/-70	140	-240/820	140/-120	130/-130	210	300	690
AUTOBRAKE 2	8760	120/-130	250	-390/1330	80/-130	240/-240	360	140	140
Good To Medium Reported Braking Action									
MAX MANUAL	6700	90/-90	180	-300/1060	210/-180	160/-160	220	570	1430
AUTOBRAKE MAX	6690	90/-90	180	-300/1060	230/-190	160/-160	230	570	1420
AUTOBRAKE 2	8900	120/-130	260	-410/1410	150/-180	240/-240	360	250	610
Medium Reported Braking Action									
MAX MANUAL	7540	100/-100	210	-360/1290	290/-240	180/-180	240	830	2160
AUTOBRAKE MAX	7540	100/-100	220	-360/1290	310/-250	180/-180	250	830	2150
AUTOBRAKE 3	8320	110/-110	230	-390/1380	190/-140	220/-220	390	350	1440
Medium To Poor Reported Braking Action									
MAX MANUAL	8420	120/-120	260	-440/1610	460/-340	210/-210	260	1300	3710
AUTOBRAKE MAX	8440	130/-120	260	-440/1620	480/-350	210/-210	260	1300	3710
AUTOBRAKE 3	8930	130/-130	260	-460/1670	390/-270	240/-240	370	970	3260
Poor Reported Braking Action									
MAX MANUAL	9300	140/-140	300	-510/1930	620/-430	230/-230	270	1760	5250
AUTOBRAKE MAX	9340	150/-140	300	-510/1940	640/-450	240/-240	270	1770	5260
AUTOBRAKE 3	9540	140/-140	290	-520/1960	580/-390	250/-250	340	1580	5070

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4220	80/-40	80	-140/480	50/-40	80/-80	150	60	120
AUTOBRAKE MAX	4860	70/-60	110	-180/620	10/0	110/-110	230	0	0
AUTOBRAKE 2	8150	140/-120	230	-380/1280	40/-100	220/-220	360	70	70
Good Reported Braking Action									
MAX MANUAL	5570	80/-60	130	-230/800	120/-110	120/-120	200	270	620
AUTOBRAKE MAX	5540	80/-60	130	-230/800	130/-120	120/-120	210	260	610
AUTOBRAKE 2	8150	140/-120	230	-380/1280	50/-100	220/-220	360	70	70
Good To Medium Reported Braking Action									
MAX MANUAL	6350	100/-80	170	-290/1030	200/-170	150/-150	220	510	1270
AUTOBRAKE MAX	6340	100/-80	170	-290/1030	220/-180	150/-150	230	510	1260
AUTOBRAKE 2	8280	140/-120	240	-400/1360	120/-150	220/-220	360	170	510
Medium Reported Braking Action									
MAX MANUAL	7130	110/-100	200	-350/1260	280/-220	170/-170	240	750	1920
AUTOBRAKE MAX	7130	110/-100	200	-350/1260	300/-240	170/-170	240	750	1910
AUTOBRAKE 3	7720	120/-100	210	-370/1330	190/-120	200/-200	380	340	1360
Medium To Poor Reported Braking Action									
MAX MANUAL	7950	130/-120	240	-430/1580	440/-320	200/-200	260	1180	3310
AUTOBRAKE MAX	7970	130/-120	240	-430/1580	460/-340	200/-200	260	1180	3310
AUTOBRAKE 3	8320	140/-120	240	-440/1620	390/-240	220/-220	360	920	2980
Poor Reported Braking Action									
MAX MANUAL	8770	150/-130	270	-500/1890	600/-410	220/-220	270	1600	4700
AUTOBRAKE MAX	8810	150/-130	280	-500/1890	620/-430	220/-220	270	1600	4700
AUTOBRAKE 3	8920	150/-130	270	-500/1910	580/-360	230/-230	340	1490	4590

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4680	140/-50	100	-150/500	50/-50	100/-100	130	130	290
AUTOBRAKE MAX	6530	80/-70	160	-230/740	0/0	160/-170	260	0	0
AUTOBRAKE 2	10740	170/-160	350	-440/1480	230/-260	300/-300	300	920	940
Good Reported Braking Action									
MAX MANUAL	6560	90/-80	180	-250/860	150/-130	160/-160	180	520	1240
AUTOBRAKE MAX	6820	90/-80	180	-260/880	80/-60	170/-170	260	370	1110
AUTOBRAKE 2	10740	170/-160	350	-440/1480	230/-260	300/-300	300	920	940
Good To Medium Reported Braking Action									
MAX MANUAL	7620	120/-100	230	-320/1110	240/-200	200/-200	210	920	2390
AUTOBRAKE MAX	7670	120/-100	230	-320/1120	200/-160	200/-200	260	830	2280
AUTOBRAKE 2	10820	180/-160	350	-460/1550	280/-290	310/-310	300	1020	1530
Medium Reported Braking Action									
MAX MANUAL	8680	140/-120	280	-380/1360	330/-270	230/-230	230	1320	3530
AUTOBRAKE MAX	8520	140/-120	270	-380/1350	320/-250	220/-220	250	1280	3440
AUTOBRAKE 3	10280	160/-140	310	-440/1540	220/-230	280/-280	340	630	2130
Medium To Poor Reported Braking Action									
MAX MANUAL	9750	170/-150	330	-470/1710	520/-380	260/-260	250	1970	5860
AUTOBRAKE MAX	9570	170/-140	330	-460/1690	510/-380	260/-260	260	1930	5740
AUTOBRAKE 3	10800	180/-160	350	-500/1820	410/-340	300/-300	340	1350	4840
Poor Reported Braking Action									
MAX MANUAL	10820	190/-170	380	-550/2050	700/-490	290/-290	270	2620	8180
AUTOBRAKE MAX	10620	190/-160	380	-540/2030	700/-500	290/-290	270	2570	8040
AUTOBRAKE 3	11310	190/-170	390	-560/2100	600/-450	310/-310	330	2070	7550

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH UP AUTHORITY (Flaps ≥ 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4230	100/-40	90	-140/470	50/-40	90/-90	130	100	220
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500
Good Reported Braking Action									
MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	410	960
AUTOBRAKE MAX	6080	90/-70	160	-240/830	110/-70	150/-150	240	410	1000
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500
Good To Medium Reported Braking Action									
MAX MANUAL	6800	110/-90	200	-300/1060	220/-190	170/-170	210	740	1870
AUTOBRAKE MAX	6900	110/-90	200	-300/1070	220/-150	180/-180	250	730	1880
AUTOBRAKE 2	9620	160/-150	300	-430/1470	210/-250	270/-270	300	600	1030
Medium Reported Braking Action									
MAX MANUAL	7730	130/-110	240	-360/1300	310/-250	200/-200	230	1060	2770
AUTOBRAKE MAX	7720	130/-110	240	-360/1300	320/-230	200/-200	260	1050	2750
AUTOBRAKE 3	9070	150/-130	260	-410/1450	170/-180	250/-250	350	460	1760
Medium To Poor Reported Braking Action									
MAX MANUAL	8690	160/-130	290	-440/1640	490/-360	230/-230	250	1610	4620
AUTOBRAKE MAX	8690	160/-130	290	-440/1640	500/-350	230/-230	270	1600	4610
AUTOBRAKE 3	9600	170/-150	300	-480/1730	360/-290	260/-270	350	1130	3960
Poor Reported Braking Action									
MAX MANUAL	9650	180/-150	330	-520/1970	660/-460	260/-260	270	2150	6470
AUTOBRAKE MAX	9660	180/-150	330	-520/1970	670/-470	260/-260	270	2150	6470
AUTOBRAKE 3	10120	180/-160	330	-540/2010	550/-400	270/-280	340	1800	6160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PRI FLIGHT COMPUTERS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good Reported Braking Action									
MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130
Medium Reported Braking Action									
MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680
Poor Reported Braking Action									
MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SLATS DRIVE (Flaps 20)
VREF30 + 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4500	120/-40	100	-140/490	50/-50	90/-100	130	120	260
AUTOBRAKE MAX	6230	80/-70	150	-220/720	0/0	150/-150	260	0	0
AUTOBRAKE 2	10250	170/-150	320	-430/1450	220/-240	290/-290	310	730	740
Good Reported Braking Action									
MAX MANUAL	6270	90/-80	170	-240/850	140/-130	150/-150	190	460	1090
AUTOBRAKE MAX	6580	90/-80	170	-250/870	100/-70	160/-160	260	420	1090
AUTOBRAKE 2	10250	170/-150	320	-430/1450	220/-240	290/-290	310	730	740
Good To Medium Reported Braking Action									
MAX MANUAL	7270	110/-100	220	-310/1100	240/-200	180/-190	220	820	2080
AUTOBRAKE MAX	7440	120/-100	220	-320/1110	210/-160	190/-190	260	800	2080
AUTOBRAKE 2	10330	170/-160	330	-450/1520	270/-270	290/-290	310	830	1300
Medium Reported Braking Action									
MAX MANUAL	8260	130/-120	260	-380/1340	330/-270	210/-220	240	1170	3060
AUTOBRAKE MAX	8290	140/-120	260	-380/1340	320/-250	220/-220	260	1170	3060
AUTOBRAKE 3	9840	150/-140	290	-430/1500	210/-230	270/-270	320	570	1930
Medium To Poor Reported Braking Action									
MAX MANUAL	9280	160/-140	310	-460/1680	510/-380	250/-250	260	1750	5050
AUTOBRAKE MAX	9300	170/-140	310	-460/1680	510/-370	250/-250	270	1750	5050
AUTOBRAKE 3	10370	170/-160	330	-500/1790	410/-350	290/-290	320	1240	4290
Poor Reported Braking Action									
MAX MANUAL	10300	190/-160	360	-540/2020	690/-480	280/-280	270	2330	7030
AUTOBRAKE MAX	10310	190/-160	360	-540/2020	700/-490	280/-280	270	2330	7040
AUTOBRAKE 3	10900	190/-170	370	-560/2070	600/-460	300/-300	320	1910	6640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4010	70/-40	80	-130/460	50/-40	80/-80	130	90	200
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8700	120/-130	260	-390/1330	80/-170	240/-240	340	210	210
Good Reported Braking Action									
MAX MANUAL	5510	70/-70	140	-230/790	130/-110	130/-130	190	380	890
AUTOBRAKE MAX	5640	70/-70	140	-230/810	120/-100	130/-130	210	390	930
AUTOBRAKE 2	8700	120/-130	260	-390/1330	80/-170	240/-240	340	210	210
Good To Medium Reported Braking Action									
MAX MANUAL	6370	90/-90	180	-290/1030	220/-180	160/-160	220	680	1740
AUTOBRAKE MAX	6440	90/-90	180	-290/1040	220/-180	160/-160	230	690	1760
AUTOBRAKE 2	8780	130/-140	260	-410/1400	140/-200	240/-240	340	320	790
Medium Reported Braking Action									
MAX MANUAL	7230	110/-110	220	-350/1270	300/-240	180/-180	240	980	2580
AUTOBRAKE MAX	7240	110/-110	220	-350/1270	310/-250	180/-180	240	980	2580
AUTOBRAKE 3	8150	110/-120	230	-390/1370	150/-110	220/-220	380	430	1890
Medium To Poor Reported Braking Action									
MAX MANUAL	8130	130/-130	260	-430/1600	470/-340	210/-210	260	1500	4330
AUTOBRAKE MAX	8140	130/-130	270	-430/1600	490/-360	210/-210	260	1500	4340
AUTOBRAKE 3	8690	130/-140	270	-450/1660	370/-230	240/-240	380	1150	3920
Poor Reported Braking Action									
MAX MANUAL	9030	150/-150	300	-510/1920	640/-440	230/-230	270	2010	6080
AUTOBRAKE MAX	9040	150/-150	310	-510/1920	660/-460	240/-240	270	2010	6090
AUTOBRAKE 3	9230	150/-150	300	-510/1940	590/-340	250/-250	370	1860	5950

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3840	70/-40	80	-130/440	40/-40	70/-70	130	80	180
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8090	140/-120	230	-380/1280	60/-140	220/-220	330	130	130
Good Reported Braking Action									
MAX MANUAL	5230	80/-60	130	-220/770	120/-110	120/-120	190	340	800
AUTOBRAKE MAX	5340	80/-70	130	-220/780	110/-100	120/-120	210	350	830
AUTOBRAKE 2	8090	140/-120	230	-380/1280	60/-140	220/-220	330	130	130
Good To Medium Reported Braking Action									
MAX MANUAL	6040	100/-80	170	-280/1010	210/-170	150/-150	210	620	1560
AUTOBRAKE MAX	6090	100/-90	170	-280/1010	210/-170	150/-150	230	620	1570
AUTOBRAKE 2	8180	140/-120	240	-390/1350	110/-170	220/-220	330	230	680
Medium Reported Braking Action									
MAX MANUAL	6840	110/-100	200	-340/1240	290/-230	170/-170	230	890	2310
AUTOBRAKE MAX	6840	110/-100	200	-340/1240	300/-240	170/-170	240	880	2300
AUTOBRAKE 3	7570	130/-100	210	-370/1320	150/-100	200/-200	370	420	1770
Medium To Poor Reported Braking Action									
MAX MANUAL	7680	140/-120	240	-420/1560	460/-330	200/-200	250	1360	3870
AUTOBRAKE MAX	7690	140/-120	240	-420/1560	470/-340	200/-200	260	1350	3870
AUTOBRAKE 3	8110	150/-120	250	-440/1610	370/-220	220/-220	370	1080	3570
Poor Reported Braking Action									
MAX MANUAL	8510	160/-130	280	-490/1880	620/-420	220/-220	270	1820	5430
AUTOBRAKE MAX	8530	160/-140	280	-490/1880	630/-430	220/-220	270	1820	5440
AUTOBRAKE 3	8640	160/-130	280	-500/1890	580/-330	230/-230	360	1730	5360

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

STABILIZER (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4230	100/-40	90	-140/470	50/-40	90/-90	130	100	220
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500
Good Reported Braking Action									
MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	410	960
AUTOBRAKE MAX	6080	90/-70	160	-240/830	110/-70	150/-150	240	410	1000
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500
Good To Medium Reported Braking Action									
MAX MANUAL	6800	110/-90	200	-300/1060	220/-190	170/-170	210	740	1870
AUTOBRAKE MAX	6900	110/-90	200	-300/1070	220/-150	180/-180	250	730	1880
AUTOBRAKE 2	9620	160/-150	300	-430/1470	210/-250	270/-270	300	600	1030
Medium Reported Braking Action									
MAX MANUAL	7730	130/-110	240	-360/1300	310/-250	200/-200	230	1060	2770
AUTOBRAKE MAX	7720	130/-110	240	-360/1300	320/-230	200/-200	260	1050	2750
AUTOBRAKE 3	9070	150/-130	260	-410/1450	170/-180	250/-250	350	460	1760
Medium To Poor Reported Braking Action									
MAX MANUAL	8690	160/-130	290	-440/1640	490/-360	230/-230	250	1610	4620
AUTOBRAKE MAX	8690	160/-130	290	-440/1640	500/-350	230/-230	270	1600	4610
AUTOBRAKE 3	9600	170/-150	300	-480/1730	360/-290	260/-270	350	1130	3960
Poor Reported Braking Action									
MAX MANUAL	9650	180/-150	330	-520/1970	660/-460	260/-260	270	2150	6470
AUTOBRAKE MAX	9660	180/-150	330	-520/1970	670/-470	260/-260	270	2150	6470
AUTOBRAKE 3	10120	180/-160	330	-540/2010	550/-400	270/-280	340	1800	6160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)							
		AIRPORT PRESSURE ALTITUDE (FT)							
°C	°F	-2000	0	2000	4000	6000	8000	9000	9800
54	129	672.3	628.0						
52	126	690.0	643.1						
50	122	707.8	659.3	605.6					
48	118	725.5	677.8	619.9					
46	115	743.7	696.5	635.4	585.0				
44	111	761.0	714.1	652.5	600.2				
42	108	777.3	732.3	671.6	614.6	563.6			
40	104	793.0	750.7	689.9	629.6	576.5			
38	100	809.0	769.5	707.1	644.2	589.2	523.7		
36	97	823.4	785.6	722.9	658.1	600.0	534.2	502.7	
34	93	834.9	801.0	739.6	671.9	609.6	544.6	512.6	489.6
32	90	835.0	816.7	753.4	684.7	618.5	554.2	522.5	499.3
30	86	835.0	830.3	765.2	699.0	627.8	562.5	531.8	509.0
28	82	835.0	830.6	775.5	709.9	638.0	570.7	539.9	517.9
26	79	835.0	830.8	787.4	718.4	648.3	578.8	547.8	525.4
24	75	835.0	831.0	787.5	725.5	659.0	587.6	555.5	533.1
22	72	835.0	831.2	787.7	732.4	666.4	596.9	563.5	540.4
20	68	835.0	831.5	787.8	732.6	671.0	604.8	572.3	548.7
18	64	835.0	831.6	788.0	732.8	675.5	610.3	580.0	556.9
16	61	835.0	831.8	788.2	732.9	675.6	614.2	585.3	563.9
14	57	835.0	831.9	788.4	733.1	675.8	617.6	588.9	568.4
12	54	835.0	832.1	788.5	733.3	675.9	617.8	590.8	571.7
10	50	835.0	832.1	788.7	733.4	675.9	617.9	591.9	574.1
8	46	835.0	832.2	788.9	733.6	676.0	617.9	591.9	574.1
6	43	835.0	832.3	788.9	733.7	676.0	617.8	587.1	561.7
4	40	835.0	832.4	781.7	706.6	645.9	570.9	535.1	509.7
2	36	835.0	832.4	781.9	706.7	646.0	570.9	535.3	509.9
0	32	835.0	832.5	781.9	706.8	646.1	571.0	535.3	509.9
-40	-40	835.0	832.7	781.9	706.8	646.1	571.1	535.3	509.9

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.
With engine bleed for packs off, increase weight by 2800 lb.
With engine and wing anti-ice on, decrease weight by 4800 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 48400 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)							
		AIRPORT PRESSURE ALTITUDE (FT)							
°C	°F	-2000	0	2000	4000	6000	8000	9000	9800
54	129	680.0	637.9						
52	126	695.9	653.6						
50	122	712.4	668.9	615.7					
48	118	729.4	684.9	630.1					
46	115	746.7	701.5	645.6	594.1				
44	111	763.5	718.1	662.4	609.4				
42	108	779.7	735.6	679.3	624.3	572.7			
40	104	795.5	753.2	695.5	639.7	586.1			
38	100	811.6	771.9	711.8	655.4	599.2	533.2		
36	97	826.3	788.0	727.2	668.7	611.1	543.8	511.5	
34	93	835.0	803.5	743.1	681.2	620.9	554.2	521.6	498.5
32	90	835.0	819.5	756.3	692.2	630.5	564.5	531.5	508.2
30	86	835.0	833.3	767.7	705.0	639.8	573.1	541.7	517.9
28	82	835.0	833.5	778.2	715.2	650.4	581.7	550.1	527.3
26	79	835.0	833.7	790.3	723.4	660.6	589.8	558.2	535.3
24	75	835.0	834.0	790.5	730.1	670.3	598.7	566.1	543.2
22	72	835.0	834.2	790.6	736.7	676.8	608.2	574.3	550.5
20	68	835.0	834.4	790.8	736.9	680.7	616.4	583.6	559.3
18	64	835.0	834.6	791.0	737.0	684.6	622.2	591.3	567.7
16	61	835.0	834.7	791.2	737.2	684.7	626.3	596.8	575.0
14	57	835.0	834.9	791.3	737.4	684.8	629.8	600.5	579.6
12	54	835.0	835.0	791.5	737.5	684.9	630.0	602.5	583.1
10	50	835.0	835.0	791.7	737.7	685.0	630.1	603.8	585.5
8	46	835.0	835.0	791.8	737.9	685.1	630.1	604.1	585.5
6	40	835.0	835.0	791.9	738.0	685.2	630.0	604.1	585.5
4	36	835.0	835.0	792.0	738.1	685.2	618.9	581.6	554.7
2	36	835.0	835.0	792.1	738.2	685.3	619.0	581.8	554.9
0	32	835.0	835.0	792.1	738.2	685.4	619.0	581.8	554.9
-40	-40	835.0	835.0	792.4	738.4	685.8	619.3	582.0	555.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.
With engine bleed for packs off, increase weight by 3100 lb.
With engine and wing anti-ice on, decrease weight by 4000 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 49000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT	OAT	PRESSURE ALTITUDE (1000 FT)																	
(1000 LB)	(°C)	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
780	0	21.8	24.3	27.4	32.5	36.7	41.9	45.4	51.9	59.7	59.5	68.4	79.1	74.6	86.1	99.7	90.2	104.1	119.9
	10	22.4	25.0	28.2	33.4	37.8	43.1	46.8	53.6	61.6	61.4	70.6	81.6	77.0	88.8	102.7	93.1	107.2	123.6
	15	22.8	25.5	28.7	34.0	38.5	43.9	47.7	54.5	62.7	62.5	71.9	83.0	78.3	90.3	104.4	94.7	109.0	125.6
	20	23.2	25.9	29.2	34.7	39.2	44.7	48.5	55.5	63.8	63.5	73.1	84.4	79.7	91.9	106.1	96.2	110.8	127.5
	30	23.8	26.6	29.9	35.5	40.2	45.9	49.8	57.0	65.5	65.3	75.1	86.8	81.9	94.4	109.0	98.9	113.7	130.8
	40	23.9	26.8	30.2	35.9	40.7	46.5	50.6	57.9	66.7	66.4	76.5	88.5	83.4	96.3	111.2	100.8	116.0	133.2
740	0	21.0	23.3	26.2	31.1	35.2	40.0	43.5	49.6	57.0	56.8	65.4	75.5	71.3	82.3	95.2	86.3	99.6	115.2
	10	21.5	24.0	27.0	32.0	36.2	41.2	44.8	51.2	58.8	58.6	67.4	77.9	73.6	84.9	98.2	89.1	102.7	118.5
	15	21.9	24.4	27.5	32.6	36.9	42.0	45.6	52.1	59.9	59.7	68.6	79.2	74.9	86.4	99.9	90.6	104.4	120.4
	20	22.3	24.9	28.0	33.2	37.5	42.7	46.4	53.0	60.9	60.7	69.8	80.6	76.2	87.8	101.5	92.1	106.1	122.3
	30	22.8	25.4	28.6	34.0	38.5	43.8	47.6	54.4	62.6	62.4	71.7	82.8	78.3	90.2	104.3	94.7	109.0	125.5
	40	23.0	25.6	28.9	34.4	38.9	44.4	48.3	55.3	63.6	63.4	73.1	84.4	79.7	92.0	106.3	96.5	111.1	127.9
700	0	20.1	22.3	25.1	29.8	33.6	38.2	41.5	47.3	54.3	54.2	62.2	71.8	68.0	78.4	90.7	82.4	95.1	110.0
	10	20.6	23.0	25.8	30.6	34.6	39.3	42.8	48.8	56.0	55.9	64.2	74.1	70.1	80.9	93.6	85.0	98.0	113.2
	15	21.0	23.4	26.3	31.2	35.2	40.0	43.6	49.7	57.0	56.9	65.4	75.4	71.4	82.3	95.2	86.4	99.7	115.1
	20	21.4	23.8	26.7	31.8	35.8	40.8	44.3	50.6	58.0	57.9	66.5	76.7	72.6	83.7	96.7	87.9	101.3	116.9
	30	21.9	24.4	27.4	32.5	36.7	41.8	45.5	51.9	59.6	59.5	68.3	78.8	74.6	86.0	99.4	90.3	104.1	120.0
	40	22.0	24.5	27.6	32.9	37.2	42.3	46.1	52.7	60.6	60.5	69.5	80.3	76.0	87.7	101.4	92.1	106.2	122.3
620	0	18.4	20.4	22.8	27.1	30.5	34.5	37.6	42.7	48.9	48.8	56.0	64.4	61.2	70.4	81.4	74.1	85.6	99.0
	10	18.9	21.0	23.5	27.9	31.3	35.6	38.7	44.0	50.4	50.4	57.7	66.5	63.1	72.7	84.0	76.5	88.3	102.1
	15	19.3	21.4	23.9	28.4	31.9	36.2	39.4	44.8	51.3	51.3	58.8	67.7	64.2	74.0	85.5	77.8	89.8	103.8
	20	19.6	21.7	24.3	28.9	32.5	36.8	40.1	45.6	52.2	52.2	59.8	68.8	65.4	75.2	86.9	79.2	91.3	105.5
	30	20.0	22.2	24.9	29.6	33.3	37.8	41.1	46.8	53.6	53.6	61.4	70.7	67.1	77.3	89.3	81.4	93.8	108.3
	40	20.1	22.3	25.1	29.9	33.6	38.2	41.7	47.5	54.4	54.4	62.4	72.0	68.3	78.8	91.1	82.9	95.7	110.5
540	0	16.8	18.5	20.7	24.4	27.4	30.9	33.6	38.1	43.4	43.4	49.6	56.9	54.2	62.2	71.8	65.5	75.6	87.4
	10	17.2	19.0	21.2	25.1	28.1	31.8	34.6	39.2	44.7	44.8	51.1	58.7	55.9	64.2	74.1	67.6	78.0	90.2
	15	17.5	19.4	21.6	25.6	28.7	32.4	35.2	39.9	45.6	45.6	52.1	59.8	56.9	65.3	75.4	68.8	79.3	91.7
	20	17.8	19.7	22.0	26.0	29.2	33.0	35.9	40.6	46.4	46.4	53.0	60.8	57.9	66.5	76.7	70.0	80.7	93.2
	30	18.2	20.1	22.5	26.6	29.9	33.8	36.8	41.7	47.6	47.6	54.4	62.5	59.4	68.3	78.8	71.9	82.9	95.8
	40	18.3	20.2	22.6	26.9	30.2	34.1	37.2	42.2	48.3	48.3	55.2	63.6	60.4	69.5	80.3	73.3	84.5	97.7
460	0	15.2	16.7	18.5	21.8	24.3	27.3	29.6	33.4	38.0	37.9	43.1	49.4	47.0	53.8	61.9	56.6	65.1	75.1
	10	15.6	17.1	19.0	22.4	25.0	28.1	30.5	34.4	39.1	39.1	44.5	50.9	48.4	55.5	63.8	58.4	67.1	77.5
	15	15.9	17.4	19.4	22.8	25.4	28.7	31.0	35.0	39.8	39.8	45.3	51.8	49.3	56.5	65.0	59.4	68.3	78.9
	20	16.1	17.8	19.7	23.2	25.9	29.2	31.6	35.6	40.5	40.5	46.1	52.7	50.2	57.4	66.1	60.5	69.5	80.2
	30	16.5	18.1	20.2	23.7	26.5	29.9	32.4	36.5	41.6	41.5	47.3	54.1	51.5	59.0	67.9	62.1	71.4	82.5
	40	16.5	18.2	20.3	23.9	26.7	30.1	32.7	37.0	42.1	42.1	47.9	55.0	52.3	60.0	69.1	63.2	72.7	84.1
380	0	13.6	14.9	16.5	19.2	21.3	23.8	25.6	28.7	32.5	32.4	36.6	41.7	39.6	45.1	51.7	47.3	54.1	62.3
	10	14.0	15.3	16.9	19.7	21.8	24.5	26.3	29.6	33.5	33.3	37.7	43.0	40.8	46.5	53.3	48.8	55.8	64.3
	15	14.2	15.6	17.2	20.0	22.2	24.9	26.8	30.1	34.1	33.9	38.4	43.8	41.6	47.3	54.3	49.7	56.9	65.4
	20	14.5	15.8	17.5	20.4	22.6	25.4	27.3	30.6	34.7	34.5	39.1	44.6	42.3	48.2	55.2	50.5	57.8	66.6
	30	14.8	16.2	17.9	20.8	23.2	26.0	28.0	31.4	35.6	35.4	40.1	45.7	43.4	49.4	56.7	51.9	59.4	68.4
	40	14.8	16.2	18.0	20.9	23.3	26.2	28.2	31.7	36.0	35.8	40.6	46.4	44.0	50.2	57.6	52.7	60.4	69.6

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.
If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Event Adjusted Brake Energy (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	4.4	14.1	23.7	33.2	42.6	51.9	61.2	70.5	79.9	89.3	98.9	108.7
	MAX AUTO	4.4	13.1	21.7	30.2	38.7	47.3	56.0	65.0	74.3	83.9	94.0	104.6
	AUTOBRAKE 4	4.3	12.5	20.4	28.1	35.7	43.4	51.2	59.3	67.7	76.6	86.1	96.4
	AUTOBRAKE 3	4.2	11.9	19.2	26.3	33.3	40.3	47.4	54.8	62.6	70.8	79.7	89.3
	AUTOBRAKE 2	4.1	11.2	17.9	24.4	30.8	37.2	43.7	50.5	57.6	65.1	73.2	81.9
	AUTOBRAKE 1	4.0	10.3	16.3	22.1	27.8	33.4	39.1	45.1	51.3	58.0	65.1	72.9

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	3.3	12.0	21.0	30.0	38.9	47.5	56.1	64.5	72.8	81.0	89.2	97.5
	MAX AUTO	2.0	8.7	15.5	22.3	29.3	36.4	43.8	51.5	59.6	68.3	77.5	87.4
	AUTOBRAKE 4	1.4	5.6	10.4	15.6	20.9	26.4	32.2	38.3	44.8	51.9	59.6	68.0
	AUTOBRAKE 3	0.9	3.2	6.4	10.3	14.3	18.5	23.0	27.9	33.2	39.0	45.4	52.4
	AUTOBRAKE 2	0.3	1.8	4.0	6.5	9.3	12.3	15.6	19.2	23.3	27.9	33.0	38.7
	AUTOBRAKE 1	0.2	1.2	2.6	4.3	6.1	8.1	10.3	12.8	15.6	18.8	22.3	26.4

Cooling Time (Minutes)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
	16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
GEAR DOWN INFLIGHT	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE
GROUND		11	18	26	42	55	66	73		
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds for each taxi mile.
For one brake deactivated, increase brake energy by 10 percent.
For two brakes deactivated, increase brake energy by 20 percent.
When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 8 minutes.
When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.
Brake temperature monitor system (BTMS) indication on EICAS may be used 10 to 15 minutes after airplane has come to a complete stop, or inflight with gear retracted, to determine recommended cooling schedule. (When inflight with gear extended, the BTMS indications may vary between individual brakes, due to airstream effects.)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for one pack on and anti-ice off

TAT	PRESSURE ALTITUDE (1000 FT)								
(°C)	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	98.3	97.9	97.6
-5	98.4	99.9	101.2	101.3	100.5	100.2	99.7	99.3	98.8
-10	97.4	99.0	100.3	101.6	101.3	101.3	100.7	100.3	100.0
-15	96.5	98.1	99.3	100.6	101.0	102.0	101.1	100.8	100.5
-20	95.6	97.1	98.3	99.6	100.1	101.0	100.1	99.8	99.5
-25	94.6	96.1	97.4	98.6	99.1	100.0	99.1	98.8	98.5
-30	93.7	95.2	96.4	97.6	98.1	99.0	98.1	97.8	97.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	97.1	96.8	96.5
-40	91.7	93.2	94.4	95.6	96.0	96.9	96.1	95.8	95.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.86	94.3	95.4	96.4	97.4	98.4	99.5	100.5	101.4	101.2	100.2	98.9	97.7
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	102.0	100.6	99.1	98.0
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2
27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.2
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	37	35	33	31	29	27
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/I ON - PACKS OFF	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
25000 FT to 18000 FT Pressure Altitudes

25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3
18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100.0	100.9	101.8	102.0	100.6	99.4
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
16000 FT to 5000 FT Pressure Altitudes

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4
240	0.47	97.3	98.2	99.2	100.1	101.1	102.0	102.8	102.5	100.6	99.0	97.8	96.7
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8
10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	16	14	12	10	5
ENGINE A/I ON	-0.3	-0.2	-0.4	-0.5	-0.5
WING A/I ON - PACKS ON	-0.4	-0.5	-0.6	-0.7	-0.8
WING A/I ON - PACKS OFF	-0.6	-0.7	-0.8	-0.9	-1.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	758	298	18000	16800	15600
740	720	290	19300	18200	17000
700	682	283	20500	19600	18500
660	642	275	21700	20900	20000
620	601	267	23200	22200	21200
580	562	258	25000	24000	22800
540	524	249	27000	26100	24700
500	485	241	29100	28400	27000
460	448	231	30900	30500	29400
420	409	221	32600	32300	31700
380	369	211	34400	34300	34000

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
134	126	118	111	105	100	95	90	86	82	79
269	251	236	222	210	200	190	181	173	165	159
403	377	354	334	316	300	285	272	260	248	238
536	502	472	445	421	400	380	362	346	332	318
670	627	589	556	526	500	475	453	433	415	398
803	752	707	667	632	600	571	544	520	498	478
936	877	824	778	737	700	666	635	607	582	558
1068	1001	942	889	842	800	761	726	695	665	639
1201	1126	1059	1000	947	900	856	817	782	749	719
1333	1250	1176	1111	1052	1000	952	908	869	833	799
1466	1374	1293	1222	1157	1100	1047	1000	956	916	880
1598	1499	1411	1332	1262	1200	1142	1091	1043	1000	960
1731	1623	1528	1443	1368	1300	1238	1182	1131	1084	1040
1863	1747	1645	1554	1473	1400	1333	1273	1218	1167	1121
1996	1872	1762	1665	1578	1500	1428	1364	1305	1251	1201
2129	1997	1880	1776	1683	1600	1524	1455	1392	1334	1281
2262	2121	1997	1887	1788	1700	1619	1546	1479	1418	1361
2395	2246	2115	1998	1894	1800	1714	1637	1566	1501	1441

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)											TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)											
	380	420	460	500	540	580	620	660	700	740	780	
100	2.4	2.6	2.9	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.2	0:16
200	5.4	6.0	6.5	7.1	7.4	7.8	8.3	8.7	9.0	9.5	9.8	0:31
300	8.7	9.5	10.4	11.2	11.8	12.5	13.2	13.9	14.5	15.4	15.9	0:46
400	11.9	13.1	14.2	15.4	16.3	17.2	18.2	19.2	20.1	21.2	22.1	1:01
500	14.9	16.4	17.8	19.3	20.5	21.7	23.0	24.2	25.3	26.8	28.0	1:16
600	17.9	19.6	21.3	23.1	24.6	26.1	27.5	29.0	30.4	32.2	33.7	1:31
700	20.8	22.8	24.8	26.9	28.6	30.4	32.1	33.8	35.4	37.5	39.3	1:46
800	23.7	26.0	28.3	30.6	32.5	34.6	36.5	38.5	40.4	42.7	44.9	2:01
900	26.6	29.2	31.7	34.3	36.5	38.8	41.0	43.2	45.4	48.0	50.5	2:15
1000	29.5	32.3	35.1	37.9	40.4	42.9	45.4	47.9	50.3	53.2	56.0	2:30
1100	32.3	35.4	38.4	41.5	44.3	47.1	49.8	52.5	55.2	58.3	61.4	2:44
1200	35.1	38.5	41.8	45.1	48.1	51.2	54.1	57.1	60.1	63.5	66.8	2:59
1300	37.9	41.5	45.1	48.7	51.9	55.2	58.5	61.7	64.9	68.6	72.2	3:14
1400	40.7	44.6	48.4	52.2	55.7	59.3	62.8	66.2	69.7	73.6	77.5	3:28
1500	43.4	47.6	51.6	55.7	59.5	63.3	67.0	70.7	74.5	78.6	82.8	3:43
1600	46.1	50.5	54.9	59.2	63.2	67.3	71.3	75.2	79.2	83.6	88.1	3:58
1700	48.8	53.5	58.1	62.7	66.9	71.2	75.5	79.7	83.9	88.6	93.3	4:13
1800	51.5	56.4	61.2	66.1	70.6	75.2	79.6	84.1	88.6	93.5	98.5	4:27

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	15300	14000	12400
760	16000	14400	12900
740	16700	15200	13300
720	17500	16000	14200
700	18300	16800	15100
680	19100	17600	16000
660	20000	18500	16800
640	20500	19300	17700
620	21100	20100	18700
600	21700	20800	19700
580	22500	21400	20400
560	23400	22100	21100
540	24300	23100	21700
520	25400	24200	22600
500	26600	25300	23700
480	27900	26600	24900
460	29300	27900	26200
440	30400	29200	27600
420	31300	30400	29000
400	32200	31600	30400
380	33200	32700	31700
360	34200	33900	33000

With engine anti-ice on, no altitude capability adjustment is required.
With engine and wing anti-ice on, decrease altitude capability by 300 ft.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
780	%N1	91.3	96.8								
	MACH	.602	.664								
	KIAS	334	337								
	FF/ENG	22536	24156								
740	%N1	90.4	95.1	97.9							
	MACH	.602	.660	.678							
	KIAS	334	335	332							
	FF/ENG	21826	22989	23330							
700	%N1	89.4	93.5	95.6	98.8						
	MACH	.599	.649	.665	.684						
	KIAS	333	329	325	322						
	FF/ENG	21042	21608	21727	22025						
660	%N1	87.7	91.9	93.6	96.1						
	MACH	.583	.637	.653	.670						
	KIAS	324	323	319	315						
	FF/ENG	19683	20284	20323	20423						
620	%N1	85.9	90.2	91.9	93.6	96.5					
	MACH	.567	.621	.641	.657	.675					
	KIAS	315	315	313	309	305					
	FF/ENG	18411	18905	19032	19011	19194					
580	%N1	84.1	88.4	90.1	91.8	93.7	96.8				
	MACH	.551	.602	.625	.644	.661	.680				
	KIAS	306	305	305	302	298	295				
	FF/ENG	17177	17504	17683	17733	17760	18050				
540	%N1	82.1	86.3	88.2	89.9	91.6	93.7	97.0			
	MACH	.534	.582	.605	.627	.646	.663	.683			
	KIAS	296	294	295	294	292	288	285			
	FF/ENG	15983	16124	16312	16429	16476	16562	16922			
500	%N1	80.1	84.1	86.0	87.8	89.5	91.2	93.5	97.0		
	MACH	.516	.563	.583	.606	.629	.648	.665	.686		
	KIAS	286	284	284	284	284	281	277	274		
	FF/ENG	14812	14796	14951	15098	15202	15263	15363	15748		
460	%N1	77.9	81.8	83.6	85.5	87.2	88.9	90.7	93.1	96.7	
	MACH	.498	.543	.563	.583	.607	.630	.649	.666	.688	
	KIAS	276	274	273	273	273	272	270	266	264	
	FF/ENG	13638	13500	13643	13767	13886	13996	14052	14137	14531	
420	%N1	75.5	79.3	81.2	82.9	84.8	86.5	88.2	90.0	92.4	96.1
	MACH	.480	.521	.540	.560	.581	.605	.628	.648	.666	.688
	KIAS	266	263	262	262	261	261	261	258	255	252
	FF/ENG	12483	12254	12367	12495	12575	12676	12787	12829	12899	13288
380	%N1	73.1	76.7	78.5	80.3	82.0	83.8	85.6	87.3	89.1	91.5
	MACH	.462	.500	.517	.536	.556	.578	.601	.625	.646	.664
	KIAS	255	252	251	250	249	249	249	249	247	243
	FF/ENG	11350	11040	11139	11257	11323	11376	11460	11565	11610	11661
340	%N1	70.3	73.9	75.7	77.4	79.1	80.8	82.5	84.3	86.1	88.0
	MACH	.443	.478	.494	.511	.530	.550	.571	.594	.620	.642
	KIAS	245	240	239	238	237	236	236	236	236	234
	FF/ENG	10261	9890	9952	10062	10110	10131	10176	10235	10339	10404

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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
286	264	244	227	213	200	190	181	173	166	159
569	525	487	454	425	400	381	364	348	333	320
853	788	730	681	638	600	572	546	522	501	482
1138	1051	974	908	851	800	763	729	698	669	643
1424	1316	1219	1136	1064	1000	954	911	872	836	803
1711	1580	1464	1364	1278	1200	1144	1093	1046	1003	964
1999	1846	1709	1592	1491	1400	1335	1275	1220	1170	1124
2288	2111	1954	1820	1704	1600	1526	1457	1394	1337	1285
2578	2378	2201	2049	1918	1800	1717	1639	1568	1504	1445
2869	2646	2447	2278	2132	2000	1907	1821	1742	1670	1605

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	9.2	0:38	8.1	0:37	7.3	0:36	6.5	0:35	6.1	0:34
400	19.3	1:12	17.7	1:09	16.5	1:06	15.6	1:04	15.3	1:02
600	29.2	1:46	27.2	1:41	25.7	1:37	24.5	1:34	24.4	1:30
800	39.0	2:21	36.6	2:14	34.7	2:07	33.2	2:03	33.3	1:58
1000	48.7	2:56	45.9	2:47	43.7	2:38	41.9	2:33	42.1	2:26
1200	58.4	3:31	55.1	3:20	52.6	3:09	50.5	3:03	50.7	2:55
1400	67.9	4:06	64.2	3:53	61.4	3:41	59.0	3:33	59.2	3:24
1600	77.4	4:41	73.2	4:27	70.1	4:12	67.4	4:03	67.6	3:53
1800	86.8	5:17	82.1	5:01	78.6	4:44	75.6	4:33	75.8	4:22
2000	96.1	5:53	90.9	5:35	87.2	5:16	83.8	5:03	84.0	4:51

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	400	450	500	550	600	650	700	750	800
10	-1.7	-1.3	-0.8	-0.4	0.0	0.8	1.8	2.9	4.2
20	-3.7	-2.7	-1.8	-0.9	0.0	1.8	3.9	6.3	9.0
30	-5.7	-4.2	-2.7	-1.4	0.0	2.8	6.0	9.6	13.7
40	-7.7	-5.7	-3.7	-1.9	0.0	3.8	8.0	12.8	18.1
50	-9.8	-7.2	-4.7	-2.4	0.0	4.7	10.0	15.9	22.4
60	-11.8	-8.7	-5.7	-2.8	0.0	5.6	11.9	18.9	26.6
70	-13.9	-10.2	-6.7	-3.3	0.0	6.5	13.7	21.8	30.6
80	-15.9	-11.7	-7.7	-3.8	0.0	7.3	15.5	24.5	34.5
90	-18.0	-13.2	-8.7	-4.3	0.0	8.1	17.2	27.2	38.1
100	-20.1	-14.8	-9.7	-4.8	0.0	8.9	18.8	29.7	41.7

Includes APU fuel burn.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
800	%N1	81.3	84.8	89.5	94.9			
	KIAS	273	275	276	301			
	FF/ENG	20620	20800	21460	23060			
760	%N1	79.7	83.0	87.8	92.7			
	KIAS	266	268	269	285			
	FF/ENG	19500	19610	20160	21200			
720	%N1	78.2	81.2	86.1	90.8	99.6		
	KIAS	259	260	261	271	297		
	FF/ENG	18410	18460	18870	19520	22300		
680	%N1	76.5	79.4	84.3	88.9	96.1		
	KIAS	252	253	254	256	286		
	FF/ENG	17340	17340	17630	18000	20240		
640	%N1	74.7	77.7	82.3	87.1	92.7		
	KIAS	245	245	246	248	267		
	FF/ENG	16280	16250	16430	16710	18210		
600	%N1	72.9	75.8	80.2	85.1	90.3		
	KIAS	236	237	238	239	251		
	FF/ENG	15240	15180	15250	15440	16560		
560	%N1	70.9	73.8	78.1	83.0	88.0	96.0	
	KIAS	231	231	231	231	234	263	
	FF/ENG	14210	14140	14130	14260	15010	16930	
520	%N1	68.8	71.9	76.0	80.8	85.8	91.6	
	KIAS	225	225	225	225	225	243	
	FF/ENG	13210	13140	13070	13140	13740	14810	
480	%N1	66.7	69.6	73.8	78.3	83.5	88.4	98.4
	KIAS	220	220	220	220	220	224	245
	FF/ENG	12240	12170	12060	12090	12540	13170	15210
440	%N1	64.6	67.3	71.6	75.9	80.8	85.7	93.3
	KIAS	213	213	213	213	213	213	232
	FF/ENG	11280	11200	11070	11080	11390	11800	13060
400	%N1	62.4	65.0	69.1	73.4	78.1	83.2	88.3
	KIAS	207	207	207	207	207	207	209
	FF/ENG	10360	10250	10130	10120	10320	10640	11140
360	%N1	60.0	62.6	66.4	70.7	75.3	80.3	85.0
	KIAS	200	200	200	200	200	200	200
	FF/ENG	9480	9350	9220	9210	9310	9520	9830

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available
Flaps 20

TAT (°C)	RATE OF CLIMB (FT/MIN) PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	430	320					
50	480	370	210				
48	530	420	270				
46	570	470	320	160			
44	620	530	370	210			
42	670	570	410	250	90		
40	710	620	460	290	120		
38	740	670	510	330	150		
36	740	710	540	370	180	-20	
34	740	760	580	400	210	0	-190
32	750	760	610	440	240	30	-160
30	750	770	640	460	280	60	-130
20	770	780	650	510	350	170	-10
10	790	800	600	420	260	130	-300
0	810	810	590	360	130	-110	-320
-20	840	850	610	370	130	-110	-330
-40	880	880	640	390	140	-120	-340

Rate of climb capability shown is valid for 500000 lb, gear down at VREF20 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Flaps 25

TAT (°C)	RATE OF CLIMB (FT/MIN) PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	80	-20					
50	130	20	-130				
48	180	70	-80				
46	220	120	-30	-190			
44	260	170	20	-140			
42	310	210	60	-100	-270		
40	350	260	100	-60	-240		
38	380	300	140	-30	-210	-410	
36	380	340	170	0	-180	-380	
34	380	380	210	30	-150	-360	-550
32	380	390	240	70	-130	-330	-520
30	390	390	260	90	-90	-310	-500
20	400	400	270	130	-20	-210	-390
10	410	410	270	-10	-190	-350	-470
0	420	420	200	-20	-250	-480	-690
-20	440	440	210	-20	-250	-500	-720
-40	460	460	220	-20	-260	-520	-740

Rate of climb capability shown is valid for 500000 lb, gear down at VREF25 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available
Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-140	-250					
50	-100	-210	-360				
48	-60	-160	-320				
46	-10	-120	-270	-420			
44	30	-70	-220	-380			
42	70	-30	-180	-340	-500		
40	100	20	-150	-310	-470		
38	140	60	-110	-280	-450		
36	140	100	-70	-250	-420	-620	
34	140	130	-40	-210	-400	-600	-780
32	140	150	-10	-180	-370	-580	-760
30	140	150	10	-160	-340	-550	-740
20	150	150	20	-120	-270	-460	-640
10	160	160	0	-150	-300	-660	-800
0	160	160	-50	-270	-500	-730	-940
-20	170	170	-60	-280	-510	-750	-970
-40	180	170	-60	-300	-530	-780	-1010

Rate of climb capability shown is valid for 500000 lb, gear down at VREF30 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Alternate Mode EEC Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	9800
55	131	94.3	96.7	97.0	96.7	96.5	96.6	96.4	96.3	96.1	95.5	94.6	93.7	93.0
50	122	95.7	98.1	98.6	98.2	97.9	97.9	97.8	97.6	97.4	96.8	95.9	95.1	94.4
45	113	97.2	99.6	100.1	99.8	99.4	99.3	99.1	98.9	98.8	98.2	97.3	96.4	95.7
40	104	98.9	101.2	101.9	101.4	101.0	100.8	100.6	100.4	100.0	99.4	98.6	97.7	97.0
35	95	100.9	102.7	104.7	104.2	103.1	102.6	102.1	101.7	101.1	100.4	99.6	98.9	98.3
30	86	100.5	103.7	106.9	106.4	105.6	105.0	104.3	103.7	102.6	101.5	100.7	99.9	99.3
25	77	99.7	102.8	106.0	106.7	107.3	107.2	106.7	106.5	105.3	103.8	102.4	101.0	100.3
20	68	98.8	101.9	105.1	105.8	106.4	106.8	107.1	107.5	106.8	105.9	104.8	103.5	102.4
15	59	98.0	101.1	104.2	104.9	105.5	105.8	106.2	106.5	106.4	106.1	105.6	104.9	104.4
10	50	97.1	100.2	103.3	104.0	104.6	104.9	105.3	105.6	105.5	105.2	104.9	104.6	104.5
5	41	96.3	99.3	102.4	103.0	103.7	104.0	104.3	104.7	104.5	104.2	104.0	103.7	103.6
0	32	95.4	98.4	101.4	102.1	102.7	103.1	103.4	103.7	103.6	103.3	103.0	102.7	102.7
-10	14	93.6	96.6	99.6	100.2	100.8	101.2	101.5	101.8	101.7	101.4	101.1	100.8	100.8
-20	-4	91.8	94.7	97.7	98.3	98.9	99.2	99.5	99.9	99.7	99.5	99.2	98.9	98.8
-30	-22	90.0	92.8	95.7	96.3	96.9	97.2	97.5	97.9	97.7	97.5	97.2	96.9	96.9
-40	-40	88.1	90.9	93.7	94.3	94.9	95.2	95.5	95.8	95.7	95.4	95.2	94.9	94.8
-50	-58	86.2	88.9	91.7	92.3	92.9	93.1	93.4	93.8	93.6	93.4	93.1	92.9	92.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)												
	-2	-1	0	1	2	3	4	5	6	7	8	9	9.8
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

220 KIAS Max Climb %N1

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	91.4	91.1	92.1	91.3	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.4	91.4	92.1	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	89.7	90.7	91.4	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	89.7	89.9	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.3	92.2	92.1	90.6	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.2	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.2	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

***Packs on or off with 2 bleed sources.**
****Packs off with 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18600	16600	14200
760	19100	17200	14800
740	19700	17900	15500
720	20200	18500	16100
700	21000	19400	17100
680	21900	20400	18200
660	22900	21500	19400
640	23900	22500	20600
620	25000	23500	21900
600	25900	24600	23000
580	27000	25700	24200
560	28000	27000	25400
540	29100	28200	26700
520	30100	29500	28000
500	30900	30500	29300
480	31600	31300	30500
460	32400	32200	31500
440	33300	33100	32600
420	34100	33900	33600
400	34900	34800	34600
380	35800	35700	35600
360	36700	36600	36400

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
800	%N1	84.9	89.2	91.3	93.9						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16879	17230	17550	18041						
760	%N1	84.0	88.3	90.3	92.5						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16350	16643	16893	17295						
720	%N1	83.2	87.5	89.4	91.4	94.2					
	MACH	.488	.535	.556	.578	.600					
	KIAS	270	270	270	270	270					
	FF/ENG	15899	16146	16324	16639	17073					
680	%N1	81.4	85.8	87.8	89.6	91.8					
	MACH	.475	.521	.542	.564	.587					
	KIAS	263	263	263	263	264					
	FF/ENG	14938	15104	15281	15498	15865					
640	%N1	79.5	83.9	86.0	87.8	89.7	92.1				
	MACH	.461	.506	.526	.548	.570	.594				
	KIAS	255	255	255	255	256	256				
	FF/ENG	13989	14087	14216	14393	14638	14997				
600	%N1	77.6	82.1	84.1	86.0	87.7	89.7	92.5			
	MACH	.447	.491	.511	.531	.553	.576	.600			
	KIAS	247	247	247	247	248	248	248			
	FF/ENG	13042	13113	13185	13337	13490	13756	14123			
560	%N1	75.5	80.0	82.0	84.0	85.8	87.6	89.6	92.7		
	MACH	.433	.475	.494	.514	.535	.557	.581	.606		
	KIAS	239	239	239	239	239	240	240	240		
	FF/ENG	12107	12162	12207	12291	12445	12584	12856	13237		
520	%N1	73.3	77.8	79.8	81.8	83.7	85.4	87.3	89.4	92.8	
	MACH	.418	.459	.477	.496	.516	.538	.560	.584	.610	
	KIAS	231	231	231	231	231	231	231	232	232	
	FF/ENG	11193	11213	11263	11306	11394	11539	11679	11939	12332	
480	%N1	71.1	75.5	77.4	79.4	81.3	83.2	85.0	86.8	89.1	92.8
	MACH	.402	.442	.459	.478	.497	.517	.539	.562	.587	.614
	KIAS	222	222	222	222	222	222	222	222	223	223
	FF/ENG	10294	10279	10324	10368	10407	10495	10627	10769	11006	11406
440	%N1	68.6	73.1	75.0	76.8	78.9	80.7	82.7	84.4	86.2	88.5
	MACH	.387	.425	.442	.460	.478	.498	.519	.540	.563	.588
	KIAS	213	213	213	213	213	213	213	213	213	214
	FF/ENG	9429	9422	9440	9486	9514	9547	9627	9739	9856	10065
400	%N1	66.5	71.0	72.8	74.7	76.7	78.7	80.4	82.3	84.0	85.9
	MACH	.375	.413	.429	.446	.465	.484	.504	.525	.548	.571
	KIAS	207	207	207	207	207	207	207	207	207	207
	FF/ENG	8736	8731	8729	8756	8786	8810	8845	8930	9028	9136
360	%N1	64.3	68.7	70.5	72.3	74.4	76.4	78.2	79.9	81.8	83.6
	MACH	.363	.399	.415	.432	.450	.468	.488	.508	.530	.553
	KIAS	200	200	200	200	200	200	200	200	200	200
	FF/ENG	8041	8029	8026	8031	8049	8072	8095	8137	8220	8303

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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
316	284	257	235	216	200	189	180	171	162	155
634	570	515	470	433	400	379	359	341	326	312
956	859	774	706	650	600	568	539	512	489	468
1282	1149	1035	943	867	800	757	718	683	651	623
1610	1442	1297	1180	1084	1000	947	898	853	813	778
1942	1737	1560	1419	1302	1200	1136	1077	1024	976	933
2276	2034	1825	1658	1520	1400	1325	1256	1193	1137	1087
2614	2333	2091	1898	1739	1600	1514	1434	1362	1298	1241
2954	2634	2358	2138	1958	1800	1702	1613	1531	1459	1394
3297	2936	2626	2379	2176	2000	1891	1791	1701	1619	1547
3642	3240	2894	2620	2396	2200	2080	1969	1869	1780	1700
3991	3546	3164	2862	2615	2400	2268	2147	2037	1939	1852
4342	3853	3435	3104	2835	2600	2456	2324	2205	2098	2004
4697	4164	3707	3347	3055	2800	2644	2502	2373	2258	2156
5054	4476	3981	3591	3275	3000	2832	2679	2541	2416	2307
5414	4789	4255	3836	3495	3200	3020	2856	2708	2575	2458
5778	5105	4531	4081	3716	3400	3208	3033	2875	2734	2609
6146	5424	4808	4326	3937	3600	3396	3210	3041	2891	2759
6516	5744	5086	4572	4159	3800	3584	3386	3208	3049	2909
6889	6066	5365	4819	4380	4000	3772	3564	3375	3207	3059

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	15.5	0:49	14.1	0:47	12.4	0:44	11.4	0:42	10.6	0:40
400	31.3	1:36	29.1	1:31	26.2	1:24	24.6	1:20	23.3	1:15
600	47.2	2:24	44.0	2:16	40.0	2:04	37.8	1:57	36.1	1:51
800	62.4	3:12	58.4	3:02	53.3	2:46	50.5	2:36	48.3	2:27
1000	77.7	4:01	72.9	3:47	66.7	3:27	63.2	3:15	60.5	3:03
1200	92.4	4:51	86.8	4:34	79.6	4:10	75.4	3:55	72.2	3:40
1400	107.2	5:41	100.8	5:21	92.5	4:52	87.7	4:34	84.0	4:17
1600	121.4	6:32	114.3	6:08	105.0	5:35	99.5	5:14	95.4	4:55
1800	135.6	7:23	127.8	6:56	117.5	6:18	111.4	5:55	106.8	5:32
2000	149.4	8:15	140.8	7:45	129.6	7:02	122.9	6:36	117.8	6:10
2200	163.1	9:07	153.9	8:34	141.7	7:46	134.4	7:17	128.8	6:49
2400	176.4	10:01	166.5	9:23	153.4	8:31	145.6	7:58	139.5	7:28
2600	189.6	10:54	179.1	10:13	165.0	9:16	156.7	8:40	150.1	8:07
2800	202.5	11:49	191.2	11:04	176.4	10:02	167.5	9:23	160.4	8:46
3000	215.3	12:44	203.4	11:55	187.7	10:47	178.3	10:05	170.7	9:26
3200	227.7	13:40	215.1	12:47	198.7	11:34	188.7	10:49	180.7	10:06
3400	240.1	14:36	226.9	13:39	209.6	12:21	199.2	11:32	190.7	10:46
3600	252.1	15:33	238.3	14:32	220.3	13:08	209.3	12:16	200.3	11:27
3800	264.1	16:30	249.6	15:26	230.9	13:56	219.4	13:00	210.0	12:08
4000	275.9	17:28	260.7	16:20	241.3	14:44	229.3	13:45	219.4	12:50

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
20	-2.9	-2.0	-1.1	0.0	1.7	4.0	6.6	9.5
40	-6.3	-4.3	-2.2	0.0	3.2	7.4	12.3	18.0
60	-9.7	-6.5	-3.3	0.0	4.7	10.7	17.8	25.9
80	-12.9	-8.7	-4.4	0.0	6.2	13.9	22.9	33.3
100	-16.1	-10.8	-5.5	0.0	7.6	16.8	27.7	40.2
120	-19.2	-12.9	-6.5	0.0	8.9	19.7	32.2	46.5
140	-22.2	-15.0	-7.6	0.0	10.2	22.3	36.3	52.3
160	-25.2	-17.0	-8.6	0.0	11.5	24.8	40.2	57.6
180	-28.0	-19.0	-9.6	0.0	12.7	27.2	43.7	62.3
200	-30.8	-20.9	-10.6	0.0	13.8	29.4	46.9	66.5
220	-33.5	-22.8	-11.6	0.0	14.9	31.5	49.8	70.1
240	-36.2	-24.7	-12.6	0.0	16.0	33.4	52.3	73.3
260	-38.7	-26.5	-13.6	0.0	17.0	35.1	54.5	75.8
280	-41.2	-28.2	-14.5	0.0	17.9	36.7	56.4	77.9

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30+80

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	35	39	43	48	52	56	60	64	69	73
TIME (MINUTES)	11	12	12	13	14	15	15	16	17	17

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
800	%N1	76.4						
	KIAS	262						
	FF/ENG	17280						
760	%N1	75.4	78.5					
	KIAS	262	262					
	FF/ENG	16690	16710					
720	%N1	73.9	76.9					
	KIAS	256	256					
	FF/ENG	15790	15760					
680	%N1	72.1	75.1	79.6				
	KIAS	248	248	248				
	FF/ENG	14820	14790	14740				
640	%N1	70.2	73.3	77.7				
	KIAS	241	241	241				
	FF/ENG	13860	13840	13780				
600	%N1	68.5	71.7	76.1				
	KIAS	236	236	236				
	FF/ENG	13050	13040	12960				
560	%N1	66.9	69.9	74.3	78.9			
	KIAS	231	231	231	231			
	FF/ENG	12270	12260	12180	12240			
520	%N1	65.3	68.1	72.5	77.1	81.9		
	KIAS	225	225	225	225	225		
	FF/ENG	11520	11490	11400	11430	11550		
480	%N1	63.6	66.3	70.7	75.2	80.0		
	KIAS	220	220	220	220	220		
	FF/ENG	10800	10750	10660	10660	10770		
440	%N1	61.7	64.5	68.6	73.1	77.8	82.7	
	KIAS	213	213	213	213	213	213	
	FF/ENG	10080	10000	9900	9890	9980	10110	
400	%N1	59.8	62.5	66.5	71.0	75.6	80.4	85.0
	KIAS	207	207	207	207	207	207	207
	FF/ENG	9380	9290	9170	9170	9210	9290	9520
360	%N1	57.7	60.4	64.3	68.7	73.3	78.2	82.7
	KIAS	200	200	200	200	200	200	200
	FF/ENG	8670	8580	8440	8430	8440	8500	8680

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
800	%N1	76.0	79.1	84.0	88.5	94.6
	KIAS	242	242	242	242	242
	FF/ENG	16960	17050	17030	17300	18200
760	%N1	74.9	78.0	82.7	87.3	92.6
	KIAS	242	242	242	242	242
	FF/ENG	16320	16370	16340	16570	17270
720	%N1	73.3	76.4	80.9	85.7	90.6
	KIAS	236	236	236	236	236
	FF/ENG	15370	15390	15380	15540	16070
680	%N1	71.5	74.5	78.9	83.9	88.7
	KIAS	228	228	228	228	228
	FF/ENG	14380	14390	14380	14500	14850
640	%N1	69.4	72.6	77.0	81.9	86.7
	KIAS	221	221	221	221	221
	FF/ENG	13410	13410	13390	13510	13770
600	%N1	67.6	70.8	75.2	79.9	84.9
	KIAS	216	216	216	216	216
	FF/ENG	12590	12580	12530	12660	12860
560	%N1	65.9	68.9	73.3	77.9	83.0
	KIAS	211	211	211	211	211
	FF/ENG	11790	11760	11700	11810	11950
520	%N1	64.1	66.9	71.3	75.8	81.0
	KIAS	205	205	205	205	205
	FF/ENG	11000	10950	10880	10950	11070
480	%N1	62.2	64.9	69.3	73.8	78.7
	KIAS	200	200	200	200	200
	FF/ENG	10250	10170	10090	10130	10240
440	%N1	60.1	62.8	66.9	71.4	76.2
	KIAS	193	193	193	193	193
	FF/ENG	9480	9380	9290	9300	9400
400	%N1	57.9	60.7	64.6	69.1	73.7
	KIAS	187	187	187	187	187
	FF/ENG	8740	8640	8520	8500	8570
360	%N1	55.6	58.2	62.2	66.4	71.0
	KIAS	180	180	180	180	180
	FF/ENG	8010	7900	7760	7710	7760

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		VREF30 + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
700	674	253	5200	4000	1700
660	635	246	7100	6200	4600
620	596	239	9100	8400	7200
580	557	232	10900	10200	9100
540	519	227	12700	12100	10900
500	480	222	14500	14000	12900
460	442	216	16500	15900	15000
420	404	210	18600	18200	17000
380	366	203	20800	20500	19700

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
740	800		
720	2200		
700	3600	1100	
680	4600	2700	
660	5600	4200	1400
640	6600	5400	3200
620	7600	6700	4800
600	8700	7900	6300
580	9700	9000	7900
560	10700	10100	9000
540	11700	11000	9900
520	12700	12000	10900
500	13600	13000	11800
480	14500	14000	12900
460	15500	15100	14000
440	16600	16000	15100
420	17700	17000	16100
400	18800	18400	17200
380	20000	19800	18700
360	21200	20800	20100

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)							
		5	7	9	11	13	15	17	19
680	%N1	97.1							
	MACH	.418							
	KIAS	253							
	FF/ENG	29597							
640	%N1	94.7	97.1						
	MACH	.407	.421						
	KIAS	246	246						
	FF/ENG	27548	27915						
600	%N1	92.6	94.4	97.1					
	MACH	.395	.409	.423					
	KIAS	239	239	238					
	FF/ENG	25711	25775	26281					
560	%N1	90.5	92.1	94.1	97.1				
	MACH	.383	.396	.410	.425				
	KIAS	232	231	231	231				
	FF/ENG	23975	23881	24040	24623				
520	%N1	88.5	90.1	91.9	94.1	97.5			
	MACH	.372	.386	.400	.415	.431			
	KIAS	225	225	225	225	225			
	FF/ENG	22233	22269	22345	22621	23249			
480	%N1	86.4	88.2	89.8	91.7	94.1	97.9		
	MACH	.363	.376	.391	.405	.421	.437		
	KIAS	220	220	220	220	220	220		
	FF/ENG	20677	20727	20792	20944	21208	21887		
440	%N1	84.0	85.9	87.7	89.4	91.3	93.8	97.9	
	MACH	.353	.366	.380	.394	.409	.425	.442	
	KIAS	213	213	213	213	213	213	213	
	FF/ENG	19092	19110	19166	19293	19457	19720	20473	
400	%N1	81.5	83.5	85.3	87.2	89.0	90.9	93.5	97.8
	MACH	.342	.355	.368	.382	.397	.413	.429	.446
	KIAS	207	207	207	207	207	207	207	207
	FF/ENG	17577	17577	17585	17695	17852	18003	18297	19100
360	%N1	78.9	80.7	82.7	84.6	86.5	88.3	90.2	92.9
	MACH	.331	.343	.356	.370	.384	.399	.415	.432
	KIAS	200	200	200	200	200	200	200	200
	FF/ENG	16044	16055	16035	16082	16230	16375	16525	16831

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
165	145	129	117	108	100	93	87	81	77	73
332	295	263	238	218	200	187	175	165	156	148
500	444	396	358	327	300	281	263	247	234	222
669	593	528	477	436	400	374	350	329	311	295
839	743	662	597	545	500	467	438	411	388	368
1009	894	795	718	655	600	561	525	494	466	442
1180	1044	928	838	764	700	654	612	575	543	515
1351	1196	1063	958	874	800	747	700	657	620	588
1523	1347	1197	1079	983	900	840	787	739	697	661
1696	1499	1331	1199	1093	1000	933	874	820	773	733

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
100	8.6	0:27	8.1	0:27	7.6	0:26	7.2	0:26	6.9	0:25
200	17.4	0:52	16.7	0:51	16.0	0:50	15.4	0:49	15.0	0:47
300	26.2	1:18	25.2	1:15	24.3	1:13	23.6	1:11	23.1	1:10
400	34.9	1:43	33.7	1:40	32.6	1:37	31.7	1:35	31.1	1:32
500	43.4	2:08	42.0	2:05	40.8	2:01	39.7	1:58	39.0	1:54
600	52.0	2:34	50.3	2:29	48.8	2:25	47.6	2:21	46.8	2:17
700	60.4	3:00	58.5	2:54	56.9	2:49	55.4	2:45	54.5	2:40
800	68.7	3:25	66.6	3:20	64.8	3:14	63.2	3:08	62.1	3:03
900	76.9	3:51	74.7	3:45	72.6	3:38	70.9	3:32	69.6	3:26
1000	85.1	4:18	82.6	4:10	80.4	4:03	78.5	3:56	77.0	3:49

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
15	-2.5	-1.7	-0.8	0.0	1.6	3.3	5.2	7.3
20	-3.4	-2.3	-1.1	0.0	2.1	4.4	7.0	9.9
25	-4.3	-2.8	-1.4	0.0	2.6	5.5	8.8	12.5
30	-5.2	-3.4	-1.7	0.0	3.0	6.5	10.5	14.9
35	-6.0	-4.0	-2.0	0.0	3.5	7.6	12.2	17.4
40	-6.9	-4.6	-2.3	0.0	3.9	8.5	13.8	19.7
45	-7.8	-5.2	-2.6	0.0	4.4	9.5	15.4	22.0
50	-8.7	-5.8	-2.9	0.0	4.8	10.4	16.9	24.3
55	-9.6	-6.4	-3.2	0.0	5.2	11.3	18.4	26.5
60	-10.5	-7.0	-3.5	0.0	5.6	12.2	19.9	28.6
65	-11.4	-7.6	-3.8	0.0	6.0	13.1	21.3	30.7
70	-12.3	-8.2	-4.0	0.0	6.3	13.9	22.7	32.7
75	-13.1	-8.7	-4.3	0.0	6.7	14.7	24.0	34.6
80	-14.0	-9.3	-4.6	0.0	7.0	15.4	25.3	36.5
85	-14.9	-9.9	-4.9	0.0	7.3	16.1	26.5	38.4
90	-15.8	-10.5	-5.2	0.0	7.6	16.8	27.7	40.1

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
760	%N1	96.6			
	KIAS	262			
	FF/ENG	34160			
720	%N1	94.7			
	KIAS	256			
	FF/ENG	32150			
680	%N1	92.8	96.4		
	KIAS	248	248		
	FF/ENG	30210	30360		
640	%N1	90.8	94.0		
	KIAS	241	241		
	FF/ENG	28280	28220		
600	%N1	89.1	92.1	98.5	
	KIAS	236	236	236	
	FF/ENG	26550	26560	27770	
560	%N1	87.2	90.3	95.3	
	KIAS	231	231	231	
	FF/ENG	24850	25010	25470	
520	%N1	85.2	88.5	92.8	
	KIAS	225	225	225	
	FF/ENG	23170	23340	23590	
480	%N1	83.0	86.4	90.7	97.9
	KIAS	220	220	220	220
	FF/ENG	21570	21710	21890	22980
440	%N1	80.7	84.0	88.5	93.8
	KIAS	213	213	213	213
	FF/ENG	19930	20050	20190	20710
400	%N1	78.4	81.5	86.3	90.9
	KIAS	207	207	207	207
	FF/ENG	18360	18460	18510	18900
360	%N1	76.0	78.9	83.6	88.3
	KIAS	200	200	200	200
	FF/ENG	16800	16850	16850	17190

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

General

FMC Takeoff Speeds

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight is determined as follows:

(1) Determine the dry field/obstacle limit weight for the takeoff flap setting.

(2) Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.

(3) Adjust field length available for temperature by amount shown on chart.

(4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff speed determination:

(1) Determine takeoff speeds V1, VR and V2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on reversers operating and a 15 ft. screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around %N1

To find Go-Around %N1 based on normal engine bleed for packs on and anti-ice off, enter the Go-Around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for engine bleeds for various conditions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability at two center of gravity positions: 7.5% MAC (FMC default) for use when no center of gravity is entered on the PERF INIT page, and 30% MAC (typical mid cruise center of gravity) for use when 30% MAC is entered. Crews may interpolate between these values to determine the airplane's capability at other specific center of gravity positions. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude, .84 Mach approximates the Long Range Cruise Mach schedule.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Descent at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing Flaps 30 at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed for the selected flap setting. Flaps 1 is based on VREF30 + 60 speed schedule. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

The table "Approach or Landing Climb Limited Weight" presents the data which are the more limiting of Approach Climb Limit Weight and Landing Climb Limit Weight.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind, at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 Table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (LB/HR)				
	GROSS WEIGHT (1000 LB)				
	700	600	500	400	300
43				360	310
39			420	360	310
35		470	420	380	300
31	520	500	450	370	310
25	510	490	440	380	340
20	520	520	460	410	360
15	520	520	480	440	400
10	540	520	510	490	440
5	590	590	570	530	480

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing is planned. The tables show gear down rate of climb available for Flaps 20, Flaps 25 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Mode EEC

For most conditions, no takeoff speed adjustments or other performance adjustments other than takeoff power setting adjustments are required for operation of EEC in the ALTERNATE mode. For pressure altitudes between -2000 feet and -1000 feet and temperatures greater than ISA + 15°C, a thrust reduction occurs with EEC in the ALTERNATE mode. Performance software must be used to account for appropriate takeoff performance in this environmental region.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777-300ER GE90-115BL LB FT FAA TO1-10 TO2-20 TALPA

Pkg Model Identification PI.ModID.40.1

General PI.40.1

VREF PI.40.1
Flap Maneuver Speed PI.40.2
Slush/Standing Water Takeoff. PI.40.3
Slippery Runway Takeoff PI.40.7
TO1 Slush/Standing Water Takeoff PI.40.11
TO1 Slippery Runway Takeoff. PI.40.15
TO2 Slush/Standing Water Takeoff PI.40.19
TO2 Slippery Runway Takeoff. PI.40.23
Minimum Control Speeds. PI.40.27
Go-Around %N1. . . . . PI.40.28
Max Climb %N1. . . . . PI.40.29
Flight With Unreliable Airspeed / Turbulent Air Penetration PI.40.30

All Engine PI.41.1

Long Range Cruise Maximum Operating Altitude. PI.41.1
Long Range Cruise Control PI.41.5
Long Range Cruise Enroute Fuel and Time - Low Altitudes . PI.41.6
Long Range Cruise Enroute Fuel and Time - High Altitudes. PI.41.7
Long Range Cruise Wind-Altitude Trade. PI.41.9
Descent at .84M/310/250 . . . . . PI.41.9
Holding PI.41.10

Advisory Information. PI.42.1

Runway Surface Condition Correlation PI.42.1
Normal Configuration Landing Distance PI.42.2
Non-Normal Configuration Landing Distance PI.42.8
ADIRU/GPS DISAGREE (Flaps 25) PI.42.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADIRU/GPS DISAGREE (Flaps 30) PI.42.9
AIR DATA SYS (Flaps 20) PI.42.10
Airspeed Unreliable (Flaps 20) PI.42.11
ANTISKID (Flaps 25) PI.42.12
ANTISKID (Flaps 30) PI.42.13
ENG SHUTDOWN L, R (Flaps 20) PI.42.14
ENG SHUTDOWN L, R (Flaps 30) PI.42.15
FLAP / SLAT CONTROL (Flaps 20) PI.42.16
FLAPS DRIVE (Flaps ≤ 5) PI.42.17
FLAPS DRIVE (5 < Flaps < 20) PI.42.18
FLAPS DRIVE (Flaps ≥ 20) PI.42.19
FLAPS PRIMARY FAIL (Flaps 20) PI.42.20
FLIGHT CONTROL MODE (Flaps 20) PI.42.21
FLIGHT CONTROLS (Flaps 20) PI.42.22
HYD PRESS SYS C (Flaps 20). PI.42.23
HYD PRESS SYS L (Flaps 25) PI.42.24
HYD PRESS SYS L (Flaps 30) PI.42.25
HYD PRESS SYS L+C (Flaps 20) PI.42.26
HYD PRESS SYS L+R (Flaps 20) PI.42.27
HYD PRESS SYS R (Flaps 25). PI.42.28
HYD PRESS SYS R (Flaps 30). PI.42.29
HYD PRESS SYS R+C (Flaps 20) PI.42.30
NAV AIR DATA SYS (Flaps 20). PI.42.31
PITCH DOWN AUTHORITY (Flaps 25) PI.42.32
PITCH DOWN AUTHORITY (Flaps 30) PI.42.33
PITCH UP AUTHORITY (Flaps ≤ 15) PI.42.34
PITCH UP AUTHORITY (Flaps ≥ 20) PI.42.35
PRI FLIGHT COMPUTERS (Flaps 20) PI.42.36
SLATS DRIVE (Flaps 20) PI.42.37
SPOILERS (Flaps 25) PI.42.38
SPOILERS (Flaps 30) PI.42.39
STABILIZER (Flaps 20) PI.42.40
Approach or Landing Climb Limited Weight PI.42.41
Recommended Brake Cooling Schedule. PI.42.43

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Inoperative PI.43.1

Initial Max Continuous %N1 . . . . . PI.43.1
Max Continuous %N1 . . . . . PI.43.2
Driftdown Speed/Level Off Altitude PI.43.5
Driftdown/LRC Cruise Range Capability PI.43.6
Long Range Cruise Altitude Capability PI.43.7
Long Range Cruise Control PI.43.8
Long Range Cruise Diversion Fuel and Time PI.43.9
Holding PI.43.10
Gear Down Landing Rate of Climb Available PI.43.11

Alternate Mode EEC PI.44.1

Alternate Mode EEC Max Takeoff %N1 . . . . . PI.44.1

Gear Down PI.45.1

220 KIAS Max Climb %N1 . . . . . PI.45.1
Long Range Cruise Altitude Capability PI.45.2
Long Range Cruise Control PI.45.3
Long Range Cruise Enroute Fuel and Time PI.45.4
Descent at VREF30+80 . . . . . PI.45.5
Holding PI.45.6

Gear Down, Engine Inoperative PI.46.1

Driftdown Speed/Level Off Altitude PI.46.1
Long Range Cruise Altitude Capability PI.46.2
Long Range Cruise Control PI.46.3
Long Range Cruise Diversion Fuel and Time PI.46.4
Holding PI.46.6

Text PI.47.1

Introduction PI.47.1
General PI.47.1
All Engines PI.47.4
Advisory Information PI.47.6
Engine Inoperative PI.47.9

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Mode EEC PI.47.12
Gear Down PI.47.12

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
201	HL7782	37643	WD946
202	HL7783	37644	WD947
215	HL8006	37652	WE473
216	HL8007	43815	WE474
217	HL8008	43816	WE475
218	HL8009	41999	WE476
213	HL8010	42120	WE471
214	HL8011	42123	WE472
204	HL8208	37645	WD949

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airplane Number	Registry Number	Serial Number	Tabulation Number
205	HL8209	37646	WD950
206	HL8210	40377	WD951
207	HL8216	37647	WD952
208	HL8217	37648	WD953
209	HL8218	37649	WD954
210	HL8250	37650	WD955
211	HL8274	41998	WD956
212	HL8275	37651	WD957

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

VREF

WEIGHT (1000 LB)	VREF (KIAS) FLAPS 30	25	20
800	185	187	200
750	180	183	196
700	173	177	189
650	162	171	183
600	156	164	176
550	149	157	168
500	142	150	161
450	135	142	152
400	127	134	144
350	118	125	134

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS UP	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-83.3	-94.5	-105.7	-98.7	-109.9	-121.1	-124.4	-135.6	-146.8
800	-80.4	-91.6	-102.8	-94.8	-106.0	-117.2	-118.5	-129.7	-140.9
760	-77.3	-88.5	-99.7	-90.6	-101.8	-113.0	-112.4	-123.6	-134.8
720	-73.5	-84.7	-95.9	-85.8	-97.0	-108.2	-105.5	-116.7	-127.9
680	-69.1	-80.3	-91.5	-80.2	-91.4	-102.6	-97.9	-109.1	-120.3
640	-63.9	-75.1	-86.3	-73.8	-85.0	-96.2	-89.5	-100.7	-111.9
600	-58.1	-69.3	-80.5	-66.8	-78.0	-89.2	-80.3	-91.5	-102.7
560	-51.6	-62.8	-74.0	-59.0	-70.2	-81.4	-70.3	-81.5	-92.7
520	-44.5	-55.7	-66.9	-50.5	-61.7	-72.9	-59.6	-70.8	-82.0
480	-36.6	-47.8	-59.0	-41.3	-52.5	-63.7	-48.1	-59.3	-70.5
440	-28.1	-39.3	-50.5	-31.4	-42.6	-53.8	-35.8	-47.0	-58.2
400	-19.1	-30.3	-41.5	-20.9	-32.1	-43.3	-22.9	-34.1	-45.3
360	-10.1	-21.3	-32.5	-10.4	-21.6	-32.8	-10.1	-21.3	-32.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7000	343.3			371.4			419.6		
7400	396.8			425.4			475.2	370.4	
7800	450.6	348.7		480.7	376.8		532.2	425.1	
8200	506.2	402.1		537.5	430.9		590.6	480.8	375.9
8600	563.6	456.1	354.0	596.2	486.3	382.2	650.7	537.9	430.7
9000	623.2	511.8	407.5	656.9	543.3	436.4	712.6	596.6	486.5
9400	685.1	569.5	461.6	719.8	602.2	491.9	776.3	656.8	543.7
9800	749.7	629.2	517.5	785.2	663.1	549.1		718.9	602.5
10200	817.0	691.4	575.4		726.2	608.2		782.9	662.9
10600		756.3	635.3		791.9	669.3			725.2
11000		823.8	697.8			732.7			789.4
11400			763.0			798.6			

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -180 ft/+170 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-25	-23	-21	-21	-19	-17	-14	-12	-10
760	-27	-25	-23	-23	-21	-19	-15	-13	-11
720	-29	-27	-25	-25	-23	-21	-16	-14	-12
680	-30	-28	-26	-26	-24	-22	-18	-16	-14
640	-31	-29	-27	-27	-25	-23	-19	-17	-15
600	-31	-29	-27	-28	-26	-24	-20	-18	-16
560	-31	-29	-27	-28	-26	-24	-22	-20	-18
520	-31	-29	-27	-28	-26	-24	-23	-21	-19
480	-30	-28	-26	-28	-26	-24	-23	-21	-19
440	-29	-27	-25	-28	-26	-24	-24	-22	-20
400	-29	-27	-25	-27	-25	-23	-24	-22	-20
360	-28	-26	-24	-26	-24	-22	-24	-22	-20

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-115.4	-127.8	-140.2	-134.1	-146.5	-158.9	-164.7	-177.1	-189.5
800	-110.3	-122.7	-135.1	-127.5	-139.9	-152.3	-155.2	-167.6	-180.0
760	-105.1	-117.5	-129.9	-120.8	-133.2	-145.6	-145.5	-157.9	-170.3
720	-99.3	-111.7	-124.1	-113.4	-125.8	-138.2	-135.4	-147.8	-160.2
680	-92.9	-105.3	-117.7	-105.5	-117.9	-130.3	-124.7	-137.1	-149.5
640	-85.9	-98.3	-110.7	-97.0	-109.4	-121.8	-113.5	-125.9	-138.3
600	-78.3	-90.7	-103.1	-88.0	-100.4	-112.8	-101.8	-114.2	-126.6
560	-70.1	-82.5	-94.9	-78.3	-90.7	-103.1	-89.6	-102.0	-114.4
520	-61.3	-73.7	-86.1	-68.1	-80.5	-92.9	-76.9	-89.3	-101.7
480	-51.9	-64.3	-76.7	-57.3	-69.7	-82.1	-63.7	-76.1	-88.5
440	-42.0	-54.4	-66.8	-45.9	-58.3	-70.7	-49.9	-62.3	-74.7
400	-31.6	-44.0	-56.4	-34.1	-46.5	-58.9	-35.8	-48.2	-60.6
360	-21.2	-33.6	-46.0	-22.2	-34.6	-47.0	-21.7	-34.1	-46.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
10200							429.6		
10600							495.1	384.7	
11000				363.8			562.5	449.1	339.8
11400				431.9	316.1		632.0	515.1	403.9
11800	363.6			502.3	384.2		703.7	583.1	468.7
12200	434.3	314.3		575.7	452.7	336.6	778.0	653.3	535.3
12600	508.2	384.8		652.8	523.9	404.6		725.7	603.9
13000	586.7	456.1	335.4	734.1	598.5	473.8		800.8	674.8
13400	670.7	531.2	405.9	820.0	676.7	545.9			748.0
13800	761.9	611.3	478.2		759.4	621.5			823.6
14200	859.2	697.2	554.7		846.1	701.0			
14600		790.9	636.4			785.2			
15000			724.4						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -280 ft/+270 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-41	-37	-33	-35	-31	-27	-23	-19	-15
760	-43	-39	-35	-37	-33	-29	-25	-21	-17
720	-45	-41	-37	-39	-35	-31	-27	-23	-19
680	-46	-42	-38	-41	-37	-33	-29	-25	-21
640	-47	-43	-39	-42	-38	-34	-32	-28	-24
600	-47	-43	-39	-43	-39	-35	-34	-30	-26
560	-47	-43	-39	-44	-40	-36	-36	-32	-28
520	-47	-43	-39	-44	-40	-36	-37	-33	-29
480	-47	-43	-39	-44	-40	-36	-39	-35	-31
440	-46	-42	-38	-44	-40	-36	-40	-36	-32
400	-46	-42	-38	-44	-40	-36	-40	-36	-32
360	-45	-41	-37	-44	-40	-36	-41	-37	-33

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	-3.2	-6.4	-45.4	-48.6	-51.8	-85.6	-88.8	-92.0
800	0.0	-3.2	-6.4	-46.4	-49.6	-52.8	-83.4	-86.6	-89.8
760	-2.4	-5.6	-8.8	-47.3	-50.5	-53.7	-81.1	-84.3	-87.5
720	-7.6	-10.8	-14.0	-47.7	-50.9	-54.1	-78.5	-81.7	-84.9
680	-11.3	-14.5	-17.7	-47.6	-50.8	-54.0	-75.7	-78.9	-82.1
640	-13.2	-16.4	-19.6	-47.0	-50.2	-53.4	-72.5	-75.7	-78.9
600	-13.9	-17.1	-20.3	-45.2	-48.4	-51.6	-68.3	-71.5	-74.7
560	-13.6	-16.8	-20.0	-42.2	-45.4	-48.6	-62.7	-65.9	-69.1
520	-12.4	-15.6	-18.8	-37.9	-41.1	-44.3	-55.7	-58.9	-62.1
480	-10.3	-13.5	-16.7	-32.1	-35.3	-38.5	-47.3	-50.5	-53.7
440	-7.2	-10.4	-13.6	-25.1	-28.3	-31.5	-37.5	-40.7	-43.9
400	-3.2	-6.4	-9.6	-16.8	-20.0	-23.2	-26.3	-29.5	-32.7
360	0.0	-1.4	-4.6	-7.1	-10.3	-13.5	-13.7	-16.9	-20.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5000	396.3								
5400	513.2	396.3							
5800	629.1	513.2	396.3						
6200	744.1	629.1	513.2	317.2					
6600	858.4	744.1	629.1	391.6					
7000		858.4	744.1	468.4	361.7				
7400			858.4	548.5	437.4	332.1			
7800				632.2	516.0	406.8			
8200				720.2	598.3	484.2	369.2		
8600				812.9	684.4	564.9	414.9		
9000					775.2	649.4	462.2	360.3	
9400						738.3	511.2	405.7	
9800						831.7	562.3	452.6	351.4
10200							615.7	501.3	396.4
10600							671.7	551.9	443.0
11000							730.6	604.8	491.4
11400							793.3	660.2	541.6
11800								718.6	594.0
12200								780.4	648.9
12600									706.6
13000									767.8

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -190 ft/+180 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-7	-5	-3	-18	-16	-14	-32	-30	-28
760	-9	-7	-5	-21	-19	-17	-35	-33	-31
720	-10	-8	-6	-23	-21	-19	-37	-35	-33
680	-11	-9	-7	-24	-22	-20	-39	-37	-35
640	-12	-10	-8	-25	-23	-21	-40	-38	-36
600	-13	-11	-9	-26	-24	-22	-41	-39	-37
560	-13	-11	-9	-26	-24	-22	-41	-39	-37
520	-13	-11	-9	-27	-25	-23	-42	-40	-38
480	-14	-12	-10	-27	-25	-23	-42	-40	-38
440	-14	-12	-10	-27	-25	-23	-42	-40	-38
400	-14	-12	-10	-28	-26	-24	-42	-40	-38
360	-15	-13	-11	-29	-27	-25	-41	-39	-37

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-6.4	-6.4	-6.4	-74.5	-74.5	-74.5	-126.1	-126.1	-126.1
800	-11.5	-11.5	-11.5	-73.4	-73.4	-73.4	-120.9	-120.9	-120.9
760	-16.3	-16.3	-16.3	-72.4	-72.4	-72.4	-115.8	-115.8	-115.8
720	-20.5	-20.5	-20.5	-71.5	-71.5	-71.5	-111.2	-111.2	-111.2
680	-23.8	-23.8	-23.8	-70.8	-70.8	-70.8	-107.0	-107.0	-107.0
640	-26.4	-26.4	-26.4	-70.2	-70.2	-70.2	-103.2	-103.2	-103.2
600	-27.7	-27.7	-27.7	-68.3	-68.3	-68.3	-98.4	-98.4	-98.4
560	-27.6	-27.6	-27.6	-64.5	-64.5	-64.5	-92.0	-92.0	-92.0
520	-26.1	-26.1	-26.1	-58.9	-58.9	-58.9	-83.7	-83.7	-83.7
480	-23.2	-23.2	-23.2	-51.3	-51.3	-51.3	-73.8	-73.8	-73.8
440	-18.9	-18.9	-18.9	-42.0	-42.0	-42.0	-62.3	-62.3	-62.3
400	-13.2	-13.2	-13.2	-30.7	-30.7	-30.7	-49.0	-49.0	-49.0
360	-6.0	-6.0	-6.0	-17.5	-17.5	-17.5	-33.9	-33.9	-33.9

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
6200	502.7	311.8							
6600	678.3	541.9	365.2						
7000	820.6	708.7	578.6						
7400		847.7	737.9						
7800			874.7						
9400				405.5					
9800				613.9	380.0				
10200				775.2	595.7	353.1			
10600					760.3	577.1			
11000					905.4	745.3			
11400						890.9			
...									
15400							324.8		
15800							570.0	294.2	
16200							738.4	550.3	
16600							879.7	723.4	529.9
17000								865.7	708.0
17400									851.7

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -100 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -270 ft/+270 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-10	-6	-2	-27	-23	-19	-52	-48	-44
760	-12	-8	-4	-30	-26	-22	-55	-51	-47
720	-14	-10	-6	-32	-28	-24	-58	-54	-50
680	-15	-11	-7	-35	-31	-27	-61	-57	-53
640	-17	-13	-9	-36	-32	-28	-64	-60	-56
600	-18	-14	-10	-38	-34	-30	-67	-63	-59
560	-18	-14	-10	-40	-36	-32	-69	-65	-61
520	-19	-15	-11	-41	-37	-33	-70	-66	-62
480	-20	-16	-12	-43	-39	-35	-71	-67	-63
440	-21	-17	-13	-44	-40	-36	-71	-67	-63
400	-22	-18	-14	-46	-42	-38	-71	-67	-63
360	-23	-19	-15	-48	-44	-40	-71	-67	-63

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-78.3	-89.5	-100.7	-93.6	-104.8	-116.0	-119.3	-130.5	-141.7
800	-75.4	-86.6	-97.8	-89.7	-100.9	-112.1	-113.6	-124.8	-136.0
760	-72.7	-83.9	-95.1	-86.1	-97.3	-108.5	-108.3	-119.5	-130.7
720	-70.3	-81.5	-92.7	-82.7	-93.9	-105.1	-103.1	-114.3	-125.5
680	-67.3	-78.5	-89.7	-78.7	-89.9	-101.1	-97.2	-108.4	-119.6
640	-63.5	-74.7	-85.9	-73.8	-85.0	-96.2	-90.3	-101.5	-112.7
600	-58.8	-70.0	-81.2	-68.0	-79.2	-90.4	-82.6	-93.8	-105.0
560	-53.4	-64.6	-75.8	-61.4	-72.6	-83.8	-73.8	-85.0	-96.2
520	-47.2	-58.4	-69.6	-53.9	-65.1	-76.3	-64.2	-75.4	-86.6
480	-40.2	-51.4	-62.6	-45.6	-56.8	-68.0	-53.7	-64.9	-76.1
440	-32.4	-43.6	-54.8	-36.5	-47.7	-58.9	-42.2	-53.4	-64.6
400	-23.8	-35.0	-46.2	-26.5	-37.7	-48.9	-29.9	-41.1	-52.3
360	-14.8	-26.0	-37.2	-16.0	-27.2	-38.4	-17.0	-28.2	-39.4

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800							313.5		
6200	298.1			325.6			373.3		
6600	356.6			384.7			433.3	319.5	
7000	415.2	303.9		444.3	331.5		494.7	379.3	
7400	475.2	362.4		505.8	390.7		558.0	439.3	325.5
7800	537.5	421.1	309.7	569.5	450.4	337.4	623.5	501.0	385.3
8200	602.5	481.3	368.3	635.8	512.1	396.6	691.1	564.5	445.4
8600	670.4	543.9	427.0	704.9	576.1	456.5	761.3	630.1	507.2
9000	741.8	609.1	487.5	777.2	642.6	518.3	833.8	698.0	570.9
9400	816.8	677.4	550.3	851.9	712.0	582.6	906.6	768.5	636.8
9800	892.7	749.1	615.8		784.7	649.4		841.0	704.9
10200		824.4	684.4		859.4	719.1		913.9	775.7
10600		900.3	756.5			792.2			848.3
11000			832.0			866.9			
11400			907.9						

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -180 ft/+170 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-22	-20	-18	-17	-15	-13	-9	-7	-5
760	-24	-22	-20	-20	-18	-16	-11	-9	-7
720	-26	-24	-22	-21	-19	-17	-12	-10	-8
680	-27	-25	-23	-23	-21	-19	-14	-12	-10
640	-28	-26	-24	-24	-22	-20	-15	-13	-11
600	-28	-26	-24	-25	-23	-21	-17	-15	-13
560	-28	-26	-24	-25	-23	-21	-18	-16	-14
520	-28	-26	-24	-25	-23	-21	-19	-17	-15
480	-27	-25	-23	-25	-23	-21	-20	-18	-16
440	-26	-24	-22	-24	-22	-20	-20	-18	-16
400	-26	-24	-22	-24	-22	-20	-20	-18	-16
360	-25	-23	-21	-23	-21	-19	-20	-18	-16

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-111.3	-123.7	-136.1	-130.5	-142.9	-155.3	-162.7	-175.1	-187.5
800	-106.4	-118.8	-131.2	-124.1	-136.5	-148.9	-153.4	-165.8	-178.2
760	-101.6	-114.0	-126.4	-117.8	-130.2	-142.6	-144.3	-156.7	-169.1
720	-96.9	-109.3	-121.7	-111.7	-124.1	-136.5	-135.3	-147.7	-160.1
680	-91.7	-104.1	-116.5	-105.0	-117.4	-129.8	-125.8	-138.2	-150.6
640	-85.8	-98.2	-110.6	-97.7	-110.1	-122.5	-115.7	-128.1	-140.5
600	-79.3	-91.7	-104.1	-89.7	-102.1	-114.5	-105.0	-117.4	-129.8
560	-72.0	-84.4	-96.8	-80.9	-93.3	-105.7	-93.7	-106.1	-118.5
520	-64.1	-76.5	-88.9	-71.5	-83.9	-96.3	-81.8	-94.2	-106.6
480	-55.4	-67.8	-80.2	-61.5	-73.9	-86.3	-69.2	-81.6	-94.0
440	-46.1	-58.5	-70.9	-50.7	-63.1	-75.5	-56.1	-68.5	-80.9
400	-36.1	-48.5	-60.9	-39.3	-51.7	-64.1	-42.4	-54.8	-67.2
360	-25.7	-38.1	-50.5	-27.5	-39.9	-52.3	-28.3	-40.7	-53.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
8600							302.3		
9000							375.7		
9400							450.3	324.3	
9800				329.4			528.3	397.8	
10200				410.6			610.1	473.2	346.3
10600	356.7			495.2	353.6		696.5	552.3	420.2
11000	443.9	296.6		585.8	435.3	297.2	788.1	635.4	496.6
11400	537.9	382.5		683.6	521.6	377.9	883.3	723.3	576.8
11800	641.5	471.2	322.2	790.5	614.2	460.6		816.4	661.3
12200	757.9	567.8	408.4	903.3	714.6	548.6		912.1	750.7
12600	886.3	674.7	499.2		824.0	643.4			844.9
13000		795.8	598.6			746.4			
13400			709.4			857.8			
13800			834.4						

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -280 ft/+270 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-36	-32	-28	-29	-25	-21	-16	-12	-8
760	-39	-35	-31	-32	-28	-24	-18	-14	-10
720	-41	-37	-33	-34	-30	-26	-20	-16	-12
680	-42	-38	-34	-36	-32	-28	-23	-19	-15
640	-43	-39	-35	-37	-33	-29	-25	-21	-17
600	-43	-39	-35	-39	-35	-31	-28	-24	-20
560	-43	-39	-35	-39	-35	-31	-30	-26	-22
520	-43	-39	-35	-40	-36	-32	-32	-28	-24
480	-43	-39	-35	-40	-36	-32	-34	-30	-26
440	-42	-38	-34	-40	-36	-32	-35	-31	-27
400	-41	-37	-33	-39	-35	-31	-35	-31	-27
360	-41	-37	-33	-39	-35	-31	-36	-32	-28

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	-3.2	-6.4	-39.0	-42.2	-45.4	-79.4	-82.6	-85.8
800	0.0	-3.2	-6.4	-40.0	-43.2	-46.4	-77.2	-80.4	-83.6
760	0.0	-3.2	-6.4	-41.1	-44.3	-47.5	-75.3	-78.5	-81.7
720	-0.9	-4.1	-7.3	-42.4	-45.6	-48.8	-73.8	-77.0	-80.2
680	-6.4	-9.6	-12.8	-43.4	-46.6	-49.8	-72.0	-75.2	-78.4
640	-10.3	-13.5	-16.7	-43.8	-47.0	-50.2	-69.9	-73.1	-76.3
600	-12.3	-15.5	-18.7	-43.6	-46.8	-50.0	-67.4	-70.6	-73.8
560	-13.0	-16.2	-19.4	-42.1	-45.3	-48.5	-63.6	-66.8	-70.0
520	-12.7	-15.9	-19.1	-39.2	-42.4	-45.6	-58.2	-61.4	-64.6
480	-11.4	-14.6	-17.8	-34.8	-38.0	-41.2	-51.3	-54.5	-57.7
440	-9.1	-12.3	-15.5	-29.0	-32.2	-35.4	-42.9	-46.1	-49.3
400	-5.7	-8.9	-12.1	-21.7	-24.9	-28.1	-32.8	-36.0	-39.2
360	-1.3	-4.5	-7.7	-12.9	-16.1	-19.3	-21.1	-24.3	-27.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4600	364.9								
5000	488.8	364.9							
5400	611.7	488.8	364.9						
5800	733.7	611.7	488.8	310.5					
6200	855.0	733.7	611.7	389.4					
6600		855.0	733.7	470.9	357.7				
7000			855.0	556.1	437.9	326.3	284.0		
7400				645.6	521.6	405.4	331.5		
7800				740.0	609.2	487.6	379.1		
8200				839.5	701.6	573.7	428.1	322.0	
8600					799.4	664.1	479.0	369.5	
9000					899.6	759.6	532.1	418.1	312.5
9400						859.5	587.5	468.6	360.0
9800							645.8	521.3	408.3
10200							707.4	576.2	458.4
10600							772.8	633.9	510.6
11000							841.4	694.8	565.0
11400							910.2	759.4	622.2
11800								827.7	682.3
12200								896.5	746.1
12600									813.9
13000									882.7

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -190 ft/+180 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff
10% Thrust Reduction
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-6	-4	-2	-16	-14	-12	-29	-27	-25
760	-8	-6	-4	-19	-17	-15	-32	-30	-28
720	-9	-7	-5	-20	-18	-16	-34	-32	-30
680	-10	-8	-6	-22	-20	-18	-35	-33	-31
640	-11	-9	-7	-23	-21	-19	-37	-35	-33
600	-11	-9	-7	-23	-21	-19	-37	-35	-33
560	-12	-10	-8	-24	-22	-20	-38	-36	-34
520	-12	-10	-8	-24	-22	-20	-38	-36	-34
480	-12	-10	-8	-24	-22	-20	-38	-36	-34
440	-12	-10	-8	-25	-23	-21	-38	-36	-34
400	-13	-11	-9	-25	-23	-21	-38	-36	-34
360	-13	-11	-9	-26	-24	-22	-38	-36	-34

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	0.0	0.0	-68.2	-68.2	-68.2	-120.4	-120.4	-120.4
800	-3.6	-3.6	-3.6	-67.1	-67.1	-67.1	-115.5	-115.5	-115.5
760	-8.7	-8.7	-8.7	-66.3	-66.3	-66.3	-110.9	-110.9	-110.9
720	-13.7	-13.7	-13.7	-65.8	-65.8	-65.8	-106.5	-106.5	-106.5
680	-18.2	-18.2	-18.2	-65.5	-65.5	-65.5	-102.6	-102.6	-102.6
640	-21.8	-21.8	-21.8	-65.3	-65.3	-65.3	-99.2	-99.2	-99.2
600	-24.5	-24.5	-24.5	-65.2	-65.2	-65.2	-96.2	-96.2	-96.2
560	-25.9	-25.9	-25.9	-63.7	-63.7	-63.7	-91.9	-91.9	-91.9
520	-25.8	-25.8	-25.8	-60.1	-60.1	-60.1	-85.7	-85.7	-85.7
480	-24.2	-24.2	-24.2	-54.4	-54.4	-54.4	-77.7	-77.7	-77.7
440	-21.1	-21.1	-21.1	-46.7	-46.7	-46.7	-67.7	-67.7	-67.7
400	-16.4	-16.4	-16.4	-36.9	-36.9	-36.9	-55.8	-55.8	-55.8
360	-10.2	-10.2	-10.2	-24.9	-24.9	-24.9	-41.8	-41.8	-41.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5800	519.6	314.6							
6200	705.4	561.1	372.9						
6600	857.4	737.4	600.0						
7000		887.0	768.3						
7400			916.7						
8600				341.7					
9000				588.1	311.8				
9400				769.2	567.4	282.0			
9800					752.8	546.0			
10200					912.9	736.0			
10600						896.9			
...									
14200							401.0		
14600							637.8	369.0	
15000							808.0	618.2	335.0
15400								792.4	597.9
15800									776.8

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -100 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -270 ft/+270 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff
10% Thrust Reduction
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-9	-5	-1	-24	-20	-16	-47	-43	-39
760	-11	-7	-3	-26	-22	-18	-50	-46	-42
720	-12	-8	-4	-29	-25	-21	-53	-49	-45
680	-14	-10	-6	-31	-27	-23	-56	-52	-48
640	-15	-11	-7	-32	-28	-24	-58	-54	-50
600	-16	-12	-8	-34	-30	-26	-61	-57	-53
560	-16	-12	-8	-35	-31	-27	-63	-59	-55
520	-17	-13	-9	-37	-33	-29	-64	-60	-56
480	-18	-14	-10	-38	-34	-30	-65	-61	-57
440	-18	-14	-10	-40	-36	-32	-65	-61	-57
400	-19	-15	-11	-41	-37	-33	-65	-61	-57
360	-20	-16	-12	-43	-39	-35	-65	-61	-57

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-74.8	-86.0	-97.2	-90.1	-101.3	-112.5	-116.1	-127.3	-138.5
800	-71.8	-83.0	-94.2	-86.1	-97.3	-108.5	-110.2	-121.4	-132.6
760	-68.9	-80.1	-91.3	-82.2	-93.4	-104.6	-104.5	-115.7	-126.9
720	-66.2	-77.4	-88.6	-78.6	-89.8	-101.0	-99.3	-110.5	-121.7
680	-64.0	-75.2	-86.4	-75.6	-86.8	-98.0	-94.6	-105.8	-117.0
640	-61.6	-72.8	-84.0	-72.2	-83.4	-94.6	-89.5	-100.7	-111.9
600	-58.3	-69.5	-80.7	-67.9	-79.1	-90.3	-83.2	-94.4	-105.6
560	-54.1	-65.3	-76.5	-62.5	-73.7	-84.9	-76.0	-87.2	-98.4
520	-48.9	-60.1	-71.3	-56.2	-67.4	-78.6	-67.5	-78.7	-89.9
480	-42.8	-54.0	-65.2	-48.8	-60.0	-71.2	-58.1	-69.3	-80.5
440	-35.8	-47.0	-58.2	-40.6	-51.8	-63.0	-47.6	-58.8	-70.0
400	-27.9	-39.1	-50.3	-31.3	-42.5	-53.7	-36.0	-47.2	-58.4
360	-19.2	-30.4	-41.6	-21.1	-32.3	-43.5	-23.5	-34.7	-45.9

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400							315.6		
5800	306.4			334.0			381.9		
6200	371.3			399.6			448.5	322.3	
6600	436.5	312.9		466.1	340.6		517.2	388.5	
7000	504.0	377.8		535.2	406.2	281.7	588.3	455.3	328.9
7400	574.5	443.1	319.4	607.3	472.9	347.1	662.0	524.2	395.1
7800	648.6	510.9	384.3	682.7	542.3	412.7	738.8	595.5	462.1
8200	726.6	581.7	449.7	761.9	614.7	479.7	818.6	669.6	531.2
8600	809.2	656.1	517.8	844.5	690.5	549.4	899.3	746.6	602.8
9000	893.4	734.7	589.0		770.0	622.1		826.7	677.1
9400		817.6	663.8		852.7	698.2		907.4	754.5
9800		901.8	742.8			778.2			834.7
10200			826.0			861.0			915.5
10600			910.2						

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -180 ft/+170 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-19	-17	-15	-14	-12	-10	-5	-3	-1
760	-21	-19	-17	-16	-14	-12	-6	-4	-2
720	-23	-21	-19	-18	-16	-14	-8	-6	-4
680	-24	-22	-20	-20	-18	-16	-10	-8	-6
640	-25	-23	-21	-21	-19	-17	-11	-9	-7
600	-26	-24	-22	-22	-20	-18	-13	-11	-9
560	-25	-23	-21	-22	-20	-18	-14	-12	-10
520	-25	-23	-21	-22	-20	-18	-15	-13	-11
480	-24	-22	-20	-22	-20	-18	-16	-14	-12
440	-23	-21	-19	-21	-19	-17	-17	-15	-13
400	-23	-21	-19	-21	-19	-17	-17	-15	-13
360	-22	-20	-18	-20	-18	-16	-17	-15	-13

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	-109.4	-121.8	-134.2	-129.3	-141.7	-154.1	-163.0	-175.4	-187.8
800	-104.3	-116.7	-129.1	-122.7	-135.1	-147.5	-153.5	-165.9	-178.3
760	-99.3	-111.7	-124.1	-116.2	-128.6	-141.0	-144.3	-156.7	-169.1
720	-94.5	-106.9	-119.3	-109.9	-122.3	-134.7	-135.2	-147.6	-160.0
680	-89.9	-102.3	-114.7	-103.8	-116.2	-128.6	-126.2	-138.6	-151.0
640	-85.0	-97.4	-109.8	-97.5	-109.9	-122.3	-117.0	-129.4	-141.8
600	-79.3	-91.7	-104.1	-90.3	-102.7	-115.1	-107.1	-119.5	-131.9
560	-72.8	-85.2	-97.6	-82.4	-94.8	-107.2	-96.5	-108.9	-121.3
520	-65.6	-78.0	-90.4	-73.7	-86.1	-98.5	-85.2	-97.6	-110.0
480	-57.6	-70.0	-82.4	-64.3	-76.7	-89.1	-73.3	-85.7	-98.1
440	-48.9	-61.3	-73.7	-54.1	-66.5	-78.9	-60.7	-73.1	-85.5
400	-39.4	-51.8	-64.2	-43.2	-55.6	-68.0	-47.4	-59.8	-72.2
360	-29.1	-41.5	-53.9	-31.6	-44.0	-56.4	-33.5	-45.9	-58.3

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
7800							295.8		
8200							383.1		
8600							473.0	322.0	
9000				370.5			569.3	409.6	
9400	333.9			472.2	302.1		673.2	501.3	348.2
9800	441.8			583.6	400.5		786.0	599.7	436.6
10200	561.3	365.8		707.9	504.5	331.3	905.9	706.0	530.1
10600	699.2	476.0	291.8	848.1	619.3	430.6		821.4	630.6
11000	862.5	600.4	397.7		748.3	537.4			739.4
11400		745.9	511.6		892.3	656.4			857.4
11800		913.7	641.6			790.6			
12200			794.8						

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -280 ft/+270 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-31	-27	-23	-23	-19	-15	-7	-3	0
760	-34	-30	-26	-26	-22	-18	-10	-6	-2
720	-36	-32	-28	-29	-25	-21	-12	-8	-4
680	-37	-33	-29	-31	-27	-23	-15	-11	-7
640	-38	-34	-30	-32	-28	-24	-18	-14	-10
600	-39	-35	-31	-34	-30	-26	-21	-17	-13
560	-39	-35	-31	-34	-30	-26	-24	-20	-16
520	-39	-35	-31	-35	-31	-27	-26	-22	-18
480	-38	-34	-30	-35	-31	-27	-28	-24	-20
440	-38	-34	-30	-35	-31	-27	-29	-25	-21
400	-37	-33	-29	-35	-31	-27	-30	-26	-22
360	-36	-32	-28	-34	-30	-26	-31	-27	-23

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	-3.2	-6.4	-34.0	-37.2	-40.4	-75.3	-78.5	-81.7
800	0.0	-3.2	-6.4	-35.0	-38.2	-41.4	-73.1	-76.3	-79.5
760	0.0	-3.2	-6.4	-36.0	-39.2	-42.4	-70.9	-74.1	-77.3
720	0.0	-3.2	-6.4	-37.0	-40.2	-43.4	-69.1	-72.3	-75.5
680	0.0	-3.2	-6.4	-38.6	-41.8	-45.0	-67.9	-71.1	-74.3
640	-5.6	-8.8	-12.0	-39.9	-43.1	-46.3	-66.6	-69.8	-73.0
600	-9.6	-12.8	-16.0	-40.6	-43.8	-47.0	-64.9	-68.1	-71.3
560	-11.5	-14.7	-17.9	-40.6	-43.8	-47.0	-62.8	-66.0	-69.2
520	-12.2	-15.4	-18.6	-39.2	-42.4	-45.6	-59.1	-62.3	-65.5
480	-11.8	-15.0	-18.2	-36.3	-39.5	-42.7	-53.8	-57.0	-60.2
440	-10.3	-13.5	-16.7	-31.7	-34.9	-38.1	-46.7	-49.9	-53.1
400	-7.7	-10.9	-14.1	-25.5	-28.7	-31.9	-37.9	-41.1	-44.3
360	-4.0	-7.2	-10.4	-17.8	-21.0	-24.2	-27.4	-30.6	-33.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
4200	324.0								
4600	455.9	324.0							
5000	586.8	455.9	324.0						
5400	716.7	586.8	455.9	299.5					
5800	845.8	716.7	586.8	383.3					
6200		845.8	716.7	470.0	349.7				
6600			845.8	560.9	434.9	316.2	286.7		
7000				656.8	524.0	400.4	337.3		
7400				758.6	617.9	487.8	388.3		
7800				865.4	717.1	579.7	441.1	327.2	
8200					822.5	676.7	496.2	378.0	
8600						779.7	553.9	430.4	317.0
9000						886.8	614.6	485.0	367.7
9400							678.8	542.1	419.7
9800							747.2	602.2	473.8
10200							820.2	665.6	530.5
10600							894.1	733.1	589.9
11000								805.4	652.6
11400								879.3	719.3
11800									790.6
12200									864.5

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -190 ft/+180 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff
20% Thrust Reduction
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-6	-4	-2	-15	-13	-11	-27	-25	-23
760	-7	-5	-3	-17	-15	-13	-29	-27	-25
720	-9	-7	-5	-19	-17	-15	-31	-29	-27
680	-9	-7	-5	-20	-18	-16	-32	-30	-28
640	-10	-8	-6	-21	-19	-17	-33	-31	-29
600	-10	-8	-6	-21	-19	-17	-34	-32	-30
560	-11	-9	-7	-22	-20	-18	-35	-33	-31
520	-11	-9	-7	-22	-20	-18	-35	-33	-31
480	-11	-9	-7	-22	-20	-18	-35	-33	-31
440	-11	-9	-7	-23	-21	-19	-35	-33	-31
400	-12	-10	-8	-23	-21	-19	-35	-33	-31
360	-12	-10	-8	-23	-21	-19	-35	-33	-31

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
840	0.0	0.0	0.0	-64.0	-64.0	-64.0	-117.7	-117.7	-117.7
800	0.0	0.0	0.0	-63.0	-63.0	-63.0	-112.5	-112.5	-112.5
760	-1.6	-1.6	-1.6	-61.9	-61.9	-61.9	-107.6	-107.6	-107.6
720	-6.7	-6.7	-6.7	-61.0	-61.0	-61.0	-103.1	-103.1	-103.1
680	-11.8	-11.8	-11.8	-60.7	-60.7	-60.7	-99.0	-99.0	-99.0
640	-16.4	-16.4	-16.4	-60.6	-60.6	-60.6	-95.4	-95.4	-95.4
600	-20.2	-20.2	-20.2	-60.7	-60.7	-60.7	-92.4	-92.4	-92.4
560	-23.0	-23.0	-23.0	-60.9	-60.9	-60.9	-89.7	-89.7	-89.7
520	-24.4	-24.4	-24.4	-59.4	-59.4	-59.4	-85.6	-85.6	-85.6
480	-24.1	-24.1	-24.1	-55.6	-55.6	-55.6	-79.4	-79.4	-79.4
440	-22.2	-22.2	-22.2	-49.6	-49.6	-49.6	-71.1	-71.1	-71.1
400	-18.6	-18.6	-18.6	-41.4	-41.4	-41.4	-60.7	-60.7	-60.7
360	-13.5	-13.5	-13.5	-30.9	-30.9	-30.9	-48.1	-48.1	-48.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
5400	522.5	295.8							
5800	723.4	567.7	359.8						
6200	888.7	757.9	610.0						
6600			790.9						
8200				528.9					
8600				740.6	503.8				
9000				918.2	721.8	477.7			
9400					900.6	702.6			
9800						882.9			
...									
13000							416.2		
13400							669.3	381.7	
13800							852.7	648.5	344.2
14200								835.2	627.0
14600									817.8

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -100 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -270 ft/+270 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff
20% Thrust Reduction
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	4000	8000	S.L.	4000	8000	S.L.	4000	8000
800	-8	-4	0	-21	-17	-13	-42	-38	-34
760	-10	-6	-2	-23	-19	-15	-44	-40	-36
720	-11	-7	-3	-26	-22	-18	-47	-43	-39
680	-12	-8	-4	-27	-23	-19	-50	-46	-42
640	-13	-9	-5	-29	-25	-21	-52	-48	-44
600	-14	-10	-6	-30	-26	-22	-55	-51	-47
560	-15	-11	-7	-32	-28	-24	-56	-52	-48
520	-15	-11	-7	-33	-29	-25	-58	-54	-50
480	-16	-12	-8	-34	-30	-26	-58	-54	-50
440	-16	-12	-8	-35	-31	-27	-58	-54	-50
400	-17	-13	-9	-37	-33	-29	-58	-54	-50
360	-18	-14	-10	-38	-34	-30	-58	-54	-50

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Minimum Control Speeds

V1(MCG), Minimum VR
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	116	118	113	115	111	113	109	111				
50	122	119	121	116	118	111	113	109	111	106	109	103	106
40	104	126	127	123	124	118	120	113	115	108	111	103	106
30	86	128	130	128	130	123	125	118	120	112	115	106	109
20	68	129	130	129	130	125	126	120	122	116	118	110	113
-60	-76	130	130	130	130	126	126	121	122	117	118	112	114

TO1 V1(MCG), Minimum VR
10% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)											
		-2000		0		2000		4000		6000		8000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	111	112	107	110	105	107	103	106				
50	122	113	115	110	112	105	108	103	106	101	104	98	101
40	104	119	121	117	119	112	114	107	110	103	105	98	101
30	86	122	123	121	123	116	118	112	114	107	109	101	104
20	68	122	124	121	123	118	119	114	116	110	112	104	107
-60	-76	124	124	123	123	119	120	115	116	111	112	106	108

TO2 V1(MCG), Minimum VR
20% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	105	107	102	104	100	102	98	101						
50	122	107	109	105	107	100	103	98	101	96	99	93	96	89	92
40	104	113	115	111	113	106	108	102	104	97	100	93	96	89	92
30	86	115	117	115	117	110	112	106	108	101	104	96	99	91	94
20	68	115	117	115	117	112	114	108	110	104	106	99	102	94	97
-60	-76	117	117	116	117	113	114	109	111	105	107	101	103	97	99

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Go-Around %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

REPORTED OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (1000 FT)												
°C	°F		-2	-1	0	1	2	3	4	5	6	7	8	9	10
66	150	70	93.7	93.8	94.1	93.9	93.8	93.7	93.6	93.4	93.3	92.6	91.5	90.5	89.6
56	133	60	96.5	96.6	96.9	96.7	96.6	96.5	96.4	96.2	96.1	95.4	94.3	93.4	92.5
51	124	55	97.8	98.0	98.3	98.1	97.9	97.9	97.7	97.6	97.4	96.7	95.7	94.7	93.9
46	115	50	99.1	99.3	99.6	99.4	99.3	99.2	99.1	98.9	98.7	98.0	97.0	96.1	95.2
41	106	45	100.2	100.7	101.1	101.0	100.9	100.7	100.5	100.4	100.0	99.3	98.3	97.3	96.5
36	97	40	101.5	102.4	103.2	103.2	102.8	102.6	102.3	102.0	101.4	100.5	99.5	98.6	97.8
31	88	35	101.2	103.9	105.8	105.4	105.1	104.7	104.3	103.8	102.7	101.7	100.6	99.7	98.9
26	79	30	100.4	103.1	105.9	106.8	107.3	106.8	106.6	106.4	105.0	103.4	101.9	100.8	100.0
21	70	25	99.5	102.2	105.0	105.9	106.5	107.0	107.4	107.4	106.8	105.7	104.0	102.3	101.3
16	61	20	98.7	101.4	104.1	105.0	105.6	106.1	106.5	107.0	106.8	106.3	105.2	104.2	103.3
11	53	15	97.9	100.5	103.2	104.1	104.7	105.2	105.6	106.1	105.9	105.5	104.9	104.4	104.0
7	44	10	97.0	99.6	102.3	103.2	103.8	104.3	104.7	105.1	105.0	104.6	104.0	103.5	103.4
2	35	5	96.1	98.7	101.4	102.3	102.9	103.4	103.8	104.2	104.1	103.7	103.1	102.6	102.5
-3	26	0	95.3	97.8	100.5	101.4	102.0	102.4	102.8	103.3	103.1	102.7	102.2	101.7	101.6
-13	8	-10	93.5	96.0	98.6	99.5	100.1	100.5	100.9	101.4	101.2	100.8	100.3	99.8	99.7
-23	-10	-20	91.7	94.2	96.7	97.6	98.2	98.6	99.0	99.4	99.3	98.9	98.3	97.9	97.8
-33	-27	-30	89.9	92.3	94.8	95.6	96.2	96.6	97.0	97.4	97.3	96.9	96.4	95.9	95.8
-43	-45	-40	88.0	90.4	92.8	93.6	94.2	94.6	95.0	95.4	95.3	94.9	94.4	93.9	93.9
-53	-63	-50	86.1	88.4	90.8	91.6	92.2	92.6	93.0	93.3	93.2	92.9	92.3	91.9	91.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)												
	-2	-1	0	1	2	3	4	5	6	7	8	9	10
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
1 PACK ON	-0.2	-0.2	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	0.84	0.84	0.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

***Packs on or off with 2 bleed sources.**
****Packs off with 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	**PITCH ATT**	**4.5**	**4.0**			
	V/S (FT/MIN)	1100	700			
30000 (280 KIAS)	**PITCH ATT**	**5.5**	**5.0**	**5.0**	**4.5**	**4.0**
	V/S (FT/MIN)	2800	2100	1500	1100	800
20000 (270 KIAS)	**PITCH ATT**	**8.5**	**7.5**	**7.5**	**7.5**	**7.0**
	V/S (FT/MIN)	4100	3100	2400	1700	1300
10000 (270 KIAS)	**PITCH ATT**	**11.5**	**10.5**	**9.5**	**9.5**	**9.0**
	V/S (FT/MIN)	5400	4100	3300	2600	2100
SEA LEVEL (270 KIAS)	**PITCH ATT**	**15.0**	**13.0**	**12.0**	**11.5**	**11.0**
	V/S (FT/MIN)	6300	4900	3900	3200	2600

Cruise

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	**PITCH ATT**	**2.5**	**3.0**			
	%N1	82.1	87.2			
35000 (280 KIAS)	**PITCH ATT**	**1.5**	**2.5**	**3.0**	**3.5**	
	%N1	78.9	81.6	85.3	92.0	
30000 (280 KIAS)	**PITCH ATT**	**2.0**	**2.5**	**3.0**	**3.0**	**3.0**
	%N1	74.5	77.2	80.7	84.8	88.8
25000 (280 KIAS)	**PITCH ATT**	**2.0**	**2.5**	**3.5**	**3.5**	**3.5**
	%N1	70.6	73.0	76.1	80.0	83.7
20000 (270 KIAS)	**PITCH ATT**	**2.0**	**3.0**	**4.0**	**4.0**	**4.0**
	%N1	65.8	68.3	71.4	75.2	78.9
15000 (270 KIAS)	**PITCH ATT**	**2.0**	**3.0**	**4.0**	**4.5**	**4.5**
	%N1	61.8	64.4	67.2	70.4	74.3

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	**PITCH ATT**	**-1.0**	**0.0**			
	V/S (FT/MIN)	-2700	-2700			
30000 (280 KIAS)	**PITCH ATT**	**-1.0**	**0.0**	**1.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-2200	-2000	-1900	-2100	-2500
20000 (270 KIAS)	**PITCH ATT**	**-0.5**	**0.5**	**1.5**	**2.0**	**1.5**
	V/S (FT/MIN)	-1800	-1600	-1500	-1500	-1600
10000 (270 KIAS)	**PITCH ATT**	**-1.0**	**0.0**	**1.5**	**2.5**	**2.5**
	V/S (FT/MIN)	-1600	-1400	-1400	-1400	-1400
SEA LEVEL (270 KIAS)	**PITCH ATT**	**-1.0**	**0.0**	**1.0**	**2.0**	**2.5**
	V/S (FT/MIN)	-1400	-1300	-1200	-1200	-1300

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	52.8	57.5	62.0	66.1	69.7
	KIAS	207	222	238	258	276
5000	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	49.3	53.8	58.0	61.9	65.6
	KIAS	207	222	237	256	274

Terminal Area (5000 FT)

Set Thrust for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS UP	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
GEAR UP	%N1	49.5	54.2	58.5	62.6	66.4
(VREF30+80)	KIAS	207	222	235	252	264
FLAPS 1	**PITCH ATT**	**6.5**	**7.0**	**7.5**	**7.5**	**8.0**
GEAR UP	%N1	50.4	55.4	60.0	64.3	68.0
(VREF30+60)	KIAS	187	202	215	232	244
FLAPS 5	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
GEAR UP	%N1	50.9	56.1	61.0	65.2	69.1
(VREF30+40)	KIAS	167	182	195	212	224
FLAPS 15	**PITCH ATT**	**6.5**	**7.0**	**7.0**	**7.0**	**7.0**
GEAR UP	%N1	52.1	57.7	62.7	66.9	71.2
(VREF30+20)	KIAS	147	162	175	192	204
FLAPS 20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**5.5**
GEAR DOWN	%N1	57.9	63.7	69.3	74.0	78.1
(VREF30+20)	KIAS	147	162	175	192	204

Final Approach (1500 FT)

Gear Down, Set Thrust for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS 20 (VREF20+10)	**PITCH ATT**	**1.0**	**1.0**	**1.5**	**1.5**	**2.0**
	%N1	39.7	43.9	47.9	51.1	53.8
	KIAS	153	170	185	199	209
FLAPS 25 (VREF25+10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	50.0	54.5	58.5	62.2	64.7
	KIAS	144	159	173	186	196
FLAPS 30 (VREF30+10)	**PITCH ATT**	**1.0**	**1.5**	**1.5**	**1.0**	**1.0**
	%N1	54.3	59.4	63.6	69.6	73.5
	KIAS	137	152	165	182	194

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	**PITCH ATT**	**18.0**	**14.5**	**12.5**	**10.5**	**9.0**
	V/S (FT/MIN)	4000	3100	2500	2000	1600
	KIAS	147	162	176	193	205
5000	**PITCH ATT**	**22.5**	**18.0**	**15.0**	**12.5**	**11.0**
	V/S (FT/MIN)	5000	4000	3300	2700	2200
	KIAS	147	162	176	192	205
SEA LEVEL	**PITCH ATT**	**27.0**	**21.5**	**18.0**	**15.0**	**13.0**
	V/S (FT/MIN)	5800	4700	3900	3300	2800
	KIAS	147	162	175	192	204

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	30800	29100	27600
760	28800	2	31300	29700	28200
740	29400	0	31800	30200	28700
720	30000	-1	32300	30700	29100
700	30700	-2	32800	31100	29600
680	31300	-4	33200	31600	30100
660	31900	-5	33700	32100	30600
640	32600	-7	34300	32700	31200
620	33300	-8	34800	33200	31700
600	34000	-10	35300	33800	32300
580	34700	-11	35900	34300	32900
560	35400	-13	36500	34900	33500
540	36200	-15	37100	35600	34100
520	37000	-15	37800	36200	34800
500	37800	-15	38400	36900	35500
480	38600	-15	39100	37600	36200
460	39500	-15	39900	38300	36900
440	40400	-15	40600	39100	37700
420	41400	-15	41400	39900	38600
400	42400	-15	42300	40800	39400
380	43100	-15	43100	41800	40500

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	30800	29100	27600
760	28800	8	31300	29700	28200
740	29400	6	31800	30200	28700
720	30000	5	32300	30700	29100
700	30700	3	32800	31100	29600
680	31300	2	33200	31600	30100
660	31900	1	33700	32100	30600
640	32600	-1	34300	32700	31200
620	33300	-2	34800	33200	31700
600	34000	-4	35300	33800	32300
580	34700	-6	35900	34300	32900
560	35400	-7	36500	34900	33500
540	36200	-9	37100	35600	34100
520	37000	-9	37800	36200	34800
500	37800	-9	38400	36900	35500
480	38600	-9	39100	37600	36200
460	39500	-9	39900	38300	36900
440	40400	-9	40600	39100	37700
420	41400	-9	41400	39900	38600
400	42400	-9	42300	40800	39400
380	43100	-9	43100	41800	40500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Forward C.G. (7.5% MAC - FMC Default)

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	30800	29100	27600
760	28800	13	31300	29700	28200
740	29400	12	31800	30200	28700
720	30000	11	32300	30700	29100
700	30700	9	32800	31100	29600
680	31300	8	33200	31600	30100
660	31900	6	33700	32100	30600
640	32600	5	34300	32700	31200
620	33300	3	34800	33200	31700
600	34000	2	35300	33800	32300
580	34700	0	35900	34300	32900
560	35400	-2	36500	34900	33500
540	36200	-3	37100	35600	34100
520	37000	-3	37800	36200	34800
500	37800	-3	38400	36900	35500
480	38600	-3	39100	37600	36200
460	39500	-3	39900	38300	36900
440	40400	-3	40600	39100	37700
420	41400	-3	41400	39900	38600
400	42400	-3	42300	40800	39400
380	43100	-3	43100	41800	40500

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust, Mid C.G. (30% MAC)

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	3	31800	30200	28600
760	28800	2	32400	30700	29200
740	29400	0	32900	31300	29700
720	30000	-1	33300	31700	30200
700	30700	-2	33800	32200	30700
680	31300	-4	34300	32700	31200
660	31900	-5	34800	33200	31700
640	32600	-7	35300	33700	32200
620	33300	-8	35800	34200	32700
600	34000	-10	36300	34800	33300
580	34700	-11	36900	35300	33900
560	35400	-13	37500	35900	34500
540	36200	-15	38100	36600	35100
520	37000	-15	38800	37200	35800
500	37800	-15	39400	37900	36400
480	38600	-15	40100	38600	37100
460	39500	-15	40900	39300	37900
440	40400	-15	41600	40100	38700
420	41400	-15	42400	40900	39500
400	42400	-15	43100	41700	40300
380	43100	-15	43100	42800	41400

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	9	31800	30200	28600
760	28800	8	32400	30700	29200
740	29400	6	32900	31300	29700
720	30000	5	33300	31700	30200
700	30700	3	33800	32200	30700
680	31300	2	34300	32700	31200
660	31900	1	34800	33200	31700
640	32600	-1	35300	33700	32200
620	33300	-2	35800	34200	32700
600	34000	-4	36300	34800	33300
580	34700	-6	36900	35300	33900
560	35400	-7	37500	35900	34500
540	36200	-9	38100	36600	35100
520	37000	-9	38800	37200	35800
500	37800	-9	39400	37900	36400
480	38600	-9	40100	38600	37100
460	39500	-9	40900	39300	37900
440	40400	-9	41600	40100	38700
420	41400	-9	42400	40900	39500
400	42400	-9	43100	41700	40300
380	43100	-9	43100	42800	41400

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust, Mid C.G. (30% MAC)
ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	28300	15	31800	30200	28600
760	28800	13	32400	30700	29200
740	29400	12	32900	31300	29700
720	30000	11	33300	31700	30200
700	30700	9	33800	32200	30700
680	31300	8	34300	32700	31200
660	31900	6	34800	33200	31700
640	32600	5	35300	33700	32200
620	33300	3	35800	34200	32700
600	34000	2	36300	34800	33300
580	34700	0	36900	35300	33900
560	35400	-2	37500	35900	34500
540	36200	-3	38100	36600	35100
520	37000	-3	38800	37200	35800
500	37800	-3	39400	37900	36400
480	38600	-3	40100	38600	37100
460	39500	-3	40900	39300	37900
440	40400	-3	41600	40100	38700
420	41400	-3	42400	40900	39500
400	42400	-3	43100	41700	40300
380	43100	-3	43100	42800	41400

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		25	27	29	31	33	35	37	39	41	43
780	%N1	84.2	85.9	87.1	89.6						
	MACH	.819	.840	.839	.838						
	KIAS	346	342	327	313						
	FF/ENG	11439	11411	11201	11537						
740	%N1	83.4	84.8	85.9	87.7	90.7					
	MACH	.819	.837	.840	.839	.837					
	KIAS	346	341	328	313	299					
	FF/ENG	11096	10974	10668	10708	11189					
700	%N1	82.5	83.7	84.9	86.1	88.3					
	MACH	.812	.831	.839	.840	.838					
	KIAS	343	338	327	314	300					
	FF/ENG	10640	10513	10229	10021	10265					
660	%N1	81.0	82.5	83.7	84.9	86.4	89.1				
	MACH	.795	.819	.835	.840	.839	.837				
	KIAS	335	332	325	314	300	286				
	FF/ENG	10011	9983	9794	9536	9480	9831				
620	%N1	79.4	81.1	82.5	83.8	84.9	86.7				
	MACH	.775	.803	.825	.838	.840	.839				
	KIAS	326	325	321	313	300	287				
	FF/ENG	9341	9384	9307	9103	8893	8984				
580	%N1	77.6	79.4	81.1	82.4	83.6	84.8	87.5			
	MACH	.751	.782	.809	.830	.839	.840	.838			
	KIAS	315	316	314	310	300	287	274			
	FF/ENG	8646	8743	8740	8651	8448	8289	8522			
540	%N1	75.9	77.5	79.3	81.0	82.3	83.4	85.2	88.6		
	MACH	.728	.757	.788	.814	.833	.840	.839	.837		
	KIAS	305	305	305	303	298	287	274	261		
	FF/ENG	8016	8060	8128	8113	8011	7814	7757	8113		
500	%N1	74.4	75.7	77.3	79.1	80.7	82.1	83.5	85.9		
	MACH	.709	.731	.761	.792	.818	.835	.840	.839		
	KIAS	296	294	294	294	292	285	274	262		
	FF/ENG	7478	7417	7468	7518	7504	7376	7226	7293		
460	%N1	72.8	74.0	75.3	77.0	78.9	80.4	82.1	84.0	86.5	
	MACH	.691	.710	.733	.764	.795	.821	.836	.840	.839	
	KIAS	288	285	282	283	283	280	273	262	250	
	FF/ENG	6982	6872	6822	6874	6918	6892	6790	6706	6803	
420	%N1	70.8	72.3	73.5	74.8	76.5	78.4	80.3	82.4	84.2	86.8
	MACH	.669	.690	.710	.733	.764	.796	.822	.837	.840	.839
	KIAS	278	276	273	270	271	271	268	261	250	238
	FF/ENG	6457	6375	6276	6235	6280	6311	6314	6265	6188	6260
380	%N1	68.5	70.1	71.6	72.8	74.2	75.9	78.2	80.4	82.5	84.3
	MACH	.639	.665	.688	.708	.731	.762	.795	.821	.836	.840
	KIAS	266	266	264	260	258	258	258	255	249	239
	FF/ENG	5889	5850	5779	5697	5655	5676	5727	5783	5742	5644
340	%N1	65.9	67.6	69.2	70.7	72.0	73.3	75.3	78.0	80.3	82.5
	MACH	.604	.632	.659	.683	.704	.726	.757	.790	.817	.835
	KIAS	250	251	252	251	247	244	244	245	242	237
	FF/ENG	5299	5296	5253	5205	5135	5071	5094	5184	5243	5194

Shaded area approximates optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
282	261	242	226	213	200	191	182	174	167	160
561	520	484	452	425	400	382	366	351	337	325
840	779	725	678	637	600	574	550	528	508	489
1120	1039	966	904	849	800	766	734	705	678	653
1401	1299	1208	1130	1062	1000	957	918	881	848	817
1683	1560	1451	1357	1274	1200	1149	1101	1057	1017	980
1966	1822	1694	1583	1487	1400	1340	1285	1234	1187	1144
2250	2085	1937	1811	1700	1600	1532	1469	1410	1356	1307
2535	2348	2181	2038	1913	1800	1723	1652	1586	1525	1470
2820	2611	2425	2265	2126	2000	1915	1835	1762	1695	1633

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	9.1	0:37	7.9	0:36	6.5	0:35	5.8	0:34	5.1	0:33
400	18.7	1:09	17.1	1:06	14.8	1:03	13.6	1:01	12.6	0:58
600	28.4	1:42	26.3	1:36	23.1	1:31	21.4	1:28	20.1	1:24
800	37.9	2:15	35.3	2:07	31.3	1:59	29.1	1:55	27.5	1:49
1000	47.3	2:48	44.3	2:38	39.4	2:27	36.8	2:22	34.8	2:15
1200	56.7	3:22	53.2	3:09	47.5	2:56	44.4	2:49	42.1	2:40
1400	66.1	3:55	62.1	3:41	55.5	3:24	51.9	3:17	49.3	3:06
1600	75.3	4:29	70.8	4:12	63.5	3:53	59.4	3:44	56.4	3:32
1800	84.5	5:04	79.5	4:44	71.4	4:22	66.8	4:12	63.5	3:58
2000	93.6	5:38	88.2	5:17	79.2	4:51	74.2	4:40	70.6	4:24

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	400	450	500	550	600	650	700	750	800
10	-1.4	-1.0	-0.7	-0.3	0.0	0.4	0.8	1.2	1.7
20	-2.9	-2.2	-1.5	-0.7	0.0	0.9	1.8	2.8	3.8
30	-4.5	-3.4	-2.3	-1.1	0.0	1.4	2.9	4.4	5.9
40	-6.1	-4.6	-3.1	-1.5	0.0	1.9	3.9	6.0	8.1
50	-7.6	-5.8	-3.9	-1.9	0.0	2.5	5.0	7.6	10.2
60	-9.2	-7.0	-4.7	-2.3	0.0	3.0	6.1	9.2	12.3
70	-10.7	-8.1	-5.5	-2.7	0.0	3.6	7.2	10.8	14.4
80	-12.3	-9.3	-6.3	-3.1	0.0	4.2	8.3	12.4	16.5
90	-13.8	-10.5	-7.1	-3.5	0.0	4.8	9.4	14.0	18.5
100	-15.3	-11.6	-7.8	-3.9	0.0	5.4	10.6	15.7	20.6
110	-16.9	-12.8	-8.6	-4.3	0.0	6.0	11.7	17.3	22.7
120	-18.4	-13.9	-9.4	-4.7	0.0	6.6	12.9	19.0	24.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1032	976	925	879	838	800	767	736	708	682	657
1543	1460	1385	1317	1256	1200	1151	1106	1063	1024	989
2056	1946	1846	1756	1675	1600	1535	1475	1419	1367	1320
2571	2433	2308	2195	2094	2000	1920	1845	1775	1710	1651
3088	2922	2771	2635	2513	2400	2304	2214	2131	2053	1982
3606	3412	3235	3076	2932	2800	2688	2583	2486	2396	2313
4126	3904	3699	3517	3352	3200	3072	2953	2842	2739	2645
4649	4396	4165	3959	3772	3600	3456	3322	3197	3082	2976
5172	4890	4631	4400	4192	4000	3840	3691	3552	3424	3307
5697	5384	5098	4843	4612	4400	4224	4060	3908	3767	3637
6223	5880	5565	5285	5033	4800	4608	4429	4263	4109	3967
6751	6376	6034	5729	5453	5200	4992	4798	4617	4450	4297
7281	6874	6503	6172	5874	5600	5375	5166	4971	4791	4626
7812	7373	6973	6616	6295	6000	5759	5534	5324	5131	4954
8345	7874	7444	7061	6716	6400	6142	5901	5678	5471	5282
8880	8376	7915	7506	7138	6800	6525	6269	6030	5811	5610
9418	8880	8388	7952	7560	7200	6908	6636	6383	6150	5936
9959	9385	8863	8399	7982	7600	7291	7002	6735	6488	6262
10502	9893	9338	8846	8405	8000	7674	7369	7086	6826	6587

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
800	27.2	1:48	26.3	1:47	25.5	1:47	25.3	1:48	26.2	1:48
1200	41.3	2:39	40.1	2:36	39.0	2:36	38.4	2:37	39.5	2:38
1600	55.4	3:30	53.9	3:26	52.4	3:25	51.6	3:27	52.7	3:28
2000	69.6	4:21	67.7	4:16	65.8	4:15	64.8	4:16	66.0	4:18
2400	83.1	5:13	80.9	5:07	78.8	5:05	77.4	5:06	78.5	5:07
2800	96.7	6:06	94.1	5:58	91.7	5:55	90.1	5:55	90.9	5:57
3200	109.9	6:59	107.1	6:50	104.4	6:45	102.4	6:45	103.0	6:47
3600	122.9	7:54	119.8	7:42	116.9	7:36	114.6	7:35	114.9	7:37
4000	135.9	8:48	132.6	8:34	129.3	8:27	126.7	8:25	126.7	8:27
4400	148.4	9:43	144.8	9:28	141.3	9:19	138.4	9:16	138.1	9:17
4800	160.8	10:39	157.0	10:22	153.2	10:10	150.1	10:07	149.5	10:07
5200	173.0	11:36	168.9	11:17	165.0	11:03	161.5	10:58	160.6	10:57
5600	185.0	12:33	180.6	12:12	176.4	11:57	172.8	11:50	171.6	11:47
6000	197.0	13:30	192.3	13:08	187.9	12:50	184.0	12:41	182.5	12:38
6400	208.5	14:28	203.5	14:05	198.9	13:45	194.8	13:34	193.0	13:29
6800	220.0	15:27	214.8	15:02	209.9	14:41	205.5	14:27	203.5	14:21
7200	231.4	16:26	225.8	16:00	220.7	15:37	216.1	15:21	213.8	15:13
7600	242.5	17:26	236.6	16:58	231.2	16:33	226.4	16:16	223.9	16:05
8000	253.6	18:26	247.4	17:56	241.8	17:30	236.7	17:11	234.0	16:58

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitudes

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	400	450	500	550	600	650	700	750	800
20	-3.7	-2.7	-1.7	-0.8	0.0	2.7	8.7	17.9	30.3
40	-8.1	-6.1	-4.1	-2.0	0.0	4.9	13.5	26.0	42.2
60	-12.3	-9.4	-6.4	-3.2	0.0	6.8	17.9	33.3	53.0
80	-16.5	-12.7	-8.7	-4.3	0.0	8.6	22.0	40.0	62.6
100	-20.6	-15.9	-10.9	-5.4	0.0	10.3	25.6	45.9	71.2
120	-24.5	-19.0	-13.1	-6.5	0.0	11.8	28.9	51.1	78.6
140	-28.4	-22.0	-15.1	-7.5	0.0	13.2	31.8	55.7	84.9
160	-32.2	-24.9	-17.1	-8.6	0.0	14.5	34.3	59.5	90.0
180	-35.9	-27.8	-19.1	-9.6	0.0	15.5	36.4	62.6	94.1
200	-39.5	-30.5	-21.0	-10.6	0.0	16.5	38.1	65.0	97.0
220	-43.0	-33.2	-22.8	-11.5	0.0	17.3	39.5	66.7	98.9
240	-46.4	-35.8	-24.6	-12.4	0.0	17.9	40.4	67.7	99.6
260	-49.7	-38.3	-26.3	-13.3	0.0	18.4	41.0	68.0	99.2
280	-52.9	-40.8	-27.9	-14.2	0.0	18.7	41.2	67.5	97.6
300	-56.0	-43.1	-29.5	-15.1	0.0	18.9	41.1	66.4	95.0
320	-59.0	-45.4	-31.0	-15.9	0.0	19.0	40.5	64.6	91.2
340	-61.9	-47.5	-32.4	-16.7	0.0	18.9	39.5	62.0	86.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)										
	780	740	700	660	620	580	540	500	460	420	380
43							188	94	35	6	0
41						153	77	29	6	0	8
39					117	58	22	4	0	8	23
37			147	84	40	14	2	1	9	22	38
35		101	56	25	7	0	2	10	23	37	52
33	66	34	14	3	0	4	13	24	38	52	64
31	18	6	0	1	7	16	27	39	52	63	72
29	1	0	4	10	19	30	42	53	63	71	76
27	2	7	15	24	34	44	55	64	71	76	77
25	12	20	29	38	48	57	65	71	75	77	76

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent at .84M/310/250

PRESSURE ALTITUDE (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	96	104	111	118	124	129	135	140	145	150
TIME (MINUTES)	20	21	22	23	24	24	25	26	26	27

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
800	%N1	62.7	65.6	69.7	74.5	79.1	83.7	88.8			
	KIAS	273	275	276	301	314	318	312			
	FF/ENG	10540	10420	10330	10690	11040	11440	12000			
760	%N1	61.3	64.2	68.3	72.8	77.7	82.4	87.0			
	KIAS	266	268	269	285	306	309	312			
	FF/ENG	10010	9920	9800	9990	10430	10760	11180			
720	%N1	59.9	62.7	66.8	71.0	76.2	80.9	85.5			
	KIAS	259	260	261	271	297	300	305			
	FF/ENG	9490	9400	9280	9340	9830	10070	10400			
680	%N1	58.5	61.2	65.4	69.3	74.6	79.3	84.0			
	KIAS	252	253	254	256	286	291	296			
	FF/ENG	8980	8890	8760	8740	9200	9410	9720			
640	%N1	57.0	59.6	63.8	67.7	72.8	77.6	82.2			
	KIAS	245	245	246	248	267	282	286			
	FF/ENG	8470	8370	8250	8210	8480	8780	9070			
600	%N1	55.5	58.0	62.0	66.1	70.7	75.8	80.6	85.3		
	KIAS	236	237	238	239	251	273	276	279		
	FF/ENG	7980	7860	7740	7680	7800	8190	8420	8790		
560	%N1	53.9	56.4	60.2	64.4	68.7	74.0	78.7	83.5		
	KIAS	231	231	231	231	234	263	266	270		
	FF/ENG	7500	7370	7230	7170	7180	7600	7780	8020		
520	%N1	52.3	54.7	58.4	62.5	66.7	71.8	76.6	81.5		
	KIAS	225	225	225	225	225	243	256	259		
	FF/ENG	7060	6910	6740	6660	6650	6880	7150	7370		
480	%N1	50.7	53.0	56.6	60.5	64.7	69.3	74.5	79.3		
	KIAS	220	220	220	220	220	224	245	248		
	FF/ENG	6640	6470	6270	6190	6160	6210	6540	6720		
440	%N1	48.8	51.2	54.7	58.4	62.6	66.9	72.2	77.1	83.5	
	KIAS	213	213	213	213	213	213	232	237	240	
	FF/ENG	6240	6050	5840	5750	5680	5670	5920	6090	6440	
400	%N1	46.8	49.3	52.8	56.3	60.4	64.7	69.4	74.5	81.0	
	KIAS	207	207	207	207	207	207	209	225	228	
	FF/ENG	5850	5660	5430	5340	5250	5200	5230	5480	5760	
360	%N1	44.7	47.1	50.7	54.2	57.9	62.4	66.6	71.8	78.3	82.3
	KIAS	200	200	200	200	200	200	200	212	215	217
	FF/ENG	5590	5400	5170	5050	4940	4870	4840	4900	5110	5270

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
800	%N1	65.2	68.1	72.7	77.2	82.2
	KIAS	242	242	242	242	242
	FF/ENG	11530	11500	11450	11560	11820
760	%N1	63.7	66.5	70.9	75.4	80.5
	KIAS	242	242	242	242	242
	FF/ENG	10890	10840	10770	10840	11080
720	%N1	62.2	65.0	69.2	73.8	78.8
	KIAS	236	236	236	236	236
	FF/ENG	10290	10230	10160	10190	10400
680	%N1	60.6	63.5	67.6	72.2	77.1
	KIAS	228	228	228	228	228
	FF/ENG	9700	9640	9560	9570	9740
640	%N1	59.0	61.8	65.9	70.5	75.3
	KIAS	221	221	221	221	221
	FF/ENG	9130	9050	8960	8960	9090
600	%N1	57.3	60.0	64.1	68.4	73.2
	KIAS	216	216	216	216	216
	FF/ENG	8560	8480	8360	8360	8430
560	%N1	55.6	58.1	62.2	66.4	71.2
	KIAS	211	211	211	211	211
	FF/ENG	8010	7910	7790	7760	7810
520	%N1	53.9	56.3	60.2	64.3	68.9
	KIAS	205	205	205	205	205
	FF/ENG	7480	7350	7220	7180	7200
480	%N1	52.1	54.4	58.1	62.2	66.5
	KIAS	200	200	200	200	200
	FF/ENG	6990	6830	6670	6610	6600
440	%N1	50.1	52.4	56.0	59.9	64.1
	KIAS	193	193	193	193	193
	FF/ENG	6510	6330	6140	6050	6030
400	%N1	48.0	50.3	53.8	57.4	61.7
	KIAS	187	187	187	187	187
	FF/ENG	6050	5850	5650	5540	5490
360	%N1	45.5	48.1	51.5	54.9	59.0
	KIAS	180	180	180	180	180
	FF/ENG	5730	5530	5300	5180	5100

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4280	90/-50	80	-150/490	50/-50	80/-80	140	80	180
AUTOBRAKE MAX	5590	80/-70	130	-210/710	0/0	130/-130	250	0	0
AUTOBRAKE 4	7120	120/-90	170	-300/1010	0/0	180/-180	360	0	0
AUTOBRAKE 3	8340	140/-120	220	-370/1270	0/-50	220/-220	400	0	0
AUTOBRAKE 2	9190	160/-140	260	-430/1450	100/-200	240/-240	320	240	240
AUTOBRAKE 1	9940	180/-160	310	-490/1690	290/-300	260/-260	320	970	1210
Good Reported Braking Action									
MAX MANUAL	5810	80/-70	140	-240/860	130/-120	130/-130	200	350	810
AUTOBRAKE MAX	6010	90/-70	150	-250/890	120/-90	140/-140	230	370	850
AUTOBRAKE 4	7150	120/-90	170	-300/1040	30/-10	180/-180	360	20	140
AUTOBRAKE 3	8340	140/-120	220	-370/1270	10/-50	220/-220	400	0	0
AUTOBRAKE 2	9190	160/-140	260	-430/1450	100/-200	240/-240	320	240	240
AUTOBRAKE 1	9940	180/-160	310	-490/1690	290/-300	260/-260	320	970	1210
Good To Medium Reported Braking Action									
MAX MANUAL	6700	100/-90	180	-310/1130	220/-180	160/-160	220	630	1580
AUTOBRAKE MAX	6810	110/-90	180	-320/1140	210/-170	160/-160	250	640	1600
AUTOBRAKE 4	7500	130/-100	200	-350/1220	140/-80	190/-190	360	440	1230
AUTOBRAKE 3	8510	140/-120	220	-400/1390	80/-90	220/-220	400	200	790
AUTOBRAKE 2	9270	160/-140	260	-440/1540	160/-220	240/-240	320	350	740
AUTOBRAKE 1	9950	180/-160	320	-490/1710	320/-310	260/-270	320	1010	1410
Medium Reported Braking Action									
MAX MANUAL	7600	130/-100	220	-380/1390	310/-240	180/-180	250	920	2360
AUTOBRAKE MAX	7600	130/-100	220	-380/1390	310/-240	180/-180	260	910	2350
AUTOBRAKE 4	7840	140/-100	220	-390/1410	240/-150	200/-200	360	850	2320
AUTOBRAKE 3	8680	150/-130	230	-430/1520	150/-140	230/-230	400	390	1590
AUTOBRAKE 2	9360	160/-140	260	-460/1620	220/-250	240/-240	320	450	1230
AUTOBRAKE 1	9960	180/-160	320	-490/1740	360/-320	260/-280	320	1050	1610

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	8540	150/-130	260	-470/1750	490/-350	210/-210	270	1410	3980
AUTOBRAKE MAX	8550	150/-130	260	-470/1750	490/-360	210/-210	280	1410	3970
AUTOBRAKE 4	8670	160/-130	260	-470/1770	460/-290	220/-220	340	1380	3960
AUTOBRAKE 3	9240	170/-140	260	-490/1830	360/-250	240/-250	400	1050	3510
AUTOBRAKE 2	9780	170/-150	290	-520/1910	400/-350	250/-250	320	990	3160
AUTOBRAKE 1	10260	190/-170	330	-550/2000	510/-400	270/-280	320	1430	3250
Poor Reported Braking Action									
MAX MANUAL	9490	170/-150	310	-550/2120	670/-460	240/-240	290	1910	5600
AUTOBRAKE MAX	9500	170/-150	310	-550/2120	680/-470	240/-240	290	1910	5600
AUTOBRAKE 4	9500	180/-150	310	-550/2120	680/-440	240/-240	320	1910	5600
AUTOBRAKE 3	9800	180/-150	300	-560/2150	560/-370	250/-260	390	1710	5440
AUTOBRAKE 2	10200	180/-160	320	-580/2200	590/-450	260/-260	320	1530	5090
AUTOBRAKE 1	10560	200/-170	350	-600/2250	670/-480	280/-280	320	1810	4890

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 240 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4460	80/-50	90	-150/510	50/-50	80/-80	140	90	210
AUTOBRAKE MAX	5970	70/-70	140	-220/740	0/0	140/-140	260	0	0
AUTOBRAKE 4	7660	90/-100	200	-310/1060	0/0	200/-200	370	0	0
AUTOBRAKE 3	8990	120/-130	240	-390/1320	0/-80	240/-240	400	10	10
AUTOBRAKE 2	9830	140/-150	290	-450/1510	140/-220	260/-260	330	370	370
AUTOBRAKE 1	10600	170/-170	350	-520/1750	320/-330	290/-290	330	1140	1500
Good Reported Braking Action									
MAX MANUAL	6120	70/-80	150	-250/890	140/-120	140/-140	200	380	900
AUTOBRAKE MAX	6350	80/-80	160	-260/910	130/-70	150/-150	250	400	950
AUTOBRAKE 4	7690	90/-100	200	-320/1080	30/-10	200/-200	380	20	140
AUTOBRAKE 3	8990	120/-130	240	-390/1320	10/-80	240/-240	400	10	10
AUTOBRAKE 2	9830	140/-150	290	-450/1510	140/-220	260/-260	330	370	370
AUTOBRAKE 1	10600	170/-170	350	-520/1750	320/-330	290/-290	330	1140	1500
Good To Medium Reported Braking Action									
MAX MANUAL	7080	90/-100	200	-320/1160	230/-190	170/-170	220	700	1760
AUTOBRAKE MAX	7190	100/-100	200	-330/1170	230/-160	170/-170	260	710	1790
AUTOBRAKE 4	8040	100/-110	220	-360/1270	130/-80	210/-210	380	440	1330
AUTOBRAKE 3	9170	120/-130	250	-410/1450	90/-130	240/-250	400	220	850
AUTOBRAKE 2	9920	140/-150	290	-460/1590	200/-250	260/-260	330	480	890
AUTOBRAKE 1	10620	170/-170	350	-520/1780	360/-340	290/-290	330	1180	1710
Medium Reported Braking Action									
MAX MANUAL	8040	120/-120	240	-390/1430	320/-260	200/-200	250	1010	2620
AUTOBRAKE MAX	8040	120/-120	240	-390/1430	330/-240	200/-200	280	1010	2620
AUTOBRAKE 4	8400	120/-120	240	-400/1460	230/-150	220/-220	380	860	2520
AUTOBRAKE 3	9340	130/-140	250	-440/1580	160/-170	240/-250	390	430	1680
AUTOBRAKE 2	10020	140/-150	300	-470/1670	250/-280	260/-260	330	590	1410
AUTOBRAKE 1	10640	170/-170	350	-520/1810	390/-350	290/-290	330	1220	1920

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	9040	140/-140	290	-480/1790	510/-370	230/-230	270	1560	4430
AUTOBRAKE MAX	9050	140/-140	290	-480/1790	520/-370	230/-230	290	1560	4430
AUTOBRAKE 4	9230	140/-140	290	-480/1810	470/-300	240/-240	350	1480	4390
AUTOBRAKE 3	9910	140/-150	290	-510/1890	370/-290	260/-260	390	1120	3840
AUTOBRAKE 2	10440	160/-160	330	-530/1960	440/-370	280/-280	330	1160	3540
AUTOBRAKE 1	10940	180/-180	360	-570/2060	540/-430	290/-290	330	1620	3700
Poor Reported Braking Action									
MAX MANUAL	10040	160/-160	330	-560/2160	700/-480	260/-260	290	2100	6230
AUTOBRAKE MAX	10060	160/-160	330	-560/2160	710/-490	260/-260	300	2100	6240
AUTOBRAKE 4	10070	160/-160	330	-560/2160	700/-450	260/-260	320	2100	6260
AUTOBRAKE 3	10480	160/-160	330	-590/2210	580/-400	280/-280	390	1810	5990
AUTOBRAKE 2	10870	170/-170	360	-600/2250	630/-470	290/-290	330	1730	5660
AUTOBRAKE 1	11250	180/-180	370	-620/2320	690/-520	300/-300	330	2010	5490

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 250 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 220 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4800	100/-50	100	-160/530	60/-50	90/-90	150	120	240
AUTOBRAKE MAX	6540	80/-80	150	-230/780	0/0	160/-160	280	0	0
AUTOBRAKE 4	8490	100/-120	220	-330/1130	0/0	230/-230	400	0	0
AUTOBRAKE 3	9980	140/-150	280	-410/1400	10/-90	280/-280	430	30	30
AUTOBRAKE 2	10930	160/-170	330	-470/1600	160/-250	300/-300	360	490	490
AUTOBRAKE 1	11780	200/-200	400	-540/1850	360/-380	330/-330	360	1400	1830
Good Reported Braking Action									
MAX MANUAL	6660	80/-90	170	-260/930	150/-140	160/-160	210	460	1080
AUTOBRAKE MAX	6920	90/-90	180	-280/950	130/-70	160/-160	280	460	1120
AUTOBRAKE 4	8500	100/-120	220	-350/1150	30/-10	230/-230	400	20	160
AUTOBRAKE 3	9980	140/-150	280	-410/1400	10/-90	280/-280	430	30	30
AUTOBRAKE 2	10930	160/-170	330	-470/1600	160/-250	300/-300	360	490	490
AUTOBRAKE 1	11780	200/-200	400	-540/1850	360/-380	330/-330	360	1400	1830
Good To Medium Reported Braking Action									
MAX MANUAL	7730	100/-110	220	-340/1210	250/-210	190/-200	240	830	2110
AUTOBRAKE MAX	7870	110/-110	230	-350/1220	250/-170	200/-200	280	830	2120
AUTOBRAKE 4	8870	120/-130	250	-390/1340	140/-90	240/-240	400	490	1560
AUTOBRAKE 3	10160	140/-150	290	-440/1530	100/-140	280/-280	430	260	1020
AUTOBRAKE 2	11010	160/-170	340	-490/1680	220/-280	300/-300	360	610	1100
AUTOBRAKE 1	11790	200/-200	400	-550/1880	400/-390	330/-330	360	1440	2080
Medium Reported Braking Action									
MAX MANUAL	8810	130/-130	260	-410/1500	360/-290	220/-230	260	1210	3140
AUTOBRAKE MAX	8810	130/-130	280	-410/1500	370/-260	230/-230	290	1200	3130
AUTOBRAKE 4	9250	130/-140	280	-430/1530	250/-160	240/-240	400	970	2960
AUTOBRAKE 3	10340	140/-150	300	-470/1660	180/-180	280/-280	430	490	2000
AUTOBRAKE 2	11100	160/-170	350	-510/1760	280/-310	300/-300	360	720	1710
AUTOBRAKE 1	11810	200/-200	400	-550/1910	440/-390	330/-330	360	1480	2320

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	VREF ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	9930	160/-160	320	-510/1870	560/-410	250/-260	290	1840	5300
AUTOBRAKE MAX	9940	160/-160	330	-510/1880	570/-400	260/-260	300	1830	5300
AUTOBRAKE 4	10150	160/-160	330	-510/1900	510/-330	270/-270	380	1720	5210
AUTOBRAKE 3	10940	160/-170	340	-550/1980	410/-320	290/-290	420	1290	4560
AUTOBRAKE 2	11550	180/-180	370	-570/2060	480/-410	310/-310	350	1390	4240
AUTOBRAKE 1	12120	200/-200	410	-600/2170	600/-480	340/-340	360	1930	4430
Poor Reported Braking Action									
MAX MANUAL	11050	180/-180	380	-600/2250	760/-530	290/-290	310	2470	7450
AUTOBRAKE MAX	11060	180/-180	380	-600/2270	770/-540	300/-300	310	2470	7460
AUTOBRAKE 4	11060	180/-180	380	-600/2270	770/-490	300/-300	360	2470	7460
AUTOBRAKE 3	11550	180/-180	380	-620/2310	630/-450	310/-310	410	2090	7120
AUTOBRAKE 2	11990	200/-200	400	-630/2360	690/-520	320/-320	350	2050	6760
AUTOBRAKE 1	12420	210/-210	430	-660/2430	760/-560	350/-350	360	2380	6540

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 280 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 230 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4680	120/-50	110	-180/620	80/-70	100/-100	150	200	450
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6330	90/-90	180	-290/1040	210/-170	150/-150	200	630	1570
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7110	100/-100	210	-350/1290	310/-240	180/-180	220	980	2600
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7890	120/-120	250	-420/1550	420/-320	200/-200	240	1320	3630
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8920	150/-140	300	-520/2010	760/-460	230/-230	260	2070	6680
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9960	170/-170	350	-620/2480	1100/-610	260/-260	270	2820	9730
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4460	110/-50	100	-170/600	80/-70	90/-90	150	180	400
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6000	100/-80	160	-280/1010	200/-160	140/-140	200	570	1410
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	6730	110/-100	200	-340/1260	300/-230	160/-160	220	880	2330
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7460	130/-110	230	-400/1510	400/-300	190/-190	240	1190	3260
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8430	160/-130	280	-500/1970	730/-440	210/-210	250	1890	6010
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9400	180/-160	320	-600/2430	1060/-580	240/-240	270	2580	8750
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good Reported Braking Action									
MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130
Medium Reported Braking Action									
MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680
Poor Reported Braking Action									
MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5080	100/-60	110	-160/540	60/-60	110/-110	N/A	160	340
AUTOBRAKE MAX	6160	70/-70	150	-220/720	0/0	150/-150	N/A	0	0
AUTOBRAKE 2	10690	150/-170	330	-450/1490	110/-170	300/-300	N/A	260	260
Good Reported Braking Action									
MAX MANUAL	6980	90/-90	190	-270/920	170/-150	170/-170	N/A	580	1410
AUTOBRAKE MAX	6960	90/-90	190	-270/920	170/-150	170/-170	N/A	580	1410
AUTOBRAKE 2	10690	150/-170	330	-450/1490	110/-170	300/-300	N/A	260	260
Good To Medium Reported Braking Action									
MAX MANUAL	8040	110/-120	240	-340/1180	280/-230	210/-210	N/A	1010	2670
AUTOBRAKE MAX	8020	120/-120	240	-340/1180	290/-240	210/-210	N/A	1010	2670
AUTOBRAKE 2	10780	150/-170	330	-470/1570	190/-210	310/-310	N/A	410	1280
Medium Reported Braking Action									
MAX MANUAL	9090	130/-140	290	-410/1430	390/-310	240/-240	N/A	1440	3930
AUTOBRAKE MAX	9070	140/-140	290	-400/1430	410/-330	240/-240	N/A	1440	3920
AUTOBRAKE 3	10000	130/-140	290	-440/1530	210/-170	280/-280	N/A	670	3100
Medium To Poor Reported Braking Action									
MAX MANUAL	10160	160/-170	350	-490/1780	590/-430	270/-270	N/A	2130	6460
AUTOBRAKE MAX	10160	170/-170	350	-490/1780	610/-450	280/-280	N/A	2130	6460
AUTOBRAKE 3	10730	160/-160	340	-510/1840	480/-330	300/-300	N/A	1640	5950
Poor Reported Braking Action									
MAX MANUAL	11230	190/-190	400	-570/2130	790/-550	300/-300	N/A	2810	8990
AUTOBRAKE MAX	11240	190/-190	410	-570/2130	810/-570	310/-310	N/A	2820	9000
AUTOBRAKE 3	11450	180/-180	390	-580/2150	740/-480	320/-320	N/A	2610	8800

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6990	100/-100	210	-340/1240	280/-230	170/-170	220	880	2280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6990	100/-100	210	-340/1240	280/-230	170/-170	220	880	2280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7860	120/-120	250	-420/1560	450/-330	200/-200	240	1360	3850
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8730	140/-140	290	-490/1880	610/-420	230/-230	250	1830	5420
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10080	180/-170	350	-650/2670	2060/-670	270/-270	270	3320	7250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11430	210/-200	410	-810/3460	3500/-910	300/-300	280	4800	9070
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6610	110/-90	190	-330/1210	270/-210	160/-160	220	800	2050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6610	110/-90	190	-330/1210	270/-210	160/-160	220	800	2050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7430	130/-110	230	-410/1530	430/-310	190/-190	240	1230	3460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8250	150/-130	270	-480/1840	580/-400	210/-210	250	1660	4870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9530	190/-160	330	-630/2620	1980/-640	250/-250	270	3050	7290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10800	220/-190	380	-780/3390	3380/-870	280/-280	280	4430	9700
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4220	100/-50	90	-140/480	50/-50	90/-90	130	0	110
AUTOBRAKE MAX	5690	70/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9870	130/-140	280	-430/1430	40/-110	280/-280	430	0	0

Good Reported Braking Action

MAX MANUAL	6070	80/-80	160	-250/860	160/-140	150/-150	200	0	510
AUTOBRAKE MAX	6320	80/-80	160	-260/880	150/-130	150/-160	230	0	540
AUTOBRAKE 2	9870	130/-140	280	-430/1430	40/-110	280/-280	430	0	0

Good To Medium Reported Braking Action

MAX MANUAL	7260	100/-110	210	-330/1150	290/-240	190/-190	240	0	1030
AUTOBRAKE MAX	7390	110/-110	210	-340/1160	280/-220	190/-200	270	0	1050
AUTOBRAKE 2	10000	140/-150	290	-450/1530	140/-150	290/-290	430	0	360

Medium Reported Braking Action

MAX MANUAL	8440	120/-130	250	-410/1440	420/-330	230/-230	270	0	1550
AUTOBRAKE MAX	8460	130/-130	260	-410/1440	410/-310	230/-230	300	0	1550
AUTOBRAKE 3	9280	130/-140	270	-430/1520	270/-200	260/-260	390	0	1120

Medium To Poor Reported Braking Action

MAX MANUAL	9820	150/-160	310	-520/1870	720/-500	280/-280	300	0	2660
AUTOBRAKE MAX	9830	160/-160	320	-520/1870	720/-500	280/-280	320	0	2660
AUTOBRAKE 3	10310	160/-170	330	-530/1910	640/-410	290/-290	380	0	2470

Poor Reported Braking Action

MAX MANUAL	11190	180/-190	370	-620/2290	1020/-670	320/-320	330	0	3770
AUTOBRAKE MAX	11200	190/-190	380	-620/2290	1030/-680	320/-320	330	0	3770
AUTOBRAKE 3	11340	190/-190	380	-620/2300	1000/-620	320/-320	370	0	3820

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3750	80/-40	70	-130/440	40/-40	70/-70	120	0	80
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8140	140/-110	220	-380/1280	40/-70	220/-230	390	0	0
Good Reported Braking Action									
MAX MANUAL	5250	80/-60	130	-230/790	130/-120	120/-120	190	0	370
AUTOBRAKE MAX	5460	80/-70	130	-230/810	120/-110	130/-130	210	0	400
AUTOBRAKE 2	8140	140/-110	220	-380/1280	40/-70	220/-230	390	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6210	100/-80	170	-300/1060	240/-200	150/-160	220	0	760
AUTOBRAKE MAX	6320	100/-90	170	-300/1070	240/-180	160/-160	250	0	770
AUTOBRAKE 2	8260	150/-120	230	-400/1380	130/-110	230/-230	390	0	280
Medium Reported Braking Action									
MAX MANUAL	7170	120/-100	200	-370/1320	350/-280	180/-190	250	0	1140
AUTOBRAKE MAX	7180	120/-100	210	-370/1320	350/-250	190/-190	280	0	1140
AUTOBRAKE 3	7760	130/-110	220	-390/1390	240/-190	210/-210	350	0	880
Medium To Poor Reported Braking Action									
MAX MANUAL	8290	150/-130	250	-470/1720	610/-420	220/-230	270	0	1950
AUTOBRAKE MAX	8300	150/-130	260	-470/1720	620/-410	230/-230	290	0	1960
AUTOBRAKE 3	8650	160/-130	260	-480/1760	550/-370	240/-240	330	0	1840
Poor Reported Braking Action									
MAX MANUAL	9410	170/-150	300	-560/2110	860/-560	260/-260	290	0	2760
AUTOBRAKE MAX	9420	180/-150	300	-560/2110	880/-570	260/-260	290	0	2770
AUTOBRAKE 3	9540	180/-150	300	-560/2120	850/-550	260/-260	310	0	2800

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAP / SLAT CONTROL (Flaps 20)

VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4170	90/-40	90	-140/460	50/-40	80/-80	130	100	210
AUTOBRAKE MAX	5690	70/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430
Good Reported Braking Action									
MAX MANUAL	5790	70/-80	150	-230/810	130/-120	140/-140	180	400	940
AUTOBRAKE MAX	6020	80/-80	160	-240/830	110/-60	140/-140	240	400	970
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430
Good To Medium Reported Braking Action									
MAX MANUAL	6730	90/-100	190	-300/1060	220/-190	170/-170	210	730	1840
AUTOBRAKE MAX	6840	100/-100	200	-300/1070	220/-150	170/-170	250	720	1850
AUTOBRAKE 2	9580	140/-150	300	-430/1460	190/-250	260/-260	310	530	960
Medium Reported Braking Action									
MAX MANUAL	7660	110/-110	230	-360/1300	310/-250	190/-200	230	1050	2730
AUTOBRAKE MAX	7660	110/-110	240	-360/1300	320/-230	200/-200	250	1040	2720
AUTOBRAKE 3	8990	120/-130	260	-410/1440	160/-160	240/-240	370	430	1740
Medium To Poor Reported Braking Action									
MAX MANUAL	8640	140/-140	280	-440/1630	490/-360	220/-230	250	1600	4610
AUTOBRAKE MAX	8640	140/-140	290	-440/1640	500/-350	230/-230	260	1600	4610
AUTOBRAKE 3	9520	140/-150	300	-480/1730	360/-280	260/-260	370	1130	3970
Poor Reported Braking Action									
MAX MANUAL	9610	160/-160	330	-520/1960	660/-460	250/-250	270	2150	6480
AUTOBRAKE MAX	9620	160/-160	330	-520/1970	670/-470	260/-260	270	2150	6490
AUTOBRAKE 3	10040	160/-160	330	-540/2010	550/-390	270/-270	360	1820	6190

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≤ 5)
VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4620	150/-50	130	-150/630	50/-50	120/-100	170	150	380
AUTOBRAKE MAX	6730	90/-70	170	-230/760	0/0	170/-170	270	0	0
AUTOBRAKE 2	11280	190/-180	370	-460/1520	200/-250	320/-320	360	880	880
Good Reported Braking Action									
MAX MANUAL	6450	90/-80	180	-250/850	140/-120	160/-160	180	530	1280
AUTOBRAKE MAX	6960	90/-80	180	-260/890	60/-40	180/-180	270	310	1090
AUTOBRAKE 2	11280	190/-180	370	-460/1520	200/-250	320/-320	360	880	880
Good To Medium Reported Braking Action									
MAX MANUAL	7570	120/-100	230	-320/1110	240/-200	200/-200	210	980	2610
AUTOBRAKE MAX	7800	120/-100	230	-320/1130	200/-150	210/-210	270	860	2500
AUTOBRAKE 2	11350	190/-180	380	-470/1600	240/-280	320/-320	360	970	1540
Medium Reported Braking Action									
MAX MANUAL	8680	140/-120	280	-380/1360	330/-270	230/-230	240	1430	3940
AUTOBRAKE MAX	8640	140/-120	280	-380/1360	330/-250	230/-230	260	1410	3900
AUTOBRAKE 3	10660	160/-150	320	-450/1560	180/-190	300/-300	380	580	2330
Medium To Poor Reported Braking Action									
MAX MANUAL	9830	170/-150	340	-470/1710	520/-390	260/-260	270	2190	6860
AUTOBRAKE MAX	9800	170/-150	340	-470/1710	520/-380	270/-270	280	2180	6830
AUTOBRAKE 3	11160	180/-170	360	-510/1840	390/-300	310/-310	380	1450	5750
Poor Reported Braking Action									
MAX MANUAL	10970	200/-170	400	-550/2050	700/-500	290/-290	290	2940	9780
AUTOBRAKE MAX	10960	200/-170	400	-550/2050	710/-510	300/-300	290	2940	9760
AUTOBRAKE 3	11650	200/-180	400	-570/2120	600/-410	320/-320	380	2320	9160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (5 < Flaps < 20)

VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4200	110/-40	90	-140/460	50/-40	80/-80	120	100	230
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9710	160/-150	300	-420/1410	120/-180	270/-270	370	360	360
Good Reported Braking Action									
MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	440	1040
AUTOBRAKE MAX	6040	90/-70	160	-240/830	110/-70	150/-150	240	430	1070
AUTOBRAKE 2	9710	160/-150	300	-420/1410	120/-180	270/-270	370	360	360
Good To Medium Reported Braking Action									
MAX MANUAL	6830	110/-90	200	-300/1060	220/-190	170/-170	210	810	2100
AUTOBRAKE MAX	6910	110/-90	200	-300/1070	220/-170	180/-180	240	800	2100
AUTOBRAKE 2	9780	170/-150	300	-440/1480	170/-210	270/-270	370	460	990
Medium Reported Braking Action									
MAX MANUAL	7800	130/-110	240	-360/1310	310/-250	200/-200	240	1170	3150
AUTOBRAKE MAX	7780	130/-110	240	-360/1300	320/-260	200/-200	240	1160	3130
AUTOBRAKE 3	9100	140/-130	260	-410/1450	140/-140	250/-250	390	430	2080
Medium To Poor Reported Braking Action									
MAX MANUAL	8810	160/-140	290	-450/1650	490/-360	230/-230	260	1790	5410
AUTOBRAKE MAX	8810	160/-140	290	-450/1640	510/-370	230/-230	260	1790	5400
AUTOBRAKE 3	9630	160/-140	300	-480/1740	370/-260	270/-270	390	1270	4730
Poor Reported Braking Action									
MAX MANUAL	9820	180/-160	340	-530/1980	670/-470	260/-260	280	2410	7670
AUTOBRAKE MAX	9830	180/-160	340	-530/1980	690/-480	260/-260	280	2410	7670
AUTOBRAKE 3	10160	180/-150	340	-540/2020	600/-370	280/-280	380	2100	7370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≥ 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4170	100/-40	90	-140/460	50/-40	80/-80	130	100	210
AUTOBRAKE MAX	5690	70/-70	130	-210/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430
Good Reported Braking Action									
MAX MANUAL	5790	70/-80	150	-230/810	130/-120	140/-140	180	400	940
AUTOBRAKE MAX	5990	80/-80	160	-240/830	110/-70	140/-140	240	400	970
AUTOBRAKE 2	9500	140/-150	290	-410/1390	140/-220	260/-260	310	430	430
Good To Medium Reported Braking Action									
MAX MANUAL	6730	90/-90	190	-300/1050	220/-180	170/-170	210	720	1840
AUTOBRAKE MAX	6820	100/-100	200	-300/1060	210/-150	170/-170	250	720	1840
AUTOBRAKE 2	9570	140/-150	300	-430/1460	190/-240	260/-260	310	530	960
Medium Reported Braking Action									
MAX MANUAL	7660	110/-110	240	-360/1300	310/-250	200/-200	230	1050	2740
AUTOBRAKE MAX	7650	120/-110	240	-360/1300	320/-230	200/-200	250	1040	2720
AUTOBRAKE 3	8970	120/-130	260	-410/1440	160/-160	240/-240	370	430	1740
Medium To Poor Reported Braking Action									
MAX MANUAL	8640	140/-140	280	-440/1630	490/-360	220/-220	250	1600	4610
AUTOBRAKE MAX	8630	140/-140	280	-440/1630	490/-350	230/-230	260	1590	4600
AUTOBRAKE 3	9510	140/-150	290	-470/1720	350/-270	260/-260	360	1130	3960
Poor Reported Braking Action									
MAX MANUAL	9610	160/-160	330	-520/1970	660/-460	250/-250	270	2150	6480
AUTOBRAKE MAX	9620	160/-160	330	-520/1970	670/-470	260/-260	270	2150	6490
AUTOBRAKE 3	10050	160/-160	330	-540/2010	550/-390	270/-270	360	1820	6190

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS PRIMARY FAIL (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4690	80/-50	100	-150/510	60/-50	100/-100	160	120	270
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170
Good Reported Braking Action									
MAX MANUAL	6410	80/-80	170	-250/870	160/-140	150/-150	220	490	1170
AUTOBRAKE MAX	6390	80/-90	170	-250/870	150/-130	150/-150	240	490	1160
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170
Good To Medium Reported Braking Action									
MAX MANUAL	7380	110/-110	220	-320/1120	260/-210	180/-180	250	870	2260
AUTOBRAKE MAX	7360	110/-110	220	-320/1120	260/-220	190/-190	260	860	2240
AUTOBRAKE 2	9870	140/-160	300	-440/1500	150/-180	280/-280	400	300	1020
Medium Reported Braking Action									
MAX MANUAL	8350	130/-130	260	-390/1370	350/-280	210/-210	280	1240	3340
AUTOBRAKE MAX	8320	130/-130	260	-380/1370	370/-300	220/-220	280	1230	3320
AUTOBRAKE 3	9130	130/-130	260	-410/1460	200/-140	250/-250	410	580	2630
Medium To Poor Reported Braking Action									
MAX MANUAL	9350	160/-150	310	-470/1710	540/-400	240/-240	300	1860	5560
AUTOBRAKE MAX	9340	160/-150	310	-470/1710	570/-420	250/-250	300	1860	5560
AUTOBRAKE 3	9820	150/-150	310	-480/1770	450/-290	270/-270	400	1460	5140
Poor Reported Braking Action									
MAX MANUAL	10340	180/-170	360	-550/2050	730/-510	270/-270	310	2470	7780
AUTOBRAKE MAX	10360	180/-170	360	-550/2050	760/-530	280/-280	310	2480	7790
AUTOBRAKE 3	10500	170/-170	350	-550/2070	700/-440	290/-290	380	2330	7640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROL MODE (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good Reported Braking Action									
MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130
Medium Reported Braking Action									
MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680
Poor Reported Braking Action									
MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROLS (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4910	90/-50	110	-160/540	80/-70	110/-110	210	190	430
AUTOBRAKE MAX	5740	70/-60	130	-210/690	0/0	140/-140	240	0	30
AUTOBRAKE 2	10010	160/-150	290	-430/1440	30/-120	290/-290	440	60	60
Good Reported Braking Action									
MAX MANUAL	6820	100/-90	190	-270/920	200/-170	170/-170	280	680	1700
AUTOBRAKE MAX	6770	100/-90	190	-270/920	210/-180	170/-170	280	670	1660
AUTOBRAKE 2	10010	160/-150	290	-430/1440	30/-120	290/-290	440	60	60
Good To Medium Reported Braking Action									
MAX MANUAL	7870	130/-110	240	-340/1180	320/-260	200/-200	310	1160	3160
AUTOBRAKE MAX	7830	130/-110	250	-340/1180	330/-270	210/-210	310	1150	3130
AUTOBRAKE 2	10110	160/-150	300	-450/1520	120/-150	290/-290	440	290	1700
Medium Reported Braking Action									
MAX MANUAL	8910	150/-130	290	-410/1440	430/-340	230/-230	330	1630	4610
AUTOBRAKE MAX	8890	150/-130	300	-410/1440	440/-350	240/-240	330	1630	4600
AUTOBRAKE 3	9300	150/-120	280	-420/1480	310/-150	250/-260	410	1220	4190
Medium To Poor Reported Braking Action									
MAX MANUAL	9960	180/-160	350	-500/1790	640/-470	270/-270	350	2360	7490
AUTOBRAKE MAX	9950	180/-160	360	-500/1790	650/-480	270/-270	350	2370	7490
AUTOBRAKE 3	10170	180/-150	340	-500/1810	580/-340	280/-280	400	2140	7270
Poor Reported Braking Action									
MAX MANUAL	11000	210/-180	410	-580/2130	840/-590	300/-300	360	3090	10360
AUTOBRAKE MAX	11010	210/-180	410	-580/2130	860/-600	300/-300	360	3100	10380
AUTOBRAKE 3	11040	210/-170	400	-580/2140	840/-530	300/-300	390	3060	10340

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS C (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4690	80/-50	100	-150/510	60/-50	100/-100	160	120	270
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170
Good Reported Braking Action									
MAX MANUAL	6410	80/-80	170	-250/870	160/-140	150/-150	220	490	1170
AUTOBRAKE MAX	6390	80/-90	170	-250/870	150/-130	150/-150	240	490	1160
AUTOBRAKE 2	9780	140/-150	290	-420/1420	80/-140	270/-270	400	170	170
Good To Medium Reported Braking Action									
MAX MANUAL	7380	110/-110	220	-320/1120	260/-210	180/-180	250	870	2260
AUTOBRAKE MAX	7360	110/-110	220	-320/1120	260/-220	190/-190	260	860	2240
AUTOBRAKE 2	9870	140/-160	300	-440/1500	150/-180	280/-280	400	300	1020
Medium Reported Braking Action									
MAX MANUAL	8350	130/-130	260	-390/1370	350/-280	210/-210	280	1240	3340
AUTOBRAKE MAX	8320	130/-130	260	-380/1370	370/-300	220/-220	280	1230	3320
AUTOBRAKE 3	9130	130/-130	260	-410/1460	200/-140	250/-250	410	580	2630
Medium To Poor Reported Braking Action									
MAX MANUAL	9350	160/-150	310	-470/1710	540/-400	240/-240	300	1860	5560
AUTOBRAKE MAX	9340	160/-150	310	-470/1710	570/-420	250/-250	300	1860	5560
AUTOBRAKE 3	9820	150/-150	310	-480/1770	450/-290	270/-270	400	1460	5140
Poor Reported Braking Action									
MAX MANUAL	10340	180/-170	360	-550/2050	730/-510	270/-270	310	2470	7780
AUTOBRAKE MAX	10360	180/-170	360	-550/2050	760/-530	280/-280	310	2480	7790
AUTOBRAKE 3	10500	170/-170	350	-550/2070	700/-440	290/-290	380	2330	7640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4150	80/-40	90	-140/480	50/-50	80/-90	150	0	120
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8900	120/-130	250	-400/1350	0/-10	250/-250	470	0	0
Good Reported Braking Action									
MAX MANUAL	5980	70/-80	150	-250/880	170/-150	150/-150	220	0	540
AUTOBRAKE MAX	6100	70/-80	160	-260/890	160/-130	150/-150	250	0	560
AUTOBRAKE 2	8900	120/-130	250	-400/1350	0/-10	250/-250	470	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	7190	100/-100	200	-340/1200	320/-260	190/-190	260	0	1120
AUTOBRAKE MAX	7240	100/-100	210	-340/1200	320/-250	190/-190	280	0	1130
AUTOBRAKE 2	9100	130/-130	260	-430/1480	140/-80	260/-260	470	0	550
Medium Reported Braking Action									
MAX MANUAL	8390	120/-120	250	-420/1510	470/-360	220/-220	300	0	1700
AUTOBRAKE MAX	8380	120/-120	260	-420/1510	480/-370	230/-230	300	0	1700
AUTOBRAKE 3	8640	120/-130	260	-430/1530	400/-220	240/-240	400	0	1640
Medium To Poor Reported Braking Action									
MAX MANUAL	9840	150/-150	320	-550/2010	860/-560	270/-270	330	0	3030
AUTOBRAKE MAX	9850	150/-150	330	-550/2010	870/-570	280/-280	330	0	3040
AUTOBRAKE 3	9980	150/-160	330	-550/2020	830/-480	280/-280	390	0	3010
Poor Reported Braking Action									
MAX MANUAL	11290	170/-180	380	-670/2510	1240/-760	320/-320	350	0	4360
AUTOBRAKE MAX	11320	180/-180	390	-670/2510	1260/-770	320/-320	350	0	4370
AUTOBRAKE 3	11320	180/-180	390	-670/2510	1260/-740	320/-320	380	0	4370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3970	80/-40	80	-140/470	50/-50	80/-80	150	0	100
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8220	140/-120	220	-380/1290	0/0	230/-230	450	0	0
Good Reported Braking Action									
MAX MANUAL	5680	90/-70	140	-250/860	170/-140	140/-140	220	0	490
AUTOBRAKE MAX	5770	90/-70	150	-250/870	150/-130	140/-140	240	0	500
AUTOBRAKE 2	8220	140/-120	220	-380/1290	0/0	230/-230	450	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6810	110/-90	190	-330/1170	310/-240	180/-180	260	0	1020
AUTOBRAKE MAX	6850	110/-90	200	-330/1170	310/-240	180/-180	270	0	1030
AUTOBRAKE 2	8420	150/-120	240	-410/1420	140/-70	240/-240	450	0	550
Medium Reported Braking Action									
MAX MANUAL	7940	130/-110	240	-410/1470	450/-340	210/-210	290	0	1550
AUTOBRAKE MAX	7930	130/-110	240	-410/1470	460/-350	210/-210	300	0	1550
AUTOBRAKE 3	8080	140/-120	240	-410/1480	420/-230	220/-220	370	0	1560
Medium To Poor Reported Braking Action									
MAX MANUAL	9320	160/-140	300	-530/1960	830/-540	260/-260	320	0	2770
AUTOBRAKE MAX	9320	160/-140	300	-530/1970	840/-550	260/-260	330	0	2780
AUTOBRAKE 3	9400	170/-140	300	-530/1970	820/-480	260/-260	370	0	2780
Poor Reported Braking Action									
MAX MANUAL	10690	190/-160	360	-650/2450	1200/-730	300/-300	350	0	3990
AUTOBRAKE MAX	10710	190/-160	360	-650/2460	1220/-740	300/-300	350	0	4000
AUTOBRAKE 3	10710	200/-160	360	-650/2460	1220/-720	300/-300	360	0	4000

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5110	100/-50	110	-170/570	80/-70	110/-110	210	0	190
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	10070	160/-140	280	-430/1450	0/0	290/-290	510	0	0
Good Reported Braking Action									
MAX MANUAL	7370	110/-90	200	-300/1010	240/-200	190/-190	300	0	850
AUTOBRAKE MAX	7240	110/-90	200	-290/1000	260/-190	190/-190	310	0	820
AUTOBRAKE 2	10070	160/-140	280	-430/1450	0/0	290/-290	510	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	8820	140/-120	260	-390/1350	430/-340	240/-240	340	0	1710
AUTOBRAKE MAX	8730	140/-120	270	-390/1350	460/-350	240/-240	350	0	1680
AUTOBRAKE 2	10360	170/-140	300	-470/1590	240/-100	300/-300	510	0	1120
Medium Reported Braking Action									
MAX MANUAL	10260	170/-140	320	-480/1690	620/-470	280/-280	380	0	2560
AUTOBRAKE MAX	10210	170/-140	330	-480/1690	650/-500	280/-280	380	0	2540
AUTOBRAKE 3	10240	170/-150	330	-480/1690	640/-420	290/-290	400	0	2550
Medium To Poor Reported Braking Action									
MAX MANUAL	11970	210/-180	400	-620/2230	1090/-710	340/-340	410	0	4460
AUTOBRAKE MAX	11950	210/-180	410	-620/2230	1130/-740	340/-340	410	0	4460
AUTOBRAKE 3	11970	210/-180	410	-620/2230	1120/-700	350/-350	420	0	4460
Poor Reported Braking Action									
MAX MANUAL	13670	240/-210	480	-750/2760	1560/-950	390/-390	440	0	6360
AUTOBRAKE MAX	13690	250/-210	490	-750/2760	1600/-980	400/-400	440	0	6370
AUTOBRAKE 3	13690	250/-210	490	-750/2760	1600/-980	400/-400	440	0	6370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+R (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5510	100/-60	130	-200/670	120/-100	130/-130	230	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8760	120/-100	240	-380/1300	440/-350	240/-240	370	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	11280	160/-140	330	-540/1880	980/-670	330/-330	440	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	13800	200/-170	410	-700/2450	1520/-990	420/-420	510	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	17750	250/-200	550	-1010/3660	4490/-1810	560/-560	570	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	21700	290/-230	680	-1310/4860	7450/-2620	690/-690	630	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4530	60/-50	100	-160/560	70/-70	100/-100	170	0	180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6520	80/-90	180	-290/1010	220/-190	160/-160	240	0	740
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7760	110/-110	230	-380/1360	410/-310	200/-200	280	0	1440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	9000	130/-130	280	-470/1700	590/-430	240/-240	310	0	2130
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10460	160/-160	350	-600/2260	1090/-660	290/-290	330	0	3670
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11910	190/-190	410	-730/2820	1590/-880	330/-330	350	0	5210
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4310	60/-50	90	-160/540	70/-60	90/-90	160	0	160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6110	90/-80	160	-280/970	210/-170	150/-150	230	0	640
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7240	120/-100	210	-370/1310	380/-290	190/-190	260	0	1240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8370	140/-120	250	-450/1640	540/-400	220/-220	290	0	1840
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9700	170/-150	310	-580/2180	1010/-610	260/-260	310	0	3160
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11020	200/-170	370	-700/2720	1480/-810	300/-300	330	0	4470
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6200	80/-70	150	-230/770	140/-130	150/-150	260	0	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8890	140/-120	260	-390/1340	410/-330	240/-240	350	0	1610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	10490	180/-150	340	-500/1770	710/-520	290/-290	390	0	2950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	12090	210/-180	410	-610/2200	1010/-700	340/-340	420	0	4290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	13900	250/-220	500	-780/2890	1920/-1020	400/-400	450	0	7180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	15700	290/-250	580	-940/3570	2820/-1330	450/-450	470	0	10060
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
NAV AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good Reported Braking Action									
MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130
Medium Reported Braking Action									
MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680
Poor Reported Braking Action									
MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4410	80/-40	80	-150/490	50/-40	80/-80	150	60	140
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8760	120/-130	250	-390/1330	70/-130	240/-240	360	140	140
Good Reported Braking Action									
MAX MANUAL	5860	70/-70	140	-240/820	130/-110	130/-130	200	300	700
AUTOBRAKE MAX	5840	70/-70	140	-240/820	140/-120	130/-130	210	300	690
AUTOBRAKE 2	8760	120/-130	250	-390/1330	80/-130	240/-240	360	140	140
Good To Medium Reported Braking Action									
MAX MANUAL	6700	90/-90	180	-300/1060	210/-180	160/-160	220	570	1430
AUTOBRAKE MAX	6690	90/-90	180	-300/1060	230/-190	160/-160	230	570	1420
AUTOBRAKE 2	8900	120/-130	260	-410/1410	150/-180	240/-240	360	250	610
Medium Reported Braking Action									
MAX MANUAL	7540	100/-100	210	-360/1290	290/-240	180/-180	240	830	2160
AUTOBRAKE MAX	7540	100/-100	220	-360/1290	310/-250	180/-180	250	830	2150
AUTOBRAKE 3	8320	110/-110	230	-390/1380	190/-140	220/-220	390	350	1440
Medium To Poor Reported Braking Action									
MAX MANUAL	8420	120/-120	260	-440/1610	460/-340	210/-210	260	1300	3710
AUTOBRAKE MAX	8440	130/-120	260	-440/1620	480/-350	210/-210	260	1300	3710
AUTOBRAKE 3	8930	130/-130	260	-460/1670	390/-270	240/-240	370	970	3260
Poor Reported Braking Action									
MAX MANUAL	9300	140/-140	300	-510/1930	620/-430	230/-230	270	1760	5250
AUTOBRAKE MAX	9340	150/-140	300	-510/1940	640/-450	240/-240	270	1770	5260
AUTOBRAKE 3	9540	140/-140	290	-520/1960	580/-390	250/-250	340	1580	5070

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4220	80/-40	80	-140/480	50/-40	80/-80	150	60	120
AUTOBRAKE MAX	4860	70/-60	110	-180/620	10/0	110/-110	230	0	0
AUTOBRAKE 2	8150	140/-120	230	-380/1280	40/-100	220/-220	360	70	70
Good Reported Braking Action									
MAX MANUAL	5570	80/-60	130	-230/800	120/-110	120/-120	200	270	620
AUTOBRAKE MAX	5540	80/-60	130	-230/800	130/-120	120/-120	210	260	610
AUTOBRAKE 2	8150	140/-120	230	-380/1280	50/-100	220/-220	360	70	70
Good To Medium Reported Braking Action									
MAX MANUAL	6350	100/-80	170	-290/1030	200/-170	150/-150	220	510	1270
AUTOBRAKE MAX	6340	100/-80	170	-290/1030	220/-180	150/-150	230	510	1260
AUTOBRAKE 2	8280	140/-120	240	-400/1360	120/-150	220/-220	360	170	510
Medium Reported Braking Action									
MAX MANUAL	7130	110/-100	200	-350/1260	280/-220	170/-170	240	750	1920
AUTOBRAKE MAX	7130	110/-100	200	-350/1260	300/-240	170/-170	240	750	1910
AUTOBRAKE 3	7720	120/-100	210	-370/1330	190/-120	200/-200	380	340	1360
Medium To Poor Reported Braking Action									
MAX MANUAL	7950	130/-120	240	-430/1580	440/-320	200/-200	260	1180	3310
AUTOBRAKE MAX	7970	130/-120	240	-430/1580	460/-340	200/-200	260	1180	3310
AUTOBRAKE 3	8320	140/-120	240	-440/1620	390/-240	220/-220	360	920	2980
Poor Reported Braking Action									
MAX MANUAL	8770	150/-130	270	-500/1890	600/-410	220/-220	270	1600	4700
AUTOBRAKE MAX	8810	150/-130	280	-500/1890	620/-430	220/-220	270	1600	4700
AUTOBRAKE 3	8920	150/-130	270	-500/1910	580/-360	230/-230	340	1490	4590

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4680	140/-50	100	-150/500	50/-50	100/-100	130	130	290
AUTOBRAKE MAX	6530	80/-70	160	-230/740	0/0	160/-170	260	0	0
AUTOBRAKE 2	10740	170/-160	350	-440/1480	230/-260	300/-300	300	920	940
Good Reported Braking Action									
MAX MANUAL	6560	90/-80	180	-250/860	150/-130	160/-160	180	520	1240
AUTOBRAKE MAX	6820	90/-80	180	-260/880	80/-60	170/-170	260	370	1110
AUTOBRAKE 2	10740	170/-160	350	-440/1480	230/-260	300/-300	300	920	940
Good To Medium Reported Braking Action									
MAX MANUAL	7620	120/-100	230	-320/1110	240/-200	200/-200	210	920	2390
AUTOBRAKE MAX	7670	120/-100	230	-320/1120	200/-160	200/-200	260	830	2280
AUTOBRAKE 2	10820	180/-160	350	-460/1550	280/-290	310/-310	300	1020	1530
Medium Reported Braking Action									
MAX MANUAL	8680	140/-120	280	-380/1360	330/-270	230/-230	230	1320	3530
AUTOBRAKE MAX	8520	140/-120	270	-380/1350	320/-250	220/-220	250	1280	3440
AUTOBRAKE 3	10280	160/-140	310	-440/1540	220/-230	280/-280	340	630	2130
Medium To Poor Reported Braking Action									
MAX MANUAL	9750	170/-150	330	-470/1710	520/-380	260/-260	250	1970	5860
AUTOBRAKE MAX	9570	170/-140	330	-460/1690	510/-380	260/-260	260	1930	5740
AUTOBRAKE 3	10800	180/-160	350	-500/1820	410/-340	300/-300	340	1350	4840
Poor Reported Braking Action									
MAX MANUAL	10820	190/-170	380	-550/2050	700/-490	290/-290	270	2620	8180
AUTOBRAKE MAX	10620	190/-160	380	-540/2030	700/-500	290/-290	270	2570	8040
AUTOBRAKE 3	11310	190/-170	390	-560/2100	600/-450	310/-310	330	2070	7550

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH UP AUTHORITY (Flaps ≥ 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4230	100/-40	90	-140/470	50/-40	90/-90	130	100	220
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500
Good Reported Braking Action									
MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	410	960
AUTOBRAKE MAX	6080	90/-70	160	-240/830	110/-70	150/-150	240	410	1000
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500
Good To Medium Reported Braking Action									
MAX MANUAL	6800	110/-90	200	-300/1060	220/-190	170/-170	210	740	1870
AUTOBRAKE MAX	6900	110/-90	200	-300/1070	220/-150	180/-180	250	730	1880
AUTOBRAKE 2	9620	160/-150	300	-430/1470	210/-250	270/-270	300	600	1030
Medium Reported Braking Action									
MAX MANUAL	7730	130/-110	240	-360/1300	310/-250	200/-200	230	1060	2770
AUTOBRAKE MAX	7720	130/-110	240	-360/1300	320/-230	200/-200	260	1050	2750
AUTOBRAKE 3	9070	150/-130	260	-410/1450	170/-180	250/-250	350	460	1760
Medium To Poor Reported Braking Action									
MAX MANUAL	8690	160/-130	290	-440/1640	490/-360	230/-230	250	1610	4620
AUTOBRAKE MAX	8690	160/-130	290	-440/1640	500/-350	230/-230	270	1600	4610
AUTOBRAKE 3	9600	170/-150	300	-480/1730	360/-290	260/-270	350	1130	3960
Poor Reported Braking Action									
MAX MANUAL	9650	180/-150	330	-520/1970	660/-460	260/-260	270	2150	6470
AUTOBRAKE MAX	9660	180/-150	330	-520/1970	670/-470	260/-260	270	2150	6470
AUTOBRAKE 3	10120	180/-160	330	-540/2010	550/-400	270/-280	340	1800	6160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PRI FLIGHT COMPUTERS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4750	90/-50	100	-160/520	60/-50	100/-100	170	130	290
AUTOBRAKE MAX	5690	60/-70	130	-200/680	0/0	140/-140	240	0	0
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good Reported Braking Action									
MAX MANUAL	6510	80/-90	170	-260/880	160/-140	150/-160	230	520	1240
AUTOBRAKE MAX	6460	80/-90	180	-260/880	160/-140	160/-160	250	510	1230
AUTOBRAKE 2	9850	140/-150	290	-430/1430	50/-120	280/-280	420	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	7520	110/-110	220	-330/1140	270/-220	190/-190	260	920	2420
AUTOBRAKE MAX	7470	110/-110	230	-330/1140	280/-230	190/-190	270	910	2400
AUTOBRAKE 2	9950	140/-160	300	-440/1510	130/-160	280/-280	420	250	1130
Medium Reported Braking Action									
MAX MANUAL	8520	130/-130	270	-390/1390	370/-300	220/-220	290	1320	3590
AUTOBRAKE MAX	8480	130/-130	270	-390/1390	390/-320	220/-220	290	1310	3570
AUTOBRAKE 3	9160	130/-130	260	-420/1460	220/-130	250/-250	420	720	2980
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	160/-160	320	-480/1740	570/-420	250/-250	310	1980	6030
AUTOBRAKE MAX	9540	160/-160	330	-480/1740	590/-440	250/-250	310	1980	6020
AUTOBRAKE 3	9930	160/-150	320	-490/1780	480/-300	270/-270	400	1630	5680
Poor Reported Braking Action									
MAX MANUAL	10570	180/-180	370	-560/2080	760/-530	280/-280	330	2640	8460
AUTOBRAKE MAX	10590	180/-180	380	-560/2080	790/-550	280/-280	330	2640	8470
AUTOBRAKE 3	10690	180/-170	370	-560/2090	740/-470	290/-290	380	2540	8370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SLATS DRIVE (Flaps 20)
VREF30 + 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4500	120/-40	100	-140/490	50/-50	90/-100	130	120	260
AUTOBRAKE MAX	6230	80/-70	150	-220/720	0/0	150/-150	260	0	0
AUTOBRAKE 2	10250	170/-150	320	-430/1450	220/-240	290/-290	310	730	740
Good Reported Braking Action									
MAX MANUAL	6270	90/-80	170	-240/850	140/-130	150/-150	190	460	1090
AUTOBRAKE MAX	6580	90/-80	170	-250/870	100/-70	160/-160	260	420	1090
AUTOBRAKE 2	10250	170/-150	320	-430/1450	220/-240	290/-290	310	730	740
Good To Medium Reported Braking Action									
MAX MANUAL	7270	110/-100	220	-310/1100	240/-200	180/-190	220	820	2080
AUTOBRAKE MAX	7440	120/-100	220	-320/1110	210/-160	190/-190	260	800	2080
AUTOBRAKE 2	10330	170/-160	330	-450/1520	270/-270	290/-290	310	830	1300
Medium Reported Braking Action									
MAX MANUAL	8260	130/-120	260	-380/1340	330/-270	210/-220	240	1170	3060
AUTOBRAKE MAX	8290	140/-120	260	-380/1340	320/-250	220/-220	260	1170	3060
AUTOBRAKE 3	9840	150/-140	290	-430/1500	210/-230	270/-270	320	570	1930
Medium To Poor Reported Braking Action									
MAX MANUAL	9280	160/-140	310	-460/1680	510/-380	250/-250	260	1750	5050
AUTOBRAKE MAX	9300	170/-140	310	-460/1680	510/-370	250/-250	270	1750	5050
AUTOBRAKE 3	10370	170/-160	330	-500/1790	410/-350	290/-290	320	1240	4290
Poor Reported Braking Action									
MAX MANUAL	10300	190/-160	360	-540/2020	690/-480	280/-280	270	2330	7030
AUTOBRAKE MAX	10310	190/-160	360	-540/2020	700/-490	280/-280	270	2330	7040
AUTOBRAKE 3	10900	190/-170	370	-560/2070	600/-460	300/-300	320	1910	6640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4010	70/-40	80	-130/460	50/-40	80/-80	130	90	200
AUTOBRAKE MAX	5190	60/-60	120	-190/640	0/0	120/-120	230	0	0
AUTOBRAKE 2	8700	120/-130	260	-390/1330	80/-170	240/-240	340	210	210
Good Reported Braking Action									
MAX MANUAL	5510	70/-70	140	-230/790	130/-110	130/-130	190	380	890
AUTOBRAKE MAX	5640	70/-70	140	-230/810	120/-100	130/-130	210	390	930
AUTOBRAKE 2	8700	120/-130	260	-390/1330	80/-170	240/-240	340	210	210
Good To Medium Reported Braking Action									
MAX MANUAL	6370	90/-90	180	-290/1030	220/-180	160/-160	220	680	1740
AUTOBRAKE MAX	6440	90/-90	180	-290/1040	220/-180	160/-160	230	690	1760
AUTOBRAKE 2	8780	130/-140	260	-410/1400	140/-200	240/-240	340	320	790
Medium Reported Braking Action									
MAX MANUAL	7230	110/-110	220	-350/1270	300/-240	180/-180	240	980	2580
AUTOBRAKE MAX	7240	110/-110	220	-350/1270	310/-250	180/-180	240	980	2580
AUTOBRAKE 3	8150	110/-120	230	-390/1370	150/-110	220/-220	380	430	1890
Medium To Poor Reported Braking Action									
MAX MANUAL	8130	130/-130	260	-430/1600	470/-340	210/-210	260	1500	4330
AUTOBRAKE MAX	8140	130/-130	270	-430/1600	490/-360	210/-210	260	1500	4340
AUTOBRAKE 3	8690	130/-140	270	-450/1660	370/-230	240/-240	380	1150	3920
Poor Reported Braking Action									
MAX MANUAL	9030	150/-150	300	-510/1920	640/-440	230/-230	270	2010	6080
AUTOBRAKE MAX	9040	150/-150	310	-510/1920	660/-460	240/-240	270	2010	6090
AUTOBRAKE 3	9230	150/-150	300	-510/1940	590/-340	250/-250	370	1860	5950

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3840	70/-40	80	-130/440	40/-40	70/-70	130	80	180
AUTOBRAKE MAX	4860	70/-60	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8090	140/-120	230	-380/1280	60/-140	220/-220	330	130	130
Good Reported Braking Action									
MAX MANUAL	5230	80/-60	130	-220/770	120/-110	120/-120	190	340	800
AUTOBRAKE MAX	5340	80/-70	130	-220/780	110/-100	120/-120	210	350	830
AUTOBRAKE 2	8090	140/-120	230	-380/1280	60/-140	220/-220	330	130	130
Good To Medium Reported Braking Action									
MAX MANUAL	6040	100/-80	170	-280/1010	210/-170	150/-150	210	620	1560
AUTOBRAKE MAX	6090	100/-90	170	-280/1010	210/-170	150/-150	230	620	1570
AUTOBRAKE 2	8180	140/-120	240	-390/1350	110/-170	220/-220	330	230	680
Medium Reported Braking Action									
MAX MANUAL	6840	110/-100	200	-340/1240	290/-230	170/-170	230	890	2310
AUTOBRAKE MAX	6840	110/-100	200	-340/1240	300/-240	170/-170	240	880	2300
AUTOBRAKE 3	7570	130/-100	210	-370/1320	150/-100	200/-200	370	420	1770
Medium To Poor Reported Braking Action									
MAX MANUAL	7680	140/-120	240	-420/1560	460/-330	200/-200	250	1360	3870
AUTOBRAKE MAX	7690	140/-120	240	-420/1560	470/-340	200/-200	260	1350	3870
AUTOBRAKE 3	8110	150/-120	250	-440/1610	370/-220	220/-220	370	1080	3570
Poor Reported Braking Action									
MAX MANUAL	8510	160/-130	280	-490/1880	620/-420	220/-220	270	1820	5430
AUTOBRAKE MAX	8530	160/-140	280	-490/1880	630/-430	220/-220	270	1820	5440
AUTOBRAKE 3	8640	160/-130	280	-500/1890	580/-330	230/-230	360	1730	5360

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
STABILIZER (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	550000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 550000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4230	100/-40	90	-140/470	50/-40	90/-90	130	100	220
AUTOBRAKE MAX	5740	80/-60	130	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500
Good Reported Braking Action									
MAX MANUAL	5860	80/-70	150	-230/810	130/-120	140/-140	180	410	960
AUTOBRAKE MAX	6080	90/-70	160	-240/830	110/-70	150/-150	240	410	1000
AUTOBRAKE 2	9540	160/-140	290	-410/1390	160/-220	260/-260	300	500	500
Good To Medium Reported Braking Action									
MAX MANUAL	6800	110/-90	200	-300/1060	220/-190	170/-170	210	740	1870
AUTOBRAKE MAX	6900	110/-90	200	-300/1070	220/-150	180/-180	250	730	1880
AUTOBRAKE 2	9620	160/-150	300	-430/1470	210/-250	270/-270	300	600	1030
Medium Reported Braking Action									
MAX MANUAL	7730	130/-110	240	-360/1300	310/-250	200/-200	230	1060	2770
AUTOBRAKE MAX	7720	130/-110	240	-360/1300	320/-230	200/-200	260	1050	2750
AUTOBRAKE 3	9070	150/-130	260	-410/1450	170/-180	250/-250	350	460	1760
Medium To Poor Reported Braking Action									
MAX MANUAL	8690	160/-130	290	-440/1640	490/-360	230/-230	250	1610	4620
AUTOBRAKE MAX	8690	160/-130	290	-440/1640	500/-350	230/-230	270	1600	4610
AUTOBRAKE 3	9600	170/-150	300	-480/1730	360/-290	260/-270	350	1130	3960
Poor Reported Braking Action									
MAX MANUAL	9650	180/-150	330	-520/1970	660/-460	260/-260	270	2150	6470
AUTOBRAKE MAX	9660	180/-150	330	-520/1970	670/-470	260/-260	270	2150	6470
AUTOBRAKE 3	10120	180/-160	330	-540/2010	550/-400	270/-280	340	1800	6160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	672.3	628.0				
52	126	690.0	643.1				
50	122	707.8	659.3	605.6			
48	118	725.5	677.8	619.9			
46	115	743.7	696.5	635.4	585.0		
44	111	761.0	714.1	652.5	600.2		
42	108	777.3	732.3	671.6	614.6	563.6	
40	104	793.0	750.7	689.9	629.6	576.5	
38	100	809.0	769.5	707.1	644.2	589.2	523.7
36	97	823.4	785.6	722.9	658.1	600.0	534.2
34	93	834.9	801.0	739.6	671.9	609.6	544.6
32	90	835.0	816.7	753.4	684.7	618.5	554.2
30	86	835.0	830.3	765.2	699.0	627.8	562.5
28	82	835.0	830.6	775.5	709.9	638.0	570.7
26	79	835.0	830.8	787.4	718.4	648.3	578.8
24	75	835.0	831.0	787.5	725.5	659.0	587.6
22	72	835.0	831.2	787.7	732.4	666.4	596.9
20	68	835.0	831.5	787.8	732.6	671.0	604.8
18	64	835.0	831.6	788.0	732.8	675.5	610.3
16	61	835.0	831.8	788.2	732.9	675.6	614.2
14	57	835.0	831.9	788.4	733.1	675.8	617.6
12	54	835.0	832.1	788.5	733.3	675.9	617.8
10	50	835.0	832.1	788.7	733.4	675.9	617.9
8	46	835.0	832.2	788.9	733.6	676.0	617.9
6	43	835.0	832.3	788.9	733.7	676.0	617.8
4	40	835.0	832.4	781.7	706.6	645.9	570.9
2	36	835.0	832.4	781.9	706.7	646.0	570.9
0	32	835.0	832.5	781.9	706.8	646.1	571.0
-40	-40	835.0	832.7	781.9	706.8	646.1	571.1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.
With engine bleed for packs off, increase weight by 2900 lb.
With engine and wing anti-ice on, decrease weight by 4800 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 48400 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	-2000	0	2000	4000	6000	8000
54	129	680.0	637.9				
52	126	695.9	653.6				
50	122	712.4	668.9	615.7			
48	118	729.4	684.9	630.1			
46	115	746.7	701.5	645.6	594.1		
44	111	763.5	718.1	662.4	609.4		
42	108	779.7	735.6	679.3	624.3	572.7	
40	104	795.5	753.2	695.5	639.7	586.1	
38	100	811.6	771.9	711.8	655.4	599.2	533.2
36	97	826.3	788.0	727.2	668.7	611.1	543.8
34	93	835.0	803.5	743.1	681.2	620.9	554.2
32	90	835.0	819.5	756.3	692.2	630.5	564.5
30	86	835.0	833.3	767.7	705.0	639.8	573.1
28	82	835.0	833.5	778.2	715.2	650.4	581.7
26	79	835.0	833.7	790.3	723.4	660.6	589.8
24	75	835.0	834.0	790.5	730.1	670.3	598.7
22	72	835.0	834.2	790.6	736.7	676.8	608.2
20	68	835.0	834.4	790.8	736.9	680.7	616.4
18	64	835.0	834.6	791.0	737.0	684.6	622.2
16	61	835.0	834.7	791.2	737.2	684.7	626.3
14	57	835.0	834.9	791.3	737.4	684.8	629.8
12	54	835.0	835.0	791.5	737.5	684.9	630.0
10	50	835.0	835.0	791.7	737.7	685.0	630.1
8	46	835.0	835.0	791.8	737.9	685.1	630.1
6	43	835.0	835.0	791.9	738.0	685.2	630.0
4	40	835.0	835.0	792.0	738.1	685.2	618.9
2	36	835.0	835.0	792.1	738.2	685.3	619.0
0	32	835.0	835.0	792.1	738.2	685.4	619.0
-40	-40	835.0	835.0	792.4	738.4	685.8	619.3

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off.
With engine bleed for packs off, increase weight by 3200 lb.
With engine and wing anti-ice on, decrease weight by 4000 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 49000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT	OAT	PRESSURE ALTITUDE (1000 FT)																	
(1000 LB)	(°C)	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8	0	4	8
780	0	21.8	23.8	26.1	32.5	35.8	39.7	45.4	50.5	56.5	59.5	66.5	74.6	74.6	83.6	94.0	90.2	101.1	113.5
	10	22.4	24.5	26.9	33.4	36.9	40.9	46.8	52.1	58.2	61.4	68.6	77.0	77.0	86.3	96.9	93.1	104.2	116.8
	15	22.8	24.9	27.4	34.0	37.6	41.7	47.7	53.1	59.3	62.5	69.9	78.4	78.3	87.8	98.6	94.7	106.0	118.7
	20	23.2	25.4	27.8	34.7	38.2	42.4	48.5	54.0	60.3	63.5	71.1	79.7	79.7	89.3	100.2	96.2	107.7	120.6
	30	23.8	26.0	28.5	35.5	39.2	43.5	49.8	55.4	62.0	65.3	73.0	81.9	81.9	91.7	102.9	98.9	110.6	123.7
	40	23.9	26.1	28.7	35.9	39.7	44.1	50.6	56.3	63.0	66.4	74.4	83.5	83.4	93.5	105.0	100.8	112.8	126.0
740	0	21.0	22.8	25.0	31.1	34.3	38.0	43.5	48.3	53.9	56.8	63.5	71.2	71.3	79.9	89.8	86.3	96.8	108.7
	10	21.5	23.5	25.7	32.0	35.3	39.1	44.8	49.8	55.6	58.6	65.5	73.5	73.6	82.5	92.6	89.1	99.8	111.9
	15	21.9	23.9	26.2	32.6	36.0	39.8	45.6	50.7	56.6	59.7	66.7	74.8	74.9	83.9	94.2	90.6	101.5	113.8
	20	22.3	24.3	26.7	33.2	36.6	40.5	46.4	51.6	57.6	60.7	67.9	76.1	76.2	85.3	95.8	92.1	103.1	115.6
	30	22.8	24.9	27.3	34.0	37.5	41.6	47.6	53.0	59.2	62.4	69.7	78.2	78.3	87.7	98.4	94.7	105.9	118.6
	40	23.0	25.1	27.5	34.4	37.9	42.1	48.3	53.8	60.1	63.4	71.0	79.7	79.7	89.4	100.4	96.5	108.1	120.9
700	0	20.1	21.9	23.9	29.8	32.8	36.2	41.5	46.1	51.4	54.2	60.5	67.8	68.0	76.2	85.6	82.4	92.4	103.8
	10	20.6	22.5	24.6	30.6	33.7	37.3	42.8	47.5	53.0	55.9	62.4	70.0	70.1	78.6	88.3	85.0	95.2	106.9
	15	21.0	22.9	25.1	31.2	34.3	38.0	43.6	48.4	53.9	56.9	63.5	71.2	71.4	80.0	89.8	86.4	96.9	108.7
	20	21.4	23.3	25.5	31.8	35.0	38.7	44.3	49.2	54.9	57.9	64.6	72.4	72.6	81.3	91.3	87.9	98.5	110.4
	30	21.9	23.8	26.1	32.5	35.8	39.7	45.5	50.5	56.4	59.5	66.4	74.4	74.6	83.6	93.8	90.3	101.2	113.4
	40	22.0	24.0	26.3	32.9	36.2	40.2	46.1	51.3	57.3	60.5	67.6	75.8	76.0	85.2	95.7	92.1	103.2	115.6
620	0	18.4	20.0	21.8	27.1	29.7	32.8	37.6	41.6	46.3	48.8	54.4	60.9	61.2	68.4	76.8	74.1	83.1	93.4
	10	18.9	20.5	22.4	27.9	30.6	33.8	38.7	42.9	47.7	50.4	56.1	62.8	63.1	70.6	79.3	76.5	85.7	96.3
	15	19.3	20.9	22.8	28.4	31.2	34.4	39.4	43.6	48.6	51.3	57.1	63.9	64.2	71.9	80.7	77.8	87.2	97.9
	20	19.6	21.3	23.2	28.9	31.7	35.0	40.1	44.4	49.4	52.2	58.1	65.0	65.4	73.1	82.0	79.2	88.7	99.6
	30	20.0	21.7	23.8	29.6	32.5	35.9	41.1	45.6	50.7	53.6	59.7	66.8	67.1	75.1	84.3	81.4	91.2	102.3
	40	20.1	21.9	23.9	29.9	32.8	36.3	41.7	46.2	51.5	54.4	60.7	68.0	68.3	76.5	85.9	82.9	93.0	104.3
540	0	16.8	18.1	19.8	24.4	26.7	29.4	33.6	37.1	41.2	43.4	48.3	53.9	54.2	60.5	67.8	65.5	73.4	82.5
	10	17.2	18.6	20.3	25.1	27.5	30.3	34.6	38.2	42.4	44.8	49.8	55.5	55.9	62.4	69.9	67.6	75.7	85.1
	15	17.5	19.0	20.7	25.6	28.0	30.8	35.2	38.9	43.2	45.6	50.7	56.5	56.9	63.5	71.2	68.8	77.1	86.5
	20	17.8	19.3	21.0	26.0	28.5	31.4	35.9	39.6	44.0	46.4	51.5	57.5	57.9	64.6	72.4	70.0	78.4	88.0
	30	18.2	19.7	21.5	26.6	29.2	32.1	36.8	40.6	45.1	47.6	52.9	59.1	59.4	66.4	74.4	71.9	80.6	90.4
	40	18.3	19.8	21.6	26.9	29.4	32.5	37.2	41.1	45.7	48.3	53.7	60.1	60.4	67.6	75.8	73.3	82.1	92.2
460	0	15.2	16.4	17.7	21.8	23.8	26.1	29.6	32.6	36.0	37.9	42.0	46.7	47.0	52.3	58.5	56.6	63.3	70.9
	10	15.6	16.8	18.2	22.4	24.4	26.8	30.5	33.5	37.1	39.1	43.3	48.2	48.4	53.9	60.3	58.4	65.3	73.2
	15	15.9	17.1	18.6	22.8	24.9	27.3	31.0	34.2	37.8	39.8	44.1	49.1	49.3	54.9	61.4	59.4	66.4	74.5
	20	16.1	17.4	18.9	23.2	25.3	27.8	31.6	34.8	38.5	40.5	44.9	49.9	50.2	55.9	62.5	60.5	67.6	75.8
	30	16.5	17.8	19.3	23.7	25.9	28.4	32.4	35.6	39.4	41.5	46.0	51.3	51.5	57.4	64.2	62.1	69.4	77.8
	40	16.5	17.8	19.4	23.9	26.1	28.7	32.7	36.0	39.9	42.1	46.7	52.0	52.3	58.3	65.3	63.2	70.7	79.3
380	0	13.6	14.6	15.8	19.2	20.8	22.7	25.6	28.1	30.9	32.4	35.7	39.6	39.6	43.9	48.9	47.3	52.7	58.9
	10	14.0	15.0	16.2	19.7	21.4	23.4	26.3	28.9	31.8	33.3	36.8	40.8	40.8	45.3	50.4	48.8	54.3	60.7
	15	14.2	15.3	16.5	20.0	21.8	23.8	26.8	29.4	32.4	33.9	37.4	41.5	41.6	46.1	51.4	49.7	55.3	61.8
	20	14.5	15.5	16.8	20.4	22.2	24.2	27.3	29.9	33.0	34.5	38.1	42.3	42.3	46.9	52.3	50.5	56.3	62.9
	30	14.8	15.9	17.2	20.8	22.7	24.8	28.0	30.6	33.8	35.4	39.1	43.3	43.4	48.1	53.6	51.9	57.8	64.6
	40	14.8	15.9	17.2	20.9	22.8	25.0	28.2	30.9	34.2	35.8	39.6	43.9	44.0	48.8	54.5	52.7	58.7	65.8

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.
If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Event Adjusted Brake Energy (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	4.4	14.1	23.7	33.2	42.6	51.9	61.2	70.5	79.9	89.3	98.9	108.7
	MAX AUTO	4.4	13.1	21.7	30.2	38.7	47.3	56.0	65.0	74.3	83.9	94.0	104.6
	AUTOBRAKE 4	4.3	12.5	20.4	28.1	35.7	43.4	51.2	59.3	67.7	76.6	86.1	96.4
	AUTOBRAKE 3	4.2	11.9	19.2	26.3	33.3	40.3	47.4	54.8	62.6	70.8	79.7	89.3
	AUTOBRAKE 2	4.1	11.2	17.9	24.4	30.8	37.2	43.7	50.5	57.6	65.1	73.2	81.9
	AUTOBRAKE 1	4.0	10.3	16.3	22.1	27.8	33.4	39.1	45.1	51.3	58.0	65.1	72.9

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	3.3	12.0	21.0	30.0	38.9	47.5	56.1	64.5	72.8	81.0	89.2	97.5
	MAX AUTO	2.0	8.7	15.5	22.3	29.3	36.4	43.8	51.5	59.6	68.3	77.5	87.4
	AUTOBRAKE 4	1.4	5.6	10.4	15.6	20.9	26.4	32.2	38.3	44.8	51.9	59.6	68.0
	AUTOBRAKE 3	0.9	3.2	6.4	10.3	14.3	18.5	23.0	27.9	33.2	39.0	45.4	52.4
	AUTOBRAKE 2	0.3	1.8	4.0	6.5	9.3	12.3	15.6	19.2	23.3	27.9	33.0	38.7
	AUTOBRAKE 1	0.2	1.2	2.6	4.3	6.1	8.1	10.3	12.8	15.6	18.8	22.3	26.4

Cooling Time (Minutes)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
	16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
GEAR DOWN INFLIGHT	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE
GROUND		11	18	26	42	55	66	73		
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds for each taxi mile.
For one brake deactivated, increase brake energy by 10 percent.
For two brakes deactivated, increase brake energy by 20 percent.
When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 8 minutes.
When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.
Brake temperature monitor system (BTMS) indication on EICAS may be used 10 to 15 minutes after airplane has come to a complete stop, or inflight with gear retracted, to determine recommended cooling schedule. (When inflight with gear extended, the BTMS indications may vary between individual brakes, due to airstream effects.)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for one pack on and anti-ice off

TAT	PRESSURE ALTITUDE (1000 FT)								
(°C)	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	98.3	97.9	97.6
-5	98.4	99.9	101.2	101.3	100.5	100.2	99.7	99.3	98.8
-10	97.4	99.0	100.3	101.6	101.3	101.3	100.7	100.3	100.0
-15	96.5	98.1	99.3	100.6	101.0	102.0	101.1	100.8	100.5
-20	95.6	97.1	98.3	99.6	100.1	101.0	100.1	99.8	99.5
-25	94.6	96.1	97.4	98.6	99.1	100.0	99.1	98.8	98.5
-30	93.7	95.2	96.4	97.6	98.1	99.0	98.1	97.8	97.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	97.1	96.8	96.5
-40	91.7	93.2	94.4	95.6	96.0	96.9	96.1	95.8	95.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.86	94.3	95.4	96.4	97.4	98.4	99.5	100.5	101.4	101.2	100.2	98.9	97.7
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	102.0	100.6	99.1	98.0
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2
27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.2
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	37	35	33	31	29	27
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/I ON - PACKS OFF	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
25000 FT to 18000 FT Pressure Altitudes

25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3
18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100.0	100.9	101.8	102.0	100.6	99.4
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
16000 FT to 5000 FT Pressure Altitudes

16000 FT PRESS ALT								TAT (°C)					
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4
14000 FT PRESS ALT								TAT (°C)					
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4
240	0.47	97.3	98.2	99.2	100.1	101.1	102.0	102.8	102.5	100.6	99.0	97.8	96.7
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6
12000 FT PRESS ALT								TAT (°C)					
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8
10000 FT PRESS ALT								TAT (°C)					
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6
5000 FT PRESS ALT								TAT (°C)					
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	16	14	12	10	5
ENGINE A/I ON	-0.3	-0.2	-0.4	-0.5	-0.5
WING A/I ON - PACKS ON	-0.4	-0.5	-0.6	-0.7	-0.8
WING A/I ON - PACKS OFF	-0.6	-0.7	-0.8	-0.9	-1.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	758	298	18000	16800	15600
740	720	290	19300	18200	17000
700	682	283	20500	19600	18500
660	642	275	21700	20900	20000
620	601	267	23200	22200	21200
580	562	258	25000	24000	22800
540	524	249	27000	26100	24700
500	485	241	29100	28400	27000
460	448	231	30900	30500	29400
420	409	221	32600	32300	31700
380	369	211	34400	34300	34000

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
134	126	118	111	105	100	95	90	86	82	79
269	251	236	222	210	200	190	181	173	165	159
403	377	354	334	316	300	285	272	260	248	238
536	502	472	445	421	400	380	362	346	332	318
670	627	589	556	526	500	475	453	433	415	398
803	752	707	667	632	600	571	544	520	498	478
936	877	824	778	737	700	666	635	607	582	558
1068	1001	942	889	842	800	761	726	695	665	639
1201	1126	1059	1000	947	900	856	817	782	749	719
1333	1250	1176	1111	1052	1000	952	908	869	833	799
1466	1374	1293	1222	1157	1100	1047	1000	956	916	880
1598	1499	1411	1332	1262	1200	1142	1091	1043	1000	960
1731	1623	1528	1443	1368	1300	1238	1182	1131	1084	1040
1863	1747	1645	1554	1473	1400	1333	1273	1218	1167	1121
1996	1872	1762	1665	1578	1500	1428	1364	1305	1251	1201
2129	1997	1880	1776	1683	1600	1524	1455	1392	1334	1281
2262	2121	1997	1887	1788	1700	1619	1546	1479	1418	1361
2395	2246	2115	1998	1894	1800	1714	1637	1566	1501	1441

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)											TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)											
	380	420	460	500	540	580	620	660	700	740	780	
100	2.4	2.6	2.9	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.2	0:16
200	5.4	6.0	6.5	7.1	7.4	7.8	8.3	8.7	9.0	9.5	9.8	0:31
300	8.7	9.5	10.4	11.2	11.8	12.5	13.2	13.9	14.5	15.4	15.9	0:46
400	11.9	13.1	14.2	15.4	16.3	17.2	18.2	19.2	20.1	21.2	22.1	1:01
500	14.9	16.4	17.8	19.3	20.5	21.7	23.0	24.2	25.3	26.8	28.0	1:16
600	17.9	19.6	21.3	23.1	24.6	26.1	27.5	29.0	30.4	32.2	33.7	1:31
700	20.8	22.8	24.8	26.9	28.6	30.4	32.1	33.8	35.4	37.5	39.3	1:46
800	23.7	26.0	28.3	30.6	32.5	34.6	36.5	38.5	40.4	42.7	44.9	2:01
900	26.6	29.2	31.7	34.3	36.5	38.8	41.0	43.2	45.4	48.0	50.5	2:15
1000	29.5	32.3	35.1	37.9	40.4	42.9	45.4	47.9	50.3	53.2	56.0	2:30
1100	32.3	35.4	38.4	41.5	44.3	47.1	49.8	52.5	55.2	58.3	61.4	2:44
1200	35.1	38.5	41.8	45.1	48.1	51.2	54.1	57.1	60.1	63.5	66.8	2:59
1300	37.9	41.5	45.1	48.7	51.9	55.2	58.5	61.7	64.9	68.6	72.2	3:14
1400	40.7	44.6	48.4	52.2	55.7	59.3	62.8	66.2	69.7	73.6	77.5	3:28
1500	43.4	47.6	51.6	55.7	59.5	63.3	67.0	70.7	74.5	78.6	82.8	3:43
1600	46.1	50.5	54.9	59.2	63.2	67.3	71.3	75.2	79.2	83.6	88.1	3:58
1700	48.8	53.5	58.1	62.7	66.9	71.2	75.5	79.7	83.9	88.6	93.3	4:13
1800	51.5	56.4	61.2	66.1	70.6	75.2	79.6	84.1	88.6	93.5	98.5	4:27

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	15300	14000	12400
760	16000	14400	12900
740	16700	15200	13300
720	17500	16000	14200
700	18300	16800	15100
680	19100	17600	16000
660	20000	18500	16800
640	20500	19300	17700
620	21100	20100	18700
600	21700	20800	19700
580	22500	21400	20400
560	23400	22100	21100
540	24300	23100	21700
520	25400	24200	22600
500	26600	25300	23700
480	27900	26600	24900
460	29300	27900	26200
440	30400	29200	27600
420	31300	30400	29000
400	32200	31600	30400
380	33200	32700	31700
360	34200	33900	33000

With engine anti-ice on, no altitude capability adjustment is required.
With engine and wing anti-ice on, decrease altitude capability by 300 ft.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
780	%N1	91.3	96.8								
	MACH	.602	.664								
	KIAS	334	337								
	FF/ENG	22536	24156								
740	%N1	90.4	95.1	97.9							
	MACH	.602	.660	.678							
	KIAS	334	335	332							
	FF/ENG	21826	22989	23330							
700	%N1	89.4	93.5	95.6	98.8						
	MACH	.599	.649	.665	.684						
	KIAS	333	329	325	322						
	FF/ENG	21042	21608	21727	22025						
660	%N1	87.7	91.9	93.6	96.1						
	MACH	.583	.637	.653	.670						
	KIAS	324	323	319	315						
	FF/ENG	19683	20284	20323	20423						
620	%N1	85.9	90.2	91.9	93.6	96.5					
	MACH	.567	.621	.641	.657	.675					
	KIAS	315	315	313	309	305					
	FF/ENG	18411	18905	19032	19011	19194					
580	%N1	84.1	88.4	90.1	91.8	93.7	96.8				
	MACH	.551	.602	.625	.644	.661	.680				
	KIAS	306	305	305	302	298	295				
	FF/ENG	17177	17504	17683	17733	17760	18050				
540	%N1	82.1	86.3	88.2	89.9	91.6	93.7	97.0			
	MACH	.534	.582	.605	.627	.646	.663	.683			
	KIAS	296	294	295	294	292	288	285			
	FF/ENG	15983	16124	16312	16429	16476	16562	16922			
500	%N1	80.1	84.1	86.0	87.8	89.5	91.2	93.5	97.0		
	MACH	.516	.563	.583	.606	.629	.648	.665	.686		
	KIAS	286	284	284	284	284	281	277	274		
	FF/ENG	14812	14796	14951	15098	15202	15263	15363	15748		
460	%N1	77.9	81.8	83.6	85.5	87.2	88.9	90.7	93.1	96.7	
	MACH	.498	.543	.563	.583	.607	.630	.649	.666	.688	
	KIAS	276	274	273	273	273	272	270	266	264	
	FF/ENG	13638	13500	13643	13767	13886	13996	14052	14137	14531	
420	%N1	75.5	79.3	81.2	82.9	84.8	86.5	88.2	90.0	92.4	96.1
	MACH	.480	.521	.540	.560	.581	.605	.628	.648	.666	.688
	KIAS	266	263	262	262	261	261	261	258	255	252
	FF/ENG	12483	12254	12367	12495	12575	12676	12787	12829	12899	13288
380	%N1	73.1	76.7	78.5	80.3	82.0	83.8	85.6	87.3	89.1	91.5
	MACH	.462	.500	.517	.536	.556	.578	.601	.625	.646	.664
	KIAS	255	252	251	250	249	249	249	249	247	243
	FF/ENG	11350	11040	11139	11257	11323	11376	11460	11565	11610	11661
340	%N1	70.3	73.9	75.7	77.4	79.1	80.8	82.5	84.3	86.1	88.0
	MACH	.443	.478	.494	.511	.530	.550	.571	.594	.620	.642
	KIAS	245	240	239	238	237	236	236	236	236	234
	FF/ENG	10261	9890	9952	10062	10110	10131	10176	10235	10339	10404

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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
286	264	244	227	213	200	190	181	173	166	159
569	525	487	454	425	400	381	364	348	333	320
853	788	730	681	638	600	572	546	522	501	482
1138	1051	974	908	851	800	763	729	698	669	643
1424	1316	1219	1136	1064	1000	954	911	872	836	803
1711	1580	1464	1364	1278	1200	1144	1093	1046	1003	964
1999	1846	1709	1592	1491	1400	1335	1275	1220	1170	1124
2288	2111	1954	1820	1704	1600	1526	1457	1394	1337	1285
2578	2378	2201	2049	1918	1800	1717	1639	1568	1504	1445
2869	2646	2447	2278	2132	2000	1907	1821	1742	1670	1605

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	9.2	0:38	8.1	0:37	7.3	0:36	6.5	0:35	6.1	0:34
400	19.3	1:12	17.7	1:09	16.5	1:06	15.6	1:04	15.3	1:02
600	29.2	1:46	27.2	1:41	25.7	1:37	24.5	1:34	24.4	1:30
800	39.0	2:21	36.6	2:14	34.7	2:07	33.2	2:03	33.3	1:58
1000	48.7	2:56	45.9	2:47	43.7	2:38	41.9	2:33	42.1	2:26
1200	58.4	3:31	55.1	3:20	52.6	3:09	50.5	3:03	50.7	2:55
1400	67.9	4:06	64.2	3:53	61.4	3:41	59.0	3:33	59.2	3:24
1600	77.4	4:41	73.2	4:27	70.1	4:12	67.4	4:03	67.6	3:53
1800	86.8	5:17	82.1	5:01	78.6	4:44	75.6	4:33	75.8	4:22
2000	96.1	5:53	90.9	5:35	87.2	5:16	83.8	5:03	84.0	4:51

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	400	450	500	550	600	650	700	750	800
10	-1.7	-1.3	-0.8	-0.4	0.0	0.8	1.8	2.9	4.2
20	-3.7	-2.7	-1.8	-0.9	0.0	1.8	3.9	6.3	9.0
30	-5.7	-4.2	-2.7	-1.4	0.0	2.8	6.0	9.6	13.7
40	-7.7	-5.7	-3.7	-1.9	0.0	3.8	8.0	12.8	18.1
50	-9.8	-7.2	-4.7	-2.4	0.0	4.7	10.0	15.9	22.4
60	-11.8	-8.7	-5.7	-2.8	0.0	5.6	11.9	18.9	26.6
70	-13.9	-10.2	-6.7	-3.3	0.0	6.5	13.7	21.8	30.6
80	-15.9	-11.7	-7.7	-3.8	0.0	7.3	15.5	24.5	34.5
90	-18.0	-13.2	-8.7	-4.3	0.0	8.1	17.2	27.2	38.1
100	-20.1	-14.8	-9.7	-4.8	0.0	8.9	18.8	29.7	41.7

Includes APU fuel burn.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
800	%N1	81.3	84.8	89.5	94.9			
	KIAS	273	275	276	301			
	FF/ENG	20620	20800	21460	23060			
760	%N1	79.7	83.0	87.8	92.7			
	KIAS	266	268	269	285			
	FF/ENG	19500	19610	20160	21200			
720	%N1	78.2	81.2	86.1	90.8	99.6		
	KIAS	259	260	261	271	297		
	FF/ENG	18410	18460	18870	19520	22300		
680	%N1	76.5	79.4	84.3	88.9	96.1		
	KIAS	252	253	254	256	286		
	FF/ENG	17340	17340	17630	18000	20240		
640	%N1	74.7	77.7	82.3	87.1	92.7		
	KIAS	245	245	246	248	267		
	FF/ENG	16280	16250	16430	16710	18210		
600	%N1	72.9	75.8	80.2	85.1	90.3		
	KIAS	236	237	238	239	251		
	FF/ENG	15240	15180	15250	15440	16560		
560	%N1	70.9	73.8	78.1	83.0	88.0	96.0	
	KIAS	231	231	231	231	234	263	
	FF/ENG	14210	14140	14130	14260	15010	16930	
520	%N1	68.8	71.9	76.0	80.8	85.8	91.6	
	KIAS	225	225	225	225	225	243	
	FF/ENG	13210	13140	13070	13140	13740	14810	
480	%N1	66.7	69.6	73.8	78.3	83.5	88.4	98.4
	KIAS	220	220	220	220	220	224	245
	FF/ENG	12240	12170	12060	12090	12540	13170	15210
440	%N1	64.6	67.3	71.6	75.9	80.8	85.7	93.3
	KIAS	213	213	213	213	213	213	232
	FF/ENG	11280	11200	11070	11080	11390	11800	13060
400	%N1	62.4	65.0	69.1	73.4	78.1	83.2	88.3
	KIAS	207	207	207	207	207	207	209
	FF/ENG	10360	10250	10130	10120	10320	10640	11140
360	%N1	60.0	62.6	66.4	70.7	75.3	80.3	85.0
	KIAS	200	200	200	200	200	200	200
	FF/ENG	9480	9350	9220	9210	9310	9520	9830

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available
Flaps 20

TAT (°C)	RATE OF CLIMB (FT/MIN) PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	430	320				
50	480	370	210			
48	530	420	270			
46	570	470	320	160		
44	620	530	370	210		
42	670	570	410	250	90	
40	710	620	460	290	120	
38	740	670	510	330	150	
36	740	710	540	370	180	-20
34	740	760	580	400	210	0
32	750	760	610	440	240	30
30	750	770	640	460	280	60
20	770	780	650	510	350	170
10	790	800	600	420	260	130
0	810	810	590	360	130	-110
-20	840	850	610	370	130	-110
-40	880	880	640	390	140	-120

Rate of climb capability shown is valid for 500000 lb, gear down at VREF20 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Flaps 25

TAT (°C)	RATE OF CLIMB (FT/MIN) PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	80	-20				
50	130	20	-130			
48	180	70	-80			
46	220	120	-30	-190		
44	260	170	20	-140		
42	310	210	60	-100	-270	
40	350	260	100	-60	-240	
38	380	300	140	-30	-210	-410
36	380	340	170	0	-180	-380
34	380	380	210	30	-150	-360
32	380	390	240	70	-130	-330
30	390	390	260	90	-90	-310
20	400	400	270	130	-20	-210
10	410	410	270	-10	-190	-350
0	420	420	200	-20	-250	-480
-20	440	440	210	-20	-250	-500
-40	460	460	220	-20	-260	-520

Rate of climb capability shown is valid for 500000 lb, gear down at VREF25 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available
Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-140	-250				
50	-100	-210	-360			
48	-60	-160	-320			
46	-10	-120	-270	-420		
44	30	-70	-220	-380		
42	70	-30	-180	-340	-500	
40	100	20	-150	-310	-470	
38	140	60	-110	-280	-450	
36	140	100	-70	-250	-420	-620
34	140	130	-40	-210	-400	-600
32	140	150	-10	-180	-370	-580
30	140	150	10	-160	-340	-550
20	150	150	20	-120	-270	-460
10	160	160	0	-150	-300	-660
0	160	160	-50	-270	-500	-730
-20	170	170	-60	-280	-510	-750
-40	180	170	-60	-300	-530	-780

Rate of climb capability shown is valid for 500000 lb, gear down at VREF30 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 500000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 500000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Alternate Mode EEC Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (1000 FT)											
°C	°F	-2	-1	0	1	2	3	4	5	6	7	8	8.4
55	131	94.3	96.7	97.0	96.7	96.5	96.6	96.4	96.3	96.1	95.5	94.6	94.2
50	122	95.7	98.1	98.6	98.2	97.9	97.9	97.8	97.6	97.4	96.8	95.9	95.6
45	113	97.2	99.6	100.1	99.8	99.4	99.3	99.1	98.9	98.8	98.2	97.3	96.9
40	104	98.9	101.2	101.9	101.4	101.0	100.8	100.6	100.4	100.0	99.4	98.6	98.2
35	95	100.9	102.7	104.7	104.2	103.1	102.6	102.1	101.7	101.1	100.4	99.6	99.3
30	86	100.5	103.7	106.9	106.4	105.6	105.0	104.3	103.7	102.6	101.5	100.7	100.3
25	77	99.7	102.8	106.0	106.7	107.3	107.2	106.7	106.5	105.3	103.8	102.4	101.8
20	68	98.8	101.9	105.1	105.8	106.4	106.8	107.1	107.5	106.8	105.9	104.8	104.3
15	59	98.0	101.1	104.2	104.9	105.5	105.8	106.2	106.5	106.4	106.1	105.6	105.3
10	50	97.1	100.2	103.3	104.0	104.6	104.9	105.3	105.6	105.5	105.2	104.9	104.8
5	41	96.3	99.3	102.4	103.0	103.7	104.0	104.3	104.7	104.5	104.2	104.0	103.8
0	32	95.4	98.4	101.4	102.1	102.7	103.1	103.4	103.7	103.6	103.3	103.0	102.9
-10	14	93.6	96.6	99.6	100.2	100.8	101.2	101.5	101.8	101.7	101.4	101.1	101.0
-20	-4	91.8	94.7	97.7	98.3	98.9	99.2	99.5	99.9	99.7	99.5	99.2	99.0
-30	-22	90.0	92.8	95.7	96.3	96.9	97.2	97.5	97.9	97.7	97.5	97.2	97.1
-40	-40	88.1	90.9	93.7	94.3	94.9	95.2	95.5	95.8	95.7	95.4	95.2	95.0
-50	-58	86.2	88.9	91.7	92.3	92.9	93.1	93.4	93.8	93.6	93.4	93.1	93.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)											
	-2	-1	0	1	2	3	4	5	6	7	8	8.4
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

220 KIAS Max Climb %N1

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	91.4	91.1	92.1	91.3	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.4	91.4	92.1	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	89.7	90.7	91.4	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	89.7	89.9	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.3	92.2	92.1	90.6	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.2	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.2	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE & WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE & WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

***Packs on or off with 2 bleed sources.**
****Packs off with 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18600	16600	14200
760	19100	17200	14800
740	19700	17900	15500
720	20200	18500	16100
700	21000	19400	17100
680	21900	20400	18200
660	22900	21500	19400
640	23900	22500	20600
620	25000	23500	21900
600	25900	24600	23000
580	27000	25700	24200
560	28000	27000	25400
540	29100	28200	26700
520	30100	29500	28000
500	30900	30500	29300
480	31600	31300	30500
460	32400	32200	31500
440	33300	33100	32600
420	34100	33900	33600
400	34900	34800	34600
380	35800	35700	35600
360	36700	36600	36400

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
800	%N1	84.9	89.2	91.3	93.9						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16879	17230	17550	18041						
760	%N1	84.0	88.3	90.3	92.5						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16350	16643	16893	17295						
720	%N1	83.2	87.5	89.4	91.4	94.2					
	MACH	.488	.535	.556	.578	.600					
	KIAS	270	270	270	270	270					
	FF/ENG	15899	16146	16324	16639	17073					
680	%N1	81.4	85.8	87.8	89.6	91.8					
	MACH	.475	.521	.542	.564	.587					
	KIAS	263	263	263	263	264					
	FF/ENG	14938	15104	15281	15498	15865					
640	%N1	79.5	83.9	86.0	87.8	89.7	92.1				
	MACH	.461	.506	.526	.548	.570	.594				
	KIAS	255	255	255	255	256	256				
	FF/ENG	13989	14087	14216	14393	14638	14997				
600	%N1	77.6	82.1	84.1	86.0	87.7	89.7	92.5			
	MACH	.447	.491	.511	.531	.553	.576	.600			
	KIAS	247	247	247	247	248	248	248			
	FF/ENG	13042	13113	13185	13337	13490	13756	14123			
560	%N1	75.5	80.0	82.0	84.0	85.8	87.6	89.6	92.7		
	MACH	.433	.475	.494	.514	.535	.557	.581	.606		
	KIAS	239	239	239	239	239	240	240	240		
	FF/ENG	12107	12162	12207	12291	12445	12584	12856	13237		
520	%N1	73.3	77.8	79.8	81.8	83.7	85.4	87.3	89.4	92.8	
	MACH	.418	.459	.477	.496	.516	.538	.560	.584	.610	
	KIAS	231	231	231	231	231	231	231	232	232	
	FF/ENG	11193	11213	11263	11306	11394	11539	11679	11939	12332	
480	%N1	71.1	75.5	77.4	79.4	81.3	83.2	85.0	86.8	89.1	92.8
	MACH	.402	.442	.459	.478	.497	.517	.539	.562	.587	.614
	KIAS	222	222	222	222	222	222	222	222	223	223
	FF/ENG	10294	10279	10324	10368	10407	10495	10627	10769	11006	11406
440	%N1	68.6	73.1	75.0	76.8	78.9	80.7	82.7	84.4	86.2	88.5
	MACH	.387	.425	.442	.460	.478	.498	.519	.540	.563	.588
	KIAS	213	213	213	213	213	213	213	213	213	214
	FF/ENG	9429	9422	9440	9486	9514	9547	9627	9739	9856	10065
400	%N1	66.5	71.0	72.8	74.7	76.7	78.7	80.4	82.3	84.0	85.9
	MACH	.375	.413	.429	.446	.465	.484	.504	.525	.548	.571
	KIAS	207	207	207	207	207	207	207	207	207	207
	FF/ENG	8736	8731	8729	8756	8786	8810	8845	8930	9028	9136
360	%N1	64.3	68.7	70.5	72.3	74.4	76.4	78.2	79.9	81.8	83.6
	MACH	.363	.399	.415	.432	.450	.468	.488	.508	.530	.553
	KIAS	200	200	200	200	200	200	200	200	200	200
	FF/ENG	8041	8029	8026	8031	8049	8072	8095	8137	8220	8303

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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
316	284	257	235	216	200	189	180	171	162	155
634	570	515	470	433	400	379	359	341	326	312
956	859	774	706	650	600	568	539	512	489	468
1282	1149	1035	943	867	800	757	718	683	651	623
1610	1442	1297	1180	1084	1000	947	898	853	813	778
1942	1737	1560	1419	1302	1200	1136	1077	1024	976	933
2276	2034	1825	1658	1520	1400	1325	1256	1193	1137	1087
2614	2333	2091	1898	1739	1600	1514	1434	1362	1298	1241
2954	2634	2358	2138	1958	1800	1702	1613	1531	1459	1394
3297	2936	2626	2379	2176	2000	1891	1791	1701	1619	1547
3642	3240	2894	2620	2396	2200	2080	1969	1869	1780	1700
3991	3546	3164	2862	2615	2400	2268	2147	2037	1939	1852
4342	3853	3435	3104	2835	2600	2456	2324	2205	2098	2004
4697	4164	3707	3347	3055	2800	2644	2502	2373	2258	2156
5054	4476	3981	3591	3275	3000	2832	2679	2541	2416	2307
5414	4789	4255	3836	3495	3200	3020	2856	2708	2575	2458
5778	5105	4531	4081	3716	3400	3208	3033	2875	2734	2609
6146	5424	4808	4326	3937	3600	3396	3210	3041	2891	2759
6516	5744	5086	4572	4159	3800	3584	3386	3208	3049	2909
6889	6066	5365	4819	4380	4000	3772	3564	3375	3207	3059

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	15.5	0:49	14.1	0:47	12.4	0:44	11.4	0:42	10.6	0:40
400	31.3	1:36	29.1	1:31	26.2	1:24	24.6	1:20	23.3	1:15
600	47.2	2:24	44.0	2:16	40.0	2:04	37.8	1:57	36.1	1:51
800	62.4	3:12	58.4	3:02	53.3	2:46	50.5	2:36	48.3	2:27
1000	77.7	4:01	72.9	3:47	66.7	3:27	63.2	3:15	60.5	3:03
1200	92.4	4:51	86.8	4:34	79.6	4:10	75.4	3:55	72.2	3:40
1400	107.2	5:41	100.8	5:21	92.5	4:52	87.7	4:34	84.0	4:17
1600	121.4	6:32	114.3	6:08	105.0	5:35	99.5	5:14	95.4	4:55
1800	135.6	7:23	127.8	6:56	117.5	6:18	111.4	5:55	106.8	5:32
2000	149.4	8:15	140.8	7:45	129.6	7:02	122.9	6:36	117.8	6:10
2200	163.1	9:07	153.9	8:34	141.7	7:46	134.4	7:17	128.8	6:49
2400	176.4	10:01	166.5	9:23	153.4	8:31	145.6	7:58	139.5	7:28
2600	189.6	10:54	179.1	10:13	165.0	9:16	156.7	8:40	150.1	8:07
2800	202.5	11:49	191.2	11:04	176.4	10:02	167.5	9:23	160.4	8:46
3000	215.3	12:44	203.4	11:55	187.7	10:47	178.3	10:05	170.7	9:26
3200	227.7	13:40	215.1	12:47	198.7	11:34	188.7	10:49	180.7	10:06
3400	240.1	14:36	226.9	13:39	209.6	12:21	199.2	11:32	190.7	10:46
3600	252.1	15:33	238.3	14:32	220.3	13:08	209.3	12:16	200.3	11:27
3800	264.1	16:30	249.6	15:26	230.9	13:56	219.4	13:00	210.0	12:08
4000	275.9	17:28	260.7	16:20	241.3	14:44	229.3	13:45	219.4	12:50

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
20	-2.9	-2.0	-1.1	0.0	1.7	4.0	6.6	9.5
40	-6.3	-4.3	-2.2	0.0	3.2	7.4	12.3	18.0
60	-9.7	-6.5	-3.3	0.0	4.7	10.7	17.8	25.9
80	-12.9	-8.7	-4.4	0.0	6.2	13.9	22.9	33.3
100	-16.1	-10.8	-5.5	0.0	7.6	16.8	27.7	40.2
120	-19.2	-12.9	-6.5	0.0	8.9	19.7	32.2	46.5
140	-22.2	-15.0	-7.6	0.0	10.2	22.3	36.3	52.3
160	-25.2	-17.0	-8.6	0.0	11.5	24.8	40.2	57.6
180	-28.0	-19.0	-9.6	0.0	12.7	27.2	43.7	62.3
200	-30.8	-20.9	-10.6	0.0	13.8	29.4	46.9	66.5
220	-33.5	-22.8	-11.6	0.0	14.9	31.5	49.8	70.1
240	-36.2	-24.7	-12.6	0.0	16.0	33.4	52.3	73.3
260	-38.7	-26.5	-13.6	0.0	17.0	35.1	54.5	75.8
280	-41.2	-28.2	-14.5	0.0	17.9	36.7	56.4	77.9

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30+80

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	35	39	43	48	52	56	60	64	69	73
TIME (MINUTES)	11	12	12	13	14	15	15	16	17	17

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
800	%N1	76.4						
	KIAS	262						
	FF/ENG	17280						
760	%N1	75.4	78.5					
	KIAS	262	262					
	FF/ENG	16690	16710					
720	%N1	73.9	76.9					
	KIAS	256	256					
	FF/ENG	15790	15760					
680	%N1	72.1	75.1	79.6				
	KIAS	248	248	248				
	FF/ENG	14820	14790	14740				
640	%N1	70.2	73.3	77.7				
	KIAS	241	241	241				
	FF/ENG	13860	13840	13780				
600	%N1	68.5	71.7	76.1				
	KIAS	236	236	236				
	FF/ENG	13050	13040	12960				
560	%N1	66.9	69.9	74.3	78.9			
	KIAS	231	231	231	231			
	FF/ENG	12270	12260	12180	12240			
520	%N1	65.3	68.1	72.5	77.1	81.9		
	KIAS	225	225	225	225	225		
	FF/ENG	11520	11490	11400	11430	11550		
480	%N1	63.6	66.3	70.7	75.2	80.0		
	KIAS	220	220	220	220	220		
	FF/ENG	10800	10750	10660	10660	10770		
440	%N1	61.7	64.5	68.6	73.1	77.8	82.7	
	KIAS	213	213	213	213	213	213	
	FF/ENG	10080	10000	9900	9890	9980	10110	
400	%N1	59.8	62.5	66.5	71.0	75.6	80.4	85.0
	KIAS	207	207	207	207	207	207	207
	FF/ENG	9380	9290	9170	9170	9210	9290	9520
360	%N1	57.7	60.4	64.3	68.7	73.3	78.2	82.7
	KIAS	200	200	200	200	200	200	200
	FF/ENG	8670	8580	8440	8430	8440	8500	8680

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
800	%N1	76.0	79.1	84.0	88.5	94.6
	KIAS	242	242	242	242	242
	FF/ENG	16960	17050	17030	17300	18200
760	%N1	74.9	78.0	82.7	87.3	92.6
	KIAS	242	242	242	242	242
	FF/ENG	16320	16370	16340	16570	17270
720	%N1	73.3	76.4	80.9	85.7	90.6
	KIAS	236	236	236	236	236
	FF/ENG	15370	15390	15380	15540	16070
680	%N1	71.5	74.5	78.9	83.9	88.7
	KIAS	228	228	228	228	228
	FF/ENG	14380	14390	14380	14500	14850
640	%N1	69.4	72.6	77.0	81.9	86.7
	KIAS	221	221	221	221	221
	FF/ENG	13410	13410	13390	13510	13770
600	%N1	67.6	70.8	75.2	79.9	84.9
	KIAS	216	216	216	216	216
	FF/ENG	12590	12580	12530	12660	12860
560	%N1	65.9	68.9	73.3	77.9	83.0
	KIAS	211	211	211	211	211
	FF/ENG	11790	11760	11700	11810	11950
520	%N1	64.1	66.9	71.3	75.8	81.0
	KIAS	205	205	205	205	205
	FF/ENG	11000	10950	10880	10950	11070
480	%N1	62.2	64.9	69.3	73.8	78.7
	KIAS	200	200	200	200	200
	FF/ENG	10250	10170	10090	10130	10240
440	%N1	60.1	62.8	66.9	71.4	76.2
	KIAS	193	193	193	193	193
	FF/ENG	9480	9380	9290	9300	9400
400	%N1	57.9	60.7	64.6	69.1	73.7
	KIAS	187	187	187	187	187
	FF/ENG	8740	8640	8520	8500	8570
360	%N1	55.6	58.2	62.2	66.4	71.0
	KIAS	180	180	180	180	180
	FF/ENG	8010	7900	7760	7710	7760

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		VREF30 + 80 DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
700	674	253	5200	4000	1700
660	635	246	7100	6200	4600
620	596	239	9100	8400	7200
580	557	232	10900	10200	9100
540	519	227	12700	12100	10900
500	480	222	14500	14000	12900
460	442	216	16500	15900	15000
420	404	210	18600	18200	17000
380	366	203	20800	20500	19700

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
740	800		
720	2200		
700	3600	1100	
680	4600	2700	
660	5600	4200	1400
640	6600	5400	3200
620	7600	6700	4800
600	8700	7900	6300
580	9700	9000	7900
560	10700	10100	9000
540	11700	11000	9900
520	12700	12000	10900
500	13600	13000	11800
480	14500	14000	12900
460	15500	15100	14000
440	16600	16000	15100
420	17700	17000	16100
400	18800	18400	17200
380	20000	19800	18700
360	21200	20800	20100

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)							
		5	7	9	11	13	15	17	19
680	%N1	97.1							
	MACH	.418							
	KIAS	253							
	FF/ENG	29597							
640	%N1	94.7	97.1						
	MACH	.407	.421						
	KIAS	246	246						
	FF/ENG	27548	27915						
600	%N1	92.6	94.4	97.1					
	MACH	.395	.409	.423					
	KIAS	239	239	238					
	FF/ENG	25711	25775	26281					
560	%N1	90.5	92.1	94.1	97.1				
	MACH	.383	.396	.410	.425				
	KIAS	232	231	231	231				
	FF/ENG	23975	23881	24040	24623				
520	%N1	88.5	90.1	91.9	94.1	97.5			
	MACH	.372	.386	.400	.415	.431			
	KIAS	225	225	225	225	225			
	FF/ENG	22233	22269	22345	22621	23249			
480	%N1	86.4	88.2	89.8	91.7	94.1	97.9		
	MACH	.363	.376	.391	.405	.421	.437		
	KIAS	220	220	220	220	220	220		
	FF/ENG	20677	20727	20792	20944	21208	21887		
440	%N1	84.0	85.9	87.7	89.4	91.3	93.8	97.9	
	MACH	.353	.366	.380	.394	.409	.425	.442	
	KIAS	213	213	213	213	213	213	213	
	FF/ENG	19092	19110	19166	19293	19457	19720	20473	
400	%N1	81.5	83.5	85.3	87.2	89.0	90.9	93.5	97.8
	MACH	.342	.355	.368	.382	.397	.413	.429	.446
	KIAS	207	207	207	207	207	207	207	207
	FF/ENG	17577	17577	17585	17695	17852	18003	18297	19100
360	%N1	78.9	80.7	82.7	84.6	86.5	88.3	90.2	92.9
	MACH	.331	.343	.356	.370	.384	.399	.415	.432
	KIAS	200	200	200	200	200	200	200	200
	FF/ENG	16044	16055	16035	16082	16230	16375	16525	16831

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
165	145	129	117	108	100	93	87	81	77	73
332	295	263	238	218	200	187	175	165	156	148
500	444	396	358	327	300	281	263	247	234	222
669	593	528	477	436	400	374	350	329	311	295
839	743	662	597	545	500	467	438	411	388	368
1009	894	795	718	655	600	561	525	494	466	442
1180	1044	928	838	764	700	654	612	575	543	515
1351	1196	1063	958	874	800	747	700	657	620	588
1523	1347	1197	1079	983	900	840	787	739	697	661
1696	1499	1331	1199	1093	1000	933	874	820	773	733

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
100	8.6	0:27	8.1	0:27	7.6	0:26	7.2	0:26	6.9	0:25
200	17.4	0:52	16.7	0:51	16.0	0:50	15.4	0:49	15.0	0:47
300	26.2	1:18	25.2	1:15	24.3	1:13	23.6	1:11	23.1	1:10
400	34.9	1:43	33.7	1:40	32.6	1:37	31.7	1:35	31.1	1:32
500	43.4	2:08	42.0	2:05	40.8	2:01	39.7	1:58	39.0	1:54
600	52.0	2:34	50.3	2:29	48.8	2:25	47.6	2:21	46.8	2:17
700	60.4	3:00	58.5	2:54	56.9	2:49	55.4	2:45	54.5	2:40
800	68.7	3:25	66.6	3:20	64.8	3:14	63.2	3:08	62.1	3:03
900	76.9	3:51	74.7	3:45	72.6	3:38	70.9	3:32	69.6	3:26
1000	85.1	4:18	82.6	4:10	80.4	4:03	78.5	3:56	77.0	3:49

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
15	-2.5	-1.7	-0.8	0.0	1.6	3.3	5.2	7.3
20	-3.4	-2.3	-1.1	0.0	2.1	4.4	7.0	9.9
25	-4.3	-2.8	-1.4	0.0	2.6	5.5	8.8	12.5
30	-5.2	-3.4	-1.7	0.0	3.0	6.5	10.5	14.9
35	-6.0	-4.0	-2.0	0.0	3.5	7.6	12.2	17.4
40	-6.9	-4.6	-2.3	0.0	3.9	8.5	13.8	19.7
45	-7.8	-5.2	-2.6	0.0	4.4	9.5	15.4	22.0
50	-8.7	-5.8	-2.9	0.0	4.8	10.4	16.9	24.3
55	-9.6	-6.4	-3.2	0.0	5.2	11.3	18.4	26.5
60	-10.5	-7.0	-3.5	0.0	5.6	12.2	19.9	28.6
65	-11.4	-7.6	-3.8	0.0	6.0	13.1	21.3	30.7
70	-12.3	-8.2	-4.0	0.0	6.3	13.9	22.7	32.7
75	-13.1	-8.7	-4.3	0.0	6.7	14.7	24.0	34.6
80	-14.0	-9.3	-4.6	0.0	7.0	15.4	25.3	36.5
85	-14.9	-9.9	-4.9	0.0	7.3	16.1	26.5	38.4
90	-15.8	-10.5	-5.2	0.0	7.6	16.8	27.7	40.1

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
760	%N1	96.6			
	KIAS	262			
	FF/ENG	34160			
720	%N1	94.7			
	KIAS	256			
	FF/ENG	32150			
680	%N1	92.8	96.4		
	KIAS	248	248		
	FF/ENG	30210	30360		
640	%N1	90.8	94.0		
	KIAS	241	241		
	FF/ENG	28280	28220		
600	%N1	89.1	92.1	98.5	
	KIAS	236	236	236	
	FF/ENG	26550	26560	27770	
560	%N1	87.2	90.3	95.3	
	KIAS	231	231	231	
	FF/ENG	24850	25010	25470	
520	%N1	85.2	88.5	92.8	
	KIAS	225	225	225	
	FF/ENG	23170	23340	23590	
480	%N1	83.0	86.4	90.7	97.9
	KIAS	220	220	220	220
	FF/ENG	21570	21710	21890	22980
440	%N1	80.7	84.0	88.5	93.8
	KIAS	213	213	213	213
	FF/ENG	19930	20050	20190	20710
400	%N1	78.4	81.5	86.3	90.9
	KIAS	207	207	207	207
	FF/ENG	18360	18460	18510	18900
360	%N1	76.0	78.9	83.6	88.3
	KIAS	200	200	200	200
	FF/ENG	16800	16850	16850	17190

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

General

FMC Takeoff Speeds

FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. Takeoff is not permitted in this condition as certified limits have been exceeded. The options are to select a smaller flap setting, select derate thrust and/or add weight (fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method may not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight is determined as follows:

(1) Determine the dry field/obstacle limit weight for the takeoff flap setting.

(2) Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.

(3) Adjust field length available for temperature by amount shown on chart.

(4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff speed determination:

(1) Determine takeoff speeds V1, VR and V2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

(2) If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on reversers operating and a 15 ft. screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around %N1

To find Go-Around %N1 based on normal engine bleed for packs on and anti-ice off, enter the Go-Around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for engine bleeds for various conditions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability at two center of gravity positions: 7.5% MAC (FMC default) for use when no center of gravity is entered on the PERF INIT page, and 30% MAC (typical mid cruise center of gravity) for use when 30% MAC is entered. Crews may interpolate between these values to determine the airplane's capability at other specific center of gravity positions. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude, .84 Mach approximates the Long Range Cruise Mach schedule.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Descent at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing Flaps 30 at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed for the selected flap setting. Flaps 1 is based on VREF30 + 60 speed schedule. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

The table "Approach or Landing Climb Limited Weight" presents the data which are the more limiting of Approach Climb Limit Weight and Landing Climb Limit Weight.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind, at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 Table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (LB/HR)				
	GROSS WEIGHT (1000 LB)				
	700	600	500	400	300
43				360	310
39			420	360	310
35		470	420	380	300
31	520	500	450	370	310
25	510	490	440	380	340
20	520	520	460	410	360
15	520	520	480	440	400
10	540	520	510	490	440
5	590	590	570	530	480

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing is planned. The tables show gear down rate of climb available for Flaps 20, Flaps 25 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Mode EEC

For most conditions, no takeoff speed adjustments or other performance adjustments other than takeoff power setting adjustments are required for operation of EEC in the ALTERNATE mode. For pressure altitudes between -2000 feet and -1000 feet and temperatures greater than ISA + 15°C, a thrust reduction occurs with EEC in the ALTERNATE mode. Performance software must be used to account for appropriate takeoff performance in this environmental region.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

777F GE90-110B1L LB FT FAA TO1-10 TO2-20 CREW3 TALPA HIGH_ALT

Pkg Model Identification PI.ModID.50.1

General PI.50.1

VREF PI.50.1
Flap Maneuver Speed PI.50.3
Slush/Standing Water Takeoff. PI.50.4
Slippery Runway Takeoff PI.50.8
TO1 Slush/Standing Water Takeoff PI.50.13
TO1 Slippery Runway Takeoff. PI.50.17
TO2 Slush/Standing Water Takeoff PI.50.22
TO2 Slippery Runway Takeoff. PI.50.26
Minimum Control Speeds. PI.50.31
Go-around %N1 . . . . . PI.50.32
Max Climb %N1. . . . . PI.50.33
Flight With Unreliable Airspeed / Turbulent Air Penetration PI.50.34

All Engine PI.51.1

Long Range Cruise Maximum Operating Altitude. PI.51.1
Long Range Cruise Control PI.51.3
Long Range Cruise Enroute Fuel and Time - Low Altitude. . PI.51.4
Long Range Cruise Enroute Fuel and Time - High Altitude . PI.51.5
Long Range Cruise Wind-Altitude Trade. PI.51.7
Descent at .84M/310/250 . . . . . PI.51.7
Holding PI.51.8

Advisory Information. PI.52.1

Runway Surface Condition Correlation PI.52.1
Normal Configuration Landing Distance PI.52.2
Non-Normal Configuration Landing Distance PI.52.8
ADIRU/GPS DISAGREE (Flaps 25) PI.52.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADIRU/GPS DISAGREE (Flaps 30) PI.52.9
AIR DATA SYS (Flaps 20) PI.52.10
AIRSPEED UNRELIABLE (Flaps 20) PI.52.11
ANTISKID (Flaps 25) PI.52.12
ANTISKID (Flaps 30) PI.52.13
ENG SHUTDOWN L, R (Flaps 20) PI.52.14
ENG SHUTDOWN L, R (Flaps 30) PI.52.15
FLAP / SLAT CONTROL (Flaps 20) PI.52.16
FLAPS DRIVE (Flaps ≤ 5) PI.52.17
FLAPS DRIVE (5 < Flaps < 20) PI.52.18
FLAPS DRIVE (Flaps ≥ 20) PI.52.19
FLAPS PRIMARY FAIL (Flaps 20) PI.52.20
FLIGHT CONTROL MODE (Flaps 20) PI.52.21
FLIGHT CONTROLS (Flaps 20) PI.52.22
HYD PRESS SYS C (Flaps 20) PI.52.23
HYD PRESS SYS L (Flaps 25) PI.52.24
HYD PRESS SYS L (Flaps 30) PI.52.25
HYD PRESS SYS L+C (Flaps 20) PI.52.26
HYD PRESS SYS L+R (Flaps 20) PI.52.27
HYD PRESS SYS R (Flaps 25) PI.52.28
HYD PRESS SYS R (Flaps 30) PI.52.29
HYD PRESS SYS R+C (Flaps 20) PI.52.30
NAV AIR DATA SYS (Flaps 20) PI.52.31
PITCH DOWN AUTHORITY (Flaps 25) PI.52.32
PITCH DOWN AUTHORITY (Flaps 30) PI.52.33
PITCH UP AUTHORITY (Flaps ≤ 15) PI.52.34
PITCH UP AUTHORITY (Flaps ≥ 20) PI.52.35
PRI FLIGHT COMPUTERS (Flaps 20) PI.52.36
SLATS DRIVE (Flaps 20) PI.52.37
SPOILERS (Flaps 25) PI.52.38
SPOILERS (Flaps 30) PI.52.39
STABILIZER (Flaps 20) PI.52.40
Approach or Landing Climb Limited Weight PI.52.41
Recommended Brake Cooling Schedule PI.52.43

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Inoperative PI.53.1

Initial Max Continuous %N1 . . . . . PI.53.1
Max Continuous %N1 . . . . . PI.53.2
Driftdown Speed/Level Off Altitude PI.53.5
Driftdown/LRC Cruise Range Capability PI.53.6
Long Range Cruise Altitude Capability PI.53.7
Long Range Cruise Control PI.53.8
Long Range Cruise Diversion Fuel and Time PI.53.9
Holding PI.53.10
Gear Down Landing Rate of Climb Available PI.53.11

Alternate Mode EEC PI.54.1

Alternate Mode EEC Max Takeoff %N1 . . . . . PI.54.1

Gear Down PI.55.1

220 KIAS Max Climb %N1 . . . . . PI.55.1
Long Range Cruise Altitude Capability PI.55.2
Long Range Cruise Control PI.55.3
Long Range Cruise Enroute Fuel and Time PI.55.4
Descent at VREF30 + 80 . . . . . PI.55.5
Holding PI.55.6

Gear Down, Engine Inoperative PI.56.1

Driftdown Speed/Level Off Altitude PI.56.1
Long Range Cruise Altitude Capability PI.56.1
Long Range Cruise Control PI.56.2
Long Range Cruise Diversion Fuel and Time PI.56.3
Holding PI.56.5

Text PI.57.1

Introduction PI.57.1
General PI.57.1
All Engines PI.57.4
Advisory Information PI.57.6
Engine Inoperative PI.57.9

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Mode EEC PI.57.12
Gear Down PI.57.12

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

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

Airplane Number	Registry Number	Serial Number	Tabulation Number
305	HL8005	37642	WF140
306	HL8043	62693	WF141
307	HL8044	62694	WF142
308	HL8045	62695	WF143
309	HL8046	62696	WF144
310	HL8075	62631	WF191
311	HL8076	62632	WF216
312	HL8077	62697	WF217
303	HL8226	37640	WF138

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airplane Number	Registry Number	Serial Number	Tabulation Number
301	HL8251	37639	WF136
302	HL8252	37638	WF137
304	HL8285	37641	WF139

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

VREF

Flaps 30

WEIGHT (LB)	VREF (KIAS) PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
780000	184	184	184	185	185	185
740000	178	178	178	179	179	179
700000	172	172	172	172	172	173
660000	164	164	164	164	164	164
620000	158	158	158	158	158	159
580000	151	151	151	151	151	152
540000	145	145	145	145	145	146
500000	140	140	140	140	140	140
460000	137	134	134	134	134	134
420000	137	134	130	128	128	128
380000	137	134	130	126	121	121
340000	137	134	130	126	121	116
339999 & BELOW	143	140	137	134	132	128

Flaps 25

WEIGHT (LB)	VREF (KIAS) PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
780000	183	183	183	183	184	184
740000	179	179	179	179	180	180
700000	174	174	175	175	175	175
660000	169	169	170	170	170	170
620000	164	164	164	165	165	165
580000	159	159	159	159	159	159
540000	153	153	154	154	154	154
500000	148	148	148	148	148	148
460000	142	142	142	142	142	142
420000	137	135	135	135	135	136
380000	137	134	130	129	129	129
340000	137	134	130	126	121	121
339999 & BELOW	143	140	137	134	132	128

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

VREF

Flaps 20

WEIGHT (LB)	VREF (KIAS)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
780000	193	193	194	194	194	196
740000	189	189	189	190	190	191
700000	184	184	184	185	185	186
660000	179	179	179	179	179	180
620000	173	174	174	174	174	174
580000	168	168	168	168	168	168
540000	162	162	162	162	163	163
500000	156	156	156	156	156	157
460000	150	150	150	150	150	150
420000	143	143	143	143	143	143
380000	137	136	136	136	136	136
340000	137	134	130	128	128	129
339999 & BELOW	143	140	137	134	132	129

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Maneuver Speed

FLAP POSITION	MANEUVER SPEED
FLAPS 0	VREF30 + 80
FLAPS 1	VREF30 + 60
FLAPS 5	VREF30 + 40
FLAPS 15	VREF30 + 20
FLAPS 20	VREF30 + 20
FLAPS 25	VREF25
FLAPS 30	VREF30

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust
Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-90.8	-105.8	-120.8	-106.0	-121.0	-136.0	-130.9	-145.9	-160.9
760	-84.9	-99.9	-114.9	-98.9	-113.9	-128.9	-121.6	-136.6	-151.6
720	-78.7	-93.7	-108.7	-91.6	-106.6	-121.6	-112.0	-127.0	-142.0
680	-72.3	-87.3	-102.3	-83.8	-98.8	-113.8	-102.0	-117.0	-132.0
640	-65.6	-80.6	-95.6	-75.8	-90.8	-105.8	-91.7	-106.7	-121.7
600	-58.5	-73.5	-88.5	-67.3	-82.3	-97.3	-81.1	-96.1	-111.1
560	-51.2	-66.2	-81.2	-58.5	-73.5	-88.5	-70.2	-85.2	-100.2
520	-43.7	-58.7	-73.7	-49.4	-64.4	-79.4	-59.0	-74.0	-89.0
480	-35.8	-50.8	-65.8	-39.9	-54.9	-69.9	-47.4	-62.4	-77.4
440	-27.7	-42.7	-57.7	-30.1	-45.1	-60.1	-35.6	-50.6	-65.6
400	-19.3	-34.3	-49.3	-20.0	-35.0	-50.0	-23.5	-38.5	-53.5
360	-11.0	-26.0	-41.0	-9.9	-24.9	-39.9	-11.4	-26.4	-41.4
320	-2.6	-17.6	-32.6	0.0	-14.8	-29.8	0.0	-14.3	-29.3

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
7000							315.8		
7400				314.5			362.4		
7800	332.1			361.0			408.9		
8200	378.3			407.5			455.6		
8600	424.6			454.1			502.6	321.6	
9000	471.1			501.1	320.3		549.9	368.2	
9400	518.0	337.9		548.5	366.8		597.6	414.8	
9800	565.3	384.1		596.2	413.3		645.5	461.5	
10200	613.0	430.4		644.2	460.0		693.7	508.5	327.4
10600	661.1	477.0	297.4	692.7	507.0	326.1	742.3	555.9	374.0
11000	709.6	523.9	343.6	741.5	554.4	372.6	791.2	603.5	420.6
11400	758.5	571.3	389.9	790.7	602.2	419.1		651.5	467.4
11800	807.9	619.0	436.2		650.3	465.9		699.8	514.4
12200		667.2	482.8		698.8	512.9		748.4	561.8
12600		715.7	529.8		747.6	560.4		797.4	609.5
13000		764.7	577.2		796.9	608.2			657.5
13400		814.0	625.0			656.3			705.8
13800			673.2			704.8			754.5
14200			721.8			753.8			803.5
14600			770.8			803.1			

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -210 ft/+210 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-29	-26	-24	-24	-22	-19	-16	-14	-11
720	-31	-29	-26	-27	-24	-22	-18	-15	-13
640	-32	-29	-27	-28	-26	-23	-20	-17	-15
560	-31	-29	-26	-28	-26	-23	-22	-19	-17
480	-31	-28	-26	-29	-26	-24	-24	-22	-19
400	-31	-29	-26	-30	-27	-25	-26	-24	-21
320	-32	-30	-27	-31	-28	-26	-28	-25	-23

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-119.2	-134.2	-149.2	-137.0	-152.0	-167.0	-165.1	-180.1	-195.1
760	-111.5	-126.5	-141.5	-127.6	-142.6	-157.6	-152.5	-167.5	-182.5
720	-103.6	-118.6	-133.6	-118.0	-133.0	-148.0	-139.9	-154.9	-169.9
680	-95.4	-110.4	-125.4	-108.2	-123.2	-138.2	-127.3	-142.3	-157.3
640	-87.0	-102.0	-117.0	-98.2	-113.2	-128.2	-114.8	-129.8	-144.8
600	-78.4	-93.4	-108.4	-88.1	-103.1	-118.1	-102.2	-117.2	-132.2
560	-69.5	-84.5	-99.5	-77.7	-92.7	-107.7	-89.7	-104.7	-119.7
520	-60.4	-75.4	-90.4	-67.2	-82.2	-97.2	-77.3	-92.3	-107.3
480	-51.0	-66.0	-81.0	-56.5	-71.5	-86.5	-64.8	-79.8	-94.8
440	-41.5	-56.5	-71.5	-45.6	-60.6	-75.6	-52.4	-67.4	-82.4
400	-31.7	-46.7	-61.7	-34.6	-49.6	-64.6	-40.0	-55.0	-70.0
360	-21.9	-36.9	-51.9	-23.5	-38.5	-53.5	-27.5	-42.5	-57.5
320	-12.1	-27.1	-42.1	-12.5	-27.5	-42.5	-15.1	-30.1	-45.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
10600							304.4		
11000							367.2		
11400							429.9		
11800							490.3		
12200				317.4			547.9	288.7	
12600				392.1			603.0	351.5	
13000	270.8			464.8			656.1	414.3	
13400	356.3			531.0			707.2	475.5	
13800	440.8			592.1	298.8		756.7	533.7	273.0
14200	515.4			649.1	373.4		804.6	589.5	335.8
14600	581.6			702.8	447.3		852.3	643.0	398.6
15000	641.7	334.9		753.6	515.0			694.6	460.5
15400	697.3	420.4		802.0	577.2	280.1		744.4	519.4
15800	749.0	497.6		849.9	635.2	354.8		792.7	575.7
16200	797.6	565.7			689.6	429.3		840.3	629.8

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -320 ft/+320 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-45	-40	-35	-38	-33	-28	-26	-21	-16
720	-47	-42	-37	-41	-36	-31	-28	-23	-18
640	-48	-43	-38	-43	-38	-33	-32	-27	-22
560	-48	-43	-38	-44	-39	-34	-36	-31	-26
480	-47	-42	-37	-45	-40	-35	-39	-34	-29
400	-48	-43	-38	-47	-42	-37	-43	-38	-33
320	-50	-45	-40	-48	-43	-38	-45	-40	-35

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-8.1	-13.1	-18.1	-52.5	-57.5	-62.5	-89.4	-94.4	-99.4
760	-13.5	-18.5	-23.5	-55.2	-60.2	-65.2	-88.9	-93.9	-98.9
720	-16.6	-21.6	-26.6	-55.7	-60.7	-65.7	-86.5	-91.5	-96.5
680	-17.5	-22.5	-27.5	-54.0	-59.0	-64.0	-82.1	-87.1	-92.1
640	-16.2	-21.2	-26.2	-49.9	-54.9	-59.9	-75.7	-80.7	-85.7
600	-14.3	-19.3	-24.3	-45.2	-50.2	-55.2	-68.8	-73.8	-78.8
560	-12.5	-17.5	-22.5	-40.5	-45.5	-50.5	-61.8	-66.8	-71.8
520	-10.6	-15.6	-20.6	-35.9	-40.9	-45.9	-54.7	-59.7	-64.7
480	-8.9	-13.9	-18.9	-31.3	-36.3	-41.3	-47.6	-52.6	-57.6
440	-7.2	-12.2	-17.2	-26.7	-31.7	-36.7	-40.4	-45.4	-50.4
400	-5.6	-10.6	-15.6	-22.2	-27.2	-32.2	-33.1	-38.1	-43.1
360	-4.0	-9.0	-14.0	-17.7	-22.7	-27.7	-25.9	-30.9	-35.9
320	-2.4	-7.4	-12.4	-13.3	-18.3	-23.3	-18.5	-23.5	-28.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALTI (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5000	256.1								
5400	347.2								
5800	438.2	256.1							
6200	529.0	347.2							
6600	619.5	438.2	256.1						
7000	709.8	529.0	347.2	333.8					
7400	799.8	619.5	438.2	397.5					
7800		709.8	529.0	462.4	286.1				
8200		799.8	619.5	528.5	349.7				
8600			709.8	596.0	413.7		312.8		
9000			799.8	664.9	478.8	302.0	354.3		
9400				735.4	545.3	365.6	396.1		
9800				807.4	613.1	429.8	438.6		
10200					682.4	495.3	481.9	307.6	
10600					753.2	562.1	526.0	349.1	
11000					825.6	630.3	571.0	390.8	
11400						700.0	616.9	433.2	
11800						771.2	663.8	476.4	302.4
12200							711.8	520.4	343.9
12600							760.9	565.3	385.6
13000							811.1	611.1	427.9
13400								657.9	471.0
13800								705.7	514.9
14200								754.7	559.7
14600								804.8	605.3
15000									652.0
15400									699.7
15800									748.5
16200									798.5

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -110 ft/+110 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -150 ft/+150 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -210 ft/+210 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustments (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-9	-6	-4	-21	-18	-16	-36	-33	-31
720	-12	-10	-7	-25	-23	-20	-40	-38	-35
640	-14	-11	-9	-27	-25	-22	-43	-40	-38
560	-14	-12	-9	-28	-26	-23	-44	-42	-39
480	-15	-12	-10	-30	-27	-25	-46	-43	-41
400	-17	-14	-12	-32	-29	-27	-47	-45	-42
320	-20	-18	-15	-35	-33	-30	-50	-47	-45

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-23.3	-28.3	-33.3	-81.2	-86.2	-91.2	-127.3	-132.3	-137.3
760	-27.9	-32.9	-37.9	-81.4	-86.4	-91.4	-123.0	-128.0	-133.0
720	-30.5	-35.5	-40.5	-79.9	-84.9	-89.9	-117.5	-122.5	-127.5
680	-31.1	-36.1	-41.1	-76.8	-81.8	-86.8	-110.8	-115.8	-120.8
640	-29.6	-34.6	-39.6	-72.0	-77.0	-82.0	-102.8	-107.8	-112.8
600	-27.4	-32.4	-37.4	-66.5	-71.5	-76.5	-94.4	-99.4	-104.4
560	-25.2	-30.2	-35.2	-60.8	-65.8	-70.8	-85.9	-90.9	-95.9
520	-22.8	-27.8	-32.8	-55.0	-60.0	-65.0	-77.4	-82.4	-87.4
480	-20.3	-25.3	-30.3	-49.0	-54.0	-59.0	-68.7	-73.7	-78.7
440	-17.8	-22.8	-27.8	-42.7	-47.7	-52.7	-59.9	-64.9	-69.9
400	-15.2	-20.2	-25.2	-36.3	-41.3	-46.3	-51.0	-56.0	-61.0
360	-12.4	-17.4	-22.4	-29.7	-34.7	-39.7	-42.0	-47.0	-52.0
320	-9.7	-14.7	-19.7	-23.1	-28.1	-33.1	-33.0	-38.0	-43.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
6600	368.4								
7000	517.9								
7400	643.5	388.9							
7800	754.0	534.6	242.2						
8200	855.8	658.0	408.8						
8600		767.0	551.0						
9000			672.3						
9400			779.8						
10200				333.7					
10600				525.8					
11000				653.4					
11400				755.9	419.8				
11800				846.3	577.8				
12200					694.0	271.8			
12600					790.3	487.1			
13000						624.5			
13400						731.9			
13800						823.9			
15800							273.0		

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -120 ft/+120 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -190 ft/+190 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -300 ft/+300 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-13	-8	-3	-30	-25	-20	-57	-52	-47
720	-16	-11	-6	-35	-30	-25	-63	-58	-53
640	-18	-13	-8	-39	-34	-29	-68	-63	-58
560	-20	-15	-10	-42	-37	-32	-72	-67	-62
480	-22	-17	-12	-45	-40	-35	-75	-70	-65
400	-24	-19	-14	-50	-45	-40	-78	-73	-68
320	-27	-22	-17	-56	-51	-46	-82	-77	-72

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-90.2	-105.2	-120.2	-105.5	-120.5	-135.5	-131.3	-146.3	-161.3
760	-84.6	-99.6	-114.6	-98.8	-113.8	-128.8	-122.4	-137.4	-152.4
720	-79.0	-94.0	-109.0	-92.2	-107.2	-122.2	-113.5	-128.5	-143.5
680	-73.2	-88.2	-103.2	-85.2	-100.2	-115.2	-104.3	-119.3	-134.3
640	-67.0	-82.0	-97.0	-77.8	-92.8	-107.8	-94.7	-109.7	-124.7
600	-60.5	-75.5	-90.5	-69.9	-84.9	-99.9	-84.7	-99.7	-114.7
560	-53.7	-68.7	-83.7	-61.7	-76.7	-91.7	-74.3	-89.3	-104.3
520	-46.5	-61.5	-76.5	-53.0	-68.0	-83.0	-63.6	-78.6	-93.6
480	-39.0	-54.0	-69.0	-44.0	-59.0	-74.0	-52.4	-67.4	-82.4
440	-31.2	-46.2	-61.2	-34.5	-49.5	-64.5	-40.9	-55.9	-70.9
400	-23.0	-38.0	-53.0	-24.6	-39.6	-54.6	-29.0	-44.0	-59.0
360	-14.7	-29.7	-44.7	-14.5	-29.5	-44.5	-16.9	-31.9	-46.9
320	-6.3	-21.3	-36.3	-4.4	-19.4	-34.4	-4.8	-19.8	-34.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
6600							321.0		
7000	293.9			322.6			370.5		
7400	343.1			372.1			420.0		
7800	392.5			421.7			470.0		
8200	442.1			471.8			520.5	327.2	
8600	492.4	300.1		522.6	328.8		571.6	376.7	
9000	543.4	349.2		574.0	378.3		623.2	426.2	
9400	595.0	398.7		626.1	428.0		675.5	476.2	
9800	647.4	448.4		678.9	478.2		728.5	526.8	333.4
10200	700.5	498.8	306.2	732.3	529.0	335.0	782.0	578.0	382.9
10600	754.4	549.8	355.4	786.5	580.5	384.4		629.7	432.5
11000	809.0	601.6	404.8		632.7	434.2		682.1	482.5
11400		654.0	454.7		685.5	484.5		735.1	533.2
11800		707.2	505.1		739.1	535.4		788.8	584.4
12200		761.1	556.2		793.4	587.0			636.2
12600		815.8	608.1			639.2			688.7
13000			660.6			692.2			741.8
13400			713.9			745.8			795.5
13800			767.9			800.2			

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -210 ft/+210 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-27	-25	-22	-22	-20	-17	-14	-11	-9
720	-30	-27	-25	-25	-23	-20	-15	-13	-10
640	-31	-28	-26	-26	-24	-21	-17	-15	-12
560	-30	-27	-25	-27	-24	-22	-20	-17	-15
480	-29	-27	-24	-27	-25	-22	-22	-19	-17
400	-30	-27	-25	-28	-25	-23	-24	-22	-19
320	-31	-28	-26	-29	-27	-24	-26	-24	-21

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-119.0	-134.0	-149.0	-137.6	-152.6	-167.6	-167.7	-182.7	-197.7
760	-111.6	-126.6	-141.6	-128.5	-143.5	-158.5	-155.4	-170.4	-185.4
720	-104.2	-119.2	-134.2	-119.4	-134.4	-149.4	-143.1	-158.1	-173.1
680	-96.6	-111.6	-126.6	-110.1	-125.1	-140.1	-130.8	-145.8	-160.8
640	-88.7	-103.7	-118.7	-100.6	-115.6	-130.6	-118.5	-133.5	-148.5
600	-80.5	-95.5	-110.5	-90.9	-105.9	-120.9	-106.2	-121.2	-136.2
560	-72.0	-87.0	-102.0	-80.9	-95.9	-110.9	-93.9	-108.9	-123.9
520	-63.3	-78.3	-93.3	-70.7	-85.7	-100.7	-81.6	-96.6	-111.6
480	-54.2	-69.2	-84.2	-60.3	-75.3	-90.3	-69.3	-84.3	-99.3
440	-44.9	-59.9	-74.9	-49.7	-64.7	-79.7	-57.0	-72.0	-87.0
400	-35.3	-50.3	-65.3	-38.8	-53.8	-68.8	-44.6	-59.6	-74.6
360	-25.6	-40.6	-55.6	-27.7	-42.7	-57.7	-32.2	-47.2	-62.2
320	-15.8	-30.8	-45.8	-16.7	-31.7	-46.7	-19.8	-34.8	-49.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
9800							305.5		
10200							375.9		
10600							445.8		
11000				272.1			513.2		
11400				357.7			577.9	287.9	
11800	245.2			443.7			640.4	358.3	
12200	345.5			522.9			700.8	428.6	
12600	445.6			595.7			759.6	496.7	
13000	533.6			663.6	336.3		817.2	562.0	
13400	611.3			727.6	422.7			625.0	340.7
13800	681.9	320.3		788.4	503.8			685.9	411.1
14200	747.3	421.5			578.0			745.1	479.9
14600	808.9	512.8			647.0	314.8		802.8	545.9
15000		592.5			711.9	401.0			609.4
15400		664.8	295.1		773.5	484.2			670.8

1. **Enter Weight Adjustment table with slush/standing water depth and TO1 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -320 ft/+320 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slush/Standing Water Takeoff

10% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-42	-37	-32	-35	-30	-25	-20	-15	-10
720	-45	-40	-35	-38	-33	-28	-23	-18	-13
640	-45	-40	-35	-40	-35	-30	-27	-22	-17
560	-45	-40	-35	-41	-36	-31	-31	-26	-21
480	-45	-40	-35	-42	-37	-32	-36	-31	-26
400	-46	-41	-36	-44	-39	-34	-39	-34	-29
320	-47	-42	-37	-46	-41	-36	-43	-38	-33

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustments (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-0.8	-5.8	-10.8	-44.6	-49.6	-54.6	-82.6	-87.6	-92.6
760	-6.7	-11.7	-16.7	-48.0	-53.0	-58.0	-82.8	-87.8	-92.8
720	-12.2	-17.2	-22.2	-51.2	-56.2	-61.2	-82.8	-87.8	-92.8
680	-15.4	-20.4	-25.4	-52.0	-57.0	-62.0	-80.8	-85.8	-90.8
640	-16.3	-21.3	-26.3	-50.4	-55.4	-60.4	-76.7	-81.7	-86.7
600	-15.0	-20.0	-25.0	-46.4	-51.4	-56.4	-70.5	-75.5	-80.5
560	-13.1	-18.1	-23.1	-41.8	-46.8	-51.8	-63.7	-68.7	-73.7
520	-11.3	-16.3	-21.3	-37.3	-42.3	-47.3	-56.9	-61.9	-66.9
480	-9.6	-14.6	-19.6	-32.8	-37.8	-42.8	-50.0	-55.0	-60.0
440	-7.9	-12.9	-17.9	-28.3	-33.3	-38.3	-43.0	-48.0	-53.0
400	-6.3	-11.3	-16.3	-23.9	-28.9	-33.9	-35.9	-40.9	-45.9
360	-4.6	-9.6	-14.6	-19.4	-24.4	-29.4	-28.7	-33.7	-38.7
320	-3.1	-8.1	-13.1	-14.9	-19.9	-24.9	-21.4	-26.4	-31.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff
10% Thrust Reduction
Maximum Reverse Thrust
V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5000	318.9								
5400	414.7								
5800	510.2	318.9							
6200	605.6	414.7							
6600	700.6	510.2	318.9	327.4					
7000	795.5	605.6	414.7	394.5					
7400		700.6	510.2	462.9	277.2				
7800		795.5	605.6	532.7	344.1				
8200			700.6	604.0	411.5		317.6		
8600			795.5	677.0	480.2	293.9	361.5		
9000				751.8	550.4	360.9	405.8		
9400				828.2	622.1	428.5	450.9		
9800					695.6	497.6	497.0	312.1	
10200					770.8	568.1	544.0	356.0	
10600						640.3	592.1	400.2	
11000						714.2	641.2	445.2	
11400						789.9	691.6	491.2	306.7
11800							743.2	538.1	350.5
12200							796.1	586.0	394.6
12600								635.0	439.6
13000								685.2	485.4
13400								736.7	532.2
13800								789.5	580.0
14200									628.8
14600									678.9
15000									730.1

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -110 ft/+110 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -150 ft/+150 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -210 ft/+210 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff
10% Thrust Reduction
Maximum Reverse Thrust
V1 Adjustments (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-10	-7	-5	-20	-18	-15	-34	-31	-29
720	-12	-10	-7	-24	-21	-19	-38	-36	-33
640	-14	-11	-9	-26	-23	-21	-41	-38	-36
560	-14	-12	-9	-27	-24	-22	-42	-39	-37
480	-15	-12	-10	-28	-26	-23	-43	-41	-38
400	-17	-14	-12	-30	-27	-25	-45	-42	-40
320	-20	-17	-15	-33	-31	-28	-47	-45	-42

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff

10% Thrust Reduction

No Reverse Thrust

Weight Adjustment (1000 LB)

TO1 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-15.7	-20.7	-25.7	-74.5	-79.5	-84.5	-122.7	-127.7	-132.7
760	-20.8	-25.8	-30.8	-75.2	-80.2	-85.2	-119.0	-124.0	-129.0
720	-25.7	-30.7	-35.7	-75.8	-80.8	-85.8	-115.2	-120.2	-125.2
680	-28.5	-33.5	-38.5	-74.7	-79.7	-84.7	-110.1	-115.1	-120.1
640	-29.1	-34.1	-39.1	-71.8	-76.8	-81.8	-103.7	-108.7	-113.7
600	-27.6	-32.6	-37.6	-67.1	-72.1	-77.1	-95.9	-100.9	-105.9
560	-25.5	-30.5	-35.5	-61.8	-66.8	-71.8	-87.8	-92.8	-97.8
520	-23.2	-28.2	-33.2	-56.3	-61.3	-66.3	-79.5	-84.5	-89.5
480	-20.9	-25.9	-30.9	-50.5	-55.5	-60.5	-71.1	-76.1	-81.1
440	-18.5	-23.5	-28.5	-44.6	-49.6	-54.6	-62.5	-67.5	-72.5
400	-16.0	-21.0	-26.0	-38.4	-43.4	-48.4	-53.8	-58.8	-63.8
360	-13.3	-18.3	-23.3	-31.9	-36.9	-41.9	-44.9	-49.9	-54.9
320	-10.6	-15.6	-20.6	-25.2	-30.2	-35.2	-35.9	-40.9	-45.9

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
6200	364.9								
6600	526.1								
7000	660.4	387.2							
7400	777.8	544.1							
7800		675.8	408.7						
8200		791.5	561.8						
8600			691.0						
9000			805.3						
9400				250.7					
9800				487.7					
10200				635.6					
10600				749.8	351.7				
11000				848.7	549.1				
11400					681.2				
11800					787.5	440.3			
12200						602.9			
12600						723.2			
13000						824.2			
14600							261.7		
15000							373.9		

1. **Enter Weight Adjustment table with reported braking action and TO1 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -120 ft/+120 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -190 ft/+190 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -300 ft/+300 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO1 Slippery Runway Takeoff
10% Thrust Reduction
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-13	-8	-3	-28	-23	-18	-53	-48	-43
720	-15	-10	-5	-33	-28	-23	-58	-53	-48
640	-17	-12	-7	-36	-31	-26	-63	-58	-53
560	-19	-14	-9	-39	-34	-29	-67	-62	-57
480	-21	-16	-11	-42	-37	-32	-70	-65	-60
400	-23	-18	-13	-46	-41	-36	-73	-68	-63
320	-25	-20	-15	-52	-47	-42	-77	-72	-67

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-89.0	-104.0	-119.0	-104.2	-119.2	-134.2	-130.5	-145.5	-160.5
760	-83.2	-98.2	-113.2	-97.4	-112.4	-127.4	-121.6	-136.6	-151.6
720	-77.7	-92.7	-107.7	-91.0	-106.0	-121.0	-113.1	-128.1	-143.1
680	-72.7	-87.7	-102.7	-84.9	-99.9	-114.9	-104.9	-119.9	-134.9
640	-67.4	-82.4	-97.4	-78.6	-93.6	-108.6	-96.4	-111.4	-126.4
600	-61.7	-76.7	-91.7	-71.7	-86.7	-101.7	-87.4	-102.4	-117.4
560	-55.6	-70.6	-85.6	-64.3	-79.3	-94.3	-77.9	-92.9	-107.9
520	-49.1	-64.1	-79.1	-56.4	-71.4	-86.4	-68.0	-83.0	-98.0
480	-42.1	-57.1	-72.1	-48.0	-63.0	-78.0	-57.5	-72.5	-87.5
440	-34.8	-49.8	-64.8	-39.0	-54.0	-69.0	-46.5	-61.5	-76.5
400	-27.0	-42.0	-57.0	-29.6	-44.6	-59.6	-35.1	-50.1	-65.1
360	-18.8	-33.8	-48.8	-19.7	-34.7	-49.7	-23.2	-38.2	-53.2
320	-10.5	-25.5	-40.5	-9.6	-24.6	-39.6	-11.1	-26.1	-41.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
6200							326.9		
6600	303.9			332.6			380.5		
7000	357.2			386.3			434.3		
7400	411.0			440.4			488.8		
7800	465.4			495.4			544.1	333.6	
8200	520.8	310.5		551.3	339.3		600.4	387.2	
8600	577.2	363.9		608.1	393.0		657.5	441.1	
9000	634.6	417.7		666.0	447.2		715.5	495.7	
9400	693.0	472.3		724.8	502.3	292.5	774.5	551.1	340.3
9800	752.6	527.8	317.2	784.8	558.3	346.0		607.4	393.9
10200	813.3	584.3	370.6		615.3	399.8		664.7	447.8
10600		641.8	424.5		673.3	454.1		722.8	502.6
11000		700.4	479.2		732.3	509.3		782.0	558.1
11400		760.1	534.8		792.4	565.4			614.5
11800		820.9	591.4			622.5			671.9
12200			649.1			680.6			730.2
12600			707.8			739.7			789.4
13000			767.7			799.9			

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -210 ft/+210 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-24	-22	-19	-19	-16	-14	-9	-6	-4
720	-27	-25	-22	-22	-19	-17	-11	-8	-6
640	-28	-25	-23	-23	-21	-18	-13	-11	-8
560	-27	-25	-22	-24	-21	-19	-16	-13	-11
480	-27	-24	-22	-24	-22	-19	-18	-16	-13
400	-27	-25	-22	-25	-23	-20	-21	-18	-16
320	-28	-26	-23	-26	-24	-21	-23	-21	-18

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff

20% Thrust Reduction

No Reverse Thrust

Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-118.7	-133.7	-148.7	-138.0	-153.0	-168.0	-170.0	-185.0	-200.0
760	-111.2	-126.2	-141.2	-128.9	-143.9	-158.9	-157.7	-172.7	-187.7
720	-103.9	-118.9	-133.9	-119.9	-134.9	-149.9	-145.6	-160.6	-175.6
680	-96.9	-111.9	-126.9	-111.2	-126.2	-141.2	-133.7	-148.7	-163.7
640	-89.6	-104.6	-119.6	-102.3	-117.3	-132.3	-121.7	-136.7	-151.7
600	-82.0	-97.0	-112.0	-93.1	-108.1	-123.1	-109.8	-124.8	-139.8
560	-74.0	-89.0	-104.0	-83.6	-98.6	-113.6	-97.7	-112.7	-127.7
520	-65.7	-80.7	-95.7	-73.8	-88.8	-103.8	-85.7	-100.7	-115.7
480	-57.1	-72.1	-87.1	-63.8	-78.8	-93.8	-73.6	-88.6	-103.6
440	-48.2	-63.2	-78.2	-53.5	-68.5	-83.5	-61.4	-76.4	-91.4
400	-38.9	-53.9	-68.9	-42.9	-57.9	-72.9	-49.2	-64.2	-79.2
360	-29.2	-44.2	-59.2	-31.9	-46.9	-61.9	-36.9	-51.9	-66.9
320	-19.5	-34.5	-49.5	-20.9	-35.9	-50.9	-24.5	-39.5	-54.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
9000							303.3		
9400							386.6		
9800							469.0		
10200				317.3			547.7		
10600				420.5			623.4	282.4	
11000	338.3			517.6			696.6	365.8	
11400	458.6			605.3			767.6	448.6	
11800	562.1			686.7	291.7			528.3	
12200	653.1			763.3	394.4			604.7	261.6
12600	735.6	307.9		837.2	494.3			678.5	344.9
13000	812.4	429.8			584.1			750.1	428.2
13400		537.8			666.9	266.3		820.1	508.7
13800		631.3			744.5	368.5			585.8
14200		715.5	277.6		818.6	470.3			660.2
14600		793.4	399.5			562.4			732.4
15000		870.3	512.5			646.8			802.6
15400			609.0			725.6			

1. **Enter Weight Adjustment table with slush/standing water depth and TO2 dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -320 ft/+320 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slush/Standing Water Takeoff
20% Thrust Reduction
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-38	-33	-28	-29	-24	-19	-11	-6	-1
720	-40	-35	-30	-32	-27	-22	-15	-10	-5
640	-41	-36	-31	-35	-30	-25	-20	-15	-10
560	-41	-36	-31	-36	-31	-26	-25	-20	-15
480	-41	-36	-31	-37	-32	-27	-30	-25	-20
400	-42	-37	-32	-39	-34	-29	-34	-29	-24
320	-44	-39	-34	-42	-37	-32	-38	-33	-28

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
Maximum Reverse Thrust
Weight Adjustments (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	0.0	0.0	-3.6	-37.5	-42.5	-47.5	-76.9	-81.9	-86.9
760	0.0	-4.4	-9.4	-40.8	-45.8	-50.8	-77.0	-82.0	-87.0
720	-5.3	-10.3	-15.3	-44.2	-49.2	-54.2	-77.2	-82.2	-87.2
680	-10.9	-15.9	-20.9	-47.6	-52.6	-57.6	-77.4	-82.4	-87.4
640	-14.4	-19.4	-24.4	-48.7	-53.7	-58.7	-75.7	-80.7	-85.7
600	-15.3	-20.3	-25.3	-47.0	-52.0	-57.0	-71.6	-76.6	-81.6
560	-13.9	-18.9	-23.9	-43.0	-48.0	-53.0	-65.4	-70.4	-75.4
520	-12.0	-17.0	-22.0	-38.5	-43.5	-48.5	-58.8	-63.8	-68.8
480	-10.3	-15.3	-20.3	-34.1	-39.1	-44.1	-52.0	-57.0	-62.0
440	-8.6	-13.6	-18.6	-29.6	-34.6	-39.6	-45.2	-50.2	-55.2
400	-6.9	-11.9	-16.9	-25.2	-30.2	-35.2	-38.2	-43.2	-48.2
360	-5.3	-10.3	-15.3	-20.8	-25.8	-30.8	-31.1	-36.1	-41.1
320	-3.7	-8.7	-13.7	-16.3	-21.3	-26.3	-23.8	-28.8	-33.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff
20% Thrust Reduction
Maximum Reverse Thrust
V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4600	287.1								
5000	388.3								
5400	489.4	287.1							
5800	590.3	388.3							
6200	691.0	489.4	287.1	320.6					
6600	791.5	590.3	388.3	391.7					
7000		691.0	489.4	464.1					
7400		791.5	590.3	538.3	338.3				
7800			691.0	614.3	409.6		323.9		
8200			791.5	692.2	482.5	285.1	370.5		
8600				772.2	557.1	356.0	417.8		
9000					633.6	427.7	466.2		
9400					712.0	501.0	515.6	318.0	
9800					792.6	576.0	566.2	364.7	
10200						653.0	618.1	411.9	
10600						731.9	671.3	460.1	
11000						813.0	726.0	509.4	312.2
11400							782.2	559.9	358.8
11800								611.6	405.9
12200								664.6	454.0
12600								719.1	503.2
13000								775.1	553.5
13400									605.0
13800									657.9
14200									712.2
14600									768.0

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -110 ft/+110 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -150 ft/+150 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -210 ft/+210 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction

Maximum Reverse Thrust

V1 Adjustments (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-9	-7	-4	-18	-16	-13	-30	-28	-25
720	-12	-9	-7	-22	-19	-17	-35	-32	-30
640	-13	-10	-8	-24	-21	-19	-37	-34	-32
560	-13	-11	-8	-24	-22	-19	-38	-36	-33
480	-14	-11	-9	-25	-23	-20	-39	-37	-34
400	-15	-13	-10	-27	-25	-22	-41	-38	-36
320	-18	-15	-13	-30	-28	-25	-43	-41	-38

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction
No Reverse Thrust
Weight Adjustment (1000 LB)

TO2 DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-8.2	-13.2	-18.2	-68.5	-73.5	-78.5	-119.0	-124.0	-129.0
760	-13.4	-18.4	-23.4	-69.2	-74.2	-79.2	-115.3	-120.3	-125.3
720	-18.5	-23.5	-28.5	-70.0	-75.0	-80.0	-111.7	-116.7	-121.7
680	-23.5	-28.5	-33.5	-70.8	-75.8	-80.8	-108.1	-113.1	-118.1
640	-26.5	-31.5	-36.5	-70.0	-75.0	-80.0	-103.3	-108.3	-113.3
600	-27.2	-32.2	-37.2	-67.1	-72.1	-77.1	-97.0	-102.0	-107.0
560	-25.6	-30.6	-35.6	-62.5	-67.5	-72.5	-89.3	-94.3	-99.3
520	-23.6	-28.6	-33.6	-57.2	-62.2	-67.2	-81.2	-86.2	-91.2
480	-21.4	-26.4	-31.4	-51.7	-56.7	-61.7	-73.0	-78.0	-83.0
440	-19.1	-24.1	-29.1	-46.0	-51.0	-56.0	-64.7	-69.7	-74.7
400	-16.6	-21.6	-26.6	-40.0	-45.0	-50.0	-56.1	-61.1	-66.1
360	-14.1	-19.1	-24.1	-33.8	-38.8	-43.8	-47.4	-52.4	-57.4
320	-11.4	-16.4	-21.4	-27.2	-32.2	-37.2	-38.4	-43.4	-48.4

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5800	357.2								
6200	533.2								
6600	677.7	381.7							
7000	803.4	552.6							
7400		694.3	405.4						
7800		818.4	571.6						
8200			710.6						
8600			833.4						
9000				431.2					
9400				610.1					
9800				739.3	256.3				
10200				848.6	508.0				
10600					662.1				
11000					781.4	367.1			
11400						571.9			
11800						709.7			
12200						821.7			
13400							240.8		
13800							364.7		
14200							486.2		
14600							603.1		
15000							716.0	302.7	

1. **Enter Weight Adjustment table with reported braking action and TO2 dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -120 ft/+120 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -190 ft/+190 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -300 ft/+300 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.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

TO2 Slippery Runway Takeoff

20% Thrust Reduction

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
800	-12	-7	-2	-25	-20	-15	-47	-42	-37
720	-14	-9	-4	-29	-24	-19	-53	-48	-43
640	-16	-11	-6	-32	-27	-22	-57	-52	-47
560	-17	-12	-7	-35	-30	-25	-61	-56	-51
480	-19	-14	-9	-38	-33	-28	-64	-59	-54
400	-20	-15	-10	-41	-36	-31	-67	-62	-57
320	-23	-18	-13	-46	-41	-36	-70	-65	-60

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Minimum Control Speeds

V1(MCG), Minimum VR

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	125	127	121	124	119	122	117	120						
50	122	129	131	125	128	119	122	117	120	115	118	111	114	106	110
40	104	136	138	133	135	127	130	122	125	117	120	111	114	106	110
30	86	138	140	138	140	133	136	128	130	122	125	115	118	109	112
20	68	139	140	138	140	134	137	131	133	126	129	119	123	113	116
-60	-76	140	140	139	140	136	137	132	133	127	129	121	124	116	119

TO1 V1(MCG), Minimum VR
10% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	119	121	115	118	113	116	111	114						
50	122	122	124	118	121	113	116	111	114	109	112	105	108	101	104
40	104	129	131	126	128	120	123	115	118	110	114	105	108	101	104
30	86	130	132	130	132	126	129	121	124	115	119	109	112	103	106
20	68	131	132	130	132	127	129	123	126	119	122	113	116	107	110
-60	-76	132	133	132	133	128	130	125	126	120	122	115	117	110	113

TO2 V1(MCG), Minimum VR
20% Thrust Reduction

TEMP		PRESSURE ALTITUDE (FT)													
		-2000		0		2000		4000		6000		8000		10000	
°C	°F	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR	V1 (MCG)	Min VR
60	140	112	115	108	111	106	109	105	108						
50	122	115	118	112	115	107	110	105	108	103	106	99	102	95	99
40	104	122	124	119	121	113	116	108	112	104	108	99	102	95	99
30	86	123	125	122	125	119	121	113	116	108	112	103	106	97	101
20	68	123	125	123	125	119	122	116	119	112	115	106	110	101	104
-60	-76	125	126	124	126	121	123	117	119	113	116	108	111	104	107

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Go-around %N1

Based on engine bleed for packs on and anti-ice off

REPORTED OAT		TAT °C	AIRPORT PRESSURE ALTITUDE (1000 FT)														
°C	°F		-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12
66	150	70	93.2	93.3	93.6	93.4	93.3	93.3	93.3	93.4	93.3	92.6	91.5	90.5	89.6	88.9	88.2
56	133	60	95.9	96.1	96.4	96.2	96.1	96.1	96.1	96.2	96.1	95.4	94.3	93.4	92.5	91.8	91.0
51	124	55	97.2	97.6	97.9	97.7	97.5	97.5	97.5	97.5	97.4	96.7	95.7	94.7	93.9	93.1	92.4
46	115	50	98.5	98.9	99.3	99.2	98.9	98.8	98.8	98.8	98.7	98.0	97.0	96.1	95.2	94.5	93.8
41	106	45	99.6	100.1	100.6	100.5	100.2	100.2	100.1	100.2	100.0	99.3	98.3	97.3	96.5	95.8	95.1
36	97	40	100.4	101.6	102.4	102.3	101.9	101.8	101.7	101.7	101.3	100.5	99.5	98.6	97.8	97.1	96.4
31	88	35	99.6	101.2	103.2	104.4	103.9	103.7	103.6	103.5	102.7	101.7	100.6	99.7	98.9	98.3	97.6
26	79	30	98.8	100.4	102.3	103.8	105.1	105.9	105.9	106.1	105.0	103.4	101.9	100.8	100.0	99.4	98.7
21	70	25	97.9	99.5	101.5	102.9	104.2	105.2	106.3	107.2	106.8	105.7	104.0	102.3	101.3	100.5	99.8
16	61	20	97.1	98.7	100.6	102.0	103.3	104.3	105.4	106.5	106.8	106.3	105.2	104.2	103.3	102.3	101.3
11	53	15	96.3	97.9	99.8	101.2	102.4	103.4	104.5	105.6	105.9	105.5	104.9	104.4	104.0	103.7	103.3
7	44	10	95.4	97.0	98.9	100.3	101.5	102.5	103.6	104.6	105.0	104.6	104.0	103.5	103.4	103.5	103.6
2	35	5	94.6	96.1	98.0	99.4	100.6	101.6	102.7	103.7	104.1	103.7	103.1	102.5	102.5	102.6	102.7
-3	26	0	93.7	95.3	97.1	98.5	99.7	100.7	101.7	102.8	103.1	102.7	102.1	101.6	101.6	101.7	101.8
-13	8	-10	92.0	93.5	95.3	96.7	97.9	98.8	99.8	100.9	101.2	100.8	100.3	99.7	99.7	99.8	99.9
-23	-10	-20	90.2	91.7	93.5	94.8	96.0	96.9	97.9	98.9	99.3	98.9	98.3	97.8	97.8	97.9	98.0
-33	-27	-30	88.4	89.9	91.7	92.9	94.1	95.0	96.0	97.0	97.3	96.9	96.4	95.9	95.8	95.9	96.0
-43	-45	-40	86.6	88.0	89.7	91.0	92.1	93.0	94.0	95.0	95.3	94.9	94.4	93.9	93.9	93.9	94.0
-53	-63	-50	84.7	86.1	87.8	89.0	90.1	91.0	91.9	92.9	93.2	92.9	92.3	91.8	91.8	91.9	92.0

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)														
	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.4	0.4
1 PACK ON	-0.2	-0.2	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4
ENGINE ANTI-ICE AUTO (OAT < 10°C)	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	0.0	0.0
ENGINE ANTI-ICE AUTO (OAT > 10°C)	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	-0.5	-0.5
ENGINE ANTI-ICE ON (OAT < 10°C)	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	-0.5	-0.5
ENGINE ANTI-ICE ON (OAT > 10°C)	-0.3	-0.4	-0.4	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.5	-0.5
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
WING ANTI-ICE AUTO (OAT < 10°C)	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
WING ANTI-ICE AUTO (OAT > 10°C)	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	0.0	0.0

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT) / SPEED (KIAS OR MACH)									
	0	5	10	15	20	25	30	35	40	43
	310	310	310	310	310	310	310	.84	.84	.84
60	88.3	88.1	90.3	91.0	93.1	96.7	99.6	101.7	101.8	101.3
50	90.6	90.4	90.2	89.6	91.7	95.3	98.0	100.1	100.2	99.7
40	92.5	92.4	92.4	92.2	90.5	93.8	96.5	98.6	98.7	98.2
30	91.6	94.1	94.2	94.0	93.1	94.2	95.2	97.0	97.1	96.6
20	90.1	92.5	95.1	95.8	95.9	95.9	96.9	95.9	95.5	95.0
15	89.3	91.7	94.3	96.9	96.9	96.9	97.8	96.6	95.8	95.4
10	88.6	90.9	93.5	96.1	98.4	98.1	98.8	97.2	96.5	96.0
5	87.8	90.1	92.7	95.2	98.1	99.6	100.1	98.1	97.2	96.8
0	87.0	89.3	91.8	94.4	97.3	99.9	101.5	99.3	98.1	97.6
-5	86.2	88.5	91.0	93.5	96.4	99.0	101.9	100.5	99.5	98.8
-10	85.4	87.7	90.1	92.6	95.5	98.1	100.9	101.3	100.5	100.0
-15	84.6	86.8	89.3	91.7	94.5	97.1	100.0	101.0	100.9	100.5
-20	83.7	86.0	88.4	90.8	93.6	96.2	99.0	100.1	99.9	99.5
-25	82.9	85.1	87.5	89.9	92.7	95.2	98.0	99.1	98.9	98.5
-30	82.1	84.3	86.7	89.0	91.8	94.3	97.0	98.1	97.9	97.5
-35	81.2	83.4	85.8	88.1	90.8	93.3	96.0	97.0	96.9	96.5
-40	80.4	82.5	84.9	87.2	89.8	92.3	95.0	96.0	95.9	95.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)									
	0	5	10	15	20	25	30	35	40	43
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5	-0.6	-0.6

***Packs on or packs off with 2 bleed sources.**
****Packs off with 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	**PITCH ATT**	**5.0**	**4.5**			
	V/S (FT/MIN)	1800	1000			
30000 (280 KIAS)	**PITCH ATT**	**6.0**	**5.5**	**5.5**	**5.0**	**4.5**
	V/S (FT/MIN)	2900	2100	1500	1100	800
20000 (270 KIAS)	**PITCH ATT**	**8.5**	**8.0**	**8.0**	**8.0**	**7.0**
	V/S (FT/MIN)	4000	3100	2300	1800	1300
10000 (270 KIAS)	**PITCH ATT**	**12.0**	**10.5**	**10.0**	**9.5**	**9.5**
	V/S (FT/MIN)	5500	4200	3300	2700	2100
SEA LEVEL (270 KIAS)	**PITCH ATT**	**15.5**	**13.0**	**12.0**	**11.5**	**11.0**
	V/S (FT/MIN)	6400	4900	4000	3200	2600

Cruise

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	**PITCH ATT**	**2.5**	**3.5**			
	%N1	81.2	86.6			
35000 (.82M)	**PITCH ATT**	**2.0**	**2.5**	**3.5**	**4.0**	
	%N1	77.9	80.7	84.8	90.8	
30000 (280 KIAS)	**PITCH ATT**	**2.0**	**2.5**	**3.5**	**4.0**	**3.5**
	%N1	73.8	76.3	80.0	84.2	88.6
25000 (280 KIAS)	**PITCH ATT**	**2.0**	**3.0**	**3.5**	**4.5**	**4.0**
	%N1	69.8	72.3	75.4	79.2	83.2
20000 (270 KIAS)	**PITCH ATT**	**2.5**	**3.0**	**4.0**	**5.0**	**5.5**
	%N1	64.8	67.5	70.6	74.3	78.5
15000 (270 KIAS)	**PITCH ATT**	**2.5**	**3.0**	**4.0**	**5.0**	**5.5**
	%N1	60.8	63.4	66.4	69.6	73.6

Descent

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT) (SPEED)		WEIGHT (1000 LB)				
		400	500	600	700	800
40000 (.82M)	**PITCH ATT**	**-0.5**	**0.5**			
	V/S (FT/MIN)	-2700	-2700			
30000 (280 KIAS)	**PITCH ATT**	**-0.5**	**0.5**	**1.0**	**1.5**	**0.5**
	V/S (FT/MIN)	-2100	-1900	-1800	-1900	-2500
20000 (270 KIAS)	**PITCH ATT**	**0.0**	**1.0**	**2.0**	**3.0**	**3.0**
	V/S (FT/MIN)	-1600	-1500	-1400	-1400	-1500
10000 (270 KIAS)	**PITCH ATT**	**-0.5**	**0.5**	**1.5**	**2.5**	**3.0**
	V/S (FT/MIN)	-1500	-1400	-1300	-1300	-1300
SEA LEVEL (270 KIAS)	**PITCH ATT**	**-1.0**	**0.5**	**1.5**	**2.0**	**3.0**
	V/S (FT/MIN)	-1400	-1200	-1200	-1200	-1200

In shaded areas, data reflects the minimum speed limitation of 15 knots above minimum maneuvering speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding

Flaps Up, Set Thrust for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	**PITCH ATT**	**4.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	52.8	56.9	61.3	65.5	69.3
	KIAS	216	220	236	252	266
5000	**PITCH ATT**	**4.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	49.3	53.3	57.4	61.3	65.1
	KIAS	216	220	236	252	265

Terminal Area (5000 FT)

%N1 for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS UP	**PITCH ATT**	**4.5**	**6.0**	**6.0**	**6.0**	**6.5**
GEAR UP	%N1	49.6	53.8	58.1	62.3	66.1
(VREF30+80)	KIAS	217	220	236	252	265
FLAPS 1	**PITCH ATT**	**6.0**	**7.5**	**7.5**	**7.5**	**8.0**
GEAR UP	%N1	50.5	55.2	59.8	64.1	67.9
(VREF30+60)	KIAS	197	200	216	232	245
FLAPS 5	**PITCH ATT**	**5.0**	**6.5**	**6.5**	**6.5**	**6.5**
GEAR UP	%N1	51.0	55.9	60.7	64.9	68.8
(VREF30+40)	KIAS	177	180	196	212	225
FLAPS 15	**PITCH ATT**	**5.5**	**7.5**	**7.0**	**7.0**	**7.0**
GEAR UP	%N1	51.8	57.8	62.6	66.8	71.0
(VREF30+20)	KIAS	157	160	176	192	205
FLAPS 20	**PITCH ATT**	**4.0**	**5.5**	**5.5**	**5.5**	**5.5**
GEAR DOWN	%N1	58.3	63.3	68.8	73.6	77.7
(VREF30+20)	KIAS	157	160	176	192	205

Final Approach (1500 FT)

Gear Down, %N1 for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		400	500	600	700	800
FLAPS 20 (VREF20+10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	38.8	42.9	46.8	50.2	53.0
	KIAS	149	166	181	194	204
FLAPS 25 (VREF25+10)	**PITCH ATT**	**1.0**	**1.5**	**1.5**	**1.5**	**2.0**
	%N1	50.3	52.5	56.5	60.4	63.7
	KIAS	147	158	172	184	194
FLAPS 30 (VREF30+10)	**PITCH ATT**	**0.5**	**1.0**	**1.0**	**1.0**	**1.0**
	%N1	56.4	57.6	62.5	67.6	71.9
	KIAS	147	150	166	182	195

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Go-Around

Flaps 20, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		400	500	600	700	800
10000	**PITCH ATT**	**18.5**	**15.0**	**12.5**	**10.5**	**9.0**
	V/S (FT/MIN)	4000	3100	2500	2000	1600
	KIAS	145	160	176	193	207
5000	**PITCH ATT**	**22.5**	**18.5**	**15.0**	**12.5**	**11.0**
	V/S (FT/MIN)	5100	4000	3300	2700	2300
	KIAS	148	160	176	192	206
SEA LEVEL	**PITCH ATT**	**24.5**	**21.0**	**17.5**	**14.5**	**12.5**
	V/S (FT/MIN)	5800	4400	3700	3100	2700
	KIAS	157	160	176	192	205

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude
Max Climb Thrust
ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	27700	5	30800	29100	27600
760	28200	3	31400	29700	28100
740	28800	2	31900	30200	28700
720	29400	1	32300	30700	29100
700	30100	-1	32800	31200	29600
680	30700	-2	33300	31600	30100
660	31300	-4	33800	32200	30600
640	32000	-5	34300	32700	31200
620	32700	-7	34800	33200	31700
600	33400	-8	35400	33800	32300
580	34100	-10	35900	34300	32900
560	34800	-12	36500	34900	33500
540	35600	-13	37100	35600	34100
520	36400	-15	37800	36200	34800
500	37200	-15	38500	36900	35500
480	38100	-15	39100	37600	36200
460	38900	-15	39900	38300	36900
440	39900	-15	40600	39100	37700
420	40800	-15	41400	39900	38500
400	41900	-15	42300	40800	39400
380	42900	-15	43100	41800	40500
360	43100	-15	43100	42900	41600

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	27700	10	30800	29100	27600
760	28200	9	31400	29700	28100
740	28800	8	31900	30200	28700
720	29400	6	32300	30700	29100
700	30100	5	32800	31200	29600
680	30700	3	33300	31600	30100
660	31300	2	33800	32200	30600
640	32000	0	34300	32700	31200
620	32700	-1	34800	33200	31700
600	33400	-3	35400	33800	32300
580	34100	-4	35900	34300	32900
560	34800	-6	36500	34900	33500
540	35600	-8	37100	35600	34100
520	36400	-9	37800	36200	34800
500	37200	-9	38500	36900	35500
480	38100	-9	39100	37600	36200
460	38900	-9	39900	38300	36900
440	39900	-9	40600	39100	37700
420	40800	-9	41400	39900	38500
400	41900	-9	42300	40800	39400
380	42900	-9	43100	41800	40500
360	43100	-9	43100	42900	41600

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Maximum Operating Altitude

Max Climb Thrust

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)		
			1.30 (39°)	1.40 (44°)	1.50 (48°)
780	27700	16	30800	29100	27600
760	28200	15	31400	29700	28100
740	28800	13	31900	30200	28700
720	29400	12	32300	30700	29100
700	30100	11	32800	31200	29600
680	30700	9	33300	31600	30100
660	31300	8	33800	32200	30600
640	32000	6	34300	32700	31200
620	32700	5	34800	33200	31700
600	33400	3	35400	33800	32300
580	34100	1	35900	34300	32900
560	34800	0	36500	34900	33500
540	35600	-2	37100	35600	34100
520	36400	-3	37800	36200	34800
500	37200	-3	38500	36900	35500
480	38100	-3	39100	37600	36200
460	38900	-3	39900	38300	36900
440	39900	-3	40600	39100	37700
420	40800	-3	41400	39900	38500
400	41900	-3	42300	40800	39400
380	42900	-3	43100	41800	40500
360	43100	-3	43100	42900	41600

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		25	27	29	31	33	35	37	39	41	43
780	%N1	83.7	85.7	87.1	89.5						
	MACH	.819	.840	.838	.832						
	KIAS	346	342	327	310						
	FF/ENG	11185	11318	11154	11433						
740	%N1	82.9	84.4	85.9	87.6	90.3					
	MACH	.819	.838	.840	.836	.828					
	KIAS	346	341	328	312	296					
	FF/ENG	10816	10808	10624	10644	10953					
700	%N1	81.7	82.9	84.4	85.8	88.0					
	MACH	.816	.832	.839	.839	.833					
	KIAS	345	338	327	313	298					
	FF/ENG	10351	10200	10031	9886	10098					
660	%N1	80.1	81.7	82.9	84.4	86.0					
	MACH	.799	.823	.836	.840	.837					
	KIAS	337	334	326	314	299					
	FF/ENG	9714	9663	9497	9348	9306					
620	%N1	78.5	80.2	81.7	83.0	84.5	86.3				
	MACH	.776	.807	.828	.838	.840	.835				
	KIAS	327	327	322	313	300	285				
	FF/ENG	9057	9105	9004	8862	8740	8806				
580	%N1	76.9	78.6	80.3	81.6	83.1	84.4	87.1			
	MACH	.751	.784	.813	.831	.839	.839	.833			
	KIAS	315	317	316	310	300	287	272			
	FF/ENG	8383	8481	8481	8367	8245	8139	8348			
540	%N1	75.1	76.8	78.5	80.2	81.4	82.9	84.8			
	MACH	.726	.757	.791	.818	.834	.840	.838			
	KIAS	304	305	307	305	298	287	273			
	FF/ENG	7752	7816	7891	7870	7758	7643	7611			
500	%N1	73.6	74.9	76.6	78.3	80.0	81.2	83.1	85.5		
	MACH	.707	.729	.762	.796	.822	.836	.840	.837		
	KIAS	296	293	294	296	293	285	274	261		
	FF/ENG	7231	7174	7244	7303	7275	7156	7084	7154		
460	%N1	72.0	73.2	74.5	76.2	78.0	79.6	81.3	83.6	86.1	
	MACH	.690	.708	.731	.765	.799	.824	.837	.840	.836	
	KIAS	288	284	281	283	284	281	273	262	249	
	FF/ENG	6761	6643	6599	6672	6724	6679	6596	6581	6668	
420	%N1	69.9	71.5	72.7	74.0	75.8	77.6	79.5	81.7	83.8	
	MACH	.666	.689	.708	.731	.765	.800	.825	.837	.840	
	KIAS	277	276	272	269	271	272	269	261	250	
	FF/ENG	6228	6173	6067	6033	6099	6136	6118	6086	6073	
380	%N1	67.5	69.2	70.8	72.0	73.4	75.1	77.3	79.7	81.8	83.9
	MACH	.635	.662	.687	.706	.729	.763	.799	.824	.837	.840
	KIAS	264	264	263	259	257	258	259	256	249	239
	FF/ENG	5652	5640	5596	5509	5473	5515	5566	5604	5573	5535
340	%N1	65.0	66.5	68.2	69.9	71.3	72.5	74.6	77.2	79.6	81.6
	MACH	.602	.627	.655	.682	.702	.724	.757	.794	.821	.836
	KIAS	249	249	250	250	247	244	244	246	244	237
	FF/ENG	5104	5085	5062	5041	4972	4908	4948	5036	5085	5031

Shaded area approximates optimum altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - Low Altitude

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
279	259	241	226	212	200	191	182	174	167	161
552	514	480	450	424	400	383	367	352	338	326
826	769	718	674	635	600	575	551	529	509	491
1101	1025	957	898	847	800	767	736	707	681	657
1376	1282	1197	1123	1059	1000	959	920	885	852	822
1653	1539	1437	1348	1270	1200	1151	1105	1062	1023	987
1930	1796	1677	1573	1482	1400	1342	1288	1239	1193	1151
2207	2055	1918	1799	1695	1600	1534	1473	1416	1364	1316
2486	2314	2159	2025	1907	1800	1726	1658	1594	1534	1480
2765	2573	2400	2251	2119	2000	1918	1841	1770	1705	1645

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	8.7	0:37	7.6	0:36	6.3	0:35	5.6	0:34	4.9	0:33
400	18.0	1:09	16.5	1:06	14.4	1:03	13.2	1:01	12.2	0:58
600	27.3	1:42	25.3	1:37	22.4	1:31	20.7	1:28	19.4	1:24
800	36.5	2:14	34.1	2:08	30.3	1:59	28.2	1:55	26.5	1:49
1000	45.6	2:47	42.7	2:39	38.2	2:27	35.7	2:22	33.6	2:14
1200	54.7	3:20	51.3	3:10	46.1	2:56	43.0	2:50	40.6	2:40
1400	63.6	3:54	59.9	3:42	53.8	3:24	50.4	3:17	47.6	3:05
1600	72.6	4:27	68.3	4:13	61.6	3:53	57.6	3:45	54.6	3:31
1800	81.4	5:01	76.7	4:45	69.2	4:22	64.8	4:12	61.4	3:57
2000	90.2	5:35	85.0	5:18	76.9	4:51	72.0	4:40	68.3	4:23

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB) 400	500	600	700	800
10	-1.4	-0.7	0.0	0.8	2.1
20	-2.9	-1.5	0.0	1.9	4.6
30	-4.5	-2.3	0.0	3.0	7.1
40	-6.0	-3.1	0.0	4.0	9.5
50	-7.6	-3.9	0.0	5.1	11.9
60	-9.1	-4.7	0.0	6.1	14.2
70	-10.7	-5.5	0.0	7.2	16.5
80	-12.2	-6.2	0.0	8.2	18.7
90	-13.7	-7.0	0.0	9.2	20.9

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitude

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
647	612	579	550	524	500	479	460	441	424	409
1279	1212	1151	1096	1046	1000	959	921	886	853	823
1911	1812	1722	1641	1568	1500	1439	1382	1329	1281	1237
2545	2415	2295	2188	2090	2000	1919	1844	1774	1709	1649
3183	3020	2870	2735	2613	2500	2399	2305	2218	2138	2064
3823	3627	3446	3284	3136	3000	2880	2767	2663	2566	2478
4467	4236	4023	3833	3660	3500	3360	3229	3107	2995	2892
5113	4847	4602	4383	4184	4000	3840	3691	3552	3424	3306
5763	5460	5182	4934	4708	4500	4320	4153	3997	3853	3720
6415	6075	5764	5485	5233	5000	4801	4614	4441	4281	4134
7069	6692	6347	6038	5758	5500	5281	5076	4885	4709	4547
7726	7311	6931	6591	6283	6000	5761	5537	5329	5137	4960
8385	7931	7516	7145	6809	6500	6241	5998	5773	5564	5373
9046	8553	8102	7699	7335	7000	6720	6459	6216	5991	5785
9709	9176	8689	8254	7861	7500	7200	6919	6658	6417	6196
10376	9802	9278	8810	8388	8000	7679	7379	7100	6843	6606
11046	10430	9868	9367	8915	8500	8158	7838	7541	7267	7016
11720	11061	10460	9925	9443	9000	8636	8297	7981	7691	7424
12399	11696	11055	10485	9971	9500	9115	8755	8421	8113	7831
13082	12334	11651	11046	10500	10000	9593	9213	8860	8534	8236

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
500	15.9	1:09	15.4	1:09	15.1	1:10	15.1	1:11	15.8	1:11
1000	33.0	2:13	32.0	2:12	31.4	2:12	31.3	2:13	32.2	2:14
1500	50.1	3:16	48.7	3:14	47.8	3:13	47.4	3:15	48.6	3:16
2000	67.3	4:20	65.4	4:16	64.1	4:15	63.6	4:16	65.0	4:19
2500	83.7	5:25	81.4	5:19	79.8	5:17	79.0	5:18	80.3	5:21
3000	100.2	6:31	97.5	6:22	95.4	6:19	94.4	6:20	95.6	6:24
3500	116.0	7:38	112.9	7:27	110.5	7:22	109.2	7:23	110.1	7:26
4000	131.8	8:46	128.4	8:32	125.6	8:25	123.9	8:25	124.6	8:28
4500	147.0	9:55	143.3	9:39	140.2	9:30	138.1	9:28	138.5	9:30
5000	162.2	11:05	158.1	10:46	154.7	10:34	152.2	10:31	152.3	10:33
5500	176.8	12:16	172.4	11:55	168.7	11:41	165.9	11:35	165.6	11:36
6000	191.4	13:27	186.7	13:04	182.7	12:47	179.5	12:40	178.9	12:39
6500	205.5	14:40	200.4	14:15	196.1	13:55	192.6	13:45	191.7	13:42
7000	219.6	15:53	214.2	15:27	209.6	15:04	205.8	14:51	204.4	14:46
7500	233.1	17:08	227.4	16:39	222.5	16:15	218.4	15:59	216.7	15:51
8000	246.7	18:22	240.6	17:52	235.4	17:26	231.0	17:07	229.0	16:56
8500	259.9	19:39	253.4	19:06	247.9	18:38	243.2	18:17	240.8	18:03
9000	273.0	20:57	266.2	20:21	260.3	19:51	255.4	19:27	252.6	19:10
9500	285.7	22:17	278.5	21:37	272.4	21:05	267.0	20:40	264.0	20:20
10000	298.4	23:37	290.8	22:54	284.4	22:19	278.7	21:52	275.4	21:29

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Enroute Fuel and Time - High Altitude
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	400	500	600	700	800
20	-4.0	-1.5	0.0	7.7	33.2
40	-8.1	-3.9	0.0	12.1	43.3
60	-12.1	-6.2	0.0	16.3	52.7
80	-16.2	-8.5	0.0	20.1	61.3
100	-20.1	-10.7	0.0	23.7	69.2
120	-24.1	-12.9	0.0	27.1	76.3
140	-28.0	-14.9	0.0	30.1	82.7
160	-31.8	-16.9	0.0	32.9	88.4
180	-35.7	-18.9	0.0	35.5	93.3
200	-39.4	-20.7	0.0	37.7	97.4
220	-43.2	-22.5	0.0	39.7	100.8
240	-46.8	-24.2	0.0	41.4	103.5
260	-50.5	-25.9	0.0	42.9	105.4
280	-54.1	-27.5	0.0	44.1	106.5
300	-57.7	-29.0	0.0	45.0	106.9

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)											
	780	740	700	660	620	580	540	500	460	420	380	340
43							143	75	31	7	0	6
41						118	62	26	6	0	5	17
39						49	20	5	0	4	15	31
37			114	68	35	14	3	0	5	15	29	45
35	126	81	47	23	8	1	1	6	15	28	43	59
33	54	30	13	4	0	2	8	17	29	42	57	71
31	17	6	1	0	3	10	19	30	42	56	69	81
29	2	0	1	6	13	22	32	44	56	68	79	90
27	1	4	9	16	25	35	45	56	67	78	88	96
25	7	13	20	29	38	48	58	68	78	87	95	102

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); this difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent at .84M/310/250

PRESSURE ALTITUDE (1000 FT)	25	27	29	31	33	35	37	39	41	43
DISTANCE (NM)	96	103	110	117	123	128	133	139	145	150
TIME (MINUTES)	20	21	22	23	24	24	25	26	26	27

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)									
		1500	5000	10000	15000	20000	25000	30000	35000	40000	43000
780	%N1	61.5	64.4	68.5	72.9	77.8	82.6	87.6			
	KIAS	263	263	263	264	305	309	310			
	FF/ENG	10090	10010	9900	9920	10470	10840	11410			
740	%N1	60.2	63.0	67.1	71.3	76.3	81.2	86.0	95.8		
	KIAS	258	258	258	258	297	300	305	278		
	FF/ENG	9590	9500	9380	9380	9870	10160	10590	12470		
700	%N1	58.6	61.3	65.5	69.5	74.6	79.3	84.2	90.8		
	KIAS	252	252	252	252	288	291	296	278		
	FF/ENG	9020	8920	8800	8770	9200	9420	9760	10790		
660	%N1	57.1	59.7	63.8	67.8	72.6	77.5	82.3	87.9		
	KIAS	244	244	244	244	257	282	286	278		
	FF/ENG	8500	8390	8270	8220	8350	8770	9080	9730		
620	%N1	55.7	58.1	62.2	66.2	70.8	75.8	80.7	85.8		
	KIAS	238	238	238	238	238	273	277	278		
	FF/ENG	8030	7910	7780	7720	7750	8180	8440	8930		
580	%N1	54.1	56.6	60.4	64.6	69.0	74.0	78.8	83.8	94.9	
	KIAS	231	231	231	231	231	264	267	271	247	
	FF/ENG	7560	7430	7290	7210	7220	7600	7810	8120	9680	
540	%N1	52.6	55.0	58.6	62.8	67.0	71.8	76.8	81.8	89.6	
	KIAS	225	225	225	225	225	240	257	260	247	
	FF/ENG	7120	6970	6810	6720	6720	6870	7200	7430	8300	
500	%N1	51.0	53.3	56.9	60.8	65.0	69.6	74.7	79.6	86.5	94.8
	KIAS	220	220	220	220	220	220	246	250	247	231
	FF/ENG	6700	6540	6350	6260	6230	6240	6590	6800	7400	8380
460	%N1	49.2	51.7	55.2	58.9	63.1	67.3	72.5	77.5	84.0	89.0
	KIAS	217	217	217	217	217	217	236	239	242	231
	FF/ENG	6320	6150	5930	5840	5770	5750	6000	6180	6590	7060
420	%N1	47.6	50.2	53.6	57.1	61.2	65.3	69.9	75.0	81.5	85.8
	KIAS	217	217	217	217	217	217	217	227	230	231
	FF/ENG	5990	5810	5590	5480	5390	5350	5350	5580	5880	6220
380	%N1	46.0	48.4	52.0	55.6	59.3	63.6	67.8	72.4	78.8	83.0
	KIAS	217	217	217	217	217	217	217	217	218	220
	FF/ENG	5680	5500	5280	5160	5060	5110	4980	5010	5240	5430
340	%N1	44.7	47.0	50.6	54.0	57.6	61.8	65.9	70.3	76.3	80.2
	KIAS	217	217	217	217	217	217	217	217	217	217
	FF/ENG	5560	5370	5150	5000	4870	4800	4770	4640	4780	4880

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
780	%N1	64.3	67.1	71.7	76.2	81.2
	KIAS	243	243	243	243	243
	FF/ENG	11130	11090	11040	11120	11370
740	%N1	62.8	65.6	69.9	74.5	79.5
	KIAS	238	238	238	238	238
	FF/ENG	10520	10470	10400	10450	10680
700	%N1	61.2	64.1	68.3	72.9	77.8
	KIAS	232	232	232	232	232
	FF/ENG	9930	9870	9800	9810	10010
660	%N1	59.7	62.5	66.6	71.3	76.1
	KIAS	224	224	224	224	224
	FF/ENG	9360	9290	9210	9220	9370
620	%N1	58.0	60.8	64.8	69.3	74.1
	KIAS	218	218	218	218	218
	FF/ENG	8790	8710	8610	8610	8700
580	%N1	56.3	58.9	63.1	67.3	72.1
	KIAS	211	211	211	211	211
	FF/ENG	8240	8140	8030	8020	8080
540	%N1	54.7	57.1	61.1	65.2	70.0
	KIAS	205	205	205	205	205
	FF/ENG	7700	7580	7460	7430	7460
500	%N1	52.8	55.2	59.0	63.1	67.6
	KIAS	200	200	200	200	200
	FF/ENG	7180	7040	6890	6840	6860
460	%N1	50.9	53.3	56.8	60.9	65.1
	KIAS	197	197	197	197	197
	FF/ENG	6690	6530	6350	6280	6260
420	%N1	49.1	51.4	54.8	58.6	62.8
	KIAS	197	197	197	197	197
	FF/ENG	6260	6070	5870	5780	5730
380	%N1	47.1	49.6	53.0	56.5	60.6
	KIAS	197	197	197	197	197
	FF/ENG	5890	5690	5470	5370	5290
340	%N1	45.4	47.8	51.3	54.8	58.6
	KIAS	197	197	197	197	197
	FF/ENG	5700	5510	5270	5150	5040

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Runway Surface Condition Correlation

RUNWAY CONDITION CODE	RUNWAY SURFACE CONDITION DESCRIPTION	REPORTED BRAKING ACTION
6	Dry	Dry
5	Wet (Smooth, Grooved or PFC) or Frost 3 mm (0.12 inches) or less of: Water, Slush, Dry Snow or Wet Snow	Good
4	Compacted Snow at or below -15°C OAT	Good to Medium
3	Wet (Slippery), Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 3 mm (0.12 inches) of : Dry Snow or Wet Snow Compacted Snow at OAT warmer than -15°C	Medium
2	Greater than 3 mm (0.12 inches) of: Water or Slush	Medium to Poor
1	Ice	Poor
0	Wet Ice, Water on top of Compacted Snow, Dry Snow or Wet Snow over Ice	Nil

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4290	90/-10	80	-150/490	50/-50	80/-80	140	80	170
AUTOBRAKE MAX	5590	90/-10	130	-210/710	0/0	130/-130	250	0	0
AUTOBRAKE 4	7120	130/-20	180	-300/1010	0/0	180/-180	360	0	0
AUTOBRAKE 3	8330	160/-50	220	-370/1270	0/-20	220/-220	430	0	0
AUTOBRAKE 2	9270	170/-80	260	-430/1460	80/-180	250/-250	350	170	170
AUTOBRAKE 1	10070	200/-100	320	-490/1710	280/-300	280/-280	330	920	1080
Good Reported Braking Action									
MAX MANUAL	5870	90/-30	150	-250/870	140/-120	140/-140	210	320	760
AUTOBRAKE MAX	6070	100/-20	150	-250/900	130/-100	140/-140	230	350	810
AUTOBRAKE 4	7150	130/-20	180	-300/1040	30/-10	180/-180	360	20	140
AUTOBRAKE 3	8330	160/-50	220	-370/1270	10/-20	220/-220	430	0	0
AUTOBRAKE 2	9270	170/-80	260	-430/1460	80/-180	250/-250	350	170	170
AUTOBRAKE 1	10070	200/-100	320	-490/1710	280/-300	280/-280	330	920	1080
Good To Medium Reported Braking Action									
MAX MANUAL	6810	120/-50	190	-320/1150	240/-190	170/-170	230	590	1510
AUTOBRAKE MAX	6920	120/-40	190	-320/1160	230/-180	170/-170	250	600	1530
AUTOBRAKE 4	7560	140/-30	210	-350/1240	160/-90	200/-200	360	430	1200
AUTOBRAKE 3	8540	170/-50	230	-400/1400	90/-80	230/-230	430	180	780
AUTOBRAKE 2	9380	180/-80	270	-440/1550	150/-220	250/-250	350	280	660
AUTOBRAKE 1	10090	200/-100	320	-500/1740	320/-310	280/-280	330	960	1280
Medium Reported Braking Action									
MAX MANUAL	7750	140/-60	230	-390/1430	330/-260	200/-200	250	860	2270
AUTOBRAKE MAX	7760	140/-60	230	-390/1430	330/-250	200/-200	260	860	2250
AUTOBRAKE 4	7960	150/-30	230	-400/1440	290/-170	210/-210	360	830	2270
AUTOBRAKE 3	8750	170/-60	240	-430/1540	170/-140	240/-240	430	370	1560
AUTOBRAKE 2	9490	180/-80	280	-460/1640	220/-260	250/-250	350	380	1150
AUTOBRAKE 1	10110	200/-100	320	-510/1760	370/-320	280/-280	330	1000	1480

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	8770	170/-70	280	-480/1810	540/-390	230/-230	280	1340	3840
AUTOBRAKE MAX	8790	170/-80	280	-480/1810	550/-390	230/-230	280	1350	3850
AUTOBRAKE 4	8890	170/-60	280	-490/1820	520/-330	240/-240	340	1330	3850
AUTOBRAKE 3	9400	190/-70	280	-510/1880	420/-260	260/-260	430	1030	3440
AUTOBRAKE 2	10000	200/-90	310	-530/1960	430/-370	270/-270	340	890	3050
AUTOBRAKE 1	10480	210/-110	350	-560/2050	560/-430	290/-290	330	1360	3090
Poor Reported Braking Action									
MAX MANUAL	9800	200/-90	330	-580/2200	750/-510	260/-260	300	1820	5420
AUTOBRAKE MAX	9820	200/-100	330	-580/2200	760/-520	260/-260	300	1830	5440
AUTOBRAKE 4	9820	200/-90	330	-580/2200	760/-480	260/-260	320	1830	5440
AUTOBRAKE 3	10040	210/-80	320	-590/2220	670/-390	280/-280	430	1690	5320
AUTOBRAKE 2	10510	210/-100	350	-600/2280	640/-480	290/-290	330	1400	4950
AUTOBRAKE 1	10860	220/-120	370	-620/2330	750/-540	300/-300	330	1710	4690

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 250 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 200 ft.
For landing weights below 340000 lb, increase reference landing distance by 450 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV

Dry Runway

MAX MANUAL	4510	80/-20	90	-150/520	50/-50	90/-90	140	80	200
AUTOBRAKE MAX	6000	70/-30	140	-220/750	0/0	140/-140	260	0	0
AUTOBRAKE 4	7720	90/-60	200	-320/1070	0/0	200/-200	380	0	0
AUTOBRAKE 3	9070	120/-80	240	-390/1320	0/-60	240/-250	430	0	0
AUTOBRAKE 2	10010	140/-120	300	-450/1530	120/-220	280/-280	350	300	300
AUTOBRAKE 1	10830	170/-140	360	-520/1780	320/-330	300/-300	350	1120	1390

Good Reported Braking Action

MAX MANUAL	6210	70/-60	160	-250/900	140/-130	150/-150	210	360	860
AUTOBRAKE MAX	6450	80/-50	160	-260/920	130/-80	150/-150	250	390	920
AUTOBRAKE 4	7750	90/-60	200	-320/1090	30/-20	200/-200	380	20	140
AUTOBRAKE 3	9070	120/-80	240	-390/1320	10/-60	240/-250	430	0	0
AUTOBRAKE 2	10010	140/-120	300	-450/1530	120/-220	280/-280	350	300	300
AUTOBRAKE 1	10830	170/-140	360	-520/1780	320/-330	300/-300	350	1120	1390

Good To Medium Reported Braking Action

MAX MANUAL	7230	90/-70	210	-330/1180	240/-200	180/-180	240	660	1710
AUTOBRAKE MAX	7350	100/-60	210	-330/1190	240/-170	180/-180	270	680	1730
AUTOBRAKE 4	8160	100/-60	220	-370/1290	150/-100	210/-210	380	440	1310
AUTOBRAKE 3	9290	120/-90	250	-420/1470	100/-120	250/-260	420	190	820
AUTOBRAKE 2	10120	140/-120	300	-470/1620	190/-260	280/-280	350	400	820
AUTOBRAKE 1	10850	170/-140	360	-520/1810	370/-350	300/-300	350	1160	1600

Medium Reported Braking Action

MAX MANUAL	8250	120/-90	250	-400/1460	350/-280	210/-210	260	970	2550
AUTOBRAKE MAX	8260	120/-80	250	-400/1460	360/-260	220/-220	290	970	2540
AUTOBRAKE 4	8570	120/-70	250	-410/1500	260/-170	230/-230	380	850	2470
AUTOBRAKE 3	9510	130/-90	260	-450/1610	180/-170	260/-260	410	380	1640
AUTOBRAKE 2	10240	150/-120	310	-480/1700	260/-300	280/-280	350	510	1330
AUTOBRAKE 1	10870	170/-140	360	-530/1830	410/-360	300/-300	350	1200	1820

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF25	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	9340	140/-110	300	-500/1860	560/-400	250/-250	280	1500	4320
AUTOBRAKE MAX	9360	140/-100	300	-500/1860	580/-400	250/-250	290	1500	4320
AUTOBRAKE 4	9520	140/-100	300	-510/1870	530/-340	260/-260	360	1440	4290
AUTOBRAKE 3	10170	140/-110	310	-530/1950	430/-300	290/-290	410	1080	3770
AUTOBRAKE 2	10750	160/-130	350	-550/2020	480/-410	290/-290	350	1050	3420
AUTOBRAKE 1	11250	180/-140	380	-590/2120	600/-470	320/-320	350	1570	3570
Poor Reported Braking Action									
MAX MANUAL	10430	160/-130	360	-600/2250	780/-530	290/-290	300	2020	6080
AUTOBRAKE MAX	10470	160/-130	360	-600/2250	790/-540	290/-290	300	2020	6110
AUTOBRAKE 4	10470	170/-130	360	-600/2250	790/-510	290/-290	330	2020	6110
AUTOBRAKE 3	10820	160/-130	360	-610/2290	670/-440	310/-310	410	1770	5890
AUTOBRAKE 2	11270	170/-140	380	-620/2350	700/-520	310/-310	350	1600	5510
AUTOBRAKE 1	11640	180/-150	400	-640/2400	790/-580	330/-330	350	1940	5320

Reference distance is based on sea level, standard day, no wind or slope, VREF25, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 280 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 220 ft.
For landing weights below 340000 lb, increase reference landing distance by 450 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV

Dry Runway

MAX MANUAL	4780	100/-50	100	-160/540	60/-50	90/-90	150	100	230
AUTOBRAKE MAX	6470	70/-70	150	-230/780	0/0	150/-150	280	0	0
AUTOBRAKE 4	8380	100/-90	220	-330/1130	0/0	220/-220	390	0	0
AUTOBRAKE 3	9900	140/-130	280	-410/1390	0/-60	280/-280	450	0	0
AUTOBRAKE 2	10940	160/-150	330	-470/1610	130/-230	300/-300	380	360	360
AUTOBRAKE 1	11880	200/-170	400	-550/1870	350/-380	330/-330	370	1320	1600

Good Reported Braking Action

MAX MANUAL	6680	80/-70	170	-280/940	160/-140	160/-160	220	430	1010
AUTOBRAKE MAX	6910	90/-70	180	-280/970	140/-90	170/-170	260	450	1070
AUTOBRAKE 4	8410	100/-90	220	-330/1140	30/-10	220/-220	400	30	160
AUTOBRAKE 3	9900	140/-130	280	-410/1390	0/-60	280/-280	450	0	0
AUTOBRAKE 2	10940	160/-150	330	-470/1610	130/-230	300/-300	380	360	360
AUTOBRAKE 1	11880	200/-170	400	-550/1870	350/-380	330/-330	370	1320	1600

Good To Medium Reported Braking Action

MAX MANUAL	7810	100/-90	220	-350/1240	270/-220	200/-200	250	780	2010
AUTOBRAKE MAX	7920	110/-90	230	-350/1250	260/-200	210/-210	280	790	2040
AUTOBRAKE 4	8840	120/-100	250	-390/1350	160/-100	240/-240	400	510	1530
AUTOBRAKE 3	10120	140/-130	290	-440/1540	100/-120	280/-280	450	220	980
AUTOBRAKE 2	11050	160/-150	340	-490/1700	200/-270	300/-300	380	470	960
AUTOBRAKE 1	11900	200/-170	400	-560/1900	390/-390	330/-330	370	1370	1840

Medium Reported Braking Action

MAX MANUAL	8940	130/-120	280	-430/1530	380/-300	230/-230	280	1140	3010
AUTOBRAKE MAX	8940	130/-120	280	-430/1530	390/-300	240/-240	290	1130	3000
AUTOBRAKE 4	9280	130/-120	280	-440/1550	290/-180	250/-250	390	980	2900
AUTOBRAKE 3	10340	140/-130	300	-470/1680	200/-170	290/-290	450	440	1960
AUTOBRAKE 2	11170	160/-150	350	-520/1780	280/-310	310/-310	380	580	1560
AUTOBRAKE 1	11910	200/-170	400	-560/1920	440/-390	330/-330	370	1410	2080

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF20	ONE REV	NO REV
Medium To Poor Reported Braking Action									
MAX MANUAL	10140	160/-140	340	-520/1930	620/-440	280/-280	300	1750	5120
AUTOBRAKE MAX	10150	160/-140	340	-520/1940	630/-440	280/-280	300	1740	5120
AUTOBRAKE 4	10320	160/-140	340	-530/1950	580/-370	290/-290	370	1670	5070
AUTOBRAKE 3	11050	160/-140	350	-560/2030	460/-320	310/-310	440	1250	4460
AUTOBRAKE 2	11720	180/-160	390	-590/2110	510/-440	330/-330	370	1210	4060
AUTOBRAKE 1	12310	200/-180	430	-620/2210	640/-510	350/-350	370	1830	4170
Poor Reported Braking Action									
MAX MANUAL	11340	180/-160	400	-620/2330	850/-580	320/-320	320	2360	7220
AUTOBRAKE MAX	11360	180/-160	400	-620/2350	860/-590	320/-320	320	2360	7230
AUTOBRAKE 4	11360	180/-160	400	-620/2350	860/-550	320/-320	350	2360	7230
AUTOBRAKE 3	11750	180/-160	390	-640/2380	720/-460	330/-330	440	2060	6970
AUTOBRAKE 2	12270	200/-170	430	-660/2440	740/-560	350/-350	370	1850	6560
AUTOBRAKE 1	12710	210/-200	450	-680/2510	840/-620	370/-370	370	2250	6260

Reference distance is based on sea level, standard day, no wind or slope, VREF20, two-engine maximum reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 290 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 220 ft.
For landing weights below 340000 lb, increase reference landing distance by 450 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4740	120/-40	110	-180/630	80/-70	100/-100	150	190	430
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6470	90/-70	180	-300/1070	220/-180	160/-160	210	600	1520
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7310	100/-90	220	-370/1330	340/-260	190/-190	230	930	2530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8150	120/-110	260	-430/1600	460/-340	220/-220	250	1260	3540
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9300	150/-130	320	-550/2100	860/-510	260/-260	260	2000	6520
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10440	180/-150	380	-660/2600	1260/-680	300/-300	280	2730	9500
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ADIRU/GPS DISAGREE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4490	130/-30	100	-180/610	80/-70	100/-100	150	160	380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6090	100/-50	170	-290/1040	210/-170	150/-150	210	540	1340
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	6870	120/-60	200	-350/1290	320/-250	170/-180	220	830	2240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7650	140/-80	240	-420/1550	440/-320	200/-200	240	1130	3140
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	8730	170/-100	290	-530/2050	830/-490	240/-240	260	1800	5820
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9810	200/-120	350	-640/2540	1210/-650	280/-280	270	2480	8500
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4730	90/-40	100	-160/520	60/-50	100/-100	170	120	270
AUTOBRAKE MAX	5630	60/-60	130	-200/680	0/0	130/-130	240	0	0
AUTOBRAKE 2	9780	140/-130	280	-420/1420	20/-100	280/-280	440	40	40
Good Reported Braking Action									
MAX MANUAL	6530	80/-70	180	-260/890	170/-150	160/-160	240	480	1180
AUTOBRAKE MAX	6460	80/-70	180	-260/890	160/-140	160/-160	250	470	1150
AUTOBRAKE 2	9780	140/-130	280	-420/1420	20/-100	280/-280	440	40	40
Good To Medium Reported Braking Action									
MAX MANUAL	7590	110/-90	230	-330/1160	280/-230	200/-200	270	870	2320
AUTOBRAKE MAX	7520	110/-90	230	-330/1160	290/-240	200/-200	280	860	2290
AUTOBRAKE 2	9910	140/-130	290	-440/1510	120/-150	280/-290	440	190	1070
Medium Reported Braking Action									
MAX MANUAL	8640	130/-110	270	-400/1420	390/-310	230/-230	300	1250	3450
AUTOBRAKE MAX	8580	130/-110	280	-400/1420	410/-330	230/-230	300	1240	3420
AUTOBRAKE 3	9160	130/-110	270	-420/1480	250/-150	260/-260	420	730	2920
Medium To Poor Reported Braking Action									
MAX MANUAL	9760	160/-140	330	-490/1790	620/-450	270/-270	320	1900	5840
AUTOBRAKE MAX	9720	160/-140	340	-490/1790	650/-470	270/-270	320	1890	5820
AUTOBRAKE 3	10040	160/-130	330	-510/1820	550/-340	290/-290	400	1610	5540
Poor Reported Braking Action									
MAX MANUAL	10870	180/-160	390	-580/2160	850/-580	300/-300	340	2540	8220
AUTOBRAKE MAX	10860	180/-160	390	-580/2150	880/-600	310/-310	340	2540	8220
AUTOBRAKE 3	10920	180/-150	390	-590/2160	850/-530	310/-310	380	2480	8160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
AIRSPEED UNRELIABLE (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5070	100/-40	110	-160/550	60/-60	110/-110	N/A	140	320
AUTOBRAKE MAX	6100	70/-60	150	-220/710	0/0	150/-150	N/A	0	0
AUTOBRAKE 2	10660	150/-140	320	-450/1490	80/-150	310/-310	N/A	160	160
Good Reported Braking Action									
MAX MANUAL	7010	90/-80	190	-270/930	180/-160	170/-170	N/A	550	1340
AUTOBRAKE MAX	6960	90/-80	190	-270/920	180/-150	180/-180	N/A	540	1330
AUTOBRAKE 2	10660	150/-140	320	-450/1490	80/-150	310/-310	N/A	160	160
Good To Medium Reported Braking Action									
MAX MANUAL	8120	110/-100	250	-350/1200	300/-250	210/-210	N/A	970	2570
AUTOBRAKE MAX	8070	120/-100	250	-350/1190	310/-250	220/-220	N/A	960	2550
AUTOBRAKE 2	10780	150/-140	330	-470/1580	180/-200	310/-310	N/A	310	1190
Medium Reported Braking Action									
MAX MANUAL	9230	130/-120	300	-420/1470	410/-330	250/-250	N/A	1380	3800
AUTOBRAKE MAX	9180	140/-120	300	-420/1460	440/-350	250/-250	N/A	1370	3770
AUTOBRAKE 3	10000	130/-120	290	-440/1550	240/-170	280/-290	N/A	680	3060
Medium To Poor Reported Braking Action									
MAX MANUAL	10390	160/-150	360	-510/1840	650/-470	290/-290	N/A	2050	6290
AUTOBRAKE MAX	10360	170/-150	360	-510/1830	670/-490	290/-290	N/A	2050	6270
AUTOBRAKE 3	10840	160/-140	350	-520/1890	540/-350	310/-320	N/A	1630	5850
Poor Reported Braking Action									
MAX MANUAL	11540	190/-170	420	-600/2200	880/-600	330/-330	N/A	2720	8780
AUTOBRAKE MAX	11540	190/-170	420	-600/2200	900/-620	330/-330	N/A	2720	8770
AUTOBRAKE 3	11680	190/-160	410	-600/2220	840/-530	340/-340	N/A	2580	8630

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	7170	100/-70	210	-350/1270	300/-240	180/-180	220	840	2220
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	7170	100/-70	210	-350/1270	300/-240	180/-180	220	840	2220
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	8120	120/-90	260	-440/1620	490/-350	220/-220	240	1300	3760
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	9070	140/-110	310	-520/1960	680/-460	250/-250	260	1760	5290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10600	180/-140	390	-700/2810	2420/-750	310/-310	280	3240	7360
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	12130	220/-170	460	-870/3650	4160/-1040	360/-360	290	4710	9420
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6740	120/-50	200	-340/1240	290/-230	170/-170	220	750	1970
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6740	120/-50	200	-340/1240	290/-230	170/-170	220	750	1970
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7630	150/-70	240	-420/1580	470/-340	200/-200	240	1170	3340
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8520	170/-80	280	-500/1910	650/-440	230/-230	260	1580	4710
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9970	210/-110	350	-670/2740	2330/-720	280/-280	280	2960	6680
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11410	240/-140	420	-840/3570	4000/-1000	330/-330	290	4330	8650
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4200	100/-40	90	-140/480	50/-50	90/-90	130	0	100
AUTOBRAKE MAX	5630	70/-60	130	-200/680	0/0	130/-130	240	0	0
AUTOBRAKE 2	9770	130/-120	280	-420/1420	20/-70	280/-280	450	0	0
Good Reported Braking Action									
MAX MANUAL	6060	80/-70	160	-250/860	160/-140	150/-150	200	0	480
AUTOBRAKE MAX	6300	80/-70	160	-260/880	150/-130	160/-160	230	0	520
AUTOBRAKE 2	9770	130/-120	280	-420/1420	20/-70	280/-280	450	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	7280	100/-90	210	-330/1160	300/-240	190/-190	240	0	990
AUTOBRAKE MAX	7400	110/-90	210	-340/1170	300/-230	200/-200	270	0	1010
AUTOBRAKE 2	9920	140/-120	290	-450/1520	130/-120	290/-290	450	0	360
Medium Reported Braking Action									
MAX MANUAL	8490	120/-110	260	-410/1460	440/-340	230/-230	280	0	1500
AUTOBRAKE MAX	8490	130/-110	260	-410/1460	440/-320	230/-240	300	0	1500
AUTOBRAKE 3	9230	130/-110	270	-430/1530	290/-200	260/-260	410	0	1130
Medium To Poor Reported Braking Action									
MAX MANUAL	9920	150/-140	330	-520/1900	760/-520	280/-280	310	0	2600
AUTOBRAKE MAX	9930	160/-140	330	-520/1900	770/-520	280/-290	320	0	2600
AUTOBRAKE 3	10360	160/-140	330	-540/1940	670/-440	300/-300	390	0	2440
Poor Reported Braking Action									
MAX MANUAL	11350	180/-160	390	-630/2330	1080/-700	330/-330	340	0	3700
AUTOBRAKE MAX	11360	190/-160	390	-630/2330	1090/-710	330/-330	340	0	3700
AUTOBRAKE 3	11480	190/-160	390	-640/2340	1050/-670	340/-340	370	0	3740

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ENG SHUTDOWN L, R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3750	90/-10	70	-130/440	40/-40	70/-70	130	0	80
AUTOBRAKE MAX	4860	80/-10	110	-180/620	0/0	110/-110	210	0	0
AUTOBRAKE 2	8150	160/-50	220	-380/1280	30/-50	230/-230	400	0	0
Good Reported Braking Action									
MAX MANUAL	5270	90/-30	130	-230/800	140/-120	120/-120	190	0	360
AUTOBRAKE MAX	5490	90/-30	130	-230/820	130/-110	130/-130	220	0	390
AUTOBRAKE 2	8150	160/-50	220	-380/1280	30/-50	230/-230	400	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6270	110/-50	170	-300/1070	260/-200	160/-160	220	0	740
AUTOBRAKE MAX	6380	120/-40	170	-300/1080	250/-190	160/-160	250	0	750
AUTOBRAKE 2	8290	170/-50	230	-400/1380	130/-100	230/-230	400	0	280
Medium Reported Braking Action									
MAX MANUAL	7260	130/-60	210	-370/1340	370/-280	190/-190	250	0	1110
AUTOBRAKE MAX	7260	140/-50	210	-370/1340	370/-270	190/-190	280	0	1110
AUTOBRAKE 3	7810	150/-40	220	-390/1400	260/-190	210/-210	350	0	880
Medium To Poor Reported Braking Action									
MAX MANUAL	8430	160/-80	260	-470/1750	640/-440	230/-230	280	0	1910
AUTOBRAKE MAX	8440	170/-80	260	-470/1750	650/-440	230/-230	290	0	1920
AUTOBRAKE 3	8780	170/-70	270	-490/1780	580/-390	250/-250	330	0	1820
Poor Reported Braking Action									
MAX MANUAL	9600	190/-90	310	-570/2150	910/-590	270/-270	300	0	2710
AUTOBRAKE MAX	9620	190/-100	310	-570/2150	930/-600	270/-270	300	0	2720
AUTOBRAKE 3	9740	190/-90	320	-580/2160	890/-590	280/-280	310	0	2750

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAP / SLAT CONTROL (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4160	90/-40	90	-140/470	50/-40	80/-80	130	90	200
AUTOBRAKE MAX	5630	60/-60	130	-200/680	0/0	130/-130	240	0	0
AUTOBRAKE 2	9510	140/-130	290	-410/1400	110/-200	260/-260	330	310	310
Good Reported Braking Action									
MAX MANUAL	5810	70/-60	150	-240/820	140/-120	140/-140	190	370	880
AUTOBRAKE MAX	6010	80/-60	160	-240/840	120/-80	150/-150	230	390	930
AUTOBRAKE 2	9510	140/-130	290	-410/1400	110/-200	260/-260	330	310	310
Good To Medium Reported Braking Action									
MAX MANUAL	6790	90/-80	200	-310/1080	240/-190	170/-170	220	680	1750
AUTOBRAKE MAX	6890	100/-80	200	-310/1090	230/-170	180/-180	240	690	1770
AUTOBRAKE 2	9610	140/-130	300	-430/1480	180/-240	270/-270	330	410	840
Medium Reported Braking Action									
MAX MANUAL	7770	110/-100	240	-370/1330	330/-260	200/-200	240	990	2620
AUTOBRAKE MAX	7770	110/-100	240	-370/1330	340/-260	210/-210	250	980	2610
AUTOBRAKE 3	8990	120/-110	260	-410/1460	170/-150	250/-250	390	380	1700
Medium To Poor Reported Braking Action									
MAX MANUAL	8820	140/-120	290	-460/1680	540/-380	240/-240	260	1520	4450
AUTOBRAKE MAX	8830	140/-120	300	-460/1690	550/-390	250/-250	270	1520	4450
AUTOBRAKE 3	9610	140/-130	300	-490/1770	400/-280	270/-270	390	1090	3880
Poor Reported Braking Action									
MAX MANUAL	9860	160/-140	340	-540/2030	740/-500	280/-280	280	2050	6280
AUTOBRAKE MAX	9880	160/-140	350	-540/2040	750/-510	280/-280	280	2050	6290
AUTOBRAKE 3	10220	160/-140	340	-560/2070	630/-400	290/-290	380	1790	6060

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≤ 5)
VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4730	170/-30	140	-150/680	70/-50	130/-110	180	180	420
AUTOBRAKE MAX	6730	110/-20	170	-230/760	0/0	170/-170	270	0	0
AUTOBRAKE 2	11420	210/-110	380	-460/1540	190/-240	330/-330	380	740	740
Good Reported Braking Action									
MAX MANUAL	6540	100/-40	180	-250/860	140/-130	160/-160	180	500	1230
AUTOBRAKE MAX	7010	110/-20	190	-260/900	70/-50	180/-180	270	300	1080
AUTOBRAKE 2	11420	210/-110	380	-460/1540	190/-240	330/-330	380	740	740
Good To Medium Reported Braking Action									
MAX MANUAL	7720	130/-60	240	-320/1130	250/-210	200/-200	210	940	2530
AUTOBRAKE MAX	7930	130/-50	240	-330/1150	220/-160	210/-210	270	830	2440
AUTOBRAKE 2	11510	210/-120	390	-480/1620	250/-270	330/-330	380	830	1400
Medium Reported Braking Action									
MAX MANUAL	8890	150/-80	290	-390/1400	350/-290	240/-240	240	1370	3830
AUTOBRAKE MAX	8850	150/-70	290	-390/1400	360/-270	240/-240	260	1350	3800
AUTOBRAKE 3	10820	180/-90	330	-460/1590	200/-200	310/-310	400	490	2260
Medium To Poor Reported Braking Action									
MAX MANUAL	10140	180/-100	360	-490/1780	580/-420	280/-290	270	2110	6720
AUTOBRAKE MAX	10120	180/-100	360	-490/1780	590/-420	290/-290	280	2100	6700
AUTOBRAKE 3	11420	200/-100	380	-530/1900	450/-330	330/-330	400	1380	5640
Poor Reported Braking Action									
MAX MANUAL	11390	210/-120	420	-580/2150	800/-550	320/-330	290	2850	9600
AUTOBRAKE MAX	11380	210/-120	420	-580/2150	810/-560	330/-330	290	2850	9590
AUTOBRAKE 3	12020	220/-110	420	-600/2210	700/-450	350/-350	390	2260	9020

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

FLAPS DRIVE (5 < Flaps < 20)

VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4220	130/-20	90	-140/470	50/-40	90/-90	130	100	220
AUTOBRAKE MAX	5740	90/-20	140	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9790	180/-90	300	-420/1420	110/-170	270/-270	380	270	270
Good Reported Braking Action									
MAX MANUAL	5930	90/-40	160	-240/830	140/-120	140/-140	190	410	1000
AUTOBRAKE MAX	6100	100/-20	160	-240/840	120/-80	150/-150	230	420	1030
AUTOBRAKE 2	9790	180/-90	300	-420/1420	110/-170	270/-270	380	270	270
Good To Medium Reported Braking Action									
MAX MANUAL	6960	120/-60	210	-310/1090	240/-200	180/-180	220	760	2020
AUTOBRAKE MAX	7030	120/-50	210	-310/1090	240/-180	180/-180	240	760	2030
AUTOBRAKE 2	9890	190/-90	310	-440/1500	170/-200	280/-280	380	370	900
Medium Reported Braking Action									
MAX MANUAL	7980	140/-70	250	-380/1340	340/-270	210/-210	250	1110	3040
AUTOBRAKE MAX	7960	140/-70	250	-380/1340	350/-280	210/-210	250	1100	3030
AUTOBRAKE 3	9190	160/-60	260	-420/1480	160/-140	260/-260	400	400	2060
Medium To Poor Reported Braking Action									
MAX MANUAL	9080	170/-90	310	-470/1700	550/-400	250/-250	270	1720	5260
AUTOBRAKE MAX	9080	170/-90	310	-470/1710	560/-410	250/-250	270	1720	5260
AUTOBRAKE 3	9830	180/-80	310	-490/1790	430/-280	280/-280	400	1230	4650
Poor Reported Braking Action									
MAX MANUAL	10180	200/-100	360	-550/2060	760/-520	290/-290	290	2320	7480
AUTOBRAKE MAX	10190	200/-100	370	-550/2070	770/-530	290/-290	290	2330	7490
AUTOBRAKE 3	10460	200/-90	350	-560/2090	690/-410	300/-300	390	2060	7230

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS DRIVE (Flaps ≥ 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4160	90/-40	90	-140/470	50/-40	80/-80	130	90	200
AUTOBRAKE MAX	5630	60/-60	130	-200/680	0/0	130/-130	240	0	0
AUTOBRAKE 2	9510	140/-130	290	-410/1400	110/-200	260/-260	330	310	310
Good Reported Braking Action									
MAX MANUAL	5810	70/-60	150	-240/820	140/-120	140/-140	190	370	880
AUTOBRAKE MAX	6010	80/-60	160	-240/840	120/-80	150/-150	230	390	930
AUTOBRAKE 2	9510	140/-130	290	-410/1400	110/-200	260/-260	330	310	310
Good To Medium Reported Braking Action									
MAX MANUAL	6790	90/-80	200	-310/1080	240/-190	170/-170	220	680	1750
AUTOBRAKE MAX	6890	100/-80	200	-310/1090	230/-170	180/-180	240	690	1770
AUTOBRAKE 2	9610	140/-130	300	-430/1480	180/-240	270/-270	330	410	840
Medium Reported Braking Action									
MAX MANUAL	7770	110/-100	240	-370/1330	330/-260	200/-200	240	990	2620
AUTOBRAKE MAX	7770	110/-100	240	-370/1330	340/-260	210/-210	250	980	2610
AUTOBRAKE 3	8990	120/-110	260	-410/1460	170/-150	250/-250	390	380	1700
Medium To Poor Reported Braking Action									
MAX MANUAL	8820	140/-120	290	-460/1680	540/-380	240/-240	260	1520	4450
AUTOBRAKE MAX	8830	140/-120	300	-460/1690	550/-390	250/-250	270	1520	4450
AUTOBRAKE 3	9610	140/-130	300	-490/1770	400/-280	270/-270	390	1090	3880
Poor Reported Braking Action									
MAX MANUAL	9860	160/-140	340	-540/2030	740/-500	280/-280	280	2050	6280
AUTOBRAKE MAX	9880	160/-140	350	-540/2040	750/-510	280/-280	280	2050	6290
AUTOBRAKE 3	10220	160/-140	340	-560/2070	630/-400	290/-290	380	1790	6060

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLAPS PRIMARY FAIL (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4680	80/-40	100	-150/520	60/-50	100/-100	160	110	250
AUTOBRAKE MAX	5630	60/-60	130	-200/680	0/0	130/-130	240	0	0
AUTOBRAKE 2	9730	140/-130	290	-420/1420	50/-120	270/-270	420	90	90
Good Reported Braking Action									
MAX MANUAL	6430	80/-70	170	-260/880	160/-140	150/-160	230	460	1110
AUTOBRAKE MAX	6390	80/-70	170	-260/880	160/-140	160/-160	240	450	1090
AUTOBRAKE 2	9730	140/-130	290	-420/1420	50/-120	270/-270	420	90	90
Good To Medium Reported Braking Action									
MAX MANUAL	7450	100/-90	220	-330/1140	270/-220	190/-190	260	820	2160
AUTOBRAKE MAX	7410	100/-90	220	-330/1140	280/-230	190/-190	270	810	2140
AUTOBRAKE 2	9850	140/-130	300	-440/1500	140/-160	280/-280	420	220	950
Medium Reported Braking Action									
MAX MANUAL	8470	120/-110	270	-400/1400	380/-300	220/-220	280	1180	3210
AUTOBRAKE MAX	8420	120/-110	270	-390/1400	400/-320	220/-220	290	1170	3180
AUTOBRAKE 3	9120	130/-110	260	-420/1480	220/-150	260/-260	420	580	2590
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	150/-130	330	-490/1770	600/-430	260/-260	300	1780	5390
AUTOBRAKE MAX	9530	150/-130	330	-480/1760	620/-450	260/-260	310	1770	5370
AUTOBRAKE 3	9920	150/-130	320	-500/1810	510/-320	290/-290	400	1430	5030
Poor Reported Braking Action									
MAX MANUAL	10630	180/-150	380	-570/2130	810/-550	300/-300	320	2380	7560
AUTOBRAKE MAX	10630	180/-150	380	-570/2120	840/-570	300/-300	320	2370	7560
AUTOBRAKE 3	10720	170/-140	370	-580/2130	800/-490	310/-310	380	2280	7470

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROL MODE (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4730	90/-40	100	-160/520	60/-50	100/-100	170	120	270
AUTOBRAKE MAX	5630	60/-60	130	-200/680	0/0	130/-130	240	0	0
AUTOBRAKE 2	9780	140/-130	280	-420/1420	20/-100	280/-280	440	40	40
Good Reported Braking Action									
MAX MANUAL	6530	80/-70	180	-260/890	170/-150	160/-160	240	480	1180
AUTOBRAKE MAX	6460	80/-70	180	-260/890	160/-140	160/-160	250	470	1150
AUTOBRAKE 2	9780	140/-130	280	-420/1420	20/-100	280/-280	440	40	40
Good To Medium Reported Braking Action									
MAX MANUAL	7590	110/-90	230	-330/1160	280/-230	200/-200	270	870	2320
AUTOBRAKE MAX	7520	110/-90	230	-330/1160	290/-240	200/-200	280	860	2290
AUTOBRAKE 2	9910	140/-130	290	-440/1510	120/-150	280/-290	440	190	1070
Medium Reported Braking Action									
MAX MANUAL	8640	130/-110	270	-400/1420	390/-310	230/-230	300	1250	3450
AUTOBRAKE MAX	8580	130/-110	280	-400/1420	410/-330	230/-230	300	1240	3420
AUTOBRAKE 3	9160	130/-110	270	-420/1480	250/-150	260/-260	420	730	2920
Medium To Poor Reported Braking Action									
MAX MANUAL	9760	160/-140	330	-490/1790	620/-450	270/-270	320	1900	5840
AUTOBRAKE MAX	9720	160/-140	340	-490/1790	650/-470	270/-270	320	1890	5820
AUTOBRAKE 3	10040	160/-130	330	-510/1820	550/-340	290/-290	400	1610	5540
Poor Reported Braking Action									
MAX MANUAL	10870	180/-160	390	-580/2160	850/-580	300/-300	340	2540	8220
AUTOBRAKE MAX	10860	180/-160	390	-580/2150	880/-600	310/-310	340	2540	8220
AUTOBRAKE 3	10920	180/-150	390	-590/2160	850/-530	310/-310	380	2480	8160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
FLIGHT CONTROLS (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4910	100/-10	110	-160/540	80/-70	110/-110	210	180	400
AUTOBRAKE MAX	5740	90/-10	140	-210/690	0/0	140/-140	240	0	20
AUTOBRAKE 2	10050	180/-70	290	-430/1440	10/-100	290/-290	460	20	20
Good Reported Braking Action									
MAX MANUAL	6870	120/-30	200	-270/930	210/-180	170/-170	280	650	1620
AUTOBRAKE MAX	6830	120/-30	200	-270/930	210/-180	170/-170	290	630	1590
AUTOBRAKE 2	10050	180/-70	290	-430/1440	10/-100	290/-290	460	20	20
Good To Medium Reported Braking Action									
MAX MANUAL	7980	150/-50	250	-350/1200	330/-270	210/-210	310	1110	3040
AUTOBRAKE MAX	7950	150/-50	260	-350/1200	340/-280	210/-210	320	1100	3030
AUTOBRAKE 2	10170	190/-80	300	-450/1530	120/-140	300/-300	460	260	1650
Medium Reported Braking Action									
MAX MANUAL	9080	170/-70	300	-420/1470	450/-360	250/-250	330	1570	4460
AUTOBRAKE MAX	9070	170/-70	310	-420/1470	470/-370	250/-250	340	1560	4460
AUTOBRAKE 3	9420	170/-50	290	-430/1510	350/-190	260/-270	410	1220	4110
Medium To Poor Reported Braking Action									
MAX MANUAL	10220	200/-100	370	-510/1850	700/-500	290/-290	350	2290	7300
AUTOBRAKE MAX	10230	200/-100	370	-510/1850	710/-510	290/-290	360	2290	7320
AUTOBRAKE 3	10410	200/-80	360	-520/1870	650/-390	300/-300	410	2110	7140
Poor Reported Braking Action									
MAX MANUAL	11360	230/-120	430	-600/2220	940/-640	320/-320	370	3000	10140
AUTOBRAKE MAX	11380	230/-120	430	-600/2220	950/-650	330/-330	370	3010	10170
AUTOBRAKE 3	11390	230/-100	430	-600/2220	950/-590	330/-330	400	3000	10160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS C (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4680	80/-40	100	-150/520	60/-50	100/-100	160	110	250
AUTOBRAKE MAX	5630	60/-60	130	-200/680	0/0	130/-130	240	0	0
AUTOBRAKE 2	9730	140/-130	290	-420/1420	50/-120	270/-270	420	90	90
Good Reported Braking Action									
MAX MANUAL	6430	80/-70	170	-260/880	160/-140	150/-160	230	460	1110
AUTOBRAKE MAX	6390	80/-70	170	-260/880	160/-140	160/-160	240	450	1090
AUTOBRAKE 2	9730	140/-130	290	-420/1420	50/-120	270/-270	420	90	90
Good To Medium Reported Braking Action									
MAX MANUAL	7450	100/-90	220	-330/1140	270/-220	190/-190	260	820	2160
AUTOBRAKE MAX	7410	100/-90	220	-330/1140	280/-230	190/-190	270	810	2140
AUTOBRAKE 2	9850	140/-130	300	-440/1500	140/-160	280/-280	420	220	950
Medium Reported Braking Action									
MAX MANUAL	8470	120/-110	270	-400/1400	380/-300	220/-220	280	1180	3210
AUTOBRAKE MAX	8420	120/-110	270	-390/1400	400/-320	220/-220	290	1170	3180
AUTOBRAKE 3	9120	130/-110	260	-420/1480	220/-150	260/-260	420	580	2590
Medium To Poor Reported Braking Action									
MAX MANUAL	9550	150/-130	330	-490/1770	600/-430	260/-260	300	1780	5390
AUTOBRAKE MAX	9530	150/-130	330	-480/1760	620/-450	260/-260	310	1770	5370
AUTOBRAKE 3	9920	150/-130	320	-500/1810	510/-320	290/-290	400	1430	5030
Poor Reported Braking Action									
MAX MANUAL	10630	180/-150	380	-570/2130	810/-550	300/-300	320	2380	7560
AUTOBRAKE MAX	10630	180/-150	380	-570/2120	840/-570	300/-300	320	2370	7560
AUTOBRAKE 3	10720	170/-140	370	-580/2130	800/-490	310/-310	380	2280	7470

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4180	80/-20	90	-140/490	50/-50	90/-90	150	0	110
AUTOBRAKE MAX	5220	60/-30	120	-190/650	0/0	120/-120	230	0	0
AUTOBRAKE 2	8980	120/-70	250	-400/1360	0/0	250/-250	470	0	0
Good Reported Braking Action									
MAX MANUAL	6050	70/-50	160	-260/890	180/-150	150/-150	230	0	530
AUTOBRAKE MAX	6180	80/-50	160	-260/900	160/-140	150/-150	250	0	550
AUTOBRAKE 2	8980	120/-70	250	-400/1360	0/0	250/-250	470	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	7300	100/-70	210	-350/1210	340/-260	190/-190	270	0	1100
AUTOBRAKE MAX	7360	100/-70	210	-350/1220	330/-260	190/-200	280	0	1110
AUTOBRAKE 2	9200	130/-80	260	-430/1490	150/-80	260/-260	470	0	550
Medium Reported Braking Action									
MAX MANUAL	8540	120/-80	260	-430/1530	490/-370	230/-230	300	0	1670
AUTOBRAKE MAX	8540	120/-80	260	-430/1530	500/-380	230/-240	310	0	1670
AUTOBRAKE 3	8770	120/-80	260	-440/1550	430/-240	240/-250	400	0	1630
Medium To Poor Reported Braking Action									
MAX MANUAL	10060	150/-110	330	-560/2040	910/-590	290/-290	330	0	2980
AUTOBRAKE MAX	10080	150/-110	330	-560/2050	920/-600	290/-290	340	0	2990
AUTOBRAKE 3	10200	150/-110	330	-560/2060	880/-510	290/-300	390	0	2970
Poor Reported Braking Action									
MAX MANUAL	11580	180/-130	400	-680/2550	1320/-800	340/-340	360	0	4290
AUTOBRAKE MAX	11620	180/-130	400	-680/2560	1330/-810	340/-340	360	0	4310
AUTOBRAKE 3	11620	180/-130	400	-680/2560	1330/-780	340/-340	380	0	4310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3970	90/-10	80	-140/470	50/-50	80/-80	150	0	100
AUTOBRAKE MAX	4860	80/-10	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8210	170/-30	220	-380/1290	0/0	230/-230	450	0	0
Good Reported Braking Action									
MAX MANUAL	5700	100/-30	150	-250/860	170/-140	140/-140	230	0	470
AUTOBRAKE MAX	5790	100/-30	150	-250/870	150/-130	140/-140	250	0	480
AUTOBRAKE 2	8210	170/-30	220	-380/1290	0/0	230/-230	450	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	6860	130/-50	200	-330/1180	320/-250	180/-180	270	0	990
AUTOBRAKE MAX	6910	130/-50	200	-330/1180	320/-250	180/-180	280	0	990
AUTOBRAKE 2	8430	170/-30	240	-410/1420	150/-70	240/-240	450	0	550
Medium Reported Braking Action									
MAX MANUAL	8020	150/-60	240	-410/1490	470/-360	220/-220	300	0	1500
AUTOBRAKE MAX	8030	150/-60	240	-410/1490	480/-370	220/-220	300	0	1500
AUTOBRAKE 3	8150	160/-40	240	-420/1500	440/-250	220/-220	370	0	1520
Medium To Poor Reported Braking Action									
MAX MANUAL	9460	180/-80	310	-540/1990	870/-560	270/-270	330	0	2700
AUTOBRAKE MAX	9480	180/-80	310	-540/1990	890/-580	270/-270	330	0	2710
AUTOBRAKE 3	9540	190/-70	310	-540/2000	870/-510	270/-270	370	0	2720
Poor Reported Braking Action									
MAX MANUAL	10890	210/-100	370	-660/2490	1270/-760	310/-310	360	0	3900
AUTOBRAKE MAX	10920	210/-100	370	-660/2490	1290/-780	320/-320	360	0	3910
AUTOBRAKE 3	10920	220/-100	370	-660/2490	1290/-760	320/-320	370	0	3910

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5130	120/-10	110	-170/570	80/-70	110/-110	210	0	180
AUTOBRAKE MAX	5740	90/-10	140	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	10070	190/-30	280	-430/1450	0/0	290/-290	510	0	0
Good Reported Braking Action									
MAX MANUAL	7420	120/-30	200	-300/1020	240/-210	190/-190	300	0	820
AUTOBRAKE MAX	7270	120/-30	200	-300/1010	260/-200	190/-190	310	0	790
AUTOBRAKE 2	10070	190/-30	280	-430/1450	0/0	290/-290	510	0	0
Good To Medium Reported Braking Action									
MAX MANUAL	8910	160/-50	270	-400/1370	440/-350	240/-240	350	0	1660
AUTOBRAKE MAX	8800	160/-50	270	-400/1360	470/-360	240/-240	350	0	1640
AUTOBRAKE 2	10380	200/-40	310	-470/1600	260/-110	300/-300	510	0	1110
Medium Reported Braking Action									
MAX MANUAL	10400	190/-70	330	-490/1710	640/-490	290/-290	390	0	2500
AUTOBRAKE MAX	10330	190/-70	330	-490/1710	670/-510	290/-290	390	0	2480
AUTOBRAKE 3	10360	190/-60	330	-490/1710	660/-450	290/-290	400	0	2490
Medium To Poor Reported Braking Action									
MAX MANUAL	12190	230/-100	420	-630/2260	1150/-750	350/-350	420	0	4380
AUTOBRAKE MAX	12150	230/-100	420	-630/2260	1180/-770	360/-360	420	0	4370
AUTOBRAKE 3	12170	230/-100	420	-630/2260	1180/-740	360/-360	430	0	4380
Poor Reported Braking Action									
MAX MANUAL	13980	270/-130	500	-770/2810	1650/-1000	410/-410	450	0	6260
AUTOBRAKE MAX	13970	270/-130	510	-770/2810	1690/-1030	420/-420	450	0	6260
AUTOBRAKE 3	13970	270/-130	510	-770/2810	1690/-1030	420/-420	450	0	6260

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS L+R (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5490	110/-10	130	-200/670	120/-100	130/-130	230	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	8820	140/-30	240	-390/1310	450/-360	250/-250	370	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	11350	190/-50	330	-550/1880	1000/-680	340/-340	450	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	13870	230/-60	420	-700/2450	1540/-1000	420/-420	520	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	17880	280/-80	560	-1010/3650	4460/-1830	560/-560	590	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	21880	320/-100	690	-1320/4840	7380/-2650	690/-690	650	0	0
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4570	50/-30	100	-170/560	70/-70	100/-100	170	0	170
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6610	80/-60	180	-290/1020	230/-190	170/-170	250	0	720
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7900	110/-80	240	-390/1380	420/-320	210/-220	280	0	1410
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	9180	130/-90	290	-480/1730	610/-450	250/-260	310	0	2090
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	10710	160/-120	360	-620/2300	1150/-690	310/-310	340	0	3610
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	12240	190/-140	430	-750/2870	1690/-920	360/-360	360	0	5130
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4310	70/-10	90	-160/540	70/-60	90/-90	160	0	150
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6150	110/-30	160	-280/980	210/-180	150/-150	240	0	620
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	7310	140/-50	210	-370/1320	390/-300	190/-190	270	0	1210
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8470	160/-60	260	-460/1660	560/-410	230/-230	300	0	1790
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	9860	190/-90	330	-590/2220	1070/-630	280/-280	320	0	3080
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11250	220/-110	390	-720/2770	1570/-850	330/-330	340	0	4370
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
HYD PRESS SYS R+C (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6230	100/-20	160	-230/770	140/-130	150/-150	260	0	430
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	9000	160/-50	270	-390/1350	420/-340	240/-240	360	0	1580
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good To Medium Reported Braking Action

MAX MANUAL	10670	200/-80	350	-510/1790	740/-540	300/-300	400	0	2910
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	12330	230/-100	420	-630/2230	1060/-730	360/-360	430	0	4240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Medium To Poor Reported Braking Action

MAX MANUAL	14240	270/-130	520	-800/2940	2040/-1070	430/-430	460	0	7100
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	16150	310/-160	610	-960/3650	3010/-1410	490/-490	490	0	9950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
NAV AIR DATA SYS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4730	90/-40	100	-160/520	60/-50	100/-100	170	120	270
AUTOBRAKE MAX	5630	60/-60	130	-200/680	0/0	130/-130	240	0	0
AUTOBRAKE 2	9780	140/-130	280	-420/1420	20/-100	280/-280	440	40	40
Good Reported Braking Action									
MAX MANUAL	6530	80/-70	180	-260/890	170/-150	160/-160	240	480	1180
AUTOBRAKE MAX	6460	80/-70	180	-260/890	160/-140	160/-160	250	470	1150
AUTOBRAKE 2	9780	140/-130	280	-420/1420	20/-100	280/-280	440	40	40
Good To Medium Reported Braking Action									
MAX MANUAL	7590	110/-90	230	-330/1160	280/-230	200/-200	270	870	2320
AUTOBRAKE MAX	7520	110/-90	230	-330/1160	290/-240	200/-200	280	860	2290
AUTOBRAKE 2	9910	140/-130	290	-440/1510	120/-150	280/-290	440	190	1070
Medium Reported Braking Action									
MAX MANUAL	8640	130/-110	270	-400/1420	390/-310	230/-230	300	1250	3450
AUTOBRAKE MAX	8580	130/-110	280	-400/1420	410/-330	230/-230	300	1240	3420
AUTOBRAKE 3	9160	130/-110	270	-420/1480	250/-150	260/-260	420	730	2920
Medium To Poor Reported Braking Action									
MAX MANUAL	9760	160/-140	330	-490/1790	620/-450	270/-270	320	1900	5840
AUTOBRAKE MAX	9720	160/-140	340	-490/1790	650/-470	270/-270	320	1890	5820
AUTOBRAKE 3	10040	160/-130	330	-510/1820	550/-340	290/-290	400	1610	5540
Poor Reported Braking Action									
MAX MANUAL	10870	180/-160	390	-580/2160	850/-580	300/-300	340	2540	8220
AUTOBRAKE MAX	10860	180/-160	390	-580/2150	880/-600	310/-310	340	2540	8220
AUTOBRAKE 3	10920	180/-150	390	-590/2160	850/-530	310/-310	380	2480	8160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4460	80/-20	90	-150/500	50/-40	90/-90	150	60	130
AUTOBRAKE MAX	5220	60/-30	120	-190/650	0/0	120/-120	230	0	0
AUTOBRAKE 2	8880	120/-90	250	-400/1340	50/-120	240/-240	380	100	100
Good Reported Braking Action									
MAX MANUAL	5970	70/-50	140	-240/840	130/-120	130/-140	200	280	670
AUTOBRAKE MAX	5930	70/-40	150	-240/830	150/-130	140/-140	220	280	660
AUTOBRAKE 2	8880	120/-90	250	-400/1340	60/-120	240/-240	380	100	100
Good To Medium Reported Braking Action									
MAX MANUAL	6860	90/-60	180	-310/1090	220/-190	160/-170	230	540	1390
AUTOBRAKE MAX	6830	90/-60	190	-310/1080	240/-200	170/-170	240	540	1370
AUTOBRAKE 2	9040	130/-90	260	-420/1430	150/-180	250/-250	380	200	560
Medium Reported Braking Action									
MAX MANUAL	7750	100/-70	220	-370/1330	310/-250	190/-190	250	800	2100
AUTOBRAKE MAX	7730	100/-70	220	-370/1320	330/-270	200/-200	260	790	2080
AUTOBRAKE 3	8460	110/-70	230	-400/1410	210/-150	230/-230	400	330	1410
Medium To Poor Reported Braking Action									
MAX MANUAL	8710	130/-90	270	-460/1670	500/-360	230/-230	270	1250	3620
AUTOBRAKE MAX	8710	130/-90	270	-460/1670	530/-380	230/-230	270	1250	3610
AUTOBRAKE 3	9160	130/-90	270	-470/1720	440/-290	250/-250	380	940	3200
Poor Reported Braking Action									
MAX MANUAL	9660	150/-110	310	-540/2010	690/-470	260/-260	280	1700	5130
AUTOBRAKE MAX	9690	150/-110	320	-540/2010	720/-490	260/-260	280	1700	5130
AUTOBRAKE 3	9850	140/-100	310	-540/2030	660/-420	270/-270	360	1550	4980

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH DOWN AUTHORITY (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4230	90/-10	80	-140/480	50/-40	80/-80	150	50	110
AUTOBRAKE MAX	4860	80/0	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8180	160/-60	230	-380/1290	20/-90	220/-220	380	40	40
Good Reported Braking Action									
MAX MANUAL	5630	90/-30	130	-230/810	130/-110	120/-120	200	250	590
AUTOBRAKE MAX	5580	90/-20	130	-230/810	140/-120	130/-130	210	240	570
AUTOBRAKE 2	8180	160/-50	230	-380/1290	30/-90	220/-220	380	40	40
Good To Medium Reported Braking Action									
MAX MANUAL	6460	110/-40	170	-300/1050	220/-180	150/-150	220	480	1220
AUTOBRAKE MAX	6420	110/-40	170	-300/1050	230/-190	160/-160	230	470	1200
AUTOBRAKE 2	8330	160/-60	240	-400/1370	120/-150	230/-230	380	130	470
Medium Reported Braking Action									
MAX MANUAL	7280	120/-50	200	-360/1290	300/-240	180/-180	240	710	1850
AUTOBRAKE MAX	7260	130/-50	210	-360/1290	320/-250	180/-180	250	700	1830
AUTOBRAKE 3	7780	140/-40	210	-380/1350	220/-140	210/-210	380	320	1340
Medium To Poor Reported Braking Action									
MAX MANUAL	8180	150/-70	250	-440/1630	480/-350	210/-210	260	1120	3200
AUTOBRAKE MAX	8170	150/-70	250	-440/1630	510/-360	210/-210	260	1110	3190
AUTOBRAKE 3	8470	160/-60	250	-450/1660	440/-270	230/-230	360	890	2910
Poor Reported Braking Action									
MAX MANUAL	9070	170/-80	290	-520/1960	660/-450	240/-240	270	1520	4550
AUTOBRAKE MAX	9080	170/-80	290	-520/1960	690/-470	240/-240	270	1520	4550
AUTOBRAKE 3	9160	170/-70	290	-520/1970	650/-400	250/-250	340	1450	4480

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

PITCH UP AUTHORITY (Flaps ≤ 15)

VREF30 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4710	150/-20	120	-150/570	50/-50	100/-100	130	120	280
AUTOBRAKE MAX	6730	100/-20	170	-230/760	0/0	170/-170	270	0	0
AUTOBRAKE 2	11150	200/-110	360	-450/1510	230/-270	320/-320	320	920	940
Good Reported Braking Action									
MAX MANUAL	6650	100/-40	180	-250/880	150/-130	170/-170	190	490	1200
AUTOBRAKE MAX	7070	110/-20	190	-270/910	90/-70	180/-180	270	360	1110
AUTOBRAKE 2	11150	200/-110	360	-450/1510	230/-270	320/-320	320	920	940
Good To Medium Reported Braking Action									
MAX MANUAL	7770	130/-60	240	-330/1140	260/-210	210/-210	220	880	2320
AUTOBRAKE MAX	7990	130/-50	240	-340/1160	220/-170	210/-210	270	820	2280
AUTOBRAKE 2	11250	200/-120	370	-470/1590	290/-300	320/-320	320	1020	1530
Medium Reported Braking Action									
MAX MANUAL	8880	150/-80	290	-400/1400	360/-290	240/-240	240	1270	3440
AUTOBRAKE MAX	8910	150/-70	290	-400/1410	350/-270	240/-240	270	1270	3440
AUTOBRAKE 3	10730	180/-100	330	-460/1590	240/-250	310/-310	350	600	2100
Medium To Poor Reported Braking Action									
MAX MANUAL	10050	180/-100	350	-490/1770	570/-420	280/-280	260	1910	5740
AUTOBRAKE MAX	10070	180/-100	350	-490/1770	570/-410	280/-280	280	1910	5740
AUTOBRAKE 3	11340	200/-110	380	-530/1900	460/-380	330/-330	350	1320	4820
Poor Reported Braking Action									
MAX MANUAL	11210	210/-120	410	-580/2130	780/-540	320/-320	280	2540	8030
AUTOBRAKE MAX	11230	210/-120	410	-580/2130	790/-550	320/-320	280	2540	8040
AUTOBRAKE 3	11940	220/-120	420	-600/2200	680/-500	350/-350	350	2030	7530

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PITCH UP AUTHORITY (Flaps ≥ 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4250	120/-20	90	-140/470	50/-40	90/-90	130	90	210
AUTOBRAKE MAX	5740	90/-10	140	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9650	170/-90	300	-420/1410	140/-220	270/-270	320	400	400
Good Reported Braking Action									
MAX MANUAL	5920	90/-40	160	-240/830	140/-120	140/-140	190	390	920
AUTOBRAKE MAX	6140	100/-20	160	-240/850	120/-80	150/-150	240	400	970
AUTOBRAKE 2	9650	170/-90	300	-420/1410	140/-220	270/-270	320	400	400
Good To Medium Reported Braking Action									
MAX MANUAL	6910	120/-60	200	-310/1090	240/-200	180/-180	220	700	1800
AUTOBRAKE MAX	7020	120/-40	210	-310/1100	230/-170	180/-180	250	700	1820
AUTOBRAKE 2	9750	180/-90	310	-440/1490	210/-250	270/-270	320	500	930
Medium Reported Braking Action									
MAX MANUAL	7890	140/-70	240	-370/1340	330/-270	210/-210	240	1010	2680
AUTOBRAKE MAX	7890	140/-60	250	-370/1340	340/-250	210/-210	260	1000	2670
AUTOBRAKE 3	9180	160/-70	270	-420/1470	170/-180	260/-260	370	400	1710
Medium To Poor Reported Braking Action									
MAX MANUAL	8940	170/-90	300	-460/1690	540/-390	250/-250	260	1540	4500
AUTOBRAKE MAX	8950	170/-80	300	-460/1690	550/-380	250/-250	270	1540	4500
AUTOBRAKE 3	9790	180/-90	310	-490/1780	400/-310	280/-280	370	1090	3880
Poor Reported Braking Action									
MAX MANUAL	9980	190/-100	350	-550/2040	740/-500	280/-280	280	2070	6310
AUTOBRAKE MAX	10000	190/-100	350	-550/2040	750/-510	280/-280	280	2070	6320
AUTOBRAKE 3	10400	200/-100	350	-560/2080	620/-430	300/-300	370	1770	6050

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
PRI FLIGHT COMPUTERS (Flaps 20)
VREF20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4730	90/-40	100	-160/520	60/-50	100/-100	170	120	270
AUTOBRAKE MAX	5630	60/-60	130	-200/680	0/0	130/-130	240	0	0
AUTOBRAKE 2	9780	140/-130	280	-420/1420	20/-100	280/-280	440	40	40
Good Reported Braking Action									
MAX MANUAL	6530	80/-70	180	-260/890	170/-150	160/-160	240	480	1180
AUTOBRAKE MAX	6460	80/-70	180	-260/890	160/-140	160/-160	250	470	1150
AUTOBRAKE 2	9780	140/-130	280	-420/1420	20/-100	280/-280	440	40	40
Good To Medium Reported Braking Action									
MAX MANUAL	7590	110/-90	230	-330/1160	280/-230	200/-200	270	870	2320
AUTOBRAKE MAX	7520	110/-90	230	-330/1160	290/-240	200/-200	280	860	2290
AUTOBRAKE 2	9910	140/-130	290	-440/1510	120/-150	280/-290	440	190	1070
Medium Reported Braking Action									
MAX MANUAL	8640	130/-110	270	-400/1420	390/-310	230/-230	300	1250	3450
AUTOBRAKE MAX	8580	130/-110	280	-400/1420	410/-330	230/-230	300	1240	3420
AUTOBRAKE 3	9160	130/-110	270	-420/1480	250/-150	260/-260	420	730	2920
Medium To Poor Reported Braking Action									
MAX MANUAL	9760	160/-140	330	-490/1790	620/-450	270/-270	320	1900	5840
AUTOBRAKE MAX	9720	160/-140	340	-490/1790	650/-470	270/-270	320	1890	5820
AUTOBRAKE 3	10040	160/-130	330	-510/1820	550/-340	290/-290	400	1610	5540
Poor Reported Braking Action									
MAX MANUAL	10870	180/-160	390	-580/2160	850/-580	300/-300	340	2540	8220
AUTOBRAKE MAX	10860	180/-160	390	-580/2150	880/-600	310/-310	340	2540	8220
AUTOBRAKE 3	10920	180/-150	390	-590/2160	850/-530	310/-310	380	2480	8160

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SLATS DRIVE (Flaps 20)
VREF30 + 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4520	130/-20	100	-150/490	50/-50	100/-100	130	110	250
AUTOBRAKE MAX	6220	100/-10	150	-220/720	0/0	150/-150	250	0	0
AUTOBRAKE 2	10390	180/-100	330	-440/1460	200/-240	290/-290	320	620	620
Good Reported Braking Action									
MAX MANUAL	6340	100/-40	170	-250/860	150/-130	160/-160	190	440	1040
AUTOBRAKE MAX	6620	100/-20	180	-260/880	120/-70	170/-170	260	420	1070
AUTOBRAKE 2	10390	180/-100	330	-440/1460	200/-240	290/-290	320	620	620
Good To Medium Reported Braking Action									
MAX MANUAL	7390	130/-60	220	-320/1120	250/-210	200/-200	220	780	2010
AUTOBRAKE MAX	7540	130/-50	230	-330/1130	240/-170	200/-200	270	770	2020
AUTOBRAKE 2	10490	190/-100	340	-460/1540	270/-280	300/-300	320	730	1180
Medium Reported Braking Action									
MAX MANUAL	8440	150/-70	270	-390/1380	350/-280	230/-230	240	1120	2970
AUTOBRAKE MAX	8460	150/-70	270	-390/1380	360/-260	230/-230	270	1120	2970
AUTOBRAKE 3	9980	170/-80	300	-440/1530	210/-230	280/-280	350	490	1860
Medium To Poor Reported Braking Action									
MAX MANUAL	9540	180/-90	330	-480/1740	560/-410	270/-270	260	1690	4930
AUTOBRAKE MAX	9560	180/-90	330	-480/1740	570/-400	270/-270	280	1690	4930
AUTOBRAKE 3	10600	190/-100	340	-510/1840	440/-360	300/-300	350	1170	4190
Poor Reported Braking Action									
MAX MANUAL	10640	200/-110	380	-560/2100	770/-530	300/-300	280	2250	6880
AUTOBRAKE MAX	10660	200/-110	380	-560/2100	780/-540	300/-300	280	2260	6890
AUTOBRAKE 3	11210	210/-110	380	-580/2150	660/-480	320/-320	340	1850	6520

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 25)
VREF25

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4050	70/-20	80	-140/460	50/-40	80/-80	140	90	190
AUTOBRAKE MAX	5220	60/-30	120	-190/650	0/0	120/-120	230	0	0
AUTOBRAKE 2	8820	130/-100	260	-400/1340	70/-150	240/-240	360	160	160
Good Reported Braking Action									
MAX MANUAL	5600	70/-50	140	-230/810	140/-120	130/-130	190	360	860
AUTOBRAKE MAX	5740	70/-50	150	-240/820	120/-110	140/-140	220	370	900
AUTOBRAKE 2	8820	130/-100	260	-400/1340	70/-150	240/-240	360	160	160
Good To Medium Reported Braking Action									
MAX MANUAL	6520	90/-70	190	-300/1060	240/-190	160/-160	220	650	1690
AUTOBRAKE MAX	6590	90/-70	190	-300/1070	230/-190	170/-170	240	660	1710
AUTOBRAKE 2	8930	130/-100	270	-420/1420	140/-190	250/-250	360	260	730
Medium Reported Braking Action									
MAX MANUAL	7430	110/-80	230	-360/1300	330/-260	190/-190	240	940	2510
AUTOBRAKE MAX	7440	110/-80	230	-360/1310	330/-270	190/-190	250	940	2510
AUTOBRAKE 3	8300	110/-80	230	-400/1400	170/-120	230/-230	390	410	1870
Medium To Poor Reported Braking Action									
MAX MANUAL	8410	130/-100	280	-450/1650	530/-380	230/-230	260	1440	4230
AUTOBRAKE MAX	8430	130/-100	280	-450/1660	540/-390	230/-230	270	1440	4240
AUTOBRAKE 3	8930	130/-90	280	-470/1710	420/-250	250/-250	390	1120	3860
Poor Reported Braking Action									
MAX MANUAL	9380	150/-110	320	-530/2000	720/-490	260/-260	280	1930	5940
AUTOBRAKE MAX	9410	150/-110	330	-530/2000	740/-500	260/-260	280	1940	5960
AUTOBRAKE 3	9550	150/-100	320	-540/2020	670/-380	270/-270	380	1820	5850

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
SPOILERS (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3850	80/-10	80	-130/450	40/-40	70/-70	130	80	170
AUTOBRAKE MAX	4860	80/-10	110	-180/620	0/0	110/-110	220	0	0
AUTOBRAKE 2	8130	160/-60	230	-380/1280	40/-120	220/-220	360	80	80
Good Reported Braking Action									
MAX MANUAL	5280	90/-30	130	-220/780	130/-110	120/-120	190	320	760
AUTOBRAKE MAX	5390	90/-30	140	-230/790	110/-100	120/-130	210	330	780
AUTOBRAKE 2	8130	160/-60	230	-380/1280	40/-120	220/-220	360	80	80
Good To Medium Reported Braking Action									
MAX MANUAL	6130	110/-40	170	-290/1030	220/-180	150/-150	220	580	1490
AUTOBRAKE MAX	6190	110/-40	180	-290/1030	220/-180	150/-160	230	590	1500
AUTOBRAKE 2	8240	160/-70	240	-400/1360	110/-160	230/-230	360	180	620
Medium Reported Braking Action									
MAX MANUAL	6970	130/-50	210	-350/1270	310/-250	180/-180	240	840	2220
AUTOBRAKE MAX	6980	130/-50	210	-350/1270	320/-250	180/-180	240	840	2220
AUTOBRAKE 3	7640	150/-40	210	-380/1350	170/-110	210/-210	380	400	1740
Medium To Poor Reported Braking Action									
MAX MANUAL	7880	150/-70	260	-430/1610	500/-360	210/-210	260	1290	3740
AUTOBRAKE MAX	7900	150/-70	260	-430/1610	510/-360	210/-210	260	1290	3750
AUTOBRAKE 3	8260	170/-60	250	-450/1660	420/-240	230/-230	370	1040	3480
Poor Reported Braking Action									
MAX MANUAL	8790	170/-90	300	-510/1950	690/-460	240/-240	270	1730	5260
AUTOBRAKE MAX	8820	170/-90	300	-510/1950	700/-470	240/-240	270	1740	5280
AUTOBRAKE 3	8880	180/-70	290	-520/1960	670/-370	250/-250	360	1680	5220

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
STABILIZER (Flaps 20)
VREF30 + 20

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	570000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 570000 LB	PER 1000 FT ABOVE SEA LEVEL	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4250	120/-20	90	-140/470	50/-40	90/-90	130	90	210
AUTOBRAKE MAX	5740	90/-10	140	-210/690	0/0	140/-140	240	0	0
AUTOBRAKE 2	9650	170/-90	300	-420/1410	140/-220	270/-270	320	400	400
Good Reported Braking Action									
MAX MANUAL	5920	90/-40	160	-240/830	140/-120	140/-140	190	390	920
AUTOBRAKE MAX	6140	100/-20	160	-240/850	120/-80	150/-150	240	400	970
AUTOBRAKE 2	9650	170/-90	300	-420/1410	140/-220	270/-270	320	400	400
Good To Medium Reported Braking Action									
MAX MANUAL	6910	120/-60	200	-310/1090	240/-200	180/-180	220	700	1800
AUTOBRAKE MAX	7020	120/-40	210	-310/1100	230/-170	180/-180	250	700	1820
AUTOBRAKE 2	9750	180/-90	310	-440/1490	210/-250	270/-270	320	500	930
Medium Reported Braking Action									
MAX MANUAL	7890	140/-70	240	-370/1340	330/-270	210/-210	240	1010	2680
AUTOBRAKE MAX	7890	140/-60	250	-370/1340	340/-250	210/-210	260	1000	2670
AUTOBRAKE 3	9180	160/-70	270	-420/1470	170/-180	260/-260	370	400	1710
Medium To Poor Reported Braking Action									
MAX MANUAL	8940	170/-90	300	-460/1690	540/-390	250/-250	260	1540	4500
AUTOBRAKE MAX	8950	170/-80	300	-460/1690	550/-380	250/-250	270	1540	4500
AUTOBRAKE 3	9790	180/-90	310	-490/1780	400/-310	280/-280	370	1090	3880
Poor Reported Braking Action									
MAX MANUAL	9980	190/-100	350	-550/2040	740/-500	280/-280	280	2070	6310
AUTOBRAKE MAX	10000	190/-100	350	-550/2040	750/-510	280/-280	280	2070	6320
AUTOBRAKE 3	10400	200/-100	350	-560/2080	620/-430	300/-300	370	1770	6050

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
For landing weights below 340000 lb, increase reference landing distance by 620 ft.
Reference Distance includes an air distance allowance of 1500 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 30

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)							
		AIRPORT PRESSURE ALTITUDE (FT)							
°C	°F	-2000	0	2000	4000	6000	8000	9000	9800
54	129	655.4	615.4						
52	126	675.3	632.9						
50	122	694.9	649.3	594.5					
48	118	713.2	669.0	610.4					
46	115	731.7	688.8	626.4	572.4				
44	111	750.5	707.9	642.6	590.2				
42	108	771.1	725.4	659.4	606.3	554.7			
40	104	786.4	743.6	677.3	620.4	566.6			
38	100	802.1	764.9	696.8	634.6	579.4	515.4		
36	97	808.2	780.4	712.5	646.8	593.7	525.7	495.1	
34	93	808.8	795.8	728.6	661.1	605.2	535.8	504.8	482.4
32	90	809.3	801.0	744.2	675.3	614.6	544.8	514.4	492.1
30	86	809.9	801.3	760.2	690.5	623.8	553.2	523.3	501.8
28	82	810.5	801.6	772.3	703.0	633.7	561.4	531.3	510.0
26	79	811.1	801.9	772.6	711.6	644.3	569.4	539.0	517.5
24	75	811.6	802.2	772.7	718.8	654.6	579.4	546.4	524.8
22	72	812.2	802.5	772.8	721.9	662.2	591.6	554.7	532.0
20	68	812.7	802.8	773.0	722.1	666.9	601.4	563.2	540.4
18	64	813.3	803.1	773.2	722.2	671.7	606.8	570.8	548.3
16	61	813.9	803.4	773.3	722.4	671.9	610.6	576.4	555.4
14	57	814.4	803.6	773.5	722.6	672.1	614.1	581.2	559.7
12	54	814.8	803.9	773.7	722.7	672.2	614.3	585.1	562.9
10	50	815.2	804.2	773.8	722.9	672.2	614.4	585.2	565.1
8	46	815.6	804.4	774.1	723.1	672.3	614.5	585.4	565.2
6	43	815.9	804.6	771.1	723.2	672.4	601.5	555.2	527.7
4	40	816.1	804.8	752.9	691.8	632.3	562.1	527.6	503.2
2	36	816.3	804.9	753.0	691.9	632.4	562.1	527.6	503.2
0	32	816.5	805.0	753.1	691.9	632.4	562.2	527.7	503.2
-40	-40	817.9	805.6	753.1	691.9	632.4	562.2	527.7	503.3

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.
With engine bleed for packs off, increase weight by 2600 lb.
With engine anti-ice on, decrease weight by 300 lb.
With engine and wing anti-ice on, decrease weight by 5100 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 54300 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Approach or Landing Climb Limited Weight

Valid for approach with flaps 20 and landing with flaps 25

AIRPORT OAT		APPROACH OR LANDING CLIMB LIMITED WEIGHT (1000 LB)							
		AIRPORT PRESSURE ALTITUDE (FT)							
°C	°F	-2000	0	2000	4000	6000	8000	9000	9800
54	129	667.4	627.3						
52	126	683.6	645.0						
50	122	700.3	662.0	607.7					
48	118	716.9	678.5	622.7					
46	115	734.0	695.1	639.1	588.8				
44	111	751.2	711.9	655.7	603.3				
42	108	769.0	728.3	671.2	617.6	570.8			
40	104	784.1	744.9	686.0	632.1	583.1			
38	100	799.7	762.7	702.2	646.9	595.0	531.7		
36	97	805.8	778.1	716.4	659.7	606.8	542.2	510.4	
34	93	806.4	793.3	731.5	672.4	617.1	552.4	520.4	497.3
32	90	806.9	798.3	745.6	684.4	627.1	562.6	530.2	507.1
30	86	807.5	798.6	758.9	697.1	636.4	571.1	540.0	516.7
28	82	808.1	799.0	769.7	707.7	646.7	579.6	548.3	525.9
26	79	808.7	799.3	770.1	715.6	657.3	587.6	556.4	533.7
24	75	809.2	799.6	770.3	722.3	667.2	596.5	564.0	541.5
22	72	809.8	799.9	770.4	725.4	673.5	605.7	572.4	548.8
20	68	810.3	800.1	770.6	725.5	677.4	613.3	581.4	557.4
18	64	810.9	800.4	770.8	725.7	681.3	619.5	588.9	565.7
16	61	811.5	800.7	771.0	725.8	681.5	623.5	594.3	572.8
14	57	811.9	801.0	771.1	726.0	681.6	627.0	598.3	577.3
12	54	812.4	801.2	771.3	726.1	681.7	627.2	601.3	581.0
10	50	812.8	801.5	771.4	726.3	681.8	627.4	601.5	583.1
8	46	813.1	801.7	771.6	726.4	681.9	627.4	601.6	583.1
6	43	813.4	801.9	771.7	726.6	681.9	627.4	601.6	583.1
4	40	813.6	802.0	771.8	726.7	682.0	613.7	576.8	550.3
2	36	813.8	802.2	771.9	726.8	682.1	613.8	576.8	550.3
0	32	814.0	802.3	772.0	726.8	682.2	613.8	576.8	550.4
-40	-40	815.4	802.9	772.3	727.1	682.5	614.0	577.0	550.5

Based on engine bleed for packs on, engine anti-ice off, and wing anti-ice off.
With engine bleed for packs off, increase weight by 2900 lb.
With engine anti-ice on, decrease weight by 300 lb.
With engine and wing anti-ice on, decrease weight by 5100 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 49400 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy (Millions of Foot Pounds)

		BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT	OAT	PRESSURE ALTITUDE (1000 FT)																	
(1000 LB)	(°C)	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
780	0	23.0	25.9	29.2	33.4	38.0	43.4	45.4	52.2	60.0	58.9	68.0	78.7	73.4	85.0	98.3	88.5	102.4	118.2
	10	23.6	26.6	30.1	34.3	39.2	44.8	46.8	53.8	61.9	60.7	70.2	81.1	75.7	87.7	101.4	91.3	105.6	121.6
	15	24.0	27.1	30.7	35.0	39.9	45.7	47.6	54.9	63.0	61.9	71.5	82.5	77.1	89.2	103.2	92.9	107.3	123.5
	20	24.5	27.6	31.2	35.6	40.7	46.5	48.5	55.8	64.2	63.0	72.8	84.0	78.5	90.8	104.8	94.4	109.0	125.5
	30	25.1	28.4	32.1	36.6	41.7	47.8	49.9	57.4	66.0	64.8	74.8	86.5	80.7	93.3	107.8	97.1	112.1	128.8
	40	25.4	28.7	32.5	37.1	42.5	48.5	50.7	58.5	67.3	66.1	76.4	88.3	82.4	95.4	110.1	99.2	114.5	131.4
740	0	22.0	24.9	28.1	32.0	36.4	41.5	43.4	49.9	57.3	56.3	65.1	75.0	70.2	81.2	94.0	84.7	98.0	113.2
	10	22.6	25.6	28.8	32.9	37.5	42.8	44.7	51.5	59.1	58.0	67.0	77.4	72.4	83.8	97.0	87.3	101.1	116.5
	15	23.1	26.0	29.3	33.5	38.3	43.6	45.6	52.4	60.2	59.1	68.2	78.7	73.7	85.3	98.5	88.8	102.7	118.5
	20	23.5	26.5	29.8	34.1	38.9	44.4	46.4	53.3	61.2	60.2	69.5	80.1	75.0	86.8	100.2	90.4	104.4	120.4
	30	24.1	27.2	30.7	35.0	40.0	45.6	47.7	54.8	63.0	61.9	71.5	82.4	77.2	89.2	103.0	92.9	107.4	123.6
	40	24.3	27.6	31.0	35.5	40.6	46.4	48.5	55.9	64.2	63.1	73.0	84.2	78.8	91.2	105.2	95.0	109.6	126.1
700	0	21.1	23.7	26.8	30.6	34.7	39.6	41.4	47.5	54.6	53.6	61.9	71.5	66.9	77.4	89.6	80.7	93.5	108.0
	10	21.7	24.5	27.5	31.4	35.8	40.8	42.7	49.1	56.2	55.3	63.8	73.7	69.0	79.9	92.3	83.3	96.4	111.2
	15	22.1	24.9	28.1	32.0	36.5	41.5	43.5	49.9	57.3	56.3	65.1	74.9	70.2	81.3	93.8	84.7	98.1	113.1
	20	22.5	25.4	28.6	32.6	37.1	42.4	44.3	50.8	58.4	57.3	66.2	76.3	71.5	82.6	95.6	86.2	99.7	114.9
	30	23.1	26.0	29.3	33.5	38.1	43.5	45.5	52.3	59.9	59.0	68.1	78.5	73.5	85.1	98.3	88.7	102.5	118.2
	40	23.3	26.3	29.6	33.9	38.8	44.1	46.3	53.2	61.1	60.1	69.5	80.1	75.1	86.9	100.4	90.6	104.7	120.5
620	0	19.3	21.7	24.4	27.8	31.6	35.8	37.5	42.9	49.0	48.3	55.7	64.0	60.1	69.6	80.3	72.6	84.1	97.3
	10	19.8	22.3	25.0	28.6	32.5	36.8	38.6	44.2	50.6	49.8	57.4	66.0	62.0	71.8	82.9	74.9	86.8	100.2
	15	20.2	22.7	25.5	29.1	33.0	37.6	39.3	45.1	51.6	50.7	58.5	67.3	63.2	73.1	84.3	76.2	88.2	102.0
	20	20.6	23.1	25.9	29.6	33.6	38.2	40.0	45.9	52.4	51.6	59.5	68.4	64.3	74.3	85.8	77.6	89.7	103.7
	30	21.1	23.7	26.5	30.4	34.5	39.3	41.1	47.1	54.0	53.1	61.2	70.4	66.1	76.5	88.2	79.8	92.3	106.6
	40	21.3	23.9	26.9	30.8	35.1	39.8	41.8	47.9	55.0	54.1	62.4	71.8	67.5	78.0	90.2	81.5	94.4	108.8
540	0	17.5	19.6	21.9	25.0	28.3	32.0	33.5	38.3	43.6	42.9	49.3	56.6	53.2	61.5	70.8	64.2	74.2	85.9
	10	18.0	20.1	22.6	25.7	29.1	32.9	34.5	39.4	44.9	44.2	50.8	58.4	54.9	63.4	73.0	66.2	76.6	88.5
	15	18.3	20.6	23.0	26.2	29.6	33.6	35.1	40.1	45.7	45.0	51.8	59.4	55.9	64.5	74.4	67.4	77.9	90.1
	20	18.7	20.8	23.4	26.6	30.2	34.2	35.7	40.8	46.6	45.9	52.7	60.5	56.9	65.7	75.6	68.6	79.4	91.6
	30	19.1	21.4	24.1	27.3	30.9	35.0	36.7	42.0	47.8	47.1	54.2	62.3	58.5	67.5	77.9	70.6	81.6	94.3
	40	19.3	21.6	24.3	27.6	31.4	35.6	37.2	42.6	48.7	47.9	55.2	63.5	59.6	69.0	79.4	72.0	83.4	96.3
460	0	15.8	17.6	19.6	22.2	25.1	28.3	29.5	33.5	38.1	37.5	42.9	49.0	46.1	53.1	61.0	55.4	63.9	73.8
	10	16.2	18.1	20.1	22.8	25.8	29.0	30.3	34.4	39.3	38.6	44.2	50.6	47.6	54.7	62.9	57.1	66.0	76.1
	15	16.5	18.4	20.6	23.2	26.2	29.7	30.9	35.2	40.0	39.3	45.1	51.4	48.4	55.8	64.1	58.1	67.1	77.5
	20	16.8	18.8	20.8	23.7	26.7	30.2	31.4	35.8	40.6	40.0	45.9	52.4	49.3	56.8	65.2	59.2	68.3	78.8
	30	17.2	19.2	21.4	24.3	27.4	30.9	32.3	36.7	41.8	41.1	47.1	53.9	50.7	58.3	67.2	60.9	70.3	81.2
	40	17.3	19.3	21.6	24.5	27.8	31.3	32.7	37.3	42.4	41.8	47.9	55.0	51.6	59.5	68.4	62.1	71.7	82.9
380	0	14.1	15.6	17.4	19.4	21.9	24.6	25.4	28.8	32.6	31.9	36.4	41.5	38.9	44.5	51.1	46.2	53.2	61.1
	10	14.4	16.0	17.8	20.0	22.4	25.2	26.1	29.6	33.6	32.9	37.4	42.7	40.0	45.9	52.7	47.7	54.8	63.2
	15	14.7	16.3	18.1	20.3	22.9	25.7	26.6	30.2	34.2	33.5	38.1	43.5	40.8	46.7	53.6	48.5	55.9	64.3
	20	15.0	16.6	18.4	20.7	23.3	26.1	27.1	30.7	34.8	34.1	38.9	44.4	41.5	47.6	54.5	49.4	56.9	65.3
	30	15.3	17.1	19.0	21.2	23.8	26.8	27.8	31.6	35.8	35.0	39.9	45.5	42.7	49.0	56.1	50.8	58.6	67.2
	40	15.4	17.2	19.1	21.4	24.2	27.1	28.1	32.0	36.2	35.5	40.5	46.3	43.4	49.8	57.1	51.7	59.6	68.7

To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind.
If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Event Adjusted Brake Energy (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	3.9	13.9	23.8	33.5	43.1	52.7	62.2	71.8	81.4	91.0	100.8	110.7
	MAX AUTO	3.9	12.9	21.7	30.5	39.3	48.2	57.2	66.4	75.9	85.7	95.9	106.5
	AUTOBRAKE 4	3.6	12.1	20.3	28.4	36.3	44.4	52.5	60.9	69.7	78.9	88.6	99.0
	AUTOBRAKE 3	3.2	11.4	19.2	26.7	34.0	41.4	48.8	56.5	64.5	73.0	82.1	91.9
	AUTOBRAKE 2	2.8	10.6	17.9	24.8	31.6	38.3	45.0	51.9	59.2	66.9	75.2	84.2
	AUTOBRAKE 1	2.4	9.4	15.9	22.1	28.2	34.1	40.1	46.3	52.7	59.6	66.9	74.9

2 Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)											
EVENT		10	20	30	40	50	60	70	80	90	100	110	120
RTO MAX MAN		10	20	30	40	50	60	70	80	90	100	110	120
LANDING	MAX MAN	3.2	12.1	21.5	30.8	40.0	49.0	57.8	66.4	74.9	83.4	91.8	100.2
	MAX AUTO	1.8	9.0	16.2	23.5	30.9	38.3	46.1	54.1	62.4	71.3	80.7	90.7
	AUTOBRAKE 4	1.1	5.8	11.2	17.0	22.8	28.7	34.8	41.1	47.9	55.2	63.2	71.9
	AUTOBRAKE 3	0.6	3.3	7.3	11.9	16.6	21.3	26.2	31.4	37.0	43.1	49.9	57.3
	AUTOBRAKE 2	0.0	2.5	5.2	8.1	11.2	14.4	17.9	21.7	26.0	30.8	36.3	42.4
	AUTOBRAKE 1	0.0	1.7	3.5	5.4	7.5	9.7	12.1	14.8	17.8	21.2	25.0	29.3

Cooling Time (Minutes)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)									
	16 & BELOW	17	18	20	24	28	32	35	36 TO 44	45 & ABOVE
GEAR DOWN INFLIGHT	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	6	7	7	CAUTION	FUSE PLUG MELT ZONE
GROUND		11	18	26	42	55	66	73		
BTMS	UP TO 2.4	2.4	2.6	2.9	3.4	4.0	4.5	4.9	5.0 TO 6.3	6.3 & ABOVE

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds for each taxi mile.
For one brake deactivated, increase brake energy by 10 percent.
For two brakes deactivated, increase brake energy by 20 percent.
When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 8 minutes.
When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.
Brake temperature monitor system (BTMS) indication on EICAS may be used 10 to 15 minutes after airplane has come to a complete stop, or inflight with gear retracted, to determine recommended cooling schedule. (When inflight with gear extended, the BTMS indications may vary between individual brakes, due to airstream effects.)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Initial Max Continuous %N1

Based on .84M, engine bleed for packs on and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	27	29	31	33	35	37	39	41	43
20	97.4	97.0	96.7	96.3	95.9	95.9	95.6	95.3	95.0
15	98.2	97.8	97.3	97.0	96.6	96.3	96.0	95.7	95.4
10	99.2	98.9	98.3	97.7	97.2	97.0	96.6	96.3	96.0
5	100.2	100.1	99.7	98.8	98.1	97.8	97.4	97.1	96.8
0	99.3	100.9	101.0	99.9	99.3	98.8	98.3	97.9	97.6
-5	98.4	99.9	101.2	101.3	100.5	100.2	99.7	99.3	98.8
-10	97.4	99.0	100.3	101.6	101.3	101.3	100.7	100.3	100.0
-15	96.5	98.1	99.3	100.6	101.0	102.0	101.1	100.8	100.5
-20	95.6	97.1	98.3	99.6	100.1	101.0	100.1	99.8	99.5
-25	94.6	96.1	97.4	98.6	99.1	100.0	99.1	98.8	98.5
-30	93.7	95.2	96.4	97.6	98.1	99.0	98.1	97.8	97.5
-35	92.7	94.2	95.4	96.6	97.0	97.9	97.1	96.8	96.5
-40	91.7	93.2	94.4	95.6	96.0	96.9	96.1	95.8	95.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
37000 FT to 27000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.86	94.3	95.4	96.4	97.4	98.4	99.5	100.5	101.4	101.2	100.2	98.9	97.7
240	0.74	96.1	97.2	98.3	99.3	100.4	101.4	102.1	101.9	100.9	99.5	98.1	97.1
200	0.63	95.7	96.7	97.8	98.8	99.9	100.8	101.4	100.9	100.0	98.5	97.0	96.3
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
280	0.82	94.6	95.6	96.6	97.7	98.7	99.7	100.7	101.7	101.4	100.4	99.2	98.1
240	0.71	95.1	96.2	97.2	98.3	99.3	100.3	101.3	101.8	100.9	99.8	98.3	97.2
200	0.60	94.8	95.8	96.9	97.9	98.9	99.9	100.9	101.0	100.2	98.8	97.1	96.1
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
320	0.89	91.4	92.4	93.4	94.4	95.4	96.4	97.4	98.3	99.3	100.2	99.8	98.8
280	0.79	95.0	96.0	97.1	98.1	99.2	100.2	101.2	102.2	102.4	101.0	100.0	98.7
240	0.68	95.6	96.7	97.8	98.8	99.8	100.9	101.9	102.4	101.8	100.2	98.9	97.5
200	0.58	95.9	97.0	98.0	99.1	100.1	101.1	101.6	101.6	101.0	99.3	97.9	96.4
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
320	0.85	92.7	93.8	94.8	95.7	96.7	97.7	98.7	99.6	100.5	100.8	99.7	98.4
280	0.76	96.3	97.4	98.4	99.5	100.5	101.5	102.5	103.5	102.0	100.6	99.1	98.0
240	0.66	97.4	98.4	99.5	100.5	101.5	102.6	103.3	103.0	101.0	99.5	98.1	96.9
200	0.55	97.6	98.7	99.7	100.8	101.8	102.6	102.8	102.0	100.7	98.7	97.2	96.1
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
320	0.82	93.8	94.8	95.8	96.8	97.8	98.7	99.7	100.6	101.6	100.1	98.9	97.8
280	0.73	96.6	97.6	98.6	99.6	100.6	101.6	102.6	102.5	101.0	99.5	98.1	97.1
240	0.63	98.1	99.2	100.2	101.3	102.3	103.3	103.1	101.6	99.8	98.4	97.1	96.0
200	0.53	98.6	99.7	100.7	101.7	102.7	103.2	102.7	101.2	99.4	97.7	96.3	96.2
27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
360	0.88	90.2	91.2	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.2	98.1
320	0.79	93.4	94.4	95.3	96.3	97.3	98.2	99.2	100.1	101.1	100.6	99.2	98.1
280	0.70	95.4	96.4	97.4	98.4	99.4	100.4	101.3	102.3	101.3	99.7	98.2	97.1
240	0.60	97.2	98.2	99.2	100.3	101.3	102.3	103.0	102.0	99.9	98.5	97.2	96.2
200	0.51	98.4	99.4	100.4	101.5	102.5	103.2	102.7	101.8	99.9	98.1	96.5	95.6

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	37	35	33	31	29	27
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
WING A/I ON - PACKS OFF	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off

25000 FT to 18000 FT Pressure Altitudes

25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.85	91.2	92.2	93.1	94.1	95.0	95.9	96.8	97.7	98.6	99.5	98.9	98.1
320	0.76	93.9	94.8	95.8	96.8	97.7	98.7	99.6	100.5	101.1	99.6	98.5	97.6
280	0.67	95.5	96.5	97.5	98.5	99.4	100.4	101.3	101.5	100.4	98.8	97.5	96.7
240	0.58	97.4	98.5	99.5	100.5	101.5	102.4	102.3	100.9	99.3	97.8	96.7	95.9
200	0.49	99.3	100.3	101.4	102.4	103.4	103.1	102.0	100.6	98.5	97.1	96.1	95.9
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
360	0.83	91.3	92.3	93.2	94.2	95.1	96.0	96.9	97.8	98.7	99.6	99.4	98.4
320	0.75	93.6	94.6	95.6	96.5	97.5	98.4	99.4	100.3	101.2	100.0	98.8	97.8
280	0.66	95.4	96.4	97.4	98.3	99.3	100.3	101.2	101.8	100.7	99.1	97.8	96.9
240	0.57	97.3	98.3	99.3	100.3	101.3	102.2	102.6	101.4	99.8	98.3	97.1	96.2
200	0.48	98.8	99.9	100.9	101.9	102.9	103.4	102.3	101.0	98.9	97.4	96.3	95.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.80	92.1	93.0	94.0	94.9	95.8	96.7	97.6	98.5	99.4	100.0	99.0	98.3
320	0.72	94.3	95.3	96.3	97.2	98.1	99.1	100.0	100.9	100.7	99.3	98.2	97.5
280	0.63	96.1	97.1	98.1	99.0	100.0	100.9	101.9	101.3	99.8	98.4	97.3	96.6
240	0.55	97.7	98.7	99.7	100.7	101.7	102.7	102.3	100.9	99.3	97.7	96.8	96.1
200	0.46	99.5	100.5	101.5	102.5	103.5	103.0	101.5	99.9	97.9	96.8	95.9	95.8
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
360	0.77	93.7	94.6	95.6	96.5	97.4	98.4	99.3	100.2	101.1	102.0	101.3	100.1
320	0.69	95.9	96.9	97.8	98.8	99.7	100.7	101.6	102.6	103.5	101.8	100.4	99.1
280	0.61	97.7	98.7	99.6	100.6	101.6	102.6	103.5	104.3	102.8	100.9	99.4	98.3
240	0.53	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.1	102.4	100.7	98.7	97.2
200	0.44	98.0	99.0	99.9	100.9	101.9	102.9	103.8	102.6	100.5	98.0	96.2	95.3
18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.75	94.4	95.4	96.3	97.2	98.2	99.1	100	100.9	101.8	102.0	100.6	99.4
320	0.67	96.7	97.7	98.6	99.6	100.5	101.4	102.4	103.3	102.9	101.2	99.7	98.6
280	0.59	98.5	99.5	100.5	101.5	102.4	103.4	104.3	104.0	102.3	100.4	98.9	97.8
240	0.51	99.6	100.6	101.6	102.6	103.6	104.5	104.9	103.9	101.9	100.0	98.4	97.2
200	0.42	97.2	98.2	99.2	100.1	101.1	101.9	102.0	100.8	98.8	97.3	95.8	94.4

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	25	24	22	20	18
ENGINE A/I ON	-0.2	-0.2	-0.2	-0.2	-0.2
WING A/I ON - PACKS ON	-0.3	-0.3	-0.3	-0.2	-0.3
WING A/I ON - PACKS OFF	-0.4	-0.4	-0.4	-0.3	-0.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

Max Continuous %N1

Based on engine bleed for packs on or off and anti-ice off
16000 FT to 5000 FT Pressure Altitudes

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
360	0.72	94.8	95.8	96.7	97.6	98.6	99.5	100.4	101.3	102.2	103.1	101.7	100.2
320	0.64	96.9	97.9	98.8	99.8	100.7	101.7	102.6	103.5	104.4	102.7	100.9	99.4
280	0.57	98.7	99.7	100.7	101.6	102.6	103.5	104.5	105.4	104.1	102.2	100.3	98.8
240	0.49	99.1	100.1	101.1	102.0	103.0	104.0	104.9	104.5	103.0	100.9	99.2	97.9
200	0.41	96.2	97.2	98.1	99.1	100.0	100.9	101.5	101.3	99.8	98.3	97.0	95.4
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
360	0.69	94.9	95.9	96.8	97.7	98.6	99.5	100.4	101.3	102.2	102.2	100.8	99.5
320	0.62	97.1	98.1	99.0	99.9	100.9	101.8	102.7	103.6	103.4	101.5	100.0	98.9
280	0.54	99.2	100.1	101.1	102.1	103.0	103.9	104.9	104.9	103.0	101.0	99.5	98.4
240	0.47	97.3	98.2	99.2	100.1	101.0	102.0	102.7	102.5	100.6	99.0	97.8	96.7
200	0.39	96.1	97.0	98.0	98.9	99.8	100.7	101.4	100.7	99.0	97.6	96.5	95.6
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.67	95.4	96.3	97.2	98.1	99.0	99.9	100.8	101.6	102.5	101.3	100.0	99.0
320	0.60	97.3	98.2	99.2	100.1	101.0	101.9	102.8	103.7	102.3	100.6	99.4	98.4
280	0.52	99.7	100.6	101.6	102.5	103.5	104.4	105.3	104.0	102.0	100.2	99.1	98.1
240	0.45	96.5	97.4	98.3	99.3	100.2	101.1	101.4	100.6	99.2	98.0	96.9	96.0
200	0.38	96.7	97.7	98.6	99.5	100.4	101.2	101.3	100.2	98.7	97.4	96.4	95.8
10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-15	-10	-5	0	5	10	15	20	25	30	35	40
360	0.65	94.2	95.2	96.1	96.9	97.8	98.7	99.6	100.4	101.3	101.5	100.2	99.1
320	0.58	96.1	97.1	98.0	98.9	99.8	100.7	101.6	102.4	102.6	101.0	99.7	98.6
280	0.51	98.5	99.4	100.4	101.3	102.2	103.1	104.0	104.6	102.3	100.5	99.4	98.4
240	0.43	95.6	96.6	97.5	98.4	99.3	100.2	101.0	101.1	100.3	99.1	97.8	96.9
200	0.36	96.6	97.5	98.4	99.3	100.2	101.1	101.6	101.2	100.1	98.5	97.5	96.6
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
360	0.59	92.6	93.5	94.3	95.2	96.0	96.9	97.7	98.5	99.4	100.2	99.3	98.5
320	0.53	94.0	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.9	100.1	99.1	98.2
280	0.46	95.0	95.9	96.8	97.6	98.5	99.4	100.2	101.1	100.9	99.8	98.8	97.8
240	0.40	95.7	96.6	97.5	98.4	99.3	100.2	101.0	101.6	100.5	99.4	98.3	97.4
200	0.33	97.0	97.9	98.8	99.7	100.6	101.5	102.4	101.7	100.3	99.1	98.1	97.3

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	16	14	12	10	5
ENGINE A/I ON	-0.3	-0.2	-0.4	-0.5	-0.5
WING A/I ON - PACKS ON	-0.4	-0.5	-0.6	-0.7	-0.8
WING A/I ON - PACKS OFF	-0.6	-0.7	-0.8	-0.9	-1.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	759	298	18500	17300	16100
740	722	291	19900	18800	17700
700	683	283	21100	20300	19300
660	642	275	22400	21500	20600
620	602	267	24100	23100	21900
580	562	258	25900	24900	23600
540	525	250	27900	27100	25600
500	487	241	29900	29200	28000
460	449	232	31500	31100	30300
420	409	221	33200	33000	32400
380	369	211	35000	35000	34700
340	330	200	37200	37100	36900

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
134	125	118	111	105	100	95	90	86	82	79
268	251	236	222	210	200	190	181	173	166	159
402	376	354	333	316	300	285	272	260	249	239
535	501	471	445	421	400	380	363	347	332	319
668	626	588	555	526	500	476	454	434	416	399
800	750	706	666	631	600	571	545	521	499	479
932	874	823	777	736	700	666	636	608	583	560
1064	998	940	888	841	800	762	727	696	667	640
1196	1122	1057	998	946	900	857	818	783	751	721
1327	1246	1173	1109	1051	1000	952	910	870	835	801
1459	1369	1290	1220	1156	1100	1048	1001	958	918	882
1590	1493	1407	1330	1262	1200	1143	1092	1045	1002	963
1722	1617	1524	1441	1367	1300	1239	1183	1133	1086	1043
1854	1741	1641	1552	1472	1400	1334	1275	1220	1170	1124
1986	1865	1758	1662	1577	1500	1430	1366	1307	1254	1205
2118	1989	1875	1773	1682	1600	1525	1457	1395	1338	1285
2250	2113	1992	1884	1787	1700	1620	1548	1482	1421	1365
2383	2238	2109	1995	1892	1800	1716	1639	1569	1505	1446

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)												TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)												
	340	380	420	460	500	540	580	620	660	700	740	780	
100	2.2	2.4	2.6	2.8	3.1	3.3	3.5	3.7	3.8	3.9	4.1	4.3	0:15
200	4.9	5.3	5.8	6.3	6.9	7.4	7.6	8.0	8.4	8.7	9.3	9.8	0:31
300	7.7	8.4	9.2	10.0	10.9	11.6	12.1	12.7	13.4	14.0	15.0	15.8	0:46
400	10.6	11.5	12.6	13.7	14.8	15.9	16.6	17.5	18.5	19.3	20.6	21.8	1:01
500	13.2	14.4	15.7	17.1	18.5	19.9	20.9	22.1	23.3	24.3	25.8	27.5	1:16
600	15.8	17.3	18.8	20.5	22.2	23.8	25.1	26.5	28.0	29.2	31.0	33.0	1:30
700	18.3	20.1	21.9	23.8	25.8	27.6	29.2	30.8	32.5	34.0	36.1	38.4	1:45
800	20.8	22.8	25.0	27.1	29.3	31.4	33.2	35.1	37.1	38.8	41.2	43.9	1:60
900	23.3	25.6	28.0	30.4	32.9	35.2	37.3	39.4	41.6	43.5	46.2	49.2	2:14
1000	25.8	28.3	31.0	33.7	36.4	39.0	41.3	43.6	46.0	48.3	51.2	54.5	2:28
1100	28.3	31.1	34.0	36.9	39.8	42.7	45.2	47.8	50.5	52.9	56.2	59.8	2:43
1200	30.7	33.8	36.9	40.1	43.3	46.4	49.2	52.0	54.9	57.6	61.1	65.0	2:57
1300	33.1	36.4	39.8	43.3	46.7	50.1	53.1	56.1	59.3	62.2	66.0	70.2	3:12
1400	35.5	39.1	42.7	46.4	50.1	53.7	56.9	60.3	63.6	66.8	70.8	75.3	3:26
1500	37.9	41.7	45.6	49.6	53.5	57.3	60.8	64.4	68.0	71.4	75.6	80.4	3:41
1600	40.3	44.3	48.5	52.7	56.8	60.9	64.6	68.4	72.3	75.9	80.4	85.5	3:55
1700	42.6	46.9	51.3	55.7	60.2	64.4	68.4	72.5	76.6	80.5	85.1	90.5	4:10
1800	45.0	49.5	54.1	58.8	63.4	68.0	72.2	76.5	80.8	85.0	89.9	95.5	4:25

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability
100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	15800	14600	13000
760	16500	15000	13500
740	17200	15700	14000
720	18200	16600	15000
700	19100	17500	15900
680	20000	18500	16800
660	20500	19300	17700
640	21100	20200	18700
620	21700	20700	19700
600	22500	21300	20400
580	23300	22000	21000
560	24200	23000	21700
540	25200	24000	22500
520	26400	25100	23600
500	27600	26300	24700
480	28800	27600	25900
460	30100	28800	27300
440	30900	30100	28600
420	31800	31100	30000
400	32800	32300	31200
380	33800	33400	32500
360	34800	34600	33800

With engine anti-ice on, no altitude capability adjustment is required.
With engine and wing anti-ice on, decrease altitude capability by 300 ft.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
780	%N1	90.6	95.8	99.4							
	MACH	.602	.664	.692							
	KIAS	334	337	339							
	FF/ENG	21940	23454	24386							
740	%N1	89.7	94.6	97.1							
	MACH	.602	.663	.680							
	KIAS	334	337	333							
	FF/ENG	21206	22540	22774							
700	%N1	88.5	92.7	94.5	97.3						
	MACH	.602	.651	.668	.687						
	KIAS	334	331	327	323						
	FF/ENG	20315	20930	21046	21215						
660	%N1	86.7	90.9	92.6	94.6	97.8					
	MACH	.591	.638	.656	.673	.694					
	KIAS	328	324	321	317	314					
	FF/ENG	19121	19518	19617	19670	19944					
620	%N1	85.1	89.3	90.9	92.7	95.0					
	MACH	.575	.623	.642	.661	.678					
	KIAS	319	316	314	311	307					
	FF/ENG	17868	18203	18307	18352	18459					
580	%N1	83.3	87.5	89.1	90.8	92.6	95.2				
	MACH	.560	.607	.626	.646	.664	.682				
	KIAS	311	307	305	303	300	296				
	FF/ENG	16693	16950	17015	17063	17135	17317				
540	%N1	81.3	85.4	87.3	88.9	90.6	92.4	95.4			
	MACH	.544	.590	.609	.629	.649	.667	.686			
	KIAS	302	299	297	295	293	289	286			
	FF/ENG	15571	15674	15773	15801	15865	15970	16192			
500	%N1	79.3	83.3	85.1	86.9	88.5	90.2	92.2	95.2	99.4	
	MACH	.528	.571	.591	.611	.631	.650	.669	.689	.719	
	KIAS	292	289	288	286	284	282	279	275	277	
	FF/ENG	14463	14383	14528	14583	14614	14703	14807	15030	15789	
460	%N1	77.3	81.0	82.8	84.6	86.4	88.0	89.7	91.8	94.9	99.2
	MACH	.511	.552	.571	.591	.611	.631	.651	.670	.690	.722
	KIAS	283	279	277	277	275	273	271	267	265	266
	FF/ENG	13361	13167	13259	13371	13408	13450	13540	13623	13849	14644
420	%N1	75.1	78.6	80.4	82.2	83.9	85.6	87.3	89.0	91.2	94.3
	MACH	.494	.533	.550	.569	.589	.609	.630	.651	.669	.690
	KIAS	273	269	267	266	265	263	262	259	256	253
	FF/ENG	12290	11993	12062	12138	12211	12245	12287	12361	12433	12656
380	%N1	72.7	76.1	77.8	79.5	81.3	82.9	84.7	86.4	88.1	90.2
	MACH	.476	.512	.529	.546	.565	.586	.606	.627	.648	.667
	KIAS	263	258	256	255	253	252	251	249	247	244
	FF/ENG	11256	10838	10907	10979	11001	11046	11087	11117	11180	11247
340	%N1	70.2	73.4	75.1	76.7	78.3	80.1	81.6	83.6	85.2	87.0
	MACH	.458	.491	.506	.523	.540	.559	.579	.601	.622	.644
	KIAS	253	247	245	243	242	241	239	239	237	235
	FF/ENG	10266	9746	9783	9857	9869	9853	9878	9931	9948	10006

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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
281	260	241	226	212	200	191	182	174	167	160
558	518	482	451	424	400	382	365	349	336	323
836	776	722	676	636	600	573	549	526	504	485
1115	1035	964	902	849	800	764	732	701	673	648
1394	1294	1205	1128	1061	1000	956	914	876	842	810
1674	1554	1447	1354	1273	1200	1147	1097	1052	1010	972
1955	1814	1688	1580	1486	1400	1338	1280	1227	1178	1134
2237	2075	1931	1807	1698	1600	1528	1462	1401	1345	1295
2519	2336	2173	2033	1911	1800	1720	1645	1576	1513	1456
2802	2599	2417	2260	2124	2000	1910	1827	1751	1680	1617

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	8.8	0:38	7.7	0:37	6.9	0:36	6.2	0:35	5.7	0:34
400	18.4	1:11	17.0	1:09	15.8	1:06	14.8	1:04	14.5	1:01
600	27.9	1:45	26.1	1:40	24.6	1:37	23.4	1:33	23.1	1:29
800	37.3	2:19	35.2	2:13	33.3	2:07	31.8	2:03	31.6	1:57
1000	46.7	2:53	44.1	2:45	42.0	2:38	40.2	2:32	40.0	2:25
1200	55.9	3:27	52.9	3:18	50.5	3:09	48.4	3:02	48.3	2:53
1400	65.1	4:02	61.7	3:50	58.9	3:40	56.6	3:32	56.4	3:21
1600	74.2	4:36	70.4	4:23	67.3	4:11	64.7	4:02	64.4	3:50
1800	83.1	5:11	78.9	4:57	75.6	4:43	72.7	4:32	72.3	4:19
2000	92.1	5:47	87.4	5:30	83.8	5:15	80.6	5:02	80.0	4:48

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)								
	400	450	500	550	600	650	700	750	800
10	-1.7	-1.3	-0.9	-0.4	0.0	0.7	1.7	3.0	4.5
20	-3.7	-2.7	-1.8	-0.9	0.0	1.6	3.7	6.4	9.5
30	-5.6	-4.2	-2.8	-1.4	0.0	2.5	5.7	9.6	14.3
40	-7.6	-5.7	-3.8	-1.9	0.0	3.3	7.6	12.8	18.9
50	-9.6	-7.1	-4.7	-2.4	0.0	4.1	9.4	15.8	23.2
60	-11.5	-8.6	-5.7	-2.9	0.0	4.9	11.2	18.6	27.3
70	-13.5	-10.1	-6.7	-3.4	0.0	5.8	12.9	21.4	31.2
80	-15.5	-11.6	-7.7	-3.9	0.0	6.5	14.5	24.0	34.9
90	-17.4	-13.0	-8.7	-4.4	0.0	7.3	16.2	26.5	38.3
100	-19.4	-14.5	-9.7	-4.9	0.0	8.1	17.7	28.9	41.5

Includes APU fuel burn.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
780	%N1	79.9	83.3	88.0	92.8			
	KIAS	263	263	263	264			
	FF/ENG	19620	19730	20220	20800			
740	%N1	78.4	81.5	86.3	90.9	99.6		
	KIAS	258	258	258	258	297		
	FF/ENG	18530	18600	18950	19410	22280		
700	%N1	76.5	79.5	84.3	88.9	95.9		
	KIAS	252	252	252	252	288		
	FF/ENG	17320	17340	17570	17910	20110		
660	%N1	74.6	77.6	82.3	87.1	92.4		
	KIAS	244	244	244	244	257		
	FF/ENG	16220	16200	16350	16610	17840		
620	%N1	72.9	75.8	80.2	85.1	90.2		
	KIAS	238	238	238	238	238		
	FF/ENG	15240	15160	15240	15400	16300		
580	%N1	71.0	73.9	78.2	83.1	88.1	95.8	
	KIAS	231	231	231	231	231	264	
	FF/ENG	14250	14160	14140	14260	14970	16770	
540	%N1	69.0	72.0	76.1	80.9	86.0	91.6	
	KIAS	225	225	225	225	225	240	
	FF/ENG	13280	13200	13100	13190	13790	14720	
500	%N1	67.0	69.9	74.0	78.6	83.7	88.6	98.5
	KIAS	220	220	220	220	220	220	246
	FF/ENG	12340	12260	12120	12170	12610	13160	15210
460	%N1	65.0	67.7	72.0	76.3	81.3	86.1	93.7
	KIAS	217	217	217	217	217	217	236
	FF/ENG	11440	11360	11220	11210	11550	11940	13190
420	%N1	63.1	65.7	69.8	74.2	78.9	83.7	88.8
	KIAS	217	217	217	217	217	217	217
	FF/ENG	10630	10530	10400	10360	10660	10940	11380
380	%N1	61.2	63.8	67.7	72.1	76.7	81.5	86.2
	KIAS	217	217	217	217	217	217	217
	FF/ENG	9910	9790	9650	9610	9880	10080	10370
340	%N1	59.3	62.0	65.7	70.0	74.5	79.3	84.0
	KIAS	217	217	217	217	217	217	217
	FF/ENG	9290	9150	8980	8920	9150	9320	9570

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available
Flaps 20

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	180	90					
50	230	140	0				
48	270	180	40				
46	310	230	80	-60			
44	350	270	120	-20			
42	390	310	160	20	-120		
40	410	350	200	50	-90		
38	410	390	240	90	-60	-250	
36	420	400	280	120	-40	-220	
34	420	410	310	160	-10	-200	-370
32	420	410	330	190	20	-170	-350
30	430	410	330	210	50	-150	-330
20	440	420	340	230	110	-60	-220
10	450	430	300	180	70	-300	-420
0	460	440	280	90	-100	-310	-510
-20	480	460	290	100	-100	-320	-530
-40	510	480	300	100	-100	-340	-550

Rate of climb capability shown is valid for 570000 lb, gear down at VREF20 + 5.
Decrease rate of climb 30 ft/min per 10000 lb greater than 570000 lb.
Increase rate of climb 30 ft/min per 10000 lb less than 570000 lb.

Flaps 25

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-140	-240					
50	-100	-190	-340				
48	-60	-150	-300				
46	-30	-110	-260	-400			
44	10	-70	-220	-360			
42	50	-30	-180	-320	-470		
40	70	10	-150	-290	-440		
38	70	40	-110	-260	-410	-600	
36	80	60	-80	-230	-390	-570	
34	80	60	-50	-200	-360	-550	-730
32	80	60	-20	-170	-340	-530	-710
30	80	60	-20	-150	-310	-510	-690
20	90	70	-20	-130	-250	-420	-590
10	100	70	-80	-230	-360	-490	-590
0	100	70	-90	-270	-460	-680	-880
-20	110	80	-90	-280	-480	-700	-910
-40	110	80	-100	-300	-500	-730	-940

Rate of climb capability shown is valid for 570000 lb, gear down at VREF25 + 5.
Decrease rate of climb 40 ft/min per 10000 lb greater than 570000 lb.
Increase rate of climb 30 ft/min per 10000 lb less than 570000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available
Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-390	-480					
50	-350	-440	-580				
48	-310	-400	-550				
46	-270	-360	-510	-640			
44	-240	-330	-470	-610			
42	-200	-290	-440	-570	-720		
40	-180	-250	-400	-550	-690		
38	-180	-220	-370	-520	-670	-850	
36	-180	-200	-340	-490	-650	-830	
34	-180	-200	-310	-460	-620	-810	-990
32	-170	-200	-290	-440	-600	-790	-970
30	-170	-200	-280	-410	-570	-770	-950
20	-170	-200	-290	-400	-520	-690	-860
10	-170	-200	-300	-520	-670	-830	-950
0	-170	-200	-360	-540	-730	-940	-1140
-20	-180	-210	-380	-560	-760	-980	-1190
-40	-180	-220	-390	-590	-790	-1020	-1230

Rate of climb capability shown is valid for 570000 lb, gear down at VREF30 + 5.
Decrease rate of climb 40 ft/min per 10000 lb greater than 570000 lb.
Increase rate of climb 40 ft/min per 10000 lb less than 570000 lb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ALTERNATE MODE EEC

Alternate Mode EEC Max Takeoff %N1

Based on engine bleed for packs on, engine anti-ice on or off, and wing anti-ice off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	9800
55	131	95.7	96.0	96.2	96.1	96.0	96.1	96.1	96.1	96.1	95.5	94.6	93.7	93.0
50	122	97.1	97.5	98.0	97.6	97.3	97.4	97.5	97.5	97.4	96.8	95.9	95.1	94.4
45	113	98.5	98.9	99.4	99.1	98.8	98.7	98.8	98.8	98.7	98.2	97.3	96.4	95.7
40	104	99.6	100.2	100.9	100.4	100.2	100.0	99.9	100.0	99.9	99.4	98.6	97.7	97.0
35	95	99.3	100.8	102.8	102.3	101.8	101.4	101.2	101.3	101.0	100.4	99.6	98.9	98.3
30	86	98.5	99.9	102.7	104.0	104.0	103.8	103.4	103.4	102.6	101.5	100.7	99.9	99.3
25	77	97.7	99.1	101.8	103.1	104.4	105.5	105.8	106.3	105.3	103.8	102.4	101.0	100.3
20	68	96.9	98.3	101.0	102.3	103.5	104.6	105.8	106.8	106.8	105.9	104.8	103.5	102.4
15	59	96.0	97.4	100.1	101.4	102.6	103.7	104.9	105.9	106.4	106.1	105.6	104.9	104.4
10	50	95.2	96.6	99.2	100.5	101.7	102.8	103.9	105.0	105.5	105.2	104.9	104.6	104.5
5	41	94.4	95.7	98.4	99.6	100.8	101.9	103.0	104.1	104.5	104.2	104.0	103.7	103.6
0	32	93.5	94.9	97.5	98.7	99.9	101.0	102.1	103.1	103.6	103.3	103.0	102.7	102.6
-10	14	91.8	93.1	95.7	96.9	98.1	99.1	100.2	101.2	101.7	101.4	101.1	100.8	100.8
-20	-4	90.0	91.3	93.8	95.0	96.2	97.2	98.3	99.3	99.7	99.4	99.2	98.9	98.8
-30	-22	88.2	89.5	92.0	93.1	94.3	95.3	96.3	97.3	97.7	97.5	97.2	96.9	96.8
-40	-40	86.4	87.6	90.1	91.2	92.3	93.3	94.3	95.3	95.7	95.4	95.2	94.9	94.8
-50	-58	84.5	85.7	88.1	89.2	90.3	91.3	92.3	93.2	93.6	93.4	93.1	92.9	92.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (1000 FT)												
	-2	-1	0	1	2	3	4	5	6	7	8	9	9.8
PACKS OFF	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
WING ANTI-ICE ON	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

220 KIAS Max Climb %N1

TAT (°C)	PRESSURE ALTITUDE (1000 FT)														
	0	5	10	12	14	16	18	20	22	24	26	28	30	32	34
55	88.2	88.3	91.4	91.1	92.1	91.3	94.0	95.2	95.4	98.1	99.9	101.1	102.4	102.9	103.4
50	89.5	88.8	90.7	90.4	91.4	92.1	93.3	94.5	94.7	97.3	99.2	100.3	101.6	102.1	102.6
45	90.5	90.1	90.0	89.7	90.7	91.4	92.6	93.8	93.9	96.6	98.4	99.6	100.8	101.3	101.8
40	91.6	91.2	91.2	89.7	89.9	90.7	91.9	93.0	93.2	95.8	97.6	98.8	100.0	100.5	101.0
35	92.6	92.3	92.2	92.1	90.6	89.9	91.1	92.3	92.5	95.0	96.8	98.0	99.2	99.7	100.2
30	93.0	93.2	93.2	93.0	92.2	91.2	90.9	91.5	91.7	94.3	96.0	97.2	98.4	98.9	99.4
25	92.2	94.2	94.1	94.0	93.7	92.8	92.1	92.0	91.1	93.5	95.2	96.4	97.6	98.0	98.5
20	91.4	94.2	95.1	95.0	94.9	94.4	93.4	93.0	92.8	93.6	94.4	95.6	96.8	97.2	97.7
15	90.7	93.4	96.7	96.4	96.3	96.1	94.8	94.1	94.5	94.8	95.2	95.3	96.0	96.4	96.9
10	89.9	92.6	96.3	97.9	98.1	98.1	96.8	95.5	96.5	96.2	96.4	96.4	96.6	96.1	96.0
5	89.1	91.7	95.4	97.1	98.9	100.3	99.0	97.9	98.2	97.8	97.8	97.9	97.9	97.3	96.8
0	88.3	90.9	94.6	96.2	98.0	100.1	100.8	100.3	100.1	99.7	99.4	99.4	99.5	98.6	98.1
-5	87.4	90.1	93.7	95.3	97.1	99.1	99.9	100.8	101.9	101.5	101.1	101.1	101.1	100.2	99.6
-10	86.6	89.2	92.8	94.4	96.1	98.2	98.9	99.8	101.4	102.8	102.6	102.6	103.0	101.6	100.8
-15	85.8	88.4	91.9	93.5	95.2	97.3	98.0	98.9	100.4	101.8	102.5	103.2	103.8	102.5	101.4
-20	85.0	87.5	91.1	92.6	94.3	96.3	97.0	97.9	99.4	100.8	101.5	102.2	103.3	102.4	101.3

Anti-ice Adjustment

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)							
	0	5	10	15	20	25	30	35
2 PACKS ON - 1 BLEED SOURCE	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
1 PACK ON - 1 OR 2 BLEED SOURCES	-0.4	-0.5	-0.4	-0.3	-0.2	-0.3	-0.3	-0.4
ENGINE ANTI-ICE ON	-0.3	-0.5	-0.4	-0.3	-0.1	-0.2	-0.2	-0.2
ENGINE AND WING ANTI-ICE ON*	-0.6	-0.8	-0.7	-0.5	-0.2	-0.3	-0.3	-0.4
ENGINE AND WING ANTI-ICE ON**	-1.1	-0.9	-0.9	-0.6	-0.3	-0.4	-0.5	-0.5

*** Packs on or off with 2 bleed sources.**
**** Packs off with 1 bleed source.**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Climb Thrust, 300 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
780	18900	17100	14600
760	19500	17700	15200
740	20000	18200	15800
720	21000	19300	16700
700	21900	20400	18000
680	22900	21400	19200
660	23900	22400	20400
640	25000	23500	21700
620	25900	24500	22900
600	26900	25600	24000
580	27900	26800	25200
560	28900	28100	26500
540	30000	29300	27800
520	30700	30300	29100
500	31500	31100	30300
480	32200	31900	31300
460	32900	32700	32100
440	33500	33300	32800
420	34000	33800	33400
400	34500	34400	34000
380	35100	35000	34600
360	35600	35500	35100

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
780	%N1	84.1	88.4	90.4	92.6						
	MACH	.488	.535	.556	.578						
	KIAS	270	270	270	270						
	FF/ENG	16429	16700	16930	17359						
740	%N1	83.4	87.6	89.5	91.5	94.5					
	MACH	.488	.535	.556	.578	.600					
	KIAS	270	270	270	270	270					
	FF/ENG	15979	16209	16380	16716	17176					
700	%N1	82.5	86.5	88.1	89.8	91.8					
	MACH	.488	.532	.549	.566	.586					
	KIAS	270	268	266	264	263					
	FF/ENG	15500	15528	15521	15589	15850					
660	%N1	81.1	84.8	86.6	88.1	89.8	92.0				
	MACH	.481	.520	.537	.553	.572	.593				
	KIAS	266	262	260	258	257	256				
	FF/ENG	14795	14591	14571	14570	14687	14962				
620	%N1	79.4	83.2	85.0	86.5	88.0	89.8	92.6			
	MACH	.469	.507	.524	.541	.558	.577	.599			
	KIAS	259	256	254	252	250	249	248			
	FF/ENG	13912	13703	13657	13662	13653	13810	14110			
580	%N1	77.5	81.4	83.2	84.9	86.3	87.9	89.8	92.9		
	MACH	.456	.494	.510	.527	.544	.562	.582	.605		
	KIAS	252	249	247	246	244	242	241	240		
	FF/ENG	13010	12832	12769	12741	12745	12747	12926	13255		
540	%N1	75.5	79.5	81.4	83.0	84.6	86.0	87.6	89.7	93.1	
	MACH	.442	.480	.496	.513	.529	.547	.565	.586	.610	
	KIAS	244	242	240	239	237	235	233	232	232	
	FF/ENG	12102	11962	11900	11849	11830	11823	11851	12033	12389	
500	%N1	73.4	77.5	79.2	81.0	82.5	84.1	85.6	87.3	89.4	93.2
	MACH	.427	.465	.481	.497	.514	.531	.549	.568	.590	.614
	KIAS	236	234	233	231	230	228	226	225	224	224
	FF/ENG	11197	11077	11039	10980	10935	10921	10909	10956	11130	11513
460	%N1	71.1	75.3	77.0	78.7	80.4	82.0	83.6	85.0	86.9	89.4
	MACH	.411	.449	.465	.481	.497	.514	.532	.550	.571	.596
	KIAS	227	225	225	223	222	221	219	217	217	217
	FF/ENG	10296	10179	10164	10127	10069	10028	10017	10007	10110	10332
420	%N1	68.5	72.8	74.7	76.5	78.5	80.3	82.2	83.9	85.6	87.7
	MACH	.394	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	218	217	217	217	217	217	217	216	217	217
	FF/ENG	9394	9305	9317	9358	9380	9410	9477	9573	9654	9803
380	%N1	67.4	71.9	73.7	75.5	77.5	79.4	81.1	83.0	84.7	86.5
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	9030	8998	9001	9036	9062	9088	9141	9227	9305	9401
340	%N1	66.6	71.1	72.8	74.7	76.6	78.4	80.2	82.1	83.8	85.6
	MACH	.392	.431	.448	.466	.485	.505	.526	.548	.571	.596
	KIAS	217	217	217	217	217	217	217	216	217	217
	FF/ENG	8771	8727	8722	8745	8773	8798	8845	8919	9002	9070

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
310	280	254	233	216	200	189	179	170	162	155
622	562	510	467	431	400	378	358	340	324	311
936	845	766	702	648	600	567	538	511	487	466
1253	1131	1024	937	864	800	757	718	682	650	621
1573	1418	1283	1173	1081	1000	946	897	852	812	776
1896	1706	1542	1409	1298	1200	1135	1076	1022	973	930
2222	1997	1803	1646	1515	1400	1324	1254	1191	1134	1084
2552	2291	2066	1884	1733	1600	1513	1433	1361	1296	1238
2883	2586	2329	2122	1951	1800	1702	1612	1530	1457	1392
3215	2881	2593	2361	2169	2000	1890	1790	1699	1618	1545
3547	3177	2857	2600	2387	2200	2079	1968	1868	1778	1699
3880	3472	3120	2838	2604	2400	2268	2147	2038	1940	1853
4213	3768	3384	3076	2822	2600	2457	2326	2207	2101	2007
4545	4063	3648	3315	3040	2800	2646	2505	2377	2262	2161
4878	4359	3912	3554	3258	3000	2835	2683	2546	2424	2315
5211	4655	4176	3792	3476	3200	3023	2862	2716	2585	2468
5544	4951	4440	4031	3694	3400	3212	3041	2885	2746	2622
5876	5246	4703	4269	3912	3600	3401	3220	3055	2907	2776
6209	5541	4967	4507	4130	3800	3590	3398	3224	3068	2930
6542	5837	5230	4746	4348	4000	3778	3576	3393	3229	3084

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	15.5	0:48	14.1	0:46	12.2	0:43	11.2	0:42	10.3	0:41
400	31.3	1:33	29.0	1:28	26.0	1:23	24.2	1:19	22.7	1:16
600	47.2	2:18	43.9	2:11	39.7	2:02	37.2	1:57	35.2	1:52
800	62.5	3:05	58.4	2:55	53.0	2:42	49.8	2:35	47.2	2:28
1000	77.8	3:52	72.8	3:39	66.2	3:23	62.3	3:13	59.2	3:04
1200	92.6	4:40	86.7	4:24	79.1	4:04	74.5	3:52	70.9	3:40
1400	107.4	5:28	100.7	5:09	92.0	4:45	86.8	4:30	82.6	4:16
1600	121.8	6:15	114.3	5:54	104.6	5:26	98.7	5:09	94.1	4:52
1800	136.3	7:03	128.0	6:39	117.2	6:07	110.7	5:47	105.5	5:28
2000	150.4	7:51	141.3	7:25	129.5	6:48	122.4	6:26	116.8	6:04
2200	164.5	8:39	154.7	8:10	141.8	7:29	134.1	7:04	128.0	6:40
2400	178.4	9:27	167.8	8:55	153.9	8:10	145.6	7:43	139.0	7:16
2600	192.2	10:15	180.9	9:40	166.0	8:51	157.1	8:21	150.0	7:52
2800	205.9	11:03	193.7	10:25	177.9	9:32	168.4	8:59	160.8	8:28
3000	219.5	11:51	206.6	11:10	189.8	10:13	179.7	9:38	171.7	9:04
3200	233.0	12:39	219.3	11:55	201.5	10:54	190.8	10:16	182.3	9:40
3400	246.4	13:27	232.0	12:40	213.1	11:35	201.9	10:55	192.9	10:16
3600	259.7	14:14	244.5	13:25	224.6	12:16	212.9	11:33	203.4	10:52
3800	273.0	15:02	257.0	14:10	236.2	12:57	223.8	12:12	213.9	11:28
4000	286.2	15:50	269.4	14:55	247.5	13:38	234.7	12:50	224.2	12:04

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
20	-2.3	-1.7	-1.0	0.0	1.6	3.6	6.0	8.8
40	-4.9	-3.6	-2.0	0.0	3.0	6.7	11.3	16.7
60	-7.3	-5.3	-2.9	0.0	4.2	9.6	16.2	23.9
80	-9.3	-7.0	-3.7	0.0	5.4	12.2	20.6	30.5
100	-11.2	-8.4	-4.5	0.0	6.4	14.6	24.6	36.4
120	-12.9	-9.6	-5.2	0.0	7.3	16.7	28.1	41.6
140	-14.5	-10.8	-5.9	0.0	8.2	18.6	31.2	46.1
160	-15.9	-11.9	-6.5	0.0	8.9	20.2	33.9	50.0
180	-17.1	-12.8	-7.0	0.0	9.5	21.6	36.1	53.2
200	-18.2	-13.6	-7.5	0.0	10.1	22.7	37.9	55.7
220	-19.1	-14.3	-7.9	0.0	10.5	23.6	39.3	57.6
240	-19.8	-14.9	-8.2	0.0	10.8	24.2	40.2	58.8
260	-20.4	-15.3	-8.5	0.0	11.0	24.6	40.7	59.3
280	-20.8	-15.7	-8.7	0.0	11.1	24.7	40.7	59.1
300	-21.0	-15.9	-8.9	0.0	11.1	24.6	40.3	58.3

Based on Long Range Cruise and VREF30+80 descent.

Descent at VREF30 + 80

PRESSURE ALTITUDE (1000 FT)	17	19	21	23	25	27	29	31	33	35
DISTANCE (NM)	35	40	44	48	52	57	61	65	69	74
TIME (MINUTES)	11	12	13	14	15	15	16	17	18	18

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
780	%N1	75.6	78.7					
	KIAS	263	263					
	FF/ENG	16810	16830					
740	%N1	74.3	77.4					
	KIAS	258	258					
	FF/ENG	16020	15990					
700	%N1	72.6	75.6					
	KIAS	252	252					
	FF/ENG	15070	15020					
660	%N1	70.5	73.7	78.1				
	KIAS	244	244	244				
	FF/ENG	14040	14000	13930				
620	%N1	68.9	72.1	76.4				
	KIAS	238	238	238				
	FF/ENG	13210	13190	13110				
580	%N1	67.0	70.0	74.4	79.0			
	KIAS	231	231	231	231			
	FF/ENG	12320	12300	12210	12270			
540	%N1	65.3	68.2	72.6	77.2			
	KIAS	225	225	225	225			
	FF/ENG	11550	11520	11430	11460			
500	%N1	63.7	66.5	70.9	75.3	80.2		
	KIAS	220	220	220	220	220		
	FF/ENG	10850	10800	10710	10710	10810		
460	%N1	62.4	65.1	69.3	73.8	78.5	83.2	
	KIAS	217	217	217	217	217	217	
	FF/ENG	10310	10240	10150	10130	10210	10360	
420	%N1	61.5	64.2	68.3	72.8	77.4	82.2	86.6
	KIAS	217	217	217	217	217	217	217
	FF/ENG	9980	9900	9800	9770	9840	9950	10210
380	%N1	60.6	63.4	67.4	71.9	76.5	81.1	85.6
	KIAS	217	217	217	217	217	217	217
	FF/ENG	9690	9600	9480	9450	9500	9600	9810
340	%N1	59.9	62.7	66.6	71.1	75.6	80.2	84.7
	KIAS	217	217	217	217	217	217	217
	FF/ENG	9440	9340	9210	9160	9200	9290	9480

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN

Holding
Flaps 1

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
780	%N1	75.4	78.5	83.3	87.9	93.5
	KIAS	243	243	243	243	243
	FF/ENG	16600	16670	16650	16900	17680
740	%N1	73.9	77.0	81.6	86.4	91.3
	KIAS	238	238	238	238	238
	FF/ENG	15730	15760	15750	15950	16530
700	%N1	72.3	75.3	79.8	84.7	89.5
	KIAS	232	232	232	232	232
	FF/ENG	14800	14810	14800	14930	15370
660	%N1	70.2	73.3	77.8	82.8	87.6
	KIAS	224	224	224	224	224
	FF/ENG	13790	13790	13780	13910	14180
620	%N1	68.4	71.6	75.9	80.8	85.7
	KIAS	218	218	218	218	218
	FF/ENG	12930	12920	12880	13010	13240
580	%N1	66.4	69.5	73.9	78.5	83.7
	KIAS	211	211	211	211	211
	FF/ENG	12020	11990	11940	12060	12220
540	%N1	64.5	67.4	71.9	76.4	81.6
	KIAS	205	205	205	205	205
	FF/ENG	11200	11160	11090	11180	11310
500	%N1	62.7	65.4	69.9	74.4	79.3
	KIAS	200	200	200	200	200
	FF/ENG	10430	10370	10290	10350	10470
460	%N1	61.1	63.8	68.0	72.5	77.3
	KIAS	197	197	197	197	197
	FF/ENG	9810	9720	9630	9660	9760
420	%N1	59.8	62.5	66.5	71.0	75.7
	KIAS	197	197	197	197	197
	FF/ENG	9360	9260	9160	9170	9240
380	%N1	58.6	61.4	65.3	69.8	74.4
	KIAS	197	197	197	197	197
	FF/ENG	8980	8880	8750	8750	8790
340	%N1	57.7	60.4	64.3	68.6	73.2
	KIAS	197	197	197	197	197
	FF/ENG	8670	8560	8420	8400	8420

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

Includes APU fuel burn

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE (FT)		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
740	713	260	3900	2100	100
700	673	253	5800	4700	2600
660	634	246	7800	6900	5400
620	596	239	9700	9000	7900
580	558	231	11800	11100	9900
540	518	224	13500	13000	11800
500	480	219	15300	14900	13800
460	440	217	16700	16100	15200
420	401	216	17900	17400	16300
380	364	216	19000	18600	17400
340	325	216	19900	19700	18600

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
760	1200		
740	2400		
720	3800	1600	
700	4800	3100	
680	5800	4600	2200
660	6800	5800	3900
640	7800	6900	5300
620	8700	8000	6500
600	9500	8800	7700
580	10700	10000	8900
560	11700	11000	9900
540	12600	12000	10800
520	13500	12900	11700
500	14400	13900	12800
480	15300	14900	13800
460	16000	15500	14500
440	16700	16100	15200
420	17300	16700	15700
400	17900	17400	16300
380	18500	18000	16800
360	19100	18700	17400
340	19600	19300	18100

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)							
		5	7	9	11	13	15	17	19
680	%N1	95.5	98.4						
	MACH	.409	.424						
	KIAS	248	248						
	FF/ENG	28146	28746						
640	%N1	93.2	95.4	98.6					
	MACH	.397	.412	.427					
	KIAS	241	241	241					
	FF/ENG	26225	26456	27266					
600	%N1	91.5	93.3	95.7	99.5				
	MACH	.389	.403	.419	.434				
	KIAS	236	236	236	236				
	FF/ENG	24774	24807	25189	26221				
560	%N1	90.1	91.0	92.8	95.4	99.5			
	MACH	.384	.390	.405	.420	.436			
	KIAS	232	228	228	228	228			
	FF/ENG	23567	22940	23073	23467	24429			
520	%N1	88.5	89.4	90.9	92.8	95.7			
	MACH	.377	.384	.395	.410	.426			
	KIAS	228	224	222	222	222			
	FF/ENG	22222	21693	21517	21725	22132			
480	%N1	86.3	87.7	88.9	90.7	92.8	95.9		
	MACH	.367	.376	.385	.400	.415	.432		
	KIAS	222	220	217	217	217	217		
	FF/ENG	20621	20340	20018	20133	20342	20771		
440	%N1	84.1	86.0	87.8	89.5	91.4	93.9	98.0	
	MACH	.358	.371	.385	.400	.415	.431	.448	
	KIAS	217	217	217	217	217	217	217	
	FF/ENG	19147	19157	19201	19323	19478	19724	20473	
400	%N1	82.9	84.8	86.7	88.4	90.3	92.4	95.7	100.4
	MACH	.358	.371	.385	.400	.415	.431	.448	.466
	KIAS	217	217	217	217	217	217	217	217
	FF/ENG	18419	18415	18447	18572	18703	18874	19343	20464
360	%N1	81.9	83.8	85.6	87.4	89.2	91.1	93.8	98.1
	MACH	.358	.371	.385	.400	.415	.431	.448	.466
	KIAS	217	217	217	217	217	217	217	217
	FF/ENG	17782	17766	17766	17877	18005	18133	18466	19312

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
165	145	129	118	108	100	95	90	84	78	73
332	295	263	238	218	200	187	175	165	155	147
500	444	396	358	327	300	280	262	246	233	221
669	593	528	477	436	400	374	350	329	310	294
837	742	661	597	545	500	467	437	410	387	367
1007	893	795	718	655	600	560	524	492	464	440
1177	1043	928	838	764	700	653	611	574	541	513
1347	1193	1061	958	873	800	746	698	655	618	586
1519	1344	1195	1078	983	900	839	785	737	695	659
1691	1496	1329	1198	1092	1000	933	873	819	772	731

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	6		8		10		12		14	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
100	8.5	0:27	7.9	0:27	7.4	0:26	7.0	0:26	6.7	0:25
200	17.1	0:52	16.3	0:52	15.6	0:50	15.0	0:49	14.5	0:48
300	25.8	1:17	24.7	1:16	23.7	1:14	23.0	1:12	22.4	1:10
400	34.3	1:42	33.0	1:41	31.8	1:38	30.9	1:36	30.1	1:33
500	42.8	2:07	41.2	2:06	39.8	2:02	38.7	1:59	37.8	1:56
600	51.2	2:33	49.3	2:30	47.8	2:26	46.5	2:22	45.5	2:18
700	59.5	2:58	57.4	2:55	55.7	2:50	54.2	2:45	53.0	2:41
800	67.7	3:24	65.5	3:20	63.5	3:14	61.9	3:09	60.6	3:03
900	75.9	3:49	73.4	3:44	71.3	3:38	69.5	3:32	68.0	3:26
1000	84.0	4:15	81.3	4:09	79.0	4:02	77.1	3:55	75.4	3:48

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Fuel Required Adjustment (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)							
	350	400	450	500	550	600	650	700
10	-1.1	-0.8	-0.5	0.0	0.9	2.0	3.9	5.3
15	-1.8	-1.3	-0.8	0.0	1.3	3.0	5.8	8.4
20	-2.5	-1.8	-1.0	0.0	1.8	4.0	7.5	11.3
25	-3.2	-2.3	-1.3	0.0	2.2	5.0	9.2	14.1
30	-3.8	-2.8	-1.6	0.0	2.6	5.9	10.8	16.8
35	-4.4	-3.3	-1.8	0.0	3.0	6.8	12.4	19.3
40	-5.1	-3.7	-2.1	0.0	3.3	7.7	13.9	21.7
45	-5.7	-4.1	-2.3	0.0	3.7	8.5	15.3	24.0
50	-6.2	-4.6	-2.6	0.0	4.0	9.3	16.7	26.2
55	-6.8	-5.0	-2.8	0.0	4.3	10.1	18.0	28.2
60	-7.4	-5.4	-3.0	0.0	4.6	10.8	19.2	30.1
65	-7.9	-5.8	-3.2	0.0	4.9	11.5	20.4	31.9
70	-8.5	-6.2	-3.4	0.0	5.1	12.2	21.5	33.5
75	-9.0	-6.6	-3.6	0.0	5.3	12.8	22.5	35.1
80	-9.5	-7.0	-3.8	0.0	5.5	13.4	23.5	36.5
85	-10.0	-7.3	-4.0	0.0	5.7	13.9	24.4	37.7

Based on Long Range Cruise and VREF30+80 descent. Includes APU fuel burn.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
740	%N1	95.1			
	KIAS	258			
	FF/ENG	32540			
700	%N1	93.1	96.9		
	KIAS	252	252		
	FF/ENG	30570	30800		
660	%N1	91.1	94.2		
	KIAS	244	244		
	FF/ENG	28530	28460		
620	%N1	89.4	92.4	99.1	
	KIAS	238	238	238	
	FF/ENG	26790	26760	28090	
580	%N1	87.2	90.3	95.4	
	KIAS	231	231	231	
	FF/ENG	24830	24970	25420	
540	%N1	85.2	88.5	92.8	
	KIAS	225	225	225	
	FF/ENG	23160	23320	23520	
500	%N1	83.1	86.5	90.8	98.1
	KIAS	220	220	220	220
	FF/ENG	21620	21750	21880	23000
460	%N1	81.4	84.7	89.2	94.8
	KIAS	217	217	217	217
	FF/ENG	20400	20510	20640	21230
420	%N1	80.2	83.5	88.1	93.1
	KIAS	217	217	217	217
	FF/ENG	19600	19710	19810	20240
380	%N1	79.2	82.4	87.1	91.7
	KIAS	217	217	217	217
	FF/ENG	18890	18990	19060	19430
340	%N1	78.3	81.4	86.1	90.6
	KIAS	217	217	217	217
	FF/ENG	18280	18380	18390	18690

This table includes 5% additional fuel for holding in a racetrack pattern.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer. In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the Approved Flight Manual, the Flight Manual shall always take precedence.

General

FMC Takeoff Speeds

FMC computed takeoff speeds can be used for all performance conditions and takeoff weight at or higher than 340,000 lb (154,221 kg) except where adjustments must be made to V1 for brake deactivation, improved climb, contaminated runway situations, unbalanced for brake energy or obstacle clearance with unbalanced V1. V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions. These speeds may be used for weights less than or equal to the performance limited weight.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. The FMC computes takeoff speeds consistent with the Takeoff Speeds tables described in Chapter Performance Dispatch, however, the FMC takeoff speeds should not be used for takeoff weight lower than 340,000 lb (154,221 kg) as stated in the Airplane Flight Manual. To obtain speeds for the takeoff in these situations, use available performance software.

VREF Speeds

This table contains flaps 30, 25 and 20 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides the flap speed schedule for recommended maneuver speeds. Using VREF as the basis for the schedule makes it variable as a function of weight and will provide adequate maneuver margin above stall at all weights.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

During flap retraction/extension, movement of the flap to the next position should be initiated when within 20 knots of the recommended speed for that position.

Slush/Standing Water

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in runway/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical colder weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight is determined as follows:

(1) Determine the dry field/obstacle limit weight for the takeoff flap setting.

(2) Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.

(3) Adjust field length available for temperature by amount shown on chart.

(4) Enter the V1(MCG) Limit Weight table with the field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 2 and 4.

Takeoff speed determination:

(1) Determine takeoff speeds V1, VR and V2 for actual brake release weight using Takeoff Speeds from the Performance Dispatch chapter or from the FMC.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

(2) If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on reversers operating and a 15 ft. screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Minimum Control Speeds

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG), and VR less than minimum VR, (1.05) VMCA. It is therefore necessary to compare the adjusted V1 and VR to V1(MCG) and Minimum VR respectively. To find V1(MCG) and Minimum VR, enter the V1(MCG), Minimum VR table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than Min VR, set VR equal to Min VR and determine a new V2 by adding the difference between the normal VR and Min VR to the normal V2. No takeoff weight adjustment is necessary provided that the field length available exceeds the minimum field length shown in the Field and Climb Limit Weight table.

Go-Around %N1

To find Go-Around %N1 based on normal engine bleed for packs on and anti-ice off, enter the Go-Around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. %N1 adjustments are shown for engine bleeds for various conditions.

Max Climb %N1

This table shows Max Climb %N1 for a 310/.84 climb speed schedule, normal engine bleed for packs on and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Body attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome may also cause unreliable airspeed/Mach indications. Climb, cruise and descent information is based on the recommended turbulent air penetration speed schedule: 270 knots below 25,000 feet, 280 knots or 0.82 Mach whichever is lower at 25,000 feet and above; maintain a minimum speed of 15 knots above the minimum maneuvering speed when below 0.82 Mach. This schedule provides ample protection from stall and high speed buffet, while also providing protection from exceeding structural limits. The Climb, Cruise and Descent tables in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed may also be unreliable.

Flight at Low Gross Weight

Flight at weights lower than 340,000 lb (154,221 kg) require the use of the Alternate Low Weight Operations AFM-DPI performance. The Performance Inflight sections contain only data that is considered to be minimal operationally necessary to support flight operations after dispatch. This consists of VREF, Normal Configuration Landing Distances and Non-normal Landing Configuration Distances. Low gross weight operations should be a planned event and the crews should be provided all necessary performance data from their flight planning software.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that these tables consider both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 300 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 21° may cause the airplane to lose speed and/or altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Note that optimum altitudes shown in the tables result in buffet related maneuver margins of approximately 1.3g (39° bank) or more. The altitudes shown in the table are limited to the maximum certified altitude of 43100 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude, .84 Mach approximates the Long Range Cruise Mach schedule.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .84/310/250 descent. Tables are presented for low altitudes for shorter trip distances and high altitudes for longer trip distances.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Descent at .84/310/250

Distance and time for descent are shown for a .84/310/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance in nautical miles and time in minutes. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing Flaps 30 at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed for the selected flap setting. Flaps 1 is based on VREF30 + 60 speed schedule. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Runway Surface Condition Correlation

When landing on slippery runways or runways contaminated with ice, snow, slush, or standing water, the reported braking action must be considered. A table is provided that correlates runway condition code to runway surface condition description and reported braking action that can then be used to determine the appropriate Normal Configuration Landing Distance or Non-Normal Configuration Landing Distance.

Normal Configuration Landing Distance

Tables are provided as advisory information for normal configuration landing distances on dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are 115% of the actual landing distance. The Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, two-engine maximum reverse thrust, and auto speedbrakes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

To use these tables, determine the reference landing distance for the selected braking configuration and reported braking action. Adjust this reference distance for landing weight, altitude, wind, slope, temperature, approach speed, and the number of operative thrust reversers. Each correction is applied independently to the reference landing distance. A correction for use of manual speedbrakes is provided in the table notes.

Use of the autobrake system commands the airplane to a constant deceleration rate. In some conditions, such as a runway with "poor" reported braking action, the airplane may not be able to achieve these deceleration rates. In these cases, runway slope and inoperative reversers influence the stopping distance. Since it cannot be determined quickly when this becomes a factor, it is appropriate to add the effects of slope and inoperative reversers when using the autobrake system.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect landing. Landing distances and adjustments are provided for dry runways and runways with good, good-to-medium, medium, medium-to-poor, and poor reported braking action. Landing distances (reference distances plus adjustments) are representative of the actual landing distance, and are not factored. The Non-Normal Configuration Landing Distance tables should be used enroute to make a landing distance assessment for time of arrival.

The reference landing distance is the distance from threshold to complete stop. It includes an air distance allowance of 1500 ft from threshold to touchdown. The reference distance is based on a reference landing weight and speed at sea level, standard day, zero wind, zero slope, and maximum available reverse thrust.

Tables for Non-Normal Configuration Landing Distance in this section are similar in format and used in the same manner as tables for the Normal Configuration Landing Distance previously described.

For an engine inoperative landing, check the rate of climb capability shown in Gear Down Landing Rate of Climb Available tables to ensure adequate climb performance.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach or Landing Climb Limited Weight

In the event an overweight landing is necessary and the fuel dump system is unavailable, approach or landing climb limits should be checked if a Flaps 25 or 30 landing is planned. Enter the table with airport OAT and pressure altitude to read approach or landing climb limited weight. Apply the noted adjustments as required. At weights exceeding those shown, plan a Flaps 20 landing.

The table "Approach or Landing Climb Limited Weight" presents the data which are the more limiting of Approach Climb Limit Weight and Landing Climb Limit Weight.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind, at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff.

To determine the energy per brake absorbed during landing, enter the appropriate Event Adjusted Brake Energy Table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing. The recommended cooling time is found in the final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted, may be used to determine recommended cooling schedule by entering at the bottom of the chart. An EICAS advisory message, BRAKE TEMP, will appear when any brake registers 5.0 or higher on the EICAS indication and disappear as the hottest brake cools with an EICAS indication of 3.5. Note that even without an EICAS advisory message, brake cooling is recommended.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise Mach number of .84 to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 Table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with engine bleed for packs on or off and all anti-ice bleeds off. Enter the table with pressure altitude and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Driftdown/Cruise Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to long range cruise speed. Cruise is continued at level off altitude and long range cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and correct for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Diversion Fuel and Time table.

Long Range Cruise Altitude Capability

Table show the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on LRC speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW PENALTY (LB/HR)				
	GROSS WEIGHT (1000 LB)				
	700	600	500	400	300
43				360	310
39			420	360	310
35		470	420	380	300
31	520	500	450	370	310
25	510	490	440	380	340
20	520	520	460	410	360
15	520	520	480	440	400
10	540	520	510	490	440
5	590	590	570	530	480

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .84/310/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion Table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel corrections table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel and time required for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing is planned. The tables show gear down rate of climb available for Flaps 20, Flaps 25 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Mode EEC

For most conditions, no takeoff speed adjustments or other performance adjustments other than takeoff power setting adjustments are required for operation of EEC in the ALTERNATE mode. For pressure altitudes between -2000 feet and -1000 feet and temperatures greater than ISA + 15°C, a thrust reduction occurs with EEC in the ALTERNATE mode. Performance software must be used to account for appropriate takeoff performance in this environmental region.

Max Takeoff %N1

Takeoff power settings are presented for normal air condition bleed. Max Takeoff %N1 may be read directly from the tables for the desired pressure altitude and airport OAT.

The EEC ALTERNATE mode schedule provides equal or greater thrust than the normal mode for the same lever position. Thrust protection is not provided in the ALTERNATE mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions.

Gear Down

This section contains performance for airplane operation with the landing gear extended for all phases of flight. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS will generate inaccurate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. To obtain accurate ETA predictions, gear down cruise speed and altitude should be entered on the CLB and CRZ pages. Gear down cruise speed should also be entered on the DES page and a STEP SIZE of zero should be entered on the PERF INIT or CRZ page. Use of VNAV during descent under these circumstances is not recommended.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Crew Operations Manual
777-8 & -9 Incorporation

The Boeing Company
Seattle, Washington 98124-2207

Flight Crew Operations Manual Information

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

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

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

Administrative Information

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Dimensions 1.10
Principal Dimensions 1.10.1
Turning Radius 1.10.4

Instrument Panels. 1.20
Flight Deck Panels 1.20.1

Inst. Panels, Overhead 1.21
Overhead Panel 1.21.1
Overhead Maintenance Panel 1.21.2

Inst. Panels, Fwd. 1.22
Left Forward Panel 1.22.1
Right Forward Panel 1.22.3
Glareshield Panel 1.22.5
Center Forward Panel 1.22.7
EICAS Display 1.22.7
Forward Aisle Stand 1.22.8
Multifunction Display. 1.22.9

Inst. Panels, Aft and Side 1.23
Control Stand 1.23.1
Aft Aisle Stand. 1.23.2
Left and Right Sidewall, First Observer, and Maintenance Access Terminal/Second Observer Panels 1.23.3

Controls and Indicators 1.30
Push–Button Switches 1.30.1
Alternate Action Switches 1.30.1
Momentary Action Switches 1.30.2

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Signs and Lighting 1.30.3
Lighting Panel 1.30.10
Miscellaneous Lighting Controls 1.30.12
Flight Deck Emergency Lights Switch 1.30.12
Cabin Emergency Lights Switch. 1.30.12
Floor Lights Switch. 1.30.13
Aisle Stand Panel/Flood Light Control 1.30.13
Map Light Control. 1.30.14
Forward Panel Brightness Controls 1.30.14
Doors and Windows 1.30.15
Door Synoptic Display 1.30.15
Entry Door. 1.30.18
Overwing Emergency Exit Door. 1.30.19
Door Mode Select Panel 1.30.20
Flight Deck Door. 1.30.23
Flight Deck Number Two Window. 1.30.26
Oxygen Systems 1.30.27
Oxygen Indications 1.30.27
Passenger Oxygen Switch 1.30.28
Supernumerary Oxygen Switch 1.30.28
Oxygen Mask Panel 1.30.29
Oxygen Mask and Regulator. 1.30.30
Emergency Evacuation Panel 1.30.32
Fuselage Mounted Emergency Locator Transmitter 1.30.33

Systems Description 1.40
Introduction 1.40.1
Lighting Systems 1.40.1
Exterior Lighting. 1.40.1
Exterior Lighting Locations 1.40.3
Flight Deck Lighting. 1.40.3
Master Brightness Control System 1.40.4
Cabin Lighting 1.40.5
Cabin Signs 1.40.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cabin Signs 1.40.6
Emergency Lighting 1.40.7
Oxygen Systems 1.40.12
Flight Crew Oxygen System. 1.40.12
Passenger Oxygen System 1.40.13
Supernumerary Oxygen System 1.40.13

Emergency Equipment. 1.45
Emergency Equipment Overview 1.45.1
Emergency Evacuation Signal System 1.45.1
Emergency Locator Transmitter (ELT) 1.45.1
Fuselage Mounted Emergency Locator Transmitter (ELT) . . . 1.45.2
Miscellaneous Portable Emergency Equipment 1.45.2
Fire Extinguishers 1.45.2
Halon and Halon Equivalent Fire Extinguishers 1.45.3
Water Fire Extinguishers 1.45.3
Portable Oxygen Bottles 1.45.4
Flashlights 1.45.4
Emergency Equipment. 1.45.7
Emergency Equipment Symbols 1.45.7
Emergency Equipment Locations - Passenger Airplane 1.45.7
Emergency Equipment Locations - Freighter. 1.45.14

Crew Rest 1.46
Introduction 1.46.1
Crew Rest. 1.46.1
General 1.46.1
Occupancy 1.46.2
Lower Crew Rest (LCR). 1.46.2
Door 5 Overhead Crew Rest. 1.46.3
Flight Crew Rest Layout. 1.46.4
Entrance Enclosure Door Lock. 1.46.5

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Control and Indicators 1.46.6
Main Control Panel 1.46.6
Lower Crew Rest (LCR) Control Panel 1.46.9
Amenities Module 1.46.13
Oxygen System 1.46.15
Decompression 1.46.16
Smoke and Fire 1.46.16
Crew Rest Smoke Detection 1.46.17
LCR Fire Protection 1.46.19
Emergency Equipment 1.46.21
Emergency Equipment Symbols 1.46.21
Emergency Equipment Location 1.46.21
Evacuation from the Crew Rest Area 1.46.23
Door 5 Overhead Crew Rest Emergency Hatch 1.46.23
Lower Crew Rest Emergency Hatch 1.46.27
Supernumerary Area 1.47.1
Supernumerary Area Layout 1.47.2
Supernumerary Display and Control Panel 1.47.3
Entry Door 1.47.10
Decompression 1.47.17
Supernumerary Oxygen 1.47.18
Rigid Cargo Barrier 1.47.20

Doors, Windows, Seats 1.50
Introduction 1.50.1
Doors and Windows 1.50.1
Flight Deck Door 1.50.2
Flight Deck Number Two Windows 1.50.3
Entry Doors 1.50.4
Entry Door Slide/Raft 1.50.5
Overwing Escape Slide 1.50.6
Emergency Exit Operation 1.50.6
Cargo Doors 1.50.13

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Deck Seats 1.50.14
Pilot Seats 1.50.15
Pilot Seat Adjustment 1.50.18
Observer Seats 1.50.19

EICAS Messages 1.60
Airplane General, Emergency Equipment, Doors, Windows EICAS Messages 1.60.1
EICAS Memo Messages 1.60.3

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Principal Dimensions

HL7574 - HL7766

777-200 and 777-200ER

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7573

777-300

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

777-300ER

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

777-Freighter

Turning Radius

The wing tip swings the largest arc while turning and determines the minimum obstruction clearance path. All other portions of the airplane structure remain within this arc.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7574 - HL7766

777-200 and 777-200ER

HL7574 - HL7766

CAUTION: Do not attempt to make a turn away from an obstacle within 15 feet (4.6 m) of the wing tip, or within 50 feet (15.2 m) of the nose.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

777-Freighter

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

CAUTION: Do not attempt to make a turn away from an obstacle within 15 feet (4.6 m) of the wing tip, or within 55 feet (16.8 m) of the nose.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7573

777-300

HL7532 - HL7573

CAUTION: Do not attempt to make a turn away from an obstacle within 15 feet (4.6 m) of the wing tip, or within 39 feet (11.9 m) of the nose.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

777-300ER

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

CAUTION: Do not attempt to make a turn away from an obstacle within 15 feet (4.6 m) of the wing tip, or within 45 feet (13.9 m) of the nose.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

Note: Do not touch glass displays with bare hands. This can cause damage to the coating.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Overhead Panel

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Overhead Maintenance Panel

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Left Forward Panel

HL7532 - HL7783, HL8208 - HL8218, HL8250 - HL8252

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Right Forward Panel

HL7532 - HL7783, HL8208 - HL8218, HL8250 - HL8252

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Glareshield Panel

HL7574 - HL7766, HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Center Forward Panel

EICAS Display

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Forward Aisle Stand

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Multifunction Display

HL7574 - HL7766, HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Control Stand

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Aft Aisle Stand

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Left and Right Sidewall, First Observer, and Maintenance Access Terminal/Second Observer Panels

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Push–Button Switches

The airplane has two types of push–button switches: alternate action and momentary action. Both types direct crew attention to system status and faults.

Note: Maintenance personnel should change switch lights. Changing the light requires changing the entire switch cap.

Alternate Action Switches

Alternate action switches have two positions: on and off.

When pushed in and flush with the panel, the switch is on. When the switch is on, a mechanical shutter on the top half of the switch opens to show an illuminated legend, such as "ON", "AUTO" or a flow bar.

When pushed out and extended, the switch is off. When the switch is off, the mechanical shutter closes so the legend is not shown.

Additionally, the bottom half of many switches has a light to indicate system state, such as "PRESS", "FAIL", "INOP", OR "OFF".

1 Switch is ON

ON, AUTO, or flow bar visible.

For some switches, system status (FAULT, MAN, OFF, VALVE) may be shown in the lower half of the switch.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Switch is OFF

OFF or a line is visible –

- the top of the switch is blank
- a line indicates no label in this portion of the switch.

Momentary Action Switches

Momentary action switches are spring loaded to the extended position. They are used to activate or deactivate systems or to reset system logic. The switch display indicates system status.

1 Push to Reset

Push – the switch resets the master lights and aural alerts.

2 System Operation

Push – activates or deactivates the system.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Signs and Lighting

HL7532 - HL7766

HL7532 - HL7598

OVERHEAD PANEL

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7733 - HL7766

OVERHEAD PANEL

HL7532 - HL7598

1 NO SMOKING Selector

OFF – the NO SMOKING signs are not illuminated.

AUTO – the NO SMOKING signs are illuminated or extinguished automatically with reference to cabin altitude and system configuration (refer to the Lighting System Description section).

ON – the NO SMOKING signs are illuminated.

Note: Any time passenger oxygen is deployed, the NO SMOKING and FASTEN SEAT BELTS signs illuminate automatically, regardless of the selector position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7733 - HL7766

1 NO SMOKING Selector

ON – the selector does not operate the NO SMOKING signs. The NO SMOKING signs throughout the airplane are always illuminated.

The selector may be used to operate the cabin aural chime (refer to the Lighting System Description section for chime operations).

2 DOME Light Control

Controls overhead dome light brightness.

3 Overhead (OVHD) Panel Light Control (outer)

Rotate – controls overhead panel light brightness.

4 Circuit Breaker (CB) Panel Light Control (inner)

Rotate – controls circuit breaker panel light brightness.

5 GLARESHIELD Panel (PNL) Light Control (outer)

Rotate – controls glareshield panel light and standby compass brightness.

6 GLARESHIELD FLOOD Panel Light Control (inner)

Rotate – controls glareshield flood light brightness.

7 SEAT BELTS Selector

OFF – the FASTEN SEAT BELTS and RETURN TO SEAT signs are not illuminated.

AUTO – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated or extinguished automatically with reference to airplane altitude and system configuration (refer to the Lighting System Description section).

ON – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated.

HL7532 - HL7598

Note: Any time passenger oxygen is deployed, the NO SMOKING and FASTEN SEAT BELTS signs illuminate automatically, regardless of the selector position.

HL7733 - HL7766

Note: Any time passenger oxygen is deployed, the FASTEN SEAT BELTS signs illuminate automatically, regardless of the selector position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

8 STORM Light Switch

ON – overrides normal controls and illuminates the following lights at maximum brightness:

- all illuminated indicator lights
- glareshield flood lights
- instrument panel flood lights
- aisle stand flood lights
- dome lights.

9 MASTER Brightness (BRIGHT) Light Control (outer)

Rotate (when the MASTER BRIGHTNESS switch is pushed on) –:

- controls the brightness of all panel lights and displays (dome lights, flood lights, and circuit breaker panel lights are not controlled by this switch)
- overrides individual brightness control settings
- limits adjustment range of individual brightness controls
- has full adjustment range of all lights when all individual brightness controls are set to the center detent.

10 MASTER Brightness (BRIGHT) Light Switch (inner)

A black ring on the side of the inner switch is visible when the switch is out (OFF).

PUSH ON (in) – the MASTER BRIGHTNESS control is on.

PUSH OFF (out) – the MASTER BRIGHTNESS control is off.

Note: If display brightness cannot be set as desired when master brightness is on, pushing the MASTER BRIGHTNESS switch off may allow setting display brightness to an appropriate level using individual brightness controls.

11 LANDING Light Switches

OFF – the landing light is not illuminated.

ON – the landing light is illuminated.

Note: The nose gear landing lights cannot illuminate when the nose landing gear is not down and locked.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

OVERHEAD PANEL

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 DOME Light Control

Controls overhead dome light brightness.

2 Overhead (OVHD) Panel Light Control (outer)

Rotate – controls overhead panel light brightness.

3 Circuit Breaker (CB) Panel Light Control (inner)

Rotate – controls circuit breaker panel light brightness.

4 GLARESHIELD Panel (PNL) Light Control (outer)

Rotate – controls glareshield panel light and standby compass brightness.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 GLARESHIELD FLOOD Panel Light Control (inner)

Rotate – controls glareshield flood light brightness.

6 SEAT BELTS Selector

OFF – the FASTEN SEAT BELTS and RETURN TO SEAT signs are not illuminated.

AUTO – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated or extinguished automatically with reference to airplane altitude and system configuration (refer to the Lighting System Description section).

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
ON – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
ON – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated. When selected, the main deck sidewall lights are flashed for several seconds.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Note: Any time passenger oxygen is deployed, the FASTEN SEAT BELTS signs illuminate and RETURN TO SEAT signs extinguish, regardless of selector position.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Note: Any time supernumerary oxygen is deployed, the FASTEN SEAT BELTS signs illuminate and RETURN TO SEAT signs extinguish, regardless of selector position.

7 STORM Light Switch

ON – overrides normal controls and illuminates the following lights at maximum brightness:

- all illuminated indicator lights
- glareshield flood lights
- instrument panel flood lights
- aisle stand flood lights
- dome lights.

8 MASTER Brightness (BRIGHT) Light Control (outer)

Rotate (when the MASTER BRIGHTNESS switch is pushed on) –:

- controls the brightness of all panel lights and displays (dome lights, flood lights, and circuit breaker panel lights are not controlled by this switch)
- overrides individual brightness control settings

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- limits adjustment range of individual brightness controls
- has full adjustment range of all lights when all individual brightness controls are set to the center detent.

9 MASTER Brightness (BRIGHT) Light Switch (inner)

A black ring on the side of the inner switch is visible when the switch is out (OFF).

PUSH ON (in) – the MASTER BRIGHTNESS control is on.

PUSH OFF (out) – the MASTER BRIGHTNESS control is off.

Note: If display brightness cannot be set as desired when master brightness is on, pushing the MASTER BRIGHTNESS switch off may allow setting display brightness to an appropriate level using individual brightness controls.

10 LANDING Light Switches

OFF – the landing light is not illuminated.

ON – the landing light is illuminated.

Note: The nose gear landing lights cannot illuminate when the nose landing gear is not down and locked.

Lighting Panel

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 BEACON Light Switch

ON – the red anticollision beacon lights on the top and bottom of the fuselage operate.

2 Navigation (NAV) Position Light Switch

ON – the red, green, and white navigation position lights are illuminated.

3 LOGO Light Switch

ON – the stabilizer–mounted logo lights illuminate the airline logo on the vertical tail surface.

4 WING Light Switch

ON – the wing leading edge illumination lights are illuminated.

5 Indicator Lights (IND LTS) Switch

TEST (spring–loaded):

- illuminates all annunciator lights to full brightness for 10 seconds to check the bulbs, then dims the lights as long as the switch is held
- causes test patterns to display on the stabilizer position indicators, rudder trim indicator, and radio tuning panel displays.

BRT – sets all illuminated annunciator lights to full brightness.

DIM – sets all illuminated annunciator lights to low brightness.

6 STROBE Light Switch

OFF – the white anticollision strobe lights on the tips of each wing and the tailcone are off.

ON – the strobe lights operate.

7 TAXI Light Switch

OFF – the taxi lights are extinguished.

ON – the taxi lights are illuminated.

Note: The taxi lights do not illuminate when the nose landing gear is not down and locked

8 RUNWAY TURNOFF Light Switches

OFF – the runway turnoff light is extinguished.

ON – the runway turnoff light is illuminated.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Miscellaneous Lighting Controls
Flight Deck Emergency Lights Switch

1 Emergency (EMER) LIGHTS Switch

OFF – prevents emergency lights system operation if airplane electrical power fails or is turned off.

ARMED – all emergency lights illuminate automatically if airplane electrical power fails or is turned off.

ON – all emergency lights illuminate.

Cabin Emergency Lights Switch

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Cabin Emergency (EMER) LIGHTS Switch

Push –

- Illuminated (red):
  - all cabin and exterior emergency lights illuminate
  - bypasses the flight deck emergency lights switch
- Extinguished: all cabin and exterior emergency lights extinguish.

Floor Lights Switch

1 FLOOR LIGHTS Switch

OFF – the flight deck floor lights are not illuminated.

BRT – the floor lights are illuminated bright.

DIM – the floor lights are illuminated dim.

Aisle Stand Panel/Flood Light Control

1 AISLE STAND Panel (PNL) Light Control (outer)

Rotate – controls the aisle stand instrument panel light brightness.

2 AISLE STAND FLOOD Light Control (inner)

Rotate – controls the aisle stand flood light brightness.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Map Light Control

1 MAP Light Control

Pull – on.

Push – off.

Rotate – adjusts map light brightness.

Forward Panel Brightness Controls

Note: The display and weather radar brightness controls are described in Chapter 10, Flight Instruments, Displays.

1 Forward (FWD) PANEL BRIGHTNESS Light Control (outer)

Rotate – Controls forward panel lights brightness.

2 Forward (FWD) PANEL FLOOD BRIGHTNESS Light Control (inner)

Rotate – Controls forward panel flood light brightness.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Doors and Windows
Door Synoptic Display

The doors synoptic is displayed by pushing the DOOR synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

HL7574 - HL7766

A (green) – Door mode is armed
M (white) – Door mode is manual.
(blank) - Door mode is not available

(amber) – passenger door open
(blank) – passenger door closed
(white) – door status is not available
(amber) – cargo/access door open
(blank) – cargo/access door closed
(white) – door status is not available

MULTIFUNCTION DISPLAY

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

A (green) – Door mode is automatic (armed)
M (white) – Door mode is manual (disarmed)
(blank) – Door mode is not available

(amber) – passenger door open
(blank) – passenger door closed
(white) – door status is not available
(amber) – cargo/access door open
(blank) – cargo/access door closed
(white) – door status is not available

MULTIFUNCTION DISPLAY

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

A (green) – Door mode is armed
M (white) – Door mode is manual.
(blank) - Door mode is not available

(amber) – passenger door open
(blank) – passenger door closed
(white) – door status is not available
(amber) – cargo/access door open
(blank) – cargo/access door closed
(white) – door status is not available

MULTIFUNCTION DISPLAY

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Entry Door

1 Viewing Window

Allows observation outside the airplane.

2 Slide/Raft Gas Bottle Pressure Gage

Maintenance use only.

3 Door Mode Select Panel

See door mode select panel section.

4 Power Assist Reservoir Pressure Gage

If the gage needle is outside the green zone, the system is unusable.

5 Gust Lock Release Lever

Grab and pull inward to close the door.

6 Door Operating Handle

To open the door – rotate in the direction of the arrow.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

To close the door – rotate in the opposite direction of the arrow.

7 Slide/Raft

The bustle contains the slide/raft.

8 Girt Bar Indicator Flag Viewing Windows

Yellow in view – door and slide/raft are armed.

Black in view – door and slide/raft are not armed.

Overwing Emergency Exit Door

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

1 Viewing Window

Allows observation outside the airplane.

2 Door Mode Select Panel

See door mode select panel section.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Power Assist Reservoir Pressure Gage

If the gage needle is outside the green zone, the system is unusable.

4 Gust Lock Release Lever

Grab and pull inward to close the door.

5 Door Operating Handle

To open the door – rotate in the direction of the arrow.

To close the door – rotate in the opposite direction of the arrow.

Door Mode Select Panel

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 ARMED

Red.

Door is armed if the mode select lever is in the middle of the red band.

Note: If the door is opened from the outside, the mode select lever automatically moves to the DISARMED position.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

1 AUTOMATIC

Red.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Door is armed if the mode select lever is in the middle of the red band.

Note: If the door is opened from the outside, the mode select lever automatically moves to the MANUAL position.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
2 DISARMED

Green.

Door is disarmed if the mode select lever is in the middle of the green band.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
2 MANUAL

Green.

Door is disarmed if the mode select lever is in the middle of the green band.

3 Door Mode Select Lever

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Used to select the required mode for flight, ARMED, or arrival, DISARMED.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Used to select the required mode for flight, AUTOMATIC, or arrival, MANUAL.

4 Unsafe Band

If the mode select lever is anywhere in the unsafe band, the door may be either armed or disarmed.

CAUTION: To ensure that the door is properly armed or disarmed, the door mode select lever must be positioned fully in the red or green band and remain there when released. If the door will not properly arm or disarm, contact maintenance to service the door prior to opening or closing the affected door.

WARNING: Do not attempt to move a slide pack which has released from the door. Contact maintenance.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Deck Door

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Deck Access System Switch

1 FLIGHT DECK ACCESS SYSTEM Switch

OFF - removes electrical power from door lock.

NORM (Normal) - flight deck access system configured for flight.

Flight Deck Door Lock Panel

1 LOCK FAIL Light

Illuminated (amber) - Flight Deck Door Lock selector in AUTO and door lock has failed or Flight Deck Access System switch in OFF.

2 AUTO Unlock (UNLK) Light

Illuminated (amber) - correct emergency access code entered in keypad. AUTO UNLK light flashes and continuous chime sounds before timer expires and door unlocks.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Flight (FLT) DECK DOOR Lock Selector

Spring loaded to AUTO. Selector must be pushed in to rotate from AUTO to UNLKD. Selector must not be pushed in to rotate from AUTO to DENY.

UNLKD - door unlocked while selector in UNLKD.

AUTO - door locked. Allows door to unlock after entry of emergency access code and expiration of timer, unless crew takes action.

DENY - rejects keypad entry request and prevents further emergency access code entry for a time period.

Flight Deck Number Two Window

1 Window Lock Lever

Forward – with the window fully closed, locks the window. If the lock lever is properly locked, the orange indicator is not visible below the release button. The EICAS message WINDOW FLT DECK L, R displays if a window is not properly latched.

Aft – unlocks the window so it can be cranked open.

2 Window Crank

Used to position the window open or closed when the window lock lever is unlocked.

To reposition the window crank without moving the window, push and hold the button in the center of the window crank.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Oxygen Systems
Oxygen Indications

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 Oxygen Pressure Display

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Displays crew oxygen cylinder pressure (PSI).

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Displays crew and supernumerary oxygen cylinder pressure (PSI).

Note: Access is through the display select panel STATUS switch.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Passenger Oxygen Switch

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

1 Passenger (PASS) OXYGEN Switch

Push – the cabin oxygen masks drop.

2 Passenger Oxygen ON Light

Illuminated (amber) – The passenger oxygen system is operating and the masks have dropped.

Supernumerary Oxygen Switch

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 Supernumerary (SUPRNMRY) OXYGEN Switch

RESET (spring–loaded) – flow control units close if cabin altitude is below 13,500 feet.

NORM – system activates when cabin altitude reaches approximately 13,500 feet.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ON (spring-loaded) – system activates and cabin oxygen masks drop.

Oxygen Mask Panel

1 Oxygen Flow Indicator

Shows a yellow cross when oxygen is flowing.

2 RESET/TEST Switch

Push –

- with the left oxygen panel door closed and the OXY ON flag not displayed, turns oxygen on momentarily to test the regulator
- with the left oxygen panel door closed and the OXY ON flag displayed:
  - turns oxygen off and deactivates the mask microphone
  - reactivates the boom microphone.

3 Oxygen Mask Release Levers

Squeeze and pull –

- unlocks the oxygen panel doors
- releases the mask

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- oxygen turns on when the oxygen panel doors open
- automatically selects the mask microphone when the left oxygen panel door is opened
- disables the boom microphone.

Squeeze (right lever) – inflates the mask harness.

Release – deflates the mask harness into position on the head and face.

4 Oxygen (OXY) ON Flag

In view - oxygen is on.

Oxygen Mask and Regulator

(HL7532 - HL7598 ; before SB, oxygen mask protective strip installed)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347
(HL7532 - HL7598 ; SB removes protective strip)

1 NORMAL/100% Switch

N – supplies an air/oxygen mixture on demand (the ratio depends on cabin altitude).

100% – supplies 100% oxygen on demand (not an air/oxygen mixture).

2 Oxygen Mask Emergency/Test Selector

Normal (non-emergency) position - supplies air/oxygen mixture or 100% oxygen on demand, depending upon the position of the Normal/100% switch. Automatically supplies 100% oxygen under positive pressure when cabin altitude is above a preset value.

EMERGENCY position (rotate in the direction of the arrow) – supplies 100% oxygen under positive pressure at all cabin altitudes (protects against smoke and harmful vapors). Use to purge contaminants from the mask and to remove condensation or fogging from interior of mask lens.

PRESS TO TEST– tests the positive pressure supply to the regulator.

CAUTION: Use of EMER mode depletes oxygen supply at higher rate than 100% or NORM mode. Use EMER mode only as conditions require.

Note: Communication in EMER mode may be difficult. Switch to 100% or NORM mode if conditions allow.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

(HL7532 - HL7598 ; before SB, oxygen mask protective strip installed)

3 Protective Strip

There is a protective strip of clear plastic on the top portion of the lens. This strip can be peeled off using the tab on the right side in case of icing caused by a rapid depressurization.

Emergency Evacuation Panel

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

1 Evacuation COMMAND Switch

ON –

- the red EVAC light (flight deck) and amber EVAC lights (flight attendant panels) flash
- an audio horn sounds at each panel.

OFF (guarded position) - the evacuation signals can be activated at the flight attendant panels.

2 Evacuation (EVAC) PRESS TO TEST Switch

Push – tests the EVAC light.

3 Evacuation (EVAC) Light

Illuminated (red) – a command switch is in the ON position.

4 EVACUATION SIGNAL Horn

Sounds an audio signal.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 Evacuation HORN SHUTOFF Switch

PULL – Silences the flight deck evacuation signal horn.

Fuselage Mounted Emergency Locator Transmitter

HL7202 - HL7205, HL7733 - HL8347

1 Emergency Locator Transmitter (ELT) Switch

RESET (spring-loaded) – ends transmission of emergency locator signal.

ARMED (guarded position) – transmits emergency locator signal if activated by high deceleration forces.

ON – transmits emergency locator signal.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This section describes miscellaneous airplane systems, including:

- lighting systems
- oxygen systems

Lighting Systems

Lighting systems described in this section include:

- exterior lighting
- flight deck lighting

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- cabin lighting

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

- main deck lighting
- emergency lighting.

Exterior Lighting

Exterior lighting consists of these lights:

- landing
- runway turnoff
- taxi
- strobe
- beacon
- navigation (position)
- logo
- wing leading edge illumination
- escape slide emergency lights.

Landing Lights

The landing lights consist of the left, right, and nose gear landing lights. The left and right landing lights are located in the left and right wing root. These lights are optimized for flare and ground roll. The two nose gear–located landing lights are optimized for approach.

Runway Turnoff Lights

Runway turnoff lights are installed in the left and right wing roots. The lights illuminate the area in front of the main gear.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Taxi Lights

Taxi lights are installed on the non–steerable portion of the nose strut. They are inoperative when the nose landing gear is not down and locked.

Strobe Lights

The strobe lights are white anti-collision strobe lights located on each forward wing tip and on the tail cone.

Beacon Lights

The beacon lights are red anti-collision strobe lights located on the top and bottom of the fuselage.

Navigation Position Lights

The navigation position lights are the standard red (left forward wingtip), green (right forward wingtip), and white (aft tip of both wings and tailcone) position lights.

Logo Lights

Logo lights are located on the stabilizer to illuminate the airline logo on the vertical tail surface.

Wing Lights

Wing lights are installed on the fuselage and illuminate the leading edge of the wing.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Exterior Lighting Locations

Flight Deck Lighting

Flight deck lighting is provided for panel illumination, area lighting and localized illumination. Flood lights and light plates provide panel illumination. Dome lights provide flight deck area lighting. Map lights and a single utility light provide localized illumination.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Panel and flood lights illuminate the forward panels, glareshield and aisle stand panels. When the storm light switch is on, the left and right forward panel flood lights, glare shield flood lights, dome lights, aisle stand flood light, and all illuminated annunciator lights illuminate at full brightness.

If normal electrical power is lost, standby electrical power is automatically provided to the primary displays. The aisle stand, left and right forward panel and glareshield flood lights, and the dome lights illuminate automatically at a fixed brightness.

Master Brightness Control System

The MASTER BRIGHTNESS control provides the means of controlling panel and display lighting brightness with the use of one control. Maximum and minimum brightness levels are adjusted as ambient lighting changes. The control is turned on when the MASTER BRIGHTNESS switch is pushed on.

Lighting controlled through the master brightness system are:

- PFDs
- MFDs
- EICAS
- CDUs

HL7532 - HL7783, HL8208 - HL8218, HL8250 - HL8252

- clocks
- standby instruments
- standby compass
- digital displays
- overhead panel
- glareshield panel
- forward panels (left, center, and right)

HL7202 - HL7205, HL7750 - HL8347

- side panel displays
- aisle stand panels (forward and aft).

HL7202 - HL7205, HL7750 - HL8347
The individual lighting controls for the above displays and panels, except the CDUs and side displays, have a center detent position identified by a white dot at the mid–range adjustment position.

HL7532 - HL7743
The individual lighting controls for the above displays and panels, except the CDUs, have a center detent position identified by a white dot at the mid–range adjustment position.

Individual controls can be used for dimming individual displays and panels. The individual controls have limited adjustment capability when the MASTER BRIGHTNESS switch is on, and should be centered in the detent when first adjusting the MASTER BRIGHTNESS control. They have full range of brightness control when the MASTER BRIGHTNESS switch is off.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display brightness is automatically adjusted based on ambient lighting when the MASTER BRIGHTNESS switch is on.

Note: If display brightness cannot be set as desired when master brightness is on, pushing the MASTER BRIGHTNESS switch off may allow setting display brightness to an appropriate level using individual brightness controls.

Cabin Lighting

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Cabin lighting near the flight deck entry door is automatically dimmed or extinguished when the flight deck door is opened while an engine is operating. This reduces the light level entering the flight deck at night.

Cabin Signs

HL7532 - HL7598

The cabin signs are controlled by overhead panel selectors. The cabin signs illuminate when any of the following conditions occur:

FASTEN SEAT BELTS signs (AUTO selected):

- landing gear not up and locked, or
- flap lever not up, or
- airplane altitude below an airline defined altitude, or
- cabin altitude above 10,000 feet, or
- passenger oxygen on.

NO SMOKING signs (AUTO selected):

- landing gear not up and locked, or
- cabin altitude above 10,000 feet, or
- passenger oxygen on.

All cabin signs can be controlled manually by positioning the respective switch to ON or OFF. When the SEAT BELTS and NO SMOKING selectors are in the OFF position, and oxygen is ON, the FASTEN SEAT BELTS and NO SMOKING signs illuminate.

RETURN TO SEAT signs are illuminated with the FASTEN SEAT BELTS signs, except when oxygen is deployed.

When the cabin signs illuminate or extinguish, a low tone sounds over the PA system.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cabin Signs

HL7202 - HL7205, HL7733 - HL8347

The FASTEN SEAT BELTS signs are controlled by an overhead panel selector. The FASTEN SEAT BELTS signs illuminate when the FASTEN SEAT BELTS selector is in AUTO and the following conditions are satisfied:

- landing gear not up and locked, or
- flap lever not up, or

HL7202 - HL7205, HL7733 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- airplane altitude below an airline defined altitude, or

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

- airplane altitude below 10,000, or
- cabin altitude above 10,000 feet, or

HL7202 - HL7205, HL7733 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- passenger oxygen on.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

- supernumerary oxygen on.

The FASTEN SEAT BELTS signs can be controlled manually by positioning the SEAT BELTS selector to ON or OFF. When the SEAT BELTS selector is in the OFF position, and oxygen is ON, the FASTEN SEAT BELTS signs illuminate.

RETURN TO SEAT signs are illuminated with the FASTEN SEAT BELTS signs, except when oxygen is deployed.

When the FASTEN SEAT BELTS signs illuminate or extinguish, a low tone sounds over the PA system.

HL7733 - HL7766

The NO SMOKING signs are permanently illuminated and cannot be controlled by the NO SMOKING selector.

HL7202 - HL7205, HL7782 - HL8347

The NO SMOKING signs are permanently illuminated.

HL7733 - HL7766

Although the NO SMOKING selector does not control the NO SMOKING signs, it can still be used to sound a single low tone (chime) over the PA system. The chime activates during the following NO SMOKING selector conditions:

- selector is moved from the left ON position to the middle ON position with landing gear not up and locked, or
- selector is moved from the middle ON position to the left ON position with landing gear not up and locked, or

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- selector is moved from the right ON position to the middle ON position with landing gear up and locked, or
- selector is moved from the middle ON position to the right ON position with landing gear up and locked, or
- passenger oxygen deploys with selector in the left ON position, or
- landing gear retraction/extension with selector in the middle ON position, or
- cabin altitude increases above 10,000 feet with selector in the middle ON position, or
- PASS OXYGEN switch placed to ON with selector in the middle ON position.

Emergency Lighting

The emergency lighting system is powered by remote batteries. Battery charge is maintained by the airplane electrical system. A fully charged battery provides at least 15 minutes of operation.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Emergency lighting is controlled by the EMERGENCY LIGHTS switch on the overhead panel. The switch can be used to manually activate or arm the system for automatic operation. Automatic operation occurs if DC power fails or is turned off when the system is armed. The emergency lighting system can also be controlled by the EMERGENCY LIGHTS switch on the main flight attendant switch panel.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Emergency lighting is controlled by the EMERGENCY LIGHTS switch on the overhead panel. The switch can be used to manually activate or arm the system for automatic operation. Automatic operation occurs if DC power fails or is turned off when the system is armed. The emergency lighting system can also be controlled by the EMERGENCY LIGHTS switch at door 1L.

When the EMERGENCY LIGHTS switch in the flight deck is armed, and the door mode select lever is in the armed position, moving the door handle to the open position will cause the exterior fuselage light and the interior emergency lights at that door to illuminate.

The EICAS advisory message EMER LIGHTS is displayed if:

- the emergency lights switch is not in the ARMED position, or

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- the emergency lights switch is in the ARMED position, and the emergency lights are activated by the switch at a flight attendant panel.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

- the emergency lights switch is in the ARMED position, and the emergency lights are activated by the switch at door 1L.

Interior Emergency Lighting

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Interior emergency lighting consists of door, aisle, cross–aisle, escape path, exit lights, and luminescent exit signs.

Escape path lighting consists of lights installed in the arm rest of the center passenger seats, and on center galleys, lavatories, closets and partitions spaced at intervals in the aisles and cross–aisles. Escape path lighting illuminates emergency evacuation routes for visual guidance when all sources of lighting more than four feet above the aisle floor are obscured by smoke.

Battery powered exit lights are located at each cabin exit.

Interior Emergency Lighting

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Interior emergency lighting consists of door, aisle, exit lights, and luminescent exit signs. Additional battery-powered exit identifier lights are located at each cabin exit.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Exterior Emergency Lighting

HL7574 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

HL7574 - HL7766

Exterior emergency lighting consists of escape slide lights. The lights are located aft of each door and illuminate the areas at the base of the escape slides. The slides in doors 2L and 2R have lights built into the sliding lanes. When the slide is deployed, the lights turn on automatically to illuminate the slide lanes.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Exterior emergency lighting consists of escape slide lights. The lights are located aft of each door and illuminate the areas at the base of the escape slides.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Exterior emergency lighting consists of escape slide lights. The lights are located aft of each door and illuminate the areas at the base of the escape slides. The slides in doors 3L and 3R have lights built into the sliding lanes. When the slide is deployed, the lights turn on automatically to illuminate the slide lanes.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The overwing exit lights are located aft of the door and illuminate the evacuation path to the escape slide. When the slide is deployed, the lights turn on automatically to illuminate the slide lanes.

Oxygen Systems

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
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.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Two independent oxygen systems are provided, one for the flight crew and one for the supernumeraries. Portable oxygen cylinders are located throughout the airplane for emergency use.

Flight Crew Oxygen System

The flight crew oxygen system uses quick–donning masks and regulators located at each crew station. Oxygen pressure is displayed on the MFD STATUS display.

The EICAS advisory message CREW OXYGEN LOW alerts the flight crew of a low oxygen pressure condition.

Flight crew and observer masks and regulators are installed in oxygen mask panels near each seat. Squeezing the red oxygen mask release levers releases the mask from stowage. Removing the mask:

- inflates the mask harness
- momentarily displays the yellow oxygen flow indicator
- selects the mask microphone in the removed mask (the boom microphone is deselected).

The boom microphone can be reselected by closing the left oxygen panel door and pushing and releasing the RESET/TEST switch. This also shuts off oxygen to the mask. The oxygen flow can be restored by opening the left oxygen panel door.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Oxygen Mask Microphone Test

The oxygen mask microphone can be tested without removing it from the storage box.

- Select the FLIGHT interphone transmitter and set the speaker volume as desired.
- Push and hold a MIC switch on either the audio control panel or the glare shield
- Push both the oxygen mask RESET/TEST switch and EMERGENCY/TEST selector.

The sound of oxygen flowing is heard through the speaker, verifying microphone operation.

Passenger Oxygen System

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The passenger oxygen system is supplied by individual chemical oxygen generators. The oxygen system provides oxygen to:

- passenger seats
- attendant stations

HL7574 - HL7766

- lower crew rest compartment

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- upper crew rest compartment
- lavatory service units.

The passenger oxygen masks and chemical oxygen generators are located in passenger service units (PSUs). Oxygen flows from a PSU generator when any mask hanging from that PSU is pulled. Oxygen is available for approximately 22 minutes. The masks automatically drop from the PSUs if cabin altitude exceeds approximately 13,500 feet. The passenger masks can be manually deployed from the flight deck by pushing the overhead panel PASSENGER OXYGEN switch to the ON position.

Supernumerary Oxygen System

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The supernumerary oxygen system supplies oxygen to the supernumerary area, lavatory, and crew rest.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The supernumerary oxygen system is supplied by bottled gaseous oxygen. The supernumerary oxygen masks are located in passenger service units (PSUs). The masks automatically drop from the PSUs if cabin altitude exceeds approximately 13,500 feet. The supernumerary masks can be manually deployed from the flight deck by pushing the overhead panel SUPRNMRY OXYGEN switch to the ON position. Oxygen flow can be reset by selecting the SUPRNMRY OXYGEN switch to the RESET position.

Supernumerary gaseous oxygen pressure is displayed on the MFD STATUS display.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Emergency Equipment Overview

This section describes the emergency equipment located throughout the airplane, including:

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- emergency evacuation signal system
- emergency locator transmitters (ELTs)
- fire extinguishers
- flight deck emergency equipment location
- portable passenger cabin emergency equipment location

Emergency Evacuation Signal System

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The emergency evacuation signal system alerts the flight attendants to evacuate the passenger cabin.

Placing the flight deck evacuation signal COMMAND switch to ON activates the evacuation signal on the flight deck and on the flight attendant panels.

With the flight deck evacuation signal COMMAND switch in the OFF (guard down) position, pressing an EVAC COMMAND switch on a flight attendant panel will activate the evacuation signals on the flight deck and on the flight attendant panels.

Emergency Locator Transmitter (ELT)

HL7574 - HL7766

Two emergency locator transmitters are installed:

- one in the door 1L slide/raft
- one in the door 4R slide/raft

Note: The slide/raft emergency locator transmitter automatically transmit when the slide/raft is deployed in the water.

HL7532 - HL7573

Two emergency locator transmitters are installed:

- one in the lavatory outboard stowage at door 1L
- one in the floor mounted stowage forward of door 5L lavatory

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
One emergency locator transmitter (ELT) is located in the supernumerary area in the stowage box forward of door 1R.

Fuselage Mounted Emergency Locator Transmitter (ELT)

HL7202 - HL7205, HL7733 - HL8347

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.

HL7202 - HL7205, HL7733 - HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The EICAS alert message ELT ON is displayed if the transmitter is activated. The ELT can be deactivated by placing the ELT switch to RESET momentarily, then ARMED.

HL8005 - HL8077, HL8226, HL8251, HL8252, HL8285
The EICAS alert message ELT ON is displayed if the transmitter is activated. The ELT can be deactivated by placing the ELT switch to RESET momentarily (between 1 and 3 seconds), then ARMED.

Miscellaneous Portable Emergency Equipment

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Portable emergency equipment is stowed at strategic locations throughout the airplane. See Emergency Equipment Location - Flight Deck and Emergency Equipment - Passenger Cabin below for specific location.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Portable emergency equipment is stowed at strategic locations throughout the airplane. See Emergency Equipment Location - Flight Deck / Supernumerary Area / Main Deck below for specific location.

Fire Extinguishers

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Halon, or Halon-equivalent clean agent and water fire extinguishers are located throughout the passenger cabin and on the flight deck.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Halon and Halon Equivalent Fire Extinguishers

Halon or Halon-equivalent clean agent fire extinguishers contain a liquefied gas agent under pressure. The extinguisher pressure indicator shows three pressure ranges:

- acceptable
- recharge
- overcharged

A safety pin with a pull ring prevents accidental trigger movement. When released, the liquefied gas agent vaporizes and extinguishes the fire. The extinguisher is effective on all types of fires, but is used primarily on electrical, fuel, and grease fires.

WARNING: If a Halon or equivalent fire extinguisher is to be discharged in the flight deck area, all flight crew members must wear oxygen masks and use 100% oxygen with emergency selected.

WARNING: The concentrated agent, and the by-products created by the heat of the fire, are toxic. Unprotected exposure to high concentrations of agent or byproducts can result in dizziness, difficulty breathing, and eye and nose irritation. After discharge of an entire fire extinguisher, it can take 7 minutes for agent to dissipate. Signs of smoke should be clear and agent dissipated before removal of oxygen masks or protective breathing equipment.

CAUTION: For electrical fires, remove the power source as soon as possible. Avoid discharging directly on persons due to possibility of suffocating effects. Do not discharge too close to fire as the discharge stream may scatter the fire. As with any fire, keep away from the fuel source. Avoid breathing vapors, fumes and heated smoke as much as possible.

Note: The directions for use of the fire extinguisher are printed on the extinguisher.

Water Fire Extinguishers

Water fire extinguishers contain a solution of water mixed with antifreeze. Water fire extinguishers are to be used on fabric or paper fires only. They are not to be used on electrical or grease fires.

Note: The directions for use of the fire extinguisher are printed on the extinguisher.

WARNING: An antifreeze compound has been added to the water which makes it unfit for drinking.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

CAUTION: Do not use on electrical or grease type fires.

Portable Oxygen Bottles

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Portable oxygen bottles are stowed in various locations in the cabin. The bottles are fitted with disposable masks and are used for first aid purposes or as walk–around units. All bottles are identical in size and capacity.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
There are portable oxygen bottles stowed in various locations in the supernumerary area. The bottles are fitted with disposable mask and safety straps and are used for first aid purposes or as walk-around units. All bottles are identical in size and capacity.

Flashlights

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Flashlights are stowed on the flight deck and throughout the passenger cabin. These high intensity flashlights illuminate automatically when they are removed from the stowage brackets. The light can be extinguished only by replacing the flashlight back into the stowage bracket. A battery indicator light flashes every three to four seconds to indicate adequate power. The batteries cannot be recharged.

Flashlight (Typical)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Flashlights are stowed on the flight deck and in the supernumerary area. These high intensity flashlights illuminate automatically when they are removed from the stowage brackets. The light can be extinguished only by replacing the flashlight back into the stowage bracket. The batteries cannot be recharged.

HL8043 - HL8077

Flashlight (Typical)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8226, HL8251, HL8252, HL8285

Flashlight (Typical)

1 Elastic Wrist Strap

2 Condition Light

Illuminated (green) – One flash during test indicates a normal battery charge.

Illuminated (red) – One flash during test indicates the battery should be replaced. Flashes every ten seconds when the battery has reached its end of life.

HL8043 - HL8077
3 Tamper Seal

HL8005, HL8226, HL8251, HL8252, HL8285
3 Push-to-Test Switch

Push – produces one green or red flash on the condition light.

HL8043 - HL8077
4 Push-to-Test Switch

Push – produces one green or red flash on the condition light.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Emergency Equipment
Emergency Equipment Symbols

Emergency Equipment Locations - Passenger Airplane
HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Flight Deck

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Passenger Cabin

HL7574 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7733 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7573

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7782, HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8006 - HL8042

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Emergency Equipment Locations - Freighter

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Flight Deck / Supernumerary Area

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Main Deck

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

This Section Applies to HL7202 - HL7205, HL7574 - HL8347

Introduction

This section describes the crew rest areas, including:

- location and entry enclosure
- control panels
- smoke detection
- decompression

HL7202 - HL7205, HL7574 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- emergency equipment and location
- evacuation

Crew Rest

General

HL7202 - HL7205, HL7733 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
A flight crew rest (FCR) area is located forward of the door 1L. The entrance to the FCR is located in the passageway between the passenger cabin and the flight deck.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
A flight crew rest (FCR) area is located forward of the door 1L. The entrance to the FCR is located in the passageway between the supernumerary area and the flight deck.

HL7574 - HL7766
A lower crew rest area is located in the forward section of the aft cargo area. The entrance enclosure to the area is located near the center aisle at door 3.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
A door 5 overhead flight attendant rest area is located in the aft part of the airplane in the overhead between doors 4 and 5. Entry into the area is through an enclosure located in the passenger cabin across from door 5L.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
WARNING: The crew rest area should not be occupied when the amber SUPPLY AIRFLOW OFF light is illuminated.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The entrance to the crew rest area has the same external appearance as a lavatory, but is placarded for crew use only.

HL7202 - HL7205, HL7574 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The crew rest door should remain closed and locked at all times.

Occupancy

The crew rest may be occupied by crew members trained in the use of the crew rest evacuation routes, fire fighting procedures and depressurization procedures.

Note: A placard is installed indicating any crew rest area occupancy restrictions.

Note: The crew rest area is not to be occupied during taxi, takeoff, or landing operations.

Lower Crew Rest (LCR)

HL7574 - HL7766

A lower crew rest (LCR) compartment is located in the forward section of the aft cargo compartment. The entrance enclosure to the compartment is located near the center aisle at door 3. Air conditioning is only supplied to the LCR when airplane altitude is 25,000 feet or higher, and the main entry hatch is open.

The LCR compartment has its own smoke detection and fire extinguishing system.

Note: Before entering the LCR, ensure that conditioned air flow is available. Verify that the AIR FLOW OFF light on the attendant switch panel (ASP) in the entrance enclosure is not illuminated.

WARNING: The LCR should not be occupied when the amber AIR FLOW OFF light on the compartment attendant control panel is illuminated or the main entry hatch is shut.

Conditioned air is supplied to the lower crew rest area when the airplane has reached an altitude of 25,000 feet or higher, and the main entry hatch is open. The LCR should be occupied only when the airplane has reached an altitude of 25,000 feet or higher, and the main entry hatch is open.

WARNING: Closing the main entry hatch shuts off air flow to the lower crew rest area.

Before entering the crew rest area, ensure that conditioned air flow is available. Verify that the SUPPLY AIRFLOW OFF light on the control panel in the entrance enclosure is not illuminated.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Door 5 Overhead Crew Rest

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

A door 5 overhead crew rest area is located in the aft part of the airplane in the overhead between doors 4 and 5. Entry into the area is through an enclosure located in the passenger cabin across from door 5L. The entrance to the crew rest area is placarded for crew use only.

The area has its own smoke detection system but no fire extinguishing system.

A placard is installed indicating any door 5 overhead crew rest area occupancy restrictions.

The entrance enclosure contains the main control panel.

An amber call/reset light is mounted on the exterior wall above the entrance door. When smoke is detected in the area, the light flashes. The light will illuminate steady when the attendant call button on a passenger control unit (PCU) inside the area has been pushed.

Conditioned air is used to provide temperature control and ventilation to the door 5 overhead crew rest area. When using the area, conditioned air flow must be available. An AIRFLOW OFF light on the main control panel in the entrance enclosure illuminates when conditioned air is not available.

Before entering the crew rest area, ensure that conditioned air flow is available. Verify that the AIRFLOW OFF light on the control panel in the entrance enclosure is not illuminated.

Note: The AIRFLOW OFF light will be illuminated when the airplane is below 25,000 feet.

Note: If the airplane is above 25,000 feet and the AIRFLOW OFF light is illuminated, pushing the AIRFLOW / SMOKE RESET switch resets the conditioned air system.

WARNING: If the AIRFLOW OFF light remains illuminated after the AIRFLOW / SMOKE RESET switch has been pushed, the door 5 overhead crew rest area should not be occupied.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Crew Rest Layout

HL7202 - HL7205, HL7733 - HL8347

The FCR compartment contains the following:

- an area smoke detector

HL7202 - HL7205, HL7751 - HL8347

- two bunks containing:
  - two smoke detectors in each bunk
  - oxygen mask
  - gasper air outlet
  - reading light
- an amenities module containing:
  - a speaker
  - lighting and temperature controls

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- decompression horn and silence switch
- interphone handset

Entrance Enclosure Door Lock

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

A keyless door lock is installed on the entrance to the crew rest area.

1 Door handle

2 5 button keypad

3 Reset knob

Door Lock Operation

To unlock the door, press the keypad buttons in the airline pre-programed code and rotate the door handle in either direction to retract the door bolt. When the door handle is released, the bolt automatically returns to the latched position allowing the door to be closed without retracting the bolt.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Control and Indicators
Main Control Panel
HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

1 COMMON AREA LIGHTING Switch

Push -

- turns the common seating area lights in the area on (light illuminated)/off (light extinguished).

2 Alert horn

Horn sounds when:

- airplane decompression occurs (continuous)
- smoke is detected in the overhead crew rest area (pulsating)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 SUPPLY AIRFLOW OFF Light

Illuminated (amber) -

- area airflow exhaust valves are open or during smoke detection mode operations
- the area airflow is off

Note: A HI/LO chime will sound 5 times in the area whenever the air supply shutoff valve is commanded closed.

Note: The SUPPLY AIRFLOW OFF light will be illuminated when the airplane is below 25,000 feet or in the smoke detection mode.

WARNING: The overhead crew rest area should not be occupied when the amber SUPPLY AIRFLOW OFF light is illuminated.

4 BACKUP LIGHTS/TEST Switch

Guarded switch/light.

Push - illuminated (white) -

- the emergency lights in the area turn on for approximately one minute

5 AIRFLOW / SMOKE RESET Switch

Guarded switch.

The AIRFLOW / SMOKE RESET switch is operative when:

- crew rest area smoke detectors are not in alarm
- the airplane is on the ground and the left pack is off
- the airplane is at or above 25,000 feet

Switch operative:

Push and hold (2 seconds) -

- resets the airflow to the area
- resets aft galley electrical power

HL7782, HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275

Note: In airplanes with a door 1 overhead crew rest and a door 5 overhead crew rest, both AIRFLOW / SMOKE RESET switch must be pushed to ensure proper restoration of the aft galley power.

Switch inoperative (crew rest area smoke detectors are in alarm):

- the crew rest area airflow remains shutdown
- exhaust ventilation air flow is provided to clear smoke from the crew rest area
- the SUPPLY AIRFLOW OFF light is illuminated

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- the aft galley electrical power is shut down

  Note: The supply air system will remain inoperative and the aft galley power will remain shutdown until all smoke has been cleared from the rest area and the smoke detectors are not in alarm.

Area Lights/Decompression Reset Panel

1 MAIN AREA LIGHTS Light/Switch

Push - turns area light on/off

2 HORN SHUT OFF Switch

Push -

- silences the smoke detector system alarm horns
- silences the decompression alarm horns

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Temperature Control Panel

1 Temperature Display

Displays:

- current ambient air temperature in degrees F or C
- flashing, new temperature set point when warmer or cooler arrows are pushed.

2 WARMER Arrow

Push - increases temperature in crew rest area

3 COOLER Arrow

Push - decreases temperature in crew rest area

4 UNITS Selector

Push - toggles between degrees F and degrees C for display and temperature selection

Lower Crew Rest (LCR) Control Panel

HL7574 - HL7766

The LCR area control panel is located inside the entrance enclosure. The panel has the switches necessary to arm and discharge the fire extinguishing system.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 ENTRY LIGHT

Illuminated green at all times.

Push –

- turns on the lights in entrance enclosure ceiling and near the stairs

2 Evacuation (EVAC) Light

Illuminated (red) –

- smoke has been detected in the LCR, or
- the aft cargo area fire extinguishing system ARM switch is selected

WARNING: The LCR should not be occupied when the EVAC light is illuminated.

3 AIR FLOW OFF Light

Illuminated (amber) – the valve supplying air to the LCR is commanded closed.

The air supply shutoff valve will close if:

- airplane altitude is less than 25,000 feet
- the main area hatch is closed
- smoke is detected in the LCR
- the LCR fire extinguishing system is armed
- the aft cargo fire extinguishing system is armed, or
- if the airplane is on the ground and the left pack is on

Note: A HI/LO chime will sound 5 times in the area whenever the air supply shutoff valve is commanded closed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

WARNING: The LCR should not be occupied when the amber AIR FLOW OFF light is illuminated.

1 FIRE Light

Illuminated (red) –

- smoke has been detected in the LCR, or
- the FIRE TEST switch is pushed

2 ARM Extinguisher (EXTING) Switch

Push –

- illuminates the amber ARM light
- arms the fire extinguishing system, and
- causes the air supply valve to close

3 DISCHARGE BOTTLE Switch

Push –

- discharges the halon fire extinguisher into the LCR after the ARM switch has been selected

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

DISCH illuminated (amber) –

- illuminates within 15 seconds after being pushed to indicate that extinguisher bottle has been discharged.
- extinguisher bottle pressure is low

Note: Extinguisher bottle low pressure occurs if the bottle has been discharged, or there is a leak in the extinguisher bottle.

Note: A HI/LO chime will sound 5 times in the area whenever the low pressure switch is activated on the halon bottle.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Amenities Module

HL7202 - HL7205, HL7733 - HL8347

1 **Area Light**

2 **Handle Light**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Reading Light Switch

Turns upper bunk reading light on or off.

4 FASTEN SEAT BELTS Sign

5 Reading Light Switch

Turns lower bunk reading light on or off.

6 Step Light

7 Back Up Light

Note: Illuminates when normal airplane power fails.

8 Speaker

Amenities Module Control Panel

1 Area Light Switch

2 Horn Shutoff Switch

Push -

- silences the decompression alarm horn

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Lavatory Occupied Indicator

4 Alert horn

Horn sounds when:

- airplane decompression occurs (continuous)

5 Crew Rest Heater

OFF -

- turns off crew rest area heater

HIGH -

- turns crew rest area heater to high heat

6 Interphone Handset

7 Interphone Call Switch/Light

Illuminated

- incoming call from flight deck

Push -

- calls the flight deck

Oxygen System

HL7202 - HL7205, HL7574 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The oxygen system inside the crew rest is a chemical oxygen generator system which provide oxygen for approximately 22 minutes.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The oxygen masks above the bunks and seats will drop automatically in the event of a decompression.

HL7202 - HL7205, HL7733 - HL8347
The oxygen masks in the bunks will drop automatically in the event of a decompression.

Each mask oxygen valve is held closed by a pin inserted into the valve. Pulling on the mask withdraws the pin, causing the mask oxygen valve to open and oxygen to flow to that mask.

The oxygen masks may be manually released by inserting a hair pin or thin rod into the hole of the oxygen compartment cover.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Note: When the oxygen masks deploy, the green oxygen indicator light in the common area illuminates.

Decompression

In the event of decompression, the oxygen mask will automatically deploy when the cabin altitude is approximately 13,500 feet. Additionally, the oxygen mask deployment horn will sound continuously and the air flow and oxygen alarm RESET light will illuminate. Oxygen flow is available when the mask is pulled.

Note: Cabin depressurization is indicated by a continuous alarm horn sounding in the crew rest area.

Crew rest occupants should immediately don the oxygen mask.

Evacuate the crew rest when directed.

Smoke and Fire

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The overhead crew rest has its own smoke detection system but no fire extinguishing system.

HL7574 - HL7766

The lower crew rest area has its own smoke detection and fire extinguishing system.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Rest Smoke Detection

Crew Rest Smoke Detector

HL7574 - HL7782

1 Power Indicator Light

Illuminated (green) -

- smoke detector has power and is operating

2 Interrupt Switch

Push -

- silences the horn and suppresses all alarm indications as long as the switch is pushed

3 Self Test Switch

Push -

- activates the smoke detector aural and visual alarms

Note: The system automatically resets when the test is concluded.

4 Alarm Indicator Light

Illuminated (red) -

- presence of smoke has been detected

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7783 - HL8347

Photoelectric Smoke Detector (typical)

1 Status Indicator Light

Illuminated (green) -

- steady - smoke detector has power and is operating properly
- blinking - maintenance is required

Illuminated (red) -

- steady - smoke has been detected
- blinking - detector has failed

2 Self-Test Switch

Push -

- alarm horn sounds
- Status Indicator Light illuminates red
- external horn sounds

3 Horn Cancel Switch

Push -

- alarm horn is silenced

Note: When the Cancel switch is released and smoke is not sensed for 30 seconds, the smoke detector is automatically reset.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Rest Smoke Detection

HL7202 - HL7205, HL7733 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
If smoke is detected in the Forward Crew Rest:

- a SMOKE CREW REST F/D EICAS caution message is displayed
- the air supply shutoff valve is closed
- an amber light above the entrance enclosure door flashes
- a continuous chime sounds throughout the cabin
- the smoke detector integral horn sounds
- aft galley power is removed

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
If smoke is detected in the Forward Crew Rest:

- a SMOKE CREW REST F/D EICAS caution message is displayed
- the air supply shutoff valve is closed
- an amber light above the entrance enclosure door flashes
- a continuous chime sounds throughout the supernumerary area
- the smoke detector integral horn sounds

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
If smoke is detected in the Door 5 Overhead Flight Attendant Rest:

- a SMOKE REST UPR DR5 EICAS caution message is displayed
- the air supply shutoff valve is closed
- an amber light above the entrance enclosure door flashes
- a continuous chime sounds throughout the cabin
- the smoke detector integral horn sounds
- aft galley power is removed

LCR Fire Protection

HL7574 - HL7766

Smoke Detection System

One smoke detector is installed in the LCR. There are nine smoke sniffer ports in the LCR, one in each bunk area and 3 in the common area. The smoke sniffer ports are connected to two smoke detector sensors, which are connected to the smoke detector.

If smoke is detected in the LCR:

- on the flight deck:
  - an aural caution sounds
  - a SMOKE CREW REST LWR EICAS caution message is displayed

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- in the LCR area:
  - an intermittent horn sounds

    Note: The area smoke horn is intermittent. The area oxygen horn is continuous.

  - the EVAC MODULE light illuminates red
  - the AIR FLOW OFF light illuminates amber
  - the LCR air supply shutoff valve is closed and a chime sounds 5 times
- in the LCR enclosure:
  - the red EVAC light illuminates
  - the AIR FLOW OFF light illuminates amber
  - the red FIRE light illuminates
  - the fire horn sounds
  - the LCR smoke detector integral horn sounds
- in the passenger cabin
  - an amber light above the entrance enclosure door flashes
  - a continuous high chime sounds throughout the cabin
  - the cabin attendant master call lights flash
  - a SMOKE DETECTED LCR message appears on the cabin management system control panels

Fire Extinguishing System

The fire extinguishing system in the LCR area consists of one halon bottle located inside the area. The halon bottle's discharge circuit is monitored during each flight. In the event of a leak, the DISCH lights in the entrance enclosure and the area will illuminate and a HI/LO chime will sound 5 times in the module.

Fire Extinguishing Operation

To activate the LCR fire extinguishing system:

- arm the fire extinguishing system by pushing the ARM switch on the attendant switch panel in the LCR entrance enclosure
  - verify red ARM light illuminates
- lift the guard and push the DISCH switch
  - verify the red DISCH light illuminates within 15 seconds

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Emergency Equipment

HL7202 - HL7205, HL7574 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Emergency Equipment Symbols

Emergency Equipment Location

HL7574 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7782, HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Evacuation from the Crew Rest Area

HL7202 - HL7205, HL7733 - HL8347
The flight crew rest primary evacuation route is through the entrance enclosure.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The overhead flight attendant rest primary evacuation route is through the entrance enclosure. If the main entrance is unusable, evacuation is possible through the emergency hatch.

HL7574 - HL7766
The lower crew rest primary evacuation route is through the entrance enclosure. If the main entrance is unusable, evacuation is possible through the emergency hatch.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
WARNING: During exit to the main deck, stepping on the seat back may cause the seat back to fold forward. If this occurs, the crew member may lose balance and hand grip, resulting in personal injury.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
WARNING: If the emergency hatch was used for crew evacuation, the lower hatch must be closed to help prevent the spread of smoke or fire.

HL7574 - HL7766
WARNING: If the emergency hatch was used for crew evacuation, the hatch must be closed to help prevent the spread of smoke or fire.

Door 5 Overhead Crew Rest Emergency Hatch

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

For egress:

- lift and remove the mattress pad

Note: Stow the mattress pad where it can not obstruct emergency hatch or the aisle.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- unlatch and raise upper hatch cover

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- unlatch lower hatch
- command passenger in immediate area to move clear of evacuation area

- sit on floor facing outboard and lower legs into hatch opening
- reach out and grab the outboard handhold (keep elbows close to sides)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- use step on lower hatch to climb/swing down to main deck
- exit to main deck

- close the lower hatch when evacuation is complete

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Lower Crew Rest Emergency Hatch
HL7574 - HL7766

To use the emergency hatch, follow the placarded instructions.

Emergency Hatch
(in passenger cabin with carpet folded back)

Emergency Hatch
(inside area looking up)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

This Section Applies to HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Supernumerary Area

This section describes the supernumerary area including:

- Layout
- Control panels
- Entry door
- Evacuation
- Decompression
- Oxygen system
- Rigid cargo barrier

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Supernumerary Area Layout

1 **Flight Crew Rest**

2 **Lavatory**

3 **Galley**

4 **Stowage**

5 **Interphone Handset**

6 **Rigid Cargo Barrier Door**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

7 Supernumerary Display and Control Panel

Supernumerary Display and Control Panel

1 Main deck Cargo Video

2 Main Deck Cargo Door Operating Procedures

3 Water and Waste Indicators

4 Interphone Handset

5 Main Deck Cargo Door Controls

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

6 Main Deck Cargo Lighting Control

7 Cabin Temperature Control

8 Cabin Lighting Control

Main Deck Cargo Door Video

1 Display

ON – the video display is on

OFF – the video display is off

2 Cam Sel (Camera Select)

EXT (exterior) – the video from the exterior camera is displayed

INT (interior) – the video from the interior camera is displayed

3 Dim

Rotate – controls display brightness

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Main Deck Cargo Lighting Control

Lights are turned on and off by moving either switch up or down.

1 CEILING

Illuminates the ceiling lights in the main deck cargo area.

2 SIDEWALL

Illuminates the sidewall lights in the main deck cargo area.

3 EXTERIOR CAMERA

Illuminates the area outside of the main deck cargo door.

4 SILL/LOAD Main Deck Cargo Door (MDCD)

Turns off the main deck cargo door load/sill lights when the door is not closed.

Note: The load/sill lights automatically illuminate when the door is not closed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cabin Lighting

1 CEILING LIGHTS

BRT – the ceiling lights in the supernumerary area are illuminated bright

DIM – the ceiling lights in the supernumerary area are illuminated dim

OFF – the ceiling lights in the supernumerary area are not illuminated

2 EMER LIGHTS/TEST

Push and release – Illuminates emergency lights and exit signs for 1 minute

3 Cabin Emergency (EMER) LIGHTS Switch

Push –

- Illuminated (red):
  - all cabin and exterior emergency lights illuminate
  - bypasses the flight deck emergency lights switch
- Extinguished: all cabin and exterior emergency lights extinguish

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cabin Temperature

1 CABIN Temperature Switch

Rotate – adjust temperature of supernumerary area

GROUND SERVICE

1 GROUND SERVICE Switch

Push – Powers the Ground Service and Ground Handling electrical buses.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Water and Waste Indicators

1 WATER QTY

Total water quantity in fractions.

2 WASTE QTY

Total waste quantity in fractions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Main Deck Cargo Door Controls

1 ARMED Light

Illuminated (amber) – cargo door unlocked and electrical power available.

2 OPENED Light

Illuminated (blue) – cargo door fully open.

3 CLOSED Light

Illuminated (green) – cargo door fully closed.

4 LATCHED Light

Illuminated (green) – cargo door latched.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 UNLOCKED Light

Illuminated (blue) – cargo door unlocked.

6 LOCKED Light

Illuminated (green) – cargo door locked.

7 ARMED/ARMED Switch

ARMED (push up and hold) – arms cargo door for opening.

ARMED (push down and hold) – arms cargo door for closing.

8 OPEN/CLOSE Switch

OPEN – opens cargo door when armed.

CLOSE – closes cargo door when armed.

9 UNLOCK/LOCK Switch

UNLOCK – unlocks cargo door.

LOCK – locks cargo door.

Entry Door

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Assist Handle

2 Emergency Power Assist System (EPAS) Battery cover

Spring loaded closed -

- cover flush with the door liner indicates the EPAS system is properly armed

WARNING: If the EPAS battery cover is not flush with the door liner, the EPAS system is unusable. Contact maintenance to service the door.

Note: A green light indicating that the EPAS battery is properly charged may be visible on the door bustle or if the cover is not completely flush with the door liner.

3 Viewing Window

Allows observation outside the airplane.

4 Slide/Raft Gas Bottle Pressure Gauge

Maintenance use only.

Note: If the gauge needle is outside the green zone, the system may be unusable.

5 Door Bustle Release Handle

Pull to remove door bustle for access to slide/raft.

6 Girt Bar Indicator Flag Viewing Windows

Yellow in view -

- door and slide/raft are armed for automatic operation and slide/raft deployment

Black in view -

- door and slide/raft are not armed

7 Door Bustle

The bustle contains the slide/raft.

8 Door Operating Handle

To open the door -

- rotate the door operating handle in the direction of the arrow

To close the door -

- rotate the door operating handle in the opposite direction of the arrow

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

9 Gust Lock Release Lever

Grab and pull inward to close the door.

10 Emergency Power Assist System (EPAS) Reservoir Pressure Gauge

Note: If the gauge needle is outside the green zone, EPAS is unusable.

11 Door Mode Select Panel

See following graphic.

Door Mode Select Lever

1 ARMED

Red.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The door is armed if the mode select lever is fully in the red band.

When the door operating handle is moved to the OPEN position:

- the door is powered open
- the slide/raft deploys
- the overwing ramp/slide deploys

Note: If the door is opened from the outside, the mode select lever automatically moves to the DISARMED position.

2 DISARMED

Green.

The door is disarmed if the mode select lever is fully in the green band.

Moving the door operating handle to the OPEN position raises the door for normal operation and disables:

- the power assist for door opening
- the automatic slide/raft deployment
- the automatic overwing ramp/slide deployment

3 Door Mode Select Lever

Used to select the required mode for flight, ARMED, or arrival, DISARMED.

4 Unsafe Band

Yellow and black.

If any portion of the mode select lever is anywhere in the unsafe band, the door may be either armed or disarmed.

CAUTION: To ensure that the door is properly armed or disarmed, the door mode select lever must be positioned fully in the red or green band and remain there when released. If the door will not properly arm or disarm, contact maintenance to service the door prior to opening or closing the affected door.

WARNING: Do not attempt to move a slide pack which has released from the door. Contact maintenance.

Door Mode Select Lever Operation

The mode select lever on each door controls the arming and disarming of:

- the emergency power assist system (EPAS)
- the escape slide/raft
- the overwing ramp/slide

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Setting the mode select lever to DISARMED disarms the EPAS so that the door may be opened normally without power assist and without deploying the slide. Setting the mode select lever to ARMED arms the EPAS so rotation of the inside door operating handle to OPEN activates the EPAS and automatically deploys and inflates the slide. EPAS and manual force are sufficient to open the entry door even if the airplane is not level because of landing gear collapse or uneven terrain.

The door handle on the outside of the airplane is recessed into the door. Pushing in the red flaps at the top of the door handle allows the handle to be pulled out. Pulling the handle fully out moves the mode select lever to DISARMED, which prevents powered door opening and slide deployment and inflation. Rotating the handle then unlocks and unlatches the door. After unlocking, return the handle to the stowed and latched position.

CAUTION: To ensure that the door is properly armed or disarmed, the door mode select lever must be positioned fully in the red or green band and remain there when released. If the door will not properly arm or disarm, contact maintenance to service the door prior to opening or closing the affected door.

WARNING: Do not attempt to move a slide pack which has released from the door. Contact maintenance.

Flight Lock

Each door has a flight lock that automatically engages at speeds greater than 80 knots. The flight lock allows limited travel of the door operating handle sufficient to open the vent panel but prevents the door from opening. The flight lock releases at speeds less than 80 knots.

Entry Door

Crew entry doors 1L and 1R are used to enter and exit the airplane, and also serve as emergency exits. Either door can be opened or closed manually from inside or outside of the airplane.

The entry doors are translating, plug–type doors. During opening, the door first moves inward and upward, then translates outward and forward. Each door is held in the open position by a gust lock. The gust lock drops into a latch as the door nears its forward limit of travel. A window in each door allows observation outside of the airplane.

Placing the mode select lever in the ARMED position:

- arms the emergency power assist system
- engages the girt bar on entry doors
- arms the escape slide/rafts

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Once armed, moving the interior door handle to the open position operates the emergency power assist system actuator. The pneumatic actuator drives the door open, and the slide automatically deploys and inflates.

The emergency power assist system and the slide/raft are automatically disarmed when the door is opened from the outside. If the mode select lever is in the ARMED position and the door is opened using the exterior door handle, the mode select lever automatically moves to DISARMED and the door opens without slide/raft deployment.

The following EICAS memo messages display the overall door mode select lever positions:

- DOORS AUTO (ARMED)
- DOORS MANUAL (DISARMED)
- DOORS AUTO/MANUAL (ARMED/DISARMED).

The DOORS AUTO/MANUAL message continues to be displayed for two seconds when it is being replaced by the DOORS AUTO or DOORS MANUAL message. During this time, both the DOORS AUTO/MANUAL message and the message replacing it can be displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Evacuation Slide/Rafts

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Slide/Raft Controls

1 Slide/Raft Detachment Handle

Lift flap, pull handle to release slide/raft from girt bar.

Note: For ditching use only.

2 Manual Inflation Handle

CAUTION: The entry door slide/raft should deploy and should inflate automatically. If the slide/raft does not automatically inflate, the Manual Inflation Handle must be used.

Pull -

- inflates the slide/raft

Decompression

In the event of decompression, the oxygen mask, located in the overhead, will automatically deploy when the cabin altitude is above 13,500 feet. Additionally, the oxygen mask deployment horn will sound continuously and the air flow and oxygen alarm RESET light will illuminate. Oxygen flow is available when the mask is pulled.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Supernumerary Oxygen

Supernumerary Oxygen System

The supernumerary oxygen system is supplied by bottled gaseous oxygen. The oxygen bottles provide oxygen to the passenger and lavatory service units. The supernumerary oxygen masks are located above the passenger seats in passenger service units (PSUs).

The masks automatically drop from the PSUs if cabin altitude exceeds approximately 13,500 feet.

The supernumerary masks can be manually deployed from the flight deck by pushing the overhead panel SUPRNMRY OXYGEN switch to the ON position. Oxygen flow can be reset by selecting the SUPRNMRY OXYGEN switch to the RESET position.

Supernumerary gaseous oxygen pressure is displayed on the MFD STATUS display.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Individual Mask Shut Off

Oxygen flow to each individual oxygen mask may be manually shut off.

Oxygen Box (open)

To shut off the flow of oxygen to a particular mask:

1. locate the oxygen manifold toggle valve of the mask to be shutdown
2. move the oxygen manifold toggle to the closed (up) position

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Rigid Cargo Barrier

1 Rigid Cargo Barrier Door

2 Door Handle

The rigid cargo barrier separates the main deck cargo compartment from the supernumerary area. If there is smoke in the main deck cargo compartment, the rigid cargo barrier helps prevent the smoke from entering the supernumerary area.

Two rigid cargo barrier doors are used for access between the main deck cargo compartment and the supernumerary area. The doors are to remain closed except when entering and exiting the cargo compartment.

Main Deck Cargo Compartment Access Limitations

Occupancy of the main deck cargo compartment is prohibited during taxi, takeoff, and landing.

Main deck cargo compartment access is limited to:

- caring for live animals
- caring for cargo requiring special attention

CAUTION: Portable oxygen must be carried by occupants in the main deck cargo compartment.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

This section describes miscellaneous airplane systems, including:

- doors and windows
- flight deck seats

Doors and Windows

HL7574 - HL7766
The airplane has eight passenger entry doors, one flight deck door (the flight deck/cabin entry), and three cargo doors. It also has two center electrical and electronic (E/E) equipment access doors, one forward and one main.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The airplane has two crew entry doors and four cargo doors. It also has two center electrical and electronic (E/E) equipment access doors, one forward and one main.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The airplane has eight passenger entry doors, two overwing exits, one flight deck door (the flight deck/cabin entry), and three cargo doors. It also has two center electrical and electronic (E/E) equipment access doors, one forward and one main.

CAUTION: Do not operate the entry or cargo doors with winds at the door of more than 40 knots. Do not keep doors open when wind gusts are more than 65 knots. Strong winds can cause damage to the structure of the airplane.

The flight deck number two windows, one on the left and one on the right, can be opened by the flight crew.

HL7574 - HL7766, HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
An EICAS message is displayed when an entry door, cargo door, access door, or flight deck window is not closed, latched, and locked.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
An EICAS message is displayed when an entry door, overwing exit, cargo door, access door, or flight deck window is not closed, latched, and locked.

Passenger cabin and door-mounted windows have an inner, middle, and outer pane. Each middle and outer pane is individually designed to hold maximum cabin pressure.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Deck Door

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The flight deck door meets requirements for resistance to ballistic penetration and intruder entrance. The door opens into the flight deck. When closed, the door locks when electrical power is available and unlocks when electrical power is removed. A viewing lens in the door allows observation of the cabin. The door can be manually opened from the flight deck by turning the door handle.

The door incorporates a deadbolt with a key lock. Rotating both concentric deadbolt levers to the locked (horizontal) position prevents the cabin key from unlocking the door. Rotating only the forward deadbolt lever to locked allows the key to unlock the door.

The flight deck access system consists of an emergency access panel, a chime module, a door lock selector, two indicator lights, and an access system switch. The emergency access panel includes a six button keypad for entering the numeric emergency access code along with red, amber, and green lights. The red light illuminates to indicate the door is locked. When the correct emergency access code is entered, the amber light illuminates. The green light illuminates to indicate the door is unlocked.

Two indicator lights and a three position rotary door lock selector are located on the aft aisle stand. Illumination of the amber LOCK FAIL light indicates the door lock has failed or the access system switch is in the OFF position.

The emergency access code is used to gain access to the flight deck in case of pilot incapacitation. Annunciation of a flight deck chime and illumination of the amber AUTO UNLK light indicates the correct emergency access code has been entered and the door is programmed to unlock after a time delay. Selecting the DENY position on the door lock selector denies entry and prevents further keypad entry for several minutes. To allow entry, the selector is turned to the UNLKD position which unlocks the door while held in that position. If the emergency access code is entered and the pilot takes no action, the door unlocks after expiration of the time delay. Before the door unlocks, the chime sounds continuously and the AUTO UNLK light flashes.

By pressing "1" then "ENT" keys on the emergency access panel, the flight deck chime will sound (if programmed).

The door latch system incorporates a pressure rate-sensor that unlocks the door in the event of flight deck depressurization. Two hinged decompression panels open to equalize pressure in the event of cabin depressurization. Each panel opening has a security grill on the flight deck side.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Features are included to prevent a jammed door due to structural deformation. A lower break-away panel is attached to the main door section by interlocking extrusions and two shear pins. If sufficient upward force occurs, the pins will shear and the break-away panel will separate from the door. If the pins fail to shear, they can be retracted manually to aid in egress. An angled door jamb aids in forcing the door open into the flight deck in case of surrounding bulkhead deformation.

Flight Deck Number Two Windows

The flight deck number two windows can be opened on the ground or in flight. The flight deck number two windows can be used for emergency evacuation. The associated window lock lever locks or unlocks the window. With the window unlocked, rotating the window crank opens the window. To open the window:

- rotate the window lock lever aft to the open position
- crank the window to the full open position (the WINDOW NOT CLOSED placard is visible).

When closing the window, the window lock lever must be in the unlocked position. As the window approaches the full closed position, the force required on the crank increases. To close the window:

- crank the window to the full closed position (the WINDOW NOT CLOSED placard is not visible)
- rotate the window lock lever forward to the locked position.

The windows can be opened or closed in flight with minor flight deck consequences if the airplane is unpressurized. The force required to move the crank increases with airspeed. With the window open, voice, interphone, and radio audio may not be heard due to high noise levels. Prior communications arrangements with the controlling agency should be established before opening the window. The design provides an area of relatively calm air over the open window. Forward visibility can be maintained by looking out of the open window.

Escape ropes are attached to the airplane structure above both number two flight deck windows. The ropes are stowed in compartments above the pilot seats.

The EICAS advisory message WINDOW FLT DECK (L or R) or WINDOWS (both windows) is displayed if the window(s) are not closed and latched.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Deck Window Emergency Egress

If the flight deck number two windows must be used for emergency egress, use the following procedure:

- open the window
- remove the bag containing the rope (above and aft of window)
- pull on rope to ensure it is securely attached
- throw the bag out the window (bag falls off)
- check the first rope handhold is green and is located in the window opening
- sit on the window sill with upper body outside
- exit in accordance with the above illustration.

CAUTION: Ensure the rope is securely fastened to the airplane.

Entry Doors

HL7574 - HL7766

The passenger entry doors are used to enter and exit the airplane, and also serve as emergency exits. There are no other cabin exits. The eight passenger entry doors are paired along the airplane fuselage. The doors are identified 1 through 4 left, and 1 through 4 right. The passenger entry doors can be opened or closed manually from inside or outside of the airplane.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The passenger entry doors are used to enter and exit the airplane, and also serve as emergency exits. The two overwing exit doors are only for use as emergency exits. The eight passenger entry doors and two overwing exit doors are paired along the airplane fuselage. The doors are identified 1 through 5 left, and 1 through 5 right. The doors can be opened or closed manually from inside or outside of the airplane.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Crew entry doors 1L and 1R are used to enter and exit the airplane, and also serve as emergency exits. Either door can be opened or closed manually from inside or outside of the airplane.

The entry doors are translating, plug–type doors. During opening, the door first moves inward and upward, then translates outward and forward. Each door is held in the open position by a gust lock. The gust lock drops into a latch as the door nears its forward limit of travel. A window in each door allows observation outside of the airplane.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The overwing exit doors are translating, plug-type doors. Operation is the same as the entry doors.

Each door has a vent panel connected to the door handle. The vent is designed to prevent pressurization to an unsafe level if the door is not fully closed, latched, and locked. Forward rotation of the door handle past the latched position closes the vent. Initial aft door handle rotation opens the vent to equalize cabin and ambient pressure. At low differential pressure, the door handle can be rotated to allow the door to open fully. At high differential pressure, the vent can be partially opened; however, a mechanical interlock prevents door opening until the differential pressure is reduced. At very high differential pressure, the vent cannot be opened.

Entry Door Flight Lock

Each door handle is automatically locked when airspeed is greater than 80 knots. The flight lock allows limited door handle rotation sufficient to partially open the door vent, but prevents door opening. If electrical power is removed or fails, the flight lock is spring–loaded to the unlocked position.

Entry Door Slide/Raft

Emergency evacuation slide/raft and emergency power assist systems are contained in each entry door. Each emergency power assist system has enough power to pneumatically open the door unassisted, even if the airplane is not level because of any landing gear collapse condition. A slide/raft cover in the lower face of the door contains the slide/raft.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Overwing Escape Slide

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

An overwing escape slide assembly, consisting of a dual lane ramp with a dual lane slide, is contained in a exterior compartment in the wing body fairing. On activation of the overwing escape slide assembly, the inboard spoilers retract. An EICAS message is displayed if an overwing escape slide is not closed, latched, and locked.

WARNING: If door 3 is used during ditching, the door mode selector lever must be in MANUAL to allow the door to be opened without deploying the ramp/slide.

Emergency Exit Operation

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Placing the mode select lever in the ARMED position:

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Placing the mode select lever in the AUTOMATIC position:

- arms the emergency power assist system
- engages the girt bar on entry doors
- arms the escape slide/rafts

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- arms the overwing escape slides

Once armed, moving the interior door handle to the open position operates the emergency power assist system actuator. The pneumatic actuator drives the door open, and the slide automatically deploys and inflates.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The emergency power assist system and the slide/raft are automatically disarmed when the door is opened from the outside. If the mode select lever is in the ARMED position and the door is opened using the exterior door handle, the mode select lever automatically moves to DISARMED and the door opens without slide/raft deployment.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The emergency power assist system and the slide/raft are automatically disarmed when the door is opened from the outside. If the mode select lever is in the AUTOMATIC position and the door is opened using the exterior door handle, the mode select lever automatically moves to MANUAL and the door opens without slide/raft deployment.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The following EICAS memo messages display the overall door mode select lever positions:

- DOORS AUTO
- DOORS MANUAL
- DOORS AUTO/MANUAL.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The following EICAS memo messages display the overall door mode select lever positions:

- DOORS AUTO (ARMED)
- DOORS MANUAL (DISARMED)
- DOORS AUTO/MANUAL (ARMED/DISARMED).

The DOORS AUTO/MANUAL message continues to be displayed for two seconds when it is being replaced by the DOORS AUTO or DOORS MANUAL message. During this time, both the DOORS AUTO/MANUAL message and the message replacing it can be displayed.

Slide/Raft Deployed

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Door 3 Slide Manual Inflation Handle

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Door 3 Life Line

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

A life line is installed in the door 3 frame above each overwing exit. In a ditching emergency, the life line is attached to a hook on the wing leading edge, outboard of the engine. The life line is used as an attachment for the life raft mooring line and as a hand hold for passengers to walk out on the wing and into a life raft.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Evacuation Slide/Rafts

HL7574 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Cargo Doors

There are three lower cargo doors located on the right side of the airplane; one forward, one aft, and one bulk.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Both forward and aft cargo doors are normally operated electrically from an exterior or interior fuselage–mounted control panel located with each door. A control panel light indicates cargo door latching. Forward and aft cargo door locking is accomplished manually. If necessary, the forward and aft cargo doors may be operated manually.

The bulk cargo door is manually opened and closed, and is counterbalanced for ease of operation.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The aft small cargo door is a plug type. To open, it first moves up out of the plug position, then it opens outward and upward.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The large cargo door(s) are non-plug type of door. Door latches hold the door closed against cabin pressure loads. The door opens outward and upward.

Main Deck Cargo Door
HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

A main deck cargo door is located on the aft left side of the airplane. The door is operated from inside the airplane at either the forward or aft control panel. Each panel has lights that indicate the status of the door during opening and closing. Electric power to operate the door is supplied by the ground handling bus.

Flight Deck Seats

The flight deck has three seat types:

- pilot seats (captain and first officer)
- first observer seat
- second observer seat.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Pilot Seats

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The pilot seats:

- recline
- adjust vertically
- adjust forward and aft
- adjust for thigh support
- adjust for lumbar support

The seats also have:

- adjustable armrests
- crotch straps
- inertial–reel shoulder harnesses with manual locks
- lap belts
- adjustable headrests

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The seats move outboard during the last two inches of aft travel. Electric and manual controls provide forward, aft, and vertical adjustment. Manual levers provide other adjustments.

WARNING: Seat must be in FWD straight section of tracks during taxi, takeoff and landing.

WARNING: When manually adjusting the vertical seat position, pilots should use their legs and/or the overhead hand-hold to unload their weight from the seat prior to releasing the manual lever. A weighted seat may rapidly fall to the full down position upon lever release and may result in personal injury.

WARNING: When using the Manual (override) Horizontal Adjustment Lever to move the seat, ensure the seat motion has stopped before releasing the lever. Releasing the Manual (override) Horizontal Adjustment Lever while the seat is still moving can damage the seat actuator. Manually moving the seat to the forward or aft stop is permissible as it does not impact the seat actuator.

Lumbar and thigh pad support can be adjusted using the adjustment hand wheels. Armrest pitch can be adjusted using the control knob under the armrest. The armrests can be stowed vertically for easier seat access. The headrest angle can be adjusted by moving the cushion to the right and turning it. There are eight positions.

Adjust the seat to obtain the optimum eye position as shown on the following illustration.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Pilot Seat Adjustment

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Observer Seats

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7783, HL8208 - HL8218, HL8250 - HL8252

The first observer seat is track mounted. It adjusts manually in the vertical, forward and aft directions. The seat has:

- a folding arm rest on the left side
- crotch strap
- inertial–reel shoulder harness
- lap belt
- adjustable headrest.
- lumbar support
- fold-out work table.

The second observer seat is not adjustable. The seat has:

- folding arm rests
- crotch strap
- inertial-reel shoulder harness
- lap belt
- fixed headrest.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airplane General, Emergency Equipment, Doors, Windows EICAS Messages

The following EICAS messages can be displayed.

Message	Level	Aural	Message Logic
CREW OXYGEN LOW	Advisory		Crew oxygen pressure is low.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

DOOR AFT CARGO	Caution	Beeper	Cargo door is not closed and latched and locked.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

DOOR AFT CARGO	Advisory		Cargo door is not closed and latched and locked.

DOOR BULK CARGO	Advisory		Bulk cargo door is not closed and latched and locked.
DOOR E/E, FWD ACCESS	Advisory		Access door is not closed and latched and locked.

HL7574 - HL7766

DOOR ENTRY 1–4L, R	Advisory		Entry door is not closed and latched and locked.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

DOOR ENTRY 1–5L, R	Advisory		Entry door is not closed and latched and locked.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

DOOR ENTRY 1L, 1R	Advisory		Entry door is not closed and latched and locked.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
DOOR FWD CARGO	Caution	Beeper	Cargo door is not closed and latched and locked.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

DOOR MAIN DECK CARGO	Caution	Beeper	Main deck cargo door is not closed and latched and locked.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

DOOR WING SLIDE L, R	Advisory		The door for the unpressurized wing slide compartment is not closed and locked.

DOORS	Advisory		Two or more doors are not closed and latched and locked.

HL7202 - HL7205, HL7733 - HL8347

ELT ON	Advisory		Emergency locator transmitter is on.

EMER LIGHTS	Advisory		Emergency lighting system has been manually activated or emergency lights switch is OFF.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

PASS OXYGEN ON	Advisory		Passenger oxygen system is activated.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

SUPRNMRY OXYGEN LOW	Advisory		Supernumerary oxygen pressure is low.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

SUPRNMRY OXYGEN ON	Advisory		Supernumerary oxygen system is activated.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
WINDOW FLT DECK L, R	Advisory		Side window is not closed and latched.
WINDOWS	Advisory		Left and right side windows are not closed and latched.

EICAS Memo Messages

Message	Level	Aural	Message Logic
HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347			
DOORS AUTO	Memo		All entry doors are in the automatic mode.
DOORS AUTO/MANUAL	Memo		Some entry doors are in the automatic mode and some are in the manual mode.
DOORS MANUAL	Memo		All entry doors are in the manual mode.
HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285			
DOORS AUTO	Memo		All entry doors are in the armed mode.
DOORS AUTO/MANUAL	Memo		Some entry doors are in the armed mode and some are in the disarmed mode.
DOORS MANUAL	Memo		All entry doors are in the disarmed mode.
HL7532 - HL7766			
NO SMOKING ON	Memo		NO SMOKING switch is in the on position.
PASS SIGNS ON	Memo		The NO SMOKING and SEAT BELTS switches are in the on position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
SEATBELTS ON	Memo		The SEAT BELTS switch is in the on position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 2.10
Air Conditioning System 2.10.1
Air Conditioning Panel 2.10.1
Cabin Temperature Control 2.10.6
Shoulder and Foot Heaters 2.10.7
Cargo Temperature Control 2.10.8
Lower Cargo Temperature Control. 2.10.8
Pressurization System 2.10.9
Pressurization Panel 2.10.9
Bleed Air Control. 2.10.10
Duct Pressure and Pressurization System Indications 2.10.11
Air Synoptic Display 2.10.14

Air Conditioning System Description 2.20
Introduction 2.20.1
Air Conditioning Packs 2.20.2
Pack Ground Operation 2.20.2
Pack Non–Normal Operation 2.20.2
Standby Cooling Mode 2.20.2
Air Distribution 2.20.3
Air Outlets 2.20.3
Alternate Ventilation System 2.20.4
Temperature Control 2.20.4
Crew Rest Area Temperature Control 2.20.6
Temperature Control With Loss of Trim Air 2.20.6
Operation With Complete Loss of Zone Temperature Control 2.20.6
Shoulder and Foot Heaters. 2.20.7
Main Deck Air Flow Rate System. 2.20.7
Cargo Temperature Control System 2.20.7
Cargo Heat System 2.20.7
Lower Cargo Air Conditioning System 2.20.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Conditioning System Schematic 2.20.9
Equipment Cooling, Equipment Ventilation, Lavatory and Galley Ventilation 2.20.11

Pressurization System Description 2.30
Introduction 2.30.1
Pressurization System Automatic Operation 2.30.1
Cabin Altitude Controller Automatic Operation With Loss of Landing Altitude 2.30.2
Cabin Altitude Controller Automatic Operation With Loss of Cabin Pressurization 2.30.2
Pressurization System Manual Operation 2.30.2
Operation With Loss of Cabin Pressurization 2.30.3

Bleed Air System Description 2.40
Introduction 2.40.1
Engine Bleed Air Supply 2.40.1
APU Bleed Air Supply 2.40.1
APU to Pack Takeoff 2.40.1
Ground Bleed Air Supply 2.40.2
Bleed Air Duct System 2.40.2
Duct Leak and Overheat Detection System 2.40.2
Bleed Air System Schematic 2.40.4

EICAS Messages 2.50
EICAS Alert Messages 2.50.1
EICAS Memo Messages 2.50.3

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Conditioning System
Air Conditioning Panel

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

1 Equipment Cooling (EQUIP COOLING) Switch

AUTO – equipment cooling is controlled automatically.

Off (AUTO not visible) –

- both equipment cooling supply fans are not operating
- the override valve is open
- the forward cargo heat valve is closed

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- the nitrogen generation system (NGS) is shut down
- OVRD is illuminated

OVRD (override) illuminated (amber) – the equipment cooling override valve is open. The override valve opens and the equipment cooling system configures to override mode when:

- both equipment cooling supply fans are failed, or
- smoke is detected in the equipment cooling system, or
- the EQUIP COOLING switch is off, or
- the CARGO FIRE ARM FWD switch is in ARMED

2 Flight Deck Temperature (FLT DECK TEMP) Selector

AUTO – C to W sets the temperature from 65°F to 85°F (18°C to 29°C). Mid position (12 o'clock) sets approximately 75°F (24°C).

MAN (spring loaded to 6 o'clock position) –

- C (cool) – the flight deck trim air valve moves toward closed to supply cooler air
- W (warm) – the flight deck trim air valve moves toward open to supply warmer air

3 PACK Switches

AUTO – the pack is controlled automatically.

Off (AUTO not visible) – the pack flow control valve is commanded closed.

OFF illuminated (amber) – the pack flow control valve is closed. The valve is commanded closed and the OFF light is illuminated when:

- the pack valve is failed closed, or
- a pack or compressor outlet high temperature has occurred, or
- bleed air pressure is inadequate, or

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- the R PACK valve is closed during APU to Pack Takeoff procedure, or
- the PACK switch is pushed off

4 TRIM AIR Switches

ON – the master trim air valve is commanded open and the zone trim air valves operate automatically.

Off (ON not visible) – the master trim air valve is commanded closed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FAULT illuminated (amber) –

- the trim air valve is failed closed, or
- the trim air valve is commanded closed because a zone supply duct overheat has occurred, or
- the TRIM AIR switch is off
- if a single master trim air valve is failed closed or commanded closed, the other trim air valve continues to operate normally

5 Air Conditioning Reset (AIR COND RESET) Switch

Push –

- attempts to reset any closed pack flow control valve or trim air valve held closed because an overheat, control failure, or valve failure has occurred
- attempts to reset a failed recirculation fan
- resets fault protection

6 Cabin Temperature (CABIN TEMP) Selector

C to W – sets the temperature from 65°F to 85°F (18°C to 29°C). Mid position (12 o'clock) sets approximately 75°F (24°C).

7 Recirculation Fans (RECIRC FANS) Switches

ON – the recirculation fans are controlled automatically.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 Recirculation Fans (RECIRC FANS) Switch

ON – the recirculation fans are controlled automatically.

2 Equipment Cooling (EQUIP COOLING) Switch

AUTO – equipment cooling is controlled automatically.

Off (AUTO not visible) –

- both equipment cooling supply fans are not operating
- the override valve is open
- the forward cargo heat valve is closed
- the nitrogen generation system (NGS) is shut down
- OVRD is illuminated

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

OVRD (override) illuminated (amber) – equipment cooling override valve is open. The override valve opens and the equipment cooling system configures to override mode when:

- both equipment cooling supply fans are failed, or
- smoke is detected in the equipment cooling system, or
- the EQUIPMENT COOLING switch is off, or
- the CARGO FIRE ARM FWD switch is in ARMED

3 Air Conditioning Reset (AIR COND RESET) Switch

Push –

- attempts to reset any closed pack valve flow control valve or trim air valve held closed because an overheat, control failure, or valve failure has occurred
- attempts to reset a failed recirculation fan
- resets fault protection

4 Flight Deck Temperature (FLT DECK TEMP) Selector

AUTO – C to W sets the temperature from 65°F to 85°F (18°C to 29°C). Mid position (12 o'clock) sets approximately 75°F (24°C).

MAN (spring loaded to 6 o'clock position) –

- C (cool) - the flight trim air valve moves toward closed to supply cooler air
- W (warm) - the flight deck trim air valve moves toward open to supply warmer air

5 PACK Switch

AUTO – the pack is controlled automatically.

Off (AUTO not visible) – the pack flow control valve is commanded closed.

OFF illuminated (amber) – the pack flow control valve is closed. The valve is commanded closed and the OFF light is illuminated when:

- the pack valve is failed closed, or
- a pack or compressor outlet high temperature has occurred, or
- bleed air pressure is inadequate, or
- the R PACK valve is closed during APU to Pack Takeoff procedure, or
- the PACK switch is pushed off.

6 TRIM AIR Switch

ON – the master trim air valve is commanded open and the zone trim air valves operate automatically.

Off (ON not visible) – the trim air valve is commanded closed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FAULT illuminated (amber) –

- the trim air valve is failed closed, or
- the trim air valve is commanded closed because a zone supply duct overheat has occurred, or
- the TRIM AIR switch is off.

7 Main Deck Cargo Temperature (MAIN DECK CARGO TEMP) Selector

C to W sets temperature between 40°F and 80°F (4°C and 27°C). Mid position (12 o'clock) sets approximately 60°F (16°C).

8 Alternate Ventilation (ALTN VENT) Switch

ON –

- the alternate ventilation system fan operates and the alternate ventilation system shutoff valves are open
- the lavatory galley vent fans are shut down and the lavatory galley shutoff valve are closed.

FAULT illuminated (amber) – a fault is occurring in the alternate ventilation system.

9 Main Deck Air Flow Rate (M/D FLOW) Selector

NORM – pack airflow is controlled automatically.

HIGH – all operating packs are configured to high flow.

Cabin Temperature Control

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Cabin Temperature (CABIN TEMP) Selector

C to W sets the temperature from 65°F to 85°F (18°C to 29°C). Mid position (12 o'clock) sets approximately 75°F (24°C).

Shoulder and Foot Heaters

1 SHOULDER HEATER Control

OFF to HIGH – the electric heater adds heat to the condition air supplied at shoulder level.

2 FOOT HEATER Selector

Heating rate varies based on HI and LO selection. Heater is inhibited when the temperature of the foot heater plate is above 65°F (18°C).

OFF – the under-floor electric heater is not operating.

LOW – the under-floor electric heater operates at a low heating rate.

HIGH – the under-floor electric heater operates at a high heating rate.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cargo Temperature Control

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Aft and Bulk Cargo Temperature Control

1 CARGO TEMPERATURE Selectors

OFF - shuts off bleed air to the associated compartment.

LOW – bleed air heating system maintains the compartment temperature between 40°F and 50°F (4°C to 10°C).

HIGH – bleed air heating system maintains the compartment temperature between 65°F and 75°F (18°C to 24°C). For the bulk compartment only, the bulk compartment ventilation fan operates continuously.

Lower Cargo Temperature Control

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Lower Cargo Temperature Panel

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Lower Cargo Temperature Forward (LWR CARGO TEMP FWD) Selector

A/C – C to W sets the temperature from 40°F to 80°F (4°C to 27°C). Mid position (12 o'clock) sets approximately 60°F (16°C).

2 Lower Cargo Temperature Aft (LWR CARGO TEMP AFT) Selector

A/C –

- C to W sets the temperature from 40°F to 80°F (4°C to 27°C). Mid position (12 o'clock) sets approximately 60°F (16°C).
- lower aft cargo compartment bleed air heating system does not operate

Low (L) –

- bleed air heating system maintains compartment temperature between 40°F and 50°F (4°C and 10°C)
- lower aft cargo compartment air conditioning does not operate

High (H) –

- bleed air heating system maintains the compartment temperature between 65°F and 75°F (18°C and 24°C)
- lower aft cargo compartment air conditioning does not operate

Pressurization System
Pressurization Panel

1 OUTFLOW VALVE Switches

AUTO – the outflow valve is controlled automatically.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

MAN (manual) illuminated (amber) –

- outflow valve is controlled manually
- automatic outflow valve control and cabin altitude limiter is bypassed
- AUTO is extinguished

2 OUTFLOW VALVE MANUAL Switches

OPEN – moves the outflow valve toward open.

CLOSE – moves the outflow valve toward closed.

3 Landing Altitude (LDG ALT) Selector

Pull ON, then rotate –

- sets landing altitude manually
- landing altitude followed by MAN is displayed on EICAS
- landing altitude changes in 100 foot increments at first detent, 500 foot increments at second detent

Push –

- landing altitude is set automatically from FMS – Refer to Chapter 11, Flight Management Navigation – Approach
- landing altitude followed by AUTO is displayed on primary EICAS

Bleed Air Control

1 Bleed Isolation (ISLN) Switches

AUTO – the bleed isolation valve is controlled automatically.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Off (AUTO not visible) – the valve is commanded closed.

CLOSED illuminated (amber) –

- the valve is closed because a duct leak or bleed loss has occurred, or
- the valve is failed closed, or
- the switch is off

2 APU Bleed Switch

AUTO – the APU bleed air valve opens by system logic when bleed air pressure is available.

Off (AUTO not visible) – the valve is commanded closed.

OFF illuminated (amber) –

- the valve is closed because a duct leak has occurred
- the valve is failed closed, or
- the switch is off, or
- the APU fire switch is pulled out

3 Engine (ENG) Bleed Switches

ON – the engine bleed valve opens when engine bleed air is available.

Off (ON not visible) – the valve is commanded closed.

OFF illuminated (amber) – the engine bleed valve is closed. The engine bleed valve is commanded closed and the OFF light is illuminated when:

- the engine is not running, or
- a bleed air overheat, overpressure, or bleed control system failure has occurred, or
- the valve is failed closed, or

HL7202 - HL7205, HL7782 - HL8347

- the L ENG bleed valve is closed during APU to Pack Takeoff procedure, or
- the ENG fire switch is pulled out, or
- the switch is off

Duct Pressure and Pressurization System Indications

Pressurization system indications are displayed when:

- landing altitude MAN is displayed
- either OUTFLOW VALVE switch is in MAN
- cabin altitude is in amber above normal range or in red excessive range
- cabin differential pressure is in amber above normal range or i n red excessive range

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- duct pressure is in amber below normal range with the respective engine running
- the AIR synoptic switch is pushed
- any of the following EICAS messages are displayed:
  - CABIN ALTITUDE
  - CABIN ALTITUDE AUTO
  - LANDING ALTITUDE
  - OUTFLOW VALVE AFT
  - OUTFLOW VALVE FWD.

1 Duct Pressures

White – normal range.

Amber – below normal range.

2 Cabin Altitude

White – normal range.

Amber – above normal range.

Red – excessive cabin altitude.

3 Cabin Altitude Rate

+ (plus) – rate of climb.

– (minus) – rate of descent.

4 Outflow Valve Control Source

M (manual) (amber) – manual control.

Blank – automatic control.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 Outflow Valves Position

OP – open.

CL – closed.

6 Cabin Differential Pressure

White – normal range.

Amber – above normal range.

Red – excessive cabin differential pressure.

7 Landing Altitude Selection

AUTO (white) – altitude is set automatically from the FMC.

MAN (amber) – altitude is set by the LANDING ALTITUDE selector.

8 Landing Altitude

Landing altitude is supplied by the FMC or is manually set using the LANDING ALTITUDE selector.

Blank – display is blank without a valid FMC landing altitude or a manually set landing altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Synoptic Display

The air systems synoptic is displayed by pushing the AIR Synoptic switch on the Display Select panel. Display Select panel operation is described in Chapter 10, Flight Instruments, Displays.

Air flow displayed is generated by displayed valve positions, switch positions, and pack status. It does not display actual air flow, therefore the display may not represent actual system operation.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

MULTIFUNCTION DISPLAY

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

1 Zone Temperature

MASTER - (MM) temperature setting of Passenger Temperature selector.

F/D -

- (TT) target temperature on left; displayed when:
  - at least one pack is operating, and
  - FLT DECK TEMP selector is in AUTO, and
  - temperature control is not in backup mode
- (AA) actual temperature on right

A, B, C, D, E, and F -

- (TT) target temperature on left; displayed when:
  - at least one pack is operating, and
  - temperature control is not in backup mode
- (AA) actual temperature on right

FWD - (AA) actual temperature

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

AFT, BULK -

- (TT) target temperature on left; displayed when:
  - at least one pack is operating, and
  - FWD CARGO A/C selector is in AUTO, and
  - temperature control is not in backup made
- (AA) actual temperature on right

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 Zone Temperature

F/D, SUPR -

- (TT) target temperature on left; displayed when:
  - at least one pack is operating, and
  - the FLT DECK TEMP selector is in AUTO, and
  - temperature control is not in backup mode
- (AA) actual temperature on right

MAIN DECK CARGO FWD, MAIN DECK CARGO AFT -

- (TT) target temperature on left; displayed when:
  - at least one pack is operating, and
  - temperature control is not in backup mode
- (AA) actual temperature on right

LOWER CARGO TEMP FWD, LOWER CARGO TEMP AFT -

- (TT) target temperature on left; displayed when:
  - at least one pack is operating, and
  - the LOWER CARGO TEMP selector is in A/C, and
  - temperature control is not in backup mode
- (AA) actual temperature on right

2 Flight Deck Trim Air Valve position

Position of the flight deck trim air valve.

3 Trim Air Valve

Position of the trim air valve.

4 Pack Control

Pack is operating - green oval

Pack is not operating or pack status data is invalid - white oval

Pack failed - amber oval with amber X

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 Isolation Valve

Position of the isolation valve.

6 Wing Anti-Icing Valve

Position of the wing anti-icing valve.

7 Engine Anti-Icing Valve

Position of the engine anti-icing valve.

8 Bleed Air Duct Pressure

White - 11 psi or greater.

Amber - less than 11 psi.

9 APU Bleed Air Valve

Position of the APU bleed air valve.

10 APU Start Valve

Position of the APU start valve.

11 Engine Start Valve

Position of the engine start valve.

Positions of the trim air, wing anti-icing, engine anti-icing, engine start, isolation, APU bleed air, and APU start valves are displayed as:

- open - green circle with bar in-line with duct
- closed - white circle with bars across duct
- failed open - amber valve open symbol with amber X
- failed closed - amber valve closed symbol with amber X
- valve position data is not available - white circle with no bars
- for wing anti-icing valve not in commanded position - amber valve symbol with amber X
- for isolation and APU bleed air valves selected closed - amber valve closed symbol with amber X

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The system supplies ventilation for the passenger cabin:

- lavatories
- galleys

HL7574 - HL7766
- lower crew rest compartment

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
- overhead crew rest compartments

HL7202 - HL7205, HL7733 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
- flight deck crew rest compartment

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The system supplies ventilation for the crew rest, lavatory, and galley.

Pack control, zone temperature control, cabin air recirculation, fault detection, and overheat protection are all automatic. Backup system control modes operate automatically in the event of system failures.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The airplane is divided into seven temperature zones: the flight deck and six passenger cabin zones.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The airplane is divided into six temperature zones: the flight deck, supernumerary cabin, forward and aft main deck cargo zones, and the forward and aft lower cargo compartments.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Conditioning Packs

Two identical air conditioning packs cool bleed air from the engines, APU, or high pressure air from a ground source. Bleed air is precooled before entering the pack. Each pack is controlled by two redundant channels in one of two separate controllers. If one channel fails in a controller, control of the respective pack is continued automatically by the redundant channel in that controller.

Pack Ground Operation

Both air conditioning packs are normally selected to AUTO for ground operations. Fuel consumption is about the same for single pack and two pack operation, and single pack operation causes higher flight line noise levels.

A ground source of conditioned air may be used to supply conditioned air directly to the cabin distribution system, eliminating the need for pack operation.

Pack Non–Normal Operation

Pack control, fault detection, and overheat protection are all automatic. If an overheat or other significant pack fault is detected, the pack shuts down automatically. An attempt to restore pack operation may be made by pressing the AIR COND RESET switch.

Standby Cooling Mode

For certain internal malfunctions, pack control automatically uses standby cooling mode as a backup to normal mode. In standby cooling mode, the EICAS advisory message PACK MODE (L, R) is displayed, and STBY COOLING is displayed in amber on the AIR synoptic.

If one pack is in standby cooling and the other pack is operating normally, the pack in standby cooling mode shuts down at lower altitudes and higher outside air temperatures when ambient conditions do not permit standby cooling. The pack restarts automatically when altitude and outside air temperatures are suitable for standby cooling.

If both packs are in standby cooling mode, or if one pack is inoperative and the other pack is in standby cooling mode, the packs or pack operates continuously to maintain cabin pressurization, regardless of altitude or outside air temperature.

In standby cooling mode, pack cooling capacity may be less than in normal mode and may result in warm flight deck or cabin temperatures at lower altitudes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Distribution

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The flight deck receives 100% fresh conditioned air from the left pack. The flight deck is maintained at a slightly higher pressure than the passenger cabin to prevent smoke and objectionable odors from entering the flight deck.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The flight deck and supernumerary cabin receive 100% fresh conditioned air from the left pack. To prevent smoke and objectionable odors from entering the occupied compartments, the flight deck and supernumerary cabin are maintained at a slightly higher pressure than the main deck cargo and lower cargo compartments.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Recirculation fans assist the packs to maintain a constant ventilation rate through the cabin. The fans draw cabin air through filters, then reintroduce the air into the conditioned air distribution system.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Recirculation fans assist the packs to maintain a constant ventilation rate through the cargo compartments. The fans draw cabin air through filters, then reintroduce the air into the cargo conditioned air distribution system.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Air exhausted from the passenger cabin flows into the upper recirculation system or to the lower deck, where it is either exhausted overboard through outflow valves or drawn into the lower recirculation system. Air from the recirculation fans is mixed with pack air before entering the distribution ducts.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Air exhausted from the main deck cargo compartment flows into the lower deck, where it is either exhausted overboard through outflow valves or drawn into the recirculation system. Air from the recirculation fans is mixed with pack air before entering the cargo compartment distribution ducts.

Air Outlets

In the flight deck, these outlets provide air directly from the air conditioning system:

- Vertical outlet in the overhead panel between the electrical and hydraulic panels.
- Vertical outlet in the overhead panel between the fuel and air panels.
- Vertical outlet in the center of the overhead circuit breaker panel.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

These are the best outlets to determine the temperature of conditioned air. The pilot and first officer gaspers do not provide an accurate temperature indication. The window outlets have in-line heaters, so they will not provide an accurate temperature indication.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

In the cabin, the overhead air outlet vents provide air directly from the air conditioning system and provide an accurate temperature indication of conditioned air.

Alternate Ventilation System

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The alternate ventilation system provides air flow into the flight deck and supernumerary cabin when both air conditioning packs are inoperative. If the airplane is not pressurized normally and the ALTN VENT switch is ON, air is drawn from the aft outflow valve and provided to the flight deck and supernumerary cabin. When the airplane is pressurized normally and the ALTN VENT switch is ON, there is no air flow through the alternate ventilation system.

Temperature Control

Zone temperatures are controlled by the cabin air conditioning and temperature control system (CACTCS). Hot trim air from the bleed air system is added through trim air valves in the conditioned air supply ducts. The CACTCS modulates the zone trim air valves to achieve the target temperature of the conditioned air in each zone.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Trim air from the left engine bleed is added to conditioned air ducts for the flight deck and three passenger cabin zones. Trim air from the right engine is added to the conditioned air ducts for the other three passenger cabin zones.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Trim air from the left engine bleed is added to conditioned air ducts for the flight deck, supernumerary cabin, forward main deck cargo, and lower aft cargo compartments. Trim air from the right engine is added to the conditioned air ducts for the aft main deck cargo and lower forward cargo compartments, and the flight deck equipment cooling during flight.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The CABIN TEMP selector sets a master temperature between 65°F and 85°F (18°C and 29°C). The master reference temperature is increased or decreased automatically or manually to set target temperatures for each temperature zone.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7575
For passenger comfort, the target temperature for each passenger cabin temperature zone increases automatically at a slow rate during the early part of cruise flight. This temperature increase is to compensate for a presumed decrease in passenger activity and humidity. During descent, the target temperatures decrease slowly until the comfort temperature corrections that were added are all removed. The target temperatures of each passenger cabin temperature zone may also be modified manually plus or minus 10°F (6°C), within the range of 65°F and 85°F (18°C and 29°C), using the cabin management system.

HL7202 - HL7205, HL7598 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The target temperatures of each passenger cabin temperature zone may be modified manually plus or minus 10°F (6°C), within the range of 65°F and 85°F (18°C and 29°C), using the cabin management system.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The FLT DECK TEMP selector sets the flight deck temperature to between 65°F and 85°F (18°C and 29°C). Flight deck temperature is controlled manually by setting the selector to MAN.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The FLT DECK TEMP selector sets a temperature for the flight deck zone to between 65°F and 85°F (18°C and 29°C). Flight deck cabin temperature is controlled manually by setting the selector to MAN.

The CABIN TEMP Selector on the supernumerary control and display panel sets a temperature for the supernumerary cabin zone to between 65°F and 85°F (18°C and 29°C). Manual control is not available for the supernumerary cabin zone.

The temperature zone requiring the coolest temperature controls the pack outlet temperature.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
If the flight deck or cabin temperature selector setting is unavailable to the pack temperature controller, the pack outlet temperature is regulated to achieve either the last temperature set or an average cabin temperature of 75°F (24°C).

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
If the FLT DECK TEMP or MAIN DECK CARGO TEMP selector setting is unavailable to the pack temperature controller, the pack outlet temperature is regulated to achieve either the last temperature set or an average flight deck temperature of 75°F (24°C).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Rest Area Temperature Control

HL7202 - HL7205, HL7574 - HL8347

Crew rest area temperature may be controlled manually by the heater controls in the compartment.

Temperature Control With Loss of Trim Air

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
If the left or right trim air system is off, the CACTCS attempts to maintain all zones at the average target temperature. Flight deck temperature will be maintained between 65°F and 85°F (18°C and 29°C).

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
If the left or right trim air system is off, the CACTCS attempts to maintain all zones at the average selected temperature. Flight deck temperature will be maintained between 65°F and 85°F (18°C and 29°C).

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The flight deck may become uncomfortably warm or cool. Setting the CABIN TEMP selector to a cooler or warmer master temperature may achieve a cooler or warmer flight deck temperature.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The flight deck may become uncomfortably warm or cool. Setting the FWD or AFT MAIN DECK CARGO TEMP selector to a cooler or warmer temperature may achieve a cooler or warmer flight deck temperature.

Operation With Complete Loss of Zone Temperature Control

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
If CACTCS control of cabin temperature zones fails, or all engine and APU electrical power fails, the air supply and cabin pressurization controllers control the pack flow control valves. Pack flow rate is modulated to achieve a pack outlet temperature between 40°F and 110°F (5°C and 43°C). All flight deck ECS controls are disabled except the PACK switches.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
If CACTCS control of cabin temperature zones fail, or all engine and APU electrical power fails, the air supply and cabin pressurization controllers control the pack flow control valves. Pack flow rate is modulated to achieve a pack outlet temperature between 40°F and 110°F (5°C and 43°C). All flight deck ECS controls are disabled except the PACK switches.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Shoulder and Foot Heaters

Flight crew shoulder heat is provided by electric elements in the side window air diffusers. The foot heaters have electric heating elements only, with no airflow. Both are available in flight only.

Main Deck Air Flow Rate System

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Normal and High Main Deck Cargo flow modes can be selected by positioning the M/D FLOW switch on the ECS Control Module which is located in the overhead panel.

Normal flow mode is intended for most cargo types on the Main Deck Cargo compartment. During flight it schedules a lower airflow setting which conserves fuel. Additionally, the left recirculation fan does not operate during Normal flow mode.

High flow mode is intended for carrying live animals or perishable cargo. During High flow mode, all six shut-off valves are open. In High Flow mode the cruise fuel burn increase is expected to be an additional 0.1% to 0.2%.

During a "Class E" Main Deck Cargo fire fighting mode, all six shut-off valves close.

Cargo Temperature Control System
Cargo Heat System

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The aft and bulk cargo compartments have independent bleed air heating systems. An insulated curtain separates the two compartments.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

With the CARGO TEMP selector in LOW or HIGH, the respective cargo heat shutoff valve opens and the temperature control valve opens and closes to maintain the temperature in the compartment. The lavatory/galley vent fans draw air across temperature sensors in each compartment. If both vent fans fail, cargo heat is not provided.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
With the CARGO TEMP selector in LOW and TAT less than 45°F (7°C), the respective temperature control valve opens. The compartment temperature is maintained between 40°F and 50°F (4°C and 10°C). With the CARGO TEMP selector in HIGH and TAT less than 70°F (21°C), the respective temperature control valve opens. The compartment temperature is maintained between 65°F and 75°F (18°C and 24°C).

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
With the BULK CARGO TEMP selector in HIGH the bulk ventilation fan operates. The fan is provided for animal carriage. The system has automatic overheat protection. When an automatic overheat shutdown occurs, cargo heat to the related compartment cannot be restored in flight.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
With the LWR CARGO TEMP AFT selector in LOW and TAT less than 45°F (7°C) the temperature control valve opens. The compartment temperature is maintained between 40°F and 50°F (4°C and 10°C). With the selector in HIGH and TAT less than 70°F (21°C), compartment temperature is maintained between 65°F and 75°F (18°C and 24°C).

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The lower forward cargo compartment is heated by warm air from the forward equipment ventilation system.

Lower Cargo Air Conditioning System

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

With the LWR CARGO TEMP FWD A/C selector or the LWR CARGO TEMP AFT A/C selector commanding temperature, the respective cargo heating system is shut off and a target temperature for the compartment is displayed on the AIR synoptic.

If a lower cargo temperature selector setting is not available because of system failure, the packs maintain the temperature of that compartment to the last temperature set by the respective forward or aft selector.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Conditioning System Schematic

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

F/D – flight deck
ISLN – isolation valve
WAI – wing anti–icing valve
EAI – engine anti–icing valve

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

F/D - flight deck
SUPR - supernumerary
AA (white) - actual temperature
TT (magenta) - target temperature
EAI - engine anti-icing valve
ISLN - isolation valves
WAI - wing anti-icing valve

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Equipment Cooling, Equipment Ventilation, Lavatory and Galley Ventilation

The forward equipment cooling and ventilation provides cooling and ventilation for the electrical and electronic equipment on the flight deck and in the forward electrical and electronic (E & E) compartment equipment racks.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The forward systems use internal fans and valves to direct air drawn from the cabin to the equipment and ventilates the warm exhaust air into the forward outflow valve or the forward cargo compartment, if the compartment requires additional heat. There are two cooling system supply fans, a primary and a backup. If the primary supply fan fails, the backup supply fan operates automatically.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The forward systems use internal fans and valves to direct conditioned pack air to the equipment and ventilates the warm exhaust air into the forward outflow valve or the lower forward cargo compartment if the compartment requires additional heat. There are two cooling system supply fans, a primary and a backup. If the primary supply fan fails, the backup supply fan operates automatically.

The forward system reconfigures automatically to an override mode when:

- in flight, both supply fans fail, or
- in flight, low airflow is detected, or
- smoke is detected in the forward equipment cooling system or the forward equipment ventilation system, or

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
- the FWD CARGO FIRE ARM switch is ARMED, or

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
- the LWR AFT CARGO FIRE ARM switch is ARMED, or

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
- the LWR FWD CARGO FIRE ARM switch is ARMED
- the EQUIP COOLING switch is in OVRD

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

In the override mode when the FWD CARGO FIRE ARM switch is not ARMED, the vent valve opens, both supply fans shut down, and the forward cargo heat valve closes. In the override mode when the FWD CARGO FIRE ARM switch is ARMED, the vent valve remains closed, both supply fans remain shut down, and the forward cargo heat valve is closed. Cabin differential pressure draws air through the flight deck panels and into the E & E equipment compartment to create a reverse flow of air across the equipment, then through the override valve to an overboard vent.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

In the override mode when the LWR FWD CARGO FIRE ARM switch is not ARMED, the vent valve opens, both supply fans shut down, and the lower forward cargo heat valve closes. In the override mode when the LWR FWD CARGO FIRE ARM switch is ARMED, the vent valve remains closed, both supply fans remain shut down, and the lower forward cargo heat valve is closed. Cabin differential pressure draws air through the flight deck panels and into the E & E equipment compartment to create a reverse flow of air across the equipment, then through the override valve to an overboard vent.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

When the MAIN DECK FIRE switch is ARMED, the system is configured to supply conditioned air to the flight deck and the air is exhausted through the ventilation system into the lower forward cargo compartment.

In flight, the EQUIP COOLING switch in OVRD aids smoke evacuation from the flight deck.

The override mode supplies adequate airflow for equipment cooling while the airplane is in cruise. During descent, the airflow decreases as the cabin pressure differential decreases.

On the ground, the EICAS advisory message EQUIP COOLING is displayed and the ground crew call horn in the wheel well sounds if the forward equipment cooling system is inoperative.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The aft equipment cooling and ventilating system provides cooling and ventilating air for the aft electronic equipment and ventilating air for the lavatories and galleys. Two aft ventilation fans, a primary and a backup, draw air through the aft electronic equipment and from the galleys and lavatories. The warm exhaust air is discharged through the aft outflow valve. Conditioned air is supplied to the galleys from the air distribution system.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The aft equipment cooling and ventilating system provides cooling and ventilating air for the aft electronic equipment and ventilating air for the lavatory and galley. Two aft ventilation fans, a primary and a backup, draw air through the aft electronic equipment and from the galley and lavatory. The warm exhaust air is discharged through the aft outflow valve. Conditioned air is supplied to the galley from the air distribution system.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

Cabin pressurization is controlled by regulating the discharge of conditioned cabin air through the outflow valves.

Two outflow valves are installed: one forward and one aft. Normally, most of the outflow is through the aft outflow valve. This improves ventilation and smoke removal. Cabin altitude and full ventilation rates can be maintained by either valve.

Positive and negative pressure relief valves protect the fuselage against excessive pressure differential.

The pressurization system has automatic and manual operating modes. Other than accomplishing normal procedures for entering FMC data, no specific flight crew action is required for fully automatic operation.

Pressurization System Automatic Operation

In flight, the cabin altitude controller operates in a climb mode, a cruise mode, or a descent mode.

The controller uses ambient pressure and flight plan data from the FMC to calculate a cabin pressurization schedule. The schedule provides a comfortable cabin climb to cruise altitude.

For takeoff, the system supplies a small positive pressurization prior to rotation to cause a smooth cabin altitude transition to the cabin altitude climb schedule.

In cabin altitude controller climb mode, cabin altitude increases on a schedule related to the airplane climb rate and flight plan cruise altitude. When the FMC climb path has a planned level segment, it is included in the total time required for the airplane to reach the top of climb. Cabin altitude continues to increase during the level segment. When the airplane climb flight path is above the FMC climb path and maximum cabin pressure differential is reached during the climb, cabin rate then becomes a function of airplane climb rate so maximum cabin differential pressure is not exceeded.

If cruise altitude is unavailable from the FMC in AUTO, the cabin altitude controllers assume a cruise altitude of 39,000 feet.

In cabin altitude controller cruise mode, maximum cabin altitude is 8,000 feet. When the takeoff field elevation is higher than 8,000 feet, the cabin descends to the cabin cruise altitude while the airplane is climbing.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When the destination airport elevation is greater than 8,000 feet, cabin altitude controller cruise mode maintains a cabin altitude of 8,000 feet.

The cabin altitude controllers enter cabin altitude controller descent mode at T/D or at initial descent of approximately 1,000 feet from cruise altitude, regardless of T/D.

In cabin altitude descent mode, cabin altitude decreases or increases to slightly below the FMC planned landing altitude in AUTO or the landing altitude set in MAN. The slight altitude difference ensures a small positive pressurization at touchdown. In MAN, FMC altitude information is bypassed and the cabin altitude controller uses internal rate schedules to control cabin altitude.

Landing elevation limits are 1,000 feet below sea level to 14,000 feet above sea level. The captain's altimeter setting provides landing altitude barometric pressure correction.

At touchdown, the outflow valves open to depressurize the cabin.

The cabin altitude limiter closes both outflow valves if cabin altitude exceeds 15,000 feet.

Full automatic operation of cabin altitude is possible with one outflow valve operating automatically and the other outflow valve not operating.

Cabin Altitude Controller Automatic Operation With Loss of Landing Altitude

If landing altitude is unavailable from the FMC, and not set in MAN, the EICAS advisory message LANDING ALTITUDE is displayed and the cabin altitude controller assumes a landing altitude of 1,000 feet.

Cabin Altitude Controller Automatic Operation With Loss of Cabin Pressurization

If a depressurization event occurs, the cabin altitude controller controls the outflow valves to preserve cabin pressure.

Pressurization System Manual Operation

If both OUTFLOW VALVE switches are in MAN, all automatic cabin altitude control functions are bypassed.

The pressurization system is in the manual mode when the OUTFLOW VALVE switches are set to MAN.

The system is manually operated by:

- setting the OUTFLOW VALVE switches to MAN
- holding the related OUTFLOW VALVE MANUAL switch to OPEN or CLOSE.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Outflow valve position is displayed on the EICAS display. If the outflow valve position is not available on EICAS, holding the respective OUTFLOW VALVE MANUAL switch in the desired position for 30 seconds will move the valve from full open or close to the selected position.

Landing altitude (normally provided by the FMC) can be manually set using the LANDING ALTITUDE selector. Landing field selection limits are 2,000 feet below sea level to 14,000 feet above sea level. Pulling the selector out to the detent removes the FMC landing altitude and displays pressurization system indications on the EICAS display. The knob is rotated clockwise to increase or counterclockwise to decrease the landing altitude setting. Two rates of increase or decrease, low and high, are available in each direction from the spring–loaded center position.

Operation With Loss of Cabin Pressurization

With a sudden loss of cabin pressurization, the outflow valves will close immediately in an attempt to control the cabin pressure. After descent, when the airplane and cabin altitudes are approximately equal, the outflow valves open to protect the airplane against negative pressure differentials.

It is important that the flight crew not attempt to manually close the outflow valves during the descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

Bleed air can be supplied by the engines, APU, or a ground air source.

Bleed air is used for:

- air conditioning
- pressurization
- wing and engine anti–icing
- APU and engine start
- aft cargo heat
- air driven hydraulic pumps
- hydraulic reservoir pressurization
- potable water tank pressurization
- TAT probe aspiration.

Engine Bleed Air Supply

Engine bleed air is supplied from either the high stage or the low stage engine sections. Low stage air is used during high power setting operations. High stage air is used during descent and other low power setting operations.

The engine bleed valves close automatically:

- during start
- for bleed source loss
- for bleed air overtemperature
- for bleed air overpressure
- for a bleed air duct leak
- when an engine fire switch is pulled
- when a ground cart is supplying air.

APU Bleed Air Supply

APU bleed air is used primarily during ground operations for pack operation and engine starting. In flight, APU bleed air is available at and below 22,000 feet.

The check valve in the APU supply line prevents reverse flow of bleed air from the duct into the APU.

APU to Pack Takeoff

HL7202 - HL7205, HL7782 - HL8347

Before engine start, selecting APU from the FMC scratch pad to the SEL-APU field on the THRUST LIMIT PAGE arms the system for APU to pack takeoff. Approximately one minute after starting the second engine, the bleed air supply system configures for APU to pack takeoff.

When APU is selected to the SEL-APU field after both engines are running but before takeoff, the bleed air supply immediately configures for APU to pack takeoff.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

In APU to pack takeoff configuration:

- the left engine bleed valve is closed,
- the L ENG OFF light is illuminated and remains illuminated,
- the APU provides air to air demand pump C1 and the left pack,
- the center bleed isolation valve is closed,
- the right engine provides air to air demand pump C2,
- the right pack valve is closed, and
- the R PACK OFF light is illuminated and remains illuminated.

The system reconfigures from APU to pack takeoff to normal operation when:

- thrust is reduced to climb thrust, or
- approximately 10 minutes after takeoff, or
- the airplane is above 11,400 feet altitude, or
- APU to pack configuration cannot be continued because of failures in other systems, or
- APU to pack mode is deleted manually.

Ground Bleed Air Supply

External connectors are provided to connect a ground source of high pressure air directly to the bleed air duct.

Check valves prevent reverse flow of bleed air from the bleed air duct to the connectors.

Bleed Air Duct System

The left, center, and right isolation valves separate the bleed air duct into isolated segments. The automatic system operates with the left and right isolation valves normally open. The center isolation valve is normally closed, except for engine start or single bleed source operation. When the center and respective isolation valves are open, air from the APU can be used for engine start.

Duct Leak and Overheat Detection System

If a duct leak is detected, the system automatically isolates the leak. The EICAS caution message BLEED LEAK is displayed. The automatic isolation logic may include one, two, or three sequential steps. During isolation, the ENGINE and/or APU bleed switch OFF lights and the ISOLATION switch CLOSED lights illuminate and extinguish as the respective valves close and open.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When the temperature in the affected duct area cools, the BLEED LEAK EICAS message is no longer displayed. The valves isolating the leak remain closed and the appropriate EICAS message BLEED LOSS is displayed. The switch OFF or CLOSED lights are illuminated for the respective valves which remain closed to isolate the affected duct area.

CAUTION: Do not change the APU bleed, engine bleed, or bleed isolation switch positions after the system has automatically isolated the leak. Airplane damage can occur.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Bleed Air System Schematic

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

F/D - Flight Deck
ISLN - Isolation Valve
WAI - Wing Anti-Ice Valve
EAI - Engine Anti-Ice Valve

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

F/D - flight deck
SUPER - Supernumerary
AA (white) - actual temperature
TT (magenta) - target temperature

EAI - engine anti-ice valve
ISLN - isolation valves
WAI - wing anti-ice valve

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Alert Messages

Message	Level	Aural	Message Logic
HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285			
ALTN VENT SYS	Advisory		The alternate ventilation system is failed when commanded to operate.
BLEED ISLN CLOSED C, L, R	Advisory		The isolation valve is failed closed when commanded open or the bleed isolation switch is OFF.
BLEED ISLN OPEN C, L, R	Advisory		The isolation valve is failed open when commanded closed.
BLEED LEAK BODY	Caution	Beeper	A bleed air leak is detected in the body area.
BLEED LEAK L, R	Caution	Beeper	A bleed air leak is detected in the wing or pack bay area.
HL7532 - HL7766			
BLEED LEAK STRUT L, R	Caution	Beeper	A bleed air leak is detected in the strut area.
HL7202 - HL7205, HL7782 - HL8347			
BLEED LEAK STRUT L, R	Caution	Beeper	A bleed air leak or starter duct leak is detected in the strut area.
BLEED LOSS BODY	Advisory		Bleed air from the left and right body ducts is not available.
BLEED LOSS BODY L, R	Advisory		Bleed air from the body duct is not available.
BLEED LOSS WING L, R	Advisory		Bleed air from the wing duct is not available.
BLEED OFF APU	Advisory		The APU bleed valve is closed because of a system fault or the APU bleed switch is OFF.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
BLEED OFF ENG L, R	Advisory		The engine bleed valve is closed because of a system fault or the engine bleed switch is OFF.
CABIN ALTITUDE	Warning	Siren	Cabin altitude is excessive.
CABIN ALTITUDE AUTO	Caution	Beeper	Automatic pressurization control is failed or both outflow valve switches are in manual.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

CABIN TEMPERATURE	Advisory		Flight deck or cabin temperature is excessively hot or cold. The temperature may cause incapacitation.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

CARGO A/C LWR AFT	Advisory		Aft lower cargo air conditioning is inoperative.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

CARGO A/C LWR FWD	Advisory		Forward lower cargo air conditioning is inoperative.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

CARGO HEAT AFT	Advisory		Cargo heat is inoperative or the cargo temperature selector is OFF.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

CARGO HEAT AFT, BULK	Advisory		Cargo heat is inoperative or the cargo temperature selector is OFF.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
EQUIP COOLING	Advisory		The forward equipment cooling is failed.
EQUIP COOLING OVRD	Advisory		The equipment cooling system is in override mode.
LANDING ALTITUDE	Advisory		The FMC does not supply a landing altitude or the landing altitude selector is pulled.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

MAIN DECK A/C	Advisory		Main deck cargo air conditioning is inoperative.
OUTFLOW VALVE AFT, FWD	Advisory		Automatic control of the outflow valve is inoperative or the outflow valve switch is in MAN.
PACK L, R	Advisory		Pack is inoperative.
PACK L+R	Caution	Beeper	Both packs are inoperative.
PACK MODE L, R	Advisory		The pack is in the standby mode.
TRIM AIR L, R	Advisory		The trim air valve is closed.

EICAS Memo Messages

Message	Level	Aural	Message Logic
RECIRC FANS OFF	Memo		One or both recirculation fan switches are off.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 3.10
Engine and Wing Anti Icing 3.10.1
Anti-Ice Panel 3.10.1
Anti–Icing Indications 3.10.2
Window Heat and Wiper Panels 3.10.3
Window Heat Panel 3.10.3
Wiper Panels 3.10.3

System Description 3.20
Introduction 3.20.1
Anti-Icing Systems 3.20.1
Icing Conditions Detection 3.20.1
Engine Anti–Icing 3.20.1
Wing Anti–Icing 3.20.2
Anti–Icing System Schematic 3.20.4
Flight Deck Windows 3.20.4
Windshield Wipers 3.20.5
Probe Heat 3.20.5

EICAS Messages 3.30
EICAS Alert Messages 3.30.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine and Wing Anti Icing
Anti-Ice Panel

1 WING ANTI–ICE Selector

OFF – the wing anti–icing valves are commanded closed.

AUTO – in flight, the wing anti-icing valves open when wing icing conditions exist and bleed air pressure is available, except when inhibited during and after takeoff.

ON – in flight, the wing anti–icing valves are commanded open.

Note: When the WING ANTI-ICE selector is in AUTO and an anti-icing valve is commanded open or when the WING ANTI-ICE selector is in ON, then:

- The stick shaker is set to activate at a lower angle of attack (higher airspeed) to provide an adequate margin of stall warning.
- Stall Angle-of-attack adjustment is sent to Primary Flight Displays (PFDs), Flight Controls, Autopilot and Flight Management Computer to provide adequate avoidance of wing contaminated flight critical situations.

2 ENGINE ANTI–ICE Selectors

OFF – the engine anti-icing valve is commanded closed.

AUTO – in flight, the engine anti-icing operates when engine icing conditions exist.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ON – the engine anti-icing valve is commanded open.

Note: When the ENGINE ANTI-ICE selector is in AUTO and the anti-icing valve is commanded open or when the ENGINE ANTI-ICE selector is in ON, then:

HL7532 - HL7766
- approach idle and continuous ignition are commanded by the EEC

HL7202 - HL7205, HL7782 - HL8347
- approach idle is commanded by the EEC
- The stick shaker is set to activate at a lower angle of attack (higher airspeed) to provide an adequate margin of stall warning.
- Stall Angle-of-attack adjustment is sent to Primary Flight Displays (PFDs), Flight Controls, Autopilot and Flight Management Computer to provide adequate avoidance of wing contaminated flight critical situations.

Anti–Icing Indications

1 Engine Anti-icing Indication

Displayed (green) – engine anti-icing valve is open.

2 Wing Anti-Icing Indication

Displayed (green) – wing anti-icing valve is open.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Window Heat and Wiper Panels

Window Heat Panel

1 WINDOW HEAT Switches

ON – controlled heat is applied to the respective windows.

INOP (inoperative) illuminated (amber) –

- the switch is OFF, or
- an overheat has occurred, or
- a system fault has occurred

Wiper Panels

1 WIPER Selectors

OFF – the wiper is off and is moved to stowed position.

INT (intermittent) – the wiper operates intermittently at low speed.

LOW – the wiper operates at low speed.

HIGH – the wiper operates at high speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The anti–icing and rain systems include:

- icing conditions detection
- engine anti–icing
- wing anti–icing
- flight deck window heat
- windshield wipers
- probe heat

Anti-Icing Systems

Engine and wing anti-icing is provided by distributing engine bleed air to the engine inlets and to the wing leading edges. Window anti-icing and anti-fogging is accomplished via embedded heaters. The air data probes are also anti-iced by electric heaters. The windshields are cleared of rain by windshield wipers and a hydrophobic coating.

Icing Conditions Detection

The icing conditions detection system detects when the aircraft is flying in icing conditions.

Two probes on the forward fuselage and system logic:

- automatically controls the engine and wing anti-icing valves when AUTO is selected
- display anti-icing system operating indications on EICAS, and
- display EICAS alert messages

If ice is detected on the probes, they are automatically deiced. Each occurrence of ice build-up and subsequent deicing of the probes is counted by the system as one cycle.

When two deicing cycles have occurred, the system activates engine anti-icing. When ten deicing cycles have occurred, the system activates wing anti-icing.

When the icing condition detection system no longer detects icing, engine and wing anti-icing will remain on for 3 minutes before they are deactivated to avoid the systems cycling on and off when flying in intermittent icing.

Engine Anti–Icing

The engine anti-icing valves are opened by engine bleed air pressure. When an engine anti-icing valve is open, EAI is displayed under the respective left or right engine N1 indicators on the primary EICAS display.

In flight, when an ENGINE ANTI–ICE selector is in AUTO and engine icing conditions exist, the respective engine anti-icing valve is commanded open.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When an ENGINE ANTI–ICE selector is ON, the respective engine anti-icing valve is commanded open.

Engine Anti–Icing System Leak Detection

Each engine has an anti-icing duct leak detection system. If an engine anti–icing duct leak is detected, the respective engine anti–icing valve closes.

Wing Anti–Icing

When a wing anti-icing valve is open, WAI is shown on the primary EICAS display to indicate when the wing anti-icing system is in operation.

On the ground:

- wing anti-icing valves are automatically commanded closed regardless of the WING ANTI-ICE selector position.

In flight:

- when the WING ANTI-ICE selector is in AUTO and wing icing conditions exist, the wing anti-icing valves are commanded open except when inhibited during takeoff and initial climb.
- when the WING ANTI-ICE selector is ON the wing anti-icing valves are commanded open.

Automatic wing anti–icing operation is inhibited during takeoff and initial climb until either of the following occurs:

- No Flight Director, Autopilot, and/or Flight Management Computer TAKEOFF mode is active, or
- 10 minutes have elapsed after liftoff

Note: The flight crew may activate the WING ANTI-ICE by selecting the switch to ON if required during the inhibit period. Overriding the inhibit will result in reduced performance.

If a bleed source is unavailable and bleed duct isolation has not occurred, the isolation valves open to maintain anti-icing to both wings. If a bleed air or wing anti-icing system fault occurs that would result in asymmetrical wing anti-icing, the wing anti-icing system deactivates to prevent asymmetrical anti-icing.

Anti-Ice System Effects

When any of the following occur during flight:

- Wing and/or engine anti-ice selector switches are ON
- Ice detection system has detected icing conditions

Flight systems will be adjusted to account for a buildup of ice on the wing.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

These adjustments are latched throughout the rest of the flight because the system has no means to determine whether ice, once formed, has subsequently been completely shed.

Stall Warning/Stick Shaker

The angle-of-attack activation point is set to a lower angle to provide a sufficient stall warning margin before the lower stall angle of attack that would be caused by a buildup of ice on the wing.

Flight Controls

Adjusted parameters are sent to the flight control system to allow proper operation of the stall protection at lower angles of attack.

Display Systems

PFD indications will be modified to be consistent with the adjustments. This will increase the airspeed at which the Minimum Maneuvering Speed (top of the amber colored speed tape) and the Minimum Speed (top of the black and red barber pole) are shown on the PFD. The Pitch Limit Indication (PLI) will be shown at a lower pitch attitude.

Autopilot

An adjustment is sent to the autopilot so it will not command flight operations within the amber colored speed tape bands which represent the minimum or maximum maneuver margin airspeeds. Target speeds will not appear in the amber-colored speed tape bands.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Anti–Icing System Schematic

Flight Deck Windows

Flight deck windows are electrically heated. The forward windshields have anti-icing protection on the exterior surfaces, and controlled anti-fogging heating on the interior surfaces. The side windows have controlled anti-fogging heating on the interior surfaces.

The WINDOW HEAT switches control heating for all flight deck windows.

If a fault or overheat condition is sensed, power is disconnected from the respective window heat system. Selecting a WINDOW HEAT switch off for 10 seconds, then ON, resets a window heat controller fault.

A backup anti-fogging system for the forward windows operates automatically if the primary window heat system fails.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Windshield Wipers

The three speed windshield wipers are independently controlled. When a WIPER selector is OFF, the wiper is off and stowed.

Probe Heat

Three pitot-static probes and two angle of attack probes are electrically heated for anti-icing protection when either engine is operating.

The total air temperature probe is electrically heated for anti-icing protection in flight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Alert Messages

Message	Level	Aural	Message Logic
ANTI–ICE ENG L, R	Advisory		The engine anti–icing valve is closed when commanded open.
ANTI–ICE LEAK ENG L, R	Caution	Beeper	A bleed air leak occurs in the engine anti-icing duct.
ANTI–ICE LOSS ENG L, R	Advisory		Anti–icing bleed air for the engine is not available.
ANTI–ICE ON	Advisory		The ANTI-ICE selector is ON, and TAT is more than 10 degrees C, and icing conditions do not exist.

HL7202 - HL7205, HL7733 - HL7764, HL7766 - HL8347

ANTI-ICE VLV WING L, R	Caution	Beeper	On the ground and less than 35 knots ground speed, the wing anti-icing valve is open when commanded closed.

ANTI–ICE WING	Advisory		One or both wing anti–icing valves are failed closed.
HEAT PITOT C	Advisory		The center pitot probe heat is failed.
HEAT PITOT L	Advisory		The left pitot probe heat is failed.
HEAT PITOT L+C+R	Advisory		The left, center, and right pitot probe heats are failed.
HEAT PITOT R	Advisory		The right pitot probe heat is failed.
ICE DETECTORS	Advisory		The ice detection system has failed.
ICING ENG	Caution	Beeper	Icing conditions exist and an engine ANTI-ICE selector is OFF.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
ICING WING	Advisory		Icing conditions exist and the WING ANTI-ICE selector is OFF, or icing conditions exist and wing anti-icing is inhibited during takeoff.
WINDOW HEAT	Advisory		Two or more window heats are off.
WINDOW HEAT L, R FWD	Advisory		Primary window heat for the forward window is inoperative.
WINDOW HEAT L, R SIDE	Advisory		Window heat for the side window is inoperative.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 4.10
Mode Control Panel (MCP) 4.10.1
Autopilot Flight Director System Controls. 4.10.1
Autothrottle System Controls 4.10.4
Autopilot Flight Director IAS/Mach Controls 4.10.6
Autopilot Flight Director Roll and Pitch Controls 4.10.8
Autopilot Flight Director Heading, Track, and Bank Angle Controls 4.10.12
Autopilot Flight Director Vertical Speed (V/S) and Flight Path Angle (FPA) Controls 4.10.14
Autopilot Flight Director Altitude Controls 4.10.16
Autopilot Flight Director Approach Mode Controls 4.10.18
PFD Flight Mode Annunciations (FMAs) 4.10.20
Autopilot Disconnect Switch 4.10.22
Autothrottle Disconnect and TO/GA Switches 4.10.23

System Description 4.20
Introduction 4.20.1
Autopilot Flight Director System. 4.20.1
MCP Mode Selection 4.20.1
Autopilot Engagement 4.20.2
Autopilot Disengagement 4.20.2
Autopilot and Flight Director Mode Degradations. 4.20.2
Flight Director Display 4.20.5
Autopilot Flight Director System Schematic 4.20.6
AFDS Status Annunciation. 4.20.7
AFDS Flight Mode Annunciations 4.20.7
Autothrottle System 4.20.11
Manual Flight 4.20.11
Automatic Activation 4.20.11
Autothrottle Thrust Lever Operation 4.20.14

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autothrottle Disconnect 4.20.14
Automatic Flight Operations 4.20.15
Automatic Flight - Takeoff and Climb 4.20.15
Automatic Flight Takeoff Profile 4.20.17
Automatic Flight - Cruise 4.20.17
Automatic Flight - Approach and Landing 4.20.18
Automatic Flight Approach Profile. 4.20.20
Automatic Flight - Go–Around. 4.20.21
Automatic Flight Go–Around Profile 4.20.23
Automatic Flight Windshear Recovery 4.20.25
Flight Envelope Protection. 4.20.25

EICAS Messages 4.30
Automatic Flight EICAS Messages 4.30.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Mode Control Panel (MCP)

Autopilot Flight Director System Controls

1 Autopilot (A/P) Engage Switch

Push (either switch engages the autopilot) –

- inhibited on the ground with flaps out of UP
- when either Flight Director switch is ON, the autopilot engages in the selected flight director mode(s)
- when both Flight Director switches are OFF, the autopilot engages in:
  - heading hold (HDG HOLD) or track hold (TRK HOLD) as the roll mode; or, if bank angle is greater than five degrees, attitude hold (ATT)
  - vertical speed (V/S) or flight path angle (FPA) as the pitch mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Autopilot Engaged Light

Illuminated (green) – autopilot is engaged.

3 Autopilot (A/P) DISENGAGE Bar

Push down –

- with autopilot engaged:
  - disengages autopilot
  - displays EICAS warning message AUTOPILOT DISC
  - sounds an aural warning
  - illuminates master warning lights
- prevents autopilot engagement
- displays EICAS advisory message NO AUTOLAND
- disables bank angle protection
- exposes amber and black stripes (as installed).

Lift up –

- enables autopilot engagement
- hides amber and black stripes (as installed)
- enables bank angle protection.

4 Flight Director (F/D) Switches

The left flight director switch activates the flight director steering indications on the left PFD. The right flight director switch activates the flight director steering indications on the right PFD.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ON –

- on the ground with both Flight Director switches OFF, the first Flight Director switch positioned ON arms the flight director in takeoff go–around (TO/GA) roll mode. In addition, the first switch arms the flight director in TO/GA pitch mode when MCP selected altitude differs more than 20 feet from displayed baro altitude, or activates the flight director in altitude (ALT) pitch mode when selected altitude is within 20 feet of displayed baro altitude. If ALT mode is active, selecting an altitude more than 20 feet from displayed baro altitude and recycling the first switch arms the flight director in TO/GA roll and pitch modes. The flight mode annunciation appears on both PFDs. Positioning the second switch ON displays the flight director steering indications on the second PFD
- in flight with the autopilot disengaged and both Flight Director switches OFF, the first Flight Director switch positioned to ON activates the flight director in:
  - heading hold (HDG HOLD) or track hold (TRK HOLD) as the roll mode; or, if bank angle is greater than 5°, attitude hold (ATT)
  - vertical speed (V/S) or flight path angle (FPA) as the pitch mode
- in flight with the autopilot engaged and both Flight Director switches OFF, the first Flight Director switch positioned to ON activates the flight director in the currently selected autopilot mode(s).

OFF –

- the flight director steering indications do not display, unless
- a TO/GA switch is pushed when airspeed is greater than 80 knots and flaps are out of up.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autothrottle System Controls

1 Autothrottle (A/T) ARM Switches

The left Autothrottle Arm switch arms or disarms the left engine autothrottle. The right Autothrottle Arm switch arms or disarms the right engine autothrottle.

ARM -

- arms selected autothrottle for mode activation
- autothrottle activates when VNAV, FLCH, or TO/GA switch pushed
- autothrottle activates when autothrottle switch pushed in any pitch mode
- autothrottle automatically activates in certain low airspeed situations as described in the Automatic Activation section.

OFF –

- disconnects selected autothrottle
- prevents selected autothrottle activation.

2 Climb/Continuous (CLB/CON) Thrust Switch

On the ground and below 400 feet during takeoff, the switch is inoperative.

Push –

- with two engines operating, changes the engine thrust limit to the FMC selected climb thrust
- with one engine operating, changes the thrust limit to maximum continuous (CON).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Autothrottle Engage (A/T) Switch

Push –

- above 400 feet with autothrottle armed, activates the appropriate autothrottle mode for the selected AFDS pitch mode, or if no pitch mode, in speed (SPD) mode.

4 Autothrottle Engage Light

Illuminated (green) – an autothrottle mode is active.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autopilot Flight Director IAS/Mach Controls

1 IAS/MACH Window

Shows 200 knots when power first applied.

Shows the speed selected by the IAS/MACH selector.

Blanks when the FMC controls the speed. When changing from TO/GA to V/S, FPA, or ALT, the window shows:

- the flap placard speed minus 5 knots (flaps extended), or
- 250 knots (flaps up), or
- a speed value entered in the IAS/MACH window after TO/GA was pushed.

Shows range:

- 100 – 399 KIAS
- .400 – .950 Mach.

The selected speed shows as the PFD selected speed.

In climb, automatically changes from IAS to Mach at .840 Mach.

In descent, automatically changes from Mach to IAS at 310 knots.

2 IAS/MACH Reference Switch

Push –

- alternately changes IAS/MACH window between IAS and Mach displays (Mach must be 0.4 or greater to switch from IAS to Mach)
- inoperative when IAS/MACH window is blank.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 IAS/MACH Selector

Rotate –

- sets the speed in the IAS/MACH window as the selected speed on both the PFDs
- inoperative when IAS/MACH window is blank.

Push – with VNAV active, alternately activates or blanks the IAS/MACH window.

When the window is blank, FMC computed target speed is active and shows on both PFDs.

When the window is open, FMC speed–intervention is active and IAS/MACH selector may be used to set the desired speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autopilot Flight Director Roll and Pitch Controls

MODE CONTROL PANEL (MCP)

1 Lateral Navigation (LNAV) Switch

Push –

- arms, selects, or disarms LNAV as roll mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- shows LNAV in white (armed) on both PFDs roll flight mode annunciations when armed. The previous roll mode remains active
- LNAV activates when the airplane is above 50 feet radio altitude and:
  - within 2.5 NM of the active leg
  - when not within 2.5 NM of the active leg and on an intercept heading to the active leg, remains armed then activates when approaching the active leg
  - when active, shows LNAV in green on both PFDs roll flight mode annunciation
- selection of LNAV with the airplane not on a heading to intercept the active leg, displays NOT ON INTERCEPT HEADING in the CDU scratchpad
- selection of LNAV when an active FMC route is not available displays NO ACTIVE ROUTE in the CDU scratchpad
- LNAV maintains current heading when:
  - passing last active route waypoint
  - passing last waypoint prior to a route discontinuity

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- passing last route offset waypoint
- activating the inactive route or activating an airway intercept and not within LNAV engagement criteria.

LNAV is deactivated:

- by selecting heading hold (HDG HOLD) or track hold (TRK HOLD)
- by selecting heading select (HDG SEL) or track select (TRK SEL)
- when localizer captures
- with dual FMC failure (LNAV may be re–activated if there is an active CDU ALTN NAV route available).

LNAV is disarmed by:

- pushing the LNAV switch a second time
- by arming LOC or APP
- when the TO/GA switch is pushed with flaps not up and no instrument approach procedure loaded into the FMC
- by disengaging the autopilot and turning both flight directors off.

2 LNAV Light

Illuminated (green) – the LNAV mode is armed or active.

3 Vertical Navigation (VNAV) Switch

Push –

- arms, selects, or disarms VNAV as the pitch mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- shows VNAV as armed mode on both PFDs (in white) pitch flight mode annunciation below 400 feet
- VNAV activates 400 feet above runway elevation
- when VNAV selected and the FMC has insufficient data to provide VNAV guidance (such as the gross weight is invalid or there is no end–of–descent point in descent) displays PERF/VNAV UNAVAILABLE in the CDU scratchpad
- VNAV SPD, VNAV PTH, or VNAV ALT pitch mode shows in green (active) on both PFDs pitch flight mode annunciation
- in VNAV SPD pitch mode, AFDS commands pitch to hold target airspeed. The autothrottle operates in the THR REF, THR, IDLE, or HOLD mode, as required by phase of flight
- in VNAV PTH pitch mode, the AFDS commands pitch to maintain FMC target altitude or VNAV path
- in VNAV ALT pitch mode, the AFDS commands pitch to maintain MCP selected altitude; autothrottles operates in speed (SPD) mode

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- when selecting VNAV and VNAV commands a descent with the MCP altitude window above the current airplane altitude, the autopilot maintains the altitude at which VNAV was selected. When on an instrument approach using VNAV, selecting the missed approach altitude does not interfere with the VNAV descent
- when selecting VNAV and VNAV commands a climb with the MCP altitude window below the current airplane altitude, the autopilot maintains the altitude at which VNAV is selected
- with the VNAV PTH pitch mode active, the autothrottle operates in the following modes:
  - for climb or cruise – operates in the speed (SPD) mode
  - for descent – operates in the IDLE, HOLD, or speed (SPD) mode
- VNAV pitch guidance is available with one engine inoperative.

VNAV is deactivated:

- by selecting TO/GA, FLCH SPD, V/S, FPA, ALT or G/S pitch mode
- if dual FMC failure
- by disengaging the autopilot and turning both flight directors off.

VNAV is disarmed by:

- pushing the VNAV switch a second time, or
- arming APP.

4 VNAV Light

Illuminated (green) – the VNAV mode is armed or active.

5 Flight Level Change (FLCH) Switch

Push –

- selects FLCH SPD pitch mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- FLCH SPD pitch mode shows in green (active) on both PFDs flight mode annunciation
- when IAS/MACH window is blank, it activates to the FMC target speed, if valid. If not valid, the IAS/MACH window activates to the current speed
- when IAS/MACH window is active, it shows command speed
- when changing from TO/GA to FLCH, IAS/MACH window shows highest value of current speed or selected speed
- AFDS pitch holds MCP selected speed. When MCP selected altitude captured, pitch flight mode annunciation changes to ALT
- A/T operates in THR, followed by HOLD mode in descent. When selected altitude captured, A/T mode changes to SPD

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- A/T advances or retards thrust levers to provide 500 FPM vertical speed for each 1000 feet altitude change
- AFDS attempts to reach the MCP selected altitude within two minutes if able with available thrust. Otherwise, A/T uses IDLE or CLB thrust to reach the MCP selected altitude
- with a higher altitude set in the altitude window, reference thrust limit changes to CLB when CRZ displayed or to CON with an engine inoperative.

6 Flight Level Change Light

Illuminated (green) – flight level change mode is active.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autopilot Flight Director Heading, Track, and Bank Angle Controls

1 Heading/Track (HDG/TRK) Reference Switch

Push –

- alternately changes the heading/track window, PFD, and ND selected heading/track references between heading and track. Also changes both PFDs roll flight mode annunciations, when the HDG or TRK mode is active.

2 Heading/Track Window

Shows selected heading or track on both PFDs and NDs. When approach armed, changes to ILS front course at LOC capture. Shows 360 when power first applied.

3 Heading/Track Hold (HOLD) Switch

Push –

- selects heading hold (HDG HOLD) or track hold (TRK HOLD) roll mode
- inoperative when the active roll mode is either LOC or FAC and the active pitch mode is either G/S or G/P

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- shows HDG HOLD or TRK HOLD on both PFDs roll flight mode annunciation
- AFDS commands wings level and holds heading or track when wings level.

4 Heading/Track Hold Light

Illuminated (green) – heading/track HOLD mode is active.

5 BANK LIMIT Selector (outer)

Rotate –

- sets AFDS commanded bank limit when in the heading select (HDG SEL) or track select (TRK SEL) roll mode as follows:
- AUTO – varies between 15 – 25 degrees, depending on TAS
- 5, 10, 15, 20, or 25 – selected value is the maximum, regardless of airspeed.

6 Heading/Track Selector (middle)

Rotate –

- sets heading or track in the heading/track window and on both PFDs and NDs.

7 Heading/Track Select (SEL) Switch (inner)

Push –

- selects heading select (HDG SEL) or track select (TRK SEL) as roll mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- shows HDG SEL or TRK SEL on both PFDs roll flight mode annunciation
- AFDS controls roll to fly the selected heading or track
- bank is limited by bank limit selector.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autopilot Flight Director Vertical Speed (V/S) and Flight Path Angle (FPA) Controls

1 Vertical Speed/Flight Path Angle (V/S – FPA) Window

Shows selected vertical speed in 100 fpm increments or the selected flight path angle in 0.1 degree increments.

Display range:

- V/S: -8000 to +6000 fpm
- FPA: -9.9 to +9.9 degrees

Blank when vertical speed (V/S) or flight path angle (FPA) pitch mode is not active; display state can be pre-selected by pushing the V/S - FPA Reference Switch.

Selected vertical speed shows on both PFDs vertical speed indication.

Selected flight path angle shows on both PFDs attitude indicator.

Flight path vector shows on both PFDs if not already shown.

2 V/S – FPA Reference Switch

Push –

- alternately changes vertical speed/flight path angle window on PFD references between vertical speed and flight path angle. Also changes both PFDs pitch flight mode annunciations, when the V/S or FPA mode is active.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 V/S – FPA Switch

Push –

- selects V/S or FPA pitch mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- shows V/S or FPA on both PFDs pitch flight mode annunciation
- shows current vertical speed or flight path angle in the vertical speed/flight path angle window
- when selected altitude is reached, the pitch mode changes to ALT
- AFDS commands pitch to maintain the vertical speed or flight path angle displayed in the vertical speed/flight path angle window
- when V/S or FPA selected while in FLCH or VNAV, autothrottle activates in speed (SPD) mode when engaged.

4 V/S – FPA Light

Illuminated (green) – the vertical speed/flight path angle mode is active.

5 V/S – FPA Selector

UP or DOWN – sets the vertical speed or flight path angle in the vertical speed/flight path angle window and on both PFDs.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autopilot Flight Director Altitude Controls

1 Altitude Window

Shows selected altitude.

The altitude shown is the reference altitude for altitude alerting and level off.

The altitude range is 0 to 50,000 feet.

Shows 10,000 feet when power is first applied.

The selected altitude shows on both PFDs altitude tapes.

Shows altitude transmitted to ATC.

2 Altitude Increment Selector (outer)

AUTO –

- the altitude selector changes in 100 foot increments
- shows the selected BARO minimum as the altitude selector passes through that altitude. If the BARO minimum is not a 10 foot increment, shows the next highest 10 foot increment

1000 – the altitude selector changes in 1,000 foot increments.

3 Altitude Selector (inner)

Rotate –

- sets altitude in the altitude window and on both PFDs.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Push –

- in climb or descent with altitude constraints, each push deletes the next waypoint constraint between the airplane altitude and the altitude window setting
- in climb with no altitude constraints, and the altitude window set above the FMC cruise altitude, the cruise altitude is changed to the altitude window setting
- in cruise:
  - with the altitude window set above or below FMC cruise altitude, resets the FMC cruise altitude to the altitude window altitude
  - when in VNAV PTH or VNAV ALT pitch mode, initiates a climb or descent toward the altitude window altitude
  - within 50 NM of the top–of–descent (T/D) point with the altitude window set below cruise altitude, initiates descend now (DES NOW) feature.

4 Altitude HOLD Switch

Push –

- selects altitude (ALT) pitch mode
- inoperative when the active roll mode is LOC and the active pitch mode is G/S
- ALT shows on both PFDs pitch flight mode annunciations
- AFDS commands pitch to maintain the altitude when the switch was pushed.

5 Altitude Hold Light

Illuminated (green) – the altitude hold mode is active.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autopilot Flight Director Approach Mode Controls

1 Localizer (LOC) Switch

Push –

- arms, disarms, or captures localizer (LOC) as the roll mode
- shows LOC in white (armed) on both PFDs roll flight mode annunciations before localizer capture; current roll mode remains active until LOC capture
- shows LOC in green (active) on both PFDs roll flight mode annunciations after localizer capture
- arms AFDS to capture and track inbound on front course
- capture point varies based on range and intercept angle
- localizer capture can occur when intercept track angle is within 120 degrees of the localizer course.

The localizer mode can be disarmed before localizer capture by:

- pushing the localizer switch a second time, or
- arming or activating LNAV.

The localizer mode can be deactivated after localizer capture by:

- selecting a roll mode other than LNAV, or
- pushing a TO/GA switch, or
- disengaging the autopilot and turning both flight director switches off, or
- pushing the localizer switch a second time above 1,500 feet radio altitude (reverts to the default roll mode).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Localizer Light

Illuminated (green) – the localizer mode is armed or active.

3 Approach (APP) Switch

Push –

- arms, disarms, or captures localizer (LOC) as roll mode and glideslope (G/S) as pitch mode
- shows LOC and G/S in white (armed) on both PFDs roll and pitch flight mode annunciations prior to localizer and glideslope capture
- shows LOC and G/S in green (engaged) on both PFDs roll and pitch flight mode annunciations after each one is captured
- AFDS captures and tracks localizer and captures the glideslope upon interception
- localizer captures when intercept track angle is within 120 degrees of localizer course
- glideslope captures when intercept track angle is within 80 degrees of localizer course.

Glideslope capture is inhibited before localizer capture.

The approach mode can be disarmed or deactivated for any status of localizer and/or glideslope by disengaging the autopilot and turning both Flight Director switches off.

When both localizer and glideslope are armed, the approach mode can be disarmed by selecting APP, LOC, LNAV, or VNAV.

The approach mode deselects:

- by pushing APP when above 1,500 feet radio altitude, or
- with localizer captured and glideslope armed, by selecting heading select (HDG SEL) or heading hold (HDG HOLD), or
- after localizer and glideslope are captured, by selecting TO/GA mode.

4 Approach Light

Illuminated (green) – the approach modes (LOC and G/S) are armed or active.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Flight Mode Annunciations (FMAs)

Note: When first activated, Autothrottle, Roll Mode, Pitch Mode and Autoland Status changes are emphasized for 10 seconds by a green box drawn around the mode.

Note: An amber horizontal line displays through the affected active pitch or roll mode when a flight mode fault is detected.

Note: NO AUTOLAND shows on both PFDs if failures cause the system to degrade from multi-channel engage status (LAND 3 or LAND 2) to single channel status during an autoland. The mode change is emphasized for 10 seconds by an amber box.

Note: NO AUTOLAND also shows on both PFDs if multi-channel approach selected but multi-channel engage status (LAND 3 or LAND 2) has not been annunciated by 600 feet AGL. Under these conditions, flare and rollout modes are not armed.

1 Autothrottle Modes (Active)

Illuminated (green) –

- HOLD
- IDLE
- SPD
- THR
- THR REF

Note: When only one autothrottle is connected and armed, the autothrottle mode annunciator is augmented by a “L-” or “R-” preceding the mode.

2 AFDS Roll Modes (Active)

Illuminated (green) –

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- ATT
- HDG HOLD
- HDG SEL
- LNAV
- LOC
- ROLLOUT
- TO/GA
- TRK HOLD
- TRK SEL

3 AFDS Roll Modes (Armed)

Illuminated (white) –

- LOC
- ROLLOUT
- LNAV

4 AFDS Pitch Modes (Active)

Illuminated (green) –

- TO/GA
- ALT
- V/S
- VNAV PTH
- VNAV SPD
- VNAV ALT
- G/S
- FLARE
- FLCH SPD
- FPA

5 AFDS Pitch Modes (Armed)

Illuminated (white) –

- G/S
- FLARE
- VNAV

6 Autoland Status Annunciation

Illuminated (green) –

- FLT DIR
- A/P
- LAND 3

Illuminated (green with white triangles) – ▷LAND2◁

Illuminated (amber) – NO AUTOLAND.

A change to the Autoland Status Annunciation is indicated by a green box surrounding the Autoland Status Annunciation for 10 seconds, except for a change to NO AUTOLAND. If the Autoland Status Annunciation changes to NO AUTOLAND, NO AUTOLAND is surrounded by an amber box for 10 seconds.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autopilot Disconnect Switch

1 Autopilot Disconnect Switch

First push (either switch) –

- disengages all autopilots
- Master Warning lights illuminate
- shows the EICAS warning message AUTOPILOT DISC
- sounds an aural warning
- if the autopilot automatically disengages, first push resets the Master Warning lights, EICAS warning message, and the aural warning.

Second push – resets:

- Master Warning lights
- EICAS warning message
- aural warning.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autothrottle Disconnect and TO/GA Switches

1 Takeoff/Go-around (TO/GA) Switches

On the ground:

Push (below 50 knots and flaps out of up) –

- activates autothrottle in THR REF mode at reference thrust limit selected on THRUST LIMIT page. If not pushed below 50 knots, autothrottle operation is inhibited until reaching 400 feet altitude.

Push (above 80 knots, prior to lift off) –

- disarms LNAV and VNAV, if they were armed
- the Flight Directors are automatically shown, if they were not ON.

In flight:

Push (after lift-off with takeoff reference thrust limit displayed) –

- removes takeoff and climb derates and assumed temperature thrust reduction
- A/T in HOLD, activates A/T in THR REF mode
- disarms LNAV and VNAV, if armed
- between 50 feet and 400 feet, selects TO/GA roll mode
- above 400 feet, selects TO/GA roll and pitch modes

Push (on approach with flaps out of up or glideslope captured) –

- activates autothrottle in THR mode with GA reference thrust limit displayed. Thrust adjusts to provide 2000 feet per minute climb
- selects TO/GA roll and pitch modes

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

- arms or activates LNAV if an LNAV path is available
- disarms AFDS modes.

Note: During landing, the TO/GA switches are inhibited after touchdown or when below 2 feet radio altitude for 3 seconds or more. If the landing is discontinued, the TO/GA switches are enabled again above 5 feet radio altitude.

Second push (go-around active with flaps out of up, LNAV armed, TO/GA roll and pitch mode) -

- activates autothrottle in THR REF using GA reference thrust, or

Second push (go-around active with flaps out of up, LNAV active, TO/GA pitch mode) -

- activates autothrottle in THR REF using GA reference thrust, roll mode remains LNAV, or

Second push (go-around active with flaps out of up, HDG SEL or HDG HOLD active, TO/GA pitch mode) -

- activates autothrottle in THR REF using GA reference thrust, selects TO/GA roll and pitch modes.

2 Autothrottle Disconnect Switches

Push (either switch) –

- disconnects autothrottle (both left and right)
- illuminates Master Caution lights
- displays EICAS message AUTOTHROTTLE DISC
- if autothrottle automatically disconnects, resets Master Caution lights and EICAS message.

Second push –

- resets Master Caution lights and EICAS message
- autothrottle remains armed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The automatic flight control system consists of the autopilot flight director system (AFDS) and the autothrottle system (A/T). The mode control panel (MCP) and the flight management computer (FMC) control the AFDS and the autothrottle system to perform climb, cruise, descent, and approach.

Autopilot Flight Director System

The AFDS consists of three autopilot flight director computers (AFDCs) and the MCP.

The MCP provides control of the autopilot, flight director, altitude alert, and autothrottle systems. The MCP is used to select and activate AFDS modes, and establish altitudes, speeds, and climb/descent profiles.

The AFDCs provide control of the flight directors and autopilot. Flight director information displays on the primary flight displays (PFDs). The AFDS does not have direct control of the flight control surfaces. The autopilot controls the elevators, ailerons, flaperons, and spoilers through the fly–by–wire flight control system. Autopilot rudder commands are added only during an autopilot approach and landing. The autopilot controls nose wheel steering during rollout after an automatic landing.

MCP Mode Selection

MCP switches select automatic flight control and flight director modes. A light on the switch illuminates to indicate the mode is armed or active. Mode activation is indicated by the PFD roll and pitch flight mode annunciations. Autothrottle modes are discussed later in this section.

Most modes activate with a single push. These modes include:

- flight level change (FLCH SPD)
- heading hold (HDG HOLD)
- track hold (TRK HOLD)
- heading select (HDG SEL)
- track select (TRK SEL)
- vertical speed (V/S)
- flight path angle (FPA)
- altitude hold (ALT)

Other modes arm or activate with a single push. These modes are:

- lateral navigation (LNAV)
- vertical navigation (VNAV)
- localizer (LOC)
- approach (APP)

Desired target values can be selected on the MCP for:

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- airspeed
- Mach
- heading
- track
- vertical speed
- flight path angle
- altitude

All of these parameters except vertical speed and flight path angle can be preselected prior to autopilot and/or flight director activation.

Autopilot Engagement

The autopilot is engaged by pushing either of the two MCP autopilot engage switches.

Autopilot Disengagement

Normal autopilot disengagement is through either control wheel autopilot disconnect switch. The autopilots can also be disengaged by:

- the MCP autopilot disengage bar, or
- overriding with the control column, control wheel, or rudder pedals (pedals will only disengage the autopilots with LAND 2 or LAND 3 annunciated)

When an override force sufficient to move the control column, control wheel, or rudder pedals (LAND 2 of LAND 3 annunciated) is applied, the fly-by-wire flight control system detects a difference between the cockpit controls and its own estimate of the expected positions and forces disengagement of the autopilot. After the autopilot is disengaged, the control system transitions the control surface commands from those of the autopilot to those of the flight crew.

An automatic autopilot disengagement occurs for some failures detected by the autopilot. The EICAS warning message AUTOPILOT DISC displays if the autopilot is manually or automatically disengaged. Depending on the system failure, it may be possible to re–engage an autopilot by pushing the autopilot engage switch.

Autopilot and Flight Director Mode Degradations

HL7202 - HL7573, HL7733 - HL8347
The AFDS can detect the degradation of a specific AFDS mode due to lack of airplane data, airplane system faults, or external factors such as erratic localizer or glideslope signals due to antenna interference from service vehicles or aircraft.

Autopilot

HL7574 - HL7598
The autopilot system can detect the degradation of a specific autopilot mode. When an engaged mode degrades, the autopilot remains engaged in an attitude stabilizing mode based on inertial data.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If the airplane is at or below 200 feet radio altitude, there is no indication to the pilot that the attitude stabilizing mode is active if the attitude stabilizing mode remains active for less than 4 seconds.

If the airplane is above 200 feet radio altitude, there is no direct indication to the pilot that the attitude stabilizing mode is active when:

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

If the airplane is at or below 200 feet radio altitude and the attitude stabilizing mode remains active for 4 seconds or more, or, if the airplane is above 200 feet radio altitude and the attitude stabilizing mode remains active for 20 seconds or more (for localizer) or 15 seconds or more (for glideslope), the condition is indicated by:

- the EICAS caution message AUTOPILOT
- an amber line through the affected flight mode annunciation on the PFD

Note: A green LAND 2 or LAND 3 can be shown when the localizer or the glideslope signals are unreliable or the localizer or glideslope indication is at full deflection.

When the degradation is no longer present, the annunciations clear, the autopilot resumes using the mode, and a green box displays around the affected flight mode annunciation on the PFD for 10 seconds.

HL7202 - HL7573, HL7733 - HL8347

When the autopilot is engaged and an active mode degrades, the autopilot remains engaged in an attitude stabilizing mode based on inertial data.

If the airplane is at or below 200 feet radio altitude, there is no indication to the pilot that the attitude stabilizing mode is active if the attitude stabilizing mode remains active for less than 4 seconds.

If the airplane is above 200 feet radio altitude, there is no direct indication to the pilot that the attitude stabilizing mode is active when:

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If the airplane is at or below 200 feet radio altitude and the attitude stabilizing mode remains active for 4 seconds or more, or, if the airplane is above 200 feet radio altitude and the attitude stabilizing mode remains active for 20 seconds or more (for localizer) or 15 seconds or more (for glideslope), the condition is indicated by:

- the EICAS caution message AUTOPILOT
- the EICAS advisory message NO AUTOLAND (if LAND 2 or LAND 3 was not shown as the AFDS Status Annunciation at the time of alerting)
- the EICAS caution message NO AUTOLAND (if LAND 2 or LAND 3 was shown as the AFDS Status Annunciation at the time of alerting and the airplane was above 200 feet radio altitude at the time of alerting)
- an amber line through the affected flight mode annunciation on the PFD
- the AFDS Status Annunciation changing to NO AUTOLAND if LAND 2 or LAND 3 was shown at the time of alerting and the airplane is above 200 feet radio altitude at the time of alerting

Note: If the degradation continues while above 500 feet radio altitude on approach, the autopilot automatically disconnects and all the alerts associated with an autopilot disconnect occur. The autopilot does not automatically disconnect at 500 feet radio altitude or below for an autopilot system mode degradation.

If the degradation is resolved, the alerts representing the degradation clear and a green box displays around the affected flight mode annunciation on the PFD for 10 seconds.

Flight Director

HL7574 - HL7598

When a specific flight director mode degrades, the flight director provides an attitude stabilizing command based on inertial data.

If the airplane is at or below 200 feet radio altitude, there is no indication to the pilot that the attitude stabilizing mode is active if the attitude stabilizing mode remains active for less than 4 seconds.

If the airplane is above 200 feet radio altitude, there is no direct indication to the pilot that the attitude stabilizing mode is active when:

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If the airplane is at or below 200 feet radio altitude and the attitude stabilizing mode remains active for 4 seconds or more, or, if the airplane is above 200 feet radio altitude and the attitude stabilizing mode remains active for 20 seconds or more (for localizer) or 15 seconds or more (for glideslope):

- the flight director roll or pitch bar is removed (if flight director is on)

When the degradation is no longer present, the flight director commands immediately return to view.

HL7202 - HL7573, HL7733 - HL8347

When the AFDS Status Annunciator is FLT DIR and a specific AFDS mode degrades, the flight director provides an attitude stabilizing command based on inertial data.

If the airplane is at or below 200 feet radio altitude, there is no indication to the pilot that the attitude stabilizing mode is active if the attitude stabilizing mode remains active for less than 4 seconds.

If the airplane is above 200 feet radio altitude, there is no direct indication to the pilot that the attitude stabilizing mode is active when:

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

If the airplane is at or below 200 feet radio altitude and the attitude stabilizing mode remains active for 4 seconds or more, or, if the airplane is above 200 feet radio altitude and the attitude stabilizing mode remains active for 20 seconds or more (for localizer) or 15 seconds or more (for glideslope):

- the flight director roll or pitch bar is removed (if flight director is on)

When the degradation is no longer present, the affected flight director bar immediately returns to view.

ILS Signal Interference Monitor

The autopilot flight director system (AFDS) can detect significant ILS signal interference due to service vehicles or aircraft. If localizer or glideslope signal interference is detected, the autopilot disregards the ILS signal and remains engaged in an attitude stabilizing mode based on inertial data. Most ILS signal interferences last only a short period of time, so there is no annunciation other than erratic movement of the ILS raw data during the time the interference is present. If the condition persists, the annunciations described above for Autopilot and Flight Director Mode Degradation are provided.

Flight Director Display

The flight director steering indications normally display any time the related flight director switch is ON.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The steering indications also display when the related flight director switch is OFF and a TO/GA switch is pushed, if airspeed is greater than 80 knots and the flaps are out of up. In this case, the flight director display can be removed by cycling the respective flight director switch on, then off.

A flight director mode failure, in either pitch or roll, causes the respective steering bars to disappear. The stall and overspeed protection functions also cause the pitch flight director bar to disappear.

Autopilot Flight Director System Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

AFDS Status Annunciation

The following AFDS status annunciations display just above the PFD attitude display:

- FLT DIR (flight director is ON and autopilots are not engaged)
- A/P (autopilots are engaged)
- LAND 3 (three autopilots are engaged and operating normally for an automatic landing)
- LAND 2 (AFDS redundancy is reduced; in some cases, only two autopilots are available)
- NO AUTOLAND (AFDS is unable to make an automatic landing).

With a LAND 3 indication, the autopilot system level of redundancy is such that a single fault cannot prevent the autopilot system from making an automatic landing (fail operational).

With a LAND 2 indication, the level of redundancy is such that a single fault cannot cause a significant deviation from the flight path (fail passive).

An EICAS message displays for any fault which limits the capability of the automatic landing system. Aural alerts for EICAS messages not affecting safety of flight are inhibited until after touchdown. Changes in autoland status below 200 feet, other than transition to NO AUTOLAND status, are inhibited.

AFDS Flight Mode Annunciations

The flight mode annunciations display just above the PFD AFDS status annunciations. The mode annunciations, from left to right, are:

- autothrottle
- roll
- pitch

Active or captured modes display at the top of the flight mode annunciation boxes in large green letters. Armed modes (except for TO/GA in the air) display in smaller white letters at the bottom of the flight mode annunciation boxes. Degradations of a specific mode while the autopilot is engaged annunciate by an amber line through the mode annunciations. A green box displays around the mode annunciation for 10 seconds when a mode first becomes active, and when the amber line through a degraded mode is removed.

Autothrottle Modes

Autothrottle annunciations are:

- THR – autothrottle applies thrust to maintain the climb/descent rate required by the pitch mode
- THR REF – thrust set to the reference thrust limit displayed on EICAS

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- IDLE – displays while the autothrottle moves thrust levers to idle; IDLE mode is followed by HOLD mode
- HOLD – thrust lever autothrottle servos are inhibited. The pilot can set thrust levers manually
- SPD – autothrottle maintains command speed. Speed can be set using the MCP IAS/MACH selector or by the FMC, as displayed on the CDU CLIMB, CRUISE, or DESCENT page.

Note: In SPD mode, the autothrottle will not exceed the operating speed limits for the airplane configuration or the referenced thrust limits displayed on the EICAS.

Note: If only one thrust lever is active, “L” or “R” displays in front of SPD for the active thrust lever.

Roll Modes

Roll annunciations are:

LNAV –

- LNAV (armed) – LNAV is armed to activate when parameters are met
- LNAV (active) – LNAV activates when above 50 feet and in position to turn onto the active route leg. In flight, selection causes immediate activation if within 2 1/2 nm of the active leg.

HDG –

- HDG SEL (active) – airplane turns to or maintains the heading set in the MCP heading/track window
- HDG HOLD (active) – AFDS holds present heading. When turning, AFDS holds the heading reached after rolling wings level.

TRK –

- TRK SEL (active) – airplane turns to or maintains the track set in the MCP heading/track window
- TRK HOLD (active) – AFDS holds present track. When turning, AFDS holds the track reached after rolling wings level.

ATT – (active) – when the autopilot is first engaged or the flight director is first turned on in flight, AFDS holds a bank angle between 5 and 30 degrees and will not roll to wings level. When the bank angle is less than 5 degrees, AFDS rolls to wings level (HDG HOLD or TRK HOLD). When the bank angle is greater than 30 degrees, AFDS rolls to 30 degrees of bank.

LOC –

- LOC (armed) – AFDS captures localizer when within range and within 120 degrees of localizer course
- LOC (active) – AFDS follows the localizer course.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

TO/GA –

- On the ground, TO/GA annunciates by positioning either flight director switch ON when both flight directors are OFF; or, by pushing either TO/GA switch with airspeed greater than 80 KTS. TO/GA roll guidance becomes active at lift–off
- In flight, TO/GA is armed when flaps are out of up or glideslope is captured. There is no flight mode annunciation for TO/GA armed. TO/GA is activated in flight by pushing a TO/GA switch. The roll steering indication provides guidance to maintain the ground track present at mode engagement.

ROLLOUT –

- ROLLOUT (armed) – displayed below 1500 feet radio altitude and activates below 2 feet
- ROLLOUT (active) – after touchdown, AFDS uses rudder and nosewheel steering to steer the airplane on the localizer centerline.

Pitch Modes

Pitch annunciations are:

TO/GA –

On the ground, TO/GA annunciates by positioning either flight director switch ON when both flight directors are OFF, or by pushing either TO/GA switch with airspeed greater than 80 knots. The flight director PFD pitch bar indicates an initial pitch of eight degrees up. TO/GA pitch guidance becomes active at lift-off.

After lift-off, the AFDS commands a pitch attitude to maintain:

- a target speed of V2 plus 15 knots or the airspeed at rotation (pitch attitude greater than two degrees) plus 15 knots, whichever is greater
- if current airspeed exceeds the target speed for 5 seconds, the target speed is reset to the lesser of the current airspeed or V2 plus 25 knots
- the IAS/MACH window speed when the window speed is changed to a speed greater than the target speed.

Note: AFDS uses the speed set in the IAS/MACH window for V2.

In flight, TO/GA is armed when flaps are out of up or glideslope is captured.

When a go–around is initiated, the command speed is the MCP IAS/MACH window or current airspeed, whichever is higher, to a maximum of the IAS/MACH window speed plus 25 knots. GA displays as the thrust limit on the primary EICAS engine display.

VNAV –

VNAV is armed by pushing the VNAV switch (the light illuminates and VNAV is annunciated on the PFD pitch mode annunciation in white characters below the current pitch mode).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

VNAV activates at 400 feet and provides pitch commands to maintain the FMC computed airspeed/path:

- VNAV SPD (active) – AFDS maintains the FMC speed displayed on the PFD, and/or the CDU CLIMB or DESCENT pages. If speed intervention is selected, the MCP IAS/MACH selector is used to manually select the speed
- VNAV PTH (active) – AFDS maintains FMC altitude or descent path with pitch commands. If the MCP altitude window remains set to the current cruise altitude and the airplane is within two minutes of the top of descent, the CDU scratchpad message RESET MCP ALT displays
- VNAV ALT (active) – when a conflict occurs between the VNAV profile and the MCP altitude, the airplane levels and the pitch flight mode annunciation becomes VNAV ALT. The airplane maintains altitude. To continue the climb or descent, change the MCP altitude and push the altitude selector or change the pitch mode
- if an early descent is desired, FLCH, V/S, or FPA may be selected to descend below the VNAV descent path. If, during the decent, VNAV is armed and the airplane descent path subsequently intercepts the VNAV descent path, VNAV activates in VNAV PTH.

V/S (active) – pushing the MCP VS/FPA switch opens the vertical speed window to display the current vertical speed. Pitch commands maintain the rate of climb or descent set in the VS/FPA window.

FPA (active) – pushing the MCP VS/FPA switch opens the flight path angle window to display the current flight path angle. Pitch commands maintain the flight path angle set in the VS/FPA window.

FLCH SPD (active) – pushing the MCP FLCH switch opens IAS/MACH window (if blanked). Pitch commands maintain IAS/MACH window airspeed or Mach.

ALT (active) – altitude hold mode is activated by:

- pushing the MCP altitude HOLD switch, or
- capturing the selected altitude from a V/S, FPA, or FLCH climb or descent

G/S (active) – AFDS follows the ILS glideslope.

FLARE (armed) – during autoland, FLARE displays below 1500 feet RA.

FLARE (active) – during autoland, flare activates between 60 and 40 feet RA.

FLARE deactivates at touchdown and smoothly lowers the nosewheel to the runway.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autothrottle System

The autothrottle system provides thrust control from takeoff through landing. Autothrottle operation is controlled from the MCP and CDUs. The MCP provides mode and speed selection. The CDUs enable FMC reference thrust limit selection. When VNAV is active, the FMC selects autothrottle modes and target thrust values. Refer to Chapter 11, Flight Management, Navigation, for FMS and CDU operation. Refer to Chapter 10, Flight Instruments, Displays, for PFD indications.

The autothrottle is either off, armed, or active. The autothrottle is off when the A/T ARM switches are OFF. The autothrottle is armed when the A/T ARM switches are on and the autothrottle mode is blank. The autothrottle is active when the A/T ARM switches are on and there is an autothrottle mode shown. The active autothrottle modes are: IDLE, HOLD, THR, THR REF, and SPD.

Manual Flight

The autothrottle can be operated with flight directors OFF and the autopilot not engaged. When the autopilot is not engaged, but one or both flight directors are ON and the autothrottle is active, turning off both flight directors transitions the autothrottle to SPD. The autothrottle maintains the IAS/MACH window speed.

HL7532 - HL7598
During a manual landing, when the active autothrottle mode is SPD, or the pitch mode is VNAV with the autothrottle active, thrust reduces to IDLE at 25 feet RA and the autothrottle mode transitions to IDLE.

HL7202 - HL7205, HL7733 - HL8347
During a manual landing, when the active autothrottle mode is SPD, or the pitch mode is VNAV or FLCH SPD with the autothrottle active, thrust reduces to IDLE at 25 feet RA and the autothrottle mode transitions to IDLE.

Automatic Activation

The autothrottle can automatically activate to provide stall protection when armed and not active (A/T mode is blank).

HL7532 - HL7598
With the autothrottle armed and not active, the autothrottle automatically activates when the pitch mode is ALT, V/S, FPA, VNAV ALT, VNAV PTH, G/S, or there is no active pitch mode, and:

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347
With the autothrottle armed and not active, the autothrottle automatically activates when the pitch mode is ALT, V/S, FPA, VNAV ALT, VNAV PTH, VNAV SPD, FLCH SPD, G/S, TOGA or there is no active pitch mode, and:

- speed is less than an FMC calculated value for one second, and
- thrust is below reference thrust limit, and
- airplane barometric altitude is 400 feet above the airport on takeoff or airplane altitude is above 100 feet RA on approach.

HL7532 - HL7598
If speed decreases to near stick shaker activation, the autothrottle automatically activates in SPD mode and advances thrust to maintain minimum maneuvering speed (approximately the top of the amber band) or the speed set in the IAS/MACH window, whichever is greater.

HL7202 - HL7205, HL7733 - HL8347
If the current pitch mode is no mode, ALT, V/S, FPA, G/S, or VNAV ALT, then autothrottle engages into SPD mode, and it will maintain minimum maneuvering speed (approximately the top of the amber band) or the speed set in the IAS/MACH window, whichever is greater.

Note: During a climb in VNAV SPD with the autothrottle armed and not active, the autothrottle automatically activates in THR REF mode and advances thrust to the current reference thrust limit.

HL7202 - HL7205, HL7733 - HL8347
Note: During a descent in VNAV SPD or FLCH SPD with the autothrottle armed and not active, the autothrottle automatically activates in THR mode and advances thrust to a throttle position corresponding to the relative distance speed has decreased into the amber band so that if speed continues to decrease, thrust will reach the CLB thrust limit as stick shaker is activated.

HL7532 - HL7598
Note: During a descent in VNAV SPD with the autothrottle armed and not active, the autothrottle can automatically activate in HOLD mode and will not advance thrust levers to support stall protection.

HL7202 - HL7205, HL7733 - HL8347
Note: During a climb in FLCH SPD, with the autothrottle armed and not active, the autothrottle automatically activates in THR mode and advances.

HL7202 - HL7205, HL7733 - HL8347
Note: During a climb in TOGA after a go-around, with the autothrottle armed and not active, the autothrottle automatically activates in THR mode and increases thrust towards the reference thrust limit.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7598
Note: The autothrottle will not automatically activate to support stall protection when the pitch mode is FLCH SPD or TO/GA.

HL7532 - HL7598
Note: The autothrottle will not support stall protection when the A/T mode is HOLD.

HL7202 - HL7205, HL7733 - HL8347
If the pitch mode is FLCH SPD, VNAV SPD, or VNAV PTH and A/T is in HOLD or THR mode, and speed decreases into the amber band, the A/T will change from HOLD to THR mode if necessary, and thrust will increase proportional to the amount speed has decreased into the amber band.

HL7202 - HL7205, HL7733 - HL8347
If the pitch mode is TOGA during takeoff, and the A/T is in HOLD mode, and thrust has been manually set below the TO thrust reference, and a low speed condition is encountered, then the A/T mode will change from HOLD to THR REF and will advance thrust towards the selected TO thrust reference while airspeed is within 10 kts of stick shaker speed.

When the respective autothrottle servo fails or the switch is selected off the AUTOTHROTTLE L or R EICAS advisory message shows. If the autothrottle is active and only one autothrottle is armed, the PFD autothrottle flight mode annunciation shows L or R preceding the mode. For example, L SPD indicates only the left autothrottle is active in speed mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autothrottle Thrust Lever Operation

The autothrottle system moves either or both thrust levers to provide speed or thrust control, depending on the active mode.

Thrust levers can be manually positioned without disconnecting the autothrottle. After manual positioning, the autothrottle system repositions thrust levers to comply with the active mode. The autothrottle system does not reposition thrust levers while in HOLD mode.

Note: When the pitch flight mode annunciation is FLCH SPD, the autothrottle can enter the HOLD mode. This occurs if the pilot overrides thrust levers; or, in a descent, when thrust levers retard to IDLE. When in HOLD mode, thrust lever servos are inhibited and the autothrottle does not control thrust or speed. Thrust levers can be manually advanced.

Autothrottle Disconnect

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

Autothrottle disconnect occurs automatically:

- if a fault in the active autothrottle mode is detected
- when either reverse thrust lever is raised to reverse idle
- if the thrust levers are overridden during a manual landing, after the autothrottle has begun to retard the thrust levers to idle
- when both engines are shut down.

When the autothrottle is manually or automatically disconnected or failed the AUTOTHROTTLE DISC EICAS caution message shows and an aural alert sounds. The EICAS caution message and aural alert are inhibited if the disconnect occurs because of reverse thrust.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Automatic Flight Operations
Automatic Flight - Takeoff and Climb

Takeoff is a flight director only function of the takeoff/go–around (TO/GA) mode. The autopilot may be engaged after takeoff.

During preflight:

- with the autopilot disengaged and both flight director switches OFF, annunciation of TO/GA roll and pitch mode occurs when the first flight director switch is positioned ON
- PFD displays FLT DIR as AFDS status and TO/GA as the pitch and roll flight mode annunciations
- pitch command is set to approximately eight degrees up
- roll command is wings level.

During takeoff prior to lift–off:

- with speed less than 50 knots, pushing a TO/GA switch activates the autothrottle in thrust reference (THR REF) and advances thrust levers to the selected reference thrust limit. If the autothrottle is not active by 50 knots, it cannot be activated until above 400 feet
- at 80 knots, autothrottle annunciation changes to HOLD
- with speed greater than 80 knots, pushing a TO/GA switch disarms LNAV and VNAV
- during takeoff, the FMC records the barometric altitude as the airplane accelerates through 100 knots. This altitude is used to activate VNAV, enable autothrottle activation (if not active), command acceleration for flap retraction, and set climb thrust if an altitude has been selected. Radio altitude is used for activation of LNAV.

At lift–off:

- pitch command target speed is V2 + 15. If current airspeed remains above target speed for 5 seconds, target airspeed is reset to current airspeed (limited to a maximum of V2 + 25)
- if an engine failure occurs on the ground, the pitch command target speed at lift–off is V2 or airspeed at lift–off, whichever is greater
- roll command maintains ground track.

After lift–off:

- if an engine failure occurs, the pitch command target speed is:
  - V2, if airspeed is below V2
  - existing speed, if airspeed is between V2 and V2 + 15
  - V2 + 15, if airspeed is above V2 + 15.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- if a TO/GA switch is pushed:
  - removes takeoff and climb derates and assumed temperature thrust reduction
  - A/T in HOLD, A/T activates in THR REF
- at 50 feet radio altitude, LNAV activates, if armed. Roll commands bank to track the active route
- at 400 feet, VNAV activates, when armed. Pitch commands the current airspeed. The autothrottle sets the selected reference thrust and annunciates THR REF
- at acceleration height or altitude capture below acceleration height, pitch commands speed to 5 knots below takeoff flap placard speed. As flaps are retracted, pitch commands an acceleration to 5 knots below the placard speed of the commanded flap position
- when flaps are up, pitch commands an acceleration to VNAV climb speed. VNAV climb speed is the greater of:
  - VREF + 80 knots, or
  - speed transition associated with origin airport
- at thrust reduction point (either an altitude or a flap position), FMC changes reference thrust limit to armed climb limit (CLB, CLB 1, or CLB 2).

The TO/GA mode is terminated by selecting any other pitch and roll mode or by activation of LNAV/VNAV modes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Automatic Flight Takeoff Profile

Automatic Flight - Cruise

The autopilot and/or flight director can be used after takeoff to fly a lateral navigation track (LNAV) and a vertical navigation track (VNAV) provided by the FMS. Using LNAV and VNAV ensures the most economical operation.

Other roll modes available are:

- heading hold (HDG HOLD)
- heading select (HDG SEL)
- track hold (TRK HOLD)
- track select (TRK SEL)

Other pitch modes available are:

- altitude hold (ALT)
- flight level change (FLCH SPD)
- vertical speed (V/S)
- flight path angle (FPA)

Profile illustrations show the use of LNAV and VNAV.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Automatic Flight - Approach and Landing

The AFDS provides autopilot guidance for ILS approaches.

Pushing the APP switch arms localizer in roll mode and glideslope in pitch mode. Glideslope capture is inhibited until the localizer is captured.

Pushing the LOC switch arms the AFDS for localizer tracking. Descent on the localizer can be accomplished using VNAV, V/S, FLCH, or FPA pitch modes. The localizer mode cannot capture if the intercept angle exceeds 120 degrees. All other non-ILS approaches can be flown using LNAV and VNAV modes, or HDG SEL, TRK SEL, V/S, or FPA modes.

With a command speed of VREF+5 knots and landing flaps, there is sufficient wind and gust protection available with the autothrottle active. The autothrottle adjusts thrust quickly when airspeed decreases below command speed. The autothrottle decreases thrust slowly when airspeed is more than command speed. In turbulence, thrust may be somewhat higher than necessary to maintain command speed. Average speed may be somewhat higher than the command speed.

Runway Alignment

Runway alignment is a submode of the approach mode. With crosswinds, the crab angle is reduced at touchdown. Runway alignment also compensates for a single engine approach.

For crosswinds requiring more than 10 degrees of crab angle, runway alignment occurs at 500 feet AGL. A sideslip of 5 degrees is established to reduce the crab angle. This configuration is maintained until touchdown. The airplane lands with the upwind wing low.

For crosswinds requiring a crab angle of between 5 and 10 degrees, an initial alignment occurs at 500 feet AGL, followed by a second alignment at 200 feet AGL. The initial alignment initiates a sideslip to reduce the crab angle to 5 degrees. This configuration is maintained to 200 feet AGL, where a second sideslip alignment increases the sideslip to further reduce the touchdown crab angle.

For crosswinds requiring a crab angle of less than 5 degrees, no runway alignment occurs until 200 feet AGL, where a sideslip is introduced to align the airplane with the runway.

If an engine fails prior to the approach, the AFDS introduces a sideslip at 1,300 feet AGL. This establishes a wings level configuration. If an engine fails during the approach, the wings level configuration is established when the engine failure is detected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

In the event of moderate or strong crosswinds from the side opposite the failed engine, no wings level sideslip is commanded, since the airplane is already banked into the wind.

Flare

The flare mode brings the airplane to a smooth automatic landing touchdown. The flare mode is not intended for single autopilot or flight director only operation.

Flare is armed when LAND 3 or LAND 2 is annunciated on the PFDs. At approximately 50 feet radio altitude, the autopilots start the flare maneuver. FLARE replaces the G/S pitch flight mode annunciation.

During flare:

- between 25 and 50 feet radio altitude, the autothrottle begins retarding thrust levers to idle
- PFD autothrottle annunciation changes from SPD to IDLE
- at touchdown, the FLARE annunciation no longer displays and the nose wheel is lowered to the runway.

Rollout

Rollout provides localizer centerline rollout guidance. Rollout arms when LAND 3 or LAND 2 annunciates.

At less than two feet radio altitude, rollout activates. ROLLOUT replaces the LOC roll mode annunciation.

The autopilot controls rudder and nose wheel steering to track the localizer centerline.

During rollout, autothrottle IDLE mode remains active until the autothrottle disconnects with thrust levers in reverse.

Rollout guidance continues until the autopilots disengage.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Automatic Flight Approach Profile

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Automatic Flight - Go–Around

TO/GA is armed when flaps are out of up or glideslope is captured. The reference thrust limit changes to GA when flaps are extended out of up, flaps are extended to landing position, or glideslope is captured. The reference thrust limit is locked in GA when flaps are in landing position or glideslope is captured.

With flaps out of up, but not in landing position, activation of VNAV in VNAV PTH changes the reference thrust limit to CRZ. However, pressing TO/GA changes the reference thrust limit to GA and GA thrust is available.

Pushing either TO/GA switch activates a go-around. The mode remains active even if the airplane touches down while executing the go–around.

Note: During landing, the TO/GA switches are inhibited after touchdown or when below 2 feet radio altitude for 3 seconds or more. If the landing is discontinued, the TO/GA switches are enabled again above 5 feet radio altitude.

When the flight director switches are off, pushing either TO/GA switch displays the flight director bars.

With the first push of either TO/GA switch:

- roll and pitch activate in TO/GA
- autothrottle activates in thrust (THR) to establish a minimum climb rate of 2,000 fpm
- the AFDS increases pitch to hold the selected speed as thrust increases
- if current airspeed remains above the target speed for 5 seconds, the target airspeed is reset to current airspeed (to a maximum of the IAS/MACH window speed plus 25 knots)

HL7202 - HL7205, HL7782 - HL8347

- with an LNAV path available, LNAV automatically activates:
  - above 50 feet radio altitude when autopilot is not engaged, or
  - above 200 feet radio altitude when autopilot is engaged.

HL7202 - HL7205, HL7782 - HL8347

Note: With an LNAV path available, LNAV arms until above minimum engagement altitude.

HL7202 - HL7205, HL7782 - HL8347

Note: During go-around from a LAND 2 or LAND 3 approach, automatic LNAV activation causes disengagement of autopilot rudder control. If executing an engine out missed approach with thrust asymmetry compensation inoperative, manual rudder control may be required to prevent large roll and yaw excursions.

With the second push of either TO/GA switch, autothrottle activates in thrust reference (THR REF) at full go–around thrust.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347
With an LNAV path available, LNAV remains active following a second TO/GA push.

TO/GA level–off:

- when reaching the altitude set in the Altitude window, AFDS pitch mode changes to altitude hold (ALT)
- when altitude is captured or V/S or FPA is active, MCP speed is automatically set to:
  - the flap placard speed minus 5 knots
  - 250 knots if flaps are up, or
  - a speed value entered in the IAS/Mach window after TO/GA was pushed

HL7532 - HL7766
- TO/GA remains the active roll mode until another roll mode is selected

HL7202 - HL7205, HL7782 - HL8347
- TO/GA remains the active roll mode until LNAV automatically engages or another roll mode is selected.

TO/GA mode termination:

HL7532 - HL7766
- below 400 feet radio altitude, disengage autopilot and turn off both flight directors.

HL7202 - HL7205, HL7782 - HL8347
- below 400 feet radio altitude, disengage autopilot and turn off both flight directors, or automatic LNAV activation (after automatic LNAV activation, a different roll mode can be selected)
- above 400 feet radio altitude, select a different roll or pitch mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Automatic Flight Go–Around Profile

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Automatic Flight Windshear Recovery

The AFDS provides windshear recovery guidance by means of the normal go–around pitch and roll modes. With go–around armed, pushing a TO/GA switch commands a pitch–up of 15 degrees or slightly below the pitch limit, whichever is lower.

As rate of climb increases, the AFDS transitions from pitch to airspeed control. The target airspeed is IAS/MACH window airspeed or current airspeed, whichever is greater when TO/GA is activated. If current airspeed remains above the selected speed for 5 seconds, the selected airspeed is reset to current airspeed, (to a maximum of the IAS/MACH window speed plus 25 knots).

If the autopilot is not engaged when go–around is initiated, the pilot must fly the windshear recovery following the flight director commands. If the autothrottle is not armed, the thrust levers must be advanced manually.

Flight Envelope Protection

There are three forms of flight envelope protection in the autopilot:

- stall protection
- overspeed protection
- roll envelope bank angle protection

An AUTOPILOT caution message and roll or pitch mode failures alert the pilot if the envelope is exceeded, and the autopilot prevents further envelope violations.

Refer to Chapter 9, Flight Controls, for a description of flight envelope protection.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Automatic Flight EICAS Messages

The following EICAS messages can be displayed.

Message	Level	Aural	Message Logic
AUTOPILOT	Caution	Beeper	Autopilot is operating in a degraded mode. Active roll and/or pitch mode may have failed, or the autopilot has entered envelope protection.
AUTOPILOT DISC	Warning	Siren	Autopilot has disengaged.
AUTOTHROTTLE DISC	Caution	Beeper	Both autothrottles have disconnected.
AUTOTHROTTLE L, R	Advisory		Affected autothrottle is OFF or has failed.

HL7574 - HL7598

NO AUTOLAND			Autoland is not available.
	Caution	Beeper	Message is a caution if fault occurs after LAND 3 or LAND 2 is annunciated and, or approach has been selected but does not engage by 600 feet AGL.
	Advisory		Message is an advisory if fault occurs before LAND 3 or LAND 2 is annunciated.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic

HL7202 - HL7573, HL7733 - HL8347

NO AUTOLAND	Caution	Beeper	Autoland is not available. Message is a caution if fault occurs after LAND 3 or LAND 2 is annunciated and airplane is above 200 feet radio altitude, or approach has been selected but does not engage by 600 feet radio altitude.
	Advisory		Message is an advisory if fault occurs before LAND 3 or LAND 2 is annunciated.

HL7574 - HL7598

NO LAND 3	Caution	Beeper	Autoland system does not have redundancy for triple channel autoland. Message is a caution if fault occurs after LAND 3 is annunciated.
	Advisory		Message is an advisory if fault occurs before LAND 3 is annunciated.

HL7202 - HL7573, HL7733 - HL8347

NO LAND 3	Caution	Beeper	Autoland system does not have redundancy for triple channel autoland. Message is a caution if fault occurs after LAND 3 is annunciated and airplane is above 200 feet radio altitude.
	Advisory		Message is an advisory if fault occurs before LAND 3 is annunciated.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 5.10
Audio Control Panel. 5.10.1
Radio System 5.10.3
Radio Tuning Panel 5.10.3
Radio Tuning Panel Indications 5.10.5
Miscellaneous Communication Controls 5.10.6
Headphone/Boom Microphone [Typical]. 5.10.6
Hand Microphone [Typical] 5.10.7
Oxygen Mask Microphone [Typical] 5.10.7
Control Wheel Microphone/Interphone Switch 5.10.8
Glareshield Microphone Switch 5.10.8
Service Interphone Switch 5.10.9
Handset 5.10.10
Flight Deck Speaker 5.10.12
Boom Microphone/Headphone Panel. 5.10.12
Observer Audio Selector. 5.10.12
Call Panel 5.10.13
Flight Deck Call Switch 5.10.14
Cargo Interphone Component Locations 5.10.15
Cargo Interphone Components 5.10.16
Data Link Accept/Cancel/Reject Switches 5.10.19
Cockpit Voice Recorder System 5.10.20
Cockpit Voice Recorder Panel 5.10.20
Cockpit Voice Recorder Microphone [Typical] 5.10.22
Printer Controls 5.10.22

System Description 5.20
Introduction 5.20.1
Audio Control Panels 5.20.1
Cockpit Voice Recorder System 5.20.2
Radio Tuning Panels 5.20.2

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Radio Communication Systems 5.20.2
VHF Communication System 5.20.2
HF Communication System 5.20.3
Stuck Mic Protection 5.20.3
SELCAL System 5.20.4
SATCOM System 5.20.4
SATCOM Main Menu Pages [Typical] 5.20.4
SATCOM Directory Page [Typical] 5.20.7
SATCOM Directory Display Page [Typical] 5.20.8
SATCOM Phone Pages [Typical] 5.20.8
SATCOM Directory Index Page [Typical] 5.20.11
SATCOM Directory Page [Typical] 5.20.11
SATCOM Phone Pages [Typical] 5.20.12
SATCOM Directory Index Page [Typical] 5.20.14
SATCOM Directory Page [Typical] 5.20.14
Communication Crew Alerting System 5.20.15
Crew Alert Categories 5.20.15
Main Deck Alert System 5.20.16

Interphone Systems 5.30
Interphone Communication System 5.30.1
Flight Interphone System 5.30.1
Service Interphone System 5.30.2
Passenger Address System 5.30.2
Personnel Address System 5.30.3
Cabin Interphone System 5.30.3
CDU Menu Page 5.30.4
Cabin Interphone CDU Controls 5.30.5
Cabin Interphone Main Menu 5.30.5
Cabin Interphone Main Menu Page [Typical] 5.30.6
Cabin Interphone Directory Page [Typical] 5.30.8
Cabin Interphone Subdirectory Page [Typical] 5.30.8
Cabin Interphone System 5.30.9

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cargo Interphone System 5.30.10
Cargo Intercom System 5.30.10

MFD Communications Functions 5.40
Introduction 5.40.1
Communications Menus 5.40.2
Communications Control and Input Functions 5.40.4
Command Key Locations 5.40.4
Command Key Functions 5.40.5
Text Entry 5.40.11
Menu Entry Fields 5.40.12
Invalid Entries 5.40.12
Message List 5.40.13
Message Display Format 5.40.14
Exclusive and Nonexclusive Select Keys 5.40.16
Information Messages 5.40.17
Communications Information Messages 5.40.17
Uplink Message 5.40.19
ATC Data Link 5.40.21
Crew Feedback 5.40.21
FMC Data Loading 5.40.21
Downlink Pages 5.40.22
ATC Menu 5.40.22
Altitude Request 5.40.24
Level Request 5.40.25
Altitude Request Reason Page 5.40.27
Level Request Reason Page 5.40.28
Route Request 5.40.30
Speed Request 5.40.33
Clearance Request 5.40.34
Combination Downlink Request 5.40.35
When Can We Expect 5.40.38
Voice Contact Request 5.40.40
ATC Logon/Status 5.40.41

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ATC Connection Displays 5.40.46
Emergency Report. 5.40.49
ATC Reports. 5.40.52
ATC Requested Report 5.40.52
Armable Report. 5.40.54
Conditional Clearances 5.40.56
Position Report 5.40.57
Optional Position Report Items. 5.40.60
Free Text Message 5.40.61
Flight Information 5.40.61
Flight Information Menu. 5.40.61
Departure Clearance Request 5.40.63
Oceanic Clearance Request. 5.40.64
ATIS Request 5.40.66
TWIP Request 5.40.67
Pushback Clearance Request. 5.40.68
Expected Taxi Clearance Request. 5.40.70
Company Menu 5.40.71
Company Downlink Message Page 5.40.72
Review Menu 5.40.73
Review State Indicators. 5.40.74
Manager Functions 5.40.75
Manager Menu 5.40.75
ACARS Manager 5.40.76
ACARS Manager Page 2/2 . . . . . 5.40.79
VHF Manager 5.40.79
SATCOM Manager. 5.40.80
Automatic Dependent Surveillance Manager 5.40.80
System Information Manager 5.40.81
Printer Manager. 5.40.83
Automatic Messages Manager 5.40.84
Master Manager 5.40.84
Diagnostics Manager. 5.40.86

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Manager Messages 5.40.86
New Messages 5.40.89
New Messages Menu 5.40.89
New Message – No Response Required. 5.40.91
New Message – Response Required. 5.40.92

EICAS Messages. 5.50
Communications EICAS Alert Messages 5.50.1
EICAS Communication Messages. 5.50.2

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Audio Control Panel

1 Transmitter Select Switches

Push –

- the 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

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- pushing the CAB transmitter select switch twice within one second places a priority call to a selected cabin station.

Second push –

- deselects the transmitter
- deselects receiver audio

Note: Second push of the CAB select switch deselects the transmitter and receiver audio only after one second has elapsed from the first push.

2 MIC Lights

Illuminated (green) – indicates the transmitter is selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 CALL Lights

Illuminated (green) –

- indicates a call on SELCAL, the flight interphone (FLT), the cabin interphone (CAB), or SATCOM (SAT)
- resets when the respective transmitter select switch is pushed or, if already pushed, by pressing a MIC/INTERPHONE switch (the SATCOM CALL light remains illuminated until the call ends)
- PA does not have a CALL light

4 MIC/Interphone (INT) Switch

MIC – keys the boom microphone or oxygen mask on the selected radio transmitter or other system.

Center – off position (spring-loaded to center).

INT – keys the boom microphone or oxygen mask on the flight interphone.

5 VOR/ADF Receiver Selector

Selects the VOR or ADF receiver to be monitored:

- VOR L – left VOR
- VOR R – right VOR
- ADF L – left ADF
- ADF R – right ADF

6 Receiver Lights

Illuminated (green) – indicates the respective receiver volume control is manually selected on.

7 Receiver Volume Controls

Push – turns the respective receiver audio on or off.

Rotate – controls receiver volume.

8 Speaker (SPKR) Volume Control

Push – adds or removes communication audio from the flight deck speaker.

Rotate – controls the communication audio volume in the flight deck speaker.

Note: Inoperative on First and Second Observer audio control panels.

9 Approach (APP) Receiver Selector

Selects the approach receiver to be monitored:

- APP L – left ILS
- APP C – center ILS

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- APP R – right ILS
- MKR – marker beacon

10 Navigation Filter Selector

Filters VOR, ADF, ILS, or DME audio:

- V (voice) – only the voice audio is heard
- B (both) – both the voice and range audio are heard
- R (range) – range audio (navigation aid Morse code identifier) is heard

Note: Marker beacon audio is available in all positions.

Radio System
Radio Tuning Panel

1 Radio Tuning Panel OFF Light

Illuminated (green) – the radio tuning panel is off.

2 Radio Tuning Panel OFF Switch

Push – disconnects the panel from the communication radios.

3 ACTIVE Frequency Window

Displays the tuned frequency of the selected radio.

Displays DATA if the selected radio is in the data mode (not applicable for VHF L).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Offside Tuning Light

Illuminated (green) –

- the radio normally associated with this panel is being tuned by another radio tuning panel, or
- the radio tuning panel is being used to tune a radio not normally associated with this radio tuning panel

Note: The left radio tuning panel is normally associated with VHF L and HF L. The right radio tuning panel is normally associated with VHF R and HF R. The center radio tuning panel is normally associated with VHF C.

5 Frequency Transfer Switch

Push –

- transfers the STANDBY window frequency to the ACTIVE window and tunes the selected radio to the new active frequency
- transfers the ACTIVE window frequency to the STANDBY window

6 STANDBY Frequency Window

Displays the preselected or previously tuned frequency of the selected radio.

With data link installed, displays DATA when selection of the frequency transfer switch would reconfigure the selected radio to the data mode (not applicable for VHF L).

7 Frequency Selector

Rotate –

- outer knob – selects the portion of the STANDBY frequency to the left of the decimal point
- inner knob – selects the portion of the STANDBY frequency to the right of the decimal point

8 Radio Tuning Switches

Push –

- selects the radio to be tuned
- the tuned frequency is displayed in the ACTIVE frequency window
- the standby frequency is displayed in the STANDBY frequency window

Push and hold – removes automatic squelch on selected VHF radio until switch is released.

HL7532 - HL7598

Note: The left radio tuning panel removes automatic squelch from VHF L or VHF C. The right radio tuning panel removes automatic squelch from VHF R.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

9 Radio Tuning Lights

Illuminated – indicates the selected radio.

10 AM Switch

Push – sets the AM or USB mode for the selected HF.

11 AM Light

Illuminated – HF AM is selected.

Extinguished – HF USB is selected.

12 HF Sensitivity Control

Rotate – adjusts the sensitivity of the on–side HF receiver.

Radio Tuning Panel Indications

1 DATA Mode

Displays DATA in the ACTIVE frequency window when the selected radio is being used in the data mode.

2 Radio Fail

Displays dashes in both windows when the selected radio is failed or has been disconnected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 PANEL FAIL

The radio tuning panel is failed.

Miscellaneous Communication Controls
Headphone/Boom Microphone [Typical]

1 Headphone

Used to monitor audio from the respective audio control panel.

Audio volume is adjusted using audio control panel controls for the associated station.

Available at all flight deck stations.

2 Boom Mic

Activation of a control wheel, glareshield or audio control panel mic/interphone switch transmits on the system selected for use at that station.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Hand Microphone [Typical]

1 Hand Microphone Push–To–Talk Switch

Push – activates the hand microphone.

2 Hand Microphone

Transmits on the system selected by the audio control panel.

Available at the Captain and First Officer stations.

- Optional for the First and Second Observer stations.

Oxygen Mask Microphone [Typical]

1 Oxygen Mask Microphone

Enabled when the oxygen mask doors are open. The boom microphone is disabled.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Activation of a control wheel, glareshield or audio control panel mic/interphone switch transmits on the system selected for use at that station.

Control Wheel Microphone/Interphone Switch

1 Control Wheel Mic/Interphone Switch

MIC – allows oxygen mask or boom microphone transmission on selected transmitter. Spring-loaded to center.

CENTER – off position.

INT – allows oxygen mask or boom microphone transmission on the flight interphone system. Spring-loaded to center.

Glareshield Microphone Switch

1 Glareshield MIC Switch

Push – allows oxygen mask or boom microphone transmission on the selected transmitter.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Service Interphone Switch

1 Service (SERV) Interphone (INTPH) Switch

OFF – allows independent operation of the service and flight interphone systems.

ON – connects the service and flight interphone systems.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Handset

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

1 Passenger Address Push To Talk Switch

Push –

- connects the handset microphone to the selected PA area
- only used in the PA mode

2 Reset Switch

Push – cancels a call or incorrectly selected code.

3 Numeric Keys

Push – selecting a code calls the respective station or PA area.

Note: Dial codes entered using the handset are not displayed on the CDU cabin interphone pages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 Push To Talk (PTT) Switches

Push - extinguishes FLT DECK call switch light.

2 Reset (R) Switch

Push - cancels call.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Deck Speaker

1 Flight Deck Speaker

Controlled by the speaker volume control on the respective audio control panel.

Boom Microphone/Headphone Panel

1 HEAD PHONE Jack

Accepts a flight crew headphone plug.

2 BOOM MIC HEADSET Jack

Accepts a flight crew boom mic plug.

Observer Audio Selector

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Observer (OBS) AUDIO Selector

CAPT – connects the Captain's hand microphone, headphone, boom microphone/headset, oxygen mask microphone, speaker, and mic/interphone switches to the First Observer audio control panel.

NORM – the First Observer audio control panel is connected to the First Observer's hand microphone, headphone, boom microphone/headset and oxygen mask microphone.

F/O – connects the First Officer's hand microphone, headphone, boom microphone/headset, oxygen mask microphone, speaker, and mic/interphone switches to the First Observer audio control panel.

Call Panel

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 Ground (GND) Call Switch

Illuminated (green) - indicates nose wheel well horn is sounding.

Push – sounds three second horn in nose wheel well.

2 CREW REST Call Switch

Illuminated (green) - indicates crew rest is being called. Light extinguishes when call is answered.

Push - illuminates Flight Deck switch on crew rest handset cradle and sounds chime in crew rest area.

Second push (light illuminated) - cancels call to crew rest.

3 Supernumerary (SUPRNMRY) Call Switch

Illuminated (green) - indicates supernumerary is being called. Light extinguishes when call is answered.

Push - illuminates Flight Deck switches on the two supernumerary handset cradles and sounds chime in supernumerary area.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Second push (illuminated) - cancels call to supernumerary area.

4 CARGO Call Switch

Illuminated (green) - indicates cargo area is being called. Light extinguishes when call is answered by any loadmaster amplifier panel or cargo area station.

Push - illuminates Flight Deck switch on loadmaster amplifier panels, wing inspection stations, and cargo speaker/mike stations.

Second push (illuminated) - cancels call to cargo area.

5 CARGO AUDIO Switch

Illuminated (green) - indicates cargo and cabin interphone systems are connected.

Push - disconnects cargo and cabin interphone systems. Cargo and cabin interphones automatically connect for incoming or outgoing calls. Disconnect following cargo call may eliminate circuit noise.

6 MAIN Deck (DK) ALERT Switch

Illuminated (green) - indicates system activation. Extinguishes after several seconds to indicate system reset.

Push - activates main deck aural warning and flashes main deck sidewall lights for several seconds.

Flight Deck Call Switch

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 Flight (FLT) DECK Call Switch

Illuminated (white) – interphone call from flight deck received, chime also sounds.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Push – sounds chime in flight deck, displays CREW REST CALL or SUPRNMY CALL on EICAS, and illuminates Cabin (CAB) CALL light on audio control panel.

Cargo Interphone Component Locations

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cargo Interphone Components

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Loadmaster Amplifier Panel

1 PUSH TO TALK Switch

Push - activates loadmaster amplifier panel microphone and connects to any selected area except flight deck.

2 CALL Switches

Illuminated (white) - indicates a call from the respective area. Extinguishes when pushed.

Push - sounds a chime in area being called.

3 FLIGHT DECK/INTERCOM Switch

FLIGHT DECK - connects loadmaster amplifier panel handset to flight deck interphone. Handset must be used for communication with flight deck.

INTERCOM - connects loadmaster panel to main cargo deck speaker/microphone panels.

4 LOWER LOBE Switch

ON - activates lower lobe speaker/microphone panels.

OFF - deactivates lower lobe speaker/microphone panels.

5 VOLUME Selector

Rotate - adjusts loadmaster amplifier panel speaker volume.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

6 ALARM RESET Switch

Push - resets aft CG audio alarm.

Loadmaster Handset

The loadmaster handset provides communications on cargo interphone and intercom systems.

1 Push To Talk (PTT) Switches

Push - extinguishes Call switch lights.

2 Reset (R) Switch

Push - cancels call.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Wing Inspection Station Call Panel

1 Flight (FLT) DECK CALL Switch

Illuminated (white) - interphone call from flight deck received. Extinguishes when pushed.

Push - sounds chime in flight deck, displays CARGO CALL on EICAS, and illuminates Cabin (CAB) CALL light on audio control panel.

2 HEADSET Jack

Receptacle for headset connection.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Main Cargo Deck Speaker/Microphone Panel

1 CALL Switch

Push (on ground) - sounds a tone and illuminates Main Deck Call switch on loadmaster amplifier panel.

2 Flight (FLT) DECK CALL Switch

Illuminated (white) - interphone call from flight deck received. Extinguishes when pushed.

Push - sounds chime in flight deck, displays CARGO CALL on EICAS, and illuminates Cabin (CAB) CALL light on audio control panel.

3 HEADSET Jack

Receptacle for headset connection.

Data Link Accept/Cancel/Reject Switches

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Accept (ACPT) Switch

Push –

- a positive response to a displayed message is downlinked to the origin of the displayed message
- functions the same as selecting an MFD communications display ACCEPT command key

2 Cancel (CANC) Switch

Push –

- the message is removed from the display
- functions the same as selecting an MFD communications display CANCEL command key

3 Reject (RJCT) Switch

Push –

- a negative response to the displayed message is downlinked to the origin of the displayed message
- functions the same as selecting an MFD communications display REJECT command key

Cockpit Voice Recorder System
Cockpit Voice Recorder Panel

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

HL7532 - HL7598

1 Cockpit Voice Monitor Indicator

Pointer deflection indicates recording or erasure on all channels.

During test, the pointer rises into the green band.

HL7202 - HL7205, HL7733 - HL8347

1 STATUS Indicator

Illuminated – test completed successfully. Test light can take up to 6 seconds to illuminate after switch release.

2 Cockpit Voice Recorder TEST Switch

Push and hold for five seconds – tests audio and datalink recording system.

3 Cockpit Voice Recorder ERASE Switch

Push and hold for three seconds – erases voice recorder if on the ground, AC power on, and parking brake set.

4 Cockpit Voice Recorder Headset Jack

A headset may be plugged in to monitor playback of voice audio, or to monitor tone transmission during test.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cockpit Voice Recorder Microphone [Typical]

1 Cockpit Voice Recorder Microphone

Area microphone for the voice recorder.

Printer Controls

HL7532 - HL7783, HL8006 - HL8011, HL8208 - HL8218, HL8250, HL8274, HL8275

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8041, HL8042, HL8346, HL8347

HL8043 - HL8046, HL8076, HL8077

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8075, HL8226, HL8251, HL8252, HL8285

HL7532 - HL8011, HL8075, HL8208 - HL8285
1 Printer FAIL Light

Illuminated amber - printer failed

HL7532 - HL8011, HL8075, HL8208 - HL8285
2 Printer PAPER Light

Illuminated (amber):

- printer is out of paper, or
- paper is jammed

HL7532 - HL8011, HL8075, HL8208 - HL8285
3 Switch is not functional

HL7532 - HL8011, HL8075, HL8208 - HL8285
4 Printer SLEW Switch

Push and hold – advances the printer paper

HL7532 - HL8011, HL8075, HL8208 - HL8285
5 Printer RESET Switch

Push – illuminated

- clears out current print job
- resets printer

HL7532 - HL8011, HL8075, HL8208 - HL8285
6 Printer TEST Switch

Push – illuminated

- tests printer and printer lights
- prints test page

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8041 - HL8046, HL8076, HL8077, HL8346, HL8347
1 Printer POWER Switch

Push –

- illuminated - printer on
- not illuminated - printer off

HL7202 - HL7205, HL8041 - HL8046, HL8076, HL8077, HL8346, HL8347
2 Printer FAIL Light

Illuminated -

- during power-up, indicates printer is booting up
- after power-up, indicates printer failed

HL7202 - HL7205, HL8041 - HL8046, HL8076, HL8077, HL8346, HL8347
3 DOOR PAPER Lights

Illuminated -

- DOOR Light - door not latched
- PAPER Light - out of paper

HL7202 - HL7205, HL8041 - HL8046, HL8076, HL8077, HL8346, HL8347
4 Printer SLEW Switch

Push and hold – advances the printer paper

HL7202 - HL7205, HL8041 - HL8046, HL8076, HL8077, HL8346, HL8347
5 Printer RESET Switch

Push – illuminated

- clears all print jobs
- resets printer

HL7202 - HL7205, HL8041 - HL8046, HL8076, HL8077, HL8346, HL8347
6 Printer TEST Switch

Push – illuminated

- tests printer and printer lights
- prints test page

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The communication systems include:

- cockpit voice recorder system
- radio communication system
- SELCAL system
- SATCOM system
- communication crew alerting system
- interphone communication system (refer to Section 30 of this chapter)

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

- main deck alert system
- data communication system (refer to Section 40 of this chapter).

The communication systems are controlled using the:

- audio control panels
- radio tuning panels

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- CDU communications pages (refer to Section 30 of this chapter)

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

- call panel
- MFD communications pages (refer to Section 40 of this chapter)

Audio Control Panels

The audio control panels are used to manage the radio and interphone communication systems. Navigation receiver audio can also be monitored. The Captain, First Officer, and First Observer audio control panels are installed on the aft aisle stand.

The Second Observer audio control panel is installed on the right sidewall panel.

Microphones are keyed by pushing the desired audio control panel transmitter select switch and using the MIC position of a control wheel or audio control panel microphone/interphone switch, a glareshield MIC switch, or a hand microphone push–to–talk switch. Systems are monitored using headphones or speakers. An oxygen mask microphone is enabled and the boom microphone is disabled when the oxygen mask stowage doors are open. The oxygen mask microphone is disabled and the boom microphone is enabled when the left oxygen mask stowage box door is closed and the RESET/TEST switch is pushed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cockpit Voice Recorder System

HL7532 - HL7783
The cockpit voice recorder records any transmitted or received flight deck audio as selected on the audio control panels. It also records flight deck area conversations using an area microphone and crewmember boom, oxygen mask, and hand microphones, independent of microphone/interphone switch positions. All inputs are recorded continuously.

HL7202 - HL7205, HL8005 - HL8347
The cockpit voice recorder records any transmitted or received datalink communications and flight deck audio as selected on the audio control panels. It also records flight deck area conversations using an area microphone and crewmember boom, oxygen mask, and hand microphones, independent of microphone/interphone switch positions. All inputs are recorded continuously.

HL7202 - HL7205, HL8005 - HL8347
Recording continues for 10 minutes after AC electrical power is off.

Radio Tuning Panels

The radio tuning panels are used to tune the VHF and HF radios. The panels are designated left, center, and right, and are normally associated with the respective VHF and HF radios.

Radio Communication Systems

The radio communication systems consist of the VHF communication system, the HF communication system, the SATCOM system, and the SELCAL system.

VHF Communication System

Three independent VHF voice/data radios, designated VHF L, VHF C, and VHF R are installed. Any VHF radio can be controlled by any radio tuning panel. The audio control panels are used to control voice transmission and receiver monitoring.

VHF L is configured for voice communication only. VHF C and VHF R can be configured for data or voice communication. However, only one VHF radio can operate in the data mode at a time. Data communication is normally selected on VHF C.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Data Mode

The data mode can be selected and deselected on the MFD COMM display or by pushing the frequency transfer switch on the radio tuning panel. If the selected VHF radio is the default data radio (selected on the MFD COMM display), then the word DATA is displayed in the radio tuning panel active frequency window. When a standby frequency is transferred to the active window, DATA is displayed in the standby window. If a new frequency is selected in the standby window when DATA is displayed, DATA is replaced by the new frequency. Data can be returned to the standby window by selecting a frequency higher or lower than the allowable VHF frequency range.

When a VHF radio is in the data mode, it is not available for voice communications. A VHF radio can be returned to the voice communication mode by transferring a voice frequency into the ACTIVE frequency window.

HF Communication System

There are two independent HF communication radios, designated HF L and HF R. Each HF radio can be tuned by any radio tuning panel. HF radio sensitivity can only be set on the on–side radio tuning panel.

The audio control panels are used to control voice transmission and receiver monitoring.

HL7532 - HL7598
When a HF transmitter is keyed after a frequency change, the antenna tunes while a continuous tone can be heard through the audio system. A tone lasting longer than 7 seconds indicates failure of the system to tune.

HL7202 - HL7205, HL7733 - HL8347
When a HF transmitter is keyed after a frequency change, the antenna tunes while a continuous or intermittent tone may be heard through the audio system. A tone lasting longer than 7 seconds indicates failure of the system to tune. Data is stored in memory for the last 100 tuned frequencies. Stored frequencies may tune quickly and a tone may not be noticeable.

Both HF radios use a common antenna. When either HF radio is transmitting, the antenna is disconnected from the other HF radio, and it cannot be used to transmit or receive. However, both HF radios can receive simultaneously if neither is being used for transmitting.

Stuck Mic Protection

In the event a VHF or HF radio transmits for more than 30 seconds, the EICAS advisory message RADIO TRANSMIT is displayed. The message is removed when the transmission stops.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347
On the ground with both engines shut down, any VHF radio that transmits for more than 35 seconds is automatically disabled and an intermittent tone can be heard through the audio system for that radio. That radio is enabled when the microphone switch for that radio is released.

HL7532 - HL7598
On the ground with both engines shut down, any VHF radio that transmits for more than 35 seconds is automatically disabled, dashes appear in the tuning panel frequency window, and an intermittent tone can be heard through the audio system for that radio. That radio is enabled when the microphone switch for that radio is released.

SELCAL System

The SELCAL system monitors the three VHF radios and the two HF radios. When the system receives a call from a ground station, the crew is alerted through the communication crew alerting system.

SATCOM System

The SATCOM system provides both data and voice communications. The system is managed by the satellite data unit. Flight deck voice calls are controlled using the CDUs and audio control panels.

The SATCOM control pages are displayed by selecting SAT on the CDU menu page. Directories of airline-defined numbers are line-selectable or numbers may be manually entered if function is enabled by the operator.

Incoming SATCOM calls are annunciated by a SELCAL chime and illumination of a CALL light on the audio control panel. Pressing the respective transmitter select switch connects the call to the pilot headset/hand mic.

SATCOM calls are terminated when the CALL light extinguishes (ground party hang-up or pilot ends call).

The EICAS communication message SATCOM MESSAGE displays when a SATCOM message requires flight crew attention. Servicing the message clears the EICAS message.

SATCOM Main Menu Pages [Typical]

HL7532 - HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275

The SATCOM main menu pages allow the flight crew to initiate, answer and terminate calls, monitor call status, and access lower-level pages. Control functions are active when displayed with an asterisk.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

SATCOM Main Menu Page 1/2

1 Channel 1 Control Field

Push – selects active control function, SATCOM priority page, or manual phone number entry (as installed). Channel 1 status information displays in center of field.

2 Channel 2 Control Field

Push – selects active control function, SATCOM priority page, or manual phone number entry (as installed). Channel 2 status information displays in center of field.

3 COMPANY-X

Displays last index label accessed. Index labels are defined by the operator.

Push – displays SATCOM directory page associated with displayed index label.

4 INDEX

Push – displays SATCOM directory (DIR) index page containing a list of index labels. Selecting desired index label displays associated SATCOM directory page.

5 PRIORITY

The following call priority levels can display:

- EMG (Emergency) - emergency and distress calls (activates ground station alarm)
- HGH (High) - regulatory and flight safety calls
- LOW - non-safety related service calls
- PUB (Public) - passenger cabin calls

Push (channel not in use) – displays SATCOM priority page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

6 EMERGENCY

Displays label of first index (normally emergency).

Push – displays SATCOM directory page 1/20.

SATCOM Main Menu Page 2/2

1 Built-In-Test-Equipment (BITE)

Displays current BITE status.

Push – displays SATCOM BITE status page for access to system fault information.

2 CONFIG

Push – displays SATCOM config page for access to system configuration information.

3 Directory (DIR) DISPLAY

Prompt does not display if both voice channels unavailable.

Push – displays SATCOM directory display page (XX of 20).

4 LOG

Push – displays SATCOM log page for manual selection and control of log-on process.

5 CABIN CALLS

HL7532 - HL7598, HL7751 - HL7766
Push – selects desired cabin call status by toggling between enabled and disabled. Selecting enabled prompt displays the SATCOM cabin disable page for confirmation. If pilot confirms disabled, cabin calls in progress are terminated.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7733 - HL7750, HL7782, HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275

Push – selects desired cabin call status by toggling between enabled and disabled. Selecting enabled prompt displays the SATCOM cabin disable page for confirmation. If pilot confirms disabled, cabin calls in progress are not affected.

SATCOM Directory Page [Typical]

HL7532 - HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275

The SATCOM directory page (XX of 20) contains a list of phone numbers used for making line-selectable calls.

1 Phone Number List

Push – preselects phone number for making call, selects voice channel via left (SAT1) or right (SAT2) line select key, and returns display to SATCOM main menu page. Phone number labels and content are defined by the operator.

2 RETURN

Push – display returns to page displayed prior to entering SATCOM directory page.

3 Index Label

Displays index label associated with current SATCOM directory page. Index labels and content are defined by the operator.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

SATCOM Directory Display Page [Typical]

HL7532 - HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275

The SATCOM directory display page (XX of 20) contains a list of phone number labels used to revise or add directory phone numbers.

1 Phone Number Labels

Push – displays SATCOM number (NUM) entry page used to revise or add related phone number.

2 RETURN

Push – display returns to SATCOM main menu page 2/2.

3 Index Label

Displays index label associated with current SATCOM directory display page. Index labels and content are defined by the operator.

SATCOM Phone Pages [Typical]

HL7202 - HL7205, HL8006 - HL8077, HL8346, HL8347

The SATCOM phone pages allow the flight crew to initiate, answer and terminate calls, monitor call status, and access lower-level pages. Control functions are active when displayed with a caret.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

SATCOM Phone Page 1/2

1 Channel L Control Field

Push – selects active control function or manual phone number entry from scratchpad. Call status information displays in small font.

2 Channel R Control Field

Push – selects active control function or manual phone number entry from scratchpad. Call status information displays in small font.

3 Channel L PRIORITY

The following call priority levels can display:

- EMG (Emergency) - emergency and distress calls (activates ground station alarm)
- HGH (High) - regulatory and flight safety calls
- LOW - non-safety related service calls
- PUB (Public) - passenger correspondence calls

Push (channel not in use) – toggles between levels for selecting call priority.

4 DIRECTORY

Push – displays SATCOM directory index page.

5 Channel R PRIORITY

The call priority level displays SBB (SwiftBroadband) PUB when SBB voice service is available.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

SATCOM Phone Page 2/2

1 LOG

Push – displays SATCOM log page for manual selection and control of log-on process.

2 Directory (DIR) DETAILS

Push – displays SATCOM directory details page.

3 Built-In-Test-Equipment (BITE) Status

Displays current BITE status.

Push – displays SATCOM BITE status page for access to system fault information.

4 CONFIG

Push – displays SATCOM config page for access to system configuration information.

5 SWIFT

Push – displays SBB status page for access to high speed SATCOM services information.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

SATCOM Directory Index Page [Typical]

HL7202 - HL7205, HL8006 - HL8077, HL8346, HL8347

The SATCOM directory index page (X/2) is used to access directory pages.

1 Index Labels

Push – displays SATCOM directory page associated with selected index label. Index labels are defined by the operator.

2 RETURN

Push – display returns to SATCOM phone page 1/2.

SATCOM Directory Page [Typical]

HL7202 - HL7205, HL8006 - HL8077, HL8346, HL8347

The SATCOM directory page (XX/20) contains a list of phone numbers used for making line-selectable calls.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Phone Number List

Push – preselects phone number for making call, selects voice channel via left (SAT-L) or right (SAT-R) line select key, and returns display to SATCOM phone page 1/2. Phone number labels and content are defined by the operator.

2 RETURN

Push – display returns to SATCOM directory index page.

3 Index Label

Displays index label associated with selected SATCOM directory page.

SATCOM Phone Pages [Typical]

HL8005, HL8226, HL8251, HL8252, HL8285

The SATCOM phone pages allow the flight crew to initiate, answer and terminate calls, monitor call status, and access lower-level pages. Control functions are active when displayed with a caret.

SATCOM Phone Page 1/2

1 Channel 1 Control Field

Push – selects active control function, priority level, or manual phone number entry from scratchpad. Call status information displays in small font.

2 Channel 2 Control Field

Push – selects active control function, priority level, or manual phone number entry from scratchpad. Call status information displays in small font.

3 DIRECTORY INDEX

Push – displays SATCOM directory index page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Priority (PRI)

The following call priority levels can display:

- EME (Emergency) - emergency and distress calls (activates ground station alarm)
- HGH (High) - regulatory and flight safety calls
- LOW - non-safety related service calls
- SBB (SwiftBroadband) - non-safety related calls (displays when SBB voice service available)

Push – toggles between levels for selecting call priority.

SATCOM Phone Page 2/2

1 LOG-ON

Push – displays SATCOM log-on page for manual selection and control of log-on process.

2 Channel (CHAN) STATUS

Push – displays SATCOM channel status page.

3 MAINTENANCE

Push – displays SATCOM maintenance page.

4 Configuration (CONFIG)

Push – displays SATCOM configuration page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

SATCOM Directory Index Page [Typical]
HL8005, HL8226, HL8251, HL8252, HL8285

The SATCOM directory index page is used to access directory pages.

1 RETURN

Push – display returns to SATCOM phone page 1/2.

2 Index Labels

Push – displays SATCOM directory page associated with selected index label. Index labels are defined by the operator.

SATCOM Directory Page [Typical]
HL8005, HL8226, HL8251, HL8252, HL8285

The SATCOM directory page contains a list of phone numbers used for making line-selectable calls.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Phone Number List

Push – preselects phone number for making call, selects voice channel via left (SAT-1) or right (SAT-2) line select key, and returns display to SATCOM phone page 1/2. Phone number labels and content are defined by the operator.

2 RETURN

Push – display returns to SATCOM directory index page.

3 Index Label

Displays index label associated with selected SATCOM directory page.

Communication Crew Alerting System

The communication crew alerting system provides aural and visual alerts for normal operations requiring crew awareness that may require crew action. Visual alerts are presented as EICAS messages preceded by a bullet symbol (•). The aural alert is a high–low chime. The following table shows communication crew alert categories and the respective aural and visual alerts for each category. Refer to section 50 of this chapter for a list of possible messages.

Crew Alert Categories

Communication Crew Alert Category	Aural Alert	Visual Alert	Comments
High	High–low chime	EICAS communication message	None currently implemented. Reserved for future use.
Medium	High–low chime	EICAS communication message	Message awareness required. Crew action may be required.
Low	None	EICAS communication message	Crew action may be required.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Main Deck Alert System

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The main deck alert system activates an aural warning and flashes the cargo area sidewall lights for several seconds to alert crewmembers in the main deck cargo compartment to return to the cabin. The system activates automatically upon main cargo deck smoke detection or cabin depressurization, or manually by pushing the MAIN DK ALERT switch on the flight deck call panel. The switch light illuminates to indicate system activation and extinguishes to indicate reset.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Interphone Communication System

The interphone communication system includes the:

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- flight interphone system
- cabin interphone system
- service interphone system
- passenger address (PA) system

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

- flight interphone system
- cabin interphone system
- service interphone system
- personnel address (PA) system
- cargo interphone system
- cargo intercom system

The flight interphone, service interphone, and PA systems are normally operated through the audio control panel.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The cabin interphone system is operated through the audio control panel, CDU, and flight deck handset.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The cabin and cargo interphone systems are operated through the audio control panel and flight deck call panel.

Flight Interphone System

The flight interphone system provides communications between flight deck crew members. The flight interphone system also provides communications between the flight deck and ground crew through a flight interphone jack on the nose landing gear.

The system is used by selecting the INT (interphone) position of a control wheel or audio control panel mic/interphone switch. The interphone can also be used by selecting the FLT transmitter selector on an audio control panel and then selecting one of the following microphone switches:

- MIC position of a control wheel switch
- MIC position of an audio control panel mic/interphone switch

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- a hand microphone push to talk switch
- a glareshield MIC switch

Note: Voice level from both flight deck speakers decreases significantly when selecting the MIC/INT switch on the ACP or control wheel, the PTT switch on the hand microphone, or the MIC switch on the glareshield.

Crew alerting of a ground crew initiated call is provided by an aural alert chime, the GROUND CALL EICAS communication message, and a CALL light illuminated on the audio control panel transmitter select switch.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The ground crew is called by selecting the GND CREW dial code from the center CDU.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The ground crew is called by pushing the GND call switch on the call panel.

Service Interphone System

The service interphone system provides voice communications between ground crew stations at various locations around the airplane. The system can be connected to the flight interphone system through the service interphone switch on the overhead panel.

Passenger Address System

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The PA system is used by the flight crew to make cabin announcements. Pushing a PA transmitter select switch on an audio control panel and activation of a microphone switch provides direct access to all PA areas.

The system is monitored by pushing the PA receiver volume control on an audio control panel. The PA system can also be selected through the cabin interphone system or the flight deck handset.

Cabin PA announcement priorities are:

- flight deck announcements from an audio control panel
- cabin handset direct access announcements
- priority (all area) announcements
- normal announcements from flight attendant or flight deck handsets

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Personnel Address System

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The PA system is used by the flight crew to make announcements to the supernumerary and crew rest areas. Pushing a PA transmitter select switch on an audio control panel and activation of a microphone switch provides direct access to all PA areas.

Cabin Interphone System

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The cabin interphone system provides voice communications between the flight deck and the flight attendant stations. Boom microphones, oxygen mask microphones, and hand microphones are used by selecting the CAB transmitter select switch on an audio control panel and pushing the mic/interphone switch to the MIC position. A cabin interphone station(s) must be selected and a call initiated from the center CDU to alert the desired station to pick up the call.

EICAS communications alert messages and chimes alert the pilots to incoming cabin calls. Normal priority calls from the cabin display the CABIN CALL EICAS message. Normal priority calls made to the flight deck while another call is in progress will result in a busy signal at the handset, the calling station being displayed in the call queue, and the CABIN CALL memo message being set in EICAS. The call queue and memo messages will be cleared when communication is established between that calling station and the flight deck. Priority calls from the cabin display the CABIN ALERT EICAS message. Priority calls automatically disconnect lower priority cabin interphone calls. Priority calls placed while a priority call is in progress are automatically connected as a conference call.

The cabin interphone call queue, speed dial numbers, and directories are accessed from the center CDU cabin interphone menu.

Calls are initiated by:

- line selecting the call location on the CDU display, or
- entering the appropriate call code in the CDU scratchpad and selecting SEND

Pushing the audio control panel CAB transmitter select switch twice within one second places a priority call to an airline–designated call location.

A station which is in use will be disconnected from the call in progress and connected to the flight deck.

Note: Flight deck initiated calls will not interrupt a current PA announcement from the dialed station.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Calls can be answered by selecting an audio control panel CAB transmitter select switch or, if a CAB transmitter select switch is already pushed in, by pressing a mic/interphone switch to the MIC position.

Calls can be ended by selecting the CDU prompt END CALL or de–selecting the CAB transmitter selector on the audio control panel. The call also ends if the other party terminates the call.

Calls can also be answered or placed using the flight deck handset. Desired call locations are entered using the numeric keys on the handset. Pressing the handset reset switch or placing the handset back on the cradle terminates the call.

Note: The handset PA push–to–talk switch is not required to operate the handset except for PA announcements.

CDU Menu Page

Pushing the CDU MENU key displays the CDU menu page.

Normally, the cabin interphone (CAB INT) and SATCOM (SAT) displays are viewed on the center CDU. The SATCOM prompt is available on all CDUs.

1 CAB INT

Push – displays the CDU cabin interphone pages.

Note: Available only on the center CDU.

2 SAT

Push – displays the CDU SATCOM pages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cabin Interphone CDU Controls

1 Period (.) key

Push – displays an asterisk (*) in the scratchpad.

2 Plus/Minus (+/-) Key

Push – displays a pound sign (#) in the cabin interphone scratchpad.

3 Delete Key

Push –

- displays DELETE in the cabin interphone scratchpad
- used to delete calls from the call queue

Cabin Interphone Main Menu

The cabin interphone menu allows the pilots to send or end calls. Calls are sent by selecting a station from the speed dial page or the directory. Two digit station codes can be manually entered into the scratchpad and the call sent using the SEND prompt. A list of the two digit station codes is located on the handset.

The directory of stations is created by the customer airline and is not shown here. The following depict typical main menu pages and selected options.

Speed Dial

The speed dial menu provides a quick means to call up to five predefined stations or groups of stations. A single push initiates the selected call.

Call Queue

When the flight deck is involved in a call, additional incoming calls are displayed in the queue. Up to four calls can be displayed in order of the priority assigned as follows:

- PILOT ALERT
- conference calls

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- cabin calls
- other calls

The PILOT ALERT queue entry is displayed only when the flight deck is using the PA and an incoming call is received.

When there are four calls in the queue and a new, higher priority call is received, the lowest priority call is removed from the queue and the new call is displayed in the proper priority.

Cabin Interphone Main Menu Page [Typical]

1 SPEED DIAL Labels

Lists the dial code labels of predefined stations, station groups, or functions:

- PA CALL – selects the passenger address system
- ALL CALL – selects all cabin interphone stations
- PURSER – selects the purser station
- GALLEY FWD – selects the forward galley station
- GND CREW – activates an alert horn in the nose wheel well. When selected, the horn sounds briefly to alert the ground crew for communications with the flight crew

Push – directly dials the selected station, station group or enables the selected call function.

2 SEND

A two–digit dial code may be manually entered with the CDU keyboard. If the dial code is valid, the dial code, dial code label, and SEND are displayed. If the dial code is invalid, INVALID CODE is displayed in the scratchpad.

Push – initiates a call to the selected station.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 END CALL

Displayed during a connect call.

Push – disconnects all existing call connections.

3 CURRENT CALL

Displays the most recently selected dial code and label when a call is being connected. Dial code is removed when call is established.

Note: XX BUSY appears in the scratchpad when a cabin interphone call is attempted from the CDU to a handset that is off the hook. Line selecting <END CALL will remove the XX BUSY annunciation.

4 CALL QUEUE Labels

Lists the dial code labels of unanswered calls to the flight deck.

Push –

- initiates a call back to the displayed station(s)
- adds station(s) to the existing call (if the flight deck is currently connected in a call)

5 IN USE Status

PA IN USE –

- a portion of the airplane PA system is in use by/from the cabin crew, or
- both the PA and video entertainment systems are in use by/from the cabin crew

VIDEO IN USE – a portion of the video entertainment system is in use.

Blank (dashes) – neither the PA nor video system is in use.

6 DIRECTORY

Push – displays the cabin interphone DIRECTORY page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cabin Interphone Directory Page [Typical]

The cabin interphone directory pages are used to access subdirectory pages. CDU cabin interphone directory pages and individual directory entries are predefined by the airline. Each directory label is the name of a subdirectory where the dial code labels of the individual stations or functions are listed.

Selection of the specific location(s) is accomplished on the subdirectory page.

1 Directories

Up to 20 subdirectories can be predefined.

Push – displays the appropriate subdirectory page

2 CAB INT

Push – returns the display to the cabin interphone main menu page.

Cabin Interphone Subdirectory Page [Typical]

Selecting a dial code label on the subdirectory page initiates a call to that station or station group.

The cabin interphone subdirectory pages are used to view and select individual locations through their dial code labels.

Typical stations or station groups are:

- individual cabin station
- two or more cabin stations for conference calls
- PA call to all cabin areas
- PA call to individual cabin areas
- PA priority call to all cabin areas
- ground crew alert
- gate station (on the ground)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Dial Code Labels

Push – initiates a call to the appropriate station(s).

2 CAB INT

Push – returns the display to the cabin interphone main menu page.

Cabin Interphone System

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The cabin interphone system provides voice communications between flight deck, crew rest, and supernumerary stations. Boom microphones, oxygen mask microphones, and hand microphones are used by selecting the CAB transmitter select switch on an audio control panel and pushing the mic/interphone switch to the MIC position. A call is initiated from the call panel to alert the desired station to pick up the call.

The cabin interphone can be connected to the cargo interphone with the CARGO AUDIO switch on the call panel. An incoming cargo call or pushing the CARGO call switch on the call panel automatically selects cargo audio. The CARGO AUDIO switch should be disconnected following a cargo call to eliminate residual circuit noise on the cabin interphone.

EICAS communication messages and chimes alert the pilots to incoming cabin/cargo calls. Calls made to the flight deck from any crew rest, supernumerary, or cargo area illuminate the CALL light on the CAB transmitter select switch and display the associated EICAS communication message. The communication message clears from EICAS when communication is established between the calling station and the flight deck. Any additional incoming calls are added to the call already in progress.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Calls are initiated by selecting the call location on the call panel. Multiple calls can be initiated simultaneously or while other calls are already in progress.

Cargo Interphone System

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The cargo interphone system is used for ground and in-flight communications between cargo area stations over handsets/headsets. The cargo interphone is accessed through the Loadmaster Amplifier panel handset, headset jacks at four wing inspection station call panels, and headset jacks at eight main cargo deck speaker/microphone panels. The cargo interphone system is independent of the cargo intercom speaker/microphone panels. The cargo interphone system can be connected to the cabin interphone system for communications with the flight deck, crew rest, and supernumerary areas by selecting the CARGO AUDIO switch on the flight deck call panel.

Cargo Intercom System

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The cargo intercom system has speaker/microphone panels located throughout the main cargo deck. The cargo intercom speaker/microphone panels are controlled by the Loadmaster Amplifier panel and are active only on the ground.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The MFD communications functions are used to control data link features. Data link messages not processed by the FMC are received, accepted, rejected, reviewed, composed, sent, and printed using communications functions on the MFD. Data link communications can be established with participating ATC and company locations. ACARS and data link radio management functions are provided through communications management menus.

The COMM display switch, located on the display select panel, displays the communications main menu on the selected MFD. Communications functions are selected using the cursor control device. Message text entry is accomplished by entering data into the CDU scratchpad and transferring it to the appropriate area. Messages can be printed on the flight deck printer. Incoming message traffic is annunciated by EICAS communications messages.

Illustrations shown in this section depict the COMM menu with all features enabled. ATC data link requires appropriate airplane and ATC capability.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Communications Menus

MFD

Note: Shown with all menu functions active.

Company communications functions can be customized by airlines. Descriptions and illustrations provided in this section are examples of a typical installation with all communications functions active (depending on airline configuration or function availability, some functions may be inhibited).

Selectable menu items (active functions) have white text on a gray background. Inhibited items have cyan text on a black background with a cyan border. Inhibited items cannot be selected. The background color for a selected top level function is green.

Selecting ATC, FLIGHT INFORMATION, COMPANY, REVIEW, MANAGER, or NEW MESSAGES selection:

- places the appropriate title in the menu heading line
- displays the subordinate menu selections for that function in the menu/data area

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Subordinate menu items which lead to subsequent subordinate menu(s) are followed by three dots (…). Making a selection from the subordinate menu places the title of that function in the menu heading and displays a new subordinate menu or data below. Making a selection from the subordinate menu displays the appropriate title, the menu heading, and the data below.

ATC provides downlink messages to ATC, where available.

HL7532 - HL7598
FLIGHT INFORMATION provides for downlink messages that allow request of Departure Clearance, Oceanic Clearance, or Automatic Terminal Information Service (ATIS) information.

HL7202 - HL7205, HL7733 - HL8347
FLIGHT INFORMATION provides for downlink messages that allow request of Pushback Clearance, Taxi Clearance, Departure Clearance, Oceanic Clearance, Automatic Terminal Information Service (ATIS) information, or Terminal Weather Information for Pilots (TWIP).

COMPANY provides for downlink messages to airline facilities.

REVIEW displays a list of all transmitted messages, received messages not requiring a response, or received messages with the response already sent. REVIEW is inhibited if there are no listed messages.

MANAGER provides the controls for data link and communications systems in general.

NEW MESSAGES displays a list of uplinked messages that have not been displayed or responded to. NEW MESSAGES is inhibited when there are no new messages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Communications Control and Input Functions

Communications menus, controls, and data input methods are similar for ATC, FLIGHT INFORMATION, and COMPANY functions. Basic functions are explained here.

Command Key Locations

Communications command keys are displayed at the bottom of communications pages. Command keys change as appropriate for pages displayed. Each key has a label which changes based on the page displayed and the possible action. Only one label is displayed in a single location for a specific condition on the page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Command Key Functions

The following table describes the key functions and labels for all ATC, FLIGHT INFORMATION, and COMPANY functions.

Command key label	Displayed/Inhibited	Key function
ACCEPT (uplink messages)	Displayed when: • message requires an accept/reject response, and • all message pages have been displayed Inhibited for first 2 seconds of message display	Select: • message acceptance downlinked to message sender • ACCEPT & REJECT keys removed • message status displayed in info box • CANCEL command key displayed
APPEND (company downlink accept/ reject response)	Displayed when: • all pages of the uplinked message have been displayed, and • company data link capability is operational Inhibited when: • for first 2 seconds of uplink display, or • when company data link capability is not operational	Select: • uplink message is removed, and • downlinked message page is displayed
ARM (ATC downlink reports)	Displayed when an armable report is open: • REPORT LEAVING • REPORT LEVEL • REPORT PASSING • REPORT REACHING.	Select: • arms the report for automatic downlink to ATC when report conditions are met • key function changes to DISARM • report status changes from OPEN to ARMED

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Command key label	Displayed/Inhibited	Key function
CANCEL	Displayed when: • uplink message is displayed which does not require an accept or reject response, or • an uplink message is displayed which has been accepted, rejected, or • review message is displayed Inhibited for first 2 seconds of message display.	Message is removed.
DELETE (ATC reports)	Displayed when a downlink report page is open for entry.	Select: • deletes the report without sending. • displays the COMM menu
DISARM (ATC reports)	Displayed when an armable report is ARMED: • REPORT LEAVING • REPORT LEVEL • REPORT PASSING • REPORT REACHING	Select: • disarms automatic report downlink to ATC • key function changes to ARM • Report status changes from ARMED to OPEN
DISPLAY REPORT	Displayed after accepting an uplink message which contains a report.	Displays the downlink report attached to an uplinked message.
DISPLAY REQUEST	Displayed after accepting an ATC uplink message which contains a request.	Downlink request which required an ATC response is displayed,

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Command key label	Displayed/Inhibited	Key function
EXIT	Displayed when: • a downlink message is displayed, or • a manager page is displayed	COMM main menu is displayed
EXIT MENU	Displayed when menu is displayed.	COMM main menu is displayed.
LOAD FMC (ATC uplink)	Displayed when uplinked ATC message contains data which can be loaded into the FMC. Inhibited when active route is in a MOD condition.	Select: • FMC data is transferred into the active route, and • FMC modification is started.
PRINT	Displayed when: • displayed message can be printed, and • printer is available Inhibited when printer is not available.	Message is sequenced for printing.
PRINT LIST	Displayed when: • new message list page is displayed, or • review list page is displayed Inhibited when printer is not available.	All messages in the list are sequenced for printing.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Command key label	Displayed/Inhibited	Key function
REJECT (uplink messages)	Displayed when: • message requires an accept/reject response, and • all message pages have been displayed Inhibited for first 2 seconds of message display.	Select: • message rejection downlinked to message sender • ACCEPT and REJECT command keys removed • CANCEL command key displayed • message status displayed in info box, and • message cleared from the display 5 seconds after status changes to REJECTED
REJECT REASONS (ATC reject downlink)	Displayed when an uplink message requires an accept or reject response.	Displays REJECT REASON page.
RESET (downlink pages)	Displayed when downlink page is displayed.	Message parameters are reset to their default values.
RESET ALL (ATC downlink pages)	Displayed when ATC VERIFY REQUEST page is displayed.	Select: • all request parameters on the VERIFY REQUEST are set to reset/default values • ATC combined request pages are reset, or • COMM main menu is displayed

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Command key label	Displayed/Inhibited	Key function
RETURN	Displayed when: • a review message is displayed, or • a downlink message is displayed, or • a VERIFY REQUEST page is displayed, or • a manager page is displayed	Previous list page, request page, or menu is displayed.
SEND (downlink messages)	Displayed when: • required data complete, and • all company message pages have been displayed Inhibited when transmission queue is full.	Select: • message transmission initiated • message status displayed in info box, and • message cleared from the display 5 seconds after status changes to SENT
STANDBY (ATC uplink messages)	Displayed when: • uplinked message is received which requires an accept/reject response, and • STANDBY has not been previously selected for this message	Standby response is sent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Command key label	Displayed/Inhibited	Key function
VERIFY	Displayed when data is entered on more than one of the following ATC pages: **HL7532 - HL7598** • ALTITUDE REQUEST **HL7202 - HL7205, HL7733 - HL8347** • LEVEL REQUEST • ROUTE REQUEST • SPEED REQUEST	Displays VERIFY REQUEST page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Text Entry

Downlink message pages provide text entry fields. Scratchpad entries transfer to selected entry fields when a cursor select switch is pushed. Scratchpad entries blank when successfully transferred. Scratchpad entries remain and an INVALID ENTRY message is displayed on the MFD when the entry is not valid.

An entry field resets to a default value when a blank scratchpad is transferred. An entry field resets to the default entry prompt when DELETE is transferred.

Box and dash prompts indicate the maximum number of characters allowed.

Some entry fields have format requirements. Entry prompts display the required entry format, with special characters separating entry boxes. The required data is entered without the special characters or spaces. Scratchpad data is transferred to entry boxes after being checked for proper format. Invalid data or format prevents transfer and displays an INVALID ENTRY message.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Menu Entry Fields

Menu entry fields are used to make text entry selections from a list. Menu entry fields distinguish mandatory versus optional entry in the same manner as CDU entry field.

The menu entry field is distinguished from other entry fields by the pointer to the right of the field.

When initially selected, a list of menu items is displayed to the side of the pointer. If an item from the list is then selected using the cursor and cursor select switch, that item is transferred to the entry field. If the menu prompt is selected again and the CDU contains a valid value, that CDU value is transferred to the entry field. Actions for invalid values, an empty scratchpad, space characters, and the delete key are the same as for the CDU entry field. When the entry field is selected with text already inserted, the menu list is removed from the display.

Invalid Entries

When the scratchpad contains invalid data for the entry field, the INVALID ENTRY message is displayed in the INFO BOX. Re–entering valid data clears the INVALID ENTRY message on an ATC downlink page. Selecting the EXIT INFO key also clears the INVALID ENTRY message and removes the info box.

INVALID ENTRY messages on a company downlink page must be individually cleared by selecting the EXIT INFO key before valid data is re–entered into the field.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message List

Message titles and related information can be displayed in a list. The illustration shows the REVIEW message list. A similar list is available for NEW MESSAGES.

The NEW MESSAGE list is sorted by the time of receipt, the most current message at the top. ATC uplink messages have an ATC label to the right of the message block. The message remains in the list until it is accepted, rejected, or displayed. Messages requiring an accept/reject remain in the list until the accept/reject response is accomplished.

Selecting an item from the list with the cursor and pushing the cursor select switch displays the message page. Lists are also used to view new messages.

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

1 Current Time

Displays current time.

2 Message Time

For new messages – time the message is received.

For review messages – time the message is received or sent.

3 Message Title

Displays message title information.

4 Message Status

Only displayed for review list boxes.

The appropriate status indicator is displayed.

Message Display Format

A typical message display format is shown. Messages selected from a list are displayed in this format.

Note: Selection of a main menu item exits the message page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7598

HL7202 - HL7205, HL7733 - HL8347

1 Message Time

For downlink messages – current time.

For new messages – time the message is received.

For review messages – time the message is received or sent.

2 Message Title

Displays message title information.

3 Review State

Only displayed for review messages.

The appropriate state indicator is displayed.

4 Message Content

Located between the title and the keys.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Exclusive and Nonexclusive Select Keys

Manager and new message pages can contain select keys to activate features. Pushing the cursor select switch when the key is highlighted makes the selection. A second selection of a nonexclusive key toggles to the deselected state.

1 Exclusive Select Key

The diamond–shaped exclusive select keys are used to select a single feature from a group. Selecting a key activates the feature and all other exclusive select keys in that group are deselected. The keys are displayed in their selected or default condition. If selection is required, the SEND key is not displayed until a selection is made.

2 Nonexclusive Select Key

The square–shaped nonexclusive select keys are used to select multiple features. Selecting a key activates the feature. The keys are displayed in their previously selected or default condition. If selection is required, the SEND key is not displayed until a selection is made.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Information Messages

Messages are displayed in an information box at the bottom of the MFD. The information box covers command keys. Information messages, such as INVALID ENTRY, are cleared by selecting EXIT INFO. Some information messages automatically disappear.

1 Information Message Text

The text starts at the left of the box.

2 EXIT INFO Key

Select – removes the information box for the displayed message from the display.

Communications Information Messages

Communications information messages are described in the following table.

Information Message	Condition
ABORTED	ATC connection not established, lost, or loss of handoff to a new active center, while a message is transmitting, or before acceptance.
ACCEPTED	ACCEPT response received.
ACCEPTING	ACCEPT response sent.
DISPLAYED	All pages of a message not requiring an ACCEPT or REJECT response have been displayed.
COMM CONTROL TRANSITION – COMPANY MESSAGES LOST	Airplane data link system switched to a new AIMS master. Company datalink information may be lost. Incomplete company downlink messages are lost and must be created/transmitted again. If previously received Company messages are required, they must be requested again. ATC connections, data, and messages are not affected.
CONNECTING	Logon request sent, network acknowledgment received, and connect or start request not received.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Information Message	Condition
INCOMPLETE MESSAGE	Only part of the displayed message is received.
INVALID ENTRY	An entry box is selected and the CDU scratchpad value is not valid.
LOADED	ATC uplink route modification is successfully loaded into the FMC.
LOAD ABORTED	Loading of ATC uplink route modification into the FMC is aborted.
LOADING	ATC uplink route modification is loading into the FMC.
MESSAGE TO PRINTER	Selected message(s) sent to printer.
MESSAGE LIMIT EXCEEDED	Maximum number of characters that can be transmitted in ATC downlink message is exceeded.
NO ACCEPT (company)	ACCEPT response is not successfully transmitted or an ACCEPT response is not required.
NO PRINT	An attempt to send a message(s) to the printer is unsuccessful.
NO REJECT (company)	REJECT response is not successfully transmitted or a REJECT response is not required by the message.
NO SEND	An attempt to send a downlink message is unsuccessful.
PARTIAL LOAD	ATC uplink route modification was partially loaded into the FMC.
PRINTING	ATC message is printing.
REJECTED	REJECT response received.
REJECTING	REJECT response transmitting.
SENDING	The downlink message is sent.
SENT	The downlink message is received.
UNABLE TO LOAD	ATC uplink route modification can not be loaded into the FMC.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Uplink Message

ATC Uplinks

Arriving ATC uplink messages are annunciated by an •ATC communications message, an aural chime, and the display of the EICAS ATC message block. The message text is displayed below the normal EICAS engine display. Uplink messages too large to fit in the message area display the message LARGE ATC MESSAGE. The message text is displayed using the NEW MESSAGE menu selection.

Flight Information Uplinks

Arriving flight information uplink messages are annunciated by a •COMM communications message and an aural chime. The message text is displayed using the NEW MESSAGE menu selection.

Company Uplinks

Arriving company uplink messages are annunciated by a •COMM communications message and an optional aural chime.

Accept/Reject Uplinks

ATC messages requiring an accept or reject response display those options on the EICAS display. The MFD message page displays ACCEPT, STANDBY, REJECT REASONS, and REJECT keys at the bottom. Select ACCEPT or REJECT to respond to the uplink message. The REJECT REASONS key can be selected to inform ATC why the message is being rejected.

Company messages can also be accepted or rejected on the message page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

After making a selection, the status changes to ACCEPTING/REJECTING while the response is transmitting. When the communications network sends a response indicating that the message was received, the message status changes to ACCEPTED/REJECTED. After a message has been accepted or rejected, a CANCEL key is displayed at the bottom of the page. Selecting CANCEL will clear the message from the display. Rejected messages are automatically removed 5 seconds after the message status changes to REJECTED.

The ACCEPT, CANCEL, and REJECT buttons on the glareshield perform the same function as the same keys on the MFD.

Reject Reasons Page

If the response to an ATC uplink message is to reject the message, the REJECT REASONS key can be selected to inform ATC why the clearance message is being rejected. Up to three lines of text can be included. Select REJECT to send the reject message with the applicable reasons.

Standby Response

When more time is required to respond to an ATC uplink, use the STANDBY key to send a delay notification.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ATC Sidelinks

ATC sidelinks are system generated ATC communication messages. They are annunciated by an •ATC communications message, aural chime, and display of the EICAS ATC message block. The message text is displayed below the normal EICAS engine display. Selecting CANCEL with the cursor control device or glareshield button will clear the message from the display.

ATC Data Link

ATC data link communicates with participating air traffic control centers, reducing the need for VHF voice communications. Airplane situation reports, route changes, speed and vertical clearances, and voice contact requests can be sent or received as appropriate. The COMM display ATC menu selection allows display of downlink message pages.

Uplink and downlink messages are stored. All messages are assigned the time of receipt/transmission and are printable.

ATC data link requires manual logon to a participating ATC facility. Once logged on, transfer to adjacent ATC facilities is normally automatic.

Crew Feedback

ATC uplinks containing clearance data that the crew can set on the MCP or EFIS control panel have a crew feedback display function. When the message is displayed on EICAS or the message page, the data values change from white to green when properly set by the crew. Data which provides feedback is:

- MCP speed
- MCP heading
- MCP altitude
- barometer setting
- transponder code
- VHF frequency
- HF frequency

FMC Data Loading

Some ATC uplinks contain data for loading into the FMC. Display of the LOAD FMC command key indicates that FMC data is available for loading. Selecting LOAD FMC transfers data to the FMC and creates an FMC modification.

Both MFD information messages and FMC scratchpad messages provide indications of loading progress.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Downlink Pages
ATC Menu

HL7532 - HL7598

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC		
ALTITUDE REQUEST	WHEN CAN WE EXPECT	EMERGENCY REPORT
ROUTE REQUEST	VOICE CONTACT REQUEST	ATC REQUESTED REPORTS...
SPEED REQUEST	LOGON / STATUS	POSITION REPORT
CLEARANCE REQUEST		FREE TEXT MESSAGE

ATC Menu

HL7202 - HL7205, HL7733 - HL8347

ATC	FLIGHT INFORMATION	COMPANY
REVIEW	MANAGER	NEW MESSAGES
ATC		
LEVEL REQUEST	WHEN CAN WE EXPECT	EMERGENCY REPORT
ROUTE REQUEST	VOICE CONTACT REQUEST	ATC REQUESTED REPORTS...
SPEED REQUEST	FREE TEXT MESSAGE	CONDITIONAL CLEARANCES
CLEARANCE REQUEST	LOGON / STATUS	POSITION REPORT

ATC Menu

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347

ATC Menu - ATN Connection Established

The ATC menu provides access to ATC downlink pages.

The ATC REQUESTED REPORTS menu selection is inhibited (cyan) when no reports are requested by ATC.

HL7202 - HL7205, HL7733 - HL8347
The CONDITIONAL CLEARANCES menu selection is inhibited (cyan) unless a conditional clearance is accepted by the flight crew.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347
Some ATC menu selections and request messages are inhibited (cyan) when an ATN (Aeronautical Telecommunication Network) data link connection is established.

Note: This menu is not repeated when describing individual pages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Altitude Request

HL7532 - HL7598

The ALTITUDE REQUEST page allows selection of an altitude, an altitude block, or a VMC descent. A second request page allows selection of a reason for the request.

1 ALTITUDE

The requested altitude is entered into the dash prompt and the SEND key becomes active.

Pushing the SEND key requests a normal climb at climb power unless otherwise requested, or a normal descent.

Additional climb or descent options are:

- STEP AT – allows entering a time or position for the start of the climb or descent
- CRUISE CLIMB – begin a cruise climb from present position

STEP AT is inhibited when the ALTITUDE value is less than 150 feet from current airplane altitude. Altitude entries are any valid FMC altitude. Time entries are in four digit, hours and minutes, optionally followed by a Z. Position entries are any valid FMC position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 BLOCK

BLOCK is the beginning of a block altitude. TO is the end of the altitude block. Altitude entries are any valid FMC altitude.

The SEND key becomes active with an entry.

3 REQUEST VMC DESCENT

A VMC descent is begun from present position.

The SEND key becomes active with this selection.

Level Request

HL7202 - HL7205, HL7733 - HL8347

The LEVEL REQUEST page allows selection of an altitude, an altitude block, or a VMC descent. A second request page allows selection of a reason for the request.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347

1 LEVEL

The requested flight level is entered into the dash prompt and the SEND key becomes active.

Pushing the SEND key requests a normal climb at climb power unless otherwise requested, or a normal descent.

Additional climb or descent options are:

- STEP AT – allows entering a time or position for the start of the climb or descent
- CRUISE CLIMB – begin a cruise climb from present position

STEP AT is inhibited when the LEVEL value is less than 150 feet from current airplane altitude. Flight level entries are any valid FMC altitude. Time entries are in four digit, hours and minutes, optionally followed by a Z. Position entries are any valid FMC position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 BLOCK

BLOCK is the beginning of a block altitude. TO is the end of the altitude block. Altitude entries are any valid FMC altitude.

The SEND key becomes active with an entry.

3 REQUEST VMC DESCENT

A VMC descent is begun from present position.

The SEND key becomes active with this selection.

Altitude Request Reason Page

HL7532 - HL7598

The page scroll bar selects a second ALTITUDE REQUEST page. Reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Level Request Reason Page

HL7202 - HL7205, HL7733 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347

The page scroll bar selects a second LEVEL REQUEST page. Reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Route Request

The ROUTE REQUEST page allows selection of a direct to waypoint, new route, heading or track, departure and transition, arrival and transition, weather deviation, or a route offset. A second request page allows selection of a reason for the request.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347

1 DIRECT TO

Enter any valid FMC waypoint. The SEND key becomes active with this selection.

2 ROUTE

Selects FMC route 1 or 2. Sends the selected route, including any modifications. The SEND key becomes active with this selection.

3 HEADING

Enter desired heading. When displays are referenced to true north, a TRU label is displayed right of the heading. The SEND key becomes active with this selection.

4 TRACK

Enter desired ground track. When displays are referenced to true north, a TRU label is displayed right of the ground track. The SEND key becomes active with this selection.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 Departure (DEP)/Arrival (ARR)

Enter one of the following:

- departure
- arrival
- departure and transition
- arrival and transition

Default entries are:

- departure procedure/transition selected for the selected route
- the approach procedure/transition selected for the active route when the airplane is in the air and an arrival procedure/transition is not selected

The SEND key becomes active when one of the check boxes is selected.

6 WEATHER DEVIATION UP TO

Enter desired offset in nautical miles. Valid entries are L (left) or R (right) NNN (NNN is any number from 1 to 128). Entries can be made without L or R to allow for offsets to either side of the route. The SEND key becomes active with this selection.

7 OFFSET

Enter desired FMC route offset in nautical miles. Valid entries are L or R XX (XX is any number from 1 to 99). The SEND key becomes active with this selection.

8 OFFSET AT

Enter a time or position to begin the offset. Time entries are in four digit, hours and minutes, optionally followed by a Z. Position entries are any valid FMC position.

Route Request Reason Page

HL7532 - HL7598
The page scroll bar selects a second ROUTE REQUEST page similar to the ALTITUDE REQUEST page previously described. The reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

HL7202 - HL7205, HL7733 - HL8347
The page scroll bar selects a second ROUTE REQUEST page similar to the LEVEL REQUEST page previously described. The reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Speed Request

The SPEED REQUEST page allows selection of speed. A second request page allows selection of a reason for the request.

1 SPEED

Enter any valid FMC speed or mach number. IAS entries are rounded to the nearest 10 knots. The SEND key becomes active with this entry.

Speed Request Reason Page

HL7532 - HL7598
The page scroll bar selects a second SPEED REQUEST page similar to the ALTITUDE REQUEST page previously described. The reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

HL7202 - HL7205, HL7733 - HL8347
The page scroll bar selects a second SPEED REQUEST page similar to the LEVEL REQUEST page previously described. The reasons for a request are optionally entered on this page. Up to three lines of free text can be included.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Clearance Request

Selecting REQUEST CLEARANCE informs ATC that the crew is ready for a clearance, such as predeparture or pushback. Up to three lines of free text can be included. The SEND key becomes active with this selection.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Combination Downlink Request

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

HL7532 - HL7598

Requests from the altitude, speed, and route pages can be combined into one downlink request. Each request is individually selected and filled out. Select subsequent request pages by selecting RETURN, and selecting additional downlink pages from the ATC main menu. When data is entered into the second request page, the SEND key changes to VERIFY.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

Requests from the level, speed, and route pages can be combined into one downlink request. Each request is individually selected and filled out. Select subsequent request pages by selecting RETURN, and selecting additional downlink pages from the ATC main menu. When data is entered into the second request page, the SEND key changes to VERIFY.

The SEND key is active on the VERIFY REQUEST page. A combined request is limited to five elements. Selecting a sixth request element displays the MESSAGE LIMIT EXCEEDED information message.

The verify page provides a display of the combined request elements. Each element is displayed on separate lines. Elements requiring revision before sending are revised on their respective request page. Selecting SEND transmits the combined downlink message to ATC.

HL7532 - HL7598

The example shows a combined altitude and speed request. The altitude request is created first.

HL7202 - HL7205, HL7733 - HL8347

The example shows a combined level and speed request. The level request is created first.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When Can We Expect

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

HL7532 - HL7598

Making selections asks ATC the time or location the crew can expect clearance for the requested items. Altitude, speed, and cruise climb entry rules are the same as on the ALTITUDE REQUEST and SPEED REQUEST pages. Up to three lines of free text can be included. The SEND key becomes active when a check box is selected.

HL7202 - HL7205, HL7733 - HL8347

Making selections asks ATC the time or location the crew can expect clearance for the requested items. Altitude, speed, and cruise climb entry rules are the same as on the LEVEL REQUEST and SPEED REQUEST pages. Up to three lines of free text can be included. The SEND key becomes active when a check box is selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Voice Contact Request

Making selection asks ATC for a voice contact. Up to three lines of free text can be included. The SEND key becomes active when the request for voice contact box is selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ATC Logon/Status

The ATC LOGON/STATUS page allows entry of the desired ATC facility for establishment of a data link connection.

The SEND key is displayed after all logon entries are completed. Selecting the SEND key displays SENDING status during logon transmission. Five seconds after the logon status changes to SENT, the page is exited.

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7733 - HL7783, HL8208 - HL8275

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347

1 ACTIVE CENTER

Displays the ATC facility identifier where a connection is established.

2 NEXT CENTER

Displays the ATC facility identifier to which an automatic handoff transfers the connection.

3 ATC CONNECTION

Displays the status of the ATC connection, ESTABLISHED or NOT ESTABLISHED.

4 MAX UPLINK DELAY

Elapsed time from transmission to receipt of an ATC uplink message that triggers a late annunciation. The words “UPLINK DELAY EXCEEDED” precede any late ATC uplink message. Valid entries are from 1 to 999. Resets to off and displays dashes at:

- power-up
- datalink system reset

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- ATC connection terminated
- “DELETE” entry

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347
- non-ATN identifier entry into the LOGON TO field

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347
When an ATN data link connection is established, displays 040 in cyan and manual entry is inhibited. Uplink messages having an elapsed transmission time of 40 seconds or more do not display to the flight crew and an error message is sent to ATC.

5 LOGON TO

Box prompts are initially displayed. Enter the ICAO four letter identifier for the desired ATC center. The display changes to dashed prompts after establishing an ATC connection.

HL7733 - HL7783, HL8208 - HL8275
When an ICAO identifier is entered, network status displays as:
- NETWORK READY - data communication radio available
- NETWORK NOT READY - data communication radio not available

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347
When an ATN identifier is entered, network status displays as:
- NETWORK READY -
  - VHF data link mode 2 available, or
  - FANS select key selected and data communication radio available
- NETWORK NOT READY -
  - VHF data link mode 2 not available, or
  - FANS select key selected and data communication radio not available

When a non-ATN identifier is entered, network status displays as:
- NETWORK READY - data communication radio available
- NETWORK NOT READY - data communication radio not available

6 FLIGHT NUMBER

Normally displays the flight number entered on the FMC route page. When the flight number is not available, box prompts are displayed. Flight number entry on this page is copied to the FMC route page. Changing this entry after establishing an ATC connection cancels the ATC connection.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7598
7 TAIL NUMBER

Normally supplied by the airplane system. When the airplane tail number (registry number) is not available from the system, box prompts are displayed and a value can be entered. A manual entry will remain until power to AIMS is interrupted. Changing this entry after establishing an ATC connection cancels the ATC connection. Tail number is provided on the SELCAL placard.

HL7202 - HL7205, HL7733 - HL8347
7 ORIGIN

Displays flight number airport of origin.

HL7202 - HL7205, HL7733 - HL8347
8 DESTINATION

Displays flight number destination airport.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347
9 FANS Select Key

Displays when a four character ATN identifier is entered into the LOGON TO field. Selection allows the flight crew to send a FANS logon request.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ATC Connection Displays

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7733 - HL7783, HL8208 - HL8275

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347

1 ATC DATA LINK OFF

Displayed when an ATC connection is established.

Selecting ATC DATA LINK OFF displays the CONFIRM OFF selection.

2 CONFIRM OFF

Selecting CONFIRM OFF sends the termination request.

The EICAS communication message •ATC is displayed when the connection is terminated.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Loss of ATC Connection

If the EICAS alert message DATALINK LOST is displayed for 16 minutes, the ATC connection is automatically lost and the EICAS communication message •ATC is displayed

Once an ATC connection is terminated or lost, the logon entries revert to the default values.

Emergency Report

This page informs ATC of an emergency. Sending this report with MAYDAY selected places automatic dependent surveillance (ADS) into the emergency mode.

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

1 MAYDAY, PAN, CANCEL EMERGENCY

Select MAYDAY or PAN emergency. The SEND key becomes active. CANCEL EMERGENCY informs ATC that a previous emergency is now canceled and returns ADS to the normal mode. CANCEL EMERGENCY is inhibited until MAYDAY or PAN downlink is sent.

2 DIVERTING TO

Defaults to the destination airport from the active route. The default route number is displayed. Enter any valid FMC position.

3 FUEL REMAINING

Displays the FMC fuel remaining from the PROGRESS page.

4 FUEL REMAINING – HOURS + MINUTES

Defaults to time provided from the FMC. Manually enter fuel remaining in hours and minutes. Use two numeric characters for hours followed by two numeric characters for minutes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7598

5 SOULS ON BOARD

Manual entry of number of souls on board is required. Enter up to three numeric characters.

HL7202 - HL7205, HL7733 - HL8347

5 PERSONS ON BOARD

Manual entry of number of persons on board is required. Enter up to three numeric characters.

6 DESCENDING TO

Enter the altitude for an immediate descent. The default value is the MCP altitude when it is more than 150 feet below current altitude.

7 OFFSETTING

Enter any valid FMC route offset value.

8 FREE TEXT

24 characters of free text can be included.

Note: When data is entered in all fields above OFFSETTING, the system will not accept data entry for the OFFSETTING and FREE TEXT fields. Entering data in one of these two fields displays the MESSAGE LIMIT EXCEEDED information message.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ATC Reports
ATC Requested Report

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

ATC uplink messages can contain a request for a report. When the uplink is accepted, the DISPLAY REPORT key is displayed. Selecting DISPLAY REPORT displays the ATC requested report. A displayed report can be sent. Some reports can be armed for automatic transmission when conditions are met.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Armable Report

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

All reports requested by ATC can be displayed using the ATC REQUESTED REPORT menu selection. The LEAVING, LEVEL, PASSING, and REACHING reports can be armed for automatic transmission. Selecting the ARM key for a report displays ARMED for the report status. When a report is armed, the ARM key changes to DISARM. When a report is automatically transmitted, an ATC uplink message confirms the report was sent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Conditional Clearances

HL7202 - HL7205, HL7733 - HL8347

Conditional clearances are ATC directions for route modification at some future location, time or altitude. The CONDITIONAL CLEARANCES item on the ATC menu is normally non-selectable. It becomes selectable when a conditional clearance is accepted by the flight crew. The communications management system then monitors the clearance parameters and notifies the flight crew with an ATC sidelink when each condition is either met or not met.

When a conditional clearance must be canceled (e.g. a new clearance is received by voice that supersedes the conditional clearance) the crew can select CONDITIONAL CLEARANCES from the ATC menu and then choose DELETE on the CONDITIONAL MONITOR page.

Note: Deleting a conditional clearance does not disarm or delete any other ATC requested reports contained in the clearance. Each individual ATC report must be disarmed or deleted manually.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Position Report

Use the POSITION REPORT page to manually send a position report.

Note: Current position is also reported to ATC when sending the POSITION REPORT, but is not displayed.

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

1 Position (POS)

Displays the last sequenced waypoint. Displays all asterisks (*) when no FMC data is available.

Latitude and longitude are displayed in the same order as the FMC position report page. Degree and minute values precede the compass letter, just as the crew uses in a voice report.

HL7532 - HL7598

2 ALTITUDE

Displays current altitude. Displays all asterisks (*) when no FMC data is available.

HL7202 - HL7205, HL7733 - HL8347

2 LEVEL

Displays current flight level. Displays all asterisks (*) when no FMC data is available.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 EST

Displays the active waypoint. Accepts any valid FMC active route waypoint entry. Entry of a waypoint not in the active route results in the INVALID ENTRY message.

4 NEXT

Displays the next waypoint following the EST waypoint. Accepts any valid FMC active route waypoint entry. Entry of a waypoint not in the active route results in the INVALID ENTRY message.

5 SPEED

Displays FMC speed. Accepts valid speed entry.

6 Position (POS) FUEL

Displays FMC calculated fuel remaining at the POS waypoint. Displays all asterisks (*) when no FMC data is available.

7 ATA

Displays actual time of arrival at the last sequenced waypoint. Displays all asterisks (*) when no FMC data is available.

8 ETA

Displays estimated time of arrival for the EST waypoint. Accepts valid time entry.

9 Destination (DEST) ETA

Displays estimated time of arrival for the destination airport. Accepts a valid time entry. Displays all asterisks (*) when no FMC data is available.

10 Temperature (TEMP)

Displays air temperature. Displays all asterisks (*) when no FMC data is available.

11 WIND

Displays wind bearing and speed. Displays all asterisks (*) when no FMC data is available.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Optional Position Report Items

A report of current turbulence and icing conditions can be included with the position report.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Free Text Message

Nine lines of text can be transmitted.

Flight Information
Flight Information Menu

HL7532 - HL7598

FLIGHT INFORMATION Menu

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

FLIGHT INFORMATION Menu

The Flight Information menu provides access to FLIGHT INFORMATION downlink pages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Departure Clearance Request

The DEPARTURE CLEARANCE REQUEST page allows request downlinks to obtain clearance via datalink in a more timely manner with reduced risk of incorrect voice transmission. The clearance may be viewed on the MFD or printed.

1 FLIGHT NUMBER

Flight number defaults to FMC flight number, if entered. If previously entered and flight number is more than 7 characters, only the first 7 characters display.

When boxes display, valid entry is flight number up to 7 characters.

2 DEPARTURE

Departure airport defaults to FMC origin.

Valid entry is a valid ICAO identifier.

3 ATIS

Valid entry is any character A through Z.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 FACILITY

Valid entry is a 4 character ATC facility identifier.

5 DESTINATION

Destination airport defaults to FMC destination.

Valid entry is a valid ICAO identifier.

6 GATE

Valid entry is a gate number at the reference airport, POS INIT page.

Oceanic Clearance Request

The OCEANIC CLEARANCE REQUEST page allows request downlinks to obtain clearance via datalink in a more timely manner with reduced risk of incorrect voice transmission. The clearance may be viewed on the MFD or printed.

1 FLIGHT NUMBER

Flight number defaults to FMC flight number, if entered. If previously entered and flight number is more than 7 characters, only the first 7 characters display.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When boxes display, valid entry is flight number up to 7 characters.

2 ENTRY POINT

Valid entry is up to 15 characters; tenths of a minute of latitude or longitude may not display. A valid entry must be at least 3 characters. Entries of 7 or more characters are decoded as a latitude/longitude.

3 ETA

If an ENTRY POINT has been entered, it is a waypoint in the active route, and an ETA has not been entered; the ETA box defaults to the predicted ETA at the waypoint.

Valid entry is any time in the range 0000 to 2359.

4 ATC FACILITY

Valid entry is a 4 character ATC facility identifier.

5 FLIGHT LEVEL

Valid entry is a 3 character flight level; for example, 350.

6 MACH

Valid entry is any Mach number between 0.4 and 0.92. Entry of leading zero and decimal point is not required.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ATIS Request

The ATIS REQUEST page allows request downlinks for digital ATIS information without using voice radio. ATIS information may be viewed on the MFD or printed.

1 AIRPORT

If a departure airport exists in the active route and the airplane is on the ground, the default entry is the departure airport. If the destination airport exists in the active route and the airplane is in flight, the default entry is the destination airport.

Valid entry is a four character ICAO identifier.

2 ATIS SELECTOR GROUP

The default is none selected. Only one selection can be made at a time. The SEND key becomes active with selection. Pushing the SEND key requests the selected information.

3 AUTOMATIC UPDATE

If ARRIVAL selected, the AUTO update selection box displays. Selection provides automatic updating. If ENROUTE selected, updating is automatic; AUTO does not display.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 TERMINATE

Displays when an ENROUTE or ARRIVAL AUTO update has been selected. Selection cancels automatic updating and sets ATIS SELECTOR to none selected.

The SEND key becomes active with this selection.

TWIP Request

HL7202 - HL7205, HL7733 - HL8347

The Terminal Weather Information for Pilots (TWIP) REQUEST page allows request downlinks for digital TWIP information without using voice radio. TWIP information may be viewed on the MFD or printed.

1 AIRPORT

Valid entry is a four character ICAO identifier.

2 TWIP SELECTOR

The default is none selected. Only one selection can be made at a time. The SEND key becomes active with selection. Pushing the SEND key requests the selected information.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 TERMINATE AUTOMATIC UPDATE

Displays when AUTOMATIC UPDATE has been selected. Selection cancels automatic updating and sets TWIP SELECTOR to none selected.

The SEND key becomes active with this selection.

Pushback Clearance Request

HL7202 - HL7205, HL7733 - HL8347

The PUSHBACK CLEARANCE REQUEST page allows request downlinks to obtain clearance via datalink in a more timely manner with reduced risk of incorrect voice transmission. The clearance may be viewed on the MFD or printed.

1 FLIGHT NUMBER

Flight number defaults to FMC flight number, if entered. If previously entered and flight number is more than 7 characters, only the first 7 characters display.

When boxes display, valid entry is flight number up to 7 characters.

2 DEPARTURE DATE

Valid entry is scheduled departure date.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 DEPARTURE

Departure airport defaults to FMC origin.

Valid entry is a valid ICAO identifier.

4 GATE

Valid entry is a gate number at the reference airport, POS INIT page.

5 DEPARTURE TIME

Valid entry is scheduled departure time.

6 DESTINATION

Destination airport defaults to FMC destination.

Valid entry is a valid ICAO identifier.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Expected Taxi Clearance Request

HL7202 - HL7205, HL7733 - HL8347

The EXPECTED TAXI CLEARANCE REQUEST page allows request downlinks to obtain clearance via datalink in a more timely manner with reduced risk of incorrect voice transmission. The clearance may be viewed on the MFD or printed.

1 FLIGHT NUMBER

Flight number defaults to FMC flight number, if entered. If previously entered and flight number is more than 7 characters, only the first 7 characters display.

When boxes display, valid entry is flight number up to 7 characters.

2 DEPARTURE DATE

Valid entry is scheduled departure date.

3 DEPARTURE

Departure airport defaults to FMC origin.

Valid entry is a valid ICAO identifier.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 GATE

Valid entry is a gate number at the reference airport, POS INIT page.

5 DEPARTURE TIME

Valid entry is scheduled departure time.

6 DESTINATION

Destination airport defaults to FMC destination.

Valid entry is a valid ICAO identifier.

Company Menu

Typical COMPANY Menu

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Company downlink menus are accessed by selecting the COMPANY function. Actual menu and page layout is determined by the airline. An example of a typical menu and report page are provided to show common features.

Company Downlink Message Page

Typical COMPANY Page

This COMPANY report page shows both exclusive and nonexclusive selections, a required entry, and optional menu selections.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Review Menu

Typical REVIEW Menu

Review messages are accessed by selecting the REVIEW menu. Both uplink and downlink messages are displayed in review lists. The review menu is inhibited (cyan) if there are no review messages in that category.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Review State Indicators

Each review message list field and each review message displays the last state of the referenced message. Only one state can apply to a message at a time.

State Indicator	Condition
ABORTED	ATC data link connection lost before sending response to uplink message or completing a downlink message.
ACCEPTING	The received message was displayed and an ACCEPT response was initiated.
ACCEPTED	The received message was displayed, an ACCEPT response was initiated, and the service provider has acknowledged receipt of the response.
DISPLAYED	The received message was displayed (no accept/reject response was required).
NO ACCEPT	The received message was displayed, an ACCEPT response was initiated, but the service provider did not acknowledge receipt of the response.
NO REJECT	The received message was displayed, a REJECT response was initiated, but the message destination did not acknowledge receipt of the response.
NO SEND	The downlink message was initiated to be sent and the service provider did not acknowledge receipt of the message.
REJECTING	The received message was displayed and a REJECT response was initiated.
REJECTED	The received message was displayed, a REJECT response was initiated, and the message destination has acknowledged receipt of the response.
RESPONSE RCVD	ATC uplink message received in response to a downlink request.
SENDING	The downlink message was initiated to be sent.
SENT	The downlink message was initiated to be sent and the service provider has acknowledged receipt of the message.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Manager Functions
Manager Menu

HL7532 - HL7598

Typical MANAGER Menu

HL7202 - HL7205, HL7733 - HL8347

Typical MANAGER Menu

The MANAGER menu page provides access to the manager functions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ACARS Manager

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

The ACARS manager page provides selection of ACARS frequencies. Manager messages related to ACARS are on ACARS page two.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7598
If a FREQUENCY key is selected, the ACARS system tunes to the appropriate frequency. If a secondary frequency is entered, the SECONDARY FREQUENCY key is automatically selected and ACARS tunes to the secondary frequency. Frequency selections can be changed automatically by ACARS.

HL7202 - HL7205, HL7733 - HL8347
The AUTOMATIC key is selected by default and frequency selection is controlled by ACARS. Manually selecting a frequency or deselecting the AUTOMATIC key places ACARS in manual mode and disables automatic frequency scanning. If the AUTOMATIC key is subsequently selected, the system returns to automatic mode and frequency selection is controlled by ACARS. If the service provider uplinks a request to change frequency, the AUTOTUNE FREQUENCY key displays and ACARS tunes to the requested frequency.

HL7202 - HL7205, HL7782 - HL8347

HL7202 - HL7205, HL7782 - HL8347
When operating in VHF datalink (VDL) mode 2, only the service provider, active frequency, and AUTOMATIC key are displayed. Deselecting the AUTOMATIC key places ACARS in manual mode and returns to the previous page format with highest priority frequency for current position selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ACARS Manager Page 2/2

This page allows the operator to select/deselect VHF or SATCOM transmission of data. ACARS is set to auto mode (both boxes selected) at power-up or during a manual data communication system reset. Normally, this permits ACARS to automatically use VHF or SATCOM (if VHF is unavailable). If both boxes are deselected, ACARS loses the capability to send downlink messages, but can receive and display uplink messages.

VHF Manager

The VHF manager page provides the capability to select the default radio and to configure the default radio to the voice or data mode. Manager messages related to the VHF system are also presented on this page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If the DEFAULT RADIO CENTER key is selected, the center VHF radio becomes the default radio. If the DEFAULT RADIO RIGHT key is selected, the right VHF radio becomes the default radio.

Note: To select another VHF default radio, the SATCOM ENABLE key must be deselected on ACARS manager page 2.

If the DEFAULT RADIO MODE DATA key is selected, the default radio is set to data mode. If the DEFAULT RADIO MODE VOICE key is selected, the default radio is set to voice mode.

Note: The default radio can also be set to data or voice mode using the Radio Tuning Panel.

SATCOM Manager

The SATCOM manager page displays manager messages related to the SATCOM system.

Automatic Dependent Surveillance Manager

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When ADS is armed, AUTOMATIC position report messages are sent to ATC and COMPANY.

The ADS page controls the following airplane ADS functions:

- ADS ARM – allows airplane ADS functions
- ADS OFF – inhibits airplane ADS functions
- ADS EMERGENCY – sends an alert to ATC indicating an emergency situation (resets to ADS EMERGENCY OFF at power-up)
- ADS EMERGENCY OFF – cancels emergency indication to ATC

A list of ADS connection status is displayed on the ADS page.

System Information Manager

The system information manager page displays manager messages for all applicable systems.

HL7532 - HL7598

HL7733 - HL7783, HL8208 - HL8275

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347

HL7532 - HL7598

1 TAIL NUMBER

Normally supplied by the airplane system. When the airplane tail number (registry number) is not available from the system, box prompts are displayed and a value can be entered. A manual entry will remain until power to AIMS is interrupted. Changing this entry after establishing an ATC connection cancels the ATC connection. Tail number is provided on the SELCAL placard.

HL7202 - HL7205, HL7733 - HL8347

1 TAIL NUMBER

Normally supplied by the airplane system. When the airplane tail number (registry number) is not available from the system or a hot battery power cycle has occurred, box prompts are displayed and a value can be entered. If a hot battery power cycle has occurred, manually entering the tail number will validate the tail number provided by the system. The tail number then becomes a non-modifiable field. If the tail number was not available from the system, a manual entry will remain until power to AIMS is interrupted. Changing this entry after establishing an ATC connection cancels the ATC connection. Tail number is provided on the SELCAL placard. A valid tail number entry is required for both FANS and ATN CPDLC connections. Manual entry is inhibited (cyan) once the aircraft is in the air.

2 AIRLINE

Normally supplied by the airplane system, but can be manually entered or overwritten. When the airline identifier is not available from the system, box prompts are displayed. A valid entry is two alphanumeric characters and will remain until power to AIMS is interrupted. Changing this entry after establishing an ATC connection cancels the ATC connection. A valid airline ID is required for both FANS and ATN CPDLC connections. The entry into this field will be inhibited (cyan) once the aircraft is in the air.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347
3 VER

The VER field is used in ATN CPDLC addressing. Normally supplied by the airplane system, but can be manually entered or overwritten. When the VER field is not available from the system, box prompts are displayed. A valid entry is two hexadecimal characters and will remain until power to AIMS is interrupted. The only valid entry is 41. Other than an entry made when box prompts are displayed, changing the value causes ACARS to reset to voice mode. A valid VER entry is required for ATN CPDLC connections only. The entry into this field will be inhibited (cyan) once the aircraft is in the air or if the aircraft is not equipped with the ATN option.

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347
4 ADM

The ADM field is used in ATN CPDLC addressing. Normally supplied by the airplane system, but can be manually entered or overwritten. When the ADM field is not available from the system, box prompts are displayed. A valid entry is six hexadecimal characters and will remain until power to AIMS is interrupted. The value of this field is the airline ICAO three character identifier in hexadecimal. Other than an entry made when box prompts are displayed, changing the value causes ACARS to reset to voice mode. A valid ADM entry is required for ATN CPDLC connections only. The entry into this field will be inhibited (cyan) once the aircraft is in the air or if the aircraft is not equipped with the ATN option.

Printer Manager

The printer manager page can be set to send messages directly to the printer. Manager messages related to the printer system are also presented on this page.

If the COMPANY MESSAGES FUTURE key is selected, company messages that normally display on the MFD are sent directly to the printer and the •PRINTER EICAS message is displayed. Future messages are not included in the new messages or review categories.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Automatic Messages Manager

The AUTO MESSAGES OFF selection inhibits automatic sending, display, or printing of company messages. Manager messages related to the automatic messages capability are also presented on this page.

When the AUTOMATIC MESSAGES OFF key is selected, the CONFIRM OFF key is displayed. Selecting the CONFIRM OFF key turns off the capability to automatically send, display, or print company messages.

Master Manager

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

The master manager page provides the capability to reset the data communication system. Manager messages related to the master features are also presented on this page.

Data Link System Reset

If the DATA LINK SYSTEM RESET key is selected, the CONFIRM RESET key is displayed. If the CONFIRM RESET key is selected, the following occurs.

On the ground:

- all new messages are deleted
- all messages queued for downlink are deleted
- all review messages are deleted
- ATC reports are deleted

In flight:

- flight information and company new messages are deleted
- flight information and company messages queued for downlink are deleted
- flight information and company review messages are deleted
- ATC displays reset to default values

On the ground or in flight:

- flight information and company displays reset to default values
- center VHF radio is selected as the default and set to data mode on the ground or voice mode in flight
- AUTO MESSAGES OFF is deselected
- COMPANY MESSAGES FUTURE is deselected
- ADS OFF is selected
- ADS EMERGENCY OFF is selected

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- all manager status messages are deleted
- two seconds after selection, the CONFIRM RESET key is removed from the display and the DATA LINK SYSTEM RESET key is displayed as not selected

This reset does not occur at power–up.

Data link capability for the flight management system, OMS, and EICAS related maintenance functions, and cabin functions are not reset with this feature.

Data Communication Management Function (DCMF) Reset
HL7202 - HL7205, HL7733 - HL8347

If the DCMF RESET key is selected, the CONFIRM RESET key is displayed. If the CONFIRM RESET key is selected, the following occurs:

- ACARS data communication management function is reset
- center VHF radio is selected as the default and set to voice mode

Diagnostics Manager
HL7202 - HL7205, HL7733 - HL8347

The diagnostics manager page is for maintenance use only.

Manager Messages

Manager messages are displayed in reverse chronological order (the newest message is nearest the top of the display). The time of occurrence is displayed with each message. The manager messages are listed in the following table.

Function	Manager Message

HL7532 - HL7598

ACARS	ACARS CONNECTION ESTABLISHED
	NO ACARS CONNECTION
	ACARS MODE VHF - ENABLE
	ACARS MODE VHF - NOT ENABLE
	ACARS MODE SATCOM - ENABLE
	ACARS MODE SATCOM - NOT ENABLE

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Function	Manager Message

HL7733 - HL7783, HL8208 - HL8275

ACARS	ACARS CONNECTION ESTABLISHED
	NO ACARS CONNECTION
	VHF - ENABLE
	VHF - NOT ENABLE
	SATCOM - ENABLE
	SATCOM - NOT ENABLE
	VDLM2 CAPABLE
	VDLM2 NOT CAPABLE

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347

ACARS	ACARS CONNECTION ESTABLISHED
	NO ACARS CONNECTION
	VHF - ENABLE
	VHF - NOT ENABLE
	SATCOM - ENABLE
	SATCOM - NOT ENABLE
	VDLM2 CAPABLE
	VDLM2 NOT CAPABLE
	ATN CAPABLE
	ATN NOT CAPABLE

ADS	ADS CONNECTION ESTABLISHED – ATC facility
	ADS CONNECTION LOST – ATC facility
	ALL ADS CONNECTIONS LOST

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Function	Manager Message

HL7532 - HL7598

VHF	VHF LINK ESTABLISHED
	NO VHF LINK
	VHF DATA MODE RADIO FAILURE
	VHF DATA MODE RADIO NORMAL

HL7733 - HL7783, HL8208 - HL8275

VHF	VHF LINK ESTABLISHED
	NO VHF LINK
	VHF DATA MODE RADIO FAILURE
	VHF DATA MODE RADIO NORMAL
	VDLM2 ESTABLISHED
	NO VDLM2 LINK

HL7202 - HL7205, HL8005 - HL8077, HL8285 - HL8347

VHF	VHF LINK ESTABLISHED
	NO VHF LINK
	VHF DATA MODE RADIO FAILURE
	VHF DATA MODE RADIO NORMAL
	VDLM2 ESTABLISHED
	NO VDLM2 LINK
	ATN ESTABLISHED
	NO ATN LINK

SATCOM	SATCOM LINK ESTABLISHED
	NO SATCOM LINK
	SATCOM DATA MODE FAILED
	SATCOM DATA MODE NORMAL

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Function	Manager Message
PRINTER	PRINTER OPERABLE
	PRINTER NOT OPERABLE
	COMPANY FUTURE MESSAGES TO PRINTER – ON
	COMPANY FUTURE MESSAGES TO PRINTER – OFF
AUTOMATIC MESSAGES	AUTOMATIC MESSAGES – ON
	AUTOMATIC MESSAGES – OFF

HL7532 - HL7598

MASTER	DATA LINK SYSTEM – RESET

HL7202 - HL7205, HL7733 - HL8347

MASTER	DATA LINK SYSTEM – RESET
	DCMF – RESET
	DCMF – RESET FAILED

New Messages
New Messages Menu

HL7532 - HL7598

Typical NEW MESSAGE List

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

Typical NEW MESSAGE List

New uplink messages are displayed with ATC messages displayed above flight information messages which are displayed above company messages. Within ATC, flight information and company, messages are listed by the time they are received. The newest message is at the top of the group. Messages are removed from the list when displayed or an accept/reject response is sent.

New messages can also be accessed by selecting the NEW MESSAGES menu, which displays list boxes for all pending messages. A message is displayed by selecting the appropriate message line.

New ATC uplinks which respond to downlink requests display a key which displays the original downlink request.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

New Message – No Response Required

Received messages remain in the new messages list until after they are displayed. If an ACCEPT or REJECT response is required, the message remains in the list until accepted or rejected.

The display above shows a received message that does not require a response. The ACCEPT and REJECT keys are not displayed for this message. The message can be cleared by selecting the CANCEL key on the MFD or pushing the CANCEL switch on the glareshield.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

New Message – Response Required

The display above shows a message that requires an ACCEPT or REJECT response. The ACCEPT and REJECT keys are displayed.

An APPEND capability is provided for certain received messages which require an accept or reject response. In this case, the APPEND key is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Communications EICAS Alert Messages

The following EICAS alert messages can be displayed.

Message	Level	Aural	Message Logic
DATALINK LOST	Advisory		Datalink is temporarily lost.
DATALINK SYS	Advisory		Datalink system has failed.
RADIO TRANSMIT	Advisory		A VHF or HF radio is keyed for 30 seconds or more.
SATCOM	Advisory		SATCOM system has failed.
SATCOM DATALINK	Advisory		SATCOM datalink has failed.
SATCOM VOICE	Advisory		SATCOM voice communication has failed.

HL8043 - HL8077

SATVOICE LOST	Advisory		SATCOM voice communication is temporarily lost.

VHF DATALINK	Advisory		VHF datalink has failed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Communication Messages

The following EICAS communication messages can be displayed.

Message	Level	Message Logic	Crew Action
•ATC	Medium	An ATC data link message has been received or an armed report has been sent.	Respond to message displayed on EICAS or select the MFD communications display.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

•CABIN ALERT	Medium	Pilot alert received over cabin interphone.	Respond to the alert.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

•CABIN CALL	Medium	Pilot call received over cabin interphone.	Respond to the call.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

•CABIN READY	Medium	CABIN READY received over cabin interphone.	Crew awareness. Automatically removed after one minute.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

•CARGO CALL	Medium	Pilot call received over cabin interphone from loadmaster amplifier panel or wing inspection station.	Respond to the call.

•COMM	Medium/ low	A data link message has been received.	Select COMM display on the MFD.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Message Logic	Crew Action
•COMM BUSY	Medium	Communications system pending data link message queue is full.	Respond to current pending data link messages.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

•CREW REST CALL	Medium	Pilot call received over cabin interphone from crew rest.	Respond to the call.

HL8043 - HL8077

•DATALINK AVAIL	Low	A lost data link connection has been re-established.	Resume use of data link communication.

•FMC	Medium	An FMC related data link message has been received.	Select FMC from the CDU MENU page if not already in the FMC mode. View the message title in the CDU scratchpad. View the message on the appropriate CDU page.
•GROUND CALL	Medium	Pilot call received over flight interphone from nose wheel well.	Respond to the call.
•PRINTER (with data link installed)	Medium/ low	A data link message has been received and sent to the printer.	Review the printed message.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Message Logic	Crew Action
•SATCOM MESSAGE	Medium/ low	SATCOM voice system information available if SATCOM system is selected on a CDU.	View the SATCOM CDU message.

HL8043 - HL8077

•SATVOICE AVAIL	Low	SATCOM voice capability re-established after a temporary loss.	Resume use of SATCOM voice.

•SELCAL	Medium	SELCAL received or any SATCOM voice call received.	Respond to the call.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

•SUPRNMRY CALL	Medium	Pilot call received over cabin interphone from supernumerary seating area.	Respond to the call.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 6.10
Overhead Panel 6.10.1
Electrical Panel 6.10.1
Overhead Maintenance Panel. 6.10.5
Standby Power Switch 6.10.5
Medical Outlet Power Control 6.10.6
Electrical Synoptic Display 6.10.6

System Description 6.20
AC Electrical System 6.20.1
Electrical Load Management System (ELMS). 6.20.1
AC Electrical System Power Sources. 6.20.1
AC Electrical Power Distribution. 6.20.4
AC Electrical System Schematic 6.20.6
Backup AC Electrical System 6.20.7
Backup Generators 6.20.7
Backup AC Electrical System Schematic. 6.20.8
DC Electrical System. 6.20.9
Main DC Electrical System 6.20.9
Batteries 6.20.9
Flight Deck PC Power 6.20.10
DC and Flight Control Electrical Systems Schematic 6.20.11
Flight Control DC Electrical System 6.20.12
Standby Electrical System 6.20.12
Standby Electrical System Schematic 6.20.13
Main Battery 6.20.13
Standby Inverter 6.20.14
Ram Air Turbine (RAT) Generator 6.20.14
Cabin Systems and Utility Power 6.20.14
IFE/PASS SEATS and CABIN/UTILITY Power Switches. . 6.20.15
IFE and Passenger Seats 6.20.15

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cabin and Utility Systems. 6.20.15
Cabin and Utility Systems. 6.20.16

EICAS Messages 6.30
EICAS Alert Messages. 6.30.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Overhead Panel
Electrical Panel

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 BATTERY Switch

ON –

- on the ground and the airplane does not have AC power:
  - some switch annunciator lights are illuminated
  - allows the APU to be started
- on the ground after AC power is disconnected or lost:
  - standby busses and emergency lighting are powered
  - the left inboard, outboard, and upper center displays, and the left CDU are powered

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Off – on the ground, battery bus is not powered.

2 Battery OFF Light

Illuminated (amber) – the battery switch is off and the airplane has AC power.

3 APU Generator (APU GEN) Switch

ON – APU generator breaker is armed.

Off – APU generator breaker open.

4 APU Generator OFF Light

Illuminated (amber) –

- the APU GEN switch is off, or
- with the APU running, secondary external power not connected, and the auxiliary power breaker open

5 BUS TIE Switches

AUTO – bus tie breaker is armed.

Off – bus tie open.

6 Bus Isolation (ISLN) Lights

Illuminated (amber) – bus tie breaker is open because:

- BUS TIE switch is off, or
- BUS TIE switch is in AUTO and a fault has occurred

7 Generator Control (GEN CTRL) Switches

ON – generator breaker is armed.

Off –

- generator breaker open
- resets fault trip circuitry

8 Generator OFF Lights

Illuminated (amber) – generator breaker open.

9 Drive Disconnect Switches

Push –

- disconnects the integrated drive generator (IDG) from the engine
- requires maintenance action on the ground to reconnect the IDG

10 Generator DRIVE Lights

Illuminated (amber) – IDG oil pressure is low.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

11 Backup Generator OFF Lights

Illuminated (amber) –

- backup generator switch is off, or
- a fault occurred, or
- engine is shut down, or
- engine fire switch is out

12 Backup Generator (BACKUP GEN) Switches

ON – backup generator converter armed.

Off –

- backup generator control relay open
- resets the fault circuitry

13 External Power AVAIL Lights

Illuminated (green) – external power is plugged in and power quality is acceptable

14 External Power ON Lights

Illuminated (green) – external power is connected to the bus

15 External Power (EXT PWR) Switches

Push –

- when AVAIL light is illuminated, connects external AC power
- when ON light is illuminated, disconnects external AC power

16 CABIN/UTILITY Power OFF Light

Illuminated (amber) – CABIN/UTILITY power switch is off and the airplane has AC power.

17 Cabin/Utility (CABIN/UTILITY) Power Switch

ON – powers cabin and utility systems.

Off –

- disconnects power from cabin and utility systems
- powers some cabin lighting

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

18 IFE/PASS SEATS OFF Light

Illuminated (amber) – IFE/PASS SEATS power switch is off and the airplane has AC power.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

19 In-Flight Entertainment System/Passenger Seats (IFE/PASS SEATS) Power Switch

ON – powers:

- IFE and passenger seat systems

Off – disconnects power from:

- IFE and passenger seat systems

Overhead Maintenance Panel Standby Power Switch

1 STANDBY POWER Switch

Note: Ground operation only.

OFF – the AC standby bus is not powered.

AUTO (guarded) – the standby busses transfer to battery power if normal AC power is lost.

BAT (momentary) –

- with AC power not available and Battery switch ON, powers the standby AC bus from the battery through the standby static inverter
- initiates a DC/standby self-test in the inverter when AC power is available

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Medical Outlet Power Control

HL7202 - HL7205, HL8006 - HL8042, HL8346, HL8347

1 MEDICAL OUTLET POWER Switch

ON – powers medical outlet.

OFF – removes power from medical outlet.

Electrical Synoptic Display

The electrical synoptic is displayed by pushing the ELEC synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The electrical power flow display is created from the displayed switch and contactor positions and by the displayed status of electrical equipment. Actual electrical flow is not displayed, therefore the electrical flow bars do not represent actual system operation.

The electrical synoptic display of switch, contactor, and flow bar position and status are not included in the MMEL or DDG. The electrical synoptic display of switch, contactor, and flow bar position and status is not required for flight crew to accomplish any normal or non-normal procedure.

MULTIFUNCTION DISPLAY

Status of the electrical generators, drives, breakers, busses, and power flow are displayed as:

- power flowing - wide green line
- power not flowing - thin white line
- generator on or available - green
- generator off - white
- generator not supplying electrical power or failed - amber X in amber box

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- drive oil pressure low - amber DRIVE
- drive disconnected with engine running - amber X in amber box
- bus tie open due to electrical fault or BUS TIE switch Off - amber ISLN
- bus powered - green
- bus unpowered - amber
- bus state unknown - white

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

AC Electrical System

The AC electrical system is the main source for airplane electrical power.

Electrical Load Management System (ELMS)

The ELMS provides load management and protection to ensure power is available to critical and essential equipment.

If the electrical loads exceed the power available (airplane or external), ELMS automatically sheds AC loads by priority until the loads are within the capacity of the airplane or ground power generators. The load shedding is galleys first, then utility busses. Utility busses are followed by individual equipment items powered by the main AC busses. When an additional power source becomes available or the loads decrease, ELMS restores power to shed systems (in the reverse order). The message LOAD SHED displays on the electrical synoptic when load shed conditions exist.

The ELMS also provides inputs for display of EICAS messages for manual center tank fuel pump shut off during climb/cruise, and automatic shut off to prevent unintentional dry fuel pump operation when the center fuel tank is empty.

AC Electrical System Power Sources

The entire airplane AC electrical load can be supplied by any two main AC power sources.

The main AC electrical power sources are:

- left and right engine integrated drive generators (IDGs)
- APU generator
- primary and secondary external power.

The power sources normally operate isolated from one another. During power source transfers on the ground (such as switching from the APU generator to an engine generator) operating sources are momentarily paralleled to prevent power interruption.

Integrated Drive Generators (IDGs)

Each engine has an IDG. Each IDG has automatic control and system protection functions.

When an engine starts, with the GENERATOR CONTROL switch selected ON, the IDG automatically powers the respective main bus. The previous power source is disconnected from that bus.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The IDG can be electrically disconnected from the busses by pushing the GENERATOR CONTROL switch to OFF. The IDG can also be electrically disconnected from its respective bus by selecting an available external power source prior to engine shutdown. (See Primary External Power and Secondary External Power in this section.)

The DRIVE light illuminates and the EICAS message ELEC GEN DRIVE L or R displays when low oil pressure is detected in an IDG. The IDG drive can be disconnected from the engine by pushing the respective DRIVE DISCONNECT switch. The IDG cannot be reconnected by the flight crew.

High drive oil temperature causes the IDG to disconnect automatically.

APU Generator

The APU generator is electrically identical to the IDG generators. The APU generator can power either or both main busses, and may be used in flight as a replacement to an IDG source.

If no other power source is available when the APU generator becomes available, the APU generator automatically connects to both main AC busses. If the primary external source is powering both main busses, the APU powers the left main bus, and the primary external source continues to power the right main bus. If the primary external source is powering the right main bus, and the secondary external source is powering the left main bus, the APU then powers the left main bus and the primary external source continues to power the right main bus. If the secondary external source is powering both main busses, the APU then powers both main busses.

The APU generator OFF light illuminates when the APU is operating and the APU generator breaker is open because of a fault or the APU GENERATOR switch is selected OFF. When the APU GENERATOR switch is ON and a fault is detected, the APU generator cannot connect to the busses.

In flight, when both transfer busses are unpowered, the APU starts automatically, regardless of APU selector position. Refer to Chapter 7, Engines, APU for APU starter operation.

Primary External Power

Primary external power can power the left and right main busses. When the primary power source voltage and frequency are within limits, the primary external power AVAIL (available) light illuminates. If no AC power is applied, either external power source will power the airplane if the BATTERY switch is ON.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If no other source is powering the main busses, with the BATTERY switch ON, pushing the PRIMARY EXT PWR switch ON connects primary external power to both main busses. When primary external power is connected to a main bus, the PRIMARY EXT PWR ON light illuminates and the AVAIL light extinguishes.

If a single IDG powers both busses, pushing the PRIMARY EXT PWR switch ON connects primary external power to both busses and removes the IDG source.

If both IDGs are powering their respective busses, the APU generator is NOT running and secondary external power is NOT available, pushing the PRIMARY EXT PWR switch ON connects primary external power to both busses and removes the IDG sources.

If both IDGs are powering their respective busses, and secondary external power is available, pushing the PRIMARY EXT PWR switch to ON connects primary external power to the right main bus, leaving the left main bus powered from the left IDG.

If the APU generator is running, pushing the PRIMARY EXT PWR switch ON connects primary external power to the right main bus, leaving the previous source connected to the left main bus.

If both busses are powered from secondary external power, pushing the PRIMARY EXT PWR switch ON connects primary external power to the right main bus, leaving secondary external power connected to the left main bus.

Pushing the PRIMARY EXT PWR switch while primary external power is ON, disconnects primary external power. The previously connected power source is reconnected, if available.

Secondary External Power

Secondary external power can power the left and right main busses. When the secondary external power source voltage and frequency are within limits, the secondary external power AVAIL (available) light illuminates.

If no AC power is applied, the BATTERY switch must be ON or primary external power must be available for secondary external power to power the airplane. If the BATTERY switch is ON and no other source is powering the main busses, pushing the SECONDARY EXT PWR switch ON connects secondary external power to both main busses. When secondary external power is connected to a main bus, the SECONDARY EXT PWR ON light illuminates and the AVAIL light extinguishes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If a single IDG powers both main busses, pushing the SECONDARY EXT PWR switch ON connects secondary external power to both busses and removes the IDG source. Similarly, if only secondary external power is available and both IDGs are powering their respective busses, pushing the SECONDARY EXT PWR switch ON connects secondary external power to the left main bus. When the right engine is shut down, there is a no–break transfer of power of secondary external power to the right main bus.

If both IDGs are powering their respective busses, and both secondary and primary external power are available, pushing the SECONDARY EXT PWR switch ON connects secondary external power to the left main bus, leaving the right main bus powered from the right IDG.

If the APU generator is running, pushing the SECONDARY EXT PWR switch ON connects secondary external power to the left main bus, leaving the right IDG or primary external power connected to the right main bus.

If both busses are powered from primary external power, pushing the SECONDARY EXT PWR switch ON connects secondary external power to the left main bus, leaving primary external power connected to the right main bus. If no other source is available, secondary external power is connected to both main busses.

Pushing the SECONDARY EXT PWR switch while secondary external power is ON disconnects secondary external power. The previously connected power source is reconnected, if available.

AC Electrical Power Distribution

AC power is distributed through the left and right main busses, ground handling bus, and the ground service bus.

AC Main Busses

The right IDG normally powers the right main bus and the left IDG normally powers the left main bus. The APU normally powers both main busses when they are not powered by any other source.

When external power is connected:

- primary external power normally powers the right main bus
- secondary external power normally powers the left main bus.

Bus tie relays, controlled by BUS TIE switches, isolate or parallel the right and left main busses. When both BUS TIE switches are set to AUTO, the bus tie system operates automatically to maintain power to both main busses.

Power transfers are made without interruption when the airplane is on the ground, except when switching between primary and secondary external power sources.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The source order for powering left and right main busses in flight is the:

- respective IDG
- APU generator
- opposite IDG.

The main busses power individual equipment items such as:

- cooling vent fan
- recirculation fans
- lavatory/galley fans
- electric hydraulic pumps
- IFE

Each main bus also powers its associated busses (typical loads are shown in parentheses):

- transfer bus (DC system transformer–rectifiers, AC standby bus)
- utility bus (forward galley heater, chiller boost fan, gasper fan, captain's and first officer's foot and shoulder heaters, door area heaters, lavatory water heaters and shavers)
- galley busses.

Ground Service Bus

The ground service bus is normally powered by the right main bus. Alternate sources of power for the ground service bus are:

- the APU generator
- primary external power.

The ground service bus powers:

- the main battery charger
- the APU battery charger
- miscellaneous cabin and system loads.

Ground Handling Bus

The ground handling bus can be powered on the ground only from the APU generator or from the primary external power source. It is provided for loads such as cargo handling, fueling/defueling operations, and other equipment energized only during ground operations.

Autoland

During autoland, the busses isolate to allow three independent sources to power the three autopilots:

- the left IDG powers the left AC transfer bus, the left main DC bus, and the captain's flight instrument bus
- the right IDG powers the battery bus and AC standby bus through the main battery charger
- the backup system powers the right AC transfer bus, the right main DC bus, and the first officer's flight instrument bus.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

AC Electrical System Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Backup AC Electrical System

The backup electrical system is designed to automatically provide power to selected airplane systems. The backup electrical system automatically powers one or both transfer busses when:

- only one main AC generator (includes APU) is available
- power to one or both of the main AC busses is lost
- approach (APP) mode is selected for autoland

The system is automatically tested after engine starts and transfers power without interruption.

Backup Generators

Backup power is provided by one variable speed, variable frequency generator mounted on each engine. A frequency converter converts the generator frequency to a constant 400 Hz. Only one backup generator can power the converter at a time.

Each backup generator contains two permanent magnet generators (PMGs) that supply power to the flight control DC electrical system (refer to DC Electrical System).

If both IDGs and the APU generator are inoperative, a backup generator powers essential airplane equipment. To reduce electrical loading on the backup generator, the following systems are inoperative:

- TCAS
- SATCOM
- Right HF radio
- Center tank override/jettison pumps (center tank fuel is unusable and cannot be jettisoned)
- Position and other exterior lights (except nose gear landing lights)
- All non-essential cabin equipment (galleys, entertainment systems, etc.)

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- Passenger cabin lighting (except night, galley and cross-aisle lights)

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- Supernumerary cabin lighting (except night, galley and cross-aisle lights)
- Cabin temperature control (remains operative, but in degraded mode)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Backup AC Electrical System Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

DC Electrical System

The DC electrical system includes:

- main DC electrical system
- batteries
- battery chargers
- flight control DC electrical system

Main DC Electrical System

The main DC electrical system uses four transformer–rectifier units (TRUs) to produce DC power. The TRUs are powered by the AC transfer busses.

Main DC Power Distribution

TRU DC electrical power is distributed to various DC busses as follows:

The left TRU powers the left main DC bus, which provides a second DC power source for:

- left flight control power supply assembly (PSA)
- right main DC bus.

The right TRU powers the right main DC bus, which provides a second DC power source for:

- right flight control PSA
- left main DC bus.

The C1 TRU powers the captain's flight instrument bus and the battery bus. The captain's flight instrument bus provides a second DC power source for:

- center flight control PSA
- first officer's flight instrument bus

The C2 TRU powers the first officer's flight instrument bus, which provides a second DC power source for the captain's instrument bus.

Batteries

The main battery is connected directly to the hot battery bus and provides standby power to other busses (See Standby Electrical System). The main battery charger normally powers the hot battery bus and maintains the main battery fully charged.

The APU battery is connected directly to the APU battery bus and provides dedicated power to the APU electric starter, which is used when sufficient bleed air duct pressure is unavailable for the APU air turbine starter. The APU battery charger normally powers the APU battery bus and maintains the APU battery fully charged.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Deck PC Power

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Two 110V/60Hz service outlets provide AC electrical power for PC operation on the flight deck. The outlets are located on the Captain's and First Officer's lower sidewall panels.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

DC and Flight Control Electrical Systems Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Control DC Electrical System

The flight control DC electrical system is a dedicated power source for the primary flight control system.

Primary power for the flight control DC electrical system comes from permanent magnet generators (PMGs) housed within each backup generator. Variable frequency PMG AC power is used by individual power supply assemblies (PSAs) to provide DC power to the three flight control DC busses.

To ensure a high level of system reliability, each PSA also has multiple DC power sources. If primary PMG AC power is not available, secondary power for the left and right PSAs is provided by the related main DC bus. Secondary power for the center PSA is provided by the captain's flight instrument bus. The hot battery bus provides additional backup power for the left and center PSAs only.

Each PSA also uses a dedicated battery to prevent power interruptions to the related flight control DC bus. The batteries have limited capacity and are incorporated to supply power for brief periods during PSA power source transfers.

Standby Electrical System

The standby electrical system can supply AC and DC power to selected flight instruments, communications and navigation systems, and the flight control system, if there are primary electrical power system failures.

The standby electrical system consists of:

- the main battery
- the standby inverter
- the RAT generator and its associated generator control unit
- the C1 and C2 TRUs.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Standby Electrical System Schematic

Main Battery

The main battery provides standby power to the:

- hot battery bus
- battery bus
- captain's flight instrument bus

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- left and center flight control PSAs
- standby inverter.

Note: The main battery can power the standby system for a minimum of 5 minutes.

Standby Inverter

The standby inverter converts DC power to AC power. The inverter powers the AC standby bus if the left transfer bus is not powered.

Ram Air Turbine (RAT) Generator

The RAT generator provides standby power to the C1 and C2 TRUs. The RAT generator has no operating time limits, and operates at all airspeeds and altitudes.

The RAT can supply electrical and hydraulic power simultaneously. If the RAT is unable to maintain RPM, the RAT generator electrical load is shed until RPM is satisfactory. Power for standby electrical loads is provided by the main battery during deployment of the RAT and when RAT generator loads are shed.

The RAT is deployed automatically if both AC transfer busses lose power in flight.

When both transfer busses are lost, the first officer's displays will be temporarily unpowered while the captain's displays, EICAS display, and L CDU are powered by the battery. Once the RAT generator is online these displays will be powered by the RAT. The first officer's forward displays are also powered by the RAT. The lower display and the right CDU will remain unpowered.

The RAT can be manually deployed by pushing the RAM AIR TURBINE switch on the overhead panel.

RAT deployment and operation are described in Chapter 13, Hydraulics.

Cabin Systems and Utility Power

Electrical power to some cabin and utility systems are controlled from the flight deck.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

IFE/PASS SEATS and CABIN/UTILITY Power Switches

Electrical power to some non-essential loads can be controlled from the flight deck overhead electrical panel. Two switches are provided for de-energizing these loads if necessary. The IFE/PASS SEATS switch controls In-Flight Entertainment (IFE) system, passenger seat systems, video surveillance cameras, and flight deck personal electronic device (PED) power outlets. The CABIN/UTILITY switch controls galleys, most cabin lights, and other non-essential cabin utility loads.

IFE and Passenger Seats

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The IFE/PASS SEATS Power switch controls power to the IFE and passenger seats. Pushing the switch OFF removes power from:

- all IFE components
- passenger seats, including:
  - seat motor power
  - personal computer power outlets
  - telephones

Cabin and Utility Systems

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The CABIN/UTILITY Power switch controls power to cabin and utility systems. When the switch is OFF power is removed from:

- ground service bus, except:
  - main and APU battery chargers
  - left forward fuel pump
- utility busses
- galleys
- fluorescent cabin lighting
- beacon, logo, and wing lights

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Additionally, when the CABIN/UTILITY Power switch is OFF, power is provided to:

- night lights
- reading lights
- attendant work lights
- some galley and crew rest lights.

Cabin and Utility Systems

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The CABIN/UTILITY Power switch controls power to cabin and utility systems. When the switch is OFF power is removed from:

- ground service bus, except:
  - main and APU battery chargers
  - left forward fuel pump
- utility busses
- galley
- gasper fan
- beacon, logo, and wing lights
- main deck cargo, lower forward cargo, lower aft cargo compartment electrical power outlets
- supernumerary general lights
- main deck alert system, and
- in flight, main deck cargo lights.

Additionally, when the CABIN/UTILITY Power switch is OFF, power is provided to:

- night and supplemental night lights
- reading lights
- some galley and crew rest lights.

Power is removed from the main deck cargo, lower forward cargo, lower aft cargo compartment electrical power outlets when the respective compartment CARGO FIRE ARM switch is in ARMED.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Alert Messages

Message	Level	Aural	Message Logic
ELEC AC BUS L, R	Caution	Beeper	AC bus is unpowered.
ELEC BACKUP GEN L, R	Advisory		Backup generator has failed.
ELEC BACKUP SYS	Advisory		Backup power system has failed.
ELEC BATTERY OFF	Advisory		Battery switch is OFF.
ELEC BUS ISLN L, R	Advisory		Bus tie breaker is open due to an AC electrical system fault or Bus Tie switch is OFF.
ELEC CABIN/UTIL OFF	Advisory		Cabin/utility power switch is OFF.
ELEC GEN DRIVE L, R	Advisory		Generator drive oil pressure is low.
ELEC GEN OFF APU	Advisory		APU generator control breaker is open.
ELEC GEN OFF L, R	Advisory		Generator control breaker is open.
ELEC GND HDLG BUS	Advisory		Ground handling bus relay has failed.
ELEC IFE/SEATS OFF	Advisory		In-Flight Entertainment System/Passenger Seats Power switch is OFF.
ELEC STANDBY SYS	Advisory		A fault is detected in the standby power system.
MAIN BATTERY DISCH	Advisory		Main battery is discharging or hot battery bus is unpowered.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 7.10
EICAS Display. 7.10.1
Mode Indications 7.10.3
EPR Indications 7.10.4
EPR Indications (Alternate Mode) 7.10.5
N1 Indications. 7.10.5
N1 Indications (Hard Alternate Mode). 7.10.6
N1 Indications (All Modes) 7.10.7
EGT Indications 7.10.8
In–Flight Start Envelope. 7.10.10
Crossbleed Start Indications 7.10.11
Secondary Engine Indications 7.10.11
Secondary Engine Display 7.10.12
N2 Indications. 7.10.13
Fuel Flow Indications 7.10.13
Oil Pressure Indications 7.10.14
Oil Temperature Indications 7.10.15
Oil Quantity Indications 7.10.16
Engine Vibration Indications 7.10.17
Compact Engine Indications 7.10.18
Engine Controls 7.10.20
Thrust Levers 7.10.20
Fuel Control Switches. 7.10.21
Engine Control Panel 7.10.22
Auxiliary Power Unit (APU) 7.10.24
APU Controls 7.10.24
APU Indications 7.10.25

Engine System Description 7.20
Introduction 7.20.1
Engine Intermix 7.20.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Indications 7.20.2
Primary Engine Indications 7.20.2
Secondary Engine Indications 7.20.2
Normal Display Format 7.20.3
Compact Display Format 7.20.4
Electronic Engine Control (EEC) 7.20.5
EEC Normal Mode 7.20.5
EEC Alternate Mode 7.20.6
Overspeed Protection 7.20.7
Engine Idle 7.20.7
Thrust Control Malfunction Protection 7.20.8
Engine Start and Ignition System 7.20.8
Autostart 7.20.9
Autostart 7.20.10
Manual Start 7.20.11
In–Flight Start 7.20.11
Engine Ignition 7.20.12
Auto–Relight 7.20.12
Engine Start and Ignition System Schematic 7.20.14
Engine Fuel System 7.20.16
Engine Fuel System Schematic 7.20.17
Engine Oil System 7.20.19
Engine Oil System Schematic 7.20.20
Thrust Reverser System 7.20.21
Thrust Reverser Schematic 7.20.23
Airborne Vibration Monitoring System 7.20.24
Engine Failure Alert System 7.20.24

APU System Description 7.30
Introduction 7.30.1
APU Operation 7.30.1
APU Start 7.30.1
APU Automatic Start 7.30.2

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

APU Run. 7.30.2
APU Shutdown 7.30.2
APU Operating Modes 7.30.2

EICAS Messages. 7.40
EICAS Alert Messages 7.40.1
EICAS Memo Messages 7.40.3

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Display

HL7532 - HL7766

UPPER CENTER DISPLAY

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

HL7202 - HL7205, HL7782 - HL8347
1 Primary Engine Indications

Displayed full time on the EICAS display:

- N1
- EGT.

HL7532 - HL7766
1 Primary Engine Indications

Displayed full time on the EICAS display:

- EPR
- N1
- EGT.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Mode Indications

1 Total Air Temperature (TAT)

Displayed (white) – TAT (degrees C).

2 Thrust Reference Mode

Displayed (green) – selected FMS thrust reference mode:

- TO – maximum rated takeoff thrust
- TO 1 – derate one takeoff thrust
- TO 2 – derate two takeoff thrust
- D–TO – assumed temperature derated takeoff thrust
- D–TO 1 – derate one assumed temperature derated takeoff thrust
- D–TO 2 – derate two assumed temperature derated takeoff thrust
- CLB – maximum rated climb thrust
- CLB 1 – derate one climb thrust
- CLB 2 – derate two climb thrust
- CON – maximum rated continuous thrust
- CRZ – maximum rated cruise thrust
- G/A – maximum go-around thrust.

HL7202 - HL7205, HL7782 - HL8347

- A–TO, A–TO 1, A–TO 2 – APU-to-Pack or APU-to-Pack derated takeoff thrust

3 Assumed Temperature

Displayed (green) – selected assumed temperature (degrees C) for reduced thrust takeoff.

4 Thrust Reverser Indication

Displayed REV (amber) – reverser in transit.

Displayed REV (green) – reverser fully deployed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EPR Indications

HL7532 - HL7766

Note: During tailwind conditions, slight EPR fluctuations may occur prior to 5 knots forward airspeed.

Note: When reverse thrust is activated, the following indications are not displayed:

- maximum EPR line
- commanded EPR
- reference/target EPR indication
- reference EPR.

1 Maximum EPR Line

Displayed (amber).

2 Reference/Target EPR Indication

Displayed (green) – reference EPR limit.

Displayed (magenta) – target FMC commanded EPR when VNAV is engaged and:

- the autothrottle is engaged in THR or THR REF mode, or
- the autothrottle is not engaged.

3 Commanded EPR

Displayed (white).

4 Commanded EPR Sector

Displays momentary difference between engine EPR and EPR commanded by thrust lever position.

5 Reference EPR

Displayed (green).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

6 Actual EPR

Displayed (white).

7 Actual EPR Indication

Displayed (white).

EPR Indications (Alternate Mode)

HL7532 - HL7766

1 Actual EPR

Displayed (blank).

2 Actual EPR Indication

Displayed (blank).

N1 Indications

HL7532 - HL7766

1 N1 Red Line

Displayed (red) – N1 RPM operating limit.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 N1

Digital N1 RPM (%), displayed:

- (white) – normal operating range
- displayed (red) – operating limit reached.

3 N1 Indication

N1 RPM, displayed:

- (white) – normal operating range
- displayed (red) – operating limit reached.

N1 Indications (Hard Alternate Mode)

HL7532 - HL7766

Note: When reverse thrust is activated, the following indications are not displayed:

- maximum N1 line
- commanded N1
- reference/target N1 indication
- reference N1.

1 N1 Red Line

Displayed (red).

2 Reference/Target N1 Indication

Displayed (green) – reference N1 limit.

Displayed (magenta) – target FMC commanded N1 when VNAV is engaged and:

- the autothrottle is engaged in THR or THR REF mode, or
- the autothrottle is not engaged.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Commanded N1 Sector

Displays momentary difference between engine N1 and N1 commanded by thrust lever position.

4 Maximum N1 Line

Displayed (amber).

5 Reference N1

Displayed (green) – thrust reference calibrated for N1.

N1 Indications (All Modes)

HL7202 - HL7205, HL7782 - HL8347

Note: When reverse thrust is activated, the following indications are not displayed:

- maximum N1 line
- commanded N1
- reference/target N1 indication
- reference N1.

1 N1 Red Line

Displayed (red) – N1 RPM operating limit.

2 Reference/Target N1

Displayed (green) – reference N1 limit.

Displayed (magenta) – target FMC commanded N1 when VNAV is engaged and:

- the autothrottle is engaged in THR or THR REF mode, or
- the autothrottle is not engaged.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Commanded N1

Displayed (white).

4 Commanded N1 Sector

Displays momentary difference between engine N1 and N1 commanded by thrust lever position.

5 Maximum N1 Line

Displayed (amber).

6 Reference N1

Displayed (digital, green).

7 N1

Digital N1% RPM, displayed:

- (white) – normal operating range
- displayed (red) – operating limit reached.

8 N1 Indication

N1 RPM, displayed:

- (white) – normal operating range
- displayed (red) – operating limit reached.

EGT Indications

HL7202 - HL7205, HL7782 - HL8347

1 EGT Red Line

Displayed (red) – maximum takeoff EGT limit.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7766

1 EGT Red Line

Displayed (red) – maximum takeoff/in-flight start EGT limit.

2 EGT Amber Band

Displayed (amber) – maximum continuous EGT limit.

HL7202 - HL7205, HL7782 - HL8347

3 EGT Start Limit Line

Displayed (red):

- with the FUEL CONTROL switch in CUTOFF, or
- with the N2 RPM below idle.

HL7532 - HL7766

3 EGT Start Limit Line

Displayed (red):

- on the ground
- with the FUEL CONTROL switch in CUTOFF, or
- with the N2 RPM below idle.

4 EGT

EGT (degrees C), displayed:

- (white) – normal operating range
- (amber) – maximum continuous limit reached
- (red) – maximum start or takeoff limit reached.

5 EGT Indication

Displayed:

- (white) – normal operating range
- (amber) – maximum continuous limit reached
- (red) – maximum start or takeoff limit reached.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

In–Flight Start Envelope

HL7202 - HL7205, HL7782 - HL8347

HL7532 - HL7766

1 In-Flight Start Envelope

Displayed (magenta) – airspeed range for an in-flight start at the current flight level or maximum flight level (whichever is less) when the respective engine fire switch is in and:

- a FUEL CONTROL switch is in CUTOFF, or
- engine N2 RPM is below idle.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crossbleed Start Indications

1 Crossbleed (X-BLD) Start Indication

Indicates crossbleed air is recommended for an in-flight start.

Displayed (magenta):

- the in-flight start envelope is displayed, and
- the respective engine fire switch is in, and
- airspeed is lower than that for a windmilling start.

HL7202 - HL7205, HL7782 - HL8347
Note: The Crossbleed (X-BLD) indication will be shown if the airplane is above 20,000 ft and EGT is less than 100 degrees C, or the airplane is above 33,000 ft and below 270 kts.

2 DUCT Pressure (PRESS)

Displayed (white numbers) – pressure in the left and right bleed air ducts in psi when the respective engine fire switch is in and:

- a FUEL CONTROL switch is in CUTOFF, and
- engine N2 RPM is below idle.

Secondary Engine Indications

See Chapter 10, Flight Instruments, Displays, for display selection of Secondary Engine indications.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Secondary Engine Display

HL7532 - HL7766

HL7202 - HL7205, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Secondary Engine Display

Displays:

- N2 RPM
- fuel flow (FF)
- oil pressure
- oil temperature
- oil quantity
- vibration.

N2 Indications

1 N2

N2 RPM (%), displayed:

- (white) – normal operating range
- (red) – operating limit reached.

2 N2 Red Line

N2 RPM operating limit, displayed (red).

3 N2 Indication

N2 RPM, displayed:

- (white) – normal operating range
- (red) – operating limit reached.

Fuel Flow Indications

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Fuel Flow

Displayed (white) – fuel flow to the engine (pounds per hour x 1000).

Oil Pressure Indications

HL7532 - HL7766

HL7202 - HL7205, HL7782 - HL8347

HL7532 - HL7766

1 Oil Pressure

Engine oil pressure (psi), displayed:

- (white) – normal operating range
- (red) – operating limit reached.

HL7202 - HL7205, HL7782 - HL8347

1 Oil Pressure

Engine oil pressure (psi), displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7766

2 Oil Pressure Pointer

Engine oil pressure, displayed:

- (white) – normal operating range
- (red) – operating limit reached.

HL7202 - HL7205, HL7782 - HL8347

2 Oil Pressure Pointer

Engine oil pressure, displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached.

3 Oil Pressure Red Line

Displayed (red) – oil pressure operating limit.

Vertical position of oil pressure red line will vary with N2 RPM.

HL7202 - HL7205, HL7782 - HL8347

4 Oil Pressure Amber Band

Displayed (amber) – oil pressure caution range.

Oil Temperature Indications

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

1 Oil Temperature

Engine oil temperature (degrees C), displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached.

2 Oil Temperature Pointer

Engine oil temperature, displayed:

- (white) – normal operating range
- (amber) – caution range reached
- (red) – operating limit reached.

3 Oil Temperature Red Line

Displayed (red) – oil temperature operating limit.

4 Oil Temperature Amber Band

Displayed (amber) – oil temperature caution range.

Oil Quantity Indications

1 Oil Quantity

Usable oil quantity (quarts).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Displayed:

- (white) – normal quantity
- (reverses the display to show black numbers on white background) – low quantity.

Note: LO – displayed (white) when quantity is low.

Engine Vibration Indications

1 Engine Vibration

Engine vibration, displayed:

- (white) – normal operating range
- (black numbers, white background) – high vibration.

2 Engine Vibration High Band

Displayed (white) – vibration level at which automatic display of secondary engine indications occurs.

3 Vibration Source

Identifies the vibration source being displayed.

Displayed (white) – vibration source with the highest vibration:

- N1 rotor vibration
- N2 rotor vibration.

If the vibration source BB (broad band vibration) is displayed, the source is unknown and average vibration is displayed.

4 Engine Vibration Pointer

Displayed (white) – engine vibration.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Compact Engine Indications

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

EICAS DISPLAY

1 Compact Engine Indications

The following changes to EICAS and the normal secondary engine display occur:

HL7202 - HL7205, HL7782 - HL8347

- N2 changes from round dial displays to a digital display. The digital display is framed by an amber or red box if limits are exceeded.

HL7532 - HL7766

- EGT and N2 change from round dial displays to digital displays. The digital displays are framed by an amber or red box if limits are exceeded.
- FF, OIL PRESS, OIL TEMP are displayed as digital readouts only. The digital displays turn amber or red if limits are exceeded.
- OIL QTY and VIB are displayed as digital readouts only. Low oil quantity and high vibrations are displayed the same as in the normal format.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Crossbleed (XB) Start Indication

Displayed (magenta).

HL7532 - HL7766

3 EGT start limit

Displayed (red).

Engine Controls
Thrust Levers

1 Reverse Thrust Levers

Control engine reverse thrust.

Reverse thrust can only be selected when the forward thrust levers are closed.

Actuates automatic speedbrakes (refer to Chapter 9, Flight Controls).

2 Forward Thrust Levers

Controls engine forward thrust.

The thrust levers can only be advanced if the reverse thrust levers are down.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Fuel Control Switches

1 FUEL CONTROL Switch

RUN (AUTOSTART ON) –

- Opens the spar fuel valve
- arms the engine fuel valve (the EEC opens the valve when required)
- arms the selected igniters (the EEC turns the igniters on when required).

RUN (AUTOSTART OFF) –

- opens the spar fuel valve
- opens the engine fuel valve
- turns igniters on.

CUTOFF –

- closes the fuel valves
- removes igniter power
- unlocks the engine fire switch.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Control Panel

HL7532 - HL7766

HL7202 - HL7205, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Electronic Engine Control (EEC) Mode Switch

NORM –

- selects the normal engine control mode for engine control

HL7202 - HL7205, HL7782 - HL8347

- the EEC sets thrust using N1 RPM as the controlling parameter.

HL7532 - HL7766

- the EEC sets thrust using EPR as the controlling parameter.

Off (ALTN visible) –

- selects the alternate engine control mode for engine control
- thrust is set using N1 RPM as the controlling parameter.

2 Electronic Engine Control (EEC) Alternate (ALTN) Light

Illuminated (amber) – the alternate engine control mode is either automatically or manually selected.

HL7532 - HL7766

3 START/IGNITION Selector

START –

- initiates engine start by opening the start valve
- releases to NORM at start valve cutout.

NORM –

- the start valve closes
- automatic ignition is provided for both igniters (if the FUEL CONTROL switch is in RUN)
- automatic ignition operates both igniters continuously for the following conditions:
  - the flap lever is out of the up position, or
  - engine anti–ice is on.

CON – both igniters operate continuously (if the FUEL CONTROL switch is in RUN).

HL7202 - HL7205, HL7782 - HL8347

3 START Selector

START –

- initiates engine start by opening the start valve
- releases to NORM at start valve cutout.

NORM –

- the start valve closes
- ignition is automatically provided during engine start-up or if engine flameout occurs (if the FUEL CONTROL switch is in RUN).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 AUTOSTART Switch

ON – arms the autostart system.

OFF –

- the autostart system is disabled
- the start is manually controlled.

5 AUTOSTART OFF Light

Illuminated (amber) – the AUTOSTART switch is OFF.

Auxiliary Power Unit (APU)
APU Controls

1 APU Selector

OFF –

- closes the APU bleed air isolation valve
- initiates normal shutdown
- resets auto shutdown fault logic.

ON (APU operating position) –

- opens the APU fuel valve and inlet door
- activates AC or DC fuel pump
- powers the APU controller.

START (momentary position, spring–loaded to ON) – initiates automatic start sequence.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 APU FAULT Light

Illuminated (amber):

- APU fault and/or fire is detected
- APU shutdown due to fault and/or fire
- momentarily during APU controller self–test.

APU Indications

MFD STATUS DISPLAY

1 APU Status Display

RPM – APU rotation speed in percent RPM.

EGT – APU exhaust gas temperature.

OIL PRESS – APU oil pressure in PSI.

OIL TEMP – APU oil temperature.

OIL QTY – APU oil quantity (quarts).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The airplane is powered by two General Electric Model GE90–110B1L engines. The engines are rated at 110,760 pounds of takeoff thrust each.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The airplane is powered by two General Electric Model GE90–115BL engines. The engines are rated at 115,540 pounds of takeoff thrust each.

HL7532 - HL7766
The airplane is powered by two Pratt & Whitney Model PW4090 engines. The engines are rated at 91,790 pounds of takeoff thrust each.

The engines are dual rotor axial flow turbofans of high compression and bypass ratio. The N1 rotor consists of a fan, a low pressure compressor section, and a low pressure turbine section on a common shaft. The N2 rotor consists of a high pressure compressor section and a high pressure turbine section on a common shaft. The N1 and N2 rotors are mechanically independent. The N2 rotor drives the engine accessory gearbox.

Each engine is controlled by an EEC. The EECs monitor autothrottle and flight crew inputs through the thrust levers to automatically control the engines.

Each engine has individual flight deck controls. Thrust is set by positioning the thrust levers. The thrust levers are positioned automatically by the autothrottle system or manually by the flight crew. See Chapter 11, Flight Management, Navigation, for a description of FMC thrust management functions.

Engine indications are displayed on the EICAS display.

Engine Intermix

HL7202 - HL7205, HL7782 - HL8347
Both engines are set to operate at the same thrust rating. Replacement engine thrust rating is increased or decreased to match the thrust rating of the installed engine configuration. An EGT amber band (maximum continuous limit) difference between engines may be indicated, but these indications are normal.

HL7532 - HL7766
Both engines are set to operate at the same thrust rating. Replacement engine thrust rating is increased or decreased to match the thrust rating of the installed engine configuration. An EGT red line (maximum takeoff EGT limit) difference between the engines may be indicated, but these indications are normal.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Indications

Primary and secondary engine indications are provided. Engine indications are displayed on the EICAS display and any selected MFD.

Primary Engine Indications

HL7532 - HL7766
EPR, N1, and EGT are the primary engine indications. The primary engine indications are always displayed on the EICAS display. Normally the EICAS is on the upper center display unit. If that unit fails the EICAS display automatically moves to the lower center display unit.

HL7202 - HL7205, HL7782 - HL8347
N1 and EGT are the primary engine indications. The primary engine indications are always displayed on the EICAS display. Normally the EICAS is on the upper center display unit. If that unit fails, the EICAS display automatically moves to the lower center display unit.

Secondary Engine Indications

N2, fuel flow, oil pressure, oil temperature, oil quantity, and engine vibration are secondary engine indications. Secondary engine indications are displayed on the selected MFD to provide timely indication of a change to engine parameters. The secondary engine indications can be displayed by pushing the secondary engine display switch (the ENG switch on the display select panel). The secondary engine indications are automatically displayed when the display initially receives electrical power, or:

- a FUEL CONTROL switch is moved to CUTOFF in flight
- an engine fire switch is pulled in flight
- the FUEL FLOW ENG L, R alert message is displayed
- a secondary engine parameter is exceeded, or
- engine N2 RPM is below idle in flight.

The secondary engine display:

- Shows on the lower MFD, if available
- Shows and latches any time the secondary engine indications are automatically displayed
- Shows again, if latched, after any other display page is selected then blanked
- Can be cleared by pushing the secondary engine display switch, if the display is not latched

Automatic display of secondary engine indications is for crew awareness and does not require pilot action.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Only parameters with published operating limits generate EICAS messages. In general, procedures are written so that flight crews are not required to analyze or troubleshoot engine indications to diagnose problems or initiate procedures. EICAS monitors designated engine parameters and displays an EICAS alert message to notify the crew to take an action when published limits are exceeded. Flight crew procedures are accomplished in response to these alerts.

Normal Display Format

Primary engine indications and the N2 indications are both digital readouts and round dial/moving pointer indications. The digital readouts display numerical values while the moving pointers indicate relative value.

Oil pressure, oil temperature, and vibration indications are both digital readouts and vertical indication/moving pointers. Fuel flow and oil quantity are digital readouts only. All digital readouts are enclosed by boxes. The dial and vertical indications display the normal operating range, caution range, and operating limits (as applicable).

Normal operating range is displayed on a dial or vertical indication in white.

HL7532 - HL7766
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.

HL7202 - HL7205, HL7782 - HL8347
The oil temperature and oil pressure vertical indication has caution ranges displayed by amber bands. If oil temperature or oil pressure reaches the caution range, the digital readout, digital readout box, and pointer all change color to amber.

N1, N2, EGT, oil pressure, and oil temperature indications have operating limits indicated by red lines. If one of these indications reaches the red line, the digital readout, box, and pointer change color to red for that indication.

HL7202 - HL8043, HL8208 - HL8347
The EGT indication has a maximum continuous limit represented by an amber band. The maximum continuous limit does not apply during takeoff or go–around. If EGT reaches the maximum continuous limit, the digital indication, box, pointer, and dial all change color to amber. EGT indications are inhibited from changing to amber during takeoff or go–around for five minutes. The EGT indication is often in the amber band during takeoff; this is acceptable. The EGT indication has a maximum takeoff limit displayed by a red line. If EGT reaches the maximum takeoff limit, the digital indication, box, pointer and dial, all change color to red.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8044 - HL8077
The EGT indication has a maximum continuous limit represented by an amber band. The maximum continuous limit does not apply during takeoff or go–around. If EGT reaches the maximum continuous limit, the digital indication, box, pointer, and dial all change color to amber. EGT indications are inhibited from changing to amber during takeoff or go–around for five minutes. The EGT indication is often in the amber band during takeoff; this is acceptable. The inhibit is extended to ten minutes for single–engine operation. The EGT indication has a maximum takeoff limit displayed by a red line. If EGT reaches the maximum takeoff limit, the digital indication, box, pointer and dial, all change color to red.

If an N1, N2, or EGT red line is exceeded, the box enclosing the digital readout remains red after the exceeded limit returns to the normal range. The red box color can be canceled to white or recalled to red by pushing the cancel/recall switch on the display select panel. An indication changes color back to white when it returns to the normal operating range.

For low oil quantity, the oil quantity digital readout changes to black text on a white background. The white text LO is displayed adjacent to the readout.

For high engine vibration, the vibration digital readout changes to black text on a white background.

HL7532 - HL7766
The maximum EPR limit is indicated by an amber line at the top of the EPR dial. The EPR indication does not change color when maximum EPR is reached. The reference/target EPR indication displays the FMS reference or target EPR. The commanded EPR indication displays the EEC calculated EPR commanded by thrust lever position.

Compact Display Format

HL7532 - HL7766
In compact format, primary and secondary engine indications are combined on the same display. The EPR and N1 displays are the same as the normal displays. All other indications change to digital readouts only. If an amber or red line parameter for a digital indication is exceeded, the digital indication changes color to amber or red (as does the box that appears around an EGT, or N2 indication for a red line exceedance). If the EGT or N2 red line is exceeded, the red color of the box around the digital indication can be returned to white (if the exceeded parameter has returned to normal) by pushing the display select panel CANCEL/RECALL switch.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347
In compact format, primary and secondary engine indications are combined on the same display. The N1 and EGT indications are displayed as they are normally (moving pointer/round dial and digital indications). All other indications change to digital readouts only, with the exception that the N2 digital readout is boxed if a parameter is exceeded. If an amber or red line parameter for a digital indication is exceeded, the digital indication changes color to amber or red (as does the box that appears around the N2 indication for a red line exceedance). If the N2 red line is exceeded, the red color of the box around the digital indication can be returned to white (if the exceeded parameter has returned to normal) by pushing the display select panel CANCEL/RECALL switch.

Primary and secondary engine indications are displayed on EICAS in compact format whenever:

- secondary engine display is automatically selected, and the lower multifunction display is failed, unpowered, or is occupied, or
- secondary engine display is manually selected to the lower center MFD and the lower MFD is failed, unpowered, or occupied with EICAS.

Electronic Engine Control (EEC)

HL7532 - HL7766
Each EEC has full authority over engine operation. The EEC uses thrust lever inputs to automatically control forward thrust and reverse thrust. The EEC has two control modes: normal and alternate. In the normal mode, the EEC uses EPR as the parameter for setting thrust. In the alternate mode, the EEC uses N1 RPM as the controlling parameter.

HL7532 - HL7766
At altitudes of 17,000 feet and above, compressor stall protection logic causes the engines to accelerate slowly if the acceleration is initiated shortly after a deceleration. The engines may accelerate at slightly different rates. Thrust asymmetry compensation (TAC) may activate.

HL7202 - HL7205, HL7782 - HL8347
Each EEC has full authority over engine operation. The EEC uses thrust lever inputs to automatically control forward thrust and reverse thrust. The EEC has two control modes: normal and alternate. In both normal and alternate modes, the EEC uses N1 RPM as the parameter for setting thrust.

EEC Normal Mode

HL7532 - HL7766
In the normal mode, the EEC sets thrust by controlling EPR based on thrust lever position. EPR is commanded by positioning the thrust levers either automatically with the autothrottles, or manually by the flight crew.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347
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.

HL7532 - HL7766
Maximum EPR represents the maximum rated thrust available from the engine. The EEC continuously computes maximum EPR.

HL7202 - HL7205, HL7782 - HL8347
Maximum N1 represents the maximum rated thrust available from the engine. The EEC continuously computes maximum N1.

Maximum rated thrust is available in any phase of flight by moving the thrust levers to the full forward positions.

EEC Alternate Mode

If the required signals are not available to operate in the normal mode, the EEC automatically uses the alternate mode. In the alternate mode, the EEC schedules N1 as a function of thrust lever position. The alternate mode provides soft and hard levels of control:

- Soft – When the EEC automatically switches an engine to the alternate mode and the EEC mode switch remains in NORM, the EEC is in the soft alternate mode (the switch position is NORM, the EEC mode is alternate). At a fixed thrust lever position, thrust does not change.
- Hard – When ALTN is manually selected on an EEC mode switch, that engine is switched to the hard alternate mode (the switch position is ALTN, the EEC mode is alternate). Reference and target N1, and maximum and commanded N1 values are displayed on the N1 indication during the hard alternate mode. Thrust may change to set the commanded N1 when ALTN is manually selected.

HL7532 - HL7766

EEC mode switch – NORM EEC mode – Normal	EEC mode switch – NORM EEC mode – Soft Alternate	EEC mode switch – ALTN EEC mode – Hard Alternate
• EPR: actual, command, reference/target , maximum • N1: actual, red line.	• EPR: blank • N1: actual, red line.	• EPR: blank • N1: actual, command, reference/target , maximum, red line.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

For the normal, soft alternate, and hard alternate modes, actual, command, reference/target, maximum, and red line N1 information is displayed.

Automatic reversion or manual selection to the alternate mode is indicated by the EICAS advisory message ENG EEC MODE (L, R) and illumination of the EEC ALTN light on the associated EEC mode switch. Selecting the alternate mode on both engines eliminates thrust lever stagger at equal thrust settings, or asymmetric thrust when the thrust levers are operated together.

The autothrottles remain engaged whenever the EEC automatically switches to the alternate mode. The alternate mode N1 reference/target values are computed by the FMC.

Note: The autothrottles remains connected whenever the EEC is in the alternate mode.

The alternate mode schedule (N1 schedule) provides equal or greater thrust than the normal mode for the same thrust lever position.

Thrust protection is not provided in the alternate mode and maximum rated thrust is reached at a thrust lever position less than full forward. As a result, thrust overboost can occur at full forward thrust lever positions. The EICAS caution message ENG LIMIT PROT (L, R) is displayed if the thrust lever position commands an N1 greater than the maximum rated thrust (maximum N1).

N1 and N2 red line protection is provided in the alternate control mode.

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 ENG RPM LIMITED (L or R) is provided when overspeed protection is provided.

If the EECs are in alternate mode, advancing the thrust levers full forward provides some overboost and should be considered only during emergency situations when all other available actions have been taken and terrain contact is imminent.

Engine Idle

The EEC selects minimum idle or approach idle. Minimum idle is a lower thrust than approach idle.

Approach idle is selected in flight when:

- engine anti–icing is operating
- the flaps are commanded to 25 or greater

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- one hydraulic system air–driven demand pump is inoperative, and the flaps are out of the UP position
- the opposite engine bleed air valve is closed

Approach idle decreases acceleration time for go–around. Approach idle is maintained until after touchdown, when minimum idle is selected.

Thrust Control Malfunction Protection

HL7202 - HL7205, HL7782 - HL8347

The EEC provides protection against an uncontrolled high thrust malfunction during ground operation. The EEC shuts down the affected engine when:

- airplane is on ground,
- thrust lever is at idle, and
- engine is above idle speed and not decelerating normally.

The EICAS caution message ENG FAIL (L or R) is displayed when the engine falls below idle speed.

Engine Start and Ignition System

The engines can be started using the autostart system or manually. Autostart is the normal starting mode. Selecting OFF on the AUTOSTART switch disables autostart and allows manual, pilot–monitored, starting.

Bleed air powers the starter motor, which is connected to the N2 rotor. The starter air source is normally the APU, but air from ground carts or another running engine can be used.

HL7532 - HL7766
The START/IGNITION selectors control the starter air valves and provide continuous ignition capability. Ignition and fuel flow are controlled through the FUEL CONTROL switches.

HL7202 - HL7205, HL7782 - HL8347
The START selectors control the starter air valves. Ignition and fuel flow are controlled through the FUEL CONTROL switches.

HL7202 - HL7205, HL7782 - HL8347
At approximately idle N2 RPM, the EEC commands starter cutout, and the START selector releases to the NORM position.

HL7532 - HL7766
The EEC monitors the start to determine the optimum N2 RPM for starter cutout. At that RPM, the EEC commands starter cutout, and the START/IGNITION selector releases to the NORM position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

A maximum start limit line (red) is displayed on the EGT indication when the FUEL CONTROL switch is moved to CUTOFF or engine N2 RPM is below idle. It remains displayed after the FUEL CONTROL switch is moved to RUN until the engine is stabilized at idle. The EGT indication changes color to red if the EGT start limit is reached during starting.

Autostart

HL7532 - HL7766

Autostart allows the EEC to control fuel and ignition. With the AUTOSTART switch ON, the autostart sequence is initiated by rotating the START/IGNITION selector to START and moving the FUEL CONTROL switch to RUN. For in-flight windmill starts the autostart sequence is initiated by moving the FUEL CONTROL switch to RUN.

The START/IGNITION selector opens the starter air valve to begin dry motoring the engine. Moving the FUEL CONTROL switch to RUN opens the spar fuel valve, but not the engine fuel valve. The proper sequencing of fuel and ignition is controlled by the autostart system. With the FUEL CONTROL switch positioned to RUN, the EEC opens engine fuel valve and energizes the igniter(s) at the appropriate N2 RPM.

During autostart, the EEC monitors EGT, N2 RPM, and other engine parameters until the engine reaches idle. During ground start, the autostart system monitors engine parameters and will abort the start for any of the following:

- hot start
- hung start
- no EGT rise
- compressor stall
- starter shaft failure
- no N1 rotation
- insufficient air pressure for starter operation
- start time exceeds the starter duty cycle timer.

Note: The autostart system does not monitor oil pressure and temperature.

If a hot start, hung start, no EGT rise, or compressor stall is detected, and N2 RPM is less than the starter cutout speed, the EEC turns off fuel and ignition and motors the engine for approximately 30 seconds before making a second attempt. The second attempt uses both igniters. On the ground, if the second attempt fails, the EEC aborts the start. Fuel and ignition are shut off, and the engine is motored for 30 seconds to clear residual fuel. The starter air valve then closes and the START/IGNITION selector releases to the NORM position. The EICAS caution message ENG AUTOSTART (L or R) is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

On the ground, autostart does not attempt a second start if there is no N1 rotation, insufficient air pressure, the starter shaft fails, the start time exceeds the starter duty cycle, or the start is aborted above starter cutout speed and the EICAS caution message ENG AUTOSTART (L or R) is displayed.

Note: For some conditions, the EEC may rapidly cycle fuel off and on in an attempt to clear the condition.

Note: For in–flight starts, the autostart system temporarily discontinues the start if the takeoff EGT limit is exceeded. Autostart takes corrective action if some start problems are detected, but does not abort the start.

Whenever the AUTOSTART switch is selected OFF, the EICAS advisory message ENG AUTOSTART OFF is displayed and the AUTOSTART switch OFF light illuminates.

Autostart

HL7202 - HL7205, HL7782 - HL8347

Autostart allows the EEC to control fuel and ignition. With the AUTOSTART switch ON, the autostart sequence is initiated by rotating the START selector to START and moving the FUEL CONTROL switch to RUN. For in-flight windmill starts the autostart sequence is initiated by moving the FUEL CONTROL switch to RUN.

The START selector opens the starter air valve to begin dry motoring the engine. Moving the FUEL CONTROL switch to RUN opens the spar fuel valve, but not the engine fuel valve. The proper sequencing of fuel and ignition is controlled by the autostart system. With the FUEL CONTROL switch positioned to RUN, the EEC opens engine fuel valve and energizes the igniter(s) at the appropriate N2 RPM.

During autostart, the EEC monitors EGT, N2 RPM, and other engine parameters until the engine reaches idle. During ground start, the autostart system monitors engine parameters and will abort the start for any of the following:

- hot start
- hung start
- no EGT rise
- compressor stall
- starter shaft failure
- no N1 rotation
- insufficient air pressure for starter operation
- start time exceeds the starter duty cycle timer.

HL7202 - HL7205, HL8043 - HL8046, HL8076, HL8077, HL8346, HL8347

- oil pressure 10 PSI or less

HL7782 - HL8042, HL8075, HL8208 - HL8285

Note: The autostart system does not monitor oil pressure and temperature.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8043 - HL8046, HL8076, HL8077, HL8346, HL8347
Note: The autostart system does not monitor oil temperature.

If a hot start, hung start, no EGT rise, or compressor stall is detected, and N2 RPM is less than starter cutout speed, the EEC turns off fuel and ignition and motors the engine for 4 seconds before making a second or third attempt. The second attempt uses both igniters. If the second attempt fails, a third attempt is made by adjusting the starting fuel flow. If N2 RPM is greater than starter cutout speed, the EEC turns off fuel and ignition, closes the starter air valve and allows the engine to spool down below 30 percent N2 RPM. It then reopens the starter air valve and motors the engine before re-introducing fuel and ignition for subsequent attempt(s).

On the ground, if all attempts fail, the EEC aborts the start. Fuel and ignition are shut off and the engine is motored for 30 seconds to clear residual fuel. The starter air valve then closes and the START selector releases to the NORM position. The EICAS caution message ENG AUTOSTART (L or R) is displayed.

On the ground, autostart does not attempt a second or third start if there is no N1 rotation, insufficient air pressure, the starter shaft fails, the EGT exceeds the start limit line, or the start time exceeds the starter duty cycle. The EICAS caution message ENG AUTOSTART (L or R) is displayed.

Note: For in–flight starts, the autostart system temporarily discontinues the start if a preset EGT between the start and takeoff EGT red line limits is reached, or a hung start is detected. Autostart takes corrective action if some start problems are detected, but does not abort the start.

Whenever the AUTOSTART switch is selected OFF, the EICAS advisory message ENG AUTOSTART OFF is displayed and the AUTOSTART switch OFF light illuminates.

Manual Start

The AUTOSTART switch must be OFF to accomplish a manual start. The start is accomplished in accordance with the Manual Engine Start procedure (refer to Chapter SNP.7). Ignition and fuel are provided as soon as the FUEL CONTROL switch is positioned to RUN. The start must be monitored until the engine stabilizes at idle.

In–Flight Start

In–flight start envelope information is displayed on the EICAS display when an engine is not running in flight (N2 RPM below idle RPM) or when an engine is shut down in flight and the respective engine fire switch is not pulled. The in–flight start envelope indicates the airspeed range necessary to ensure an in–flight start at the current flight level. If the current flight level is above the maximum start altitude, the maximum start altitude and respective airspeed range are displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Secondary engine indications are displayed automatically when a FUEL CONTROL switch is moved to CUTOFF in flight or if N2 RPM goes below idle RPM while in flight. A crossbleed start indication is displayed next to the N2 indication if airspeed is below that recommended for a windmilling start, the in-flight start envelope is displayed, and the respective engine fire switch is in.

Refer to Engine In–Flight Start, Chapter NNC.7 for the in–flight start procedure.

For in–flight starts, autostart makes continuous start attempts until the engine either starts or the pilot aborts the start attempt by positioning the FUEL CONTROL switch to CUTOFF (and positioning the start switch to NORM if it was a starter assisted attempt).

Engine Ignition

Each engine has two igniters. The EEC automatically selects the appropriate igniter(s). The EEC alternates igniters for successive engine ground starts. Dual igniters are always used for in–flight starts.

Main AC power is the normal power source for ignition. Standby AC power provides a backup source.

HL7532 - HL7766
By positioning the START/IGNITION selector to CON, continuous ignition is selected. Both igniters operate continuously when the respective FUEL CONTROL switch is placed to RUN. The igniters are turned off when the FUEL CONTROL switch is placed to CUTOFF. When the START/IGNITION selector is in the NORM position, continuous ignition is automatically provided whenever:

- the flap lever is out of the UP position, or
- engine anti–ice is on.

HL7202 - HL7205, HL7782 - HL8347
When the START selector is in the NORM position and a flameout is detected, continuous ignition is automatically provided until three seconds after the flameout condition is cleared whenever:

- the flap lever is out of the UP position, or
- engine anti–ice is on.

HL7202 - HL7205, HL7782 - HL8347
On the ground, continuous ignition is inhibited when N1 is below approximately 55%.

Auto–Relight

HL7532 - HL7766
An auto–relight capability is provided for flameout protection. Whenever the EEC detects an engine flameout, both igniters are activated. A flameout is detected when a rapid decrease in N2 occurs, or N2 is less than idle RPM.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

An auto–relight capability is provided for flameout protection and sub–idle stall recovery. If the EEC detects an engine flameout, both igniters activate. A flameout is detected when a rapid decrease in N2 occurs, or N2 is less than idle RPM. If a sub–idle stall is detected, fuel is shut off for one second in an attempt to clear the stall.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Start and Ignition System Schematic

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Fuel System

HL7532 - HL7766
Fuel is supplied by fuel pumps located in the fuel tanks. The fuel flows through a spar fuel valve located in the main tank. It then passes through the first stage engine fuel pump where additional pressure is added. It flows through a fuel/oil heat exchanger where it is preheated. A fuel filter removes contaminants. The second stage of the engine fuel pump adds more pressure before the fuel reaches the fuel metering unit. The fuel metering unit adjusts fuel flow to meet thrust requirements. The fuel then flows through the engine fuel valve into the engine.

HL7202 - HL7205, HL7782 - HL8347
Fuel is supplied by fuel pumps located in the fuel tanks. The fuel flows through a spar fuel valve located in the main tank. It then passes through the first stage engine fuel pump where additional pressure is added. The second stage of the engine fuel pump adds more pressure. It flows through a fuel/oil heat exchanger where it is preheated. A fuel filter removes contaminants. The fuel then reaches the fuel metering unit. The fuel metering unit adjusts fuel flow to meet thrust requirements. The fuel then flows through the engine fuel valve into the engine.

The spar and engine fuel valves allow fuel flow to the engine when both valves are open. The valves open when the engine fire switch is IN and the FUEL CONTROL switch is in RUN. Both valves close when either the FUEL CONTROL switch is in CUTOFF or the engine fire switch is OUT.

Fuel flow is measured after passing through the engine fuel valve. Fuel flow is displayed on the secondary engine display. Fuel flow information is also provided to the FMS.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Fuel System Schematic

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

HL7532 - HL7766
Oil is pressurized by an engine–driven oil pump. From the pump, the oil flows through a dual oil filter. The oil flows through the air/oil heat exchanger, and fuel/oil heat exchangers and is then delivered to the engine main bearings, gears, and accessory drives. A scavenge pump returns the oil to the reservoir.

HL7532 - HL7766
The dual oil filter system incorporates a primary and secondary oil filter. If the primary oil filter becomes clogged, then oil bypasses the primary oil filter and the secondary oil filter provides filtration.

HL7202 - HL7205, HL7782 - HL8347
Oil is pressurized by an engine–driven oil pump. From the pump, the oil flows through the oil filter. If the oil filter becomes clogged, then oil bypasses the oil filter and the EICAS advisory message ENG OIL FILTER (L, R) is displayed. The oil flows through the fuel/oil heat exchangers and then through the backup generator oil/oil heat exchanger, and is then delivered to the engine main bearings, gears, and accessory drives. A scavenge pump returns the oil to the reservoir.

HL7202 - HL7205, HL7782 - HL8347
Oil pressure, temperature, and quantity are displayed on the secondary engine display. Oil pressure and oil temperature are measured prior to entering the engine.

HL7532 - HL7766
Oil pressure, temperature, and quantity are displayed on the secondary engine display. Oil pressure is measured prior to entering the engine. Oil temperature is measured after leaving the engine, prior to entering the reservoir.

There is no minimum oil quantity limit (no amber or start limit line); however, a low oil quantity causes automatic display of the secondary engine display and reverses the display indication to show black numbers on a white background. There are no operating limitations for the engine oil quantity; therefore, there are no flight crew procedures based solely on a response to low oil quantity.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Oil System Schematic

HL7532 - HL7766

HL7202 - HL7205, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Thrust Reverser System

Each engine has a hydraulically actuated fan air thrust reverser. Reverse thrust is available only on the ground.

The reverse thrust levers can be raised only when the forward thrust levers are in the idle position. When the reverse thrust levers are raised, the EEC opens the reverser isolation valve. The EEC inhibits reverser isolation valve actuation and reverser deployment unless the airplane is on the ground with the engine running. The EECs also control thrust limits during reverser operation. This requirement supports asymmetric thrust airplane controllability when a thrust reverser fails to deploy.

When the reverse thrust levers are pulled aft to the interlock position:

- the autothrottle disengages
- the auto speedbrakes deploy.

HL7532 - HL7766
When the reverser system is activated:

- the reverser translating sleeves hydraulically move aft
- the fan flow blocker doors rotate into place to direct fan air through stationary cascade guide vanes
- the reverser indication (REV) is displayed above each digital EPR indication (REV is displayed in amber when the reverser is in transit).

HL7202 - HL7205, HL7782 - HL8347
When the reverser system is activated:

- the reverser translating sleeves hydraulically move aft
- the fan flow blocker doors rotate into place to direct fan air through stationary cascade guide vanes
- the reverser indication (REV) is displayed above each digital N1 indication (REV is displayed in amber when the reverser is in transit).

When the interlock releases:

- the reverse thrust levers can be raised to the maximum reverse thrust position
- the REV indication changes to green when the reverser is fully deployed.

Pushing the reverse thrust levers to the full down position retracts the reversers to the stowed and locked position. The thrust levers cannot be moved forward until the reverse thrust levers are fully down.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The EICAS advisory message ENG REV LIMITED (L or R) is displayed if the reverser cannot deploy when commanded, or can deploy only with reverse thrust limited to idle. Not all conditions limiting or preventing reverse thrust can be detected before reverse thrust selection. For these conditions, the reverse thrust levers cannot be moved beyond the interlock position.

The EICAS advisory message ENG REVERSER (L or R) is displayed on the ground to indicate a reverser system fault.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Thrust Reverser Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

The airborne vibration monitoring system is primarily intended for engine condition monitoring, but it is also a useful tool for isolating and determining corrective action for engine anomalies. There is no certified vibration limit, but when a high vibration level is reached, the secondary engine parameters are automatically displayed. High N1 vibration indication would most likely be accompanied by tactile vibration. This is not the case with high N2 vibration indication. Both N1 and N2 high vibrations may be accompanied by anomalies in other engine parameters and will usually respond to thrust lever adjustment.

Certain engine malfunctions can result in airframe vibrations from the windmilling engine. As the airplane transitions from cruise to landing, there can be multiple, narrow regions of altitudes and airspeeds where the vibration level can become severe. In general, airframe vibrations can best be reduced by descending and reducing airspeed. However, if after descending and reducing airspeed, the existing vibration level is unacceptable, and if it is impractical to further reduce airspeed, the vibration level may be reduced to a previous, lower level by a slight increase in airspeed.

Engine Failure Alert System

The engine failure alert system provides alerts when actual engine performance is less than commanded engine performance during a part of the takeoff and for other phases of flight.

A red ENG FAIL is displayed on the PFD if actual thrust is less than commanded thrust during takeoff with airspeed between 65 knots and 6 knots prior to V1. The PFD display is accompanied by the voice annunciation ENGINE FAIL and the Master WARNING lights illuminating.

The EICAS caution message ENG FAIL (L or R) is displayed if an engine unexpectedly decelerates to less than idle speed. The message remains displayed until the engine recovers or the fuel control switch is moved to CUTOFF.

The EICAS caution message ENG THRUST (L or R) is displayed if:

- actual thrust is significantly less than commanded thrust, and
- actual thrust is not increasing to commanded thrust, and
- airspeed is V1 - 6 knots or greater.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The auxiliary power unit (APU) is a self–contained gas turbine engine located in the airplane tail cone.

The APU can be started and operated to the airplane maximum certified altitude.

The APU supplies bleed air and electrical power. Electrical power has priority over bleed air. Electrical power is available throughout the airplane operating envelope. Bleed air is available at or below 22,000 feet.

Refer to the following chapters for additional information:

- Chapter 2, Air Systems, for a description of APU bleed air operation
- Chapter 6, Electrical, for a description of APU electrical operation
- Chapter 8, Fire Protection, for a description of the APU fire protection system
- Chapter 12, Fuel, for a description of the APU fuel system.

APU Operation

APU Start

The APU is started either by an electric start motor or an air turbine starter.

The electric starter is powered by the APU battery. The main airplane battery powers the inlet door, fuel valve, and fire detection system.

The air turbine starter uses engine bleed air or ground cart air to start the APU.

Starter selection is automatic. The air turbine starter has priority over the electric start motor when there is sufficient bleed air duct pressure.

Rotating the APU selector to START begins the automatic start sequence.

APU fuel is supplied from the left fuel manifold by any operating AC fuel pump or the DC fuel pump. With AC power available and the APU selector in the ON position, the left forward fuel pump operates automatically.

If AC power is not available or no AC pump pressurizes the left fuel manifold, the DC pump in the left main tank provides APU fuel. On the ground, the APU can be started with no pumps operating.

When the APU air inlet door reaches the full open position the starter engages. After the APU reaches the proper speed, ignition and fuel are provided. When the APU reaches approximately 50 percent, the starter disengages and ignition is turned off.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If the start fails, the APU shuts down automatically. The EICAS message APU SHUTDOWN is displayed.

The APU's starter motors duty cycle for the electric starter motor and air turbine starter is 3 start attempts in a 60 minute period each.

APU Automatic Start

In flight, if both AC transfer busses lose power, the APU automatically starts, regardless of APU selector position. The APU can be shut down by positioning the selector to ON, then OFF.

APU Run

The EICAS memo message APU RUNNING is displayed when the APU is operating normally.

APU Shutdown

Rotating the APU selector to OFF begins the shutdown cycle by closing the APU bleed air valve. The APU continues running for a cooldown period. The EICAS memo message APU COOLDOWN is displayed during the cooldown period. When the cooldown period finishes, the APU shuts down.

APU Operating Modes

The APU has attended and unattended operating modes. The attended mode operates when either engine is running or starting, or when the airplane is in flight. The unattended mode operates at all other times on the ground.

APU Attended Mode

In the attended mode, any of the following faults cause the APU to shut down immediately:

- APU fire/inlet over temperature
- overspeed/loss of overspeed protection
- APU controller failure
- speed droop.

There is no cool down period. The EICAS advisory message, APU SHUTDOWN, displays.

For the following faults, the APU continues to operate and the EICAS message APU LIMIT displays:

- high EGT
- high oil temperature
- low oil pressure.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

There is no cooldown period when the APU is shut down after the APU LIMIT message is displayed.

APU Unattended Mode

In the unattended mode, in addition to all critical system faults the APU will shutdown for the following faults:

- APU fire/inlet overtemperature
- overspeed/loss of overspeed protection
- high EGT
- low oil pressure
- high oil temperature
- generator oil filter approaching bypass
- intake door failure
- APU controller failure
- speed droop
- no combustion on start
- no acceleration on start.

There is no cooldown period.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Alert Messages

Message	Level	Aural	Message Logic
APU LIMIT	Caution	Beeper	APU operation has exceeded a limit.
APU SHUTDOWN	Advisory		APU has shut down.
ENG AUTOSTART L, R	Caution	Beeper	One of these occurs: • autostart did not start the engine, or • the AUTOSTART switch is off, the FUEL CONTROL switch is in RUN, and the engine RPM is low
ENG AUTOSTART OFF	Advisory		The AUTOSTART switch is off.
ENG CONTROL L, R	Advisory		Fault has occurred in the EEC system.
ENG EEC MODE L, R	Advisory		The EEC is operating in the alternate mode.
ENG FAIL L, R	Caution	Beeper	Engine speed is below idle.
ENG FUEL FILTER L, R	Advisory		An impending fuel filter bypass condition exists.
ENG FUEL VALVE L, R	Advisory		Engine fuel or fuel spar valve position is not in the commanded position.
ENG IDLE DISAGREE	Advisory		One engine is at approach idle and the other engine is at minimum idle.
ENG LIMIT PROT L, R	Caution	Beeper	The EEC is operating in the alternate mode and commanded N1 exceeds maximum N1 limit.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic

HL7202 - HL7205, HL7782 - HL8347

ENG OIL FILTER L, R	Advisory		Engine oil filter contamination has caused oil to bypass the oil filter.

ENG OIL PRESS L, R	Caution	Beeper	The engine oil pressure is low.
ENG OIL TEMP L, R	Advisory		The engine oil temperature is high.
ENG REV LIMITED L, R	Advisory		The engine thrust reverser will not deploy or reverse thrust will be limited to idle on landing.
ENG REVERSER L, R	Advisory		A fault is detected in the engine reverser system.
ENG RPM LIMITED L, R	Advisory		The EEC is limiting engine thrust to prevent N1 or N2 from exceeding the RPM operating limit.
ENG SHUTDOWN, L R	Caution		The engine is shutdown by the FUEL CONTROL switch or the Engine Fire switch.
ENG START VALVE L, R	Advisory		The engine start valve is not in commanded position.

HL7532 - HL7766

ENG STARTER CUTOUT L, R	Caution	Beeper	The engine start valve is open when commanded to close, or the START/IGNITION selector remains in START.

HL7202 - HL7205, HL7782 - HL8347

ENG STARTER CUTOUT L, R	Caution	Beeper	The engine start valve is open when commanded to close, or the START selector remains in START.

ENG THRUST L, R	Caution	Beeper	The engine thrust is less than the thrust commanded.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Memo Messages

Message	Level	Aural	Message Logic
APU COOLDOWN	Memo		The APU is in the cool down mode.
APU RUNNING	Memo		The APU is running, and is not in the cool down mode.

HL7532 - HL7766

CON IGNITION ON L, L+R, R	Memo		Engine START/IGNITION selector CON position selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 8.10
Engine Fire Protection 8.10.1
Engine Fire Panel 8.10.1
Fuel Control Switches. 8.10.2
APU and Cargo Fire Panel. 8.10.2
APU Ground Control Fire Protection Panel 8.10.8

System Description 8.20
Introduction 8.20.1
Engine Fire Protection 8.20.1
Engine Fire and Overheat Detection. 8.20.1
Engine Fire Extinguishing 8.20.3
APU Fire Protection. 8.20.3
APU Fire Detection 8.20.4
APU Fire Extinguishing 8.20.4
Main Wheel Well Fire Protection 8.20.4
Main Wheel Well Fire Detection 8.20.4
Main Wheel Well Fire Warning 8.20.5
Cargo Compartment Fire Protection 8.20.5
Cargo Compartment Smoke Detection. 8.20.5
Cargo Compartment Fire Warning 8.20.5
Cargo Compartment Fire Suppression 8.20.5
Cargo Compartment Fire Protection 8.20.7
Cargo Compartment Smoke Detection. 8.20.7
Cargo Compartment Fire Warning 8.20.7
Lower Cargo Compartment Fire Extinguishing 8.20.7
Main Deck Cargo Compartment Fire Suppression. 8.20.8
Crew Rest Compartment Fire Protection. 8.20.8
Door 5 Upper Crew Rest Compartment Smoke Detection. . . . 8.20.8
Flight Deck Crew Rest Compartment Smoke Detection 8.20.8
Lower Crew Rest Compartment Smoke Detection. 8.20.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Lower Crew Rest Compartment Fire Extinguishing 8.20.9
Equipment Cooling System Fire Protection 8.20.9
Lavatory Fire Protection 8.20.9
Lavatory Fire Detection 8.20.9
Lavatory Fire Extinguishing 8.20.9
Fire and Overheat Detection System Fault Test 8.20.10
Fire and Overheat Detection System Automatic Fault Test . . 8.20.10
Fire and Overheat Detection System Manual Fault Test 8.20.10

EICAS Messages 8.30
Fire Protection EICAS Messages 8.30.1
Airplane System EICAS Messages 8.30.1
Cabin System EICAS Messages 8.30.3
System Test Messages 8.30.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Fire Protection
Engine Fire Panel

1 Engine Fire Switches

In (normal position, mechanically locked) – unlocks automatically for a fire warning, or when the FUEL CONTROL switch is in CUTOFF.

Out –

- arms both engine fire extinguishers
- closes the associated engine and spar fuel valves
- closes the associated engine bleed air valves
- trips the associated engine generators off
- shuts off hydraulic fluid to the associated engine–driven hydraulic pump
- depressurizes the associated engine–driven hydraulic pump
- removes power to the thrust reverser isolation valve.

Rotate to position 1 or 2 – discharges the selected fire extinguisher into the engine.

2 Engine Fire Warning Lights

Illuminated (red) –

- an engine fire is detected, or
- the FIRE/OVERHEAT TEST switch is pushed.

3 Engine Bottle Discharged (ENG BTL DISCH) Lights

Illuminated (amber) – the extinguisher bottle is discharged or has low pressure.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Engine and APU Fire Override Switches

Push – unlocks the fire switch.

Fuel Control Switches

1 FUEL CONTROL Switch Fire Warning Lights

Illuminated (red) –

- an associated engine fire is detected, or
- the FIRE/OVERHEAT TEST switch is pushed.

APU and Cargo Fire Panel

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 APU Bottle Discharge (APU BTL DISCH) Light

Illuminated (amber) – the extinguisher bottle is discharged or has low pressure.

2 APU Fire Switch

In – normal position, mechanically locked; unlocks automatically for a fire warning.

Out –

- arms the APU fire extinguisher bottle
- closes the APU fuel valve
- closes the APU bleed air valves
- closes the APU air inlet door
- trips the APU generator field and generator breaker
- shuts down the APU (if automatic shutdown does not occur).

Rotate – either direction discharges the APU fire extinguisher into the APU compartment.

3 APU Fire Warning Light

Illuminated (red) –

- an APU fire is detected, or
- the FIRE/OVERHEAT TEST switch is pushed.

The APU automatically shuts down for a detected fire.

4 CARGO FIRE ARM Switches

ARMED –

- arms all cargo fire extinguisher bottles
- arms the selected compartment suppression flow valve
- turns off both lower recirculation fans
- shuts down cargo heat
- shuts down In-Flight Entertainment (IFE) System
- commands the packs to provide air flow in the main passenger cabin which causes higher pressure to prevent smoke migration from the lower cargo compartment
- shuts down the bulk cargo compartment ventilation system operation (aft cargo fire only)
- shuts down the lavatory/galley vent fans
- puts the equipment cooling system into the override mode (forward cargo fire only)

HL7574 - HL7766

- activates lower crew rest evacuation system (aft cargo fire only)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- shuts down Nitrogen Generation System

Off (blank) – normal position.

5 CARGO FIRE Warning Lights

Illuminated (red) – the FIRE/OVERHEAT TEST switch is pushed, or associated cargo compartment smoke is detected and aircraft systems are commanded to shut down –

- AFT or FWD illuminated –
  - both lower recirculation fans
  - lavatory/galley vent fans
  - cargo heat in respective compartment
- FWD illuminated –
  - equipment cooling system in the override mode

6 CARGO FIRE Discharge (DISCH) Switch

Push – discharges the fire extinguisher bottles into the ARMED cargo compartment.

Note: The bulk cargo compartment is included in the AFT cargo fire extinguishing system.

7 CARGO FIRE Discharge (DISCH) Light

Illuminated (amber) – the fire extinguishers have discharged.

8 FIRE/OVERHEAT TEST Switch

Push and hold –

- sends fire/overheat test signals to the engine, APU, wheel well, and cargo compartment fire detector systems
- tests flight deck fire and overheat indications (see Fire and Overheat Detection System Manual Fault Test, Section 20).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

1 APU Bottle Discharge (APU BTL DISCH) Light

Illuminated (amber) – the extinguisher bottle is discharged or has low pressure.

2 APU Fire Switch

In – normal position, mechanically locked; unlocks automatically for a fire warning.

Out –

- arms the APU fire extinguisher bottle
- closes the APU fuel valve
- closes the APU bleed air valves
- closes the APU air inlet door
- trips the APU generator field and generator breaker
- shuts down the APU (if automatic shutdown does not occur).

Rotate – either direction discharges the APU fire extinguisher into the APU compartment.

3 APU Fire Warning Light

Illuminated (red) –

- an APU fire is detected, or
- the FIRE/OVERHEAT TEST switch is pushed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The APU automatically shuts down for a detected fire.

4 CARGO FIRE ARM Switches

- LWR AFT or LWR FWD or MAIN DECK – ARMED –
  - turns off both recirculation fans
  - turns off the lavatory/galley vent fans
  - turns off cargo heat in respective compartment
  - turns off electrical power outlets in respective compartment
  - commands pack to supply air to flight deck and supernumerary areas only
  - turns off the Nitrogen Generation System
- LWR AFT or LWR FWD – ARMED –
  - arms all cargo fire extinguisher bottles
  - arms the selected compartment extinguisher valve
  - puts the equipment cooling system into the override mode
  - turns off cargo air conditioning in respective compartment
- MAIN DECK – ARMED –
  - commands EE cooling to provide pack air to flight deck equipment
  - turns off main deck cargo compartment air in-flow
  - turns off aft cargo air conditioning supply and exhaust

  HL8005, HL8043 - HL8077, HL8285
  - inhibits lower cargo compartment fire warnings

Off (blank) – normal position.

5 CARGO FIRE Warning Lights

Illuminated (red) – the FIRE/OVERHEAT TEST switch is pushed, or associated cargo compartment smoke is detected and aircraft systems are commanded to shut down –

- AFT, or FWD, or MAIN illuminated –
  - both recirculation fans
  - lavatory/galley vent fans
  - cargo heat in respective compartment
- AFT or FWD illuminated –
  - cargo air conditioning in respective compartment
  - equipment cooling system in the override mode
- MAIN illuminated –
  - Main Deck Alerting System activated
  - EE cooling provides pack air to flight deck equipment

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- main deck cargo compartment air in-flow
- aft cargo air conditioning supply and exhaust

6 CARGO FIRE Depressurization/Discharge (DEPR/DISCH) Switch

Push –

MAIN DECK – ARMED – initiates airplane depressurization to a cabin altitude of approximately 23,000 feet with the airplane altitude at 25,000 feet.

LWR AFT or LWR FWD – ARMED – discharges the fire extinguisher bottles into the ARMED cargo compartment.

Note: The bulk cargo compartment is included in the LWR AFT cargo fire extinguishing system.

7 CARGO FIRE Depressurization (DEPR) Light

Illuminated (amber) – airplane depressurization initiated.

8 CARGO FIRE Discharge (DISCH) Light

Illuminated (amber) – the fire extinguishers have discharged.

9 FIRE/OVERHEAT TEST Switch

Push and hold –

- sends fire/overheat test signals to the engine, APU, wheel well, and cargo compartment fire detector systems
- tests flight deck fire and overheat indications (see Fire and Overheat Detection System Manual Fault Test, Section 20).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

APU Ground Control Fire Protection Panel

1 APU FIRE WARNING HORN

Sounds intermittently during ground operation for an APU fire or fire test.

2 APU FIRE Light

Illuminated (red) –

- an APU fire is detected, or
- a fire/overheat test is in progress.

The APU automatically shuts down for a detected fire.

3 APU FIRE BOTTLE ARMED Light

Illuminated (amber) – the APU fire extinguisher is armed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 APU BOTTLE DISCHARGED Light

Illuminated (amber) – the extinguisher bottle pressure is low.

5 APU FIRE SHUTDOWN Switch

Push (red) –

- shuts down the APU
- arms the APU fire extinguisher.

6 APU BOTTLE DISCHARGE Switch

Push – discharges the APU fire extinguisher into the APU compartment.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

There are fire detection and extinguishing systems for the:

- APU
- cargo compartments
- engines
- lavatories.

HL7202 - HL7205, HL7733 - HL8347
The flight deck crew rest compartment has a fire detection system, but no fire extinguishing system.

HL7574 - HL7766
The lower crew rest compartment has a fire detection system and a manually activated fire extinguishing system.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The door 5 upper crew rest compartment has a fire detection system, but no fire extinguishing system.

The engines also have overheat detection systems.

The main gear wheel wells have a fire detection system, but no fire extinguishing system.

Refer to the following chapters for additional information:

- Chapter 2 – Air Systems, for descriptions of equipment smoke evacuation, and bleed duct leak and overheat detection.
- Chapter 3 – Anti–Ice, Rain, for a description of engine anti–ice system leak protection.

Engine Fire Protection

Engine fire protection consists of these systems:

- engine fire and overheat detection
- engine fire extinguishing.

Engine Fire and Overheat Detection

There are two detector loops in each engine nacelle. Each detector loop provides both fire and overheat detection. Normally, both loops must detect a fire or overheat condition to cause an engine fire warning or overheat caution.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If a fault is detected in one loop, the system automatically switches to single loop operation. If the operating loop senses a fire or overheat, the system provides the appropriate fire warning or overheat caution.

If there are faults in both detector loops in an engine nacelle, no fire or overheat detection is provided. The EICAS advisory message DET FIRE ENG (L or R) is displayed if the engine fire detection system fails.

Engine Fire Warning

The indications of an engine fire are:

- the fire bell sounds
- the master WARNING lights illuminate
- the EICAS warning message FIRE ENG (L or R) is displayed
- the engine fire switch LEFT or RIGHT fire warning light illuminates
- the engine fire switch unlocks
- the engine FUEL CONTROL (L or R) switch fire warning light illuminates.

Engine Overheat Caution

The indications of an engine overheat are:

- the caution beeper sounds
- the master CAUTION lights illuminate
- the EICAS caution message OVERHEAT ENG (L or R) is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Fire Extinguishing

ENGINE FIRE EXTINGUISHING DIAGRAM

There are two engine fire extinguisher bottles. Either or both bottles can be discharged into either engine.

When the engine fire switch is pulled out, rotating the fire switch in either direction discharges a single extinguisher bottle into the associated engine. Rotating the engine fire switch in the other direction discharges the remaining extinguisher bottle into the same engine.

If an extinguisher bottle is discharged or has low pressure:

- the ENG BTL (1 or 2) DISCH light illuminates
- the EICAS advisory message BOTTLE (1 or 2) DISCH ENG is displayed.

APU Fire Protection

APU fire protection consists of these systems:

- APU fire detection
- APU fire extinguishing.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

APU Fire Detection

The APU compartment has dual fire detector loops. There is no APU overheat detection.

Normally, both loops must detect a fire to produce a fire warning. An APU fire warning automatically shuts down the APU.

If a fault is detected in one loop, the system automatically switches to single loop operation. If the operating loop detects a fire, an APU fire warning occurs and the APU shuts down.

The EICAS advisory message DET FIRE APU is displayed if the APU fire detection system fails.

APU Fire Warning

The indications of an APU fire warning are:

- the fire bell sounds
- the master WARNING lights illuminate
- the EICAS warning message FIRE APU is displayed
- the APU fire switch fire warning light illuminates
- the APU fire switch unlocks.

APU Fire Extinguishing

There is one APU fire extinguisher bottle. When the APU fire switch is pulled out, rotating the switch in either direction discharges the extinguisher bottle into the APU compartment. If the bottle is discharged or has low pressure:

- the APU BTL DISCH light illuminates
- the EICAS advisory message BOTTLE DISCH APU is displayed.

On the ground with both engines off an APU fire signal from either APU fire detector loop causes APU shutdown and extinguisher bottle discharge.

Main Wheel Well Fire Protection

The main wheel well has fire detection only. There is no fire extinguishing system. The nose wheel well does not have a fire detection system.

Main Wheel Well Fire Detection

The main wheel well fire detection system consists of dual fire detector loops.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Main Wheel Well Fire Warning

The indications for a main wheel well fire are:

- the fire bell sounds
- the EICAS warning message FIRE WHEEL WELL is displayed
- the master WARNING lights illuminate.

Cargo Compartment Fire Protection

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Cargo compartment fire protection consists of these systems:

- cargo compartment smoke detection
- cargo compartment fire suppression system.

Note: The bulk cargo compartment is included in the aft cargo smoke detection and fire suppression systems.

Cargo Compartment Smoke Detection

HL7574 - HL7766
The forward and aft cargo compartments each have smoke detectors. Each compartment is divided into three detection zones. If smoke is detected in any zone, a fire warning occurs.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
The forward and aft cargo compartments each have smoke detectors. Each compartment is divided into four detection zones. If smoke is detected in any zone, a fire warning occurs.

Whenever cargo compartment smoke detection is inoperative, the EICAS advisory message DET FIRE CARGO (FWD or AFT) is displayed.

Cargo Compartment Fire Warning

The indications of a cargo compartment fire are:

- the fire bell sounds
- the master WARNING lights illuminate
- the EICAS warning message FIRE CARGO (FWD or AFT) is displayed
- the CARGO FIRE (FWD or AFT) fire warning light illuminates.

Cargo Compartment Fire Suppression

HL7532 - HL7766
Five fire extinguisher bottles are installed for cargo compartment fire extinguishing. Pushing the FWD or AFT CARGO FIRE ARM switch (ARMED visible) arms the extinguishers.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Six fire extinguisher bottles are installed for cargo compartment fire extinguishing. Pushing the FWD or AFT CARGO FIRE ARM switch (ARMED visible) arms the extinguishers.

HL7532 - HL7766

In flight, pushing the CARGO FIRE DISCHARGE switch causes the immediate total discharge of two extinguisher bottles into the selected compartment. After a time delay, the remaining three extinguisher bottles discharge at a reduced flow rate into the selected compartment. If the airplane lands before all of the bottles discharge, one of the remaining bottles discharges at the reduced rate on touchdown.

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

In flight, pushing the CARGO FIRE DISCHARGE switch causes the immediate total discharge of two extinguisher bottles into the selected compartment. After a time delay, the remaining four extinguisher bottles discharge at a reduced flow rate into the selected compartment. If the airplane lands before all of the bottles discharge, one of the remaining bottles discharges at the reduced rate on touchdown.

On the ground, if a CARGO FIRE DISCHARGE switch is pushed, two extinguisher bottles discharge into the selected compartment, but only one of the remaining extinguisher bottles discharges after the time delay.

When cargo fire extinguisher bottle discharge is initiated:

- The CARGO FIRE DISCHARGE switch light illuminates when the first two extinguisher bottles begin to discharge.
- The EICAS advisory message BOTTLE DISCH CARGO is displayed when the first two extinguisher bottles have completely discharged.

HL7574 - HL7766

The SMOKE CREW REST LWR message may be displayed during descent following an aft cargo fire. Pressure differences between the aft cargo compartment and the lower crew rest compartment can cause smoke to enter the compartment.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cargo Compartment Fire Protection

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

Cargo compartment fire protection consists of these systems:

- cargo compartment smoke detection
- cargo compartment fire extinguishing or suppression.

Note: The bulk cargo compartment is included in the aft cargo fire detection and extinguishing systems.

Cargo Compartment Smoke Detection

The main deck, forward, and aft cargo compartments each have smoke detectors. Each compartment is divided into multiple detection zones, three for each lower compartment and eight for the main deck. If smoke is detected in any zone, a fire warning occurs.

Whenever cargo compartment smoke detection is inoperative, the EICAS advisory message DET FIRE CARGO (AFT, FWD, or MAIN) is displayed.

Cargo Compartment Fire Warning

The indications of a cargo compartment fire are:

- the fire bell sounds
- the master WARNING lights illuminate
- the EICAS warning message FIRE CARGO AFT, or FIRE CARGO FWD, or FIRE MAIN DECK is displayed
- the CARGO FIRE (AFT, FWD, or MAIN) fire warning light illuminates.

Lower Cargo Compartment Fire Extinguishing

Five fire extinguisher bottles are installed for lower cargo compartment fire extinguishing. Pushing the LWR FWD or LWR AFT CARGO FIRE ARM switch (ARMED visible) arms the extinguishers.

In flight, pushing the CARGO FIRE DEPR/DISCH switch causes the immediate total discharge of two extinguisher bottles into the selected compartment. After a time delay, the remaining three extinguisher bottles discharge at a reduced flow rate into the selected compartment. If the airplane lands before all of the bottles discharge, one of the remaining bottles discharges at the reduced rate on touchdown.

On the ground, if the CARGO FIRE DEPR/DISCH switch is pushed, two extinguisher bottles discharge into the selected compartment, but only one of the remaining extinguisher bottles discharges after the time delay.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When cargo fire extinguisher bottle discharge is initiated:

- The CARGO FIRE DEPR/DISCH switch DISCH light illuminates when the first two extinguisher bottles begin to discharge.
- The EICAS advisory message BOTTLE DISCH CARGO is displayed when the first two extinguisher bottles have completely discharged.

Main Deck Cargo Compartment Fire Suppression

The main deck cargo compartment is a Class E compartment. Pushing the MAIN DECK CARGO FIRE ARM switch configures one pack off and the other to a low flow mode. Subsequently pushing the CARGO DEPR/DISCH switch initiates a controlled depressurization to a cabin altitude of approximately 23,000 feet with the airplane altitude at 25,000 feet.

Crew Rest Compartment Fire Protection

HL7202 - HL7205, HL7574 - HL8347

Door 5 Upper Crew Rest Compartment Smoke Detection

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Smoke detectors are installed in the door 5 upper crew rest compartment. If smoke is detected, an aural alert sounds in the door 5 crew rest compartment. The EICAS caution message SMOKE REST UPR DR 5 indicates smoke in the compartment.

Flight Deck Crew Rest Compartment Smoke Detection

HL7202 - HL7205, HL7733 - HL8347

Smoke detectors are installed in the flight deck crew rest compartment. If smoke is detected, an aural alert sounds in the flight deck crew rest compartment. The EICAS caution message SMOKE CREW REST F/D indicates smoke in the flight deck crew rest compartment.

Lower Crew Rest Compartment Smoke Detection

HL7574 - HL7766

Smoke detectors are installed in the lower crew rest compartment. If smoke is detected, an aural alert sounds in the lower crew rest compartment. The EICAS caution message SMOKE CREW REST LWR indicates smoke in the lower crew rest compartment.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Lower Crew Rest Compartment Fire Extinguishing

HL7574 - HL7766

The lower crew rest compartment contains a manually activated fire extinguishing system. Portable fire extinguisher bottles augment this system. There is no flight deck indication of fire extinguishing system activation.

Equipment Cooling System Fire Protection

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

The equipment cooling system contains a smoke detector, but no fire extinguishing system. When smoke is detected in the equipment cooling system the EICAS caution message SMOKE EQUIP COOLING is displayed.

Refer to Chapter 2, Air Systems, for a description of the equipment cooling system.

Lavatory Fire Protection

Lavatory fire protection consists of these systems:

- lavatory fire detection
- lavatory waste container fire extinguishing.

Lavatory Fire Detection

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Each lavatory has a single smoke detector. If smoke is detected, an aural alert sounds in the lavatory and in the cabin. In addition, the lavatory call light flashes and the master call light at the associated attendant station flashes. The EICAS advisory message SMOKE LAVATORY is displayed.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The lavatory has a single smoke detector. If smoke is detected, an aural alert sounds in the lavatory and in the supernumerary area. The EICAS caution message SMOKE LAVATORY is shown.

Lavatory Fire Extinguishing

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Each lavatory has a fire extinguisher located in the waste container cabinet. Fire extinguisher operation is automatic. There is no flight deck indication.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
The lavatory has a fire extinguisher located in the waste container cabinet. Fire extinguisher operation is automatic. There is no flight deck indication.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Fire and Overheat Detection System Fault Test

The fire and overheat detection system has automatic and manual fault testing.

Fire and Overheat Detection System Automatic Fault Test

Fire and overheat detection system testing is automatic. The engine and APU systems continuously monitor the fire/overheat detector loops for faults. The cargo and wheel well systems continuously monitor for any system faults.

If a fault is detected, the system automatically reconfigures for single loop operation. Complete system failures are indicated by an EICAS advisory message for the failed system:

- DET FIRE ENG (L or R)
- DET FIRE APU
- DET FIRE CARGO (FWD or AFT)

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

- DET FIRE CARGO MAIN.

Fire and Overheat Detection System Manual Fault Test

The fire and overheat detection systems can be tested manually by pushing and holding the FIRE/OVERHEAT TEST switch.

The indications for a manual fire and overheat detection system test are:

- the fire bell sounds
- the nose wheel well APU fire warning horn sounds (on the ground)
- the EICAS warning message FIRE TEST IN PROG is displayed
- these lights illuminate:
  - the master WARNING lights
  - the LEFT and RIGHT engine fire warning lights
  - the APU fire warning light
  - the nose wheel well APU fire warning light
  - the LEFT and RIGHT FUEL CONTROL switch fire warning lights
  - the FWD and AFT CARGO FIRE warning lights

  HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

  - the MAIN CARGO FIRE warning light.

When the test is complete, the EICAS warning message FIRE TEST PASS or FIRE TEST FAIL replaces the FIRE TEST IN PROG message; the switch can be released. The appropriate system EICAS messages are displayed with the FIRE TEST FAIL message:

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- DET FIRE APU
- DET FIRE CARGO (FWD or AFT)

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

- DET FIRE CARGO MAIN
- DET FIRE ENG (L or R)
- DET FIRE WHEEL WELL
- DET OVERHEAT ENG (L or R).

All test messages clear when the test switch is released. If the switch is released with the FIRE TEST IN PROG message displayed, the test ends without completing.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Fire Protection EICAS Messages

The following EICAS messages can be displayed.

Airplane System EICAS Messages

Message	Level	Aural	Message Logic
BOTTLE 1, 2 DISCH ENG	Advisory		Engine fire extinguisher bottle 1 or bottle 2 pressure is low.
BOTTLE DISCH APU	Advisory		APU fire extinguisher bottle pressure is low.
BOTTLE DISCH CARGO	Advisory		Both rapid discharge cargo fire extinguisher bottle pressures are low.
DET FIRE FAIL APU	Advisory		APU fire detection is inoperative.
DET FIRE CARGO AFT, FWD	Advisory		Affected cargo compartment smoke detection is inoperative.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

DET FIRE CARGO MAIN	Advisory		Affected cargo compartment smoke detection is inoperative.

DET FIRE ENG L, R	Advisory		Affected engine fire detection and overheat are inoperative.
FIRE APU	Warning	Fire Bell	Fire is detected in the APU.
FIRE CARGO AFT, FWD	Warning	Fire Bell	Smoke is detected in the affected cargo compartment.
FIRE ENG L, R	Warning	Fire Bell	Fire is detected in the engine.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

FIRE CARGO MAIN DECK	Warning	Fire Bell	Smoke is detected in the Main Deck cargo compartment.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
FIRE WHEEL WELL	Warning	Fire Bell	Fire is detected in a main wheel well.
OVERHEAT ENG L, R	Caution	Beeper	Engine overheat detected.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

SMOKE EQUIP COOLING	Caution	Beeper	Smoke is detected in the equipment cooling system.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cabin System EICAS Messages

Cabin Area

Message	Level	Aural	Message Logic
HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347			
SMOKE LAVATORY	Advisory		Smoke is detected in one or more lavatories.
HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285			
SMOKE LAVATORY	Caution	Beeper	Smoke is detected in the lavatory.

Crew Rest Area

HL7202 - HL7205, HL7574 - HL8347

Message	Level	Aural	Message Logic
HL7733 - HL7766			
SMOKE CREW REST F/D	Caution	Beeper	Smoke is detected in flight deck crew rest compartment.
SMOKE CREW REST LWR	Caution	Beeper	Smoke is detected in lower crew rest compartment.
HL7202 - HL7205, HL7782 - HL8347			
SMOKE CREW REST F/D	Caution	Beeper	Smoke is detected in flight deck crew rest compartment.
HL7574 - HL7598			
SMOKE CREW REST LWR	Caution	Beeper	Smoke is detected in lower crew rest compartment.
HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347			
SMOKE REST UPR DR 5	Caution	Beeper	Smoke is detected in door 5 upper crew rest compartment.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

System Test Messages

The following messages are associated only with the manually-initiated fire test.

Message	Level	Aural	Message Logic
DET FIRE WHEEL WELL	Advisory		Wheel well fire detection system is failed.
DET OVERHEAT ENG L, R	Advisory		Affected engine overheat detection system is failed.
FIRE TEST FAIL	Warning		One or more fire/overheat detection systems have failed to successfully complete the manually initiated fire/–overheat test.
FIRE TEST IN PROG	Warning		A manually initiated fire/overheat detection system test is in progress.
FIRE TEST PASS	Warning		A manually initiated test of the fire/overheat detection system has been completed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 9.10
Thrust Asymmetry Compensation and Primary Flight Computers Controls 9.10.1
Pitch and Stabilizer Trim Systems 9.10.3
Control Wheel and Column 9.10.3
Stabilizer Trim System 9.10.4
Aileron and Rudder Trim Controls 9.10.6
Rudder/Brake Pedals 9.10.8
Speedbrake Lever 9.10.9
Flap System 9.10.10
Flap Controls 9.10.10
Flap Limit Placard 9.10.11
Normal Flap Position Indication 9.10.12
Flap Load Relief Indication 9.10.13
Non-Normal Flap and Slat Position Indication 9.10.14
Flight Control Synoptic Displays 9.10.16
Normal Flight Control Synoptic 9.10.16
Non–Normal Flight Control Synoptic 9.10.18

System Description 9.20
Introduction 9.20.1
Pilot Controls 9.20.2
Flight Control Surfaces 9.20.3
Flight Control Surface Locations 9.20.4
Actuator Control Electronics/Hydraulic Power Distribution 9.20.5
Primary Flight Control System Modes 9.20.6
Flight Control System Normal Mode 9.20.6
Flight Envelope Protection 9.20.8
Flight Control System Secondary Mode 9.20.8
Flight Control System Direct Mode 9.20.10

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal Mode Pitch Control 9.20.11
Primary Pitch Trim Control 9.20.11
Alternate Pitch Trim 9.20.12
Pitch Envelope Protection 9.20.12
Elevator Variable Feel. 9.20.13
Tail Strike Protection (As Installed) 9.20.13
Secondary and Direct Mode Pitch Control. 9.20.14
Stabilizer Hydraulic Power and Non–Normal Operation. 9.20.14
Stabilizer Shutdown 9.20.14
Stabilizer Position Indication and Green Band 9.20.15
Normal Mode Roll Control 9.20.16
Aileron Trim 9.20.16
Bank Angle Protection 9.20.16
Secondary and Direct Mode Roll Control 9.20.17
Normal Mode Yaw Control 9.20.18
Thrust Asymmetry Compensation 9.20.18
Wheel to Rudder Cross–Tie 9.20.19
Yaw Damping 9.20.19
Gust Suppression. 9.20.19
Rudder Trim 9.20.19
Secondary and Direct Mode Yaw Control 9.20.20
Spoilers. 9.20.21
Spoiler Speedbrake Operation. 9.20.21
Landing Attitude Modifier (LAM) 9.20.22
Flaps and Slats 9.20.23
Flap and Slat Sequencing 9.20.23
Flap and Slat Modes 9.20.24
Flap/Slat Load Relief 9.20.25
Autoslats 9.20.26
Flap and Slat Asymmetry Detection 9.20.26
Uncommanded Flap or Slat Motion 9.20.26
Flap Indications. 9.20.27

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Messages 9.30
Flight Control System EICAS Messages 9.30.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Thrust Asymmetry Compensation and Primary Flight Computers Controls

1 Thrust Asymmetry Compensation (THRUST ASYM COMP) Switch

AUTO – the thrust asymmetry compensation system operates automatically if a thrust asymmetry condition is detected.

OFF – disconnects the thrust asymmetry compensation system from the flight control system.

2 Thrust Asymmetry Compensation OFF Light

Illuminated (amber) – the thrust asymmetry compensation system has been automatically or manually disconnected.

3 PRIMARY FLIGHT COMPUTERS Disconnect Switch

DISC –

- disconnects the primary flight computers (PFCs) from the flight control system
- puts the flight control system in the direct mode
- AUTO can be reselected to attempt restoration of secondary or normal mode operation.

AUTO –

- the flight control system operates in the normal mode
- system faults automatically cause the system to switch to the secondary or direct modes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 PRIMARY FLIGHT COMPUTERS Disconnect (DISC) Light

Illuminated (amber) – the primary flight computers are disconnected automatically or manually and the system is in the direct mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Pitch and Stabilizer Trim Systems
Control Wheel and Column

1 Pitch Trim Switches

Spring–loaded to neutral.

Push (both switches) –

- in the normal mode in flight, changes the trim reference airspeed
- in the normal mode on the ground, moves the stabilizer
- in the secondary and direct modes, moves the stabilizer.

2 Control Wheel

Rotate – deflects the ailerons, flaperons, and spoilers in the desired direction.

Moves and remains displaced with aileron trim.

3 Control Column

Push/pull – commands the airplane to pitch in the desired direction:

- in the normal mode, deflects the elevator and horizontal stabilizer
- in the secondary and direct modes, deflects the elevator.

Does not move with pitch trim operation.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Stabilizer Trim System

1 Alternate (ALTN) PITCH TRIM Levers

Spring–loaded to neutral.

Push/pull (both levers) –

- in the normal mode, changes trim reference airspeed and moves the stabilizer directly
- in the secondary and direct modes, moves the stabilizer directly.

2 Stabilizer (STAB) Position Indicator

Indicates stabilizer position in units of trim.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Takeoff Trim Green Band

The green band indicates the allowable takeoff trim range, based on gross weight, takeoff thrust, and CG information from the FMC. When no information is available, or V1 speed is not selected or entered, the green band defaults to midrange.

If the stabilizer signal is not present or is invalid, the green band and the pointer are not displayed.

4 Stabilizer (STAB) Cutout Switches

NORM –

- hydraulic power is supplied to the related stabilizer trim control module
- if unscheduled stabilizer motion is detected, center and/or right system hydraulic power to the related stabilizer trim control module is automatically shut off.

CUTOUT – shuts off the respective center or right hydraulic system power to the related stabilizer trim control module.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Aileron and Rudder Trim Controls

1 AILERON TRIM Indicator

Indicates units of aileron trim.

2 RUDDER TRIM Indicator

Indicates units of rudder trim.

3 AILERON Trim Switches

Push (both switches) – moves the control wheel, ailerons, flaperons, and spoilers in the desired direction (spring–loaded to neutral).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 RUDDER Trim Selector

Spring–loaded to neutral.

Rotate –

- trims the rudder in the desired direction
- the trim runs at high speed with the knob rotated past the first left or right detent
- the rudder pedals move with rudder trim operation.

5 MANUAL TRIM CANCEL Switch

Push – cancels manual rudder trim in the normal and secondary flight control system modes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Rudder/Brake Pedals

1 Rudder Pedals

Push – deflects the rudder in the desired direction.

Refer to Chapter 14, Landing Gear, for brakes and nose-wheel steering description.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Speedbrake Lever

On the ground:

- the speedbrake lever moves to DOWN and all spoiler panels retract if either thrust lever is advanced to the takeoff thrust position
- the speedbrake lever moves to UP and all spoiler panels extend if either reverse thrust lever is raised to the reverse idle detent.

1 Speedbrake Lever

DOWN (detent) – all spoiler panels are retracted.

ARMED –

- the auto speedbrake system is armed
- after landing, the speedbrake lever automatically moves to UP and the spoiler panels extend.

UP – the required spoiler panels extend to their maximum in–flight or on–ground position (intermediate positions can be selected).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap System
Flap Controls

1 Flap Lever

Primary mode – positions the slats and flaps hydraulically.

Secondary mode – positions the slats and/or flaps electrically if hydraulic operation fails.

2 Flap Gates

1 – prevents inadvertent retraction of the slats.

20 – prevents inadvertent retraction of the flaps past the go–around position.

3 Alternate Flaps Arm (ALTN FLAPS ARM) Switch

Push (ALTN displayed) –

- arms the alternate flap control mode
- arms the alternate flaps selector
- disables primary and secondary flap/slat mode operation

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- asymmetry/skew and uncommanded motion protection, autoslat, and flap/slat load relief are not available
- the flap lever is inoperative.

4 Alternate Flaps Selector

RET – the slats and flaps are electrically retracted.

OFF – alternate flaps are deactivated.

EXT –

- the slats and flaps are electrically extended
- maximum extension is flaps 20, with the slats at the midrange position.

Flap Limit Placard

HL7574 - HL7766

HL7532 - HL7573

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

1 Flap Limit Placard

Flaps extended speed limits.

Normal Flap Position Indication

Displays combined flap and slat positions when all surfaces are operating normally and control is in the primary (hydraulic) mode. The indicator shows continuous motion.

The indication is no longer displayed 10 seconds after slat retraction.

1 Flap Position (white)

UP – the slats and flaps are retracted.

1 – the slats extend to the midrange position.

5, 15, and 20 –

- the slats remain in the midrange position
- the flaps extend to the commanded position.

25 – the slats extend to the fully extended position. The flaps extend to 25.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

30 – the flaps extend to 30.

Loss of position information is displayed as a white outline with no tape fill and no flap lever position indications.

2 Flap Lever Position (line and number)

Magenta – the slats or flaps are in transit to the commanded position.

Green – the slats and flaps are in the commanded position.

The line and number change color.

Flap Load Relief Indication

1 Flap LOAD RELIEF Indication

Displayed (white) –

- flap load relief is retracting the flaps, or inhibiting extension, as required to prevent air load damage due to excessive airspeed
- extension from UP is being inhibited due to either excessive airspeed or altitude.

2 Flap Lever Position

Magenta – the slats or flaps are in transit to the commanded position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Non-Normal Flap and Slat Position Indication

If any flap/slat is non–normal or if control is in the secondary mode, slat and flap positions are shown independently. Each wing is also shown separately.

Indicator motion is continuous between flap detents.

1 Expanded Flap and Slat Position Indications

The slat indication fills up (forward) for extension.

The flap indication fills down (aft) for extension.

Indication colors of outline and fill are:

- white when operating in secondary mode
- amber when the respective FLAPS DRIVE or SLATS DRIVE EICAS message is displayed.

Loss of position information is displayed as a white outline with no tape fill and no flap lever position indications.

2 Flap Lever Position (line and number)

Magenta – the slats or flaps are in transit to the commanded position.

Green – the slats or flaps are in the commanded position.

The numbers are shown next to the flap position indicator only.

3 Alternate Flap and Slat Position Indications (white)

Slat and flap extension is limited to slats midrange and flaps 20.

Displayed automatically when the alternate control mode is armed.

Slats – displays the position of the slats.

Flaps – displays the position of the flaps.

Flap position index marks – reference flaps 5 and 20.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Loss of position information is displayed as a white outline with no tape fill and no position index marks or numbers.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Control Synoptic Displays

The flight control synoptic is displayed by pushing the FCTL synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

Normal Flight Control Synoptic

1 **Spoiler Position**

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Flaperon Position

3 Aileron Position

4 Stabilizer Position

5 Rudder Position

6 Primary Flight Control System Mode

7 Elevator Position

8 Rudder Trim Position and Direction

L – Left

R – Right

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Non–Normal Flight Control Synoptic

1 Unknown Aileron Position

2 Unknown Spoiler Condition

3 Failed Control Surface or Trim Function (amber)

4 Hydraulic System Failure Indications

Green – the hydraulic system is functioning normally.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Amber – the failed hydraulic system.

5 Flight Control Mode SECONDARY or DIRECT Indication (amber)

6 Actuator Control Electronic Failure Indications

Green – the ACE is functioning normally.

Amber – the failed ACE.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The primary flight control system uses conventional control wheel, column, and pedal inputs from the pilot to electronically command the flight control surfaces. The system provides conventional control feel and pitch responses to speed and trim changes. The system electronic components provide enhanced handling qualities and reduce pilot workload.

The primary flight control system is highly redundant, with three operating modes: normal mode, secondary mode, and direct mode. The primary flight controls are powered by redundant hydraulic sources. The secondary flight controls, high lift devices consisting of flaps and slats, are hydraulically powered with an electrically powered backup system.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Pilot Controls

The pilot controls consist of:

- two control columns
- two control wheels
- two pairs of rudder pedals
- control wheel pitch trim switches
- alternate pitch trim levers
- the speedbrake lever
- the flap lever
- aileron trim switches
- rudder trim selector
- manual rudder trim cancel switch.

The columns and wheels are connected through jam override mechanisms. If a jam occurs in a column or wheel, the pilots can maintain control by applying extra force to the other column or wheel to overcome the jam. Override mechanisms are spring-loaded and will return to the jammed position when the pilots release the applied force.

The rudder pedals are rigidly connected between the two sides.

The speedbrake lever allows manual or automatic symmetric actuation of the spoilers.

The pilot controls command these system electronic components:

- four actuator control electronics (ACEs)
- three primary flight computers (PFCs).

The ACEs receive input signals from all pilot controls. The ACEs send control signals to the primary flight control surfaces. Each ACE is assigned to different actuators on the control surfaces. No single ACE controls more than one actuator on a control surface. Some ACEs are not assigned to all control surfaces.

The EICAS caution message FLIGHT CONTROLS is displayed if:

- multiple ACE and/or hydraulic system failures cause the loss of a significant number of control surfaces, or
- other flight control system faults are detected.

The ACEs can transmit pilot control inputs directly to the control surfaces, or they can send the pilot inputs to the PFCs. When the ACEs are sending pilot inputs to the PFCs, the ACEs receive control commands back from the PFCs and use the commands to position the flight control surfaces.

The PFCs use information from other airplane systems (such as air data, inertial data, flap and slat position, engine thrust, and radio altitude) to compute control surface commands for enhanced handling qualities. See Primary Flight Control System Modes in this Section for a description of these handling quality enhancements.

The autopilot also sends commands to the PFCs, which then produce control surface commands. See Chapter 4, Automatic Flight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Control Surfaces

Pitch control is provided by:

- two elevators
- a movable horizontal stabilizer.

Roll control is provided by:

- two flaperons
- two ailerons
- fourteen spoilers.

Yaw control is provided by:

- single rudder
- partial span tab.

The two elevators and horizontal stabilizer work together to provide pitch control. A detailed description of pitch control is given in a separate section later in this chapter.

The flaperons and ailerons provide roll control, assisted by asymmetric spoilers.

The flaperons are located between the inboard and outboard flaps on both wings. In the normal mode, they are used for roll control with the flaps either retracted or extended. For increased lift, the flaperons move down and aft in proportion to trailing edge flap extension.

The ailerons are located outboard of the outboard flaps on each wing. For increased lift, the ailerons move down for flaps 5, 15, and 20, to improve takeoff performance.

In the normal mode, the ailerons and spoilers 5 and 10 are locked out during high–speed flight; the flaperons and remaining spoilers provide sufficient roll control. During low speed flight, these panels augment roll control.

Yaw control is provided by a single rudder, which is almost the same height as the vertical tail. The lower portion of the rudder has a hinged section (tab) that deflects twice as far as the main rudder surface to provide additional yaw control authority. During takeoff, the rudder becomes aerodynamically effective at approximately 60 knots.

Flaps and slats provide high lift for takeoff, approach, and landing.

Symmetric spoilers are used as speedbrakes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Control Surface Locations

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Actuator Control Electronics/Hydraulic Power Distribution

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Primary Flight Control System Modes

There are three primary flight control system modes (flap and slat system modes are described later in this section):

- normal
- secondary
- direct.

All the modes use the same pilot controls and flight control surfaces.

Flight Control System Normal Mode

In normal mode during manual flight, four ACEs receive pilot control inputs and send these signals to the three PFCs. The PFCs verify these signals and information from other airplane systems in order to compute control surface commands. These commands are then sent back to the ACES. The ACES send enhanced signals to the flight control surface actuators.

When the autopilot is engaged, the autopilot system sends commands to the PFCs. The PFCs generate control surface commands, which are then sent to the ACEs in the same manner as pilot control inputs. The autopilot commands move the pilot controls to provide indications of what the autopilot is doing. If the pilot overrides the autopilot with control inputs, the PFCs disconnect the autopilot and use the pilot control inputs. The autopilot is only available during normal mode operation. Refer to Chapter 4, Automatic Flight, for autopilot operation.

After the hydraulic systems are shut down, the PFCs self–test. During the test, various EICAS alert and status messages display, trim indicator information blinks, and various failure indications display on the flight controls synoptic. When the self-test is complete, the EICAS messages disappear, and the trim indicator and synoptic display return to normal. This happens about two minutes after the EICAS caution message HYD PRESS SYS L+C+R is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal Mode

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Envelope Protection

The primary flight control system provides flight envelope protection when operating in normal mode. Flight envelope protection reduces the possibility of inadvertently exceeding the flight envelope by providing crew awareness of envelope margins through tactile, aural, and visual cues. Envelope protection does not reduce pilot control authority.

The envelope protection functions are described later in this section and include:

- stall protection
- overspeed protection
- bank angle protection.

Refer to Chapter 4, Automatic Flight, for a description of PFD flight mode annunciations, mode control panel operation, autothrottle operation, and flight envelope protection.

Refer to Chapter 10, Flight Instruments, Displays, for a description of PFD indications.

Refer to Chapter 15, Warning Systems, for a description of aural and visual cues.

Flight Control System Secondary Mode

When the PFCs can no longer support the normal mode due to internal faults or lack of required information from other airplane systems, they automatically revert to the secondary mode. The ACEs continue to receive pilot control inputs and send these signals to the three PFCs. However, the PFCs use simplified computations to generate flight control surfaces commands. These simplified commands are sent back to the ACEs, where they are sent to the control surface actuators the same way as in the normal mode.

The simplified PFC control laws used in the secondary mode affect airplane handling qualities. All flight control surfaces remain operable. The elevator and rudder are more sensitive at some airspeeds.

The following functions are not available in the secondary mode:

- autopilot
- auto speedbrakes
- envelope protection
- gust suppression
- tail strike protection (as installed)
- thrust asymmetry compensation
- yaw damping (may be degraded or inoperative).

The EICAS caution message FLIGHT CONTROL MODE is displayed when the primary flight control system is in the secondary mode. The secondary mode cannot be manually selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Secondary Mode

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Control System Direct Mode

The ACEs automatically transition to the direct mode when they detect the failure of all three PFCs or lose communication with the PFCs. The direct mode can also be manually selected by moving the PRIMARY FLIGHT COMPUTERS DISCONNECT switch to DISC.

In the direct mode, the PFCs no longer generate control surface commands. Pilot inputs received by the ACEs are sent directly to the control surface actuators.

The direct mode provides full airplane control for continued safe flight and landing. Airplane handling qualities are approximately the same as in the secondary mode. The EICAS caution message PRI FLIGHT COMPUTERS is displayed when the system is in the direct mode.

In the direct mode, the following functions are not available:

- autopilot
- auto speedbrakes
- envelope protection
- gust suppression
- tail strike protection (as installed)
- manual rudder trim cancel switch
- thrust asymmetry compensation
- yaw damping.

Direct Mode

Mechanical Backup

In the unlikely event of a complete electrical system shut–down, cables from the flight deck to the stabilizer and selected spoilers allow the pilot to fly straight and level until the electrical system is restarted.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal Mode Pitch Control

In the normal mode, airplane pitch control characteristics are like conventional airplanes, with improved handling qualities. Unlike conventional airplanes, the control column does not directly position the elevator in flight. The control column commands the PFCs to generate a pitch maneuver. The PFCs automatically position the elevator and the stabilizer to generate the commanded maneuver. The PFCs constantly monitor airplane response to pilot commands and reposition the elevator and stabilizer to carry out these commands. Airplane pitch responses to thrust changes, gear configuration changes, and turbulence are automatically minimized by PFC control surface commands.

The PFCs also provide compensation for flap and speedbrake configuration changes, and turns up to 30° of bank. The PFCs automatically control pitch to maintain a relatively constant flight path. This eliminates the need for the pilot to make control column inputs to compensate for these factors. For turns up to 30° of bank, the pilot does not need to add additional column back pressure to maintain altitude. For turns of more than 30° of bank, the pilot does need to add column back pressure.

As airspeed changes, the PFCs provide conventional pitch control characteristics by requiring the pilot to make control column inputs or trim changes to maintain a constant flight path.

In the landing flare, when performing a manual landing, the PFCs command a slight nose down pitch command to provide the landing characteristics of other Boeing airplanes. The nose down command allows the pilot to apply normal aft column force during landing flare.

Primary Pitch Trim Control

Primary pitch trim is controlled by the dual pitch trim switches on each control wheel. Both switches must be moved to command trim changes. The primary pitch trim switches are inhibited when the autopilot is engaged. Pitch trim does not move the control column.

In the normal mode, primary pitch trim operates differently on the ground than it does in flight. On the ground, the stabilizer is directly positioned when the pilot uses the pitch trim switches. In flight, the pitch trim switches do not position the stabilizer directly, but make inputs to the PFCs to change the trim reference speed. The trim reference speed is the speed at which the airplane would eventually stabilize if there were no control column inputs. Once the control column forces are trimmed to zero, the airplane maintains a constant speed with no column inputs. Thrust changes result in a relatively constant indicated airspeed climb or descent, with no trim inputs needed unless airspeed changes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When pilot trim inputs are made, the PFCs automatically move the elevators to achieve the trim change, then move the stabilizer to streamline the elevator. Stabilizer motion may also automatically occur to streamline the stabilizer and elevator for thrust and configuration changes.

Alternate Pitch Trim

Alternate pitch trim is controlled by the dual alternate pitch trim levers on the control stand. Both levers must be moved to command trim changes. These levers move the trim reference airspeed (normal mode) and also move the stabilizer (all modes). The alternate pitch trim levers are linked to the stabilizer trim control modules (STCM) via control cables, and then mechanically to the stabilizer. Alternate pitch trim commands have priority over wheel pitch trim commands in all flight control modes.

Moving the alternate pitch trim levers with the autopilot engaged does not disconnect the autopilot, but does move the stabilizer. Moving the alternate pitch trim levers during stall or overspeed protection does move the stabilizer, but does not remove column forces.

Note: The alternate pitch trim levers should not be used with the autopilot engaged, or during stall or overspeed protection.

Pitch Envelope Protection

The pitch envelope protection functions include:

- stall protection
- overspeed protection.

Stall Protection

Stall protection reduces the likelihood of inadvertently exceeding the stall angle of attack by providing enhanced crew awareness of the approach to a stall or to a stalled condition.

Stall protection limits the speed to which the airplane can be trimmed. The trim reference speed is limited by inhibiting trim in the nose up direction when the airplane slows to a speed where maneuver margin is limited. This trim inhibit speed is approximately the minimum maneuvering speed (top of the amber band) at lower altitudes, and can be 10 to 20 knots lower than the top of the amber band at higher altitudes. The pilot must apply continuous aft column pressure, at higher than normal force, to maintain airspeed below trim inhibit speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Overspeed Protection

Overspeed protection limits the speed to which the airplane can be trimmed. At VMO/MMO, overspeed protection limits the trim reference speed so that trim is inhibited in the nose down direction. The pilot must apply continuous forward column force to maintain airspeed above VMO/MMO. Use of the alternate pitch trim levers does not reduce column forces.

Elevator Variable Feel

The PFCs calculate feel commands based on airspeed. In general, control column forces increase:

- as airspeed increases for a given column displacement, or
- as column displacement increases.

Tail Strike Protection (As Installed)

During takeoff or landing, the PFCs calculate if a tail strike is imminent and decrease elevator deflection, if required, to reduce the potential for tail strike. Activation of tail strike protection does not provide feedback to the control column.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Secondary and Direct Mode Pitch Control

Airplane pitch control is different in the secondary and direct flight control modes. The control columns now command a proportional elevator deflection instead of a maneuver command. Secondary and direct modes do not provide automatic pitch compensation for:

- thrust changes
- gear configuration changes
- turbulence
- flap and speedbrake configuration changes
- turns to 30° bank angle.

In secondary and direct modes, the elevator variable feel system provides two feel force levels instead of a continuous variation with airspeed. The force levels change with flap position. With the flaps up, the feel forces provide maneuver force levels that discourage overcontrol in the pitch axis at high speeds. With flaps out of up, the feel forces decrease to provide force levels appropriate for approach and landing.

In the secondary and direct modes, both the primary pitch trim switches and the alternate pitch trim levers move the stabilizer directly. There is no trim reference speed.

Stabilizer Hydraulic Power and Non–Normal Operation

The stabilizer is powered by the center and right hydraulic systems. Stabilizer position commands from the PFCs and alternate pitch trim levers are sent to the stabilizer trim control modules, which control hydraulic power to the stabilizer. There are two modules, one for each stabilizer hydraulic source.

Stabilizer Shutdown

If uncommanded stabilizer motion is sensed, hydraulic power to the stabilizer trim control module that caused the motion is automatically shut off. If a module is inoperative due to an automatic shutdown or another failure, the EICAS advisory message STABILIZER C or STABILIZER R is displayed. The stabilizer remains operative through the remaining stabilizer trim control module.

If both stabilizer trim control modules automatically shut down or fail, the EICAS warning message STABILIZER is displayed. The STABILIZER warning is also displayed if automatic shutdown fails to stop uncommanded motion.

The center and right stabilizer cutout switches, located on the aisle stand, control hydraulic power to the respective stabilizer trim control module. Placing both switches in the CUTOUT position removes all hydraulic power from the stabilizer. The EICAS advisory message STABILIZER CUTOUT is displayed when both stabilizer cutout switches are in the CUTOUT position. The STABILIZER warning message is no longer displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

In the normal flight control mode, when the stabilizer is manually shut down or failed, pitch trim is still available. Pilot pitch trim inputs change the PFC trim reference speed. The PFCs then reposition the elevators to trim the airplane.

The control column can be used to interrupt pitch trim commands from the wheel pitch trim switches. This feature allows the pilot to quickly stop uncommanded trim changes due to stuck pitch trim switches. The pitch trim commands are interrupted if the control column is displaced in the opposing direction.

Stabilizer Position Indication and Green Band

Stabilizer position is displayed on two stabilizer position indicators located on the aisle stand. Stabilizer position is also displayed on the flight controls synoptic.

The stabilizer position indicators also display the takeoff green band indication. The green band automatically displays the acceptable range for takeoff stabilizer positions. There are three green band segments that can be illuminated for takeoff:

- the mid-band
- the nose down band (which includes the mid-band)
- the nose up band (which includes the mid-band).

The green band is calculated using the FMC inputs of CG, gross weight, takeoff thrust and V1.

A nose gear oleo pressure switch provides an automatic cross–check of the CG to ensure that the correct green band has been selected. When either the nose up or nose down band is selected, the pressure switch position is compared to the computed green band. The EICAS advisory message STAB GREENBAND is displayed if the pressure switch and the green band disagree. If the stabilizer signal is not present or is invalid, the green band and the pointer are not displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal Mode Roll Control

Roll control is similar to conventional airplanes. Aileron and flaperon surface deflections are proportional to control wheel displacement. Spoilers begin to extend to augment roll control after several degrees of control wheel rotation. Control wheel forces increase as control displacement increases. Control wheel forces do not change with airspeed changes. The ailerons are locked out at high speeds.

Spoilers 4 and 11 are mechanically controlled through a cable from the control wheel. These spoilers are available for roll control until the speedbrake lever is moved to near the UP position, when they function as speedbrakes only. Spoilers 5 and 10 are locked out at high speed.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
A maneuver load alleviation function can move spoilers and ailerons to reduce wing loads caused by pilot column inputs. This function can activate when in normal flight control mode with flaps up.

Aileron Trim

Dual aileron trim switches located on the aisle stand must be pushed simultaneously to command trim changes. Use of aileron trim causes control wheel rotation.

The amount of aileron trim is indicated on a scale on the top of each control column.

Aileron trim is inhibited when the autopilot is engaged.

Bank Angle Protection

Bank angle protection reduces the likelihood of exceeding the bank angle boundary due to external disturbances, system failures, or inappropriate pilot action.

Bank angle protection provides roll control wheel inputs when airplane bank angle exceeds the bank angle protection boundary of approximately 35°. If the boundary is exceeded, the control wheel force rolls the airplane back within 30° of bank. This roll command can be overridden by the pilot. Maximum control wheel deflection always commands maximum control surface deflection. The autopilot disengage bar disables bank angle protection.

Excessive bank angles are indicated on the PFD bank indicator. The indicator changes color to amber at bank angles exceeding 35°.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Secondary and Direct Mode Roll Control

Roll control in the secondary and direct modes is very similar to roll control in the normal mode. Bank angle protection is not available in either the secondary or direct mode. Spoilers 5 and 10 are always locked out.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal Mode Yaw Control

Yaw control operation is similar to a conventional airplane. Rudder surface deflections are proportional to rudder pedal movements.

Pedal forces increase as pedal displacement increases. Pedal forces do not change with airspeed changes.

The rudder ratio changer automatically reduces rudder deflection (for a given pedal input) as airspeed increases. This protects the vertical tail structure from stresses resulting from large rudder surface deflections at high airspeeds. Sufficient rudder authority is provided at all airspeeds to maintain airplane control in engine–out conditions, as well as during takeoffs and landings in crosswinds.

Thrust Asymmetry Compensation

The thrust asymmetry compensation (TAC) system significantly reduces uncommanded flight path changes associated with an engine failure. TAC continually monitors engine data to determine the thrust level from each engine. If the thrust level on one engine differs by 10 percent or more from the other engine, TAC automatically adds rudder to minimize yaw.

Before liftoff, TAC does not fully compensate for the failed engine so the pilot can recognize engine failure through roll/yaw cues. These roll/yaw cues are greatly reduced when compared to an airplane operating without TAC. After liftoff, TAC attempts to fully compensate for the failed engine.

The amount of rudder used is proportional to the engine thrust difference. Rudder movement is back–driven through the rudder pedals and displayed on the rudder trim indicator. Following engine failure, the pilot can trim the airplane using additional rudder trim, control wheel input, aileron trim, or autopilot engagement.

TAC is available except:

- when airspeed is below 70 knots on the ground, or
- when reverse thrust is applied, or
- when automatically disengaged due to system malfunction or loss of engine thrust data.

TAC automatically disengages if engine thrust data is lost. TAC may also disengage following severe engine damage or surge if it is unable to determine an accurate thrust level. TAC may still cause some rudder deflection in the appropriate direction just before automatically disengaging.

TAC can be manually overridden by making manual rudder pedal inputs. TAC is only available in the normal flight control mode. To manually disarm TAC, push the THRUST ASYM COMP switch on the overhead panel. If TAC is automatically or manually disconnected, the EICAS advisory message THRUST ASYM COMP displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Wheel to Rudder Cross–Tie

A wheel to rudder cross–tie function provides the capability of being able to control the initial effects of an engine failure using control wheel inputs only. Control wheel inputs can deflect the rudder up to 8 degrees.

Wheel to rudder cross–tie is operative in flight below 210 knots in the normal mode.

Yaw Damping

In the normal mode, the yaw damping function provides turn coordination and Dutch roll damping.

Gust Suppression

A gust suppression function reduces the effects of lateral gusts and improves lateral ride quality through a combination of yaw and roll commands. Operation does not result in either rudder pedal or control wheel movement.

Rudder Trim

The rudder trim control can be used to command manual rudder trim in all three flight control modes. Two rudder trim speeds are available. Low rate rudder trim is commanded by rotating the control to the detent. High rate rudder trim is commanded by rotating the control past the detent. Manual Trim Cancel switch actuation causes manually set rudder trim to move to the zero units position at the high speed trim rate. The zero position achieved by actuating the switch is not as accurate as manually trimming to zero units. The switch has no effect on rudder trim inputs from TAC.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Secondary and Direct Mode Yaw Control

Secondary and direct mode yaw control is similar to normal mode yaw control. Pedal feel forces are unchanged from normal mode; however, rudder response is slightly different.

In secondary and direct modes, the rudder ratio changer is degraded to two fixed ratios determined by flap position. With flaps up, the rudder response to pedal inputs is less than with the flaps down.

In the secondary mode:

- gust suppression is inoperative
- yaw damping is degraded (for some failures, it may be inoperative)
- thrust asymmetry compensation is inoperative.

In the direct mode the following are inoperative:

- gust suppression
- yaw damping
- the manual rudder trim cancel switch
- thrust asymmetry compensation.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Spoilers

There are 7 sets of spoilers, 5 outboard and 2 inboard of the flaperons, on the upper surface of each wing. The spoilers are numbered from left to right, 1 through 14. Spoilers on opposing wings are symmetrically paired.

Spoiler panels are used as speedbrakes to increase drag and reduce lift, both in flight and on the ground. The spoilers also supplement roll control in response to control wheel commands. Spoiler panels 5 and 10 are locked out during cruise, depending on altitude and airspeed.

All three hydraulic systems supply the spoilers. Each hydraulic system is dedicated to a different set of spoiler pairs to provide isolation and maintain symmetric operation in the event of hydraulic system failure. If a single spoiler fails, the corresponding spoiler on the other wing retracts. Failure of a single or multiple spoiler pairs causes the EICAS advisory message SPOILERS to display.

Spoiler Speedbrake Operation

The 14 spoiler panels are used as speedbrakes. In the normal mode, when used as speedbrakes, spoilers 5 and 10 are available as ground speedbrakes only. In the secondary and direct modes, spoilers 4, 5, 10, and 11 are locked out.

The speedbrake spoilers are controlled by the speedbrake lever located on the control stand. The speedbrake lever has three marked positions:

- DOWN
- ARMED
- UP.

The speedbrake lever can be placed in intermediate positions between ARMED and UP.

In the ARMED position, the speedbrake lever is driven aft to the UP position when the landing gear is fully on the ground (not tilted) and the thrust levers are at idle.

On the ground when either reverse thrust lever is moved to the reverse idle detent, the speedbrakes automatically extend. The speedbrake lever does not need to be in the ARMED position. A mechanical link between the speedbrake lever and the reverse thrust levers raises the speedbrake lever out of the DOWN detent. The speedbrake lever is then driven aft and the speedbrakes extend. If either thrust lever is advanced to a takeoff position, the speedbrake lever is driven to the down position.

Automatic speedbrakes are not available in the secondary and direct modes.

There is no limitation for extension of speedbrakes in a landing configuration.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Attitude Modifier (LAM)

Landing Attitude Modifier (LAM) is an automatic function used to increase pitch attitude and increase the nose gear height when landing flaps are selected at higher speeds. LAM increases pitch attitude by partially raising selected lateral control surfaces. This reduces the lift produced by the wing, requiring the airplane to fly at a higher pitch attitude. When LAM is active, some airframe buffet may occur. There are no crew procedures or monitoring requirements for this system and no alert messages specific to this function for any failure mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flaps and Slats

The flaps and slats are high lift devices that increase wing lift and decrease stall speed during takeoff, approach, and landing.

The airplane has an inboard and an outboard flap on the trailing edge of each wing, and one inboard and six outboard slats on the leading edge. A two–position Krueger flap provides a seal between the inboard slat and engine nacelle on each wing.

In the flaps 1 position, only the slats move. Flaps 5, 15, and 20 are takeoff flap positions. Flaps 25 and 30 are landing flaps positions. Flaps 20 is used for some non–normal landing conditions.

HL7532 - HL7766
To protect against inadvertent deployment during cruise, flap and slat extension from the UP position is inhibited when speed is more than 265 knots or altitude is above approximately 20,000 feet.

HL7202 - HL7205, HL7782 - HL8347
To protect against inadvertent deployment during cruise, flap and slat extension from the UP position is inhibited when speed is more than 275 knots or altitude is above approximately 20,000 feet.

If the flap handle is moved out of UP while the flaps are inhibited, LOAD RELIEF displays.

Flap and Slat Sequencing

When the flap lever is in the UP detent, all flaps and slats are commanded retracted. Moving the flap lever aft allows selection of flap detent positions 1, 5, 15, 20, 25 and 30. The flaps and slats sequence so that the slats extend first and retract last.

Starting from flaps UP, selection of flaps 1 commands the slats to move to the midrange position. The flaps remain retracted.

Selection of the flaps 5, 15, and 20 positions commands the flaps to move to the position selected. The slats remain in the midrange position.

Selection of flaps 25 commands both the flaps and slats to move to landing positions. First the slats extend to the fully extended position, then the flaps extend to the landing flaps 25 position.

Selection of flaps 30 commands the flaps to extend to the primary landing position.

During retraction, flap and slat sequencing is reversed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The mechanical gate at the flaps 20 detent prevents inadvertent retraction of the flaps past the go–around flap setting. The mechanical gate at flaps 1 prevents inadvertent retraction of the slats past the midrange position.

Flap and Slat Modes

Three modes of flap and slat operation are possible:

- primary (hydraulic)
- secondary (electric)
- alternate (electric).

The flaps and slats can operate independently in either the primary or secondary mode. However, independent flap and slat operation in the alternate mode is not possible.

Primary mode hydraulic power is supplied by the center hydraulic system. Secondary and alternate mode electrical power is supplied by the left and right AC busses.

The secondary mode is automatically engaged whenever the primary mode fails to move the flaps or slats to the selected position. Once engaged, the secondary mode remains engaged until the affected system surfaces are fully retracted or center hydraulic system pressure is restored.

HL7574 - HL7766
In the secondary mode, the flaps and slats are positioned by electric motors. Because autoslats are unavailable, the slats are fully extended at all flap positions (if airspeed is less than 239 knots) to improve stall handling characteristics. If airspeed exceeds 239 knots, the slats retract to the midrange position (the midrange index on the slat position indicator), or will not extend beyond the midrange position.

HL7532 - HL7573
In the secondary mode, the flaps and slats are positioned by electric motors. Because autoslats are unavailable, the slats are fully extended at all flap positions (if airspeed is less than 246 knots) to improve stall handling characteristics. If airspeed exceeds 246 knots, the slats retract to the midrange position (the midrange index on the slat position indicator), or will not extend beyond the midrange position.

HL7202 - HL7205, HL7782 - HL8347
In the secondary mode, the flaps and slats are positioned by electric motors. Because autoslats are unavailable, the slats are fully extended at all flap positions (if airspeed is less than 256 knots) to improve stall handling characteristics. If airspeed exceeds 256 knots, the slats retract to the midrange position (the midrange index on the slat position indicator), or will not extend beyond the midrange position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If the slats are in the midrange position (flaps 1 through 20) when the secondary mode is engaged, they remain in that position until the flaps are retracted to UP, or extended beyond 20.

On the ground, secondary electric mode extension or retraction is inhibited when groundspeed is less than 40 knots, center hydraulic system pressure is low, and two of the following three items are true:

- left engine N2 is less than 50 percent,
- right engine N2 is less than 50 percent,
- primary external power is available.

The alternate mode allows direct manual operation of the flaps and slats through the secondary drive electric motors. The alternate flaps ARM switch:

- disables normal control
- arms the alternate mode
- engages the electric motors
- the flap lever no longer controls flaps/slats.

The three–position alternate flaps selector extends and retracts the flaps and slats. The flaps and slats extend simultaneously, but slat retraction is inhibited until the flaps are up. Alternate mode flap and slat extension is limited to slats midrange and flaps 20. Asymmetry protection, uncommanded motion protection, autoslats, and flap/slat load relief are not available in the alternate mode.

The alternate mode must be manually selected. Slat and flap operation time in the secondary and alternate modes is greatly increased.

Flap/Slat Load Relief

In the primary mode, the flap load relief system protects the flaps from excessive air loads. If flap airspeed placard limits are exceeded with the flaps in the 15 through 30 position, LOAD RELIEF is displayed and the flaps automatically retract to a position appropriate to the airspeed. Flaps start to retract when airspeed is 1 knot higher than the flap placard airspeed. Load relief retraction is limited to flaps 5.

When airspeed is 5 knots below the flap placard airspeed for the commanded flap position, the flaps automatically re-extend. Re–extension is limited to the commanded flap position.

If a flap overspeed exists, load relief prevents flap extension beyond the 5, 15, 20, or 25 positions until airspeed is sufficiently reduced. Flap load relief is available only in the primary mode. The EICAS flap display indicates an in–transit flap condition and shows actual flap position. The flap lever does not move during flap load relief operation. Load relief for slats is not required in the primary or alternate modes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7574 - HL7766
Slat load relief is available in the secondary mode. If airspeed exceeds 239 knots with the slats fully extended, they retract to midrange and LOAD RELIEF is displayed.

HL7532 - HL7573
Slat load relief is available in the secondary mode. If airspeed exceeds 246 knots with the slats fully extended, they retract to midrange and LOAD RELIEF is displayed.

HL7202 - HL7205, HL7782 - HL8347
Slat load relief is available in the secondary mode. If airspeed exceeds 256 knots with the slats fully extended, they retract to midrange and LOAD RELIEF is displayed.

Autoslats

The autoslat system enhances airplane stall characteristics. Upon receiving a signal from the stall warning system, the slats automatically extend from the midrange position to the fully extended landing position. The slats retract a few seconds after the signal is removed. Slats are fully extended to improve stall handling characteristics.

Autoslat operation is armed at flaps 1, 5, 15 and 20 and is available only in the primary slat mode.

Flap and Slat Asymmetry Detection

A detection system detects asymmetrical extension or retraction of an individual flap. After detection, the flap drive shuts down and the EICAS message FLAPS DRIVE is displayed.

A detection system detects slat asymmetry. Loss of all but the most outboard slats on each wing is also detected. When slat loss or asymmetry occurs, the system shuts down the slat drive and displays the SLATS DRIVE EICAS message.

Uncommanded Flap or Slat Motion

Uncommanded motion is detected when the slats or flaps:

- move away from the commanded position
- continue to move after reaching a commanded position
- or move in a direction opposite to that commanded.

If the flap or slat is operating in the primary mode, uncommanded motion first causes an automatic transfer to the secondary mode. The EICAS message FLAPS PRIMARY FAIL or SLATS PRIMARY FAIL is displayed. If motion continues, the system shuts down. The EICAS message FLAPS DRIVE or SLATS DRIVE is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flap Indications

Flap position indications are displayed on the primary EICAS display. A single vertical indicator displays combined flap and slat position. The position commanded by the flap lever is also displayed. Ten seconds after all flaps and slats are up, the entire indication is no longer displayed.

If flap/slat control is in the secondary or alternate mode, or if any non–normal condition is detected, an expanded flap indication is displayed automatically. The position of the left and right flaps and slats are separately indicated. In the alternate mode, the position commanded by the flap lever is replaced by flap position index marks at all flap and slat positions, and numbers at flaps 5 and flaps 20. The index marks are used as a guide to position the flaps to the desired setting.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Control System EICAS Messages

Note: Configuration (CONFIG) warning messages are described in Chapter 15, Warning Systems.

The following EICAS messages can be displayed.

Message	Level	Aural	Message Logic
AUTO SPEEDBRAKE	Advisory		A fault is detected in the automatic speedbrake system.
FLAPS DRIVE	Caution	Beeper	Flap drive mechanism has failed.
FLAPS PRIMARY FAIL	Caution	Beeper	Flaps are operating in the secondary mode.
FLAP/SLAT CONTROL	Caution	Beeper	Flap/slat electronics units are inoperative.
FLIGHT CONTROL MODE	Caution	Beeper	Flight control system is operating in the secondary mode.
FLIGHT CONTROLS	Caution	Beeper	Multiple flight control surfaces are inoperative or other flight control system faults are detected.
FLT CONTROL VALVE	Advisory		One or more flight control valves are failed closed or one or more flight control shutoff switches are in SHUTOFF.
PITCH DOWN AUTHORITY	Caution	Beeper	Pitch down authority is limited.
PITCH UP AUTHORITY	Caution	Beeper	Pitch up and flare authority is limited.
PRI FLIGHT COMPUTERS	Caution	Beeper	Flight control system is operating in the direct mode.
SLATS DRIVE	Caution	Beeper	Slat drive mechanism has failed.
SLATS PRIMARY FAIL	Caution	Beeper	Slats are operating in the secondary mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
SPEEDBRAKE ARMED	Memo		Speedbrakes are armed.
SPEEDBRAKE EXTENDED	Caution	Beeper	Speedbrakes are extended and one or more of these occur: • The radio altitude is between 15 and 800 feet • The flap lever is in a landing setting • A thrust lever is not at idle
SPOILERS	Advisory		One or more spoiler pairs are inoperative.
STAB GREENBAND	Advisory		Nose gear pressure switch disagrees with computed stabilizer green band.
STABILIZER	Warning	Siren	Uncommanded stabilizer motion is detected or stabilizer is inoperative.
STABILIZER C	Advisory		Center stabilizer control path is inoperative.
STABILIZER CUTOUT	Advisory		Both stabilizer cutout switches are in CUTOUT.
STABILIZER R	Advisory		Right stabilizer control path is inoperative.
THRUST ASYM COMP	Advisory		Thrust asymmetry compensation is inoperative.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 10.10
Primary Flight Display (PFD) 10.10.1
PFD Indications 10.10.1
PFD Airspeed Indications 10.10.2
PFD Reference Speeds 10.10.4
PFD Attitude Indications 10.10.6
PFD Steering Indications 10.10.7
PFD Radio Altitude Indications 10.10.8
PFD Navigation Performance Indications 10.10.9
PFD Instrument Landing System Indications 10.10.11
PFD Expanded Localizer Indications 10.10.13
PFD Altitude Indications 10.10.14
PFD Landing Altitude/Minimums Indications 10.10.15
PFD Barometric Indications 10.10.16
PFD Vertical Speed Indications 10.10.18
PFD Heading/Track Indications 10.10.18
PFD Failure Flags 10.10.20
Navigation Display (ND) 10.10.21
ND Map Mode 10.10.21
Centered Map Mode 10.10.23
ND Grid Heading Display 10.10.24
ND Navigation Performance Indications 10.10.25
ND Weather Radar System Display Indications 10.10.26
ND Approach Mode 10.10.28
ND VOR Mode 10.10.29
ND Plan Mode 10.10.30
ND Failure Indications and Flags 10.10.30
ND Failure Messages 10.10.30
ND Failure Flags 10.10.31
Ground Maneuver Camera System 10.10.32

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EFIS Control Panels 10.10.33
EFIS Control Panel PFD Controls 10.10.33
EFIS Control Panel ND Controls 10.10.35
Instrument Source Select Panels 10.10.37
Heading Reference and Inboard Displays 10.10.38
Inboard Display Controls 10.10.38
Heading Reference Controls 10.10.39
Display Select Panel (DSP) 10.10.40
Cursor Control Device (CCD) 10.10.42
Cursor Control Device (CCD) 10.10.43
Display Brightness Controls 10.10.45
Forward Panel Brightness Controls 10.10.45
Center Panel Brightness Controls 10.10.46
Standby Flight Instruments 10.10.47
Integrated Standby Flight Display (ISFD) 10.10.48
Standby Magnetic Compass 10.10.51
Clock 10.10.52
Chronograph 10.10.55
Time/Date/Elapsed Time Display 10.10.56
EFIS Control Panels and Display Select Panel (DSP) – CDU Alternate Control 10.10.57
CDU EFIS/DSP Control Selection 10.10.57
EFIS Control CDU Pages 10.10.58
Display Select CDU Pages 10.10.62

System Description 10.20
Introduction 10.20.1
Display Selection and Control 10.20.1
Inboard Display Selectors 10.20.1
EFIS Control Panels 10.20.2
Display Select Panel 10.20.2
Display Brightness Control 10.20.4
Instrument Display Source Selection 10.20.4

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display Selection and Control Examples 10.20.4
Ground Maneuver Camera System 10.20.10
Cursor Control Devices (CCD) 10.20.10
CCD Touch Pad 10.20.11
CCD Cursor Location Control 10.20.11
Standby Flight Instruments 10.20.12
Integrated Standby Flight Display (ISFD) 10.20.12
Standby Magnetic Compass 10.20.13
Radio Altimeter (RA) 10.20.13
Clock 10.20.13
Display System Information Sources 10.20.14
Air Data Inertial Reference System (ADIRS) 10.20.14

Primary Flight Displays (PFDs) 10.30
Introduction 10.30.1
Airspeed 10.30.1
Ground Speed 10.30.2
Altitude 10.30.2
Vertical Speed 10.30.3
Attitude 10.30.3
Steering Indications 10.30.3
Radio Altitude 10.30.4
Instrument Landing System Indications 10.30.4
Approach Minimums 10.30.4
Heading/Track Indications 10.30.5
Engine Fail, GPWS, and PWS Alerts 10.30.5
Typical PFD Displays 10.30.5
PFD Takeoff Display 10.30.6
PFD Climb Display 10.30.8
PFD Cruise Display 10.30.10
PFD Descent Display 10.30.12
PFD Approach Display 10.30.14

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Landing Display 10.30.16

Navigation Displays. 10.40

Introduction 10.40.1

Map Mode 10.40.1

Navigation Data Points 10.40.1

VOR and Approach Modes 10.40.1

Plan Mode. 10.40.1

ND Information 10.40.2

Heading 10.40.2

Track 10.40.2

Traffic 10.40.2

Weather Radar. 10.40.2

Failure Flags and Messages 10.40.2

Typical ND Map Displays 10.40.2

ND Expanded Map Displays. 10.40.3

ND Symbology 10.40.10

Electronic Checklist Displays. 10.50

Normal Checklist 10.50.1

Non-Normal Checklist Queue 10.50.3

Non-Normal Checklist 10.50.4

Checklist Timer 10.50.5

Operational Note 10.50.6

Conditional Line Item 10.50.8

Deferred Line Item 10.50.10

Inhibit Checklist Line Item. 10.50.12

Checklist Override 10.50.13

Checklists Menu Page 10.50.14

Resets Page. 10.50.16

Electronic Checklist Description 10.60

Introduction 10.60.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Electronic Checklist Operation 10.60.1
Checklist Pages 10.60.1
Checklist Status 10.60.2
Checklist Line Items 10.60.2
Action Items 10.60.3
Closed Loop Action Items 10.60.3
Open Loop Action Items 10.60.3
Operational Notes 10.60.3
Conditional Line Items 10.60.4
Open Loop Conditional Line Items 10.60.4
Closed Loop Conditional Line Items 10.60.4
Inhibit Checklist Line Items 10.60.5
Deferred Line Items 10.60.5
Timers 10.60.6
Checklist Menu Operation 10.60.6
Normal Menu 10.60.6
Non-Normal Menu 10.60.6
Resets Page 10.60.7
Checklist Priority 10.60.7
Normal Checklists 10.60.7
Normal Checklist Access 10.60.7
Normal Checklist Completion 10.60.8
Incomplete Normal Checklist Alerting 10.60.8
Non-Normal Checklists 10.60.9
Non-Normal Checklist Access and Checklist Icon 10.60.9
Non-Normal Unannunciated Checklists 10.60.10
Non-Normal Checklist Completion 10.60.10
Hidden Non-Normal Checklist Alerting 10.60.10
Latched Non-Normal Checklists 10.60.11
Checklist Resets 10.60.11
Normal Checklist Automatic Reset Conditions 10.60.11
Normal Checklist Manual Resets 10.60.11
Non-Normal Checklist Manual Resets 10.60.12

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Manual Reset All. 10.60.12
Overrides 10.60.12
Item Override 10.60.12
Checklist Override 10.60.12
Electronic Checklist System Inoperative 10.60.13

Electronic Flight Bag (EFB). 10.65
Introduction 10.65.1
Display Unit 10.65.2
Display Description. 10.65.4
Main Menu (Typical) 10.65.7
Airport Maps (Typical) 10.65.12
IDENT page (Typical) 10.65.19
SYSTEM page (Typical). 10.65.22
Documents (Typical). 10.65.24
Performance (Typical) 10.65.27
Video Surveillance (Typical) 10.65.33
Pilot Utilities Application (PUA) 10.65.37
Enroute Moving Map (Typical) 10.65.39
DATA LOAD 10.65.51

EICAS Messages 10.70
Flight Instruments, Displays EICAS Messages 10.70.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Primary Flight Display (PFD)
PFD Indications

LEFT AND RIGHT FORWARD PANELS

1 Flight Mode Annunciations

Refer to Chapter 4, Automatic Flight.

2 Attitude, Steering, and Miscellaneous Indications

Displays Air Data Inertial Reference System (ADIRS) attitude information.

3 Airspeed/Mach Indications

Displays ADIRS airspeed information and other airspeed related information.

4 Autopilot, Flight Director System Status

Refer to Chapter 4, Automatic Flight.

5 Altitude Indications

Displays ADIRS altitude and other altitude–related information.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

6 Vertical Speed Indication

Displays ADIRS vertical speed and other vertical speed information.

7 Heading and Track Indications

Displays current ADIRS heading, track and other heading information.

PFD Airspeed Indications

HL7202 - HL7573, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Selected Speed

Displays the airspeed/Mach selected in the mode control panel MCP IAS/MACH window (refer to Chapter 4, Automatic Flight).

Displays the FMC–computed airspeed/Mach when the MCP IAS/MACH window is blank.

2 Speed Trend Vector

Indicates predicted airspeed in ten seconds based on current acceleration or deceleration.

3 Current Airspeed

Indicates current ADIRS airspeed.

The box around the current airspeed indication turns amber when airspeed is below minimum maneuvering speed.

4 Current Mach

Displays current ADIRS Mach at or above 0.40.

5 Maximum Speed

Indicates maximum permissible airspeed as limited by the lowest of the following:

- Vmo/Mmo
- landing gear placard speed, or
- flap placard speed.

6 Maximum Maneuvering Speed

When displayed, indicates maneuver margin to high speed buffet. Bottom of the bar is the airspeed that provides 1.3 g maneuver capability (or an alternative approved maneuver capability as preset by maintenance). Bar may be displayed when operating at high altitude at relatively high gross weights.

Note: 1.3 g maneuver capability occurs at 40 degrees of bank in level flight.

7 Speed Bug

Points to the airspeed/Mach selected in the MCP IAS/MACH window.

Points to FMC–computed airspeed when the MCP IAS/MACH window is blank.

The bug is five knots in height.

When the selected speed is off scale, the bug is parked at the top or bottom of the tape, with only one half the bug visible.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7573, HL7782 - HL8347

8 Current Ground Speed

Displays ground speed when Mach number is less than 0.40.

When a transition occurs between the display of ground speed and Mach number, the new display is highlighted with a white box for 10 seconds.

PFD Reference Speeds

1 Takeoff Reference Speeds

Displays the takeoff reference speeds V1, VR (displays R if VR is within 4 knots of V1 or V2), and V2, selected on the CDU (refer to Chapter 11, Flight Management, Navigation):

- displayed for takeoff
- NO V SPD is displayed if V speeds are not selected on the CDU
- V1 is displayed at the top of the airspeed indication when selected and if the value is off the scale
- V1 and VR are removed at lift–off
- V2 is removed on climb–out:
  - when flap retraction begins, or
  - after 10 minutes have passed without flap lever movement, or
  - after VREF has been selected (for a turn–back).

2 Flap Maneuvering Speeds

Indicates flap maneuvering speed for flap retraction or extension.

Not displayed above approximately 20,000 feet altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

To prevent clutter, a flap maneuvering speed is not shown if within 4 knots of VREF.

3 Landing Reference Speed

Displays the VREF speed as selected on the CDU (refer to Chapter 11, Flight Management, Navigation).

VREF speed is displayed at the bottom of the airspeed indication when the value is off the scale.

4 Minimum Maneuvering Speed

Indicates maneuver speed margin to stick shaker or low speed buffet. Top of the bar is the airspeed that provides:

- 1.3 g maneuver capability to stick shaker with flaps down.
- 1.3 g maneuver capability to stick shaker or VREF + 80, whichever is less, with flaps up at or below 20,200 FT.
- 1.3 g maneuver capability to low speed buffet (or an alternative approved maneuver capability as preset by maintenance), with flaps up above 20,200 FT.

Displayed with first flap retraction after takeoff.

Note: 1.3 g maneuver capability occurs at 40 degrees of bank in level flight.

5 Minimum Speed

Indicates the airspeed where stick shaker activates.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Attitude Indications

1 Bank Pointer

Indicates:

- ADIRS bank in reference to the bank scale
- direction towards wings level

Fills and turns amber if bank angle is 35 degrees or more.

2 Slip/Skid Indication

Displaces beneath the bank pointer to indicate slip or skid.

Fills white at full scale deflection.

Turns amber if bank angle is 35 degrees or more; fills amber if the slip/skid indication is also at full deflection.

3 Pitch Limit Indication

Indicates pitch limit (stick shaker activation point for existing flight conditions). Limited to a maximum of +30 degrees.

Displayed when the flaps are not retracted, or at slow speeds with the flaps retracted.

4 Horizon Line and Pitch Scale

Indicates the ADIRS horizon relative to the airplane symbol.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Pitch scale is in 2.5 degree increments.

5 Bank Scale

Fixed reference for the bank pointer.

Scale marks are at 0, 10, 20, 30, 45, and 60 degrees.

6 Airplane Symbol

Indicates airplane attitude with reference to the ADIRS horizon.

PFD Steering Indications

Note: Refer to Chapter 15, Warning Systems, for TCAS Steering Indications and Time Critical Warnings.

1 Flight Director Pitch and Roll Bars

Indicates flight director pitch and roll steering commands.

Refer to Chapter 4, Automatic Flight.

2 Flight Path Vector (FPV)

Displays flight path angle and drift angle if:

- FPV is selected on the EFIS control panel, or
- FPA (flight path angle) is selected on the MCP.

Flight path angle is displayed relative to the horizon line.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Drift angle is represented by the perpendicular distance from the centerline of the pitch scale to the FPV symbol.

3 Selected Flight Path Angle (FPA)

Indicates the selected flight path angle when FPA is selected on the MCP.

PFD Radio Altitude Indications

1 Radio Altitude

Displays radio altitude below 2500 feet AGL.

The display box is highlighted in white for 10 seconds when passing below 2500 feet.

Turns amber when below radio altitude minimums.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Navigation Performance Indications

HL7202 - HL7205, HL7782 - HL8347

Navigation Performance Scales display when LNAV, VNAV, or TO/GA are active modes or when LNAV is armed. Vertical scales do not display during cruise with VNAV PTH active.

1 Navigation Source Reference

Displays the source of navigation performance for the navigation scales.

The lateral scale source is shown first, followed by the vertical scale source. Possible combinations are:

- ILS
- LOC/VNAV – Localizer with VNAV deviation
- LNAV/ G/S – LNAV deviation with glideslope
- LNAV/VNAV – LNAV and VNAV deviation

2 Anticipation Cue

Represents the relative position of the path for the selected and activated approach.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Deviation Pointer

Indicates the position of the FMC course relative to the airplane.

Pointer:

- unfilled magenta symbol when parked at deflection limit
- filled magenta when not parked at deflection limit
- indicates relative position from the annunciated navigation source
- flashes for ten seconds if pointer migrates into bar area for more than five seconds

4 Deviation Scale

Indicates RNP for the active phase of flight.

Deviation:

- bars represent Actual Navigation Performance (ANP)
- area between bars indicates margin available to remain within Required Navigation Performance (RNP) criteria
- ANP bars and scale turn amber if pointer migrates into bar area for more than five seconds.
- ANP bars and scale turn amber when LNAV is in the armed mode and the NAV UNABLE RNP message is displayed.

If ANP equals RNP the:

- bars meet in the middle
- bars turn amber
- NAV UNABLE RNP EICAS message displays

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Instrument Landing System Indications

HL7202 - HL7205, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7766

1 Approach Reference

HL7202 - HL7205, HL7782 - HL8347
Displays the selected ILS identifier or frequency, approach front course, ILS DME distance, and source annunciation.

HL7532 - HL7766
Displays the selected ILS identifier or frequency, approach front course, and ILS DME distance.

If the tuned ILS frequencies disagree, the frequency turns amber with an amber horizontal line through it.

If the approach courses in the ILS receivers disagree, the course turns amber with an amber horizontal line through it.

2 Localizer Pointer and Scale

The localizer pointer:

- indicates localizer position relative to the airplane
- is in view when the localizer signal is received
- fills in solid when within 2 1/2 dots from the center.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The scale is in view after the frequency is tuned.

At low radio altitudes, with the autopilot or flight director engaged, the scale turns amber and the pointer flashes to indicate excessive localizer deviation.

At low altitudes, with LNAV engaged and LOC armed, the localizer scale turns amber and the pointer flashes if the localizer is not captured.

3 Marker Beacon Indication

The marker beacon indication appears flashing when over one of the marker beacon transmitters:

- IM – an airway or inner marker beacon
- MM – a middle marker beacon
- OM – an outer marker beacon.

The indication flashes in cadence with the beacon identifier.

4 Glideslope Pointer and Scale

The glideslope pointer:

- indicates glideslope position relative to the airplane, and:
  - is in view when the glideslope signal is received
  - fills in solid when within 2 1/2 dots from the scale center.

The scale is in view after the frequency is tuned.

At low radio altitudes, with the autopilot or flight director engaged, the scale turns amber and the pointer flashes to indicate excessive glideslope deviation.

PFD Expanded Localizer Indications

1 Expanded Localizer Scale

Displays when the autopilot or flight director is in LOC mode and the airplane is close to the runway center line. Provides a more sensitive display.

A rectangle equals 1/2 dot deviation.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Altitude Indications

1 Selected Altitude Bug

Indicates the altitude set in the MCP altitude window.

When the selected altitude is off scale, the bug is parked at the top or bottom of the tape, with only one half the bug visible.

2 Selected Altitude – Meters

Displayed when MTRS is selected on the EFIS control panel MTRS switch.

Indicates selected altitude in meters (selected in feet in the MCP altitude window).

Displays in 10 meter increments.

3 Selected Altitude

Displays the altitude set in the MCP altitude window.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The selected altitude box is highlighted in white between 900 feet and 200 feet prior to reaching the selected altitude.

4 Current Altitude – Meters

Displayed when MTRS is selected on the EFIS control panel MTRS switch.

Displays altitude in meters.

5 Current Altitude

Indicates current ADIRS altitude.

PFD Landing Altitude/Minimums Indications

1 BARO Minimums Pointer

When BARO minimums are displayed, the number is also represented as a pointer and line on the altitude scale.

HL8043 - HL8077
When RADIO minimums are displayed, there is no line associated with the pointer.

Turns steady amber when the airplane descends below baro minimums.

2 Landing Altitude Indication

The crosshatched area indicates the FMC landing altitude for the destination runway or airport.

Indicates the landing altitude for the departure runway or airport until 400 NM or one–half the distance to the destination, whichever occurs first.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Minimums Reference

Displays BARO when the EFIS control panel MINS reference selector is set to BARO.

HL7202 - HL8042, HL8208 - HL8347
Displays RADIO when the EFIS control panel MINS reference selector is set to RADIO (no corresponding pointer or line on the altitude scale).

HL8043 - HL8077
Displays RADIO when the EFIS control panel MINS reference selector is set to RADIO (no corresponding line on the altitude scale).

Turns amber and flashes for 3 seconds when the airplane descends below selected minimum altitude.

4 Minimums

Displays the approach minimums altitude set using the EFIS control panel MINS selector:

- BARO minimums are feet MSL
- RADIO minimums are radio altitude feet AGL.

Turns amber and flashes for 3 seconds when the airplane descends below selected minimum altitude.

5 Landing Altitude Reference Bar

Indicates the height above touchdown.

White bar – 500 to 1000 feet above landing altitude.

Amber bar – 0 to 500 feet above landing altitude.

PFD Barometric Indications

1 Barometric Setting

Indicates the barometric setting selected on the EFIS control panel barometric selector.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

STD is displayed when STD is selected on the EFIS control panel barometric STD switch.

Display is boxed and changes to amber if a barometric setting is selected, MCP altitude is above transition altitude, and airplane climbs more than 300 feet above transition altitude; or if STD is selected, MCP altitude is below transition flight level, and airplane descends more than 300 feet below transition flight level.

2 Barometric Reference

Indicates the barometric setting units selected on the EFIS control panel barometric reference selector:

- IN is inches of mercury
- HPA is Hectopascals.

3 QFE Altitude Reference

Indicates QFE altitude reference selected on the CDU APPROACH REF page.

When selected, QFE is boxed for 10 seconds.

The altitude tape is shaded green during QFE operation.

When QNH is selected, the green shading is removed; QNH is displayed for 10 seconds, then blanks.

4 Autopilot/Flight Director Barometric Source

L or R indicates that the left or right EFIS control panel is the barometric setting reference for the autopilot or flight director (the same indication is displayed on both PFDs).

Displayed when a flight director switch is ON or the autopilot is engaged.

- F/D – one turned on and one not on determines L or R
- F/D – both on – L is displayed
- A/P – first one pushed on determines L or R.

5 Preselected Barometric Setting

A barometric setting can be preselected when STD is displayed.

The preset barometric setting is selected on the EFIS control panel barometric selector and is displayed below STD.

6 QFE

When STD is selected, a small QFE appears when QFE is selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Vertical Speed Indications

1 Vertical Speed Pointer

Indicates current vertical speed.

2 Selected Vertical Speed Bug

Indicates the speed selected in the MCP vertical speed window with the V/S pitch mode engaged.

3 Vertical Speed

Displays vertical speed when greater than 400 feet per minute.

The display is located above the vertical speed indication when climbing and below when descending.

PFD Heading/Track Indications

Note: The selected track bug and selected heading bug are not displayed at the same time.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Current Heading Pointer

Indicates current heading.

2 Selected Track Bug (MCP Selection)

The selected track bug is displayed on the inside of the compass rose.

If selected track exceeds display range, the bug parks on the side of the compass rose in the direction of the shorter turn to the track.

3 Track Line

Indicates the current track.

4 Selected Heading/Track (MCP Selection)

Digital display of the selected heading or track bug.

5 Selected Heading/Track Reference (MCP Selection)

When HDG (heading) is selected, an H is displayed.

When TRK (track) is selected, a T is displayed.

6 Selected Heading Bug (MCP Selection)

The selected heading bug is displayed on the outside of the compass rose.

If selected heading exceeds display range, the bug parks on the side of the compass rose in the direction of the shorter turn to the heading.

7 Heading/Track Reference

Displays the automatic or manually selected heading/track reference:

- MAG (magnetic north)
- TRU (true north).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Failure Flags

Note: PFD failure flags replace the appropriate display to indicate source system failure, or lack of computed information.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Navigation Display (ND)

Note: Refer to the Navigation Display section of this chapter for a detailed explanation of the ND symbology shown on the following pages.

ND Map Mode

Expanded Map Mode

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Centered Map Mode

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

ND Grid Heading Display

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ND Navigation Performance Indications

HL7202 - HL7205, HL7782 - HL8347

1 Lateral Path Deviation

A digital value is displayed below the airplane symbol to show the lateral deviation (in NM) when an active path is defined. The numeric value is followed by an R or L to indicate the airplane position relative to the path.

If map range is greater than 10NM or deviation is 10NM or greater, the lateral deviation is rounded to the nearest 0.1NM.

If map range is 10NM and deviation is less than 10NM, the lateral deviation is rounded to the nearest 0.01NM.

2 Lateral RNP / ANP

Digital display (in NM) of the RNP and ANP. The RNP can be changed on the CDU RNP PROGRESS page 4.

Normally green, changes to amber when ANP exceeds RNP.

3 Vertical Path Deviation

Digital vertical path deviation (in feet) displays when value exceeds 20 feet.

4 Vertical Path Deviation Band

Band is centered on VNAV path pointer and represents current vertical RNP.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 Vertical RNP /ANP

Digital vertical deviation values (in feet). RNP can be changed on the CDU RNP PROGRESS page 4.

ND Weather Radar System Display Indications

HL7532 - HL7598

HL7202 - HL7205, HL7733 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 TCAS/Weather Radar Range Arcs

Three range arcs in place of the range scale tics on map when TCAS, weather radar, or terrain is selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ND Approach Mode

ND
EXPANDED APPROACH MODE

CENTERED APPROACH MODE

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ND VOR Mode

Reference VOR Receiver

Reference VOR Frequency or Ident

Reference VOR Course

Reference VOR DME

Selected Course Pointer

Course Deviation Indication and Scale

TO/FROM Indication

ND
EXPANDED VOR MODE

Selected Course Pointer

Course Deviation Indication and Scale

TO/FROM Indication

Track Line

CENTERED VOR MODE

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ND Plan Mode

ND Failure Indications and Flags
ND Failure Messages

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Excess Data

The amount of map information sent to the primary display system is too great to display.

2 MAP/WXR Range Disagree

The selected range and range of display information disagree.

Map information is removed.

ND Failure Flags

Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate. Flag location varies, depending on the ND mode selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Ground Maneuver Camera System

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Camera (CAM) Display Switch

Push – displays the main and nose landing gear on the selected MFD.

2 CAMERA LTS Switch

ON – turns on lights to illuminate the main and nose landing gear. The nose gear must be down and locked, and the BEACON light switch must be ON for the camera lights to operate.

3 Ground Maneuver Camera System Display

The main and nose landing gear are displayed on the selected MFD when the CAM display switch is pushed.

4 Main Landing Gear Location Stripes

The main landing gear location stripes, located on the tops of the wings, are directly above the outside of the main gear wheels. The stripes assist the pilot in locating the main gear wheels in adverse lighting conditions.

EFIS Control Panels

The left EFIS control panel controls the left PFD and ND. The right EFIS control panel controls the right PFD and ND.

EFIS Control Panel PFD Controls

1 Minimums (MINS) Reference Selector (outer)

RADIO – selects radio altitude as the PFD minimums reference.

BARO – selects barometric altitude as the PFD minimums reference.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Minimums (MINS) Selector (middle)

Rotate (slew)– adjusts the PFD radio or baro minimums altitude.

3 Minimums Reset (MINS RST) Switch (inner)

Push –

- resets the PFD minimums alert display
- blanks the minimums display when green.

4 Flight Path Vector (FPV) Switch

Push – displays the PFD flight path vector.

5 Meters (MTRS) Switch

Push – displays PFD altitude meters indications.

6 Barometric Standard (BARO STD) Switch (inner)

Push –

- selects the standard barometric setting (29.92 inches Hg/1013 HPA) for the PFD barometric reference
- if STD is displayed, selects the preselected barometric setting
- if no preselected barometric setting is displayed, displays the last value before STD was selected.

7 Barometric (BARO) Selector (middle)

Rotate (slew) – adjusts the PFD barometric reference.

8 Barometric (BARO) Reference Selector (outer)

IN – selects inches of mercury as the PFD barometric reference.

HPA – selects Hectopascals as the PFD barometric reference.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EFIS Control Panel ND Controls

1 ND Mode Selector (outer)

Selects the desired ND map display.

APP –

- displays localizer and glideslope information in heading–up format
- displays reference ILS receiver, ILS frequency or identification, course, and DME
- weather radar, TCAS, and terrain are not displayed in CTR APP mode.

VOR –

- displays VOR navigation information in heading–up format
- displays reference VOR receiver, VOR frequency or identification, course, DME, and TO/FROM indication
- weather radar, TCAS, and terrain are not displayed in CTR VOR mode.

MAP –

- displays FMC–generated route and map information, airplane position, heading, and track
- displays waypoints, including the active waypoint, within the selected range
- displays VNAV path deviation.

PLN –

- displays a non-moving, true north–up, route depiction
- the airplane symbol represents actual airplane position
- allows route step–through using the CDU legs page
- weather radar, TCAS, and terrain are not displayed in PLN mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 ND Center (CTR) Switch (inner)

Push –

- displays the full compass rose (centered) for APP, VOR, and MAP modes
- subsequent pushes alternate between expanded and centered displays.

3 VOR/ADF Switches

Displays VOR or ADF information on the respective ND.

VOR – displays the VOR pointer, VOR frequency or identification and associated DME information in all modes except PLAN.

OFF – removes VOR and ADF displays.

ADF – displays the ADF pointer and ADF frequency or identification in all modes except PLAN.

4 Map Switches

The map switches:

- displays selected detailed ND data
- displays can be selected simultaneously
- second push removes the data.

WXR (weather radar) – turns the weather radar on and off, and displays weather radar information (refer to Chapter 11, Flight Management, Navigation). Also displays range information when in the expanded APP or VOR modes.

STA (station) –

- displays high and low altitude navigation aids, if the ND range selector is in the 10, 20 or 40 NM range
- displays high altitude navigation aids, if the ND range selector is in the 80, 160, 320, or 640 NM range.

WPT (waypoint) – displays waypoints, if the ND range selector is in the 10, 20 or 40 NM range.

ARPT (airport) – displays airports on all ranges.

DATA – displays the FMC estimated time of arrival, altitude at each waypoint, and altitude constraints at each waypoint.

POS (Position) –

- displays ADIRU and GPS positions
- displays VOR raw data radials extended from the nose of the airplane to the stations displayed on the CDU NAV RAD page.

TERR (terrain) – displays terrain data. (Refer to Chapter 15, Warning Systems.)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 ND Range Selector (outer)

Selects the desired ND nautical mile range scale.

6 ND Traffic (TFC) Switch (inner)

Push – displays TCAS ND information. (Refer to Chapter 15, Warning Systems.) Also displays range information when in the expanded APP or VOR modes.

Instrument Source Select Panels

The instrument source switches are provided for use if a display–related failure is not detected by automatic system monitors. Normally, the display system automatically reconfigures for failures without the pilot having to use these switches.

1 Navigation (NAV) Source Switch

Off – normal position (CDU not visible, switch out):

- with the FMC selector in AUTO, the active FMC provides the information to generate the ND map
- if both FMCs fail, the CDU provides navigation data.

CDU – non–normal position (CDU visible, switch in). The selected CDU generates the ND map. Normally, the sources are:

- left ND map – left CDU
- right ND map – right CDU.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Display Control (DSPL CTRL) Source Switch

Off – normal position (ALTN not visible, switch out):

- automatically selects display processing channels for the left outboard and inboard, or right outboard and inboard display pairs
- reconfigures display processing channels as required for display unit or processing channel failures.

ALTN – non–normal position (ALTN visible, switch in). An alternate display processing channel is selected to replace the current display processing channel.

3 Air Data / Attitude (AIR DATA/ATT) Source Switch

Off – normal position (ALTN not visible, switch out):

- the ADIRU provides air data and attitude information to the PFD and ND
- Alternate sources or the SAARU are automatically selected to replace ADIRU air data or attitude, as required.

ALTN – non–normal position (ALTN visible, switch in). The PFD and ND alternate air data/attitude source is selected as follows:

- air data (captain): SAARU single channel
- air data (first officer): ADIRU single channel
- attitude (captain and first officer): SAARU.

4 Center Display Control (DSPL CTRL) Source Switch

Same as the display control source switches for the left and right inboard and outboard display units, except this switch controls the upper center and lower center display units.

Heading Reference and Inboard Displays
Inboard Display Controls

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 INBOARD Display (DSPL) Selector

Selects what is displayed on each inboard display unit.

PFD – displays the PFD, blanks the PFD on the outboard display unit, and inhibits selections made from the display select panel.

NAV – displays the ND and inhibits selections made from the display select panel.

MFD – displays the selection made on the display select panel.

EICAS –

- displays EICAS
- inhibits most selections made from the display select panel (limited ENG, FUEL, and AIR displays can be selected)
- blanks the upper center display unit.

Note: The PFD automatically appears on an inboard display unit if the adjacent outboard display unit fails, regardless of switch position.

Heading Reference Controls

1 Heading Reference (HDG REF) Switch

Pushing alternately selects the heading reference for the PFDs, NDs, AFDS, and FMCs.

NORM –

- normally references magnetic north
- automatically references true north when north of 82°N latitude (or north of 73°N between 80°W and 170°W) or south of 82°S latitude (or south of 60°S between 120°E and 160°E) for PFDs, NDs, and FMCs.
- provides no reference for AFDS roll modes other than LNAV when north of 82°N latitude (or north of 73°N between 80°W and 170°W) or south of 82°S latitude (or south of 60°S between 120°E and 160°E).

TRUE – references true north regardless of latitude.

When the AFDS roll mode is HDG SEL, switching the heading reference switch from NORM to TRUE or TRUE to NORM engages the HDG HOLD mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When the AFDS roll mode is TRK SEL, switching the heading reference switch from NORM to TRUE or TRUE to NORM engages the TRK HOLD mode.

Display Select Panel (DSP)

HL7574 - HL7766, HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Display Lights

Illuminates to show the display unit the display select panel controls.

2 Display Switches

Pushing the switch displays the associated display. Pushing the same switch a second time blanks the display or (left and right inboard display units) redisplays the ND if there is only one page of messages. If there are more than one page of messages, pushing STAT pages through the messages.

ENG – secondary engine EICAS (Ch. 7).

STAT – status page:

- hydraulic system indications (Ch. 13)
- APU indications (Ch. 7)
- oxygen system indications (Ch. 1)
- status messages for dispatch determination (Ch. 15).

CHKL – checklist (this chapter).

COMM – communications (Ch. 5).

NAV – navigation display (this chapter).

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
CAM – ground maneuver camera system (this chapter).

3 Multifunction Display (MFD) Switches

Selects the active MFD (left inboard, lower center, or right inboard display unit) for display selection.

The appropriate left or right INBOARD DISPLAY selector must be in the MFD or EICAS position. The other display select panel switches determine what is displayed on the selected MFD.

4 Synoptic Switches

Pushing the switch displays the associated synoptic. Synoptics present a simplified view of system status as an aid for crew situational awareness. Pushing the same switch a second time blanks the display or (left and right inboard display units) redisplays the ND.

ELEC – electrical system (Ch. 6).

HYD – hydraulic system (Ch. 13).

FUEL – fuel system (Ch. 12).

AIR – air systems (Ch. 2).

DOOR – doors (Ch. 1).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GEAR – landing gear and brake systems (Ch. 14).

FCTL – flight control system (Ch. 9).

5 Cancel/Recall (CANC/RCL) Switch

Refer to Warning Systems, Chapter 15.

Cursor Control Device (CCD)

HL7532 - HL7743

The left CCD controls the left inboard and lower center display unit cursor position and operation.

The right CCD controls the right inboard and lower center display unit cursor position and operation.

The left CCD is shown; the right CCD is similar, except the cursor select switch and the LWR CTR switches are located on the opposite side of the CCD.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Cursor Location Lights

The associated annunciator light illuminates to indicate which display unit is selected.

2 Cursor Location Switches

Selects the display unit where the cursor appears (inboard or lower center display) and automatically deselects the previous display unit.

3 Touch Pad

Finger movement on the touch pad moves the cursor on the selected display. Lifting the finger off the pad and putting it back down in a different location (except the corner areas) does not move the cursor. The cursor only moves when the finger is moved on the touch pad surface.

Corner areas – placing a finger in one of the four corners puts the cursor in that respective corner of the screen. Moving the cursor into a corner region without lifting the finger from the pad does not have this effect.

4 Cursor Select Switch

Push – activates the area of the screen that the cursor is currently in, such as a menu item or command button. The area is highlighted by a white border to indicate it can be selected.

The switch is used to select menus, checklists, checklist steps, and other functions.

Cursor Control Device (CCD)

HL7202 - HL7205, HL7750 - HL8347

The left CCD controls the left inboard, left side, and lower center display unit cursor position and operation.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The right CCD controls the right inboard, right side, and lower center display unit cursor position and operation.

The left CCD is shown; the right CCD is similar, except the cursor select, SIDE, and LWR CTR switches are located on the opposite side of the CCD.

1 Cursor Location Lights

The associated annunciator light illuminates to indicate which display unit is selected.

2 Cursor Location Switches

Selects the display unit where the cursor appears (side, inboard, or lower center display) and automatically deselects the previous display unit.

3 Touch Pad

Finger movement on the touch pad moves the cursor on the selected display. Lifting the finger off the pad and putting it back down in a different location (except the corner areas) does not move the cursor. The cursor only moves when the finger is moved on the touch pad surface.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Corner areas – placing a finger in one of the four corners puts the cursor in that respective corner of the screen. Moving the cursor into a corner region without lifting the finger from the pad does not have this effect.

4 Cursor Select Switch

Push – activates the area of the screen that the cursor is currently in, such as a menu item or command button. The area is highlighted by a white border to indicate it can be selected.

The switch is used to select menus, checklists, checklist steps, and other functions.

Display Brightness Controls
Forward Panel Brightness Controls

The left panel is shown.

1 Outboard Display (OUTBD DSPL) Brightness Control

Rotate – adjusts the brightness of the outboard display unit.

2 Inboard Display (INBD DSPL) or (INBD DSPL/WXR) Brightness Control (outer)

Rotate – adjusts the brightness of the inboard display unit.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7574 - HL7766, HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

3 Inboard Display (INBD DSPL) or (INBD DSPL/WXR) Brightness Control (inner)

Rotate – adjusts weather radar or terrain display brightness on the inboard display unit.

Weather radar and terrain data cannot be displayed at the same time.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

3 Inboard Display (INBD DSPL) Brightness Control (inner)

Rotate – adjusts weather radar, terrain display, or ground maneuver camera display brightness on the inboard display unit.

Only one function can be displayed at a time.

Center Panel Brightness Controls

1 Upper Display (UPR DSPL) Brightness Control

Rotate – adjusts the brightness of the upper center display unit.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Lower Display (LWR DSPL) or (LWR DSPL/WXR) Brightness Control (outer)

Rotate – adjusts the brightness of the lower center display unit.

HL7574 - HL7766, HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

3 Lower Display (LWR DSPL) or (LWR DSPL/WXR) Brightness Control (inner)

Rotate – adjusts weather radar or terrain display brightness on the lower center display unit.

Weather radar and terrain data cannot be displayed at the same time.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

3 Lower Display (LWR DSPL) Brightness Control (inner)

Rotate – adjusts weather radar, terrain display, or ground maneuver camera brightness on the lower center display unit.

Only one function can be displayed at a time.

Standby Flight Instruments

The standby flight instruments include the:

- integrated standby flight display
- standby magnetic compass

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Integrated Standby Flight Display (ISFD)

Provides an independent source of attitude, airspeed, and altitude information.

1 Approach (APP) Switch

Push -

- when blank, selects APP
- when APP displayed, selects BCRS
- when BCRS displayed, blanks.

2 Approach Mode Annunciation

Indicates approach mode selected.

Blank - no approach deviation data displayed.

APP - ILS localizer and glideslope deviation data displayed.

BCRS (back course) - reverses sensing for localizer pointer during back course approaches.

3 Attitude Display

Displays airplane attitude.

Indicates bank in reference to the bank scale.

Indicates the horizon relative to the airplane symbol.

Beyond 30 degrees pitch, large red arrowheads (V-shaped) indicate the attitude has become excessive and the direction to the horizon line.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Display Brightness Switches

Push -

- + increases display brightness
- - decreases display brightness.

5 Airplane Symbol

Indicates airplane position with reference to the horizon.

6 Airspeed Indications

Indicates airspeed when above 30 knots.

7 Attitude Reset (ATT RST) Switch

Push and hold at least two seconds -

- aligns horizon with the airplane symbol
- reset takes approximately ten seconds
- starts new initialization sequence if previous attempt failed (ground only).

8 Hectopascal/Inch (HP/IN) Switch

Push - changes units of barometric reference.

9 Barometric Setting

Indicates the barometric setting selected with the barometric selector.

STD is displayed when selected with the barometric selector.

10 Ambient Light Sensor

Automatically adjusts display intensity for ambient lighting condition.

11 Glideslope Pointer and Scale

The glideslope pointer indicates glideslope position relative to the airplane -

- the pointer is in view when the glideslope signal is received
- the scale is in view when the APP mode is selected
- the pointer and scale are removed when the BCRS mode is selected.

12 Current Altitude

13 Localizer Pointer and Deviation Scale

The localizer pointer indicates localizer position relative to the airplane -

- the pointer is in view when the localizer signal is received
- the scale is in view when either the APP or BCRS mode is selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

14 Barometric Selector (BARO)

Rotate - changes barometric setting.

Push -

- selects standard barometric setting (29.92 inches Hg/1013 HPA)
- if STD displayed, selects the preselected barometric setting.

15 Heading Indication

Displays airplane heading.

ISFD Messages

1 Attitude Messages

Indicates attitude display status.

ATT:RST (amber) - attitude must be reset using the attitude reset switch.

ATT 10s (amber) - 10 second attitude realignment in progress.

WAIT ATT (amber) - indicates temporary self-correcting loss of attitude.

2 Initialization message

INIT 90s (amber) - countdown of 90 second initialization -

- countdown stops if excessive motion is detected
- countdown resumes when motion stops
- ATT:RST displays if initialization is not complete within six minutes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ISFD Failure Flags

Failure flag replaces appropriate display.

OUT OF ORDER indicates instrument system failure.

ISFD

Standby Magnetic Compass

CENTER POST ABOVE GLARESHIELD

1 Standby Magnetic Compass

Displays magnetic heading.

2 Standby Magnetic Compass Correction Card

Provides appropriate heading corrections.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Clock

HL7532 - HL7783, HL8208 - HL8218, HL8250 - HL8252

1 Chronograph (CHR or CLOCK) Switch

Push – subsequent pushing starts, stops, resets the chronograph.

2 Chronograph Pointer

Indicates chronograph seconds.

3 Elapsed Time (ET) Selector

Controls the elapsed time function.

RESET – returns ET display to zero (spring loaded to HLD).

HLD (hold) – stops the elapsed time display.

RUN – starts the elapsed time display.

4 Time/Date Selector

MAN (Manual) – the clock is manually set to a time and date.

UTC – the clock is automatically set to the UTC date and time.

Push –

- alternately displays the day–month, then year in the time/date window
- subsequent selection displays only the time in the time/date window.

5 Time/Date Window

Displays time (hours, minutes) when time is selected on the time/date selector.

Alternately displays day–month and year when date is selected on the time/date selector.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

6 Elapsed Time (ET)/Chronograph (CHR) Window

Displays elapsed time (hours, minutes) or chronograph minutes.

The chronograph display replaces the elapsed time display.

Elapsed time continues to run in the background and will be displayed after the chronograph is reset.

7 Clock Set Selector

Sets the time and date when the time/date selector is set to manual.

HD (hours, day) –

- advances hours when time is selected on the time/date selector
- advances days when date is selected on the time/date selector.

MM (minutes, month) –

- advances minutes when time is selected on the time/date selector
- advances months when date is selected on the time/date selector.

HLDY (hold, year) –

- stops the time indicator and sets the seconds to zero when time is selected on the time/date selector
- advances years when date is selected on the time/date selector.

RUN – starts the time indicator.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

1 CLOCK

Coordinated Universal Time (UTC)

- displays in hours, minutes, and seconds
- displays dashes if no information available
- UTC sources are GPS or AIMS (if GPS is unavailable)

2 CLOCK SWITCH

Push - alternately selects chronograph (CHR) reset/start/stop and return to elapsed time (ET).

Chronograph:

- displays in minutes and seconds
- available if GPS is unavailable
- not available in PLAN mode

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Elapsed Time:

- displays in hours and minutes
- begins advancing at lift-off
- stops advancing at touchdown
- resets to zero:
  - at initial power-up, or
  - when both Fuel Control switches moved to Run, or
  - at lift-off

Chronograph

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

1 CLOCK Switch

Push - alternately selects chronograph (CHR) reset/start/stop and deselects display.

- displays in hours, minutes, and seconds
- analog dial and sweep second hand
- displays dashes if no information available
- chronograph available if GPS is unavailable
- chronograph not available in PLAN mode

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Time/Date/Elapsed Time Display

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

Located on lower right corner of the status (STAT) display.

1 Status Page Indications

Dashed lines are displayed if information is not available.

Elapsed time:

- displays in hours and minutes
- begins advancing at lift-off
- stops advancing at touchdown
- resets to zero:
  - at initial power-up, or
  - when both Fuel Control switches moved to Run, or
  - at lift-off

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EFIS Control Panels and Display Select Panel (DSP) – CDU Alternate Control

The CDU provides an alternate way to control the functions of the EFIS control panel and/or the display select panel.

Note: The control callouts on the following pages correspond to the control names on the EFIS control panels and the display select panel. Explanations of the CDU functions are the same as on the related control panels.

CDU EFIS/DSP Control Selection

1 EFIS Control (CTL) Select Key

Transfers control of the EFIS from the EFIS control panel to the CDU (left EFIS control panel transfers to the left CDU, right EFIS control panel transfers to the right CDU).

2 EFIS Page Select Key

Selects the EFIS CONTROL page when EFIS control is on.

3 Display Select Panel Control (DSP CTL) Select Key

Transfers control of the display select panel control from the display select panel to the CDU.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Display Select Panel (DSP) Page Select Key

Selects the DISPLAY SELECT PANEL CONTROL page when the DSP control is on.

EFIS Control CDU Pages

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EFIS Control Page

1 Barometric (BARO) SET

Valid entry is reference barometric setting.

- entries of 22.00 to 32.00 or 2200 to 3200 display as IN (inches of mercury)
- entries of 745 to 1084 display as HPA (hectopascals)
- entry of "I" to change the displayed value to IN
- entry of "H" to change the displayed value to HPA
- entry of "S" or "STD" displays 29.92 IN or 1013 HPA (depending on units being displayed on BARO SET line) and displays STD on the PFD.

2 Radio (RAD) or Barometric (BARO) Select (SEL)

- Push - alternately selects RAD (radio altimeter) or BARO (barometric altimeter) as the minimums reference on the PFD. Selected mode displays in large green font.

3 Minimums (MINS) SET

- Entered minimums display on respective PFD.
- BARO selected in 2L, valid entries are -101 to 15000 feet.
- RAD selected in 2L, valid entries are -20 to 999 feet.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Minimums (MINS) RESET

Push - resets the minimums alert on the PFD.

5 RANGE Increase (INCR)

Push - increases ND nautical mile range scale.

6 RANGE Decrease (DECR)

Push - decreases ND nautical mile range scale.

7 MODE

Push - selects desired ND display.

8 Center (CTR)

Push - alternately displays centered and expanded APP, VOR, and MAP modes.

9 OPTIONS

Push - displays EFIS OPTIONS page.

EFIS Options Page

1 WXR, POS, MTRS, FPV, TFC, TERR, WPT, STA, ARPT, DATA

Push - selects respective PFD/ND options.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 ADF/VOR

Push - sequentially selects ADF, VOR, or OFF for the pointer display on the ND. Selected mode displays in large green font.

ADF - displays the ADF pointers and frequency on the ND in all modes except PLAN.

VOR - displays the VOR pointer, frequency, and associated DME on the ND in all modes except PLAN.

OFF - removes ADF and VOR data from the ND.

3 CONTROL

Push - selects EFIS CONTROL CDU page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display Select CDU Pages

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display Modes Page

1 SEL DISPLAY

Push - selects display to be used.

2 EICAS

Push - selects EICAS display mode.

3 MODE

Push - selects display mode.

4 CANC/RCL

Push - cancels/recalls EICAS messages. Refer to Warning Systems, Chapter 15.

5 SYNOPTICS

Push - selects DISPLAY SYNOPTICS page

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display Synoptics Page

1 SEL DISPLAY

Push - selects display to be used.

2 Synoptics

Push - selects desired synoptic.

3 MODES

Push - selects DISPLAY MODES page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The flight instruments and displays supply information to the flight crew on six flat panel liquid crystal display units:

- Captain and First Officer primary flight display (PFD)
- Captain and First Officer navigation display (ND)
- the engine indication and crew alerting system (EICAS)
- the multifunction display (MFD).

Detailed information on the following subjects is found in other sections of this chapter:

- PFD – Section 30
- ND – Section 40
- Electronic Checklist – Sections 50 and 60.

HL7202 - HL7205, HL7750 - HL8347

- Electronic Flight Bag - Section 65.

Display Selection and Control

During normal operations:

- the inboard display selectors are set to MFD
- PFDs are displayed on the two outboard display units
- NDs are displayed on the two inboard display units
- EICAS is displayed on the upper center display unit
- the lower center display unit is blank. The secondary engine display is the default display at power-up.

Inboard Display Selectors

The inboard display selectors are used to select PFD, ND (NAV position), MFD, or EICAS displays on the inboard display units.

The normal position is MFD. With MFD selected, ND information is displayed on the inboard display units if NAV is selected on the display select panel (refer to Display Select Panel in this section).

In the ND, PFD, and EICAS positions, only the selected displays can appear on the inboard display units.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

With MFD selected on the inboard display selector, the following ND and EFIS control logic applies:

- if both pilots have an ND on the inboard displays, then each EFIS control panel controls its corresponding ND display
- if there is an ND display on one inboard display unit and on the lower center display unit, then the pilot who does not have an ND on the inboard display unit controls the ND on the lower center display unit
- if neither pilot has an ND display on the inboard display unit, and there is an ND display on the lower center display unit, then the left EFIS control panel controls the lower center display unit
- if both pilots have an ND display on the inboard display unit, and there is an ND on the lower center display unit, then the left EFIS control panel controls the left inboard display unit and the lower center display unit. The ND on the left inboard and the lower center display units are identical.

EFIS Control Panels

The EFIS control panels control display options, mode, and range for the respective PFDs and NDs. Refer to the PFD and ND sections of this chapter.

If an EFIS control panel fails, the displays can be controlled through the related CDU. This CDU capability is available at all times, but inhibits inputs from the respective EFIS control panel.

Display Select Panel

The display select panel controls the MFD format on the left and right inboard display units and the lower center display unit. The selected display is indicated by the illuminated annunciator light on the display select panel (L INBD, R INBD, LWR CTR).

HL7574 - HL7766, HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
After a display unit is selected, the appropriate display is selected (ENG, STAT, ELEC, HYD, FUEL, AIR, DOOR, GEAR, FCTL, CHKL, COMM, or NAV).

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
After a display unit is selected, the appropriate display is selected (ENG, STAT, ELEC, HYD, FUEL, AIR, DOOR, GEAR, FCTL, CAM, CHKL, COMM, or NAV).

A new display selection automatically replaces the previous one. A second selection of the same display for the lower center display unit blanks the display. A second selection of the same display on either inboard display causes display of the ND. If there is more than one page of messages, pushing STAT pages through the messages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Pushing the COMM or CHKL switch for either inboard display unit shows the selected display. The cursor automatically appears on the selected display.

Display select panel control is also available through any CDU. This capability is available at all times. Once display select panel control is selected on one CDU, it cannot be selected on the other two CDUs.

When used as an MFD, the lower center display unit and the two inboard display units can display the following displays:

- ND (NAV switch)
- status page (STAT switch)
- secondary engine EICAS (ENG switch)
- system synoptics (ELEC, HYD, FUEL AIR, DOOR, GEAR, FCTL switches)
- communications pages (COMM switch)
- electronic checklist (CHKL switch)

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

- ground maneuver camera system display (CAM switch)

When an inboard display selector is in the PFD position, new displays selected from the display select panel to that inboard display are inhibited. The annunciator light above the associated display select panel switch is also inhibited.

When an inboard display selector is in the EICAS position, only the ENG, AIR, and FUEL switches can affect the display. Pushing one of those switches causes the display of the respective compacted blocks of information on the EICAS display. The cancel/recall switch operates normally. Refer to these chapters for more information on compact EICAS displays:

- Chapter 2, Air Systems
- Chapter 7, Engines, APU
- Chapter 12, Fuel.

The inboard display selectors have no effect on the inboard displays if an outboard display unit fails; the PFD automatically moves to the inboard display unit regardless of the position of the inboard display selector.

Upper center display unit failure automatically switches the EICAS display to the lower center display unit. A subsequent EICAS selection on either of the inboard display selectors brings the EICAS display to that inboard display unit, and assuming no latched condition exists, the lower center display unit initially displays secondary engine instruments. Following this initial display configuration, the lower center display unit can be used in its usual MFD mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display Brightness Control

The MASTER BRIGHTNESS control provides simultaneous brightness adjustment for all displays and panel lighting. Also, each display unit has an individual control with limited range control when master brightness is on, and full range control when master brightness is off.

Two remote light sensors, located left and right on the top of the glareshield, measure brightness in the forward field of view and adjust the overall display brightness as required. Individual sensors on the front of each display unit also affect display brightness. The CDUs, mode control panel displays, standby flight instruments, and aisle stand panel displays are also controlled by the automatic display brightness control system.

Note: If display brightness cannot be set as desired when master brightness is on, pushing the MASTER BRIGHTNESS switch off may allow setting display brightness to an appropriate level using individual brightness controls.

Instrument Display Source Selection

The display system automatically reconfigures to compensate for most faults. The instrument display source select panels provide manual switches for the pilots to use if certain faults are not corrected automatically.

Instrument source select switches provide alternate information sources for the PFDs and NDs. These switches provide automatic source selection when in the off position (switch out, with the ALTN and CDU switch annunciations not visible).

If there is an undetected source failure (a display is missing or parts of a display appear faulty), the non–normal (ALTN or CDU) position provides the capability for manual selection of PFD and ND sources.

Undetected display source failures, such as missing/faulty display information or intermittent display blanking, may not result in automatic switching. The CDU position of the NAV switch or the ALTN position of the DSPL CTRL or AIR DATA/ATT switches provide the capability to manually select PFD and ND sources.

A center display control source switch is provided for the center displays.

Display Selection and Control Examples

The following examples show display selections.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal Display Configuration

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display Unit Failure Automatic Switching

1. If an outboard display unit fails, the PFD automatically moves to the inboard display unit. The INBOARD DISPLAY selector and the display select panel no longer have any control over that inboard display unit.
2. If the upper center display unit fails, the EICAS display automatically moves to the lower center display unit.

Pushing the ENG display switch switches EICAS between primary and compacted modes if no pop-up condition is active.
The display select panel can still display compact engine, air and fuel synoptics. The CANCEL/RECALL switch operates normally.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Inboard Display Switching

1. The left INBOARD DISPLAY selector is set to PFD. With an INBOARD DISPLAY selector in any position other than MFD, the selector position alone determines what is displayed on the display unit. The left inboard display cannot display any selections made on the display select panel.
2. The left outboard display blanks and the PFD moves to the left inboard display unit.
3. The left EFIS control panel controls the PFD.
4. The right INBOARD DISPLAY selector is set to EICAS. The right inboard display cannot display selections made on the display select panel, except for compact engine, air and fuel synoptics, and the CANCEL/RECALL switch functions.
5. The upper center display blanks and the EICAS display moves to the right inboard display unit. Now there is no ND visible. Either pilot could use the display select panel to display an ND on the lower center display unit (refer to the following pages).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display Select Panel MFD Selection

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EFIS Control Panel Multiple ND Control

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Ground Maneuver Camera System

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The ground maneuver camera system provides the flight crew with views of the nose gear and main gear areas during taxi operations.

The system has three cameras. The cameras supply a color image to a three–way split screen display on any multifunction display (MFD).

The nose landing gear camera is on the lower side of the fuselage. The nose landing gear camera video is displayed on the upper section of the MFD ground maneuver camera display.

The left and right main landing gear cameras are on the leading edges of the respective horizontal stabilizer. The left and right main landing gear camera video is displayed on the lower section of the ground maneuver camera display. The system automatically compensates for approximately 80 percent of stabilizer movement to keep the cameras pointed correctly.

A black stripe is painted on the top of each wing to provide guidance when the tires are in shadow. The outboard edge of each stripe corresponds to the location of the outboard tire faces on each main landing gear.

The camera windows are heated to prevent the formation of ice, frost, or condensation from blocking the camera view. Window heat operates automatically when the cameras are operating.

The camera (CAM) display switch on the display select panel (DSP) is pushed to display the ground maneuver camera system video on a multifunction display (MFD). The system is powered whenever airplane DC electrical power is available.

Ground maneuver camera lights can be turned on with the CAMERA LTS switch on the overhead panel. The BEACON switch must be on and the nose landing gear down for the camera lights to operate. The lights are located on the outboard flap track fairing of each wing and on the aft side of the nose landing gear strut.

Cursor Control Devices (CCD)

The CCDs provide control of the display cursor.

For detailed information on the following subjects, refer to:

- Chapter 5, Communications
- the Electronic Checklist sections in this chapter

HL7202 - HL7205, HL7750 - HL8347

- the Electronic Flight Bag section in this chapter

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

CCD Touch Pad

The CCD uses a touch pad. Touching the pad translates the touch location coordinates to the affected display, placing a cursor at those coordinates on the selected display.

The cursor moves relative to finger movement across the touch pad. Except for the four corners of the touch pad, lifting the finger off the touch pad and touching a different location does not move the cursor. Only finger motion in contact with the touch pad moves the cursor.

Touching a corner immediately places the cursor in the corresponding corner of the display. This helps the pilot quickly locate the cursor and speeds access to the selections at the four corners of the display.

CCD Cursor Location Control

Selecting a menu, communications, or checklist function requires the use of the cursor location switches.

If a new function is selected on an inboard display that requires a communication, checklist, or maintenance function, then the system automatically selects the respective cursor control device to that display.

If a new function requiring a cursor is selected on the lower center display, then the system automatically selects the CCD not currently being used on an inboard display to the lower center display. If neither cursor is in use, it selects the CCD cursor that was previously displayed on the lower center display. Cursor selection defaults to the left CCD on power–up.

The cursor location light above the switch illuminates to indicate the selected display unit.

Selecting a display where there is no function requiring a cursor has no effect. For example, if the inboard display does not display a communications or checklist page, pushing an INBD cursor location switch has no effect on the selected inboard display.

Only one CCD can access a given display at a time. The last pilot who selects the cursor on the selected MFD has control. The other cursor disappears from the display and the cursor location light on that CCD extinguishes. The cursors are visually different so the pilots know who is currently in control of the cursor on a display.

If both pilots are accessing the same checklist or communications functions on different displays, both are forced to the same page, with that page controlled by the pilot with cursor control.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Standby Flight Instruments

The standby flight instruments include:

- integrated standby flight display
- standby magnetic compass.

Integrated Standby Flight Display (ISFD)

HL7733 - HL7783, HL8208 - HL8217
The ISFD displays attitude, airspeed, altitude, ILS, and magnetic heading information. The ISFD receives airspeed and altitude from a dedicated pitot and static air data module. Attitude information is provided by internal inertial sensors. ILS information is provided by the center ILS receiver. The display receives its heading information from the same source as the captain's primary flight display. Heading information is not available in polar regions.

HL7202 - HL7598, HL8005 - HL8077, HL8218 - HL8347
The ISFD displays attitude, airspeed, altitude, ILS, and heading information. The ISFD receives airspeed and altitude from a dedicated pitot and static air data module. Attitude information is provided by internal inertial sensors. ILS information is provided by the center ILS receiver. The display receives its heading information from the same source as the captain's primary flight display. In non-polar regions, the ISFD displays magnetic heading. In polar regions, the ISFD displays true heading with TRU displayed on the left side of the compass rose.

Note: The standby magnetic compass must be used to validate heading information.

The left flight control DC bus powers the ISFD. The left flight control DC bus is initially powered when the main ac busses are powered and remains powered with the main busses out. Ten seconds after receiving power, a 90 second initialization sequence begins. ATT and INIT 90s messages display during initialization. Initialization will stop if airplane movement is excessive and will resume when airplane movement is acceptable for initialization. Upon completion of the initialization sequence, attitude information displays.

Detection of a momentary out-of-limit ISFD condition may cause the attitude display to blank and the WAIT ATT or ATT:RST message to display. When the ATT:RST message displays, pushing the Attitude Reset switch resets the horizon line with the airplane symbol.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

On the ground, pushing the Attitude Reset switch must be accomplished with the airplane stationary. In flight, pushing the Attitude Reset switch must be accomplished with the airplane in wings level, non-accelerated flight. During attitude reset, the ATT 10s message displays. Failure to maintain straight and level flight for 10 seconds may result in an ATT:RST message. If attitude reset is unsuccessful, the ATT:RST message remains displayed and the attitude will not be displayed.

Standby Magnetic Compass

A standard liquid–damped magnetic standby compass is provided. A card located near the compass provides heading correction factors.

Radio Altimeter (RA)

The radio altimeter measures airplane altitude above terrain. Radio altitude is displayed on the PFD.

There are three radio altimeter systems: left, center, and right. If all three radio altimeter systems are inoperative or degraded, the RA flag is displayed on the PFD. The radio altimeter systems send data to:

- autopilot flight director
- autothrottle
- GPWS
- TCAS
- weather radar
- primary flight control system

Clock

HL7532 - HL7783, HL8208 - HL8218, HL8250 - HL8252

A clock is located on each forward panel. Each clock displays airplane information management system (AIMS) generated UTC time and date, or manually set time and date. The AIMS UTC time comes from the global positioning system (GPS). In addition to time, the clocks also provide alternating day-month and year, elapsed time, and chronograph functions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

Clock information is displayed on the lower left and right corners of each PFD. GPS generated UTC time and date are displayed on the lower right corner. Elapsed time and chronograph are displayed on the lower left corner. The CLOCK switch alternately selects activation of the chronograph (reset/start/stop) and return to elapsed time. Elapsed time begins advancing at lift-off and stops advancing at touchdown. Elapsed time is reset to zero at initial power-up, or when both FUEL CONTROL switches are moved to RUN on the ground, or at lift-off.

The STATUS page also provides UTC time, day-month-year, and elapsed time.

Display System Information Sources
Air Data Inertial Reference System (ADIRS)

The ADIRS provides:

- primary, secondary and standby air data
- inertial reference information.

The major components of the ADIRS are:

- one air data inertial reference unit (ADIRU)
- one secondary attitude air data reference unit (SAARU)
- eight air data modules
- six static ports
- three pitot probes
- two angle–of–attack vanes
- one total air temperature probe.

Air Data Inertial Reference Unit (ADIRU)

The ADIRU is the primary source for speed, altitude, attitude and inertial navigation position information. The ADIRU processes information measured by its internal gyros and accelerometers, and from air data module inputs, angle–of–attack vanes and other systems.

The ADIRU is described in Chapter 11, Flight Management, Navigation.

Secondary Attitude Air Data Reference Unit (SAARU)

The SAARU is the secondary source for speed, altitude, and attitude information. The SAARU processes information measured by its internal gyros and accelerometers, and from air data module inputs, angle–of–attack vanes, and other systems.

The SAARU does not provide navigational position data. The SAARU is described in Chapter 11, Flight Management, Navigation.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Data

Three static ports are located on the left side of the airplane and three static ports are located on the right side of the airplane. Left and right static ports are paired through pneumatic tubing to each of the left, center and right air data modules. The air data modules convert static air pressure to a digital output for use by other systems. The center static ports are also connected to an independent air data module to provide static pressure measurement to the ISFD.

Two pitot probes (right and center) are mounted on the right forward section of the airplane. One pitot probe (left) is mounted on the left forward section of the airplane. An air data module is connected to each pitot probe. These air data modules convert dynamic air pressure to a digital output for use by other systems. The center pitot probe also provides dynamic pressure to the standby air data module to provide dynamic pressure measurement to the ISFD.

Angle–of–Attack

There are two angle–of–attack vanes, one located on each side of the forward fuselage. The vanes measure airplane angle–of–attack relative to the air mass.

Total Air Temperature

A total air temperature probe is mounted outside the airplane to sense air mass temperature. The temperature sensed by the probe is used by the ADIRU and the SAARU to compute total air temperature.

Static Air Temperature

Static air temperature, displayed on the CDU PROGRESS page, comes from the ADIRU, using total air temperature probe information. In the event the ADIRU value is invalid, the SAARU computed value is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The PFDs present a dynamic color display of all the parameters necessary for flight path control. The PFDs provide the following information:

- flight mode annunciation
- airspeed

HL7202 - HL7573, HL7782 - HL8347

- ground speed
- altitude
- vertical speed
- attitude
- steering information

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

- clock, elapsed time, and chronograph
- radio altitude
- instrument landing system display
- approach minimums
- heading/track indications
- engine fail, GPWS, and PWS alerts

HL7202 - HL7205, HL7782 - HL8347

Navigation Performance Scales

Failure flags are displayed for airplane system failures. Displayed information is removed or replaced by dashes if no valid information is available to the display system (because of out–of–range or malfunctioning navigation aids). Displays are removed when a source fails or when no system source information is available.

Flight mode annunciations are described in Chapter 4, Automatic Flight.

Airspeed

Airspeed is displayed on a tape and in a digital window on the left side of the PFD. The current Mach number is digitally displayed below the airspeed tape when the current Mach number is greater than 0.40. An airspeed trend vector indicates predicted airspeed in 10 seconds. Selected airspeed is displayed above the airspeed tape.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff and landing reference speeds and flap maneuvering speeds are shown along the right edge of the airspeed tape. Maximum and minimum airspeeds are also displayed along the right edge of the airspeed tape.

CAUTION: Reduced maneuver capability exists when operating within the amber regions below the minimum maneuvering speed or above the maximum maneuvering speed. During non-normal conditions the target speed may be below the minimum maneuvering speed.

Ground Speed

HL7202 - HL7573, HL7782 - HL8347

Ground speed is digitally displayed below the airspeed tape when the Mach number is less than 0.40.

Altitude

Altitude is displayed on an altitude tape along the right side of the PFD. It is also shown digitally in a window in the middle of the tape. When meters is selected on the EFIS control panel:

- current altitude in meters is also shown above the altitude window
- selected altitude in meters is displayed above the altitude tape.

Selected altitude is displayed above the altitude tape and is boxed when approaching the selected altitude. Selected altitude is also depicted with a bug on the altitude tape.

HL7202 - HL8042, HL8208 - HL8347
The selected barometric approach minimum is indicated on the altitude tape with a triangular pointer and green line.

HL8043 - HL8077
The selected barometric approach minimum is indicated on the altitude tape with a triangular pointer and a line when BARO minimums are selected. When RADIO minimums are selected, the pointer is still set at BARO minimums; there is no line.

A landing altitude reference bar is displayed along the inner edge of the altitude indication. The reference bar indicates the height above touchdown. A white bar is displayed from 1000 to 500 feet above landing altitude. An amber bar is displayed from 500 feet to the landing altitude.

The current barometric reference is displayed below the altitude tape. A preselected barometric reference can be displayed when STD is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing reference is selectable between QNH and QFE on the APPROACH REF page of the FMC. QNH is the normal operating mode. Selecting QFE sets the destination landing altitude indication to zero altitude. With the landing reference set to QFE, changing the barometric setting from STD to QFE changes the PFD altitude tape background color to green. With QFE selected and climb mode active, changing the barometric setting from QFE to STD causes the landing reference to toggle from QFE to QNH and the altitude tape background color changing from green back to normal. A description of QFE operation is contained in the Landing Reference description in Chapter 11, Flight Management, Navigation.

Vertical Speed

Vertical speed is displayed to the right of the altitude tape with a tape and pointer. Vertical speed is digitally displayed above or below the vertical speed display when vertical speed is greater than 400 feet per minute. It is displayed above with positive vertical speed and below with negative vertical speed. The selected vertical speed bug shows the selected vertical speed when in the AFDS vertical speed (V/S) pitch mode.

Attitude

The attitude indication displays the airplane pitch and roll attitude referenced to the horizon.

Pitch attitude is displayed by an airplane symbol against a pitch scale. The pitch scale is in 2.5 degree increments.

A pointer indicates bank angle in increments of 10, 20, and 30 degrees. Single marks indicate 45 and 60 degrees of bank. A small rectangle under the bank angle pointer indicates slip and skid conditions. Bank angle is also represented by the attitude of the airplane symbol against the horizon line and pitch scale.

A pitch limit indication is displayed at low speeds when the flaps are up and at all times when the flaps are down.

Steering Indications

The flight director steering indications are displayed when the associated flight director switch is on.

TCAS resolution advisories are displayed in the attitude indication area. Refer to Chapter 15, Warning Systems.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The flight path vector (FPV) symbol represents airplane flight path angle vertically and drift angle laterally. The flight path vector is displayed on the PFD when the EFIS control panel FPV switch is selected on, or the MCP FPA reference switch is selected on. The FPV shows the Flight Path Angle (FPA) above or below the horizon line and drift angle left or right of the pitch scale's center. The FPA uses inertial and barometric altitude inputs. The vertical FPA is unreliable with unreliable primary altitude displays.

The flight path angle (FPA) symbol shows the selected flight path angle when the MCP FPA reference switch is selected on and either the flight director or autopilot is engaged.

The FPV and FPA symbols are displayed in two sizes and brightness levels. The large, bright FPV/FPA symbols are displayed when the previously stated selections are made and the flight director is off. The small, dim FPV/FPA symbols are displayed when the previously stated selections are made and the flight director is displayed.

Radio Altitude

The current radio altitude is displayed in the bottom center of the attitude indication area when radio altitude is below 2,500 feet AGL.

Instrument Landing System Indications

ILS glide slope and localizer deviation, frequency/identification, DME, course, and marker beacon indications are provided.

The approach reference information appears above and to the left of the attitude display. The ILS station identification or frequency, course, and (if available) DME are displayed.

The marker beacon indication (OM – outer marker, IM – inner marker, or MM – middle marker) is displayed in the upper right corner of the attitude display area.

The glideslope pointer and scale appear on the right side of the attitude indication.

The localizer pointer and scale appear at the bottom of the attitude indication.

Approach Minimums

The selected radio altitude or barometric approach minimums set on the EFIS control panel are displayed near the bottom left of the altitude display.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Heading/Track Indications

Selected heading/track information is displayed in the bottom section of the PFD on a section of the compass rose. Current heading is displayed under a pointer at the top of the compass rose. The MCP selected heading bug is displayed on the outside of the compass rose. The MCP selected track bug is displayed on the inside of the compass rose.

Heading or track is displayed based on the position of the MCP HDG/TRK reference switch. The selected heading or selected track is annunciated in the left half of the compass rose. The current heading/track reference (MAG/TRU) is shown in the right half of the compass rose. A line drawn perpendicular to the edge of the compass rose from the invisible center depicts the current airplane track.

Engine Fail, GPWS, and PWS Alerts

Engine fail, GPWS, and PWS alerts are displayed in large capital letters between the attitude display and the heading/track compass rose. Refer to Chapter 15, Warning Systems.

Typical PFD Displays

Typical PFD configurations for six phases of flight follow. The autopilot, LNAV, and VNAV are engaged for climb, cruise, descent, approach, and landing. The AFDS approach mode is used for approach and landing.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Takeoff Display

HL7574 - HL7766

HL7532 - HL7573

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

HL7782, HL7783, HL8208 - HL8218, HL8250 - HL8252

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Climb Display

HL7532 - HL7766

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7782, HL7783, HL8208 - HL8218, HL8250 - HL8252

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Cruise Display

HL7532 - HL7766

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7782, HL7783, HL8208 - HL8218, HL8250 - HL8252

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Descent Display

HL7532 - HL7766

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7782, HL7783, HL8208 - HL8218, HL8250 - HL8252

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Approach Display

HL7574 - HL7766

HL7532 - HL7573

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

HL7782, HL7783, HL8208 - HL8218, HL8250 - HL8252

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Landing Display

HL7574 - HL7766

HL7532 - HL7573

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

HL7782, HL7783, HL8208 - HL8218, HL8250 - HL8252

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The NDs provide a mode–selectable color flight progress display. The modes are:

- MAP
- VOR
- APP (approach)
- PLN (plan).

The MAP, VOR, and APP modes can be switched between an expanded mode with a partial compass rose and a centered mode with a full compass rose.

Map Mode

The MAP mode is recommended for most phases of flight.

Presented track up, this mode shows airplane position relative to the route of flight against a moving map background.

Displayed information can include:

- selected and current track
- selected and current heading
- position trend vector
- range to selected altitude
- map range scale
- ground speed
- true airspeed
- wind direction and speed
- next waypoint distance
- waypoint estimated time of arrival
- selected navigation data points.

Navigation Data Points

Additional navigation facility (STA), waypoint (WPT), airport (ARPT), route progress (DATA) and position (POS) data are available for display on the ND in both the expanded and center map modes.

VOR and Approach Modes

The VOR and APP modes are presented heading up. The VOR and APP modes display track, heading, and wind speed and direction with VOR navigation or ILS approach information.

Plan Mode

The PLN mode is presented true north up. The active route may be viewed using the STEP prompt on the CDU LEGS pages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ND Information

Heading

Heading is supplied by the FMC or air data inertial reference system (ADIRS). The ND compass rose can be referenced to magnetic north or true north. The heading reference switch is used to manually select magnetic or true reference. The compass display is automatically referenced to true north when the airplane is north of 82° north or south of 82° south latitude, or near the magnetic poles with the heading reference switch in NORM.

Track

Track is supplied by the FMC during normal operation and by the CDU when in alternate navigation.

Traffic

Traffic information from the TCAS can be displayed on the ND. TCAS is described in Chapter 15, Warning Systems.

Weather Radar

Weather radar information can be displayed on the ND. The weather radar system is described in Chapter 11, Flight Management, Navigation.

Failure Flags and Messages

Failure flags are displayed for system failures or invalid information. Indications are removed or replaced by dashes when source system information is not available.

The message EXCESS DATA is displayed if the amount of information sent to the ND exceeds the display capability. When this occurs, the primary display system removes information from the center of the display outward; information near the outer selected range area is still displayed. The message can be removed by:

- reducing the amount of map information
- reducing range, or
- deselecting one or more of the EFIS control panel map switches (STA, WPT, ARPT, DATA, POS).

Typical ND Map Displays

Typical ND map displays are shown on the following pages. Examples of other ND displays (centered map, approach, VOR, and plan modes) are shown in Section 10 of this chapter.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ND Expanded Map Displays

HL7532 - HL7598

WXR (weather radar) map switch selected.

HL7733 - HL7766

WXR (weather radar) map switch selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

WXR (weather radar) map switch selected.

HL7532 - HL7766

STA (station) map switch selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

STA (station) map switch selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7766

WPT (waypoint) map switch selected.

ARPT (airport) map switch selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

WPT (waypoint) map switch selected.

ARPT (airport) map switch selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7766

DATA map switch selected.

POS (position) map switch selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

DATA map switch selected.

POS (position) map switch selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ND Symbology

The following symbols can be displayed on each ND, depending on EFIS control panel switch selections. Colors indicate the following:

- W (white) – present status, range scales
- G (green) – dynamic conditions
- M (magenta) – command information, pointers, symbols, fly–to condition
- B (blue or cyan) – inactive or background information
- A (amber) – cautions, faults, flags
- R (red) – warnings.

Heading, Track, and Speed

Symbol	Name	ND Mode	Remarks
TRK 062 MAG	Track orientation (G), current track (W), and track reference (G)	Shows track in MAP, MAP CTR.	Displays TRK as the orientation, the current track, and MAG or TRU as the reference, and points to the heading on the compass rose.
HDG 263 MAG	Heading orientation (G), current heading (W), heading reference (G), and heading pointer (W)	Shows HDG (heading) in VOR, VOR CTR, APP, APP CTR	Displays HDG as the display orientation, current heading, MAG or TRU as the heading reference, and points to the heading on the compass rose.
GRID 237	Grid heading (W)	MAP, MAP CTR, PLAN	Displays above 70 degrees latitude.
TIME TO ALIGN 05:35	ADIRU time to align (W)	All	Indicates time remaining for IRU alignment. Replaces wind direction/speed and wind arrow, on the ground, during alignment.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
	Selected heading bug (M)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Displays the MCP–selected heading. A dashed line (M) may extend from the marker to the airplane symbol. In the MAP mode with LNAV, LOC, or ROLLOUT engaged, the dashed line is removed 10 seconds after the selected heading bug is moved.
	Selected track bug (M)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Displays the MCP–selected track. A dashed line (M) may extend from the marker to the airplane symbol.
	Track line and range scale (W)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Indicates current track. Number indicates range (VOR CTR and APP CTR do not display range).
	Range arcs (W)	MAP, MAP CTR, VOR CTR, APP CTR	Replaces the range scale when TCAS, weather radar, or terrain is selected.
	Heading/track reference (G) box (W) in TRU, box (A) if TRU displayed in descent	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Indicates heading/track is referenced to magnetic north or true north. Switching from TRU to MAG displays a box around MAG for 10 seconds.
	Expanded compass (W)	MAP, APP, VOR	Displays 90 degrees of compass rose.
	Current heading pointer (W)	MAP, MAP CTR	Points to current heading on the compass rose.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
GS 310	Groundspeed (W)	All	Current ground speed.
TAS 312	True airspeed (W)	All	Current true airspeed displayed above 100 knots.
350°/15 ↙	Wind direction/ speed and wind arrow (W)	All	Indicates wind bearing, speed, and direction, with respect to display orientation and heading/track reference. Arrow not displayed in the PLAN map mode.

Radio Navigation

Symbol	Name	ND Mode	Remarks
VOR L, R ILS L, C, R	Reference receiver (G)	VOR, VOR CTR, APP, APP CTR	Indicates the selected receiver as the display reference.
116.80 OR SEA	ILS (W)/VOR (W) Reference receiver frequency or identifier display	VOR, VOR CTR, APP, APP CTR	Located in the upper corner. Frequency displayed before the identifier is decoded. The decoded identifier replaces the frequency. Medium size characters for VOR, small size characters for DME only.
DME 24.6	DME distance (W)	VOR, VOR CTR, APP, APP CTR	Located in the upper corner. Indicates DME distance to the reference navaid.
CRS 135	Reference ILS or VOR course (W)	VOR, VOR CTR, APP, APP CTR	Indicates the VOR course or ILS localizer course.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
	ILS localizer or VOR course deviation indication (M) and scale (W)	VOR, VOR CTR, APP, APP CTR	Displays LOC or VOR course deviation. Deviation indicator points in direction of VOR or ILS selected course. For ILS deviation, indicator fills (M) when less than 2 1/2 dots from center.
	Selected course pointer (W) and line (M)	VOR, VOR CTR, APP, APP CTR	Displays CDU–selected course.
	Glide slope pointer (M) and scale (W)	APP, APP CTR	Displays glideslope position and deviation. Deviation indicator fills (M) when less than 2 1/2 dots from center.
	To/from indication (W)	VOR CTR	Located near airplane symbol. Displays VOR TO/FROM indication.
	To/from indication (W)	VOR, VOR CTR	Displays VOR to/from indication.
	VOR (B, G), DME/TACAN (B, G), VORTAC (B, G)	MAP, MAP CTR	When the EFIS control panel STA map switch is selected on, appropriate navaids are displayed (B). Tuned VHF navaids are displayed in green, regardless of switch selection. When a navaid is manually tuned, the selected course and reciprocal are displayed.
	VOR/DME raw data radial and distance (G)		When the POS map switch is selected on, the station radial extends to the airplane.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
	Left VOR (G) or ADF (B) pointer head and tail	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Indicates bearing to (head) or from (tail) the tuned station, if selected on the respective EFIS control panel.
	Right VOR (G) or ADF (B) pointer head and tail		
	VOR (G) selection	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located lower left or right corner. Represents VOR position of the EFIS control panel VOR/ADF switches.
	ADF (B) selection	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located lower left or right corner. Represents ADF position of the EFIS control panel VOR/ADF switches.
	VOR frequency or identifier (G)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located lower left or right corner. Frequency is displayed before identifier is decoded. Decoded identifier replaces the frequency. Small size characters indicate only DME information is being received.
	ADF frequency or identifier (B)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located lower left or right corner. Frequency is displayed before identifier is decoded. Decoded identifier replaces the frequency.
	DME distance (G)	MAP, MAP CTR, VOR, VOR CTR, APP, APP CTR	Located in the lower corners. Indicates DME distance to the referenced navaid.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Map

Symbol	Name	ND Mode	Remarks
	Airplane symbol (W)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle.
	Airplane symbol (W)	VOR CTR, APP CTR	Current airplane position is at the center of the symbol.
	Position trend vector (W) (dashed line)	MAP, MAP CTR	Predicts position at the end of 30, 60, and 90 second intervals. Each segment represents 30 seconds. Based on bank angle and ground speed. Selected range determines the number of segments displayed. For range: • greater than 20 NM, 3 segments • = 20 NM, 2 segments • = 10 NM, 1 segment.
	Airplane symbol (W)	PLAN	Indicates actual position and track along the flight plan route in plan mode only. Inhibited north of 82N latitude and south of 82S latitude.
ABCDE	Active waypoint identifier (M)	MAP, MAP CTR, PLAN	Indicates the active flight plan waypoint, the next waypoint on the route of flight.
124 NM	Active waypoint distance (W)	MAP, MAP CTR, PLAN	Distance to the active waypoint.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
0025 TTG	Active waypoint time to go during alternate navigation (W)	MAP, MAP CTR, PLAN	Indicates CDU calculated time to go in hours and minutes to active waypoint during alternate navigation.
0835.4z	Active waypoint ETA (W)	MAP, MAP CTR, PLAN	Indicates ETA at the active waypoint. Time is based on distance to go and ground speed. It does not consider FMC performance predictions and may differ from other FMC ETAs that do.
AMBOY	Waypoint: active (M), inactive (W)	MAP, MAP CTR, PLAN	Active – represents the waypoint the airplane is currently navigating to. Inactive – represents the waypoints on the active route.
MLF	Off route waypoint (B)	MAP, MAP CTR	When the EFIS control panel WPT map switch is selected on, waypoints not on the selected route are displayed, in ND ranges of 10, 20, or 40.
AMBOY KILMR AMBOY KILMR AMBOY KILMR	Flight plan route: active (M), modified (W), inactive (B)	MAP, MAP CTR, PLAN	The active route is displayed with a continuous line (M) between waypoints. Active route modifications are displayed with short dashes (W) between waypoints. Inactive routes are displayed with long dashes (B) between waypoints.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
	Offset path and identifier: active route (M), modified route (W)	MAP, MAP CTR, PLAN	Presents a dashed line parallel to and offset from the active or modified route.
	Route data: active waypoint (M), inactive waypoint (W)	MAP, MAP CTR	When the EFIS control panel DATA map switch is selected on, entered or procedural altitude and ETAs for route waypoints are displayed. Times do not consider FMC performance predictions and wind data.
	Altitude range arc (G)	MAP, MAP CTR	Based on vertical speed and groundspeed, indicates the approximate map position where the MCP altitude will be reached.
	Altitude profile point and identifier (G)	MAP, MAP CTR	Indicates the approximate map position of the FMC–calculated T/C (top–of–climb), T/D (top– of–descent), S/C (step climb), and E/D (end of descent) points. Predicted altitude/ETA points entered on the FIX page display the altitude/ETA along with the profile point. Deceleration points have no identifier.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks

HL7532 - HL7766

	VNAV path pointer (M) and deviation scale (W)	MAP, MAP CTR	Displays vertical deviation from selected VNAV PATH during descent only. Scale indicates ± 400 feet deviation. Digital display is provided when the pointer indicates more than ± 400 feet.

HL7202 - HL7205, HL7782 - HL8347

	VNAV path pointer (M) deviation scale (W) digital vertical path deviation (W) vertical path deviation band (M)	MAP, MAP CTR	Displays vertical deviation from selected VNAV PATH during descent only. Scale indicates ± 400 feet deviation. Digital display is provided when the pointer indicates more than ± 20 feet.

	Airport and runway (W)	MAP, MAP CTR, PLAN	Displayed when selected as the origin or destination and ND range is 80, 160, 320, or 640 NM.
	Airport (B)	MAP, MAP CTR, PLAN	Displayed on MAP or MAP CTR mode when the EFIS control panel ARPT map switch is selected on. Display of origin and destination airports on MAP, MAP CTR, or PLAN mode is not affected by ARPT map switch selection.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
	Airport and runway (W)	MAP, MAP CTR, PLAN	Displayed when selected as the origin or destination and ND range is 10, 20, or 40 NM. Dashed runway centerlines extend 14.2 NM.
	Energy management circles (B, W)	MAP, MAP CTR	Indicates clean (B) and speedbrake (W) energy management circles as defined on the CDU OFFPATH DES page.
	Selected reference point and bearing distance information (G)	MAP, MAP CTR, PLAN	Displays the reference point selected on the CDU FIX page. Bearing and/or distance from the fix are displayed with dashes (G).
	FMC position update status (G)	MAP, MAP CTR	Indicates the system providing FMC position update.
	GPS position (W)	MAP, MAP CTR	When the EFIS POS map switch is selected on, indicates GPS position relative to FMC position.
	ADIRU position (W)	MAP, MAP CTR	When the EFIS control panel POS map switch is selected on, the star indicates ADIRU position relative to FMC position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
	Weather radar returns (R, A, G, M)	MAP, MAP CTR, VOR, APP	The most intense areas are displayed in red, lesser intensity in amber, and lowest intensity green. Turbulence is displayed in magenta.
	Weather radar Path Attenuation Compensation (A)	MAP, MAP CTR, VOR, APP	Attenuated region behind rainfall (radar shadow) is indicated by amber arc on outer range ring.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
HL7202 - HL7205, HL8006 - HL8077, HL8346, HL8347			
	Core Threat Assessment (R, A, G, M)	MAP, MAP CTR, VOR, APP	Weather radar colors are adjusted to more accurately reflect the weather threat.
	Associated Threat Assessment (R)		Lightning or hail probability is indicated by red speckled pattern in black/green/amber areas above 25,000 ft, or green/amber areas below 25,000 ft.
	Predictive OverFlight (R)		Rapidly building cell below flight altitude is indicated by red speckled pattern with red outline. Indication is replaced by actual weather when cell reaches flight altitude.
	Two-level Turbulence (M)		Severe turbulence is displayed in solid magenta. Light-to-moderate turbulence is displayed in speckled magenta.

	Selected map options (B)	MAP, MAP CTR	Displays EFIS control panel selected map options.
	North up arrow (G)	PLAN	Indicates map background is oriented and referenced to true north.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
CDU L, C, R	Map source annunciation (G)	MAP, MAP CTR	Displays ND source if: • CDU is selected on respective navigation source select switch • both FMCs fail, or • a manually selected FMC fails.
	Holding pattern: active route (M), modified route (W), inactive route (B)	MAP, MAP CTR, PLAN	A holding pattern appears when in the flight plan. Depicts entry path until entry completed.
	Procedure turn: active route (M), modified route (W), inactive route (B)	MAP, MAP CTR, PLAN	A procedure turn appears when in the flight plan. It increases in size upon entering the procedure turn. Also used for procedure hold course reversal.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode	Remarks
	Alternate airports (B)	MAP, MAP CTR, PLAN	PLAN: displays up to four alternate airports. When 640 NM range is selected, offscale airports are displayed with a directional arrow relative to PLAN center point and distance blanked. MAP, MAP CTR: displays FMC or pilot selected primary alternate airport. When EFIS control panel ARPT map switch is selected on, displays up to four alternate airports. When 640 NM range is selected, offscale airports are displayed with a directional arrow and distance relative to airplane position.

TCAS

Refer to Chapter 15, Warning systems for more information.

Symbol	Name	ND Mode
	TCAS resolution advisory (RA), relative altitude (R)	MAP, MAP CTR, APP, VOR
	TCAS traffic advisory (TA), relative altitude (A)	MAP, MAP CTR, APP, VOR
	TCAS proximate traffic, relative altitude (W)	MAP, MAP CTR, APP, VOR
	TCAS other traffic, relative altitude (W)	MAP, MAP CTR, APP, VOR

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode
● ↑ 12 8	TCAS TA, absolute altitude	MAP, MAP CTR, APP, VOR
RA 5.3 +03 ↑ TA 8.9 -12 ↑	TCAS no bearing message (RA–R, TA–A)	MAP, MAP CTR, APP, VOR
TRAFFIC	TCAS traffic alert message (RA–R, TA–A)	All
OFFSCALE	TCAS off scale message (RA–R, TA–A)	MAP, MAP CTR, APP, VOR
TFC	TCAS mode (B)	MAP, MAP CTR, APP, VOR
TA ONLY	TCAS mode (B)	All
TCAS TEST	TCAS mode (B)	All
TCAS OFF	TCAS mode (A)	MAP, MAP CTR, APP, VOR
TCAS FAIL	TCAS mode (A)	MAP, MAP CTR, APP, VOR

Radar

Refer to Chapter 11, Flight Management, Navigation for more information.

Symbol	Name	ND Mode
TEST	Weather radar test mode (B) (A)	MAP, MAP CTR, APP, VOR
WXR	Precipitation only mode (B)	MAP, MAP CTR, APP, VOR

HL7532 - HL8005, HL8208 - HL8285

WX+T	WXR and turbulence mode (B)	MAP, MAP CTR, APP, VOR

HL7202 - HL7205, HL8006 - HL8077, HL8346, HL8347

WX+T	WXR and threat mode (B)	MAP, MAP CTR, APP, VOR

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode
VAR	WXR receiver gain (B)	MAP, MAP CTR, APP, VOR
MAP	Mode used with down–tilt, when ground mapping (B)	MAP, MAP CTR, APP, VOR

HL7532 - HL7598

+15 to −15	WXR antenna tilt (B)	MAP, MAP CTR, APP, VOR

HL7202 - HL7205, HL7733 - HL8347

+5A	WXR antenna automatic tilt mode selected (B)	MAP, MAP CTR, APP, VOR
+5M	WXR antenna manual tilt mode selected (B)	MAP, MAP CTR, APP, VOR

WXR FAIL	WXR system failure (A)	MAP, MAP CTR, APP, VOR
RT	WXR receiver transmitter failure (A)	MAP, MAP CTR, APP, VOR
ANT	WXR antenna fault (A)	MAP, MAP CTR, APP, VOR

HL7202 - HL7205, HL7733 - HL8347

AUTOTILT FAIL	Automatic tilt mode failure (A)	MAP, MAP CTR, APP, VOR

CONT	WXR control panel failure (A)	MAP, MAP CTR, APP, VOR
ATT	WXR loss of attitude data (A)	MAP, MAP CTR, APP, VOR
WEAK	WXR calibration fault (A)	MAP, MAP CTR, APP, VOR

Look-Ahead Terrain

Refer to Chapter 15, Warning systems for more information.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode
HL7202 - HL7205, HL7574 - HL8347		
	Obstacle display (R, A, G)	MAP, MAP CTR, APP, VOR
	Terrain display (R, A, G, M)	MAP, MAP CTR, APP, VOR
HL7202 - HL7205, HL7574 - HL8347		
OBSTACLE	Obstacle annunciation (R, A)	All
HL7202 - HL7205, HL7574 - HL8347		
TERR 060 030	Terrain mode annunciation (C) and highest and lowest terrain or obstacle altitudes (R, A, G, M)	MAP, MAP CTR, APP, VOR
HL7532 - HL7573		
TERR	Terrain mode annunciation (C)	MAP, MAP CTR, APP, VOR
TERR TEST	Terrain test mode annunciation (C)	All
TERRAIN	Terrain annunciation (R, A)	All
TERR FAIL	Terrain status annunciation (A)	MAP, MAP CTR, APP, VOR

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Symbol	Name	ND Mode
TERR POS	Terrain status annunciation (A)	MAP, MAP CTR, APP, VOR
TERR OVRD	Terrain status annunciation (A)	MAP, MAP CTR, APP, VOR
TERR RANGE DISAGREE	Terrain range status annunciation (A)	MAP, MAP CTR, APP, VOR
MAP/TERR RANGE DISAGREE	Terrain range status annunciation (A)	MAP, MAP CTR

Predictive Windshear

Refer to Chapter 15, Warning systems for more information.

Symbol	Name	ND Mode
	Predictive windshear symbol (R, B, A)	MAP, MAP CTR, APP, VOR
WINDSHEAR	Windshear annunciation (R, A)	All

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal Checklist

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Open Loop Indicator

Indicates the line item is an open loop action item. Requires flight crew confirmation to become complete.

2 Cursor Selection Box

Highlights the cursor selection area.

3 Complete Indicator

Indicates the line item is complete.

4 Normal Checklist (NORMAL) Key

Select -

- shows the next incomplete normal checklist
- shows normal checklists menu page when all normal checklists are complete

5 Line Item Override (ITEM OVRD) Key

Select - overrides the line item in the current line item box. Item shows cyan.

6 Action Item

Shows (white) - the action item is incomplete.

Shows (green) - the action item is complete.

Shows (cyan) - the action item is inactive or overridden.

7 Current Line Item Box

Highlights the current incomplete line item.

8 Checklist Reset (CHKL RESET) Key

Select - starts the current checklist from the beginning. All line items become incomplete and the current line item box, the cursor selection box, and the cursor move to the first incomplete line item.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Non-Normal Checklist Queue

1 Checklist Key

Select - shows the checklist for the title on the key.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Non-Normal Checklist

1 Previous Page Key

Select - shows the previous checklist page.

Shows (gray) - the previous page is available.

Shows (cyan) - the key is inactive. The first page of the checklist is shown.

2 Checklist Page Key

Select - shows the checklist page corresponding to the page number on the key.

Shows (white) - the checklist page corresponding to the page number on the key is currently shown.

Shows (gray) - the checklist page corresponding to the page number on the key is not currently shown.

3 Checklist Page Number

Shows (white) - the checklist page is incomplete.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Shows (green) - the checklist page is complete.

4 Next Page Key

Select - shows the next checklist page.

Shows (gray) - the next page is available.

Shows (cyan) - the key is inactive. The last page of the checklist is shown.

5 Non-Normal checklist (NON-NORMAL) Key

Shows when there are additional incomplete non-normal checklists in the checklist queue.

Select -

- shows the next incomplete non-normal checklist when one incomplete non-normal checklist is in the checklist queue
- shows the non-normal checklist queue when more than one incomplete non-normal checklist is in the checklist queue

Shows (white) - an incomplete non-normal checklist has not been shown.

Shows (amber) - an incomplete non-normal checklist has been shown but is not currently shown.

Checklist Timer

1 Timer

Shows the time remaining of a time delay for the current line item. If the line item is complete, the current line item box stays on the line item until the timer expires.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Operational Note

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Operational Notes

Shown in a non-normal checklist.

2 Operational Notes (NOTES) Key

Select - shows the operational notes page.

3 Checklist Reference

Indicates the non-normal checklist from which operational notes originated.

4 Operational Notes

Shown on the operational notes page.

5 CHECKLIST COMPLETE Indicator

Shows when all of the line items are either complete, inactive, or overridden, and all the pages have been shown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Conditional Line Item

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Closed Loop Conditional Line Items

Shows (white) - the conditional line item is incomplete.

Shows (cyan) - the conditional line item is sensed false. All line items indented below the conditional line item become inactive and show cyan. The current line item box, cursor selection box, and cursor skip the inactive items and move to the next incomplete line item.

Shows (green) - the conditional line item is sensed true. The current line item box, cursor selection box, and cursor move to the next incomplete line item.

2 Open Loop Conditional Line Items

Shows (white) - the conditional line item is incomplete.

Shows (cyan) - the conditional line item is selected NO. All line items indented below the conditional line item become inactive and show cyan. The current line item box, cursor selection box, and cursor skip the inactive items and move to the next incomplete line item.

Shows (green) - the conditional line item is selected YES. The current line item box, cursor selection box, and cursor move to the next incomplete line item.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Deferred Line Item

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Deferred Line Items Separator

Separates deferred line items from non-normal checklist line items. All the line items below the separator are deferred.

2 Checklist Reference

Indicates the normal checklist to which deferred line items go.

3 Deferred Line Items

Shown in a non-normal checklist.

4 CHECKLIST COMPLETE EXCEPT DEFERRED ITEMS Indicator

Shows when all line items except deferred line items are either complete, inactive, or overridden, and all pages before the deferred line items separator have been shown.

5 Checklist Reference

Indicates the non-normal checklist from which deferred line items originated.

6 Deferred Line Items

Shown in a normal checklist.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Inhibit Checklist Line Item

1 Inhibit Checklist Line Item

Shows checklists which are inhibited or removed from the checklist queue and whose checklist icons are inhibited or removed from the EICAS display.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Checklist Override

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Checklist Override (CHKL OVRD) Key

Select - overrides the current checklist.

2 CHECKLIST OVERRIDDEN Indicator

Shows when the checklist is overridden. All the line items show cyan.

Checklists Menu Page

1 Normal Menu (NORMAL MENU) Key

Select - shows the normal checklists menu. The menu contains checklist keys for the normal checklists.

2 Menu Key

Indicated by three dots after the menu title.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Select - shows the checklists menu page for the title on the key.

3 Checklist Key

Select - shows the checklist for the title on the key.

4 Non-Normal Menu (NON-NORMAL MENU) Key

Select - shows the non-normal checklists menu page. The page contains menu keys for the airplane systems.

5 Exit Menu (EXIT MENU) Key

Select - exits page for access to the normal and non-normal checklist keys.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Resets Page

1 Resets Menu (RESETS) Key

Select - shows the checklist resets page.

2 Reset Key

Select - resets checklists corresponding to the title on the key. All affected checklists become incomplete.

3 Exit Menu (EXIT MENU) Key

Select - exits page for access to the normal and non-normal checklist keys.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The electronic checklist (ECL) system shows normal and non-normal checklists on a multifunction display (MFD). The electronic checklist system is not required for dispatch, and a paper checklist or other approved backup checklist must be available on the flight deck.

The checklist display switch on the display select panel opens the electronic checklist. The flight crew operates the checklist with the cursor control devices (CCDs). Cursor control devices and MFD selection are described in the System Description section of this chapter.

Electronic Checklist Operation

Pushing the checklist display switch on the display select panel shows the correct checklist (see Checklist Priority, this section, for the checklist priority order). Only one checklist can show at a time.

Three types of checklists can be shown:

- normal
- non-normal for an EICAS message (annunciated)
- non-normal for a condition without an EICAS message (unannunciated)

After each normal checklist is complete, pushing the checklist display switch twice or selecting the normal key shows the next normal checklist in sequence.

Some checklist steps must be checked off by the flight crew to show as complete. Other checklist steps are automatically checked off from sensed flight deck control positions, airplane system status, or EICAS messages.

Checklist Pages

A checklist can have one or more pages. If a checklist is longer than one page, page keys show on the right side of the page.

When a checklist has more than one page and the line items on the current page are complete, the cursor moves to the checklist page key for the next page. CONTINUED shows at the bottom of the page. Pressing the CCD cursor select switch shows the next checklist page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When a checklist is complete and there are no additional checklists in the non-normal checklist queue, the cursor automatically moves to the normal checklist key in the lower left corner of the page. Pressing the CCD cursor select switch shows the next normal checklist in sequence. If there are checklists in the non-normal queue, the cursor moves to the non-normal key in the lower right corner of the page. Pressing the CCD cursor select switch shows the next non-normal checklist (if only one is in the queue) or the non-normal checklist queue.

Checklist Status

The checklist complete indicator shows at the bottom of all pages of the checklist when all of the line items are either complete, inactive, or overridden, and every page has been shown. If the flight crew chooses not to do a line item, the line item can be overridden with the line item override key at the bottom of the page. When a line item is overridden, the text changes color to cyan and the current line item box moves down to the next incomplete line item. If the flight crew chooses to not complete a checklist, the checklist can be overridden by selecting the checklist override key at the bottom of the page. When a checklist is overridden, the text of the entire checklist changes color to cyan, and the checklist overridden indicator shows at the bottom of all pages.

Checklist Line Items

A checklist has one or more line items. These are the types of line items:

- free text
- action item
- operational note
- conditional
- inhibit checklist

Free text items show text and have no further function. The other line item types are described below.

Incomplete line items have white text. Complete line items have green text with a complete indicator (a green check mark) to the left. Overridden and inactive line items have cyan text.

When the checklist is opened, the current line item box moves to the first incomplete line item. When the cursor is on that line item, the cursor selection box encloses the current line item box. When the line item becomes complete, the cursor, the cursor selection box, and the current line item box move to the next incomplete line item.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Action Items

Each step in a checklist that requires a flight crew action is an action item. There are two types of action items: closed loop and open loop.

Closed Loop Action Items

Closed loop action items continuously monitor the position of a flight deck switch, lever, or selector. In a few cases, actual system state, such as flap or landing gear position, is monitored. When the control is in the required position, the action item color changes to green and the complete indicator shows to the left of the action item. The current line item box then moves to the next incomplete line item.

Open Loop Action Items

Open loop action items require the flight crew to manually confirm completion with the CCD. Open loop action items do not monitor control position or system state. Open loop action items look different from closed loop action items. Open loop action items have an open loop indicator, a gray box to the left of the line item. When the cursor is within the current line item box or the open loop indicator, and the CCD cursor select switch is pushed, the action item color changes from white to green and a complete indicator shows on the open loop indicator. The current line item box then moves to the next incomplete line item.

Operational Notes

Operational notes are for the ongoing consequences of a non-normal condition, such as inoperative equipment or operational limitations. The flight crew should read all operational notes, but the current line item box does not stop on an operational note because no immediate flight crew action is required. Operational notes have white text, unless inactive or overridden.

The operational notes page stores active operational notes for easy access and review by the flight crew later in flight. After a non-normal checklist that has operational notes is opened, the operational notes are available for the rest of the flight on the operational notes page. Access to the operational notes page is by the operational notes key at the bottom of the checklist page. Operational notes on the operational notes page have a checklist reference with the title of the checklist from which they came.

If there is more than one page of operational notes, page keys show.

The status of an operational note is based on the status of the EICAS message for the checklist with the note. If the EICAS message blanks, unneeded notes can also blank from the notes page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Conditional Line Items

Conditional line items control the path through a complex checklist. The current line item box steps through line items or it skips line items based on a condition.

There are two types of conditional line items: open loop and closed loop.

Open Loop Conditional Line Items

Open loop conditional line items have choices labeled YES and NO. When the conditional line item becomes the current line item, the cursor moves to the YES - NO line. The flight crew uses the CCD to select the correct answer.

If the flight crew selects YES, the line items indented below the conditional line item become active. The current line item box moves to the first incomplete line item.

If the flight crew selects NO, the line items indented below the conditional line item become inactive and change color to cyan. The current line item box skips the inactive items. Inactive operational notes are removed from the operational notes page. Inactive deferred line items are removed from their normal checklist. Inactive inhibit checklist line items have no effect.

The YES - NO choices remain available after a selection is made. The flight crew can change selections at any time.

A group of two or more open loop conditional line items can be a mutually exclusive set. When the flight crew selects YES on any one of the items in the exclusive set, all of the other items are automatically set to NO. However, the opposite is not true. If all but one of the items are selected NO, the last item is not automatically set to YES. The flight crew must manually select YES on one of the conditional line items in the exclusive set.

Closed Loop Conditional Line Items

A closed loop conditional line item works the same as an open loop item except the choice is made automatically based on a monitored flight deck control, an EICAS message, or an airplane system state. If the condition is true, the conditional line item changes color to green and the line items indented below it become active. If the condition is false, the conditional line item and the line items indented below it become inactive and change color to cyan. The current line item box skips the inactive items.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Inhibit Checklist Line Items

One airplane system failure can cause more than one EICAS alert message (a primary message and one or more consequential messages). The flight crew should do the checklist for the primary message not the consequential messages. Inhibit checklist line items remove unneeded non-normal checklists (consequential checklists) from the checklist queue.

Consequential EICAS alert messages can show for a primary failure condition. For example, the AUTO SPEEDBRAKE message shows due to a HYD PRESS SYS C condition. Consequential EICAS alert messages can also show due to flight crew actions in a non-normal checklist. For example, a PACK L message shows when the flight crew selects the pack off in the SMOKE, FIRE AND FUMES checklist. An inhibit checklist line item in the primary checklist inhibits the consequential checklists.

The inhibit checklist line item shows the consequential checklists which are inhibited. The inhibit has the following effects on a consequential checklist:

- the checklist icon is removed from the consequential EICAS message
- the consequential checklist is removed from the checklist queue
- operational notes from the consequential checklist are removed from the operational notes page
- deferred line items are removed from the normal checklists

If a consequential checklist has steps, notes, and information that are needed for the primary failure condition, then these are included in the primary checklist.

An inhibit checklist line item becomes active when the message for the primary condition shows, before its checklist is opened.

In the paper checklist, an inhibit checklist line item shows as "Do not accomplish the following checklist".

Deferred Line Items

Deferred line items are items that are part of a non-normal checklist, but must be done later in the flight, usually during approach.

When a non-normal checklist that has deferred line items is opened, the deferred line items are automatically added to the end of a normal checklist. Deferred line items in a normal checklist have a checklist reference with the title of the checklist from which they came. Any type of line item can be a deferred line item.

A non-normal checklist that has deferred line items is complete when all line items before the deferred line items are complete. The checklist complete except deferred items indicator shows at the bottom of the page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If the non-normal condition occurs after completion of the normal checklist that would get the deferred line items, the non-normal checklist is complete when all line items, including the deferred line items, are complete.

Timers

Timers help the flight crew keep track of time delays that are part of checklists. The timer shows in the upper right hand corner of the checklist page. All timers are countdown timers. Timers can be part of action items or conditional line items.

A timer on a line item starts when the line item just before it is complete. Timers run in the background. This allows the flight crew to leave the checklist to accomplish other tasks and then return to the checklist. Timers are white when they are running. When the timer is done, it shows ":00" and the color changes to amber.

The current line item box does not move to the next incomplete line item until the line item with the timer is complete and the timer is done.

Checklist Menu Operation

Usually, the flight crew uses the checklist display switch on the display select panel and the normal and non-normal keys to select checklists. Checklists can also be selected and opened with menus. The normal menu, the resets page, and the non-normal menu can be selected with the keys at the top of the checklist page, using the CCD.

An exit menu key is in the lower right corner of all menu pages. This exits the menu page to allow access to the normal and non-normal checklist keys.

Normal Menu

Normal checklists are on the normal menu in the sequence they are completed in a normal flight.

Non-Normal Menu

The non-normal menu has submenus by airplane system. An airplane system submenu has the checklists for that system. If a system has more checklists than can fit on a page, additional submenus group checklists by name. Submenu titles end with "...".

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Resets Page

The resets page shows the checklist database part number and revision information and the following manual resets:

- RESET NORMAL
- RESET NON-NORMAL
- RESET ALL

Other manual resets can also be on this page. These can reset more than one checklist. See Checklist Resets in this section.

Note: RESET NORMAL, RESET NON-NORMAL, and RESET ALL are intended for ground use only. If they are used in flight, RESET NON-NORMAL and RESET ALL will reset completed non-normal checklists, requiring the crew to start the checklists over. It can also cause needed operational notes and deferred line items to be lost.

Checklist Priority

Air/ground logic, fuel control switch and start selector position, and EICAS message level determine the priority for checklists when the checklist display switch is pushed.

On the ground with both fuel control switches in CUTOFF and both engine start selectors in NORM, the priority is:

- checklists for EICAS warning messages
- NORMAL checklists (incomplete or not yet opened)

On the ground with one or both fuel control switches in RUN, one or both engine start selectors in START; or in the air, the priority is:

- checklists for any EICAS alert messages that have icons
- incomplete unannunciated checklists
- NORMAL checklists

Normal Checklists

Normal electronic checklists are used the same way as paper checklists. The flight crew does the normal procedures from memory, then they read the checklist to confirm the actions.

Normal Checklist Access

The checklist sequence is:

- PREFLIGHT
- BEFORE START
- AFTER START

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- BEFORE TAKEOFF
- AFTER TAKEOFF
- DESCENT
- APPROACH
- LANDING
- SHUTDOWN
- SECURE

When each normal checklist is complete, the normal checklist key shows the next incomplete normal checklist in the sequence.

The flight crew can open any normal checklist from the normal menu. If a completed normal checklist is opened from the menu, it is reset.

Normal Checklist Completion

When all of the line items in a checklist are complete, the checklist complete indicator (white text on a green background) shows at the bottom of the checklist page.

When a checklist is overridden, the checklist overridden indicator (white text on a cyan background) shows at the bottom of the checklist page.

Incomplete Normal Checklist Alerting

HL7202 - HL7205, HL7733 - HL8347

The EICAS caution message CHKL INCOMPLETE NORM shows to alert the crew when critical line items in a checklist are not complete before the corresponding phase of flight. Also, the normal checklist key changes color to amber to show that one or more normal checklists are incomplete.

These are the critical flight phases:

- before takeoff phase - occurs when the airplane is on the FMC takeoff runway and aligned for takeoff
- approach phase - occurs when the airplane descends through the FMC transition altitude, and the flap handle is not in UP
- landing phase - occurs when the airplane descends below 800 feet (or 500 feet by airplane option) above the FMC landing altitude

The CHKL INCOMPLETE NORM message shows until the normal checklist is complete or overridden. The checklist icon shows with the CHKL INCOMPLETE NORM message to alert the flight crew to open the checklist, but there is no non-normal checklist for this EICAS message.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Non-Normal Checklists

Non-normal electronic checklists are used the same way as paper checklists. Non-normal checklists are done by read-and-do. If a checklist has memory steps, the flight crew does those steps before opening the checklist.

Non-Normal Checklist Access and Checklist Icon

Usually, the flight crew opens annunciated non-normal checklists by pushing the checklist display switch. Any non-normal checklist can be opened using the non-normal menu.

EICAS messages determine which non-normal checklist shows automatically. If the checklist for an EICAS alert message has not been opened or is incomplete, the message has an icon, a white box to the left of the message. (See section 10.50 for information about the checklist icon.)

If an EICAS alert message has no icon, the checklist is complete, there is no checklist for the message, or another checklist inhibits the icon.

If one EICAS alert message with an icon shows, pushing the checklist display switch shows the checklist for that message. If more than one EICAS alert message with an icon shows, pushing the checklist display switch shows a list with the non-normal checklist queue. If there are more than ten checklists in the queue, the queue has more than one page.

Checklists in the queue are in the same order as the messages show on EICAS. If there are any active unannunciated checklists, they show in the queue after all of the annunciated checklists.

When an EICAS alert message shows, its checklist automatically goes into the queue. When the checklist is complete, the EICAS alert message can still show, but the checklist is removed from the queue. A checklist is also removed from the queue when it is inhibited by another checklist that becomes active.

The flight crew uses the CCD to select a checklist from the queue. When a checklist is open, the non-normal checklist key returns to the queue if there are other non-normal checklists in the queue.

If EICAS alert messages show or blank while the checklist queue is shown, the queue does not change automatically. The flight crew must exit the queue and open it again to see the checklists for the new EICAS messages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Non-Normal Unannunciated Checklists

Non-normal checklists for conditions that do not have EICAS messages are unannunciated checklists. Unannunciated checklists can be opened only from menus. UNANNUNCIATED CHECKLISTS is the first submenu on the non-normal menu. This submenu provides quick access to all unannunciated checklists.

When an unannunciated checklist is opened, it remains in the checklist queue until it is complete.

If the flight crew opens an unannunciated checklist and chooses not to complete it, the checklist must be overridden.

Non-Normal Checklist Completion

When all of the line items in a checklist are complete or inactive, the checklist complete indicator (white text on a green background) shows at the bottom of the checklist page.

When all of the line items in a checklist are complete or inactive, except for the deferred items, the checklist complete except deferred items indicator (white text on a green background) shows at the bottom of the checklist page.

When a checklist is overridden, the checklist overridden indicator (white text on a cyan background) shows at the bottom of the checklist page.

If a checklist is opened and not completed, then another checklist is opened, the text in the non-normal checklist key changes color to amber.

Hidden Non-Normal Checklist Alerting

HL7202 - HL7205, HL7733 - HL8347

The EICAS advisory message CHKL NON-NORMAL shows when there is a non-normal checklist in the queue, its EICAS message is blank, and ECL is not open. The CHKL NON-NORMAL message alerts the flight crew to open ECL and complete the checklist. The message blanks when ECL is opened.

The hidden checklist condition usually occurs when the flight crew completes checklist memory items (for example, in response to an engine fire) that cause the EICAS message to blank, but there is still a checklist in the queue that must be completed. It also occurs when an unannunciated checklist is partially completed, then ECL is closed.

The checklist icon shows with the CHKL NON-NORMAL message to alert the flight crew to open the checklist, but there is no non-normal checklist for this EICAS message.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Latched Non-Normal Checklists

Latched checklists are those that stay in effect for the rest of the flight, even if the associated EICAS message blanks. This latching is used for conditions where effects last the rest of the flight, such as FIRE ENG. The notes, inhibits, and deferred items from a latched checklist also stay in effect the rest of the flight.

The latch goes into effect when the checklist icon shows with the EICAS message or when the checklist is opened from the menu without the message. All unannunciated checklists are latched while only some annunciated checklists are latched. There is no flight deck indication of which checklists are latched and which are not latched.

Checklist Resets

If a checklist is complete or partially complete and the flight crew wishes to begin the checklist again, the checklist can be reset. Selecting the checklist reset key at the bottom of the page resets the checklist: all action items and conditionals become incomplete. The current line item box moves to the first incomplete line item.

For some conditions, such as go-around, resets set the normal checklists back to a previous phase of flight. There are automatic resets and manual resets.

Normal Checklist Automatic Reset Conditions

Automatic checklist resets occur for the following conditions:

- go-around - if the airplane is in the air, the landing gear is not up, and TO/GA is selected, then all normal checklists beginning with the AFTER TAKEOFF checklist automatically reset
- touch-and-go - if the airplane has transitioned from air to ground, takeoff thrust is reached with ground speed greater than 80 knots, and the thrust reversers not deployed, then all normal checklists beginning with the AFTER TAKEOFF checklist automatically reset
- normal menu selection - if a previously completed normal checklist is opened from the normal menu, it automatically resets

Normal Checklist Manual Resets

The following manual resets are available for normal checklists:

- reset normal - the RESET NORMAL key resets all normal checklists. The flight sequence begins again
- individual checklist reset - the checklist reset key at the bottom of a checklist page resets the current checklist. The checklist can be started again

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Non-Normal Checklist Manual Resets

The following manual resets are available for non-normal checklists:

- reset non-normal - the RESET NON-NORMAL key resets all non-normal checklists. Icons show on any active EICAS messages with checklists that were previously completed. Use of the RESET NON-NORMAL function in flight is not recommended
- individual checklist reset - the checklist reset key at the bottom of a checklist page resets the current checklist. The checklist can be started again

Manual Reset All

The RESET ALL key resets all normal and non-normal checklists. The flight sequence begins again for normal checklists. Icons show on any active EICAS messages with checklists that were previously completed. Use of the RESET ALL function in flight is not recommended.

Overrides

There are two types of override functions: item override and checklist override.

Item Override

The flight crew uses item override when they choose not to complete an action item. If the action has been done but the closed-loop sensing does not show the action item as complete, the flight crew can override the action item. This allows the checklist to be complete.

The line item override key is available on all checklists. When an item is overridden the color changes to cyan. Closed loop and open loop action items can be overridden.

Conditional line items (open loop or closed loop) cannot be overridden. Action items indented below a conditional line item can be overridden.

Checklist Override

The flight crew uses checklist override when a checklist in the non-normal queue will not be completed or if the flight crew opens a checklist from a menu but chooses not to complete it.

The checklist override key overrides the current checklist. All of the line items change color to cyan. The checklist overridden indicator shows at the bottom of the page. For a non-normal checklist, all of its operational notes are removed from the operational notes page, deferred line items are removed from their normal checklists, and inhibit checklist line items become inactive.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Electronic Checklist System Inoperative

If the checklist display switch is pushed and the electronic checklist system is inoperative, the message CHECKLIST NOT AVAILABLE shows on the MFD. If the electronic checklist system has been disabled by maintenance, the message CHECKLIST DISABLED shows on the MFD.

When the electronic checklist system is inoperative or disabled, checklist icons do not show with any EICAS messages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

This Section Applies to HL7202 - HL7205, HL7750 - HL8347

Introduction

The electronic flight bag (EFB) is a suite of applications designed to assist the flight crew with routine tasks and reduce the reliance on paper documents. The flight crew interacts with the EFB through display units located on the side panels. The display units operate independently of each other.

Under typical flight conditions, the majority of pilot interactions consists of manipulating Line Select Keys or the touch screen on a display unit to move back and forth among applications, within applications, and to display data. In addition, the flight crew can use the cursor control device (CCD) or an optional keyboard.

The suite of applications available to the flight crew may be customized by airlines. User modifiable portions of each application may be further customized. These customizing options include assigning applications to keys, revising application names, and defining the order in which applications appear. Descriptions and illustrations provided in this section are examples of a typical installation and may not reflect the exact installed configuration.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display Unit

1 Back Key

Returns to the previous level within an application.

2 Main Menu (MENU) key

Displays MAIN MENU.

3 Bright (BRT) Dim (DIM) Control

Rocker switch, upper portion brighter, lower portion dimmer.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Line Select Keys

Selects item next to key.

5 Zoom Keys

Left key is zoom in, right is zoom out. Repeated selection increases or decreases the zoom level.

6 Page Up (PGUP)/Page Down (PGDN) Keys

Moves up or down within an application where the display exceeds one display screen in length.

7 Transfer (XFR) Key

- View other pilot's EFB display on this display
- XFR displays in green text on upper right
- Selections made off-side are seen on the on-side display in real time
- XFR key (second push) exits transfer and returns display to last view prior to selecting XFR
- MENU key exits transfer and displays the MAIN MENU

8 Enter (ENTER) Key

Activates a high-lighted item when applicable.

9 Power (PWR) Switch

Turns the display backlight on or off.

10 Touch sensitive screen

Enables direct selection on the display screen, and in some applications panning and scrolling.

11 Arrow Keys

Moves the viewing window over the display in the direction of the selected arrow.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display Description

HL8006 - HL8011

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7526 - HL8005, HL8041 - HL8285

1 Selectable Applications

Menu items for selectable applications display in white text with gray background.

2 Applications not selectable

Menu items for applications that are installed but are not selectable display in cyan text in a cyan box. An application may be initializing and may become selectable later.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Cursor

A magenta cursor appears on the display when the SIDE switch is selected on a cursor control device.

4 High-light Box

A white high-light box displays around a selectable application when:

- The cursor is moved over the menu item
- The selectable menu item is touched
- A line select key is selected

A selectable application is selected when:

- It is high-lighted with the cursor and the cursor select switch is pushed
- A menu item is touched and released
- A line select key is selected

The menu item for a selected application displays a green background momentarily and then the selection displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Main Menu (Typical)

HL7202 - HL7205, HL8005 - HL8077, HL8216 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8006 - HL8011

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7526 - HL8005, HL8041 - HL8285

1 FAULT

Displayed (amber) -

- A fault has occurred within an application
- Displays in the header regardless of the application displayed
- Displays next to the SYSTEM PAGE where fault message can be viewed and cleared
- Removed from header upon selection of the SYSTEM page

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Only one message at a time may display next to an application. FAULT takes priority over MEMO and MSG. MEMO or MSG display as applicable after the fault is cleared.

2 MEMO

Displayed (white) -

- One or more applications need attention
- Displays in the header regardless of the application displayed
- Displays next to the affected application on the MAIN MENU

3 AIRPORT MAP Application

Selects the AIRPORT MAP application.

- After flight initialization, displays the departure airport in HDG-UP (heading up) mode when on the ground at the departure airport
- Displays the destination airport NORTH-UP when in the air
- Displays the destination airport HDG-UP when on the ground at the destination airport

4 PERFORMANCE Application

Selects the PERFORMANCE application.

- After flight initialization, displays the takeoff performance page
- Subsequent selections of the application display the selection that was in view when the application was last exited

5 TERMINAL CHARTS

Selects the TERMINAL CHARTS application.

- After flight initialization, displays the ROUTE SETUP page.
- Origin and destination information downloaded from the FMS.

6 IDENT PAGE

Displays the IDENT page.

7 SYSTEM PAGE

Displays the SYSTEM page.

8 MSG

Displayed (white) -

- One or more applications has an uplink available
- Displays in the header regardless of the application displayed
- Displays next to the affected application on the main menu. Takes priority over MEMO

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

9 XFR

Displayed (green) -

- The display is in transfer mode
- No selections except MENU and XFR are enabled

10 VIDEO Application

Displays views from surveillance cameras of area outside the flight deck door.

11 DOCUMENTS Application

Selects the DOCUMENTS application

- After flight initialization, displays the documents library
- Subsequent selections of the application display the selection that was in view when the application was last exited

12 INITIALIZE FLIGHT

Initializes all the installed applications for flight

- Clears search results of all previous searches in all applications
- All applications and functions restored to default settings
- Cross loads from FMC applicable data if it has been entered in the FMC
- Menu changes to CLOSE FLIGHT
- CLOSE FLIGHT is not selectable (cyan) during flight

13 AIRPORT MAP Application

Selects the AIRPORT MAP application.

- After flight initialization, displays the departure airport in HDG-UP (heading up) mode when on the ground at the departure airport
- Displays the destination airport NORTH-UP when in the air
- Displays the destination airport HDG-UP when on the ground at the destination airport

14 INITIALIZE FLIGHT

Initializes all the installed applications for flight

- Clears search results of all previous searches in all applications
- All applications and functions restored to default settings
- Cross loads from FMC applicable data if it has been entered in the FMC
- Menu changes to CLOSE FLIGHT
- CLOSE FLIGHT is not selectable (cyan) during flight

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airport Maps (Typical)

The maps are based on precise survey of airport geometry by satellite and other means. There may be differences between the electronic airport map and the airport diagrams that are part of the terminal charts, since these charts are derived from different survey methods.

Airport Heading Up (moving) Map

The airplane symbol remains stationary and the map moves to provide the location and orientation of the airplane relative to the map.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Map Reference

Displays the map reference.

- HDG-UP (heading up) and MAG (magnetic)

2 NORTH-UP MAP

Selects north up (static) map display.

3 Airport (APRT) SEARCH

Allows searching the database for other airport maps.

4 Airplane symbol

Displays when airplane is on the ground at the displayed airport and groundspeed is less than 40 knots.

5 Display range

Indicates the map range from top to bottom of the display.

6 Airport Identifier

When departure airport is displayed, identifier is destination airport if entered in FMC.

- Selection displays the destination airport in HDG-UP (moving map) mode when on the ground at the destination airport
- Displays the destination airport in NORTH UP (static) mode when in the air

When destination airport is displayed, identifier is departure airport.

7 SHOW/HIDE Range (RNG) RING

Displays or removes a 1000 foot radius range ring around the airplane symbol.

8 SHOW/HIDE MENU

Displays or hides all other menu selections.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airport North Up (static) Map

The airplane symbol moves on a stationary map showing the airplanes general location and orientation on the ground at the selected airport. Using the touch screen to “touch and drag”, or using the arrow keys, the map may be repositioned on the display.

1 Map reference

Displays the map reference

- NORTH UP
- TRU (true) heading

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 HDG-UP MAP

On the ground, selects heading up moving map display.

In the air, the prompt is HDG -UP ARMED. This enables an automatic change to the HDG-UP display upon landing.

3 Airplane Symbol

Displays when airplane is on the ground at the displayed airport and groundspeed is less than 40 knots.

4 CANCEL/RECALL MSGS (Messages)

Toggles between Cancel and Recall when map faults exist

- CANCEL removes fault messages from the display
- RECALL re-displays fault messages

The menu item is inhibited when there are no faults to display.

5 ARPT (Airport) DIAGRAM

Displays the airport chart (10-9 chart) for the displayed airport map.

6 CENTER A/C

Centers airplane symbol horizontally and vertically on the display.

7 Map fault message display area

Amber fault messages display in this area. More than one message may display at a time.

Airport Map Faults

Display (amber) -

Faults may appear on both NORTH-UP and HDG-UP displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Fault	NORTH-UP	HDG-UP
ADIRU DATA (ADIRU data is lost or invalid.)	Airplane symbol is removed.	Airplane symbol is removed. Map freezes on position and last known heading.
GPS DATA (GPS position data is lost or invalid.)	Airplane symbol is removed.	Airplane symbol is removed. Map freezes on heading and last known position.
UNABLE POS ACCURACY (GPS position accuracy limits are exceeded. Inhibited by GPS DATA and when in flight.)	Airplane symbol is removed.	Airplane symbol is removed. Map freezes on heading and position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airport Search

Airport search allows the search and display of other airport maps. Keypad operation for entering, clearing, and deleting characters is the same as with the FMS CDU. All EFB applications that have a search function use an identical keypad and scratchpad in the lower half of the respective search display.

1 SEARCH IDENT

Initiates a search of the ident data base using the scratchpad entry.

2 SEARCH ALL

Initiates a search of the data base using the scratchpad entry.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Scratchpad

4 SYMB/NUM key

Alternates between SYMB and NUM.

- SYMB displays symbols on the keypad
- NUM displays numbers on the keypad

5 SHIFT key

Changes letter keys between upper case and lower case.

6 Airport Identifier

The results of the airport search are displayed here. Selecting the airport displays the airport map in North Up mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

IDENT page (Typical)

HL7750 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

1 A/C MODEL

Display of aircraft model.

2 DATE

Display of current date.

3 EFB EFFECTIVITY CONFIGURATION

Display of effectivity dates for loaded databases.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Out of date data base (amber)

An out of date database displays in amber. MEMO displays in the header on all pages and next to affected applications on the Main Menu page.

5 TAIL ID

Display of tail identification number.

HL7750 - HL7766
6 TIME

Display of time and source of time.

HL7202 - HL7205, HL7782 - HL8347
6 TIME

Display of current time.

HL7202 - HL7205, HL7782 - HL8347
7 WIRELESS CERTIFICATE

Display of wireless certificate expiration date.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

SYSTEM page (Typical)

1 Acknowledged fault

Fault information is displayed in cyan.

2 Unacknowledged fault

Fault information is displayed in white.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 ACKNOWLEDGE NEW FAULTS

- Becomes selectable when there are un-acknowledged faults
- Selection acknowledges all new faults
- Selection removes FAULT on MAIN MENU next to SYSTEM

4 EFB MAINTENANCE

Provides access to the maintenance menu page.

5 RESTART

Re-initializes Windows applications.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Documents (Typical)

1 Document hierarchy header

Displays the selected document, section, and sub-section.

2 Selectable documents

Displays the installed and selectable documents.

3 MENU

Initiates cascading menu.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Document hierarchy header

Displays the current document, section, and sub-section.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 MENU

Initiates cascading menu. Selected item has green background, available item has gray background, and item not selectable is blue. For example, if another function is selected, the RETURN TO DOCUMENT function turns white with a gray background.

- PRINT - Information displayed in the VIEW CONTENTS screen is printed on the flight deck printer (if applicable).
- DAY MODE - Indicates inactive display mode, selection changes mode to mode indicated. Day mode is dark text on a light background, night mode is light text on a dark background.
- SEARCH - Initiates search in multiple documents.
- HISTORY - Displays a list of entries as links for information previously displayed in the VIEW CONTENTS screen.
- BOOKMARKS - Provides link to return to item bookmarked.
- RETURN TO DOCUMENT - Allows return to document from subordinate function.
- TABLE OF CONTENTS - For the document selected.
- DOCUMENT LIBRARY - Provides list of all available documents.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Performance (Typical)

1 DRY (green)

- DRY has been selected for the runway condition
- Triangle in right side of menu indicates a list of options exists
- Selection display the options

2 NOTAMs

- May be used to enter temporary data
- Amber bar displays across menu when data has been entered

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Data field

Boxes display for fields that require data entry.

4 SHOW KYBD (Keyboard)

Displays a touch sensitive keyboard at the bottom of the page that is used for data entry.

5 WT (Weight) AND BALANCE

Displays the weight and balance page.

6 SHOW LANDING

Displays the landing page.

7 COPY FMC DATA

Cross loads applicable data from FMC.

8 SEND OUTPUT

Opens listing with available options for saving or printing data.

9 CALC (Calculate)

- Cyan - data has not been entered in all required fields
- White - all required fields have data

Selection initiates the calculation of takeoff data.

10 SHOW FULL

Selection displays full thrust data for the airport/runway entered.

11 Intersection Takeoff Options

- Intersection takeoff options display on the right side when ALL is selected for INTX (intersection)
- Selection displays takeoff data for the selected intersection

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 BRKS (Brakes)

Selection of a brake setting is required for in-flight landing calculations, not dispatch calculations.

2 NNC

Selection is required for in-flight calculations, not dispatch calculations.

3 SHOW TAKEOFF

Displays the takeoff page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 MEL

Displays MEL page.

5 Amber bar

Indicates an active MEL item exists that will be considered in the calculations.

6 CDL

Displays the CDL page.

7 Amber bar

Indicates an active CDL item exists that will be considered in the calculations.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 PAX/CARGO/OTHER/FUEL

Displays applicable input screen.

2 Aircraft weights

- Initially displays airplane operating empty weight
- Updates as data fields are filled

3 +TOW

Symbol displays airplane CG relative to the CG limits.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 COMPLETE

Selection loads the takeoff page with the calculated takeoff gross weight and CG.

5 CANCEL

Clears all entries and returns to the takeoff page.

6 CLEAR

Clears all entries.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Video Surveillance (Typical)

1 Primary Display

- Selected thumbnail image displays in this area with green border
- Border changes to cyan when FREEZE is selected
- Border is amber when the selected image is not available and NO VIDEO SIGNAL displays

2 Display selection

Name of the selected thumbnail image displays here.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 FREEZE/UNFREEZE

- Selection freezes the image in the primary display
- The display box changes to cyan while the image is frozen
- The menu changes to UNFREEZE

4 Thumbnails

- Thumbnail images display here
- Images with a gray border may be selected for display in the primary display
- Selected image has a green border
- Border is white when the cursor is moved over the image
- Border is amber when the image is not available and NO VIDEO SIGNAL displays

5 SHOW/HIDE MENU

- Selecting SHOW MENU adds the BRIGHT, CONTRAST, and MAINTENANCE menus
- After selecting SHOW MENU, the menu changes to HIDE MENU

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Primary Display

- Selected thumbnail image displays in this area with green border
- Border changes to cyan when FREEZE is selected
- Border is amber when the selected image is not available and NO VIDEO SIGNAL displays

2 Display selection

Name of the selected thumbnail image displays here.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 FREEZE/UNFREEZE

- Selection freezes the image in the primary display
- The display box changes to cyan while the image is frozen
- The menu changes to UNFREEZE

4 BRIGHT/CONTRAST

Changes the brightness and contrast of the image in the primary display as indicated by the + and - selections.

5 SHOW/HIDE MENU

- Selecting HIDE MENU removes the BRIGHT, CONTRAST, and MAINTENANCE menus
- After selecting HIDE MENU, the menu changes to SHOW MENU

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Pilot Utilities Application (PUA)

HL7202 - HL7205, HL8005 - HL8077, HL8216 - HL8347

1 Calculator

Displays calculator capable of:

- addition
- subtraction
- multiplication
- division

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- square root function
- storing numbers for later use

Equation to be calculated is displayed as it is entered. After selecting the equal sign, either the result or an error message displays.

2 Stop Watch

Counts time up or down.

Timer counts down from an entered time. If ALERT ON COMPLETION is selected, a memo message displays when the timer reaches zero.

Count up selection also displays the start time and current time.

3 Speed Conversion

Converts pilot entered speed between selected units. Unit choices include:

- feet per minute
- kilometers per hour
- knots
- meters per second
- miles per hour

4 Length Conversion

Converts pilot entered length between selected units. Unit choices include:

- feet
- kilometers
- meters
- nautical miles
- statute miles

5 Weight Conversion

Converts pilot entered weight between kilograms and pounds.

6 Temperature Conversion

Converts pilot entered temperature between Celsius and Fahrenheit.

7 Volume Conversion

Converts pilot entered volume between imperial gallons, US gallons, and liters.

8 Time Zone Conversion

Converts pilot entered Zulu time to a selected time zone. Daylight savings time can be selected to automatically adjust time 1 hour ahead of standard time.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Enroute Moving Map (Typical)

HL7202 - HL7205, HL8005 - HL8077, HL8216 - HL8347

Enroute Moving Map is a situational awareness application. When Enroute is connected to the airplane's systems, the application uses the airplane location data to enable live airplane tracking on the moving map. The application may be used to:

- View information on a moving map
- Create, modify, and load flight routes
- Search for navigational objects
- Retrieve navigational data details

CAUTION: Although the Enroute application displays navigational data, it is not designed as a navigational tool, and the application does not display an own-ship symbol. Use other tools on the flight deck to navigate the airplane on the route of flight.

Starting the Application

To start the ENROUTE application, select ENROUTE from the EFB MAIN MENU page. The Navigation Mode (NAV) page displays when the application is first started.

Four application modes are available:

- Navigation (NAV) Mode – displays a dynamic map in True North Up or Track Up orientation for situational awareness.
- Plan Route (ROUTE) mode – displays the screen for entering, reviewing or modifying a route.
- Regional Notes (NOTES) mode – displays notes equivalent to floating notes or cover/end panel notes on a paper chart.
- Reference Notes (NOTES) mode – displays information equivalent to end/cover panel information or Airway Manual references on a paper chart.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Navigation Mode (NAV) page

1 Title Bar

Displays the current application mode. Also displays map orientation (North Up or Track Up), Map theme (High Enroute or Low Enroute), and current range scale.

2 Map Display Area

Displays map objects and symbols associated with the theme selected. Each theme displays a particular set of map objects and symbols.

EFB bezel zoom keys controls change the map range scale.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EFB BRT/DIM control switch and the Day and Night modes optimize the map contrast for lighting conditions.

3 Declutter Option Soft Keys

Shows or hides a variety of navigational information.

- APT – Show/hide IFR and VFR airports and airport localizer/ILS glideslope navigational aids
- AWY – Show/hide airways
- WPT – Show/hide waypoints
- SUA – Show/hide special use airspaces
- FIR – Show/hide flight information regions
- LATLNG – Show/hide latitude/longitude grid and grid MORAs
- NAVAID – Show/hide navigational aids (NAVAIDs)
- CTRL – Show/hide controlled airspaces (Air Traffic Radar Tracking and Control Area)
- UNCTRL – Show/hide uncontrolled airspaces (Only available when CTRL is selected)
- COMM – Show/hide communications data and enroute communication sectors
- TERR – Show/hide graduated surface terrain contours (Low Enroute theme only)

Note: Soft key is dimmed if a declutter option is not available in the current theme or zoom level

4 Mode

Displays one of the four application modes.

5 Map

Enables selection and displays Map modes “North Up” or “Track Up”.

6 Theme

Displays map objects associated with high-altitude or low-altitude airspace. Sub-menu selections are:

- High – map shows objects associated with high-altitude (High Enroute) airspace (operations at 20,000 feet and above), and Low Enroute (operations up to 20,000 feet above sea level
- Low – map shows objects associated with low-altitude (Low Enroute) airspace (operations up to 20,000 feet above sea level)
- Day Mode
- Night Mode

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

7 AC Info

Provides access to airplane information and other situational details. Sub-menu selections are:

- Position Information – Show/hide airplane location information. Includes current latitude/longitude location, altitude, true track angle, ground speed, and magnetic variance
- Active Waypoint – Show/hide active waypoint. Includes ICAO identifier and name, distance to the waypoint, cross-track error (XTE), estimated time enroute (ETE), and estimated time of arrival (ETA)
- Destination Airport – Show/hide destination airport. Includes ICAO identifier and name, bearing, track, distance from present position, estimated time enroute (ETE), and estimated time of arrival (ETA).

8 PPos

Places the map within the context of the airplane's current position and restores moving map functionality if map motion had been suspended (e.g. while panning the map).

9 Search

Opens the Enroute Data Search dialog box to enable searching for navigational objects in the database.

10 Details

Opens the Details view to provide the details of an object on the map. To view object details, select the Details line select key and then select the object on the map display. Select the Close line select key to exit the details view.

11 Range Scale

Displays range scale units set by the airline EFB administrator such as: nautical miles per screen inch (NM/inch), or optional km/inch, km/cm, SM/inch, SM/cm, NM/inch, or NM/cm units.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Plan Route Mode (ROUTE) Page

1 Title Bar

Displays the current application mode. Also displays map orientation (North Up or Track Up) and active route.

2 New Route

Enables creation of a new route. If the EFB is connected to aircraft systems detects an origin and destination airport, those airports are included in each new route. The name of the route matches origin and destination airport entries.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Load Route

Displays one or more of the routes created on the route-planning map.

4 Unload Route

Clears all routes from the map.

5 List Routes

Displays a list of all routes that are currently loaded and enables retrieval of existing routes.

6 Cancel

Cancels the previous action.

7 Undo

Reverts to the previous state.

8 Enter Waypoint Field

Enter information to locate an object or designate a route. A keyboard is automatically displayed when selecting the entry field.

9 Redo

Restores the previous action – Redo reverses an Undo action.

10 Best Match Field

Displays the best match for the text entered in the Enter Waypoint field. Select the Show All to display all matches.

11 Route Information

Displays a list of available routes or the currently active route being created or modified. For each route, the application shows the origin and destination, and the total distance of the route.

12 Route Details Display Area

Displays route/waypoint details.

13 Insert Wpt

Enables insertion of a waypoint(s) from the Enter Waypoint text box. The application displays arrows next to the route detail at all of the possible insertion points. Adds the waypoint in the Enter Waypoint text box to the end of the route.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

14 Append Wpt

Adds the waypoint(s) in the Enter Waypoint text box to the end of the route.

15 Remove Wpt

Removes waypoint is currently highlighted in route.

16 Direct To

Modifies route using the current airplane position as a waypoint and removes all intermediate waypoints and airways to move directly to another waypoint.

17 Route and Map Display Area

The active route appears on the map in yellow and any other selected routes appear on the map are blue.

18 Set Active

Enables override of the automated sequencing of waypoints and setting of any waypoint in the route as the active waypoint.

19 Search

Opens the Enroute Data Search dialog box to enable searching for any navigational object in the database.

20 Details

Displays details about an object on the map.

Creating or Modifying Routes

Routes must be created before they will display on the map. Enter an origin and destination airport if not already entered. Routing points may be added by one of following three entry methods:

- Airway routing - Enter point-to-point waypoints to complete the route. Airways are separated by a single period (dot). Two dots to connect waypoints direct without an airway. For instance, KSEA..KSLC indicates that the two airports are connected directly without using an airway. Airways within a route always connect through established navaids (i.e. route sequence BTG.V23.OED.V122.LMT).
- Plain text entry - enter an ICAO identifier, IATA identifier, airport name, city name, or a text string. (i.e. waypoint "BTG")
- Latitude/Longitude routing - enter the latitude/longitude information as part of multiple waypoints

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Enter information in the Enter Waypoint field and select the Insert Wpt line select key and insert into the route. The application displays the available insertion points and draws the route on the map after insertion. Continue adding waypoints until route is complete.

Existing routes may be modified using the same entry methods described above.

Note: Closing a flight and reinitializing the EFB erases routes from system memory.

Enroute Data Search

Use the Enroute Data Search function to search for navigational objects in the database. Objects may be searched by identifier, name, or location.

Search options may be applied to show only specific object types such as navigational data types, airports, fixes, airways, airspaces and distance from current position.

ENROUTE SEARCH WINDOW

1 Search Entry Field

Enter a term to locate an object by name. A keyboard is automatically displayed when selecting the entry field.

2 Nav Data Types Soft Key

Displays a window to specify the types of navigational data to include (or exclude) in the search. All types are selected by default.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Search Options

List of search options which can be individually selected to refine search results. More than one option can be selected from the list.

4 Search Results Area

Places the map within the context of the airplane's current position and restores moving map functionality if map motion had been suspended (e.g. while panning the map).

5 Search Soft Key

Displays results based on information entered.

6 Center on Chart Soft Key

Displays results based on information selected in the Search Results area.

7 Details Soft Key

Displays results based on information selected.

8 Keyboard Soft Key

Displays a touch sensitive keypad used for data entry.

9 Close Soft Key

Selection closes the Enroute Data Search window.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Regional Notes

The Enroute application displays Regional Notes which have the following information:

- FIR / UIR Regions
- Regional Note Titles
- Regional (FIR / UIR) Notes Information

The application filters the content based on the center of the current map location.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 FIR / UIR Region Display List

Displays the list of available regions. Slide scroll box up/down or use up/down arrows to view available database regions.

2 Regional Note Titles Display List

Displays the list of Regional Notes titles associated with the selected region.

3 Regional (FIR / UIR) Note Information Display

Displays the contents of the selected Regional Note.

4 Mode

Select another application mode to exit the Regional Notes screen.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Reference Notes

The first time reference notes are accessed, the application automatically selects the coverage based on current location. Following that, reference notes always return to the information displayed during last access.

1 FIR / UIR Region Display List

Displays the list of available regions. Slide scroll box up/down or use up/down arrows to view available database regions.

2 Reference Note Titles Display List

Displays the list of Regional Notes titles associated with the selected region.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Reference Note Information Display

Displays the contents of the selected Regional Note.

4 Mode

Select another application mode to exit the Regional Notes screen.

DATA LOAD

DATA LOAD provides flight crews with one-touch loading of application data directly from the flight deck without maintenance intervention.

The airline EFB administrator can authorize data loading for the AIRPORT MAP, PERFORMANCE, TERMINAL CHARTS, and DOCUMENTS applications according to company policy.

Starting the Application

Data loading must be performed between flight close and flight initialization. After a flight is initialized, data loading is unavailable until the flight is closed.

When data is available for loading, the DATA LOAD application displays a MEMO notification next to the DATA LOAD display box on the MAIN MENU page. Selecting the DATA LOAD display box starts the application and displays the DATA LOAD page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

DATA LOAD Page (Typical)

1 LOAD

Selection:

- starts application data loading
- shuts down the AIRPORT MAP, PERFORMANCE, TERMINAL CHARTS, and DOCUMENTS applications while new data is being loaded
- application data loading typically takes less than one minute

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

After data is loaded:

- the LOAD display box displays COMPLETE
- affected applications will automatically restart. Application selection is disabled until restart is complete

  Note: Do not select any application until the applications have restarted.

Note: The LOAD selection is disabled after a flight has been initialized.

Confirming Data Load is Complete

To verify from the DATA LOAD page that new data has been loaded successfully, confirm the status on the LOAD display box displays COMPLETE.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Return to the MAIN MENU and confirm the MEMO notification next to the DATA LOAD display box is no longer displayed. Confirm the display boxes for all applications are gray, indicating the applications have restarted.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Instruments, Displays EICAS Messages

Note: The OVERSPEED warning and the ALTITUDE ALERT caution messages are covered in Chapter 15, Warning Systems.

The following EICAS messages can be displayed.

Message	Level	Aural	Message Logic
ALTN ATTITUDE	Advisory		Both AIR DATA/ATTITUDE source switches are in the ALTN position.
BARO SET DISAGREE	Advisory		Captain's and first officer's barometric settings disagree.

HL7202 - HL7205, HL7733 - HL8347

CHKL INCOMPLETE NORM	Caution	Beeper	A normal checklist needs to be completed.

HL7202 - HL7205, HL7733 - HL8347

CHKL NON-NORMAL	Advisory		A non-normal checklist is not complete, the ECL is not displayed, and the related EICAS message is not shown.

DISPLAY SELECT PNL	Advisory		Left, center, or right CDU control of the display select panel is active.
EFIS CONTROL PNL L, R	Advisory		EFIS control panel is inoperative or CDU control of the EFIS control panel is active.
SGL SOURCE AIR DATA	Advisory		Both PFDs are receiving air data from the same single channel source.
SGL SOURCE DISPLAYS	Caution	Beeper	A single source of display information is being used by some or all display units.
SGL SOURCE RAD ALT	Advisory		Both PFDs are using the same source for radio altimeter information.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
SINGLE SOURCE F/D	Advisory		Both PFDs are using the same source for flight director information.
VMO GEAR DOWN	Memo		Vmo value set for dispatch with landing gear extended.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 11.10
Flight Management System 11.10.1
Control Display Unit (CDU) 11.10.1
Function and Execute Keys 11.10.4
Alpha/Numeric and Miscellaneous Keys 11.10.6
CDU Page Components 11.10.7
CDU Page Color 11.10.9
FMC Selector 11.10.11
Air Data Inertial Reference System (ADIRU) 11.10.12
Transponder Panel 11.10.13
Weather Radar Panel 11.10.15

Navigation Systems Description 11.20
Introduction 11.20.1
Navigation Systems Flight Instrument Displays 11.20.1
Global Positioning System (GPS) 11.20.2
GPS Displays 11.20.2
GPS Data 11.20.2
GPS System Schematic 11.20.3
Inertial System 11.20.4
Air Data Inertial Reference System (ADIRS) 11.20.4
Air Data Inertial Reference Unit (ADIRU) 11.20.4
Secondary Attitude and Air Data Reference Unit (SAARU) 11.20.5
Air Data and Attitude Sources 11.20.6
ADIRS Schematic, Normal Mode 11.20.8
ADIRS Schematic, With NAV ADIRU INERTIAL Message 11.20.9
Radio Navigation Systems 11.20.10
Automatic Direction Finding (ADF) 11.20.10
Distance Measuring Equipment (DME) 11.20.10
Instrument Landing System (ILS) 11.20.11

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Navaid Identifier Decoding 11.20.12
VOR 11.20.13
Transponder 11.20.14
Weather Radar 11.20.15
Threat Assessment Feature 11.20.16

Flight Management System Description 11.30
Introduction 11.30.1
Flight Management Computer (FMC) 11.30.2
Control Display Units (CDUs) 11.30.3

Flight Management System Operation 11.31
Introduction 11.31.1
Preflight 11.31.1
Takeoff 11.31.2
Climb 11.31.2
Cruise 11.31.2
Descent 11.31.2
Approach 11.31.2
Flight Complete 11.31.2
Operational Notes 11.31.3
Terminology 11.31.5
Maintenance Index 11.31.7
Navigation Position 11.31.8
FMC Position Update 11.31.8
FMC Polar Operations 11.31.10
Navigation Performance 11.31.12
Lateral Navigation (LNAV) 11.31.14
Waypoints 11.31.14
ND Map Displays 11.31.20
Vertical Navigation (VNAV) 11.31.21
Vertical Actual Navigation Performance (VANP) 11.31.21
Speed/Altitude Constraints 11.31.21

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff and Climb 11.31.22
MCP Altitude Intervention 11.31.24
Cruise 11.31.24
Cruise Climb 11.31.24
Step Climb 11.31.25
Cruise Descent 11.31.26
Required Time of Arrival (RTA) 11.31.26
MCP Speed Intervention 11.31.27
Descent 11.31.27
Early Descent 11.31.31
Cruise and Descent Profile (Instrument Approach Using VNAV) . . 11.31.32
Approach 11.31.34
Missed Approach 11.31.35
Engine Out Operation 11.31.36
Takeoff and Climb 11.31.36
Climb (Above EO Max Alt) 11.31.38
Cruise (Above EO Max Alt) 11.31.38
Data Entry Rules 11.31.40
Altitude Entry 11.31.40
Airspeed Entry 11.31.40
Data Pairs 11.31.41

Flight Management Computer 11.32
FMC Databases 11.32.1
Thrust Management 11.32.2
Reduced Thrust Takeoff 11.32.3
Derated Thrust Climb 11.32.4
Fuel Monitoring 11.32.5
Loss of FMC Electrical Power 11.32.7
FMC Failure 11.32.8
Single FMC Failure 11.32.8
Dual FMC Failure 11.32.8

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Traffic Control Data Link 11.33
Air Traffic Control Data Link 11.33.1

Company Data Link 11.34
Company Data Link 11.34.1
Data Link. 11.34.3
Uplinks 11.34.5
Data Link Management 11.34.11
CDU Data Link Status Displays 11.34.11
FMC Communications Page 11.34.12

FMC Preflight 11.40
Introduction 11.40.1
Preflight Page Sequence. 11.40.1
Minimum Preflight Sequence 11.40.2
Supplementary Pages 11.40.3
Preflight Pages – Part 1 . . . . . 11.40.4
Initialization/Reference Index Page 11.40.5
Identification Page 11.40.7
Position Initialization Page 1/3 . . . . . 11.40.11
Position Reference Page 2/3 . . . . . 11.40.14
Position Reference Page 3/3 . . . . . 11.40.17
Route Page 1/X 11.40.19
More Route Page Prompts for an Active Route 11.40.22
Route Page 2/X 11.40.23
Departure/Arrival Index Page 11.40.26
Departures Page 11.40.28
Navigation Radio Page 11.40.30
VOR 11.40.30
ADF. 11.40.32
ILS. 11.40.33
ILS Tuning Status 11.40.35
Preflight Pages – Part 2 . . . . . 11.40.37
Performance Initialization Page 11.40.37

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Thrust Limit Page 11.40.41
Takeoff Reference Page 1/2 . . . . . 11.40.46
Takeoff Reference Page 2/2 . . . . . 11.40.51
Menu Page 11.40.56

FMC Takeoff and Climb 11.41
Introduction 11.41.1
Takeoff. 11.41.1
Climb 11.41.2
Altitude Intervention. 11.41.2
Climb Page 11.41.3
RTE X LEGS Page 11.41.7
Thrust Limit Page 11.41.10
Engine Out Climb 11.41.12
EO CLB Page 11.41.12
Engine Out Departure 11.41.13
Air Turnback 11.41.15
Arrivals Page 11.41.15

FMC Cruise. 11.42
Introduction 11.42.1
LNAV Modifications 11.42.2
RTE LEGS Page Modifications 11.42.2
Add Waypoints 11.42.3
Delete Waypoints 11.42.5
Change Waypoint Sequence 11.42.6
Remove Discontinuities 11.42.7
Direct To And Intercept Course To 11.42.8
Intercept Course From 11.42.11
Select Desired Waypoint Page 11.42.13
Airway Intercept 11.42.15
Route Offset 11.42.18
Cruise Page 11.42.19
All Engine Cruise 11.42.19

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Out Cruise 11.42.22
VNAV Modifications 11.42.26
Cruise Climb 11.42.26
Planned Step Climb 11.42.26
Calculated Step Climb 11.42.28
Constant Speed Cruise 11.42.34
Cruise Descent 11.42.35
Early Descent 11.42.36
Navigation Data 11.42.37
Reference Navigation Data Page 11.42.37
Fix Information Page 11.42.40
Route and Waypoint Data 11.42.43
Route Data Page 11.42.43
Wind Data 11.42.45
Wind Page 11.42.46
Position Report Page 11.42.48
In–Flight Position Update 11.42.50
Progress Pages 11.42.52
Progress Page 1 . . . . . 11.42.52
Progress Page 2 . . . . . 11.42.55
RTA Progress Page 3 . . . . . 11.42.58
RNP Progress Page 4 . . . . . 11.42.61
RNP Progress Page 4 . . . . . 11.42.63

FMC Descent and Approach 11.43
Introduction 11.43.1
Descent 11.43.2
Altitude Intervention 11.43.2
Descent Page 11.43.3
Descent Forecast Page 11.43.8
Offpath Descent Page 11.43.10
Engine Out Descent 11.43.11
Approach 11.43.12
Arrivals Page 11.43.13

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Arrivals Page – IFR Approaches 11.43.14
Arrivals Legs Page 11.43.17
Arrivals Page – VFR Approaches 11.43.18
Procedure Hold (in lieu of procedure turn) Legs Page 11.43.21
Approach Reference Page 11.43.22
Alternate Airport Diversions 11.43.25
Alternate Page 1/2 . . . . . 11.43.25
Alternate List Page 2/2 . . . . . 11.43.29
XXXX Alternate Page 11.43.30
Holding 11.43.34
Holding Entry 11.43.34
Hold Page (First Hold) 11.43.34
HOLD Page (Existing Hold) 11.43.38

FMS Alternate Navigation System Description 11.50
Introduction 11.50.1
Alternate Navigation Waypoints 11.50.2
Alternate Lateral Navigation 11.50.2
Route Changes 11.50.2
Course Reference 11.50.2
Alternate Navigation Radio Tuning 11.50.2
Alternate Navigation CDU Pages 11.50.3
Alternate Navigation Legs Page 11.50.3
Alternate Navigation Progress Page 11.50.5
Alternate Navigation Radio Page 11.50.7

EICAS Messages 11.60
Navigation EICAS Messages 11.60.1
FMC Messages 11.60.3
FMC Alerting Messages 11.60.4
FMC Communications Messages 11.60.8
FMC Advisory Messages 11.60.9
FMC Entry Error Messages 11.60.11

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

CDU Annunciator Lights 11.60.13

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Management System Control Display Unit (CDU)

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

1 Control Display Unit (CDU) Display

Displays FMS data pages.

2 Line Select Keys

Push –

- moves data from scratchpad to selected line
- moves data from selected line to scratchpad
- selects page, procedure, or performance mode as applicable
- deletes data from selected line when DELETE displays in scratchpad.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Conventions -

- scratchpad must be blank for line select transfer
- data can not be transferred to a blank line
- a blank scratchpad can not be transferred to a line
- not all data can be modified
- message displays if inappropriate entries attempted.

3 Display (DSPY) Light

Illuminated (white) –

- when RTE page 3 or greater, RTE LEGS page 2 or greater, RTE DATA page 2 or greater is displayed
- when airplane is not in holding pattern shown on HOLD page
- when modification is in progress, and any RTE, RTE LEGS, RTE DATA, HOLD, or VNAV page is shown.

HL7532 - HL7598

4 Brightness (BRT) Control

Rotate – controls display brightness.

HL7202 - HL7205, HL7733 - HL8347

4 Brightness (BRT) Control

Push –

- "+" increases brightness
- "-" decreases brightness
- 24 segment light brightness bar displays in the scratchpad and remains displayed for 2 seconds after release of the + or - push. Existing scratchpad information is saved and displays following fade of the brightness bar

5 Message (MSG) Light

Illuminated (white) –

- scratchpad displays message
- pushing clear key extinguishes light and clears message.

6 Offset (OFST) Light

Illuminated (white) – LNAV gives guidance for lateral route offset.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Function and Execute Keys

1 CDU Function Keys

Push –

- INIT REF – displays page for data initialization or for reference data
- RTE – displays page to input or change origin, destination, or route
- DEP ARR – displays page to input or change departure and arrival procedures
- ALTN – displays page to modify destination and route for alternate diversion
- VNAV – displays page to view or change vertical navigation path data
- FIX – displays page to create reference points on ND map
- LEGS –
  - displays page to evaluate or modify lateral and vertical route data
  - displays page to correlate route waypoints on the ND
- HOLD – displays page to create holding patterns and display holding pattern data, or to exit holding pattern
- FMC COMM – displays FMC data link status page
- PROG – displays page to view dynamic flight and navigation data, including waypoint and destination ETAs, fuel remaining, arrival estimates, and RTA and RNP information
- MENU – displays page to choose subsystems controlled by CDU
- NAV RAD – displays page to view or control navigation radio tuning
- PREV PAGE – displays previous page of multiple page displays (for example, LEGS pages)
- NEXT PAGE – displays next page of multiple page displays.

2 Execute Light

Illuminated (white) – active data is modified but not executed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Execute (EXEC) Key

Push –

- activates data modification(s)
- extinguishes execute light.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alpha/Numeric and Miscellaneous Keys

1 Alpha/Numeric Keys

Push –

- puts selected character in scratchpad
- Slash (/) key – enters "/" in scratchpad
- Plus Minus (+/-) key – first push enters "-" in scratchpad. Subsequent pushes alternate between "+" and "-".

2 Space (SP) Key

Push –

- enters space in scratchpad
- enters underscore character "_" in scratchpad when CDU is used as input device for systems other than FMC.

3 Delete (DEL) Key

Push – enters "DELETE" in scratchpad.

4 Clear (CLR) Key

Push –

- clears last scratchpad character
- clears scratchpad message.

Push and hold – clears all scratchpad data.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

CDU Page Components

1 Page Title

Subject or name of data displayed on page.

ACT (active) or MOD (modified) indicates whether page contains active or modified data.

2 Boxes

Data input is mandatory.

3 Line Title

Title of data on line below.

4 Data Line

Displays –

- prompts
- selectors
- data associated with line title.

Large font indicates crew entered or verified data. Small font indicates FMC computed data.

5 Page Number

Left number is page number. Right number is total number of related pages. Page number is blank when only one page exists.

6 Dashes

Data input is optional.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

7 Prompts

Display pages, select modes, and control displays. Caret “<” or “>” is before or after prompt.

8 Scratchpad

Displays messages, alphanumeric entries, or line selected data.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

CDU Page Color

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Color is used as follows:

- black – background color of page
- cyan –
  - ADF frequencies
  - inactive RTE page title
- green –
  - navigation radio data
  - active state of two–position and three–position selectors
- magenta – data used by FMC for lateral and vertical flight commands
  - active waypoint
  - active airspeed
  - active altitude
- shaded white –
  - modifications
  - MOD precedes page titles of modified pages
- white – most data.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Selector

1 FMC Selector

L – selects left FMC to provide guidance commands.

AUTO – automatically selects other FMC if one FMC fails.

R – selects right FMC to provide guidance commands.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Data Inertial Reference System (ADIRU)

1 On Battery (ON BAT) Light

Illuminated (white) – airplane battery powers ADIRU.

Note: The ON BAT light illuminates when the ADIRU switch is selected ON and ground power or primary power is subsequently removed or fails (battery power only remains).

2 ADIRU Switch

ON – applies power to ADIRU.

OFF – removes power when airspeed is less than 30 knots.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Transponder Panel

1 Altitude (ALT) SOURCE Selector

NORM (normal) – selects ADIRU as source for altitude reporting.

ALTN (alternate) – selects SAARU as source for altitude reporting.

2 Transponder (XPNDR) Selector

L – selects left transponder.

R – selects right transponder.

3 Transponder Code Selectors

Rotate – Sets transponder code in transponder.

4 Transponder Code Window

ATC L, ATC R – transponder selected.

Displays transponder code.

5 Transponder Mode Selector

STBY (standby) –

- transponder disabled
- ADS-B out (if installed) disabled

ALT RPTG (altitude reporting) OFF –

- transponder enabled in modes A and S
- altitude reporting disabled
- ADS-B out (if installed) enabled

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

XPNDR (transponder) –

- transponder enabled in modes A, C, and S
- in flight, altitude reporting enabled
- ADS-B out (if installed) enabled

TA (traffic advisory) ONLY and TA/RA (resolution advisory) – Refer to Chapter 15, Warning Systems.

6 Identification (IDENT) Switch

Push – transmits an identification signal.

7 TCAS Controls

Refer to Chapter 15, Warning Systems.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Weather Radar Panel

HL7532 - HL7598

1 Mode Switches

Push – selects mode.

LEFT – controls displays on left ND.

RIGHT – controls displays on right ND.

TFR (transfer) – transfers other ND display selections to related ND.

Note: Selecting both TFR switches at the same time results in the TEST mode; test pattern displays.

WX – displays weather radar returns at selected gain level.

WX+T (turbulence) – displays weather returns and turbulence within precipitation at calibrated gain level. Turbulence display available with display ranges of 40 nm or less. Selecting a range greater than 40 nm changes mode to WX.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

MAP – displays ground returns at selected gain level.

GCS (ground clutter suppression)

- IN – reduces amount of ground returns
- OUT – displays ground returns.

Note: Continuous operation is not recommended because weather return intensity may be reduced.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 MAP GAIN Control

Rotate inner knob – sets receiver sensitivity in MAP mode on related ND. Full clockwise sets receiver sensitivity at the preset calibrated level.

3 Tilt Control

Rotate outer knob clockwise – tilts radar antenna up.

Rotate outer knob counterclockwise – tilts radar antenna down.

4 Receiver/Transmitter (R/T) Switches

Push -

- LR/T – selects left R/T. Pushes out RR/T switch.
- RR/T – selects right R/T. Pushes out LR/T switch

5 TEST Switch

Push -

- tests weather radar system operation without transmitting
- displays test pattern and PWS symbol at the end of the test and any fault message on ND with WXR selected (except in PLAN, CTR VOR, and CTR APP modes).
- when on the ground, selecting WXR on the EFIS control panel and TEST on the weather radar control panel activates a 12 second test. Initially, the amber WINDSHEAR annunciation displays and the aural MONITOR RADAR DISPLAY sounds. Next, the Master Warning Light illuminates and the EICAS alert message WINDSHEAR SYS displays. Finally, the red WINDSHEAR annunciation displays and the aural GO AROUND WINDSHEAR AHEAD, and then WINDSHEAR AHEAD, WINDSHEAR AHEAD sounds
- the test pattern and PWS symbol remain displayed until WXR is selected off on the EFIS control panel, another mode is selected on the Mode Selector, or an actual PWS alert is detected. The source of any faults displays in the weather radar tilt field on the ND.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

1 TILT Control

Rotate outer knob clockwise – tilts radar antenna up.

Rotate outer knob counterclockwise – tilts radar antenna down.

2 GAIN Control

Rotate inner knob - adjusts receiver sensitivity (by detent) in MAP, WX, and WX+T modes. The 12 o'clock position sets radar sensitivity to the standard calibrated reflectivity level and is the recommended position for normal operation. Rotating the control clockwise increases sensitivity; rotating counterclockwise decreases sensitivity.

3 AUTO Switch

IN - both Captain's and First Officer's controls operate in automatic mode to optimize long and short range weather detection. Ground clutter suppression is operative. Manual tilt control is not available.

OUT - both Captain's and First Officer's controls operate manually. Ground clutter suppression is not available.

4 System Select Switch

IN - selects right system.

OUT - selects left system.

5 Mode Switches

Control display on respective ND.

Push -

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

TFR (transfer) - selects opposite display.

Note: Selecting both TFR switches at the same time results in the TEST mode; test pattern displays.

HL7733 - HL8005, HL8208 - HL8285
WX (weather) - displays weather returns.

HL7202 - HL7205, HL8006 - HL8077, HL8346, HL8347
WX (weather) - displays weather returns without threat information.

HL7733 - HL8005, HL8208 - HL8285
WX + T (weather + turbulence) - displays weather returns and turbulence within precipitation. Turbulence displays out to 40 nm for all selected ranges.

HL7202 - HL7205, HL8006 - HL8077, HL8346, HL8347
WX + T (weather + threat) - displays (weather returns and turbulence in manual mode) and (weather returns and threats in auto mode). Turbulence displays out to 40 nm for all selected ranges.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

MAP - displays ground returns at selected gain level.

6 Ground Clutter (GC) Switch

Push - allows ground clutter to display when pushed and held.

7 TEST Switch

Push –

- tests weather radar system operation without transmitting
- displays test pattern and PWS symbol at the end of the test and any fault message on ND with WXR selected (except in PLAN, CTR VOR, and CTR APP modes)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- when on the ground, selecting WXR on the EFIS control panel and TEST on the weather radar control panel activates a 12 second test. To activate the aural messages, TEST must be selected after WXR is selected on the EFIS control panel. Initially, the amber WINDSHEAR annunciation displays and the aural MONITOR RADAR DISPLAY sounds. Next, Master Warning Light illuminates and the EICAS alert message WINDSHEAR SYS displays. Finally, the red WINDSHEAR annunciation displays and the aural GO AROUND WINDSHEAR AHEAD, and then WINDSHEAR AHEAD, WINDSHEAR AHEAD sounds
- the test pattern and PWS symbol remain displayed until WXR is selected off on the EFIS control panel, another mode is selected on the Mode Selector, or an actual PWS alert is detected. The source of any faults displays in the weather radar tilt field on the ND

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

Navigation systems include global positioning system (GPS), air data inertial reference system (ADIRS), VOR, DME, ILS, ADF, ATC transponder, weather radar, and the flight management system (FMS). The FMS is described in the Flight Management System Description section of this chapter.

Navigation Systems Flight Instrument Displays

Refer to Chapter 10, Flight Instruments, Displays for flight instrument display system operations and typical instrument displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Global Positioning System (GPS)

Left and right GPS receivers are independent and supply very accurate position data to the FMC. GPS tuning is automatic.

GPS Displays

POS REF 3/3 page displays the left and right GPS position. The ND annunciates GPS when the FMC uses GPS position updates.

When the POS (position) switch on the EFIS control panel is selected, the ND map displays the left and right GPS symbols. The GPS symbols are identical and display as a single symbol when the GPS receivers calculate the same position.

GPS Data

If the ADIRU becomes inoperative during flight, the EICAS displays the message NAV ADIRU INERTIAL and the FMC uses only GPS data to navigate.

Use the GPS NAV prompt on the POS REF page to inhibit GPS navigation data. The EICAS message GPS alerts the crew when both GPS systems have failed.

GPS position updates should be used during all approaches in which the FMC database and approach procedures are referenced to the WGS-84 reference datum. GPS updates should be inhibited for other approach operations not based on WGS-84 unless other appropriate procedures are used.

GPS position updates should be used for all other operations unless a specific state requires the use of other update provisions within their airspace (eg, to accommodate a non-WGS reference datum or other reason).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

GPS System Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Inertial System
Air Data Inertial Reference System (ADIRS)

The ADIRS calculates airplane altitude, airspeed, attitude, heading, and position data for the displays, flight management system, flight controls, engine controls, and other systems. The major components of ADIRS are the air data inertial reference unit (ADIRU), secondary attitude and air data reference unit (SAARU), and air data modules.

Air Data Inertial Reference Unit (ADIRU)

The ADIRU supplies primary flight data, inertial reference, and air data. The ADIRU is fault–tolerant and fully redundant.

ADIRU Power

Initial power–up requires battery bus power and the ADIRU switch to be ON. If the ADIRU is switched off, it must complete a full realignment cycle before the airplane can be moved.

If electrical power is subsequently removed from the airplane and the Battery switch is switched OFF, the hot battery bus continues to supply electrical power to the ADIRU. The ON BAT light illuminates, and the horn in the landing gear wheel well sounds to alert maintenance personnel the ADIRU is on battery power.

When the ADIRU switch is OFF, the ADIRU remains powered for a few seconds.

In flight, system logic prevents the ADIRU from becoming unpowered if the ADIRU switch is inadvertently switched OFF.

ADIRU Alignment

On initial power–up, the ADIRU enters the align mode. The EICAS memo message ADIRU ALIGN MODE displays. Attitude or heading/track data is removed from the PFDs. Airplane latitude/longitude position must be entered on the CDU POS INIT page. The airplane should not move until alignment is complete.

If the latitude/longitude position is not close to the position of the origin airport, the scratchpad message INERTIAL/ORIGIN DISAGREE displays. If the crew–entered latitude/longitude position does not pass internal ADIRU comparison tests, the scratchpad message ENTER INERTIAL POSITION displays.

If a new airplane present position entry fails the internal check twice, the scratchpad message ALIGNMENT REINITIATED displays. The system automatically starts a new alignment cycle.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

In rare cases, a new airplane present position update of the ADIRU may cause the EICAS message NAV UNABLE RNP to momentarily display. This occurs if the entered ADIRU position is far different than the GPS position. The message displays until the FMC reconciles the difference between the new ADIRU position and the GPS position.

When the alignment is complete, the ADIRU changes to the navigate mode and the airplane can be moved. If the airplane stops for an extended period, the ADIRU changes to the automatic realign mode and refines the alignment until the airplane moves again.

In the automatic realign mode, ADIRU velocity and acceleration errors are reset to zero. The inertial position can be manually updated when the ADIRU is in the automatic realign mode by entering a new latitude/longitude position on the POS INIT 1/3 page. The ADIRU cannot be realigned in flight.

Note: A position update is recommended if the total time in the navigation mode is expected to exceed 24 hours.

Secondary Attitude and Air Data Reference Unit (SAARU)

The SAARU is a secondary source of critical flight data for displays, flight control systems, and other systems. If the ADIRU fails, the SAARU automatically supplies attitude, heading, and air data. SAARU heading must be manually set to the standby compass magnetic heading periodically.

If ADIRU inertial data fails, the EICAS caution message NAV ADIRU INERTIAL displays. The SAARU supplies attitude data to the PFD and three minutes of backup heading. The heading is based on ADIRU heading prior to failure. The CDU POS INIT page displays the SET HDG prompt three minutes after ADIRU failure. Use the SET HDG prompt to periodically set the SAARU heading to the standby compass magnetic heading. There are no other prompts to remind the crew to enter or to update the SAARU heading.

The following functions are inoperative after failure of the inertial reference portion of the ADIRU:

AFDS Modes:

- LNAV
- VNAV
- TO/GA
- LOC
- GS
- FPA
- TRK HOLD/SEL
- HDG HOLD/SEL*

Navigation Functions:

- FMC VNAV pages
- FMC Performance Predictions
- ND Wind Direction and Speed (wind arrow)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PFD Functions:

- Flap Maneuver Speeds
- PFD Heading*

Note: *This function is operative when standby magnetic compass heading is entered on the POS INIT page.

Note: ND map mode display following ADIRU failure references TRK.

Note: The autobrake is also inoperative.

The following additional functions are inoperative after failure of the inertial reference portion of the ADIRU and loss of GPS information:

- ND Map (center and expanded)
- CDU active leg course and distance
- CDU direct-to a waypoint
- FMC Alternate Airport DIVERT NOW
- FMC navigation radio autotuning

Restoration of the SAARU heading allows navigation in the ND VOR mode using radio navigation data. The FMC navigation data LNAV/VNAV guidance is no longer available when the ADIRU fails.

SAARU power–up is completely automatic at airplane power–up. There are no SAARU controls.

Air Data and Attitude Sources

The ADIRU and SAARU receive air data from the same three sources. The ADIRU and SAARU validate the air data before it may be used for navigation.

The three air data sources are the left, center, and right pitot and static systems. Air data is valid when two or more sources agree in the ADIRU, SAARU, or both.

When ADIRU air data is invalid and the AIR DATA/ATT switch is in the off position, valid SAARU air data is used. Refer to Chapter 10, Flight Instruments, Displays for a description of the AIR DATA/ATT switch.

Single channel operation occurs when the ADIRU and SAARU air data are invalid. The left PFD displays the ADIRU air data from the left pitot static system (left channel). The right PFD displays the SAARU air data from the right pitot static system (right channel).

The EICAS message AIR DATA SYS displays.

The air data modules are remote sensors for the air data functions within the ADIRU and SAARU. They measure static and pitot pressure. Both the ADIRU and SAARU receive data from all air data modules. In addition, the ADIRU and SAARU each receive data from the two angle of attack vanes and a dual element total air temperature probe.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The standby flight instrument displays receive data from the center pitot and static ports through standby air data modules. Altitude, attitude, and airspeed are independent of ADIRU and SAARU values.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADIRS Schematic, Normal Mode

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADIRS Schematic, With NAV ADIRU INERTIAL Message

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Radio Navigation Systems
Automatic Direction Finding (ADF)

Two ADF systems are installed. Either ADF can be manually tuned from the left or right CDU on the NAV RADIO page.

ADF Displays

Left and right ADF bearings display on the ND when the related VOR/ADF switch is in the ADF position. ADF data is cyan.

If both FMCs fail, the left and right ADF radios are tuned on the related left and right CDU ALTN NAV RADIO page.

Distance Measuring Equipment (DME)

Two DME systems are installed. The DMEs are usually tuned by the FMC, but may be tuned manually.

DME Tuning

DME is tuned manually when the VOR portion of a VOR/DME pair is entered on the NAV RADIO page. The FMC tunes DME as necessary for radio position updates. Manual DME tuning does not inhibit FMC DME tuning.

The FMC uses two DMEs for position updates. DME/DME position updates are usually more accurate than VOR/DME updates. The FMC cannot tune specific DMEs if the navaids are inhibited on the REF NAV DATA page.

After dual FMC failure, the left DME is tuned with the left CDU and the right DME is tuned with the right CDU. Each DME is tuned to the VOR displayed on the CDU unless the related EFIS control panel ND mode selector is set to APP. In APP, the DME is tuned to the ILS.

DME Displays

DME distance displays on the ND map when operating in the VOR mode. DME distances also display when the ND mode selector is in the VOR or APP position, and either or both VOR L or VOR R switches are selected. DME distance also displays on the PFD when the ILS receivers are tuned to a collocated DME and localizer facility.

POS REF page 2/3 displays the identifiers of the DME stations used for FMC position updates.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Instrument Landing System (ILS)

Three ILS receivers are installed. They are usually tuned by the FMC, but can be tuned manually on the NAV RADIO page.

ILS Tuning

Two conditions must be met for FMC ILS autotuning to occur:

- an ILS, LOC, Back Course, LDA (localizer–type directional aid), or SDF (simplified directional facility) approach have been selected to the active route, and
- the airplane is within 50 NM from the top of descent, 150 NM of the landing runway threshold, or the FMC is in descent mode

On initial takeoff, ILS autotuning is inhibited for 10 minutes to prevent clutter on the PFD. Selection and execution of a new approach in the active flight plan causes the ILS to autotune to the new approach frequency, even if this is accomplished during the 10 minute takeoff inhibit period. ILS autotune inhibit does not apply to subsequent takeoffs on the same flight (for example, touch–and–go or stop–and–go landings).

All three ILS receivers can be manually tuned from the NAV RADIO page at anytime unless ILS approach tuning inhibit is active.

ILS approach tuning inhibit is active when:

- the autopilot is engaged and either the localizer or glideslope is captured
- Only the flight director is engaged, and either the localizer or the glideslope is captured, and the airplane is below 500 feet radio altitude, or
- on the ground, the localizer is alive, airplane heading is within 45 degrees of the localizer front course, and ground speed is greater than 40 knots

ILS tuning is again enabled when:

- either TO/GA switch is pushed
- the autopilot is disengaged and both flight director switches are switched off, or
- the MCP approach mode is deselected above 1500 feet radio altitude

The ILS frequency is automatically retuned when ILS tuning is enabled and a new approach is selected on the CDU.

After dual FMC failure, the left and center ILS receivers are tuned with the left CDU on the ALTN NAV RADIO page. The right ILS receiver is tuned with the right CDU on the ALTN NAV RADIO page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ILS Displays

The tuned ILS frequency displays on the PFD and on the ND in the approach mode.

Localizer and glideslope deviation display on the PFD. Localizer and glideslope deviation, and selected course display on the ND when that ND is in the approach mode. Front or back course deviation is determined from airplane heading.

Navaid Identifier Decoding

The Morse code identifier of a tuned VOR, ILS, DME, or ADF can be converted to alpha characters. The decoded identifier then displays on the PFD and ND. The crew should monitor this identifier for correct navigation radio reception. The identifier name is not compared with the FMC data base.

Due to the large variation in ground station identifier quality, the decode feature may incorrectly convert the intended identifier name. Examples: the Hong Kong localizer “KL” may display as “KAI”, or the Boeing Field ILS may display as “QBFI” or “TTTT” instead of “IBFI.”

Pilots should verify the identity of the tuned navigation station from the audio Morse code when the tuned frequency remains displayed or an incorrect identifier displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

VOR

Two VOR receivers are usually tuned by the FMC but, can be tuned manually by the crew. The tuned VORs display on the ND and may be used for position updates.

VOR Tuning

The crew manually tunes VORs on the NAV RADIO page.

The FMC can tune a VOR and a collocated DME for position updates. The FMC uses VOR/DME radio position updates when more accurate sources are not available. Specific VOR/DME pairs can be inhibited on the REF NAV DATA page. If the crew enters two VOR identifiers on the NAV RADIO page, then the FMC cannot tune any other station for VOR/DME updates.

After dual FMC failure, the VOR radios can be manually tuned on the CDU ALTN NAV RADIO page. The left VOR is tuned with the left CDU and the right VOR is tuned with the right CDU.

VOR Displays

The NAV RADIO page displays FMC–tuned or manually–tuned VOR data. POS REF page 2/3 displays the identifier of the VOR and DME pair used for position updates.

The ND displays the identifier or frequency of the VORs tuned on the NAV RADIO page. The FMC usually tunes the same VOR in the left and the right. The ND VOR L VOR R data are usually the same.

Left and right VOR bearings display on the ND map when the related EFIS control panel VOR/ADF switch is in the VOR position. VOR bearings also display when the ND mode selector is in the VOR or APP position, and either or both VOR L or VOR R switches are selected. The VOR frequency and selected course display in the upper right hand corner of the ND when operating in the VOR mode. The ND also displays course deviation when operating in the VOR mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Transponder

The transponder panel controls two ATC transponders and the traffic alert and collision avoidance system (TCAS). Traffic displays if the transponder mode selector is in TA ONLY or TA/RA. The transponder responds to Mode S interrogations in all modes except STBY; and when on the ground, it provides airport position. In flight, the selected transponder activates beacon and altitude reporting when the transponder mode selector is in XPNDR, TA ONLY, or TA/RA. The EICAS advisory message TRANSPONDER L or TRANSPONDER R displays if a transponder fails. If altitude reporting fails, the transponder can be switched to the alternate altitude source. Refer to Chapter 15, Warning Systems, for a description of TCAS.

Transponders provide selective interrogation and downlink information, such as flight number, airspeed or groundspeed, magnetic heading, altitude, GPS position, etc., depending on the level of enhancement. Some airports use transponder information to monitor airplane position on the ground when the transponder is active (mode selector not in STANDBY). Transponder enhancements also enable air traffic controllers in some areas of the world to use Automatic Dependent Surveillance-Broadcast (ADS-B). TCAS modes should not be used on the ground for ground tracking.

The left (right) GPS is connected to the left (right) transponder. If GPS input to the selected transponder is unavailable, ADS-B Out position reporting is lost or degraded and ATC is alerted. If advised by ATC ADS-B Out communications are lost or degraded, selection of the other transponder restores communications and reporting.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Weather Radar

The weather radar system consists of receiver–transmitter unit, antenna, and control panel. Radar returns display on the ND in all modes except:

- Plan mode
- VOR Center
- APP (Approach) Center

The EFIS control panel weather radar (WXR) map switch controls power to the transmitter/receiver and controls the weather radar display on the ND. The radar display range automatically adjusts to the ND range selected on the EFIS control panel.

The weather radar system performs various levels of self test on power up, during each sweep, and when descending through 2,300 feet AGL.

HL7202 - HL7205, HL7733 - HL8347

Multiscan weather radar collects data from different scans and merges the information into a total weather picture. Software eliminates ground clutter resulting in clutter-free viewing of significant weather out to 320 nm. When operating in the automatic mode, multiple radar scans at pre-selected tilt angles detect short, mid, and long range weather. Tilt and gain inputs are not required. This results in weather detection at all ranges and in all phases of flight. Additional processing ensures data from thunderstorm tops within 5,000 feet of the airplane remain on the radar display until it no longer poses a danger; thus, enabling flight around thunderstorms that may not be visible otherwise.

The CDU can control the EFIS control panel functions, including the WXR. The weather radar operating modes and fault conditions display on the ND.

Turbulence can be sensed by the weather radar only when there is sufficient precipitation. Clear air turbulence cannot be sensed by radar.

The weather radar also provides predictive windshear alerting (refer to Chapter 15, Warning Systems).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Threat Assessment Feature

HL7202 - HL7205, HL8006 - HL8077, HL8346, HL8347

The Threat Assessment feature uses a combination of data from vertical and horizontal sweep data to predict the presence of turbulence and hail in anvil and electrified stratiform clouds. Navigation Display colors are enhanced to accurately reflect the weather threat. High altitude (>25,000 ft) threats display as red speckled patterns in green, amber, or black regions on the ND. An extended pattern shows the downwind direction. Low altitude (<25,000 ft) threats display as red speckled patterns in green or amber regions indicating a threat in a cell. This is an indication of a region where airplane induced lightning may occur. This function is active only with AUTO and WX+T selected.

Predictive OverFlight (POF) protection displays a cell growing into the flight path, but not currently a threat. POF displays can be an indication of clear air turbulence above a growing cell even if the visible cell may not reach the flight path. POF displays as a red enclosure with red dots. POF is active only with AUTO and WX+T selected.

When operating in AUTO, two-level turbulence detection displays severe turbulence with solid magenta areas while light-to-moderate turbulence areas display with magenta dots. Severe turbulence is for airplane loads 0.3 g or greater; light turbulence is for airplane loads 0.2 g or less.

When operating in AUTO and WX+T, threat assessment is operative for the descent profile. It is not necessary to switch to manual operation during descent.

Refer to Chapter 10.40 for ND Symbology.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The flight management system (FMS) aids the flight crew with navigation, in–flight performance optimization, automatic fuel monitoring, and flight deck displays. Automatic flight functions manage the airplane lateral flight path (LNAV) and vertical flight path (VNAV). The displays include a map for airplane orientation and command markers on the airspeed, altitude, and thrust indicators to help in flying efficient profiles.

The flight crew enters the applicable route and flight data into the CDUs. The FMS then uses the navigation database, airplane position, and supporting system data to calculate commands for manual and automatic flight path control.

The FMS tunes the navigation radios and sets courses. The FMS navigation database supplies the necessary data to fly routes, SIDs, STARs, holding patterns, and procedure turns. Cruise altitudes and crossing altitude restrictions are used to calculate VNAV commands. Lateral offsets from the programmed route can be calculated and commanded.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Management Computer (FMC)

The basis of the flight management system is the flight management computer function. Since the term FMC is universally understood, it is used here for standardization and simplification.

Under normal conditions, one FMC accomplishes the flight management tasks while the other FMC monitors. The second FMC is ready to replace the first FMC if system faults occur.

The FMC uses flight crew–entered flight plan data, airplane systems data, and data from the FMC navigation database to calculate airplane present position and pitch, roll, and thrust commands necessary to fly an optimum flight profile. The FMC sends these commands to the autothrottle, autopilot, and flight director. Map and route data are sent to the NDs. The EFIS control panels select the necessary data for the ND. The mode control panel selects the autothrottle, autopilot, and flight director operating modes. Refer to the following chapters for operation of these other systems:

- Chapter 4, Automatic Flight
- Chapter 10, Flight Instruments, Displays.

The FMC is certified for area navigation when used with navigation radio and/or GPS updating. The FMC and CDU are used for enroute and terminal area navigation, RNAV approaches, and to supplement primary navigation during all types of instrument approaches.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Control Display Units (CDUs)

The flight crew controls the FMC using three CDUs. The CDUs give alternate display, communications control, and navigation capability if there is a dual FMC failure (refer to the Alternate Navigation section of this chapter). The center CDU is a backup for the left or right CDU in case of a failure and automatically takes over functionality of the failed CDU. Only the left and right CDUs tune navigation radios when alternate navigation is active.

Left and right CDUs provide backup to the left and right EFIS control panels, while the center CDU provides EFIS control panel backup for a failed left or right CDU. If the EFIS control panel or the display select panel fails, a manual selection of the CDU backup mode can be made on the MENU page.

Refer to Chapter 10, Flight Instruments, Displays for a description of alternate display control. Refer to Chapter 5, Communications, for a description of communications control.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

When first powered, the FMS is in the preflight phase. When completing a phase, the FMS changes to the next phase in this order:

- preflight
- takeoff
- climb
- cruise
- descent
- approach
- flight complete

Preflight

During preflight, the flight crew enters the flight plan and load sheet data into the CDU. Some data can be entered by data link. The flight plan defines the route of flight from the origin to the destination and initializes LNAV. Flight plan and load sheet data provide performance data to initialize VNAV.

Required preflight data consists of:

- initial position
- route of flight
- performance data
- takeoff data

Optional preflight data includes:

- navigation database selection
- route 2
- alternate airport
- standard instrument departure (SID)
- standard terminal arrival route (STAR)
- thrust limits
- wind

Preflight starts with the IDENT page. If the IDENT page is not displayed, it can be selected with the IDENT prompt on the INIT/REF INDEX page. Visual prompts help the flight crew select CDU preflight pages. Preflight pages can be manually selected in any order.

After data on each preflight page is entered and checked, pushing the lower right line select key selects the next preflight page. After selecting ACTIVATE on the ROUTE page, the execute (EXEC) light illuminates. Pushing the EXEC key activates the route.

The departure/arrival (DEP/ARR) page can be used to select a SID. Selection of the SID may cause a route discontinuity. Resolution of the discontinuity and execution of the modification should be accomplished on the LEGS page.

When all required preflight entries are complete, the PRE–FLT line title on the TAKEOFF REF page is replaced by dashes and the THRUST LIM prompt displays at the next page select line location.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff

The takeoff phase starts with selection of TO/GA and terminates with thrust reduction for climb. LNAV and VNAV can be armed before takeoff to activate at the applicable altitude (refer to Chapter 4, Automatic Flight).

Climb

The climb phase starts at thrust reduction for climb and terminates at the top of climb (T/C) point. The T/C is where the airplane reaches the cruise altitude entered on the PERF INIT page.

Cruise

The cruise phase starts at the T/C point and terminates at the top of descent (T/D) point. Cruise can include step climbs and en route descents.

Descent

The descent phase starts at the T/D point or when the VNAV descent page becomes active, and terminates at the start of the approach phase.

Approach

The approach phase starts when the first waypoint of the procedure sequences or when the runway is the active waypoint and the distance to go is less than 25 nm.

Flight Complete

Thirty seconds after engine shutdown, the flight complete phase clears the active flight plan and load data. Some preflight data fields initialize to default values in preparation for the next flight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Operational Notes

When operating in the LNAV and VNAV modes, observe system operation for unwanted pitch, roll, or thrust commands. If unwanted operation is observed, select heading select and flight level change modes.

The system must be carefully monitored for errors following:

- activation of a new data base
- power interruption
- ADIRU failure

The FMC will not sequence the active waypoint when more than 21 nm off the active route and not on an offset route. Return to the active route can be accomplished using the DIRECT TO or INTERCEPT COURSE TO/FROM procedures.

Incorrect waypoint sequencing can occur when attempting route modifications within approximately 1 NM of the active waypoint for modifications that result in a small course change, or within approximately 4 NM of the active waypoint for modifications that results in a large course change.

When approaching an active waypoint, the following should be avoided:

- executing a lateral offset
- entering a vertical or lateral flight plan change
- executing a DIR-TO with ABEAM selected.

If a route modification is active when a waypoint is sequenced, the route modification should be erased and reattempted.

CAUTION: Should an uncommanded turn occur when using LNAV, select HDG SEL to follow the flight plan, then perform a DIRECT TO to the waypoint that prematurely sequenced. Reengage LNAV as needed.

When a waypoint is in the route more than once, certain route modifications (such as DIRECT TO and HOLD) use the first waypoint in the route.

Some SIDs or STARS contain a heading vectors leg. VECTORS waypoints display on the ND as a magenta line without an end point leading away from the airplane symbol. If LNAV is active, the DIRECT TO or INTERCEPT COURSE TO/FROM procedures can be used to start waypoint sequencing beyond the vectors leg.

When entering airways in a route page, the start and end waypoints must be in the data base. A route segment must be entered as a DIRECT leg.

During a climb or descent, changing the altimeter setting near the planned level off can cause altitude capture to fail, and the aircraft may continue to climb or descend past the planned level off altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Terminology

The following paragraphs describe FMC and CDU terminology.

Active – flight plan data used to calculate LNAV or VNAV guidance commands.

Activate – changing a route from inactive to active for navigation by:

- selecting the ACTIVATE prompt
- pushing the execute (EXEC) key

Altitude constraint – a crossing restriction at a waypoint.

Delete – using the DELETE key removes FMC data and reverts to default values, dash or box prompts, or a blank entry.

Econ – a speed schedule calculated to minimize operating cost. The economy speed is based on the cost index. A low cost index causes a lower cruise speed. Maximum range cruise or the minimum fuel speed schedule may be obtained by entering a cost index of zero. This speed schedule ignores the cost of time. A minimum time speed schedule may be obtained by entering a cost index of 9999. This speed schedule calls for maximum flight envelope speeds. A low cost index may be used when fuel costs are high compared to operating costs.

Enter – putting data in the CDU scratchpad and line selecting the data to the applicable location. New characters can be typed or existing data can be line selected to the scratchpad for entry.

Erase – removing entered data, which has resulted in a modification, by selecting the ERASE prompt.

Execute – pushing the illuminated EXEC key to make modified data active.

Inactive – data not being used to calculate LNAV or VNAV commands.

Initialize – entering data required to make the system operational.

Message – FMC information displayed in the scratchpad.

Modify – changing active data. When a modification is made to the active route or performance mode, MOD displays in the page title, ERASE displays next to line select key 6 left, and the execute key illuminates.

Prompt – CDU symbols that aid the flight crew in accomplishing a task. Prompts can be boxes, dashes, or a careted (< or >) line to remind the flight crew to enter or validate data.

Purge – select the PURGE prompt to remove all airports uplinked to the ALTN LIST.

Select – pushing a key to obtain the necessary data or action, or to copy selected data to the scratchpad.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Speed restriction – an airspeed limit associated with a specified altitude entered by the flight crew.

Speed transition – an airspeed limit associated with a specified altitude entered by the FMC.

Waypoint – a point on the route or in the navigation database. It can be a fixed point such as a latitude and longitude, VOR or ADF station, or an airway intersection. A conditional waypoint is not associated with a land reference; it is based on a time or altitude requirement. An example of a conditional waypoint is “when reaching 4,000 feet”.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Maintenance Index

The MAINTENANCE INDEX page prompts are used only on the ground.

1 AIRLINE POLICY

The airline policy pages display operating parameters kept in the airline maintained file. The FMC references this file for data before it calculates default values. These pages are not usually used by the flight crew.

2 INERTIAL MONITOR

This is a maintenance function.

3 INDEX

Push – displays the INIT/REF INDEX page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Navigation Position

The FMC position is determined from GPS, navigation radio, and ADIRS systems. When receiving reliable GPS data, the FMC position is from a GPS updated FMC position. If GPS data is not available, cannot be validated, or is inhibited, the FMC position is updated using navigation radios, when enabled. Further, if navigation radios are not available or not reliable, the FMC position is the inertial (ADIRU) position.

FMC Position Update

FMC position may be manually updated to any of the navigation system positions. This update is accomplished on POS REF page 2.

On the ground, the FMC calculates present position based on ADIRU and/or the GPS data.

If GPS updating is not available due to loss of signals, pushing a TO/GA switch updates the FMC position to the runway threshold or to the position shift position, when entered. When making an intersection takeoff, the intersection displacement distance from the runway threshold must be entered on the TAKEOFF REF page. With GPS NAV ON, the TO/GA update is inhibited.

In flight, the FMC position is the ADIRU inertial position updated by GPS source data to compensate for inertial reference errors. Radio navaid updating can be activated by selecting the RAD NAV INHIBIT toggle to OFF on the REF NAV DATA page. Updating priority is based on the availability of valid data from these sources. With all ADIRUs failed and GPS operative and valid, the FMC position is the GPS position.

The FMC automatically tunes VOR, DME, and ILS radios for position updating and displays them on the ND and NAV RADIO page. Selection is related to the active route and any procedure (SID, STAR, etc.) in the active route. Manually selecting VOR frequencies or identifiers precludes the FMC from autotuning other VOR/DME frequencies for position updating; however, the FMC continues to tune DME-DME pairs for position updating.

When available, GPS is the ADIRU inertial position updating source. With GPS inoperative or inhibited and with NAV RAD INHIBIT selected to OFF, ADIRU inertial position updating occurs in the following priority order:

- LOC and DME-DME
- LOC and collocated VOR/DME
- LOC
- DME-DME
- collocated VOR/DME.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The station identifiers in use by the FMC for navigation radio updating display on the POS REF page 2. Radio navaid updating is inhibited unless the RAD NAV INHIBIT toggle is selected to OFF on the REF NAV DATA page.

Primary FMC Position Update Source	POS REF page 2/3	ND Annunciation
GPS	GPS	GPS
LOC, DME DME valid; GPS invalid*	LOC–RADIO	LOC–DME–DME
LOC, VOR DME valid; GPS invalid*	LOC–RADIO	LOC–VOR–DME
LOC valid; GPS, DME, VOR invalid*	LOC-INERTIAL	LOC
DME valid; GPS invalid	RADIO	DME–DME
VOR DME valid; GPS invalid	RADIO	VOR–DME
GPS, VOR, DME invalid	INERTIAL	INERTIAL
GPS valid, ADIRU failed	GPS	GPS
GPS invalid; ADIRU failed	blank	map not available

Localizer updating is inhibited when GPS/INERTIAL is the navigation update mode.

* The FMC changes to LOC updating when:
- the tuned localizer is associated with the destination runway
- the airplane is less than 6,000 feet above localizer navaid elevation
- the airplane is less than 20 nm from the localizer navaid for a front course approach or less than 12 nm for a back course approach
- the airplane is within a 25° sector of the inbound localizer course
- the difference between airplane track and the localizer course is less than a 45° intercept angle

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Polar Operations

When entering the polar region, automatic switching to a true north reference is annunciated by a white box around the word TRU on the ND. A TRUE heading reference can be selected with the heading reference switch inside or outside the polar region. The ND displays a green box around the word MAG to annunciate the change back to magnetic reference when leaving the polar region. If the heading reference is TRU in the descent phase, the ND displays a flashing amber box around the word TRU.

The current GRID heading displays near the top of both NDs when the airplane is north of 70°N or south of 70°S. The GRID heading is not used by any airplane system.

Note: When operating the autopilot in the polar region in other than LNAV, the TRUE position on the heading reference switch must be selected.

Note: When operating north of 82°N or south of 82°S using the ND PLAN mode, the airplane position symbol does not display.

Note: If the ADIRU fails in a polar region, the EICAS message NAV ADIRU INERTIAL displays and all autopilot and AFDS roll modes fail. When heading information is restored by entry of a reference heading on the POS INIT page, HDG SEL and HDG HOLD roll modes are restored. GPS continues to provide navigation data to the FMC and active route information displays on the ND. When operating in this degraded mode, heading on the POS INIT page may be referenced to magnetic, true, or grid heading. The heading display drifts significantly under these conditions. Periodic updating of the heading reference on the POS INIT page should be accomplished at least every 10 minutes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Polar Regions

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Navigation Performance

The FMC uses data from the navigation systems to accurately calculate the position of the airplane. The current FMC position displays on line 1 of the POS REF page 2. The primary source of update displays in parentheses above the FMC position.

Navigation system positions display on the left side of lines 2 through 4. The bearing/distance is from the FMC position to the individual navigation system position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The FMC position displays on the ND at the tip of the triangle. All other positions display relative to the FMC. The RADIO position is shown above as a •, but is not shown on the ND. The ACTUAL navigation performance circles shown above do not display on the ND.

Actual Navigation Performance

Actual navigation performance (ANP) is the FMC position accuracy. It displays on the POS REF page 2, lines 1 - 3, for the navigation source displayed on the left side. ACTUAL navigation performance is a circular prediction centered at the FMC position. Airplane position is estimated to be within this ACTUAL navigation performance circle 95 percent of the time.

After a manual position update using the ARM function on the POS REF page 2, the ACTUAL navigation performance of the FMC changes to the ACTUAL navigation performance of the selected navigation source. In the example above, selection of the NOW> prompt on the INERTIAL line would change the FMC ACTUAL navigation performance to 5.7 NM. The FMC then updates from the best available navigation system and eventually, the manual update has no effect on position calculation. Some automatic updates can be inhibited; GPS on POS REF page 3 and VOR/DME updates on the REF NAV DATA page.

Radio navaid updating is inhibited unless the RAD NAV INHIBIT toggle is selected to OFF on the REF NAV DATA page.

Required Navigation Performance

Required Navigation Performance (RNP) is the navigation accuracy required for operation within a defined airspace. It is expressed in nautical miles. RNP values have been published for areas of operation around the world. Operations in these areas require on–board navigation systems to alert the flight crew if ANP exceeds RNP. The FMC supplies a default RNP value for takeoff, en route, oceanic/remote, terminal, and approach phases of flight. The flight crew may enter an RNP value, if required. RNP displays on POS REF page 2.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Lateral Navigation (LNAV)

LNAV provides steering commands to the next waypoint or the selected route intercept point. When armed on takeoff, LNAV engages at or above 50 feet, when laterally within 2.5 nautical miles of the active route leg. FMC LNAV guidance normally provides great circle courses between waypoints. However, when an arrival or approach from the FMC data base is entered into the active route, the FMC commands a heading, track, or a DME arc to comply with the procedure.

The FMC creates a path allowing the airplane to turn before reaching a "fly-by" waypoint. When a waypoint is defined as a "fly-over", the FMC directs the airplane to fly directly over the waypoint before turning. The flight path shows on the ND using reduced range.

Waypoints

Waypoint (navigation fix) identifiers display on the CDU and navigation display.

The CDU message NOT IN DATABASE displays if a manually entered waypoint identifier is not kept in the data base. The waypoint can still be entered as a latitude/longitude, place–bearing/distance or place–bearing/place–bearing waypoint.

FMC–generated waypoints contain a maximum of five characters assigned according to the following rules:

Navaid Waypoints

VHF – waypoints located at VHF navaids (VOR/DME/LOC) are identified by one, two, three or four character facility identifier. Examples:

- Los Angeles VORTAC – LAX
- Tyndall TACAN – PAM
- Riga Engure, Latvia – AN

NDB – waypoints located at NDBs are identified by use of the station identifier. Example: FORT NELSON, CAN – YE.

Fix Waypoints

Waypoints located at fixes with names containing five or fewer characters are identified by the name. Examples:

- DOT
- ACRA
- ALPHA

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Long Waypoints

Waypoints with more than five characters are abbreviated using the following rules sequentially until five characters remain. For double letters, one letter is deleted. Example:

- KIMMEL becomes KIMEL

Keep the first letter, first vowel and last letter. Delete other vowels starting from right to left. Example:

- BAILEY becomes BAILY

The next rule abbreviates names even further. Apply the previous rule, then delete consonants from right to left. Example:

- BRIDGEPORT becomes BRIDGPRT then BRIDT

Fixes with multi-word names use the first letter of the first word and abbreviate the last word, using the above rules sequentially until a total of five characters remain. Examples:

- CLEAR LAKE becomes CLAKE
- ROUGH ROAD becomes RROAD

Unnamed Waypoints

If an unnamed turn point, intersection, or fix is collocated with a named waypoint or navaid on a different route structure (such as low altitude routes or an approach), the name or identifier of the collocated waypoint is used. Example:

- Unnamed turn point on J2 between the Lake Charles (LCH) and New Orleans (MSY) VORTACs is coincidental with the Lafayette (LFT) low altitude VORTAC. LFT is used as the identifier for the turn point

Identifier codes for unnamed turn points not coincidental with named waypoints are constructed from the identifier of a navaid serving the point and the distance from the navaid to the point. If the distance is 99 nautical miles or less, the navaid identifier is placed first, followed by the distance. If the distance is 100 nautical miles or more, the last two digits are used and placed ahead of the navaid identifier. Examples (NAVAID – DISTANCE – IDENT):

- INW – 18 – INW18
- CSN – 106 – 06CSN

Waypoints located at unnamed flight information region (FIR), upper flight information region (UIR), and controlled airspace reporting points are identified by the three–letter airspace type identification followed by a two–digit sequence number. Example:

- FRA01

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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
- N75° W170° becomes 75N70
- N50° E020° becomes 5020E
- N06° E110° becomes 06E10
- S52° W075° becomes 5275W
- S07° W120° becomes 07W20
- S50° E020° becomes 5020S
- S06° E110° becomes 06S10

Procedure Arc Fix Waypoint Names

Unnamed terminal area fixes along a DME arc procedure are identified with the first character D. Characters 2 through 4 indicate the radial on which the fix lies. The last character indicates the arc radius. The radius is expressed by a letter of the alphabet where A = 1 mile, B = 2 miles, C = 3 miles and so forth. Example:

- EPH252°/24 = D252X

An unnamed waypoint along a DME arc with a radius greater than 26 miles is identified by the station identifier and the DME radius. Example:

- CPR338°/29 = CPR29
- CPR134°/29 = CP29A
- CPR190° /29 = CP29B

Procedure Fix Waypoints

Marker beacons are identified by the marker type identifier followed by the runway number. Examples:

- Outer Marker 13R = OM13R
- Middle Marker 21 = MM21

Runway–related fixes – waypoints located at unnamed runway–related fixes are identified by adding a two–letter prefix to the runway number. The following list is used to determine the applicable prefix:

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- RX – runway extension fix
- FA – VFR final approach fix
- CF – final approach course fix
- FF – final approach fix
- IF – initial approach fix
- OM – outer marker
- MM – middle marker
- IM – inner marker
- BM – back course marker
- MD – minimum descent altitude
- A – (+ an alpha) step down fix
- RW – runway threshold
- MA – missed approach point other than RW
- TD – touchdown point inboard of RW

Examples: OM25L, MM09, IM23, RW04, RW18L.

For airports with more than one approach to the same runway, the two letter prefix may change to allow different identifiers for the same waypoint. The first letter identifies the type of fix and the second letter identifies the type approach as follows:

- C( ) – final approach course fix
- F( ) – final approach fix
- P( ) – missed approach point
- I( ) – initial approach fix
- D( ) – minimum descent altitude
- T( ) – touch down point
- R( ) – runway centerline intercept.
- ( )I – ILS
- ( )L – localizer only( )B –backcourse ILS
- ( )D – VOR/DME
- ( )V – VOR only
- ( )S – VOR with DME points
- ( )N – NDB
- ( )Q – NDB with DME points
- ( )M – MLS
- ( )T – Tacan
- ( )R – RNAV

Examples: CI32R, PV15, FN24L.

Unnamed turn points that are part of a procedure are identified as a latitude and longitude waypoint. These include waypoints (except conditional waypoints) defined by flying a course or track from a waypoint (except conditional waypoints) to a radial or DME distance. These waypoints are automatically entered in a route by selection of a procedure using these waypoints, from the departures or arrivals page.

Airport reference points are identified by the ICAO identifier.

DME step down fixes are identified by the distance and a “D”.
Examples: 138D, 106D, 56D, 3D.

Duplicate Waypoints

When a waypoint which has a duplicate identifier in the navigation database is entered, the SELECT DESIRED WPT page displays. The page lists the latitude/longitude of duplicate waypoints and the fix type.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Entering a waypoint identifier in the route a second time displays the SELECT DESIRED WPT page. The page lists the latitude/longitude of duplicate waypoints and fix type. Line selecting the latitude/longitude of the desired waypoint enters that waypoint on the page from which the SELECT DESIRED WPT was accessed.

Conditional Waypoints

Conditional waypoints may display in the route when selecting a DEPARTURES or ARRIVALS page procedure. Usually, conditional waypoints cannot be manually entered on a route or legs page. These waypoints indicate when an event occurs and are not at a geographically–fixed position. The types of conditions are:

- climb/descent through an altitude
- 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.

Note: All waypoints except BCD and CDE are examples of conditional waypoints.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Manually Entered Latitude/ Longitude Waypoints

Pilot defined waypoints entered as a latitude and longitude display in a seven–character format. Latitude and longitude waypoints are entered with no space or slash between the latitude and longitude entries. Leading zeros must be entered. All digits and decimal points (to 1/10 minute) must be entered unless the latitude or longitude are full degrees. Examples:

- N47° W008° is entered as N47W008 and displays as N47W008
- N47° 15.4’ W008° 3.4’ is entered as N4715.4W00803.4 and displays as N47W008

Manually Entered Place Bearing/Distance or Place Bearing/Place Bearing Waypoints

Waypoints entered as a place bearing/distance or place bearing/place bearing are identified by the first three characters of the entry followed by a two–digit sequence number. Examples:

- SEA330/10 becomes SEA-01
- SEA330/OLM020 becomes SEA-02

The two digit sequence numbers reserved for RTE1 are 01 through 49. The two digit sequence numbers reserved for RTE2 are 51 through 99.

Manually Entered Airway Crossing Waypoints

Airway crossing fixes are entered as a five character waypoint name or by entering consecutive airways on the ROUTE page. In the latter case, the display is an X followed by the second airway name. Example: entering J70 on the VIA line of the ROUTE page causes box prompts to display opposite on the same line. Leaving the box prompts empty and entering J52 on the next VIA line, directly below J70, causes the FMC to calculate the intersection of the two airways and replace the boxes with the waypoint identifier, XJ52.

Manually Entered Latitude or Longitude Reporting Point Waypoints

Latitude or longitude reporting waypoints are entered as the full latitude or longitude followed by a dash, then the increment chosen for the following multiple waypoints. Example:

- W060–10 adds waypoints starting at W060 in ten degree increments from that point to the destination
- the entry must be made on a LEGS page on any line before the first reporting point
- usually, this entry is made on the active waypoint line and proper sequencing is performed by the FMC

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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 VAM-01
- ELN/-30 is 30 miles before ELN on the present route and displays as ELN-01

ND Map Displays

The route shows on the ND in the map, map center, and plan modes. The display color and format represent the following status:

- an inactive route shows as a dashed cyan line
- a pending active route shows as a dashed white line
- the active route shows in magenta
- modifications to an active route show as dashed white lines
- modified waypoints show in white
- executed route offsets show as a dashed magenta line
- missed approach route shows as a solid magenta line.

The FMC position is represented by the apex of the airplane symbol shown on the ND. All ND map data is shown relative to this apex.

When adequate GPS or radio updating is not available, the ND map can show a shift error. This error results in the shown position of the airplane, route, waypoints, and navigation aids being shifted from their actual position. An undetected, across track map shift can result in the airplane flying a ground track that is offset from the desired track. An undetected, along track map shift can result in the flight crew initiating altitude changes earlier or later than desired. In either case, an undetected map shift can compromise terrain or traffic separation.

Map shift errors can be detected by comparing the position of the airplane on the ND map with data from the ILS, VOR, DME, and ADF systems.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Vertical Navigation (VNAV)

VNAV provides vertical profile guidance through the climb, cruise, and descent phases of flight. Three VNAV CDU pages correspond to these flight phases. Pressing the VNAV function key displays the active phase page. Other VNAV pages display using the next or previous keys.

Vertical Actual Navigation Performance (VANP)

HL7202 - HL7205, HL7782 - HL8347

Vertical Actual Navigation Performance is the FMC estimate of the quality of altitude determination. It displays on the RNP PROGRESS page. VANP is the estimated maximum altitude error. The FMC computes the vertical path and the certainty the actual altitude is within a vertical range equal to plus or minus the displayed VANP value.

Note: VANP is calculated from the baro-corrected altitude provided by the Air Data System. The pilot must set the baro setting reported by ATIS or by the setting given in the approach clearance for the display to be valid.

Speed/Altitude Constraints

VNAV controls the path and speed to comply with waypoint crossing constraints. Waypoint crossing constraints are entered on the LEGS page waypoint line by pushing the applicable key on the right side of the CDU. Barometric altitude constraints must be below the cruise altitude to be valid. Values entered as part of a procedure and manually entered constraints are shown in large font. FMC predicted values do not act as constraints, and display in small font.

A waypoint constraint is magenta when it is active. The constraint does not have to be in line 1 to be active. Waypoints can have altitude or airspeed/altitude constraints.

Modified waypoint constraints are shaded white until they are executed. Speed constraint entries require an altitude constraint at the same waypoint. All speed constraints are considered by the FMC as at or below constraints.

At or above altitude constraints are entered with a suffix letter A (example: 220A). At or below altitude constraints are entered with a suffix letter B (example: 240B). Mandatory altitude constraints are entered without any suffix letter (example: 270).

Altitude constraints with two altitudes may be entered in either order. The lower altitude constraint, followed by a suffix letter A, and the upper altitude constraint, followed by a suffix letter B (example: 220A240B or 240B220A).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff and Climb

1 Takeoff

If armed for takeoff, VNAV activates at 400 feet and pitch guidance continues to maintain the target airspeed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

During takeoff, the FMC updates the target airspeed to the current airspeed until VNAV activates. The target airspeed is between V2 + 15 and V2 + 25 knots.

2 Acceleration Height

At acceleration height or altitude capture below acceleration height, VNAV commands an airspeed increase to a speed 5 knots below the flap placard speed for the existing flap setting. When flaps are retracted or at an AFDS capture altitude, VNAV commands the greater of VREF + 80 knots or the speed transition associated with the origin airport, limited by configuration.

The FMC changes the thrust reference limit to the selected climb thrust at the thrust reduction point.

3 VNAV Climb

VNAV climb profile uses VNAV SPD or VNAV PTH at the default climb speed or pilot selected climb speed to remain within all airspeed and altitude constraints of an active route Standard Instrument Departure. Autothrottle uses the armed climb thrust limit.

If the climb speed profile cannot achieve an altitude constraint, the UNABLE NEXT ALT scratchpad message displays.

4 Climb Constraints

VNAV enters the VNAV PTH mode to remain within departure or waypoint constraints. Speed maintained during this time can be:

- procedure based speed restriction
- waypoint speed restriction
- default VNAV climb speed
- manually entered climb speed

If the FMC predicts the airplane will not reach an altitude constraint, the FMS–CDU message UNABLE NEXT ALT displays. Speed intervention can be used by pushing the IAS/MACH selector and manually setting a lower airspeed to provide a steeper climb; or, climb derates can be deleted on the THRUST LIMIT page.

5 Top Of Climb (T/C)

The point where the climb phase meets the cruise altitude is called the top of climb. Approaching this point, the FMC changes from climb phase to cruise phase. The T/C displays any time the FMC calculates a change from climb phase to cruise phase, such as step climb.

The T/C point displays on the map as a green open circle with the label T/C.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

MCP Altitude Intervention

Whenever the airplane levels off at an MCP altitude not in the FMC, VNAV ALT annunciates. For example, FMC cruise altitude is FL250 and the clearance altitude, FL190, is set in the MCP. Pitch maintains altitude and thrust maintains FMC target speed. In the example, the speed after the temporary level off would be ECON CLB SPEED.

Setting the clearance altitude in the MCP window and pushing the altitude selector continues the climb. VNAV SPD activates. Pitch maintains FMC speed and thrust increases to the armed reference thrust limit. In the example, the airplane climbs to FMC CRZ ALT and then levels at FL250 in cruise.

Cruise

During cruise, the FMC commands economy cruise speed or the pilot entered speed until reaching the top–of–descent (T/D) point. Other cruise speed options are:

- long range (LRC)
- engine out (ENG OUT)
- flight crew entered speed
- flight crew entered constant Mach between two or more waypoints
- required time of arrival (RTA)

The FMC commands maximum range cruise speed with the cost index set to zero. Cost index modifications are allowed until within ten miles of the top of descent.

Cruise Climb

Setting an altitude above the current cruise altitude in the MCP altitude window and pushing the altitude selector causes the cruise altitude to be set to the MCP altitude and the airplane to climb to the new cruise altitude. The CRZ page displays ACT ECON CRZ CLB.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Step Climb

Fuel and ETA calculations assume the airplane climbs at each calculated step climb point as airplane weight decreases. FMC calculated step climb increments are based on the step size shown on the CRZ page. Entering a step size of zero causes the FMC to assume a constant altitude cruise.

Flight crew entry of a STEP TO altitude on the CRZ page or "S" on a waypoint on the LEGS page overrides FMC step climb calculations. Entry of a step altitude on the LEGS page overrides a STEP TO entry made on the CRZ page.

Calculated step altitudes display on the LEGS page. The distance and ETA to the next step point (calculated or flight crew entered) display on the CRZ and PROGRESS pages. They also display on the ND map display with a green circle and "S/C".

The FMC calculates step climb locations and altitudes as a function of lateral flight plan, current cruise speed mode and altitude, entered forecast winds and temperatures, step size, cruise cg, and gross weight.

The primary factor affecting step climb calculation is the entry of accurate forecast cruise winds and temperatures on the WINDS page. Unless enroute winds are entered, all step climb locations and altitudes are calculated assuming zero wind. IRS winds are not used in the calculation of step climb data.

For ECON cruise, step climbs are optimized to provide minimum trip cost according to the entered Cost Index. For other selected speeds, calculated step climbs minimize trip fuel.

Calculated step locations display on the ND (S/C); the next step displays on the ECON CRZ page. Flight plan calculations of time and fuel at destination are based on executing step climbs as calculated. Legs page waypoint altitudes reflect the optimum step climb profile.

Inflight entry of a STEP TO altitude in 1R causes the FMC to use the entered enroute winds and temperatures to calculate the optimum location for a climb to the step altitude; the ETA and DTG for the step display in 2R. Following entry of an altitude in 1R, the FMC uses only that altitude to calculate data for 2R. When the FMC calculates an immediate step climb to the entered altitude is optimal, 2R displays NOW. If the FMC determines remaining at the current altitude for the duration of the flight is more optimal than flying at the entered altitude, 2R displays NONE.

Planned step climb points (S/C) may be entered on the Legs page at selected waypoints. In this case, both altitude and step location are constrained. With planned step climb points entered, flight plan calculations assume a constant cruise altitude until reaching the planned step waypoint. Optimized step climb calculations resume after passing the last planned step climb waypoint.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347
When either a manually entered, or a planned step climb point entered on the LEGS page is sequenced and NOW is shown in 2R on the CRZ page, the step climb point shown in 1R can be deleted.

When the last planned step is a step descent, step climbs are no longer calculated.

Optimum (OPT) altitude calculation does not use forecast or IRS winds and temperatures. Recommended (RECMD) altitude calculation is based on step size, current CRZ ALT, and entered forecast enroute winds and temperatures.

All altitude calculations are limited by maximum (MAX) altitude.

HL7532 - HL7598
If a climb is not initiated within 5 minutes after passing a planned or calculated step climb point, the EICAS message VNAV STEP CLIMB displays.

HL7202 - HL7205, HL7733 - HL8347
If a climb is not initiated within 5 minutes after passing a planned or calculated step climb point and the difference between the CRZ ALT shown in 1L and the STEP TO altitude shown in 1R of the CRZ page is greater than 3,500 feet, the EICAS advisory message VNAV STEP CLIMB displays.

Cruise Descent

Setting an altitude below the current cruise altitude in the MCP altitude window and pushing the altitude selector (more than 50 nm from a T/D) causes the cruise altitude to be set to the MCP altitude and the airplane to descend to the new cruise altitude. The CRZ page displays ACT ECON CRZ DES. If the altitude set in the altitude window is below the speed transition (SPD TRANS) or restriction (SPD RESTR) altitude displayed on the DES page, those altitudes and speeds are deleted. Transition or speed restrictions must be maintained by flight crew action.

Required Time of Arrival (RTA)

VNAV controls cruise speed to arrive at a specified waypoint within ± 30 seconds of a specified time. If the RTA is not achievable, the FMC displays the scratchpad message UNABLE RTA.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

MCP Speed Intervention

Speed Intervention Pitch Modes

With VNAV active, pushing the IAS MACH selector enables speed intervention. Speed intervention allows the flight crew to change airplane speed with the IAS/MACH selector.

The above illustration shows the VNAV pitch flight mode annunciation for each phase of flight when using speed intervention.

In a VNAV descent after the T/D, VNAV PTH changes to VNAV SPD during speed intervention. In all other phases, the pitch mode does not change with speed intervention. Pitch controls speed in VNAV SPD mode, and during the VNAV PTH descent prior to speed intervention. Otherwise, thrust controls speed in VNAV PTH mode.

During a VNAV, non-ILS approach while using speed intervention, the pitch mode is VNAV PTH. The vertical path is maintained regardless of IAS MACH selector changes.

If a “direct to” is executed to a waypoint in the approach, VNAV transitions to the approach phase when the airplane passes the “direct to” waypoint. If a waypoint located after the first waypoint of an FMC database approach is added and executed, VNAV will not transition to approach phase when passing the first waypoint of the approach.

Descent

The FMC calculates a descent path based on airspeed and altitude constraints and the end of descent (E/D) point. Dashes display on the LEGS page for speed and altitude descent waypoints. When an arrival or approach procedure is selected on the ARRIVALS page and incorporated into the flight plan, the FMC creates an E/D. The E/D is located 50 feet above the runway threshold (RW waypoint) for all approaches except VOR approaches. The E/D for VOR approaches is the missed approach point; which may be the VOR, runway waypoint (RWXXX), or a named waypoint. During cruise, an E/D is also created when an altitude constraint is entered on the LEGS page on a downstream waypoint.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The top of descent (T/D) is the point where the cruise phase changes to the descent phase. A green circle T/D symbol displays on the ND at the start descent phase point. The FMC displays a T/D symbol at each point in the descent profile which represents a transition from a level segment to a descent segment. The descent path starts at the T/D and includes waypoint altitude constraints. The path to the first constraint is based on:

- idle thrust
- speedbrakes retracted
- FMC cruise wind
- wind entries on the DESCENT FORECAST page
- predicted use of anti-ice
- applicable target speed

The descent may be planned at economy Mach/CAS (based on Cost Index) or a manually entered Mach/CAS. VNAV will not command an economy target speed greater than 314 knots (VMO/MMO minus 16 knots) or a pilot entered speed greater than 319 knots (VMO/MMO minus 11 knots).

The FMC creates the descent path with a deceleration at the speed transition altitude (typically 250 knots below 10,000 feet). VNAV plans a speed target 10 knots below the transition speed to allow for unknown tailwinds.

Descent path segments after the first altitude constraint waypoint are constructed as straight line point-to-point segments. If the VNAV path segment is too shallow to be flown satisfactorily at IDLE thrust, the FMC commands speed on thrust levers (SPD). Elevators control the shallow descent path.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If flight plan modifications or unknown winds occur when above the first speed constraint, VNAV varies speed to maintain the path up to the following limits:

- with greater than 15 knots below the target speed, the autothrottle changes from IDLE/HOLD to SPD to provide thrust to accelerate to the target speed. If the autothrottle is not active, the scratchpad message THRUST REQUIRED displays. The airspeed may decrease to minimum maneuvering speed. Subsequently, VNAV commands the airplane to fly below the path to stop the deceleration. If VNAV can no longer maintain the airplane within 150 feet of the path without further deceleration, speed reversion occurs, the pitch mode annunciation changes from VNAV PTH to VNAV SPD, VNAV resets the target speed to 5 knots above the greater of best holding speed or minimum maneuvering speed, and the scratchpad message THRUST REQUIRED displays again
- with greater than 314 knots (VMO/MMO minus 16 knots), the scratchpad message DRAG REQUIRED displays. The airplane may accelerate up to 319 knots (VMO/MMO minus 11 knots) to maintain the path. If further correction is required, VNAV may allow the airplane to rise up to 150 feet above the path. If VNAV can no longer maintain the airplane within 150 feet of the path without further acceleration, speed reversion occurs, the pitch mode annunciation changes from VNAV PTH to VNAV SPD, VNAV resets the target speed to 314 knots (VMO/MMO minus 16 knots), and the scratchpad message DRAG REQUIRED displays again

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Early Descent

When a descent is started before the T/D, VNAV commands a descent at a reduced descent rate until the idle descent path is intercepted.

Start an early descent by setting a lower altitude and selecting the DES NOW prompt on the DES page or by pushing the MCP altitude selector. In an early descent, the autothrottle mode annunciation is initially THR, followed by HOLD, allowing the pilot to adjust the rate of descent. The pitch mode is VNAV SPD.

1 DES NOW

Use the DES NOW prompt on the VNAV DES page. VNAV starts an early descent and captures the idle descent path.

2 Within 50 NM of Top of Descent Point

Use the MCP altitude selector to start an early descent. Within 50 NM of the top of descent point, VNAV starts an early descent and captures the idle descent path.

3 More than 50 NM from Top of Descent Point

Use the MCP altitude selector to start a cruise descent. If the distance from the top of descent is more than 50 NM, VNAV begins a cruise descent to the new cruise altitude. VNAV may not capture the idle descent path since the target airspeed is economy cruise and the descent path is based on idle thrust and economy descent airspeed. In the example, VNAV levels at the new cruise altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cruise and Descent Profile (Instrument Approach Using VNAV)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Cruise

Before the top of descent, FMC is in cruise mode and commands VNAV PTH and ECON cruise speed.

2 Level Deceleration Phase

At top of descent, FMC transitions to descent and commands the airspeed to ECON descent speed and maintains altitude in VNAV PTH.

3 Descent

Nearing descent speed, VNAV commands a descent in VNAV PTH at ECON descent speed.

4 Descent Deceleration Phase

Before the speed restriction altitude, the FMC commands the target descent airspeed. The pitch mode remains VNAV PTH and the descent rate approximates 500 feet per minute.

5 Descent and Approach

When at target speed, VNAV commands a descent and starts approach in VNAV PTH at commanded speed. Extending flaps from UP to 1 arms go-around; EICAS displays GA as the reference thrust limit. Activation of VNAV changes the reference thrust limit to CRZ; selection of landing flaps (25 or 30) changes the reference thrust limit to GA. Prior to extending flaps to a landing position and with VNAV PTH and CRZ reference thrust limit, pressing TO/GA changes the reference thrust limit to GA.

6 Missed Approach

When selected during missed approach, VNAV activates in VNAV SPD.

7 Missed Approach Level Off

At missed approach altitude, VNAV SPD changes to VNAV PTH.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach

The FMC transitions to "on approach" mode for any of the following conditions:

- the descent phase is active and flaps are out of up, or
- the airplane has sequenced the first waypoint (or FAXXX) of the active approach, or
- the airplane is on a direct-to or intercept course-to the active waypoint and the distance to go is less than 12 NM, or
- the missed approach point is the active waypoint and the distance to go is less than 25 NM

The approach condition may be delayed if the flight crew manually inserts, bypasses, or deletes an approach waypoint on the LEGS page.

The FMC transitions out of "on approach" under the following conditions:

- the pilot selects TO/GA
- the airplane lands
- the airplane flies beyond the last waypoint in the approach (missed approach waypoint or runway). The VNAV page title changes from "ACT xxxxx DES" to "ACT END OF DES"

When the FMC is “on approach”, the following features are available:

- the IAS/MACH window can be opened and the command speed can be set while VNAV remains in VNAV PTH descent; VNAV commands the set speed
- the MCP altitude can be set above the airplane altitude for the missed approach. When the MCP altitude setting is at least 300 feet above the current airplane altitude, VNAV continues to command a descent
- VNAV remains in VNAV PTH and follows the descent path unless the airplane accelerates to within 5 knots of the current flap placard and the airplane rises more than 150 feet above the path. In this case, VNAV PTH changes to VNAV SPD
- When a glide path angle is specified for one or more legs on the approach, it displays on the LEGS page and VNAV provides VNAV PTH guidance at the displayed angle. When sequencing a waypoint prior to a descent leg specified by a glide path angle, VNAV commands level flight until the airplane intercepts the descent path

Note: Display of a specified glide path angle is not limited to approaches. A glide path angle may be defined for a leg in a STAR and displays on the LEGS page for the procedure.

Selection of another approach can be accomplished on the ARRIVALS page. An along-course intercept to an approach waypoint in the new approach can be selected on the “INTC CRS TO” line on the LEGS page or by selecting the "XXXXX INTC>" prompt on the ARRIVALS page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Missed Approach

A missed approach is accomplished by selection of either TO/GA switch. The following features are available:

HL7532 - HL7766
- VNAV (and LNAV) can only be activated when the airplane climbs above 400 feet radio altitude

HL7202 - HL7205, HL7782 - HL8347
- VNAV can only be activated when the airplane climbs above 400 feet radio altitude

HL7202 - HL7205, HL7782 - HL8347
- if an LNAV path is available, LNAV automatically activates:
  - above 50 feet radio altitude when autopilot is not engaged, or
  - above 200 feet radio altitude when autopilot is engaged

Note: Route discontinuities after the missed approach will prevent the TO/GA to LNAV function from activating.

- all descent altitude constraints below the current airplane altitude are deleted; the waypoints are retained in the active flight plan
- the highest altitude in the missed approach procedure becomes the new cruise altitude
- the FMC transitions from active descent to active climb. This transition also occurs when the airplane climbs toward the MCP altitude and flaps are retracted from a landing position (25 or 30 towards 20, or 20 towards 5). For example, when a missed approach is accomplished without pushing the TO/GA switch.
- AFDS guidance to fly the published missed approach procedure to the new cruise altitude is active when VNAV (and LNAV) is selected
- when cruise phase is active, the speed target is the most restrictive of speed transition, best hold speed, or ECON cruise (above speed transition altitude)

Executing a missed approach causes the flight phase transition from descent or end of descent to climb when:

- the MCP altitude window is set to an altitude greater than current altitude, and
- the airplane is climbing at a rate greater than 600 fpm, and
- flaps have been retracted from the landing position

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Out Operation

Takeoff and Climb

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Takeoff

Condition: before a sensed engine failure and above VNAV activation altitude.

Result: VNAV SPD commands a climb at V2+15 to V2+25 knots. Autothrottle annunciation is THR REF and the thrust limit is takeoff.

2 Sensed Engine Failure

Condition: after VNAV activation, engine failure is sensed, airplane below engine out acceleration height and below the thrust reduction point entered on the TAKEOFF REF page.

Result: VNAV remains in VNAV SPD and commands V2 + 15 knots. Autothrottle remains in THR REF and the thrust limit remains takeoff (TO).

3 EO SID

Condition: flaps out of up and an engine out standard instrument departure (EO SID) in the FMC database.

Result: FMC loads the EO SID as a flight plan modification. The modification may be either executed or erased.

4 EO Acceleration Height

Condition: at EO acceleration height or altitude capture below acceleration height.

Result: VNAV commands an acceleration to VREF + 80 knots, limited by the airplane configuration (flap placard). The VNAV climb page title displays the ACT VREF + 80 CLB page.

5 Thrust Reduction

Condition: airplane has accelerated to VREF + 78 knots

Result: thrust is automatically reduced from selected takeoff to continuous (CON) thrust. If the engine failure occurs above the thrust reduction point, the current climb thrust is maintained.

6 VNAV Climb (Engine Out)

Condition: Selecting the ENG OUT> prompt on the VNAV CLB page displays applicable engine out performance data. Execution activates engine out performance data and terminates the VNAV engine out takeoff phase.

Result: the FMC engine out climb function is active, the pitch mode is VNAV SPD, the command speed is EO SPD, and the reference thrust limit is CON.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Climb (Above EO Max Alt)

When the airplane is above the engine out maximum altitude, selection of ENG OUT> on the VNAV CLB page or the XXXX ALTN page creates a modification and displays applicable engine out driftdown (D/D) performance data enabling the a descent to the engine out maximum altitude. Execution of the modification activates the engine out driftdown function.

Cruise (Above EO Max Alt)

When the airplane is above the engine out maximum altitude, selection of ENG OUT> on the VNAV CRZ page or the XXXX ALTN page creates a modification and displays applicable engine out driftdown (D/D) performance data. When executing the ENG OUT modification, the reference thrust limit becomes CON, thrust levers advance to CON, the default command speed is EO SPD, and the EO MAX altitude shows as the cruise altitude in 1L. The EO MAX altitude shown in 1L does not change with time or changes in command speed.

1 Engine Out Modification

Selecting ENG OUT> creates a modification and displays the applicable engine out driftdown (D/D) performance data.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Drift Down Execution

A driftdown descent can be initiated by setting the MCP altitude at or below EO MAX altitude and executing the modification.

Result:

- VNAV commands EO SPD
- when EO SPD is achieved, VNAV controls the driftdown descent rate to a minimum of 300 feet per minute (fpm)
- time and distance for the D/D to EO MAX altitude show at 2R
- VNAV captures the MCP altitude and commands EO CRZ

Executing the ENG OUT modification without descending changes the pitch mode to VNAV ALT. A driftdown descent does not start until setting the altitude at or below EO MAX altitude and pushing the altitude selector. The result above describes the driftdown.

A normal enroute cruise descent can be initiated by setting the MCP altitude to a lower altitude and pushing the altitude selector.

Result:

- the airplane descends in a normal VNAV cruise descent at two-engine ECON speed
- the reference thrust limit is CLB/CRZ
- the airplane descends at ECON CRZ and approximately 1,250 fpm

During the enroute cruise descent, when the airplane is above EO MAX altitude, executing the ENG OUT modification commands a driftdown descent to the EO MAX altitude. The command speed is E/O SPD. The rate of descent decreases to a minimum of 300 fpm.

3 Engine Out Cruise

When VNAV captures the EO MAX altitude, the VNAV cruise page title becomes EO CRZ and the pitch annunciation is VNAV PTH, regardless of the MCP altitude window setting. Calculations for EO Step Climb display at 2R. Thrust limit remains in CON.

4 Subsequent Cruise Descent

The FMC is in engine out mode. When the airplane is more than 50 nm from T/D, setting a lower MCP altitude and pushing the altitude selector executes an engine-out cruise descent.

Result: VNAV cruise descent at approximately 1,250 fpm at EO SPD. When the EO cruise descent intersects the planned descent profile, descent mode becomes active.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Data Entry Rules

Altitude Entry

Altitudes can be entered into the FMC as three digit (XXX), four digit (XXXX), five digit (XXXXX), or flight level (FLXXX) numbers. The FMC displays altitude or flight level entries in the proper form based on the transition altitude. Some data lines further restrict the valid entry forms.

Three digit entries represent altitude or flight levels in increments of 100 feet. Leading zeros are required.

Examples of three digit (XXX, FLXXX) entries with transition altitude = 10,000 feet:

- 800 feet is entered as 008 or FL008; displays as 800
- 1,500 feet is entered as 015 or FL015; displays as 1500
- 11,500 feet is entered as 115 or FL115; displays as FL115
- 25,000 feet is entered as 250 or FL250; displays as FL250

Four digit entries represent feet, rounded to the nearest ten feet. Leading zeros are required. This form is used when the altitude does not exceed 9,994 feet.

Examples of four digit (XXXX) entries with transition altitude = 18,000 feet:

- 50 feet is entered as 0050; displays as 50
- 835 feet is entered as 0835; displays as 840
- 1,500 feet is entered as 1500; displays as 1500
- 8,500 feet is entered as 8500; displays as 8500
- 9,994 feet is entered as 9994; displays as 9990

Five digit entries represent feet, rounded to the nearest ten feet. This form is used when the altitude exceeds 9,994 feet.

Examples of five (XXXXX) digit entries with transition altitude = 4,000 feet:

- 50 feet is entered as 00050; displays as 50
- 835 feet is entered as 00835; displays as 840
- 1,500 feet is entered as 01500; displays as 1500
- 8,500 feet is entered as 08500; displays as FL085
- 9,995 feet is entered as 09995; displays as FL100
- 11,500 feet is entered as 11500; displays as FL115
- 25,000 feet is entered as 25000; displays as FL250

Negative altitude entries are allowed to -1000 feet.

Airspeed Entry

Airspeeds can be entered into the FMC as calibrated airspeed, CAS, or Mach number, M. Calibrated airspeeds are entered as three digits (XXX) in knots. Mach numbers are entered as one, two, or three digits following a decimal point.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Databases

The FMC contains three databases:

- performance
- navigation
- airline modifiable information (AMI).

The performance database supplies performance data to the flight crew. It supplies the FMC with data to calculate pitch and thrust commands. All pertinent data can be displayed on the CDU. The database includes:

- airplane drag and engine characteristics
- maximum and optimum altitudes
- maximum and minimum speeds.

The navigation database includes most data found on navigation charts. This data can be displayed on the CDU or ND. The database contains:

- location of VHF navigation aids
- airports
- runways
- other airline selected data, such as SIDs, STARs, approaches, and company routes
- transition altitudes.

The FMC contains two sets of navigation data, each valid for 28 days. Each set corresponds to the usual navigation chart revision cycle. The FMC uses the active data for navigation calculations. The contents of the navigation database are periodically updated and transferred to the FMC before the expiration date of the active data.

The AMI file contains airline specified data. If the FMC senses a conflict in an AMI value after a new AMI data load, the scratchpad displays the message CHECK AIRLINE POLICY.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Thrust Management

The thrust management function operates the autothrottle in response to flight crew mode control panel inputs or to FMC commands. Reference thrust limits can be selected on the THRUST LIM page. FMC autothrottle commands are made while VNAV is engaged. Thrust management:

- calculates reference thrust limits and thrust settings, or follows FMC thrust settings
- commands thrust levers
- senses and transmits autothrottle failures
- commands thrust equalization through the engine electronic controls.

HL7532 - HL7766
Thrust limits are expressed as EPR limits. Thrust equalization references EPR.

HL7202 - HL7205, HL7782 - HL8347
Thrust limits are expressed as N1 limits. Thrust equalization references N1.

Thrust management calculates a reference thrust for the following thrust settings:

- TO – takeoff
- TO 1 – takeoff one
- TO 2 – takeoff two
- D–TO – assumed temperature takeoff
- D–TO 1 – derate one assumed temperature takeoff
- D–TO 2 – derate two assumed temperature takeoff
- CLB – climb
- CLB 1 – climb one
- CLB 2 – climb two
- CRZ – cruise
- CON – continuous
- G/A – go–around.

HL7202 - HL7205, HL7782 - HL8347
In addition, with APU-to-Pack takeoff option, “A-TO”, “A-TO 1”, or “A-TO 2” thrust setting displays.

HL7532 - HL7766
With VNAV active, the reference thrust limit changes for the phase of flight. Thrust settings can be selected on the THRUST LIM page. The reference thrust limit displays above EICAS EPR indications.

HL7202 - HL7205, HL7782 - HL8347
With VNAV active, the reference thrust limit changes for the phase of flight. Thrust settings can be selected on the THRUST LIM page. The reference thrust limit displays above EICAS N1 indications.

The flight crew can specify the thrust reduction height where the change from takeoff to climb thrust takes place by making an entry on the CDU TAKEOFF REF page. This can be an altitude from 400 feet to 9,999 feet, an entry of 1 for Flaps 1, or an entry of 5 for flaps 5.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Reduced Thrust Takeoff

Reduced thrust takeoffs lower EGT and extend engine life.

Derate/Variable Takeoff Rating

Two fixed derates can be selected on the THRUST LIM page. TO 1 and TO 2 reduce takeoff thrust by percentages specified by the operator [Airline Selectable Option]. The derate percentages can be set between maximum takeoff thrust and the maximum certified derate in one percent increments. The Airplane Flight Manual (AFM) provides performance data for these derates.

With both TO 1 and TO 2, the thrust setting parameter is considered a limitation for takeoff; therefore, thrust levers should not be advanced further except in an emergency. A further thrust increase following an engine failure could result in a loss of directional control. Use the takeoff speeds calculated by the FMC for the selected derate or variable takeoff rating condition.

Derate/variable takeoff rating can be further reduced by assumed temperature.

Assumed Temperature Thrust Reduction Takeoff

Entering an assumed temperature higher than the actual temperature reduces takeoff thrust.

The maximum thrust reduction authorized is 25 percent below any certified rating. Do not use assumed temperature reduced thrust if conditions exist that affect braking, such as slush, snow, or ice on the runway, or if potential windshear conditions exist.

The assumed temperature thrust setting is not considered a limitation. The assumed temperature reduction can be removed. If conditions are encountered where more thrust is necessary, the crew can manually apply full thrust.

Note: When the flight crew enters an assumed temperature resulting in thrust reduction; and, manually arms CLB, a decrease in OAT may cause the FMC to recalculate V-speeds and arm CLB 1 or 2 on the THRUST LIM page. The scratchpad message TAKEOFF SPEEDS DELETED displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Derated Thrust Climb

During climb, CLB 1 and CLB 2 derates are gradually removed. In cruise, the thrust reference defaults to CLB or CRZ [Airline Selectable Option]. The reference can be manually selected on the THRUST LIM page.

Two fixed climb thrust derates can be selected on the THRUST LIM page. CLB 1 uses a 10 percent derate of CLB thrust to 10,000 feet, then increases thrust linearly with altitude to CLB thrust at 12,000 feet. CLB 2 uses a 20 percent derate of CLB thrust to 10,000 feet, then increases thrust linearly with altitude to CLB thrust at 12,000.

Use of an assumed temperature reduced thrust takeoff or takeoff derate affects automatic selection of climb derate. For a thrust reduction less than 10 percent, maximum climb thrust is automatically selected by the FMC. For takeoff thrust reductions or derates from 10 percent to less than 20 percent, CLB 1 is selected. CLB 2 is selected for all takeoff thrust reductions or derates equal to or greater than 20 percent. On the ground, the pilots may override the automatic climb derate selection after the takeoff selection is complete.

Use of derated climb thrust reduces engine maintenance costs, but increases total trip fuel.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Fuel Monitoring

The FMC receives fuel data from the fuel quantity system or from manual entries. Fuel quantity values display on the PERF INIT page as calculated (CALC), MANUAL, or SENSED. They display on PROGRESS page 2 as TOTALIZER and CALCULATED. TOTALIZER and SENSED values are the same data with different names.

The FMC usually uses the calculated value for performance computations. Before engine start, the calculated value is set to agree with the fuel quantity indicating system value. When the FMC receives a positive fuel flow signal at engine start, the calculated value is independent of the fuel quantity system and decreases at the fuel flow rate.

During fuel jettison, the calculated value is set equal to the fuel quantity system value. When fuel jettison is completed, the calculated value is independent of the fuel quantity indicating system and decreases at the fuel flow rate. This fuel quantity value displays as CALC (calculated) on the PERF INIT page and CALCULATED on PROGRESS page 2.

If the flight crew inputs a fuel quantity, the line title changes to MANUAL and replaces the calculated value. Like the calculated value, the manual value is updated by fuel flow rate.

The calculated value is invalid if fuel flow data is invalid. The FMC uses the fuel quantity indicating system quantity for performance computations. The line title on the PERF INIT page changes to SENSED and displays as TOTALIZER on PROGRESS page 2.

The fuel used by each engine is calculated with its related fuel flow signal. FUEL USED displays on PROGRESS page 2. FUEL USED values are retained through flight completion and are subsequently cleared at engine start or following a long-term power interrupt on the ground. If the fuel flow signal is invalid for greater than two minutes after engine start or is invalid while on the ground, the display blanks.

The FMC continually estimates the fuel at the destination airport when the active route is flown. The EICAS message INSUFFICIENT FUEL displays if the estimate is less than the fuel reserve value; or, if no reserve value entered, then 4,000 lbs (1,814 kgs). For a pending activation route or for the active route in a modified state, the message displays in the scratchpad.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The EICAS message FUEL DISAGREE displays if the FMC calculates a large difference between the fuel quantity indicating system quantity and calculated value. Totalizer or calculated fuel quantity can be selected with the USE prompt on PROGRESS page 2.

Note: FMC calculated fuel predictions assume a clean configuration. Flight with gear or flaps extended cause fuel prediction errors. Fuel predictions are accurate after the gear and flaps are retracted.

If the actual fuel temperature reaches the minimum value displayed on the PERF INIT page, the EICAS advisory message FUEL TEMP LOW displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Loss of FMC Electrical Power

The FMC must have continuous electrical power to operate. When the electrical power is interrupted and returns, the FMC restarts.

After restart, the performance data displayed on the PERF INIT page must be re–entered. The route previously in use is available but must be reactivated.

The flight crew must modify the active waypoint to activate LNAV. Selecting the applicable active waypoint and proceeding direct or intercepting a course to the waypoint allows LNAV activation.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Failure

Single FMC Failure

The scratchpad message SINGLE FMC L or SINGLE FMC R displays after loss of a single FMC. The EICAS advisory message FMC MESSAGE displays. Crew action is not necessary to change to single FMC operation. LNAV and VNAV, if active, remain active and all flight plan and performance data is retained.

A software reset may occur while in single FMC operation. The active route becomes inactive, the performance data is erased, and LNAV and VNAV (if engaged) modes fail. To regain FMC operation, activate and execute the flight plan, enter the necessary performance data, and engage LNAV and VNAV.

Note: If the MENU page and the scratchpad message TIMEOUT RESELECT display, the FMC is no longer connected to the CDU. Selecting the <FMC prompt connects the CDU to the FMC.

Dual FMC Failure

If both FMCs fail, LNAV and VNAV fail. The EICAS advisory message FMC displays. The CDUs supply route data to the NDs, and one of the CDUs supplies LNAV guidance to the autopilot. LNAV can be reselected on the mode control panel. FMS alternate navigation using the CDUs is discussed in Section 50 of this chapter.

Dual FMC failure may inhibit the autothrottle system. If it is available, it may be used in conjunction with any valid autopilot roll and/or pitch mode.

Note: If the MENU page displays and the <FMC prompt is not displayed in line 1, pushing the LEGS function key displays the ALTN NAV LEGS page, the PROG key displays the ALTN NAV PROGRESS page, and the NAV RAD key displays the ALTN NAV RADIO page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Traffic Control Data Link

Most Air Traffic Control data link functions are accomplished on the MFD. The CDU is used as an input keyboard for downlink message forms. Uplink messages which contain route modifications are loaded into the FMC using the LOAD FMC function on the MFD ATC page. Execution of an ATC loaded modification is accomplished using normal FMC modification procedures.

Refer to chapter 5, Communications, section 40, MFD Communications, for a description of ATC data link.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Company Data Link

The airplane communications system enables two–way data link communications between the FMC and airline operations. A downlink occurs when data is transferred from the FMC and transmitted through the airplane communications system to a receiver on the ground. Data may be downlinked from the FMC either manually or automatically. An uplink is the opposite of a downlink; data is transmitted from a ground station for input to the FMC. Data may be uplinked at the discretion of the airline operations dispatcher or in response to a downlink request.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Data Link

Downlinks are data link messages transmitted to a ground station. Requests for data and reports of FMC data are two types of downlinks. Requests are made manually by the flight crew. Reports can be made manually or may occur automatically.

Uplinks are messages transmitted to the airplane. Most uplinks require manual selections by the flight crew. Some uplinks are input automatically.

Manual Downlinks

Select a REQUEST prompt to start the downlink request for data. REQUEST prompts are on PERF INIT, TAKEOFF REF, DESCENT FORECAST, RTE, ALTN, ALTN LIST, or RTE DATA pages. Downlink reports of the active route may be accomplished by selection of the REPORT prompt on the RTE page and a position report may be downlinked by selection of the REPORT prompt on the POS REPORT page.

When the communications function is unable to prepare FMC downlinks, the words FAIL, NO COMM, or VOICE display on CDU pages in place of REQUEST and REPORT prompts. The data link status also displays on the FMC COMM page. Radios supporting data link operations can be reconfigured by the crew through the MFD COMM function; refer to Chapter 5, Communications. The status messages are:

- FAIL –
  - the AIMs data communications management function is inoperative, or
  - both the VHF and SATCOM data radios have failed
- NO COMM –
  - the VHF and SATCOM data radios are operational but not available
  - the VHF data radio has failed and the SATCOM data radio is not available, or
  - the SATCOM data radio has failed and the VHF data radio is not available
- VOICE – all available radios are operating in the VOICE mode

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Reports

Pushing the line select key for the REPORT sends a downlink report applicable to that page. The pages below contain report prompts.

Report Status

Below is a typical sequence of status in response to sending a report.

Automatic Downlinks

The FMC can be configured by the airline to automatically transmit downlinks of FMC data at predetermined points during the flight or in response to specific data requests from the airline dispatcher. The FMC response in these cases is completely automatic and no flight crew action is necessary.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Uplinks

Uplinked data may be loaded automatically or may require flight crew action. Two uplinks automatically load data into the FMC and do not require execution. Uplinked data that waits in system memory for flight crew action are considered to be pending.

A pending uplink is included or discarded when the flight crew selects the applicable prompt. Flight crew response to an uplink depends on the type of uplink. Flight crew action is made with ACCEPT/REJECT or LOAD/PURGE prompts, FMC modification ERASE prompt or EXEC key, or when the page with the uplink is selected. Glareshield–mounted accept and reject switches operate the same as MFD ACCEPT/REJECT prompts.

Data can be uplinked from the airline dispatcher directly to the PERF INIT, TAKEOFF REF, DESCENT FORECAST, RTE, ALTN, ALTN LIST, and WIND pages. The uplinks are annunciated to the crew by the •FMC EICAS communications alert and a Hi–Lo Chime. The uplink is identified by a CDU scratchpad message and by the presence of an UPLINK label over the applicable COMM page prompt.

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Requests

A REQUEST prompt on each page downlinks a unique request applicable to that page. The pages below contain request prompts.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Request Status

Below is a typical sequence of status in response to sending a request.

FMC Data Link Uplinks (Accept/Reject)

ACCEPT and REJECT display on the PERF INIT, TAKEOFF 1/2, and ALTN pages after receipt of uplink data.

Uplink data displays initially in small font for preview.

Select ACCEPT prompt:

- displays uplinked data in large font
- replaces previous data with uplinked data
- changes page to pre–uplink format
- clears scratchpad message
- transmits a downlink accept message (if enabled)

Select REJECT prompt:

- replaces uplinked data with previous data
- changes page to pre–uplink format
- clears scratchpad message
- transmits a downlink reject message (if enabled)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Data Link Uplinks (Load/Purge)

LOAD and PURGE display on the DESCENT FORECAST page after receipt of uplink data. LOAD and PURGE display on the active RTE 1 or RTE 2 page when there is an uplink to the inactive route.

Select LOAD prompt:

- loads uplinked data into FMC for viewing
- clears scratchpad message
- replaces previous data with uplinked data
- changes page to pre–uplink format
- transmits a downlink accept message (if enabled)

Select PURGE prompt:

- replaces uplinked data with previous data
- changes page to pre–uplink format
- clears scratchpad message
- transmits a downlink reject message (if enabled)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Data Link Uplinks (Load/Exec–Erase)

LOAD displays on the RTE and WIND pages after receipt of uplink data.

After the uplinked data is loaded, the EXEC light illuminates and the ERASE prompt displays.

Select LOAD prompt:

- loads uplinked data into FMC
- loaded data can be viewed
- clears scratchpad message
- replaces existing data with modified uplinked data
- changes page title to MOD
- shows ERASE prompt
- illuminates EXEC light

Push the EXEC key to:

- put modified data in active flight plan
- change page format to pre–uplink format
- transmit a downlink accept message (if enabled)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Select ERASE prompt to:

- remove modified data
- return page display to pre–uplink format
- transmit a downlink reject message (if enabled)

FMC Data Link Uplinks (Automatic)

FLT NO and ALTN LIST data can be automatically uplinked and loaded. FLT NO automatically loads into the RTE 1/x page without flight crew action. The list of 20 alternates automatically loads into the ALTN LIST page without flight crew action.

The FLT NO can be uplinked as part of a route uplink. If the route uplink is rejected, the FLT NO remains loaded on the RTE 1/x page.

The scratchpad messages FLIGHT NUMBER UPLINK or ALTN LIST UPLINK stay in the scratchpad display queue until the applicable CDU page is selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Data Link Management

The flight crew should monitor system status of FMC data link. This is accomplished on various CDU pages or on the FMC COMM page. Changes to data link system operating modes are accomplished with the COMM function on the display select panel.

CDU Data Link Status Displays

Data link operation is verified when the correct line title displays above the prompt. In the example below, the line title ROUTE is above the REQUEST and REPORT prompts on the RTE page.

When the data link system is not operating, the CDU data line changes to NO COMM, VOICE, or FAIL and the line title changes to DATA LINK.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Communications Page

General data link status displays on the FMC COMM page. Page select prompts display for each FMC page with access to data link data.

1 Uplink Status

The page line title displays UPLINK when an uplink message is pending and all preprocessing is complete. Preprocessing of uplinks ensures prerequisite data is available before the uplink message can be selected. Examples of preprocessing include:

- RTE ALTN, ALTN LIST, PERF, TAKEOFF, and WIND uplinks are held until route activation or modifications are complete
- Subsequent uplinks of the same type are held until previous uplinks are included or discarded by the flight crew
- TAKEOFF uplink is held until gross weight is entered, a pending PERF uplink is included or discarded, or a takeoff runway is entered

When both ALTN and ALTN LIST uplinks are pending, (2) displays to the right of UPLINK in the line title.

The EICAS message •FMC displays whenever any UPLINK message is pending.

2 DATA LINK

Displays the data link system status.

System status can be:

- READY
- NO COMM

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- VOICE
- FAIL

Page Select Prompts

Selection of any of these prompts displays the related page:

- RTE X
- ALTN
- PERF
- TAKEOFF
- WIND
- DES FORECAST
- POS REPORT

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

Completion of the FMC preflight requires data entry in all minimum required data locations. Entry of all required and optional preflight data optimizes FMC accuracy.

Data link can load preflight data from airline ground stations. Using data link reduces the number of required flight crew actions. Manual flight crew entries replace existing data.

Data link can also be used to load takeoff data onto the TAKEOFF REF pages.

Preflight Page Sequence

The identification page usually displays when power is applied to the FMC. Preflight flow continues in this sequence:

- identification (IDENT) page
- position initialization (POS INIT) page
- route (RTE) page
- DEPARTURES page (no prompt)
- navigation radios (NAV RAD) page (no prompt)
- performance initialization (PERF INIT) page
- thrust limit (THRUST LIM) page
- takeoff reference (TAKEOFF REF) page

Some of these pages are also used in flight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Minimum Preflight Sequence

During preflight, a prompt in the lower right directs the flight crew through the minimum requirements for preflight completion. Selecting the prompt key displays the next page in the flow. If a required entry is missed, a prompt on the TAKEOFF page leads the flight crew to the preflight page missing data.

Airplane inertial position is necessary for FMC preflight and flight instrument operation.

A route must be entered and activated. The minimum route data is origin and destination airports, and a route leg.

Performance data requires entry of airplane weights, fuel reserves, cost index, and cruise altitude.

Takeoff data requires a flap setting and center of gravity.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Supplementary Pages

Supplementary pages are sometimes required. These pages have no prompts and interrupt the usual sequence. Discussions of each page includes methods to display the page.

When the route includes SIDs and STARs, they can be entered using the DEPARTURES or ARRIVALS pages.

Route discontinuities can be removed using the RTE LEGS pages. Similarly, speed/altitude restrictions are entered and removed on the RTE LEGS page described in the FMC Cruise section of this chapter.

Alternate airports are added on the ALTN page. The ALTN page is described in the FMC Descent/Approach section of this chapter.

Waypoints, navigation, airport, and runway data is referenced on the REF NAV DATA page. The REF NAV DATA page is described in the FMC Cruise section of this chapter.

VNAV performance is improved if forecast winds and temperatures are entered during the preflight. Wind and temperature data for specific waypoints is entered on the WIND page. The WIND page is described in the FMC Cruise section of this chapter.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Preflight Pages – Part 1

The preflight pages are presented in the sequence used during a typical preflight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

Selecting INDEX from any of the below pages will return to the INIT/REF INDEX page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Identification (IDENT)

The IDENT page is used to verify basic airplane data and currency of the navigation database.

2 Position (POS)

The POS INIT page is used for ADIRU initialization.

The POS INIT page is also used for initialization of SAARU heading in the event the ADIRU fails.

3 Performance (PERF)

The PERF INIT page is used for initialization of data required for VNAV operations and performance predictions.

4 Thrust Limit (THRUST LIM)

The THRUST LIM page is used to select thrust limits and derates.

5 TAKEOFF

The TAKEOFF REF page is used to enter takeoff reference data and V speeds.

6 APPROACH

The APPROACH REF page is used for entry of the approach VREF speed.

7 NAV DATA

The REF NAV DATA page is used for data on waypoints, navaids, airports, and runways. NAV DATA pages are accessible only from this page.

8 Alternate (ALTN)

The ALTN page is used for alternate airport planning and diversions.

9 Maintenance (MAINT)

For maintenance use only; displays maintenance pages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Identification Page

Most of the data on this page is for flight crew verification. The active navigation database can be selected.

HL7532 - HL7598

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7733 - HL7766

HL7202 - HL7205, HL7782 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 MODEL

Displays airplane model as follows:

HL7574 - HL7598

Ident Page Model	Airplane
777-200.1	777-200ER

HL7733 - HL7766

Ident Page Model	Airplane
777-200.3	777-200ER with extended forward CG

HL8005, HL8075, HL8226, HL8251, HL8252, HL8285

Ident Page Model	Airplane
777-200.4	777F

HL8043 - HL8046, HL8076, HL8077

Ident Page Model	Airplane
777-200.6	777F with Value Creation Package (VCP)

HL7532 - HL7573

Ident Page Model	Airplane
777-300	777-300

HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275

Ident Page Model	Airplane
777-300.2	777-300ER with enhanced performance

HL7202 - HL7205, HL8346, HL8347

Ident Page Model	Airplane
777-300.3	777-300ER with Value Creation Package (VCP)

2 NAV DATA

Displays the navigation database identifier.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 ENG RATING

Displays engine model and thrust rating. Header displays INTERMIX RATING for engine intermix installations. YY or YYY is the engine thrust rating.

5 ACTIVE

Displays the effectivity date range for the active navigation database.

If the active navigation database is out of date, it can be changed to the inactive navigation database. Pushing the date range prompt of the inactive navigation database copies that date into the scratchpad. Pushing the date range prompt of the active navigation database transfers the scratchpad date up to the ACTIVE database line. The previous active date moves to the inactive date line.

The line title ACTIVE is above the active navigation database date. No line title is above the inactive navigation database date. The navigation database date can only be changed on the ground. Changing the navigation database removes all previously entered route data.

When an active database expires in flight, the expired database is used until the active date is changed after landing.

6 Inactive Date Range

Displays the effectivity date range for the inactive navigation database.

7 DRAG/FF

Displays the airplane drag and fuel flow correction factors.

8 Position Initialization (POS INIT)

Push – displays the POS INIT page.

HL7202 - HL7205, HL7733 - HL8347

9 AIMS Software Blockpoint

Displays the current AIMS blockpoint software loaded.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Position Initialization Page 1/3

The position initialization page allows entry of airplane present position for ADIRU alignment. The same page is used to enter the heading for SAARU initialization when the ADIRU is inoperative.

Data on the first page is used to initialize the ADIRU. In the event the ADIRU becomes inoperative in flight, initialization of the SAARU heading is accomplished on this page.

1 Reference Airport (REF AIRPORT)

Entry of the reference airport displays the airport latitude/longitude.

Optional entry.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Valid entries are ICAO four letter airport identifiers.

Removes previous GATE entry.

Entry blanks at lift–off.

2 GATE

The gate entry allows further refinement of the latitude/longitude position.

Optional entry after reference airport entered.

Valid entry is a gate number at the reference airport.

Displays the latitude and longitude of the reference airport gate.

Changes to dashes when a new reference airport entered.

Entry blanks at lift–off.

3 Coordinated Universal Time (UTC)

UTC (GPS) – displays time from GPS.

HL7532 - HL7783, HL8208 - HL8218, HL8250 - HL8252
UTC (MAN) –

- displays time from captain's clock when operative; otherwise, displays time from first officer's clock
- hours set by entering desired hour reference
- minutes set by resetting appropriate pilot's clock

4 INDEX

Push – displays the INIT/REF INDEX page.

5 Last Position (LAST POS)

Displays the last FMC calculated position.

6 GPS Position (GPS POS)

Displays the GPS present position. During preflight, the GPS POS may not display due to satellite availability, performance, or unfavorable geometry.

7 Set Inertial Position (SET INERTIAL POS)

The set inertial position entry is required to initialize the ADIRU. Select the most accurate latitude/longitude from LAST POS, REF AIRPORT, GATE, GPS POS, or make a manual entry to initialize the ADIRU.

If an entry is not made before the ADIRU completes the initial alignment, the scratchpad message ENTER INERTIAL POSITION displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If an entered position fails the ADIRU internal check, the scratchpad message ENTER INERTIAL POSITION displays. If the entered position fails the ADIRU check after the position is entered a second time, the scratchpad message ALIGNMENT REINITIATED displays.

The entered position is also compared with the FMC origin airport position. If the entered position is not within 6 NM of the FMC origin airport position, the scratchpad message INERTIAL/ORIGIN DISAGREE displays.

Dashes display when the ADIRU is in the automatic realignment mode and can receive a new position update. Enter the most accurate inertial position to remove any accumulated ADIRU position errors.

Enter airplane position latitude and longitude.

Boxes display within one minute of ADIRU power–up.

Blanks when the ADIRU changes from the alignment to the navigation mode.

Blanks when the airplane is moving or has not been stationary for a minimum of six minutes.

Dashes display when the ADIRU enters the automatic realignment mode on the ground.

New inertial position entries can be made after dashes display during ADIRU automatic realignment. New entries display for 2 seconds. After 2 seconds, dashes display to allow entry of another position.

8 ROUTE

Push – displays the ROUTE page.

9 SET HDG

Dashes display in flight when ADIRU is inoperative.

Entry of magnetic heading initializes SAARU.

Valid entry is 0 to 360 (0 or 360 displays as 360°). Entered heading displays in large font for two seconds, followed by dashes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Position Reference Page 2/3

Position reference page 2 displays positions calculated by the FMC, ADIRU, GPS, and radio navigation receivers. The FMC position can be updated to ADIRU, GPS, or radio position on this page.

This page displays latitude/longitude or bearing/distance. All position displays are in actual latitude and longitude, as calculated by the related system. The ADIRU, GPS, and radio position data can be changed to bearing/distance.

1 FMC

The source used by the active FMC for position data displays next to the FMC line title. In the example, the FMC uses GPS for position data.

Displays the FMC calculated latitude/longitude.

Identifies the source for calculating the FMC position:

- GPS – position calculated from GPS position data
- INERTIAL – position calculated from ADIRU position data
- RADIO – position calculated from navigation radio position data
- LOC-RADIO or LOC-INERTIAL – position updated by localizer data

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 INERTIAL

Displays latitude/longitude position determined by the ADIRU.

3 GPS

Displays latitude/longitude position determined by the GPS.

4 RADIO

After airborne, displays latitude/longitude position determined by navigation radios.

5 Required Navigation Performance and Actual Navigation Performance (RNP /ACTUAL)

Displays RNP values stored in the navigation database for departure and arrival procedures; or, if there are none, displays the default values stored within the FMC by flight phase. Also displays FMC actual navigation performance (ACTUAL).

Default RNP is in small font.

Valid RNP entries are in the range 0.01 to 99.9. Manual entry displays in large font and clear at flight completion; propagated to 2L RNP PROGRESS page 4. ACTUAL entry not allowed.

When ACTUAL exceeds RNP for the time specified in the Operational Program Configuration (OPC), the EICAS message NAV UNABLE RNP displays.

6 INDEX

Push – displays the INIT/REF INDEX page.

7 UPDATE ARM

Push –

- arms FMC position update function
- changes prompt to ARMED
- adds NOW prompts to right side of INERTIAL, GPS, and RADIO lines

Push a NOW prompt key to update FMC position to the selected source.

8 ACTUAL – INERTIAL

Displays actual navigation performance of the ADIRU.

9 ACTUAL – GPS

Displays actual navigation performance of the GPS; blanks if GPS position data invalid.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

10 ACTUAL – RADIO

Displays actual navigation performance of radio updating.

11 Radio Update Station(s)/Mode

Displays radio station identifiers.

Position update mode is indicated in the line title:

- DME DME
- VOR DME

Selection of "VOR" at 6R on the REF NAV DATA page does not inhibit DME DME updating.

12 Bearing/Distance (BRG/DIST) or Latitude/Longitude (LAT/LON)

Push – alternates position data format between bearing/distance or latitude/longitude.

The page illustration is shown in the latitude/longitude display format.

Latitude/longitude format displays are actual position.

Bearing/distance format displays the bearing and distance of other position sources relative to the FMC position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Position Reference Page 3/3

On position reference page 3, the flight crew can observe the calculated positions from the left and right GPS receivers and the left and right FMC calculations. This page also allows the flight crew to enable or disable GPS position updates.

This page can display the bearing/distance or latitude/longitude format. The bearing/distance format displays bearing and distance of the position sources relative to the active FMC position on the POS REF 2/3 page. In the example, both the left and right GPS agree with the left FMC position.

1 GPS L

Displays the left GPS position.

2 GPS R

Displays the right GPS position.

3 FMC L

Displays the left FMC calculated position.

Primary (PRI) displays when the left FMC is active and the right FMC is inactive.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 FMC R

Displays the right FMC calculated position.

PRI displays when the right FMC is active and the left FMC is inactive.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 GPS NAV

Push – alternately selects GPS NAV ON (enabled) and OFF (disabled).

OFF – GPS position data is not available to the FMC. OFF displays in large green letters; ON displays in small white letters.

ON – GPS position data is available to the FMC. ON displays in large green letters; OFF displays in small white letters.

Note: When power is initially applied to the airplane or when engines are shut down, GPS NAV is set to ON.

7 Latitude/Longitude (LAT/LON) or Bearing/Distance (BRG/DIST)

Push – alternately changes the display of position data on POS REF 2/3 and 3/3 to latitude/longitude format or bearing/distance format.

The page illustration is shown in the bearing/distance display mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Route Page 1/X

Two routes (RTE 1 and RTE 2) can be displayed in air traffic control format. Routes can be entered by the flight crew or uplinked through data link. All routes have two or more pages. The first route page displays origin and destination data. Subsequent route pages display route segments between waypoints or fixes. ROUTE 1 and ROUTE 2 allow management of alternate or future routes while leaving the active route unmodified. ROUTE 2 has an identical page structure as ROUTE 1. When RTE 2 is active, page display logic is the same as RTE 1.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Page Title

White when the route is active.

Cyan when the route is inactive or pending activation.

The white shaded word MOD precedes the page title when the route is modified and the change is not executed.

Multiple route pages are indicated by the page sequence number to the right of the title. The minimum number of route pages is 2.

2 ORIGIN

Entry:

- must be a valid ICAO identifier in the navigation database
- is made automatically when a company route is entered
- enables direct selection of departure and arrival procedures
- entry on the ground deletes route; in flight, entries are valid on the inactive route
- clears: wind levels on the WIND page, all existing company route identifiers, runways, destination airport, legs, and enroute procedures from an existing route

3 RUNWAY

Enter the applicable runway for the origin airport. Runway must be in the navigation database. Entry is optional.

New entries on an active route cause MOD to display in the route title.

Automatically entered when part of a company route.

Can be selected on the DEPARTURES page.

FMC deletes runway after the first waypoint is crossed.

4 ROUTE REQUEST

Line title displays DATA LINK when the data link status is NO COMM, VOICE, or FAIL.

Push – transmits a data link request for a flight plan route uplink.

Flight crew can enter origin, destination, runway, flight number, company route name, or route definition to qualify request.

5 RTE 2, ERASE

RTE 2:

Push – displays the RTE 2 page 1/x.

Allows access to an inactive route for creation and modification or activation.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Inactive route modifications do not alter the active route.

Prompt changes to RTE 1 when RTE 2 is displayed.

ERASE:

Push - deletes all lateral and vertical mods to the displayed modified route. Selection of <ERASE while a pending activation route is displayed returns the inactive route.

6 Destination (DEST)

Entry:

- must be a valid ICAO identifier in the navigation database
- is made automatically when a company route is entered
- enables selection of departure and arrival procedures

7 Flight Number (FLT NO)

Valid entry is any ATC filed and flight crew entered, or uplinked company flight number up to 10 characters.

A pilot entry on the ATC LOGON/STATUS page propagates to the ROUTE page.

The Flight number displays in the PROGRESS pages 1/4 and 2/4 title.

Transponder transmits flight number to ATC when Eurocontrol-compliant transponder installed.

8 Company Route (CO ROUTE)

A company route can be called from the navigation database by entering the route identifier. The data supplied with a company route can include origin and destination airports, departure runway, SID and STAR, and the route of flight. All company route data is automatically entered when the route identifier is entered.

An entry is optional for activation of the route.

Enter a company route identifier.

Valid entry is any flight crew entered or uplinked company route name. If the name is not contained in the NAV database, the entry is allowed and the scratchpad message NOT IN DATABASE displays.

Entry of a new company route replaces the previous route.

In–flight entry is inhibited for the active route.

9 Alternate (ALTN)

Push – displays the ALTN page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

10 ACTIVATE

Push the ACTIVATE key to arm the route for execution as the active route. When the EXECUTE key is pushed, the route becomes the active route and the ACTIVATE prompt is replaced with the next required preflight page prompt.

Push – prepares the selected route for execution as the active route.

Activation of a route is required for completion of the preflight.

Displayed on inactive route pages.

After route activation, the ACTIVATE prompt is replaced by:

- PERF INIT, when the required performance data is incomplete, or
- TAKEOFF when the required performance data is complete

More Route Page Prompts for an Active Route

1 ROUTE REPORT

REPORT:

Push – transmits a flight plan downlink report.

LOAD:

Push – when the displayed route is inactive, it is replaced or modified by the flight plan uplink. When the displayed route is active, it is replaced or modified by the flight plan uplink and a modified route is created.

2 ROUTE PRINT

Push – sends the active route to the flight deck printer.

3 Route Copy (RTE COPY)

Push – copies the entire active route (RTE x) into the inactive route (RTE y).

Displayed only on the active route page.

Displays COMPLETE after the route is copied.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Dashes change to DIRECT if the TO waypoint is entered first.

Dashes display for the first VIA beyond the end of the route.

Invalid VIA entries display the scratchpad INVALID ENTRY message.

Invalid VIA entries are:

- airways and company routes which do not contain the TO waypoint of the previous line
- airways that do not intersect the previous airway
- airways or company routes that are not in the navigation database

The start and end waypoints determine whether the entered airway is valid. The route segment must contain the waypoint entered in the TO position. The TO waypoint of the previous route segment must be the same as the start point of the next route segment or a route discontinuity is created between the segments.

Entry of a SID or transition enters the VIA and TO data for the route segments of the SID. A SID links to the next route segment when the final SID waypoint is part of the route segment.

When no SID is used, entering an airway on the first line of page 2 initiates an airway intercept from the runway heading and:

- replaces the airway with dashes in the first line VIA
- shows boxes in the first line TO waypoint
- moves the airway to line 2 after the TO waypoint is entered
- enters the first fix on the airway nearest to being abeam of the departure heading in the airway line TO waypoint

A route can contain segments formed by the intersection of two airways. Entering two intersecting airways in successive VIA lines without a TO waypoint causes the FMC to create an airway intersection waypoint to change from one segment to the next. The FMC created waypoint intersection (INTC) displays in the first airway segment TO waypoint.

LACRE3.VAMPS is an example of a SID selection made on the DEPARTURES page.

V2 and V336 are examples of airway entries.

APP TRANS is an example of a STAR selection made on the APPROACH page.

ILS32R is an example of an approach selection made on the APPROACH page.

2 TO

Enter the end point of the route segment specified by the VIA entry.

Entry of a waypoint in the TO column without first entering a VIA airway shows DIRECT in the VIA column.

Data input is mandatory when boxes are displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Departure (DEP) — Other

Displays the departure page for the airport entered into this line through the scratchpad.

DEP prompt for OTHER allows display of departure data about airports that are not an origin or destination. The data can be viewed but cannot be selected because the airport is not on the route.

4 Arrival (ARR) – Route 1 Origin

Push – displays the arrival page for route 1 origin airport. Origin airport arrivals selection is used during a turn–back situation.

5 Arrival (ARR) – Route 1 Destination

Push – displays the arrival page for route 1 destination airport.

6 Arrival (ARR) – Route 2 Origin

Push – displays the arrival page for route 2 origin airport. Origin airport arrivals selection is used during a turn–back situation.

7 Arrival (ARR) – Route 2 Destination

Push – displays the arrival page for route 2 destination airport.

8 Arrival (ARR) – Other

Displays the arrival page for the airport entered in this line through the scratchpad.

ARR prompt for OTHER allows display of arrival data about airports that are not an origin or destination. The data can be viewed but cannot be selected because the airport is not on the route.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Departures Page

The departures page is used to select the departure runway, SID, and transition for the route origin airport.

Pushing the DEP ARR function key displays the departures page for the inactive route when an inactive RTE or RTE LEGS page is displayed.

1 Standard Instrument Departures (SIDS)

Displays a list of SIDS for the airport.

Push –

- selects SID for use in the route
- other SIDs no longer display and transitions for the selected SID display
- runways for selected SID remain and others no longer display

2 Transitions (TRANS)

Displays transitions compatible with the selected SID.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Push –

- selects transition for entry in the route
- other transitions no longer display

3 Engine Out (EO) SIDS

Displays airline-defined single engine-out SIDs and all transitions for the selected runway. EO SID can be viewed before takeoff by line selecting and selecting the Legs page. EO SID automatically selected during takeoff if an engine-out detected prior to “flaps up”. The modification can be either executed or erased. If an EO SID does not exist, NONE displays.

PUSH - displays EO SID as the selected SID.

4 ERASE or INDEX

Erase displays when a route modification is pending. INDEX displays when no route modification is pending.

ERASE push – removes route modifications not executed and displays the original route.

INDEX push – displays the DEP/ARR INDEX page.

5 RUNWAYS

Displays a list of runways for the selected airport.

The runway selected on the RTE 1/X page displays as <SEL> or <ACT>.

Push –

- selects runway for use in the route. All other runways no longer display
- SIDs associated with selected runway remain, all others no longer display
- subsequent change of a runway deletes departure procedures previously selected

6 Selecting Options

Selecting an option displays <SEL> inboard of the option and creates a route modification. After executing the modification, <SEL> becomes <ACT>. Executing a modification or leaving the page and returning displays all options and the <SEL> or <ACT> prompts.

7 ROUTE

Push – displays the related RTE page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Navigation Radio Page

VOR and ILS navigation radios are normally autotuned by the FMC. ADF radios are manually tuned. The NAV RADIO page displays the VOR, ILS, and ADF radio status and allows manual control of these radios. Entering data on this page tunes the selected navigation radio. VOR courses can also be entered.

VOR

1 VOR Frequency and Tune Status

The tuning status displays adjacent to left and right VOR frequencies. Entry of a frequency or identifier manual–tunes a VOR. FMC autotunes VORs for procedure flying and route operations. The FMC also tunes related DMEs. The tuning status displays are:

- P (procedure autotuning) – FMC selects navaids for approach or departure procedure guidance
- R (route autotuning) – FMC selects navaids on the active route. The navaid is the previous VOR or a downpath VOR within 250nm of aircraft position
- A (autotuning) – FMC selects a navaid for best position orientation
- M (manual) – VOR is manual–tuned. Manual–tuning takes priority over FMC autotuning. Deletion of a manual–tuned frequency returns system to autotuning

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Valid entries:

- VOR or non–ILS DME identifier or VOR frequency (XXX.X or XXX.XX)
- VOR identifier or frequency/course; the course displays on the CRS line

The identifier and frequencies are green and tuning status is white.

Note: When the airplane magnetic variation database and the VOR ground station assigned magnetic variation values differ, the ND VOR radial and ND POS green radial will not point directly to the VOR. This split will usually decrease as the airplane approaches the VOR.

2 CRS

Blank when in autotune.

Valid entry is a three–digit course. Data can be entered when dashes or a course are displayed.

With a VOR approach selected, sequencing an IAF/FAF causes the FMC to procedure autotune the VOR frequency. When the approach has a runway waypoint, the FMC selects the inbound course.

VOR course is green. Radial is white.

3 RADIAL

Displays radial from left and right VOR stations to the airplane.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ADF

1 ADF Frequency and Tune Status

The tuning status displays adjacent to the left and right ADF frequencies. The tuning status displays are:

- ANT (antenna) – mode optimizes audio reception and removes ADF bearing data
- BFO (beat frequency oscillator) – mode for audio identification of stations transmitting unmodulated (CW) signals

Default tuning mode is ADF (no indication) giving both bearing data and audio.

Valid entries are XXX.X or XXXX.X.

Manual entry can be followed by A (ANT), B (BFO), or none, which defaults to the ADF mode.

Frequency is cyan and status is white.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ILS

1 ILS Frequency/Course and Tune Status

The tuning status displays adjacent to the ILS frequency and course. The ILS receivers operate in FMC autotune or manual–tuning modes. The FMC autotunes the ILS frequency and course. When the ILS is not necessary, the FMC sets the ILS to PARK. This removes the displays from the PFD.

Airplane position on the route determines the ILS operating mode. The operating mode displays are:

- PARK – the ILS is not being used and is not tuned
- XXX.XX/YYY PARK – the ILS is tuned for the selected approach but is not being used
- “A” indicates autotuning under FMC control for approach guidance
- “M” indicates the ILS is manually tuned

ILS autotuning is inhibited for ten minutes after takeoff and during manual–tuning. Autotuning and manual–tuning are inhibited when:

- the autopilot is engaged and either the localizer or glideslope is captured
- only the flight director is ON and either the localizer or glideslope is captured and the airplane is below 500 feet radio altitude
- on the ground with the localizer alive, the airplane heading within 45 degrees of the localizer front course and the ground speed is greater than 40 knots

Subsequent manual–tuning is enabled when:

- either TO/GA switch is pushed
- the autopilot is disengaged and both flight directors are switched off
- the MCP approach switch is deselected when the airplane is above 1500 feet radio altitude

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Valid entries:

- ILS frequency and front course (XXX.XX/YYY)
- front course, with a frequency and course already entered (/YYY)

2 PRESELECT

Any valid page data may be entered.

Put data into this line for later use. Data can be moved to the appropriate line when necessary.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ILS Tuning Status

The display initializes to PARK. When PARK displayed, the ILS is not tuned. The tuning status displays are:

- XXX.XX/YYY PARK – the ILS is autotuned for the selected approach but is not being used
- A (autotune) – ILS is autotuned for approach guidance
- M (manual) – ILS is manual–tuned

1 Park

PARK displays when:

- electrical power is first applied
- more than 200 NM from the T/D, or
- less than halfway to the destination

2 Tuning Status – Frequency, Course, and Park

ILS frequency, front course, and PARK display when an ILS, LOC, back course, localizer-type directional aid (LDA), or simplified directional facility (SDF) is selected, and:

- less than 200 NM from the T/D, or
- more than halfway to the destination, whichever represents the lesser distance to destination

Line selection manually tunes ILS.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Tuning Status – Autotune

ILS frequency, front course, and A display when an ILS, LOC, back course, LDA, or SDF is selected, and:

- less than 50 NM from the T/D, or
- less than 150 NM from the runway threshold, or
- FMC is in descent mode

4 Tuning Status – Manual

Receiver tuned manually and valid frequency/course display.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Preflight Pages – Part 2
Performance Initialization Page

The performance initialization page allows the entry of airplane and route data to initialize performance calculations. This data is required for VNAV calculations.

1 Gross Weight (GR WT)

Airplane gross weight cannot be entered by the flight crew.

The gross weight line remains blank until zero fuel and fuel weights are available for the FMC to calculate gross weight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 FUEL

Fuel on board displays when the fuel totalizer calculations are valid. The source for the display is included in the line:

- SENSED – fuel quantity is from the totalizer. Manual entry is not possible
- CALC (calculated) – fuel quantity is from FMC calculations. Manual entry is possible
- MANUAL – fuel quantity has been manually entered. The manual entry displays in 6R, CALCULATED, PROGRESS page 2/3

Valid entry is XXX or XXX.X.

Only manual entries can be deleted.

If one or more fuel quantity indicators has failed, box prompts display requiring a manual entry of total fuel quantity to initialize PERT INIT page information.

3 Zero Fuel Weight (ZFW)

Normally, ZFW is entered from the airplane dispatch papers and the FMC calculates the airplane gross weight.

Valid entry is XXX or XXX.X.

Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

ZFW can be manually entered or uplinked. When a performance uplink is pending, uplinked values (small font) display beside the entered values (large font).

4 RESERVES

Valid entry is XXX or XXX.X.

Can be manually entered or uplinked. When a performance uplink is pending, uplinked values (small font) display beside the entered values (large font).

5 Performance Initialization Request (PERF INIT REQUEST)

Push – transmits a data link request for performance data uplink.

Flight crew can fill in ZFW, CG, cruise altitude, reserves, cost index, or fuel temperature to qualify request.

6 INDEX

Push – displays the INIT/REF INDEX page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

7 Cruise Altitude (CRZ ALT)

Cruise altitude can be entered by the flight crew or from a company route or uplink.

Entry displays this cruise altitude on the CLB and CRZ pages.

8 COST INDEX

Cost index is used to calculate ECON climb, cruise, and descent speeds. Larger values increase ECON speeds. Entering zero results in maximum range airspeed and minimum trip fuel. Cost index can be entered by the flight crew or from a company route or uplink.

Valid entries are 0 to 9999.

9 Minimum Fuel Temperature (MIN FUEL TEMP)

Displays minimum fuel operating temperature (3 degrees C warmer than the fuel freeze temperature for a given fuel).

Default value from the airline policy page displays in small font and may not be deleted.

A PERF INIT uplink containing a minimum fuel temperature value pending ACCEPT/REJECT displays in small font. Accepting causes the value to display in large font.

Valid entries are -99 to -1 in degrees C.

Flight crew entered value displays in large font.

When actual fuel temperature reaches the displayed value, the EICAS advisory message FUEL TEMP LOW displays.

10 Cruise Center of Gravity (CRZ CG)

The FMC uses the CRZ CG to calculate maximum altitude, and minimum and maximum amber band speeds. The flight crew may improve the accuracy of calculated maximum altitude and maneuver margin to buffet by entering the actual CRZ CG, when known. A flight crew entered value shows in large font. A more aft CRZ CG results in a less restrictive initial buffet envelope (higher maximum altitude, lower low-speed buffet speed, and increased high speed buffet speed).

Unless modified, the CRZ CG displays the AMI default value in small font. If the value in AMI is blank, the CHECK AIRLINE POLICY message displays.

A PERF INIT uplink containing a cruise cg value pending ACCEPT/REJECT displays in small font. Accepting causes the value to display in large font.

The CRZ CG value does not change due to fuel burn.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7574 - HL7766, HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285
Valid entry is 14.0 through 44.0.

HL7202 - HL7573, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347
Valid entry is 7.5 through 44.0.

11 STEP SIZE

Displays the climb altitude increment used for planning the optimum climb profile.

Default value is: RVSM, ICAO, or 0 as selected in AMI.

Valid entries are:

- "0" to inhibit predicted step climbs, or
- altitudes from 1000 to 9900 in 100 foot increments, or
- "I" for ICAO, or
- "R" for RVSM

In-flight entries are inhibited. In-flight step size changes are made on the CRZ page.

For a non-zero entry, performance predictions are based on step climbs at optimum points. For a zero entry, performance predictions are based on a constant CRZ ALT.

12 Thrust Limit (THRUST LIM)

Push – shows the THRUST LIM page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Thrust Limit Page

The thrust limit page allows selection and display of reference thrust for takeoff. Takeoff thrust derate by use of assumed temperature is also accomplished on this page.

Additional page data displays are:

- <SEL> – identifies the selected takeoff thrust reference mode
- <ARM> – identifies the armed climb thrust reference mode

The <ARM> prompt changes to <SEL> when the armed climb mode becomes active.

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

HL7532 - HL7766

1 Assumed Temperature (SEL), Outside Air Temperature (OAT)

Entry of assumed temperature is allowed when the airplane is on the ground and dash prompts or large font temperature data is displayed.

Entry of an assumed temperature warmer than the OAT reduces takeoff thrust and displays D as part of the thrust reference mode.

Valid entries are 0 to 99 degrees Celsius (C) or 32 to 210 degrees Fahrenheit (F).

Entry of one, two, or three character temperature followed by “F” displays assumed temperature in degrees F; otherwise, assumed temperature displays in degrees C.

Uplinked temperatures display on both the THRUST LIM and TAKEOFF REF pages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight crew entered or uplinked values replace previously displayed values.

Entry of a selected temperature change greater than one degree after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

OAT displays outside air temperature in degrees C. When SEL temperature is in degrees F, the OAT converts to degrees F.

The assumed temperature thrust derate is not the same as TO 1 and TO 2 fixed thrust derates described below. If TO 1 or TO 2 is selected and an assumed temperature is then entered, thrust is further derated.

HL7202 - HL7205, HL7782 - HL8347

1 Assumed Temperature (SEL), APU-to-Pack, Outside Air Temperature (OAT)

Entry is allowed when the airplane is on the ground and dash prompts or large font temperature data is displayed.

Entry of an assumed temperature warmer than the OAT reduces takeoff thrust and displays D as part of the thrust reference mode.

Valid entries are 0 to 99 degrees Celsius (C) or 32 to 210 degrees Fahrenheit (F).

Entry of one, two, or three character temperature followed by “F” displays assumed temperature in degrees F; otherwise, assumed temperature displays in degrees C.

Uplinked temperatures display on both the THRUST LIM and TAKEOFF REF pages.

Flight crew entered or uplinked values replace previously displayed values.

Entry of a selected temperature change greater than one degree after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

“SEL-APU” displays in the header when the APU is running. Selection of “APU” from the scratchpad displays “APU” in the data line in small font representing the ARMED state. Approximately one minute after the second engine start, “APU” displays in large font representing the ACTIVE state. Entry of an assumed temperature, shutting down the APU, selecting another TO rating, or deleting the entry; deletes the APU selection.

OAT displays outside air temperature in degrees C. When SEL temperature is in degrees F, the OAT converts to degrees F.

The assumed temperature thrust derate is not the same as TO 1 and TO 2 fixed thrust derates described below. If TO 1 or TO 2 is selected and an assumed temperature is then entered, thrust is further derated.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Takeoff (TO)

Push – selects full rated (TO) takeoff thrust limit.

Selection of a new rating after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

3 Takeoff 1 (TO 1)

Push – selects percentage derate (TO 1) for takeoff thrust limit.

Takeoff thrust derate can be entered by uplink.

Selecting TO 1 arms CLB 1.

4 Takeoff 2 (TO 2)

Push – selects percentage derate (TO 2) for takeoff thrust limit.

Takeoff thrust derate can be entered by uplink.

Selecting TO 2 arms CLB 2.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 Thrust Reference Mode

Displays selected takeoff thrust mode.

"D-" displays when an assumed temperature derate is active.

HL7202 - HL7205, HL7782 - HL8347
The prefix “A-” is added to the line title TO when APU-to-Pack takeoff is selected.

HL7532 - HL7766

7 Takeoff EPR Limit

Displays the takeoff EPR calculated by the thrust management system. Displays N1 when the engines are operated in the alternate mode.

HL7202 - HL7205, HL7782 - HL8347

7 Takeoff N1 Limit

Displays takeoff N1 calculated by the thrust management system.

8 Climb (CLB)

Push – selects the full rated (CLB) climb thrust limit.

Pushing a climb line select key overrides an automatic selection.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

9 Climb 1 (CLB 1)

Push – selects a percentage derate (CLB 1) climb thrust limit.

Climb thrust derate can be entered by uplink.

10 Climb 2 (CLB 2)

Push – selects a percentage derate (CLB 2) climb thrust limit.

Climb thrust derate can be entered by uplink.

11 TAKEOFF

Push – displays the TAKEOFF REF page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Takeoff Reference Page 1/2

The takeoff reference page allows the flight crew to manage takeoff performance. Takeoff flap setting and V speeds are entered and verified. Thrust limits, takeoff position, and takeoff gross weight can be verified or changed. Preflight completion status is annunciated until complete.

Takeoff reference page entries finish the normal preflight. The takeoff flap setting must be entered and V speeds should be set before completion.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 FLAPS

Displays takeoff flap setting. Valid entries are 5, 15, or 20.

Flight crew entry or uplink.

Entry of 5 when FLAPS 5 is the climb thrust reduction point displays the scratchpad message INVALID ENTRY.

Flap position is required for takeoff V speed calculations.

Entry of a value after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

HL7532 - HL7766

2 THRUST

Displays takeoff thrust selected on THRUST LIM page, or flight crew or uplink entered assumed temperature for takeoff thrust derate calculations.

Entry is only allowed when the airplane is on the ground and dash prompts or large font temperature data is displayed.

Valid entries are 0 to 99 degrees C or 32 to 210 degrees F.

HL7202 - HL7205, HL7782 - HL8347

2 THRUST

Displays takeoff thrust selected on THRUST LIM page, or flight crew or uplink entered assumed temperature for takeoff thrust derate calculations.

Entry is only allowed when the airplane is on the ground and dash prompts or large font temperature data is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Entry of “APU” from scratchpad displays “A-XXX” with “XXX” being the takeoff thrust limit.

Valid entries are 0 to 99 degrees C or 32 to 210 degrees F.

Entry of a selected temperature change greater than one degree after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

3 Center of Gravity (CG) and TRIM

Valid entry is CG within the valid range.

After CG entered, the FMC:

- calculates and displays stabilizer takeoff setting to the right of the CG entry (trim display is in 0.25 unit increments)
- updates the takeoff green band displayed on stabilizer position indicators

4 Runway/Position (RWY/POS)

Displays the takeoff runway from the active RTE page.

Flight crew may enter or uplink runway; or intersection data, when planning an intersection takeoff.

Valid position entry is a one or two numeric in the range 0-99. It must be followed by two zeros and preceded by a slash (preceding the entry with a “-”means a longer takeoff distance is available; for example, -300 is 300 feet before the runway threshold).

Valid entry of a runway intersection is an alphanumeric up to three characters, preceded by a slash (/).

Entry of a runway or intersection after takeoff speeds are selected deletes V-speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

FMC position updating is inhibited when GPS is the primary FMC navigation source. When an intersection or position shift has been selected and an FMC position update is desired, GPS must be selected OFF.

5 TAKEOFF DATA REQUEST

REQUEST

Push – transmits a data link request for takeoff data uplink.

Flight crew can enter RWY, intersection or position shift, CG, TOGW, or OAT to qualify the request.

REJECT

Push – rejects the takeoff data uplink and returns the REQUEST prompt.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

6 INDEX

Push – displays the INIT/REF INDEX page.

7 V Speeds (V1, VR, V2)

Displays dashes when:

- required information not entered
- performance calculations are inhibited
- ADIRU is not aligned

Calculated speeds display in small font.

HL7532 - HL7766
Manually entered/selected or accepted uplink speeds replace calculated (REF) speeds. Speeds equal to or greater than calculated speeds are allowable. Entries less than calculated minimum V1, VR, or V2 speeds result in "MINV1", "MINVR", or "MINV2" display in line titles; minimum V1, VR, or V2 values display in large font on data lines.

HL7202 - HL7205, HL7782 - HL8347
Manually entered or accepted uplink speeds replace calculated (REF) speeds. Speeds equal to or greater than calculated speeds are allowable. Entries less than calculated minimum V1, VR, or V2 speeds result in "MINV1", "MINVR", or "MINV2" display in line titles; minimum V1, VR, or V2 values display in large font on data lines. Minimum VR or V2 speeds may be up to five knots lower than calculated VR or V2 speeds.

The FMC Takeoff Speed Relative Value check ensures V1 is less than or equal to VR and VR is less than or equal to V2.

Entry of V speeds not passing the check results in the scratchpad message TAKEOFF SPEEDS DELETED.

Push –

- selects V1, VR, and V2 to be sent to using systems, or
- crew entered V speeds replace calculated speeds
- display changes to large font; REF and caret no longer display

If performance data changes:

- FMC replaces existing speeds with FMC calculated speeds in small font
- V speeds are removed from the PFD
- PFD speed tape message NO V SPD displays
- scratchpad message TAKEOFF SPEEDS DELETED displays

Note: After an engine is started, the FMC recalculates the takeoff speeds. Any combination of gross weight, OAT, or pressure altitude resulting in a takeoff speed change of two or more knots from the previously calculated speeds, causes the FMC to recalculate takeoff speeds.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

8 Gross Weight (GR WT), Takeoff Gross Weight (TOGW)

GR WT displays airplane gross weight from the PERF INIT page.

TOGW – entry of airplane takeoff gross weight different from GR WT requests new takeoff data using data link.

Valid entry is any weight within the allowable airplane takeoff gross weight range. Flight crew entered value is downlinked when the REQUEST prompt is selected.

Entry of a value after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

Deletion of the TOGW value returns V speeds to small font; displays REF and caret.

A takeoff uplink displays the uplinked TOGW and associated V speeds.

9 Reference Speeds (REF SPDS), ACCEPT

REF SPDS:

Enables or disables display of the FMC calculated reference (V) speeds in the center column to the left of the V speed lines.

Push toggles between ON and OFF.

ON – displays FMC calculated takeoff speeds for comparison with the V speeds in the right column.

OFF – deletes speeds from the center column.

The active state, ON or OFF, displays in large green font; the inactive state displays in small white font.

ACCEPT:

Push – accepts the uplink takeoff data; all pending uplink values are treated as if entered by the flight crew.

10 Thrust Limit (THRUST LIM)

Push – displays THRUST LIM page.

11 Reference (REF)

Displays the FMC calculated V speeds for comparison with flight crew entered or uplinked values. Display is enabled and inhibited by the REF SPDS prompt.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Preflight Status

If the required preflight entries are not complete, the words PRE–FLT display on the right side of the dashed line. Preflight pages requiring entries display below the dashed line as prompts.

When preflight entries are complete, a dashed line displays below the takeoff reference page data. The THRUST LIM prompt displays below the dashed line.

Takeoff Reference Page 2/2

The page title displays TAKEOFF REF UPLINK when a takeoff uplink is pending; otherwise, the title is TAKEOFF REF.

Note: Acceleration/thrust reduction heights are added to airport elevation causing acceleration/thrust reduction at the desired MSL altitude. For example, for an airport elevation of 980 feet, an entry of 2020 acceleration height causes acceleration at 3,000 feet MSL.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7766

HL7202 - HL7205, HL7782 - HL8347

1 Alternate Thrust (ALTN THRUST)

Display is active if a TAKEOFF REF uplink has been accepted which includes alternate thrust data.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Line title may display:

- ALTN THRUST
- ALTN THRUST/FLAPS

Data may display temperature and:

- TO, TO/FLAPS
- TO 1, TO 1/FLAPS
- TO 2, TO 2/FLAPS
- yy° TO x (assumed temperature), yy° TO x/FLAPS

Push (with data on the line) – selects alternate thrust or alternate thrust/flaps for takeoff resulting in:

- recomputation of V speeds
- the line title displays STD THRUST or STD THRUST/FLAPS
- the ACCEPT/REJECT prompt displays on the TAKEOFF REF page 1/2
- new takeoff data displays
- the EICAS •FMC message displays
- the scratchpad message TAKEOFF DATA LOADED displays

2 WIND

Displays uplinked surface wind direction and speed.

Wind direction and speed can be entered by the flight crew or uplink.

Valid directions are from 0 to 360 degrees. (0 and 360 are shown as 000).

Valid speeds are from 0 to 250 knots.

Subsequent entries may be wind direction or speed only.

Entry of wind direction/speed results in calculation and display of RWY WIND.

Entry or uplink of a value after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

3 Runway Wind (RWY WIND)

Displays the calculated headwind/tailwind and crosswind components for the takeoff runway and surface wind.

Calculated values display in small font.

Speed displays in knots and:

- H for headwind
- T for tailwind
- R for right crosswind
- L for left crosswind

Flight crew entry is limited to headwind/tailwind entry.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Valid flight crew entries are a two digit number followed by H or T.

Flight crew speed entry without a letter defaults to a headwind component.

A flight crew entry clears the WIND line.

4 INDEX

Push – displays the INIT/REF INDEX page.

5 Engine Out Acceleration Height (EO ACCEL HT)

Displays acceleration height for flap retraction with an engine out.

Default value is from the airline policy file.

Valid entry is a height from 400 to 9999 feet.

6 Acceleration Height (ACCEL HT)

Displays acceleration height in Height Above Airport (HAA) for flap retraction.

Default value is from the airline policy file.

Entry is optional. Valid entry is an HAA height from 400 to 9999 feet. The FMC adds airport elevation to entered HAA acceleration height causing acceleration at an MSL altitude. For example, for an airport elevation of 980 feet, an entry of 2020 acceleration height causes acceleration at 3,000 feet MSL.

7 Climb Thrust and Thrust Reduction (THR REDUCTION) Altitude

Displays armed climb thrust rating and HAA height for reduction from takeoff thrust to climb thrust. Default THR REDUCTION value is from the airline policy file.

Entry

- is optional for preflight completion
- is an HAA height from 400 to 9999 feet. The FMC adds airport elevation to entered HAA thrust reduction height causing thrust reduction at an MSL altitude. For example, for an airport elevation of 980 feet, an entry of 1020 thrust reduction height causes thrust reduction at 2,000 feet MSL, or
- 1 for flaps 1 and 5 for flaps 5 (entry of 5 when FLAPS 5 is specified as the takeoff flap setting displays the scratchpad message INVALID ENTRY)

8 Limit Takeoff Gross Weight (LIM TOGW)

Displays takeoff gross weight limit for the uplinked data. Manual entry not allowed.

Prefix ALT or STD is added to line title when alternate or standard takeoff data is pending.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

9 Reference Outside Air Temperature (REF OAT)

Used for takeoff datalink request.

Enter an outside air temperature:

- the FMC recalculates takeoff V speeds
- after takeoff speeds are selected, deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED
- for a downlink transmission

Displays flight crew entered or uplinked data entry.

Valid entries are -54 to 99 degrees C, or -65 to 199 degrees F

HL7532 - HL7766

10 SLOPE

Displays flight crew entered or uplinked data entry.

Valid runway slope entries are 1 or 2 digit numbers between 0.0 through 2.0 in percent gradient. Slope entries may be proceeded by U (for uphill) or D (for downhill). Entries without a U or D are assumed to be uphill.

Entry of a value after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

HL7202 - HL7205, HL7782 - HL8347

10 Slope/Condition (SLOPE/COND)

Displays flight crew entered or uplinked data entry.

Valid runway slope entries are 1 or 2 digit numbers between 0.0 through 2.0 in percent gradient. Slope entries may be proceeded by U (for uphill) or D (for downhill). Entries without a U or D are assumed to be uphill.

Valid runway condition is “D” or “DRY” for dry or “W” or “WET” for wet.

Entry of “S” or “WET SK-R” displays “WET SK-R” and FMC computes V1 for a skid resistant runway.

Entry of a value after takeoff speeds are selected deletes V speeds and displays the scratchpad message TAKEOFF SPEEDS DELETED.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Menu Page

1 FMC

Push – Connects FMC to CDU.

2 Satellite Communication/Cabin Interphone (SAT/CAB INT)

See Chapter 5, Communications.

3 EFIS Control (EFIS CTL)

See Chapter 10, Flight Instruments, Displays.

4 EFIS

When prompt is displayed, selection displays the EFIS CONTROL page.

5 Display Select Panel Control (DSP CTL)

See Chapter 10, Flight Instruments, Displays

6 Display (DSP)

When prompt is displayed, selection displays the DISPLAY MODES page.

7 Memory

Accessible only on the ground. For maintenance use only.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The FMC takeoff phase starts with the selection of takeoff/go–around (TO/GA). Preparation for this phase starts in the preflight phase and includes entry of the TAKEOFF REF page data.

The takeoff phase changes to the climb phase when the FMC commands climb thrust. The climb phase continues to the top of climb point, where the cruise phase starts.

During takeoff and climb, the specific page listed below is used to:

- TAKEOFF REF page – make last minute changes to the departure runway
- DEPARTURES page – make last minute changes to the SID
- CLIMB page – modify climb parameters and monitor airplane climb performance
- RTE X LEGS page – modify the route and monitor route progress
- PROGRESS page – monitor the overall progress of the flight
- THRUST LIM page – select alternate climb thrust limits
- DEP/ARR INDEX page – select an approach during a turn–back

Takeoff

When changes are made to the departure runway and SID, the TAKEOFF REF and DEPARTURES pages must be modified to agree. The modified data are entered the same as during preflight.

With correct takeoff parameters, the FMC commands the selected takeoff thrust when the TO/GA switch is pushed. During the takeoff roll, the autothrottle commands the thrust and the FMC commands acceleration to between V2+15 and V2+25 knots, based on rate of rotation.

Usually, LNAV and VNAV are armed before takeoff. When armed before takeoff, LNAV activates at 50 feet radio altitude and commands roll to fly the active route leg. VNAV activates at 400 feet above runway elevation and commands pitch to fly the climb profile.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Climb

At acceleration height or altitude capture below acceleration height, VNAV commands acceleration to a speed 5 knots below the flap placard speed for the existing flap setting. When flaps are retracted, VNAV commands the speed displayed on the SPD TRANS line.

At the climb thrust reduction point, the FMC commands a reduction to the armed climb thrust. Passing the transition altitude displayed on the SPD TRANS line, VNAV commands an acceleration to economy climb speed, which is maintained until entering the cruise phase. Waypoint speed constraints take priority, provided they are greater than VREF+80 or the transition speed.

During the climb, VNAV complies with the LEGS page waypoint altitude and speed constraints. A temporary level–off for a crossing altitude restriction is accomplished at the commanded speed. The commanded speed is magenta.

When the climb speed profile causes an anticipated violation of a waypoint altitude constraint, the FMC displays the CDU scratchpad message UNABLE NEXT ALT. A different speed profile that gives a steeper climb angle must be manually selected.

Altitude Intervention

If an unplanned level-off is required, setting the altitude window to the required altitude causes the airplane to level at the set altitude. VNAV SPD changes to VNAV ALT. The climb can be continued by setting the altitude window to a higher altitude and pushing the altitude selector. If the altitude window is set to an altitude above other altitude constraints, each altitude constraint can be deleted by each push of the altitude selector. If cruise altitude is set in the altitude window, all waypoint altitude climb constraints to the T/C can be deleted by selection of the CLB DIR> prompt on the CLB page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Climb Page

The climb page is used to evaluate, monitor, and modify the climb path. The data on the climb page comes from preflight entries made on the route and performance pages, and from the airline policy file.

The climb page is the first of the three pages selected with the VNAV function key. When the FMC changes to the cruise mode, the climb page data is blanked.

FMC climb can be economy, fixed speed, or engine out.

1 Page Title

The page title displays active (ACT) or modified (MOD) climb. Usually, the title contains ECON for economy climb. Fixed speed and engine out modify the title.

- ACT ECON CLB – speed based on a cost index
- ACT MCP SPD CLB – MCP speed intervention selected
- ACT XXXKT CLB – fixed CAS climb speed selected
- ACT M.XXX CLB – fixed Mach climb speed selected
- ACT LIM SPD CLB – speed based on an envelope limiting speed

Fixed climb speeds are for:

- takeoff/climb acceleration segment constraints
- a flight crew selected speed (SEL SPD)
- a speed transition
- a speed constraint associated with an altitude
- waypoint speed constraints

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Cruise Altitude (CRZ ALT)

Displays cruise altitude entered on PERF INIT page. Displays in magenta when the altitude is the FMC target altitude.

Valid entries are: XXX, XXXX, XXXXX, or FLXXX. Altitude displays in feet or flight level depending on transition altitude.

The altitude can be changed by two methods:

- A new cruise altitude can be manually entered from the CDU. The modified cruise altitude displays in shaded white until executed.
- A new cruise altitude can be entered in the altitude window. Pushing the altitude selector changes the cruise altitude. When intermediate altitude constraints exist between the airplane altitude and the new MCP altitude, each push deletes the next altitude constraint.

3 Economy Speed (ECON SPD), Selected Speed (SEL SPD), or Engine-Out Speed (EO SPD)

The FMC commanded speed is magenta. Below CAS/Mach transition altitude, CAS is magenta and Mach is white. Above CAS/Mach transition altitude, Mach is magenta and CAS is white.

Valid entries are CAS or Mach.

ECON SPD displays in the line title when speed is based on the cost index. The FMC commands ECON SPD at altitudes higher than waypoint constraints, speed restrictions, or speed transition altitude.

SEL SPD displays in the line title when flight crew enters speed or a speed constraint exists.

EO SPD displays in the line title when ENG OUT selected.

4 Speed Transition (SPD TRANS)

The speed transition line displays the transition speed/altitude from one of these sources:

- the navigation database value for the origin airport
- the greater of the transition speed associated with the origin airport or VREF+80 knots (example 250/10000)

Displays in magenta when it is the FMC command speed.

Not displayed above transition.

Can be deleted.

5 Speed Restriction (SPD RESTR)

Speed restrictions for an altitude less than the cruise altitude are manually entered on this line.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Dashes before entry by flight crew.

Valid entry is a CAS and altitude (example 240/8000).

An entry creates a modification. Entry is shaded white until executed; magenta when it is FMC command speed.

6 Economy (ECON)

Push – changes climb speed to ECON. Must be executed.

Prompt displays when the climb speed is not ECON.

7 Waypoint Constraint (AT XXXXX)

Displays airspeed and/or altitude constraint at waypoint XXXXX.

Can also display HOLD AT XXXXX followed by a speed/altitude constraint.

FMC commands the slower of constraint speed or performance speed.

Constraints are entered on RTE LEGS page.

Delete here or on RTE LEGS page.

Blank if no constraint exists.

Magenta when it is FMC command speed or altitude.

8 ERROR at Waypoint

Displays altitude discrepancy and distance past waypoint where altitude will be reached.

Blank if no error exists.

9 Transition Altitude (TRANS ALT)

Transition altitude for origin airport contained in navigation database. FMC uses 18,000 feet if transition altitude is not available.

Manually change transition altitude here or on DESCENT FORECAST page.

Valid entries are XXX, XXXX, XXXXX, or FLXXX.

CDU altitude data change from altitudes to flight levels above the transition altitude.

10 Maximum Angle (MAX ANGLE)

Displays maximum angle of climb speed.

Entry not allowed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

11 Engine Out (ENG OUT)

Push (below speed transition or restriction altitude) –

- displays MOD EO CLB page
- deletes climb speed transition or restriction data

Push (below engine-out maximum altitude) – displays MOD EO CLB page.

Push (above engine-out maximum altitude) –

- displays MOD EO D/D page
- cruise altitude (1L) lowered to engine-out maximum altitude if that altitude is less than the active cruise altitude

Shaded white until the modification executed. Upon execution, thrust reference limit becomes CON in all cases above.

12 Climb Direct (CLB DIR)

Displays when climb altitude constraint exists between current altitude and FMC cruise altitude.

Push – deletes all waypoint altitude constraints between the airplane altitude and the MCP altitude or FMC cruise altitude, whichever is lower. FMC cruise altitude is not affected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

RTE X LEGS Page

1 Leg Direction

Leg segment data in line title:

- courses – magnetic (xxx°) or true (xxx° T)
- arcs – arc radius in miles, ARC, turn direction (example: 12 ARC L)
- heading leg segments – xxx° HDG
- track leg segments – xxx° TRK
- special procedural instructions from database - HOLD AT, PROC TURN, or PROC HOLD (FMC exits hold when crossing the fix after entry)

Calculated great circle route leg directions may be different than chart values.

Dashes display for an undefined course.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Waypoint Identifier

Active leg is always the first line of the first active RTE X LEGS page.

Active waypoint is on active leg and is magenta. Modified waypoints are shaded white until executed.

All route waypoints display in flight sequence. Waypoints on an airway are included on the route legs page.

Waypoints can be modified. Examples:

- add waypoints
- delete waypoints
- change waypoint sequence
- connect route discontinuities

Displays the waypoint by name or condition.

Boxes display for route discontinuities.

Dashes display after the end of the route.

3 Route 2 Legs (RTE 2 LEGS)

Push –

- displays the RTE 2 LEGS
- when RTE 2 LEGS page displayed, prompt changes to RTE 1 LEGS

4 Page Title

Title format displays route status:

- RTE X LEGS (cyan) – inactive route
- ACT RTE X LEGS (white) – active route
- MOD (shaded white) RTE X LEGS (white) – modified active route

5 Distance to Waypoint

Distance (decreasing) from airplane to active waypoint or from waypoint to waypoint. Blank for some leg types (e.g. HDG or VECTORS).

6 Waypoint Speed/Altitude Constraints

Waypoint speed or altitude constraints display in large font.

Manual entry allowed in climb or descent phase. Entered by FMC when constraints are part of a procedure.

Magenta when it is an FMC commanded speed/altitude. Airspeed constraint may be magenta in one line with magenta altitude in another line.

Speed constraint is assumed to be at or below the displayed speed.

Valid entries are:

- speed entry can be airspeed or Mach
- altitude entry can be thousands of feet or flight level (19000, FL190)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- XXX/XXXXX – airspeed/altitude entered simultaneously
- XXX, XXXX, XXXXX or /XXX, /XXXX, /XXXXX– altitude only
- enter FL 190 or 19,000 feet as 190 or 19000. Enter FL090 or 9,000 feet as 090 or 9000. Enter 900 feet as 009 or 0900. Enter 90 feet as 0090

Altitude constraint suffixes:

- blank – cross at altitude
- A – cross at or above altitude
- B – cross at or below altitude
- both – altitude block. If constraint is to cross between two altitudes when climbing, enter lower altitude followed by “A”; then, enter higher altitude followed by “B”. Example: 220A240B. Reverse the order for descent.
- S – planned step climb (refer to Chapter 11, Cruise)

7 Waypoint Speed/Altitude Predictions

Waypoint speed and altitude predictions display in small font.

Dashes display in predicted descent region prior to descent path calculation. Descent path calculation requires an altitude constraint below cruise altitude.

Manual entry allowed in climb or descent phase.

8 ACTIVATE, Route (RTE) DATA

RTE DATA displays when active or modified LEGS exist (not in PLAN mode).

ACTIVATE displays on an inactive LEGS page (not in PLAN mode).

Push –

- ACTIVATE – prepares inactive flight plan for activation; illuminates the EXEC key, and displays LEGS page 1/X with first waypoint of the route at the top. Other pages may be accessed and modifications performed before execution.
- RTE DATA – displays route data page

MAP CTR STEP prompt displays when the EFIS control panel ND mode selector is in PLAN position.

9 Center (<CTR>)

Displays when PLAN mode selected.

Displays adjacent to the waypoint around which ND PLAN mode is centered.

10 MAP Center (CTR) STEP

Replaces ACTIVATE or RTE DATA when PLAN mode selected.

Push - steps <CTR> to next waypoint. ND PLAN mode recenters.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Thrust Limit Page

Inflight thrust limits may be selected on this thrust limit page. When the FMC commands climb thrust; go-around, continuous, and cruise thrust limits replace takeoff thrust limits. The active thrust limit displays on the EICAS.

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

1 Go–Around (GA)

Push – selects go–around thrust limit.

2 Continuous (CON)

Push – selects maximum continuous thrust limit.

3 Cruise (CRZ)

Push – selects cruise thrust limit.

4 APPROACH

Push – displays APPROACH REF page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Out Climb

Engine out (EO) VNAV climb guidance is available on the EO CLB page. EO data with both engines operating can be displayed by selecting the ENG OUT prompt on the CLB page, without executing. Following an engine failure and selection of the ENG OUT prompt, execution displays the EO climb page.

EO CLB Page

The modified page displays engine out performance limitations. Manual entries are allowed. After execution, VNAV gives EO guidance in the climb and reference thrust limit changes to CON.

1 Page Title

Page title displays active (ACT) or modified (MOD) climb. Usually, the title contains ECON for economy climb.

Page titles include:

- ACT EO CLB - engine out selected with minimum drag climb speed
- ACT EO MCP CLB - MCP speed intervention selected
- ACT EO XXXKT CLB - fixed CAS climb speed selected
- ACT EO M.XXX CLB - fixed Mach climb speed selected

2 Cruise Altitude (CRZ ALT)

Displays cruise altitude if less than MAX ALT.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Displays EO MAX ALT if less than cruise altitude.

Manual entry is allowed.

3 Engine Out Speed (EO SPD)

Displays engine out climb speed.

Valid entry is xxx for CAS.

Valid entry is o.xxx for Mach. Trailing zeros can be omitted.

A manual entry may cause MAX ALT to change.

4 Maximum Altitude (MAX ALT)

Displays lower of maximum altitude at engine out climb speed or cruise speed.

Entry not allowed.

5 ALL ENG

Push – modifies page to display all engine (ALL ENG) performance data.

Engine Out Departure

1 Engine Out Standard Instrument Departure (EO SID)

Engine out SIDs can be created by the airline for specific runways.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The FMC puts the EO SID into the route as a modification if:

- an engine failure is sensed
- flaps extended
- and the navigation database has an EO SID for the departure runway

The modification can be executed or erased.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Air Turnback
Arrivals Page

During a turn–back situation, the flight crew requires quick access to the arrivals data for the origin airport. The arrivals page allows access without changing the destination on the route page.

During climb, less than 400 miles from the origin, and while nearer to the origin than the destination, push the DEP ARR function key to show the ARRIVALS page for the origin airport.

1 STARS

Displays STARS for origin airport.

2 Transitions (TRANS)

Displays transitions for origin airport.

3 APPROACHES

Displays approaches for origin airport.

4 RUNWAYS

Displays runways for origin airport.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The cruise phase starts at the top of climb.

During cruise, the primary FMC pages are:

- RTE X LEGS
- CRZ
- PROGRESS

The RTE LEGS pages are used to modify the route. The CRZ pages display VNAV related data. The PROGRESS pages display flight progress data. During cruise, the specific page listed below is used to:

- POS REF page – verify the FMC position
- RTE DATA page – display progress data for each waypoint on the RTE LEGS page
- WINDS page – enter forecast wind and temperature
- REF NAV DATA page – display data about waypoints, navaids, airports, or runways, and can be used to inhibit navaids
- RTE X page – use to select a route offset
- FIX INFO page – display data about waypoints. Page data can be transferred to other pages to create new waypoints and fixes.
- SELECT DESIRED WAYPOINT page – shows a list of duplicate waypoints from the navigation database. The flight crew selects the correct waypoint from the list
- POS REPORT page – display data for a position report

The CLB page changes to CRZ at the top of climb. The CRZ CLB and CRZ DES pages change to CRZ at the new cruise altitude. The CRZ page changes to DES at top of descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

LNAV Modifications

This section describes typical techniques to modify the route. The modifications include:

- add and delete waypoints
- change waypoints sequence
- remove discontinuities
- intercept a course

RTE LEGS Page Modifications

When modifications are made to a RTE LEGS page, several prompt or identifying features help the flight crew make the modifications, such as:

- ERASE
- INTC CRS TO
- INTC CRS FROM

Modified entries display in shaded white.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Add Waypoints

Waypoints can be added to the route at any point. Added waypoints are followed by route discontinuities.

First, enter the waypoint name in the scratchpad.

Second, locate the desired line in the flight plan and push the adjacent line select key. The scratchpad waypoint name is put into the selected line. The entered waypoint is connected to the waypoint above it via a direct route. A route discontinuity follows the waypoint.

For example, OED is typed into the scratchpad. Push line select key 2L to put OED into line 2. The FMC assumes BTG direct OED. RBL and the rest of the flight plan follow the route discontinuity.

1 Page Title

MOD (shaded white) – replaces ACT when modification in progress.

ACT (white) – replaces MOD when ERASE selected or execute key pushed.

2 Modified Waypoint

Waypoint name is shaded white until executed.

OED waypoint entered into the route after BTG. Modification creates a route discontinuity because OED was not in active route. The FMC now requires routing beyond OED.

3 Discontinuity Waypoint

Discontinuity is removed when applicable waypoint is entered in boxes.

4 ERASE

Push – removes all modifications and shows active data.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Displays when the FMC contains modified data.

Removed when selected or modifications executed.

5 ROUTE DISCONTINUITY

Line title separates route segments when there is a discontinuity.

Note: Performance predictions to destination on the PROGRESS page are calculated assuming the route of flight is direct between waypoints on either side of a route discontinuity.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Delete Waypoints

Use the RTE LEGS page to remove waypoints from the route. The active waypoint can not be deleted. Two methods to remove a waypoint are:

- delete the waypoint with the DELETE function key
- change the waypoint's sequence

The data in the route before and after the deleted waypoint does not change. A discontinuity is put in the route when the DELETE function key is used to remove a waypoint.

1 Active Route

The active route shows RBL followed by OAK and AVE.

2 DELETE Entry

Pushing the DEL function key arms the delete function and selects DELETE to the scratchpad.

3 Route Discontinuity

With DELETE in the scratchpad, pushing the line select key for RBL deletes the waypoint. Boxes replace RBL and a route discontinuity displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Change Waypoint Sequence

Waypoints moved from one position in the flight plan to another do not cause route discontinuities.

The waypoint may be typed in the scratchpad or copied from the flight plan. To copy a waypoint from the flight plan, find the applicable waypoint on one of the RTE LEGS pages. Push the line select key adjacent to the waypoint.

The example below shows the flight plan being modified to fly from BTG direct OAK. Push the line select key adjacent to OAK to put OAK in the scratchpad. Push the line select key adjacent to RBL. RBL is removed from the flight plan and the routing is direct from BTG to OAK to AVE. The modification does not cause a route discontinuity. Several waypoints can be removed from the flight plan at a time with this method.

1 Active Route

The active route shows RBL followed by OAK and AVE. The clearance is to fly from BTG direct OAK. The OAK waypoint is selected to the scratchpad.

2 Change OAK's Sequence

OAK is selected to the waypoint after BTG. RBL is removed with no discontinuity.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Remove Discontinuities

A discontinuity exists when two waypoints are not connected by a route segment. Connect a route segment after the discontinuity to the route segment before the discontinuity to remove the discontinuity.

Copy the subsequent waypoint from the route into the scratchpad and enter it into the discontinuity, just as when adding a waypoint.

1 Route Discontinuity

The active route has a discontinuity after BTG. The example shows how to fly direct from BTG to OAK. Copy OAK to the scratchpad. Any subsequent waypoint in the route can be selected to the scratchpad to remove the discontinuity.

2 Continuous Route

Select OAK to the boxes to remove the discontinuity.

Entering a waypoint in the boxes which does not already exist on the route moves the discontinuity one waypoint further down the route.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Direct To And Intercept Course To

If the airplane passes the last active route waypoint (or offset) or the last waypoint prior to a route discontinuity, LNAV maintains the current heading and the scratchpad message END OF ROUTE displays. If LNAV is not active, activation can be accomplished in the following three ways:

- When the airplane is within 2.5 miles of the active leg and on an intercept heading to the active leg, pushing the LNAV switch activates LNAV. The airplane turns to intercept the active leg. If the intercept angle is large, the airplane may overshoot the active leg.
- When more than 2.5 miles from the active leg, pushing the LNAV switch when the airplane is on an intercept heading to the active leg arms LNAV. Activation occurs as necessary to intercept the active leg with no overshoot. The intercept heading must intersect the active leg inbound before the active waypoint.
- Fly direct to a waypoint or intercept a course to a waypoint. Enter a waypoint in the RTE LEGS page active waypoint line to fly direct. Use the INTC CRS TO prompt in line 6R to create an intercept course to the waypoint. Pushing the LNAV switch arms or activates LNAV, depending on the distance to the active leg.

The example below depicts the airplane being off course to the right, followed by a modification to fly direct to BTG.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Leg Direction

Direct course from airplane present position to entered waypoint.

Execute to proceed direct to active waypoint.

2 Abeam Points (ABEAM PTS)

Push –

- creates place bearing distance waypoint on the Direct To leg abeam the bypassed waypoint if the bypassed waypoint was a database airport, navaid, NDB, or waypoint
- creates latitude/longitude waypoint on the Direct To leg abeam the bypassed waypoint if the bypassed waypoint was a latitude/longitude waypoint
- creates a new place bearing distance waypoint based on the original “place” on the Direct To leg abeam the bypassed waypoint if the bypassed waypoint was a place bearing distance waypoint
- creates a new latitude/longitude reporting point on the Direct To leg based on the entered latitude or longitude reporting point
- line title displays ABEAM PTS and line data displays SELECTED
- altitude/speed constraints for bypassed waypoints are removed

ABEAM PTS prompt displays whenever the active waypoint name is modified, usually for direct–to routing.

Abeam waypoints created from designated position reporting waypoints become position reporting waypoints.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Route Copy (RTE COPY)

Push –

- copies the active route into the inactive route
- erases previous inactive route
- line title displays RTE COPY and line data displays COMPLETE
- subsequent route modifications remove RTE COPY prompt

4 Intercept Course TO (INTC CRS TO) – Select

Displays whenever the active waypoint name is modified.

Displays boxes if entered waypoint not in the active route.

Displays current route course and prompt caret if entered waypoint in the active route.

When boxes displayed, valid entry is intercept course from 000° through 360°. May be changed until executed. Entered or selected value displays in large font.

Push –

- when current route course (165°) displayed, selects it as intercept course to active waypoint
- displays entry or current route course as course to active waypoint
- removes ABEAM PTS and RTE COPY prompts

5 Intercept Course

After pushing INTC CRS TO and prior to execution, displays direct–to inbound course at the waypoint; changed by entry in intercept course to (INTC CRS TO) line or by selecting intercept course to. After execution, displays current required track to fly inbound course to the waypoint.

6 Intercept Course TO (INTC CRS TO)

To change intercept course:

- enter the inbound intercept course (150°) in the scratchpad
- select the INTC CRS TO line to change the leg direction; intercept course to BTG of 150° is entered in the INTC CRS TO line and above the active waypoint

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intercept Course From

The steps to create an intercept course from a waypoint are like the steps for an intercept course to. The waypoint name in the scratchpad is suffixed with the outbound course.

An intercept course can be created outbound from a waypoint in the navigation data base or from present position. The waypoint does not have to be in the route. Entering a waypoint and course pair in the active waypoint line displays the INTC CRS FROM prompt. The FMC calculates a route leg with the waypoint as the origin of the entered course.

The example shows a 090° course from BTG, entered as BTG090. When this course intercept is line selected to the active waypoint line, the course (090°) displays in the leg direction and the waypoint displays as a conditional waypoint consisting of a course intercept (090°).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Waypoint and Outbound Course

Enter the waypoint name and outbound course in the scratchpad.

2 Present Position and Outbound Course

Enter P/P and outbound course in the scratchpad.

3 Active Outbound Course Entry

After the active waypoint line is selected, the outbound course displays. The waypoint name is not used.

For example, BTG090 is entered into the active waypoint line. The FMC calculates a new route leg with BTG as the origin on a outbound course of 090°.

4 Intercept Course From (INTC CRS FROM)

Displays outbound course from entered waypoint.

Shows the active waypoint name is modified with P/P or waypoint outbound entry.

Valid input is any course from 000° through 360°. May be changed until executed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Select Desired Waypoint Page

The SELECT DESIRED WPT page displays after a waypoint entry when the FMC encounters more than one location for the same waypoint name. Selection of a waypoint returns the display to the previous page.

1 Identifier

Displays the identifier for the duplicate named waypoints. Select the correct waypoint by pushing the applicable left or right line select key.

2 Waypoint Lines

Display a sorted list of waypoints with identifier, navaid type, frequency, and coordinates;

- when page is accessed as a result of a flight plan modification, sort is based on proximity to the waypoint preceding the entered waypoint
- when page is accessed as a result of a DIR/INTC or REF NAV DATA entry, sort is based on proximity to current aircraft position

Push - selects waypoint location for use; returns display to page previously in use.

Pushing any CDU function key exits page without selecting a waypoint.

3 Frequency

Displays frequency of the navaid.

Blank if the waypoint is not a navaid.

4 Type

Displays the type of navaid for each duplicate name.

Blank if the waypoint is not a navaid.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 Latitude/Longitude

Displays the latitude/longitude for each duplicate name.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Airway Intercept

LNAV can be used to intercept an airway. An airway intercept changes the active waypoint on the RTE and LEGS pages.

Example

The active route is direct EPH, then direct MWH. ATC clears the airplane to:

- turn right heading 110°
- intercept V2 to MWH

1 Active RTE 1 Page

The route page before the ATC clearance.

2 Enter Airway

Enter the airway in the first VIA position on the RTE page. Boxes display in the TO position. A route discontinuity follows on the next line.

3 Airway Exit

Enter desired airway exit point (MWH) in the boxes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Start Airway Waypoint

After entering MWH in the boxes, the FMC selects the waypoint preceding the closest abeam location as the starting waypoint of the new airway. This waypoint displays under TO on line 1R. The entered airway and the selected exit point display on line 2. Executing the modification makes the FMC selected first waypoint the active waypoint; BANDR in this example. If the clearance heading intercepts the new route before the next downtrack waypoint (BEEZR), LNAV can be armed and will capture the new route. The active waypoint will sequence to next downtrack waypoint (BEEZR). Since the clearance heading will not intercept V2 prior to the next downtrack waypoint (BEEZR), use the intercept course procedure to make the inbound course to the next waypoint after the V2 crossing point the active leg segment.

The LEGS page displays this waypoint sequence:

- BANDR - the active waypoint
- BEEZR
- ELN
- PLUSS
- MWH - the V2 exit waypoint

The intercept heading crosses the V2 between ELN and PLUSS. Modify the LEGS page using a course intercept to the waypoint after the airway crossing, PLUSS, making PLUSS the active waypoint on the V2 airway. If the clearance heading does not intercept the new active leg segment, the NOT ON INTERCEPT HEADING scratchpad message displays.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 New Active Waypoint

On the LEGS page, move PLUSS to the scratchpad, then to 1L. The INTC CRS TO displays boxes. Enter the V2 inbound course to PLUSS.

Following the course intercept to PLUSS modification and execution, the LEGS page displays PLUSS as the active waypoint. LNAV can be armed and the airway intercept can be completed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Route Offset

The OFFSET function is available when the airplane is in flight and not on a SID, Standard Terminal Arrival Route (STAR), or transition. The offset route displays as a white dashed line on the ND until executed or erased. An executed offset route displays as a dashed magenta line and extends along the route to a STAR, approach or approach transition, discontinuity, end of route, track change greater than 135 degrees, or holding pattern. The original route displays as a solid magenta line. When executing the offset modification with LNAV active, the airplane turns to capture the offset course.

When on the route offset, active route waypoints sequence normally. However, during transition to or from an offset route greater than 21 nm, the crosstrack limit is extended to 200 nm.

1 OFFSET

Valid entry is L (left) or R (right) XX (XX is any number from 0 to 99). When executed, the CDU OFST light illuminates.

Offset removed by deleting, entering zero, or proceeding direct to a waypoint.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cruise Page
All Engine Cruise

The cruise page is used to monitor and change cruise altitude and speed. Speed changes can be manually selected or automatically selected with the selection of other VNAV modes. Cruise climbs, cruise descents, and step climbs can be accomplished from the cruise page.

When using VNAV in economy mode, page data is based on operating at ECON SPD. Economy cruise speed is based on cost index. When the flight crew enters a selected speed, page data changes. When the FMC is in the engine out mode, the data reflects airplane capabilities with one engine inoperative. The long range cruise (LRC) mode calculates speeds to maximize airplane range.

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

1 Page Title

The page title displays active (ACT) or modified (MOD) cruise. Usually, the title contains ECON for economy cruise. Selected speeds, engine out, and long range cruise modify the title.

Page titles include:

- ACT ECON CRZ – speed based on cost index
- ACT ECON CRZ CLB or CRZ DES – cruise climb or descent with ECON speed
- ACT LRC CRZ – long range cruise speed selected
- ACT LRC CRZ CLB or DES - cruise climb or descent with LRC selected
- ACT MCP SPD CRZ – MCP speed intervention selected
- ACT XXXKT CRZ – fixed CAS cruise speed selected
- ACT M.XXX CRZ – fixed Mach cruise speed selected
- ACT LIM SPD CRZ – speed based on an envelope limiting speed
- ACT RTA CRZ - RTA cruise selected
- ACT RTA CRZ CLB - cruise climb with RTA selected

2 Cruise Altitude (CRZ ALT)

Displays cruise altitude entered on PERF INIT page.

Valid entries are: XXX, XXXX, XXXXX, OR FLXXX. Altitude displays in feet or flight level depending on the transition altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Modified values display in shaded white.

A new entry changes the page title to CRZ CLB or CRZ DES when climb or descent initiated.

Changing the MCP altitude and pushing the altitude selector enters the MCP altitude as the active cruise altitude, without creating a modification.

3 Economy Speed (ECON SPD), Selected Speed (SEL SPD), Long Range Cruise Speed (LRC SPD), or Engine-Out Speed (EO SPD)

Displays target speed or Mach in magenta.

Valid entries are CAS or Mach.

MOD displays in the page title in shaded white until the modification is erased or executed.

ECON SPD displays in line title when speed based on the cost index.

SEL SPD displays in line title when flight crew enters speed.

LRC SPD displays in line title when LRC selected.

EO SPD displays in line title when ENG OUT selected.

CO SPD displays in line title with a company defined engine-out Mach/CAS cruise speed schedule selected.

HL7532 - HL7766

4 EPR

Displays EPR to maintain level flight at the target airspeed.

HL7202 - HL7205, HL7782 - HL8347

4 N1

Displays N1 to maintain level flight at the target airspeed.

5 Economy Speed (ECON), Company Speed (CO SPD), or Required Time Of Arrival RTA/Economy (RTA/ECON)

ECON

Push – selects VNAV economy speed. Displays when economy is not the cruise speed target.

CO SPD

Push – selects a Mach/CAS schedule defined in the AMI. Displays when engine-out has been selected and the company policy engine-out speed is not the current cruise speed target.

RTA/ECON

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Push – selects RTA speed. Displays when an RTA waypoint is in the flight plan and RTA is not the cruise speed target.

6 Required Time Of Arrival (RTA) PROGRESS or Engine-Out Speed (EO SPD)

RTA PROGRESS

Push – displays RTA PROGRESS 3/4.

EO SPD

Push – changes cruise speed to engine-out minimum drag speed.

7 XXXX (Destination) ETA/FUEL, ETA/FUEL W/MOD

Displays estimated time of arrival and calculated fuel remaining at the destination.

Line Title displays "ETA/FUEL W/MOD" when a modified route is displayed.

Displays the same data for the alternate airport when a DIVERT NOW modification is selected from the ALTN page.

Calculations are based on optimum step climbs and cruise altitudes.

8 Engine Out (ENG OUT)

Push –

- displays MOD XXX CRZ page title; XXX is the active all engine CRZ speed mode before ENG OUT is selected
- changes command speed line title to EO SPD
- below engine-out maximum altitude: upon execution, thrust reference limit changes to CON and page title becomes ACT EO CRZ
- above engine-out maximum altitude: sets CRZ ALT to engine-out maximum altitude; and upon execution, thrust reference limit becomes CON and page title becomes ACT EO D/D

9 Long Range Cruise (LRC)

Push – changes cruise speed mode to LRC or EO LRC.

Engine Out Cruise

Engine out (EO) VNAV cruise guidance displays on the EO CRZ page. EO data with both engines operating can be displayed by selecting the ENG OUT prompt on the CRZ page, without executing. Following an engine failure and selection of the ENG OUT prompt, execution displays the appropriate EO CRZ page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The modified page displays engine out performance information. When above the maximum engine out cruise altitude, VNAV calculates engine out guidance for drift down (D/D). This graphic is shown under Cruise (Above EO Max Alt), 11.31. The EO D/D page changes to the EO CRZ page when reaching the engine-out cruise altitude (shown below). LRC speed may be selected at 6R.

Subsequent engine-out cruise climb or descent is accomplished the same as two engine cruise climb or descent.

As the airplane gross weight decreases, maximum altitude increases. A step climb may be possible under these conditions.

The example is based on a cruise altitude above the maximum engine-out altitude. When ENG OUT is selected, the default target speed is EO SPD.

1 Page Title

The page title displays active (ACT) or modified (MOD) cruise.

- ACT EO CRZ – engine out selected with minimum drag cruise speed
- ACT EO MCP SPD – MCP speed intervention selected
- ACT EO XXXKT CRZ – fixed CAS cruise speed selected
- ACT EO M.XXX CRZ – fixed Mach cruise speed selected
- ACT EO D/D - engine out driftdown with EO speed
- ACT LRC D/D - engine out driftdown with LRC speed selected

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- ACT EO LRC CRZ - engine out cruise with LRC speed
- ACT EO CRZ CLB/DES – cruise climb or descent with EO SPD selected

Page titles include:

2 Cruise Altitude (CRZ ALT)

Displays altitude from MAX ALT line when current CRZ ALT above MAX ALT.

Manual entry of an altitude above maximum engine-out altitude results in the scratchpad message, “MAX ALT FLXXX”.

Valid entries are the same as all engine cruise page.l

3 Engine Out Speed (EO SPD)

Displays the target speed or Mach in magenta.

Manual entry is allowed.

Valid entries are the same as all engine cruise page.

A manually entered speed changes the line title to SEL SPD.

Selecting any speed shows engine out speed (EO SPD) as a select prompt at 6L.

Manual entries may change MAX altitude.

4 Company Speed (CO SPD)

Push – Modifies the page with company speed, engine out data from the airline policy page.

5 Engine Out (EO SPD)

Push – enables execution of engine out minimum drag speed profile.

6 Optimum, Maximum and Recommended Altitude (OPT, MAX, RECMD)

OPT – calculation of OPT altitude is based on gross weight, cost index, cruise speed schedule, and cruise cg. Wind and temperature deviations from standard day are not used in the calculation. The optimum altitude is not calculated during an RTA cruise segment.

MAX – displays the maximum cruise altitude based on:

- current gross weight minus calculated fuel burn to climb to MAX altitude
- temperature
- engine out operation
- cruise reference thrust limit default set by airline (CRZ or CLB)
- speed (ECON, LRC, SEL, EO, or CO)

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- residual rate of climb default set by airline (range: 100 to 999 feet per minute)
- disregards altitude or speed constraints
- cruise CG

RECMD - displays the most economical altitude 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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

VNAV Modifications

During the cruise phase, VNAV can calculate two types of climbs: cruise and step climbs. Cruise and planned climbs can be entered by the flight crew. Optimum step climbs are calculated by the FMC. In all cases, the new climb altitude must be selected in the MCP altitude window before VNAV commands the climb.

Cruise Climb

Setting an altitude above the current cruise altitude in the MCP altitude window and pushing the altitude selector causes the cruise altitude to be set to the MCP altitude and the airplane to climb to the new cruise altitude. The reference thrust limit is CLB and the pitch flight mode annunciation is VNAV SPD.

Another method to accomplish a cruise climb: set a higher MCP altitude, enter the altitude in the CRZ ALT line, and execute.

1 During Cruise Climb

VNAV page title displays CRZ CLB in a climb to cruise altitude.

2 End of Cruise Climb

VNAV page title displays ECON CRZ after level off at cruise altitude.

Planned Step Climb

When a step climb is planned to start at a waypoint, the data can be entered on the RTE LEGS page. The FMC performance predictions assume the airplane will start the climb at the identified waypoint.

The FMC displays the distance and ETA to the step point on the PROGRESS page. The corresponding altitude profile point and identifier is shown on the ND.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7598
If a climb is not initiated within 5 minutes after passing a planned step climb point, the EICAS message VNAV STEP CLIMB displays.

HL7202 - HL7205, HL7733 - HL8347
If a climb is not initiated within 5 minutes after passing a planned step climb point and the difference between the CRZ ALT shown in 1L and the STEP TO altitude shown in 1R of the CRZ page is greater than 3,500 feet, the EICAS advisory message VNAV STEP CLIMB displays.

1 Step Climb Altitude

Enter the cruise altitude as an altitude constraint and the letter S. The FMC assumes the step climb starts at the waypoint. Accomplish the step climb at the waypoint with the steps described in cruise climb.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Calculated Step Climb

With a non-zero value entered on the STEP SIZE line on the PERF INIT or CRZ page, the FMC calculates step climb points that minimize trip cost. For all speed modes, the step climb points are a function of the lateral flight plan, the entered COST INDEX (for ECON and RTA speed modes only), entered forecast winds and temperatures, CRZ ALT, gross weight, and STEP SIZE. Multiple step climbs are possible based on performance and route length. The calculated STEP TO altitude is less than or equal to the maximum altitude at the step point.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7598
If a climb is not initiated within 5 minutes after passing a calculated step climb point, the EICAS advisory message VNAV STEP CLIMB displays.

HL7202 - HL7205, HL7733 - HL8347
If a climb is not initiated within 5 minutes after passing a planned step climb point and the difference between the CRZ ALT shown in 1L and the STEP TO altitude shown in 1R of the CRZ page is greater than 3,500 feet, the EICAS message VNAV STEP CLIMB displays.

HL7532 - HL7766

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

1 TO STEP CLIMB

When the cruise climb start point is the next VNAV event, the line title changes to TO STEP CLIMB.

Displays the ETA and DTG to the point where the step climb starts.

If the airplane passes the step climb point and has not started to climb, the ETA and DTG are replaced with the word NOW.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When the FMC calculates a step climb is not advised, the ETA and DTG are replaced with the word NONE.

2 STEP TO

STEP TO displays when all the following are true:

- an active route exists and no pending activation or flight plan modification exists
- the airplane is more than 200 nm from the T/D for calculated or planned steps
- the airplane is more than 500 nm from the destination airport for calculated steps
- an engine out drift down is not active
- step size is not zero or a planned step exists when the step size is zero

The FMC calculates performance based on accomplishing step climbs at calculated step climb points throughout the flight plan.

An altitude can be entered to evaluate a step climb. The FMC calculates the step climb location using entered forecast winds and temperatures and displays data on this page and on the PROGRESS page 1, 4R.

Valid entries are FLXXX (or XXX flight level) or XXXXX (feet).

Entry of zero for step size causes the FMC to calculate performance data at the entered CRZ ALT with no step climbs.

Preflight entry of a non–zero increment, ICAO, or RVSM step size causes the FMC to calculate STEP TO altitudes correct for the direction of flight based on the entered CRZ ALT. Inflight changes to CRZ ALT affect calculation of STEP TO altitudes when using ICAO or RVSM step size.

Displays STEP TO altitude based on entering "S" (following altitude) on a waypoint on the LEGS page. The altitude displayed in 1R can be overwritten with a manual entry above or below CRZ ALT.

When using a non-zero step size, the STEP TO altitude is the next higher altitude, calculated by adding the step size increment to the current CRZ ALT. If step climbs have not been accomplished as calculated, multiple step increments may be used.

Entering an altitude above maximum altitude displays the scratchpad message MAX ALT FLXXX.

Blank when:

- there is no active flight plan, or
- within 200 NM of the T/D, or

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- within 500 NM of the destination airport with no planned steps in the flight plan, or
- engine out drift down is active

3 TO FLXXX, AVAIL AT, AT XXXXXXX, AT, TO T/D, NONE

AT:

Displays when there is an altitude in 1R not derived from a specified climb point. Displays the ETA and DTG to the optimum climb point.

AT XXXXXXX:

Displays the LEGS page step climb waypoint when the FMC calculates the step climb can occur within 5 nm of the associated step climb waypoint. The data line displays ETA and DTG to the climb point. Displays NOW when passing the step climb point.

AVAIL AT:

Displays when a STEP TO the next step altitude entered on a LEGS page waypoint can not occur within 5 nm of the planned step point. The data line displays the ETA and DTG to the climb point. Displays NOW when passing the step climb point. Displays NONE when the planned step climb cannot be accomplished.

TO FLXXX:

Displays when the airplane is more than 200 nm from the T/D or more than 500 nm from the destination airport and engine out drift down is active. The data line displays the ETA and DTG to the climb point to the TO FLXXX altitude.

TO T/D:

Displays when the airplane is within 200 nm of the T/D or within 500 nm of the destination airport with no planned step climbs in the flight plan. The data line displays ETA and DTG to the T/D point.

NONE:

Displays when planned step climb cannot be accomplished.

4 Optimum, Maximum, and Recommended Altitude (OPT, MAX, RECMD)

Blank when RTA is active.

OPT – calculation of OPT altitude is based on gross weight, cost index, cruise speed schedule, and cruise cg. Wind and temperature deviations from standard day are not used in the calculation. The optimum altitude is not calculated during an RTA cruise segment.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

MAX – displays maximum altitude based on:

- current gross weight minus calculated fuel burn to climb to MAX altitude
- temperature
- number of engines operating
- cruise reference thrust limit default set by airline (CRZ or CLB)
- speed (ECON, LRC, SEL, or CO)
- residual rate of climb default set by airline (range: 100 to 999 feet per minute)
- disregards altitude or speed constraints
- cruise CG

RECMD – displays the most economical altitude to fly for the next 250 - 500 nm based on gross weight, cruise speed schedule, and entered forecast winds and temperatures at cruise altitudes. The FMC evaluates altitudes between 9,000 feet below the current CRZ ALT and up to MAX altitude. Recommended altitudes are consistent with the specified step size and step climb schedule. If the step size is zero, the recommended cruise level is calculated assuming a 2,000 feet step size. The recommended altitude is set to the CRZ ALT when within 200 nm of the T/D or within 500 nm of the destination airport. The recommended altitude is not calculated during an RTA cruise segment.

5 STEP SIZE

Used for calculation of optimum step point and step climb predictions.

Displays default step climb size: RVSM, ICAO, or 0 as selected in AMI.

Valid entries are:

- "0" to inhibit predicted step climbs, or
- altitudes from 1000 to 9900 in 100 foot increments, or
- "I" for ICAO, or
- "R" for RVSM

Deletion of a manual entry returns step size to the default value.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Constant Speed Cruise

A speed for a cruise segment can be specified. A cruise segment has a start waypoint and an end waypoint. The airplane maintains a constant speed between the two waypoints. The waypoints must be in the cruise phase. The FMC controls the speed after the end waypoint or top of descent.

Modification must be executed.

1 Start Waypoint for Constant Speed Cruise

The constant speed cruise starts at BTG at .800 Mach. Entry is in Mach.

2 End Waypoint for Constant Speed Cruise

The constant speed cruise ends at OAK then ECON speed is used. If an RTA waypoint exists at RBL or OAK, the RTA is deleted.

Entry can be a Mach number, ECON/ or E/, LRC/ or L/. If an RTA waypoint is in the flight plan, RTA/ or R/ may be entered.

If no end waypoint is specified, the constant speed terminates at top of descent.

The FMC may select the end waypoint if an RTA waypoint is entered. The FMC selects the end waypoint to allow enough distance to arrive at the RTA waypoint on time. In the example, if the FMC selected OAK as the end waypoint, RTA would replace ECON. See RTA PROGRESS page 3/4.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Cruise Descent

Setting an altitude below the current altitude in the MCP altitude window and pushing the altitude selector (more than 50 nm from a T/D) causes the cruise altitude to be set to the MCP altitude and the airplane to descend to the new altitude. The CRZ page displays ACT ECON CRZ DES. If the altitude set in the altitude window is below the speed transition (SPD TRANS) or restriction (SPD RESTR) altitude displayed on the DES page, those altitudes and speeds are deleted. Transition or speed restrictions must be maintained by flight crew action. The autothrottle sets a calculated thrust value for an approximate 1250 feet per minute descent. Pitch changes maintain the commanded cruise speed. Thrust levers can be manually positioned to adjust the descent rate.

1 During Cruise Descent

VNAV page title displays cruise phase in a descent to a new cruise altitude.

2 End of Cruise Descent

VNAV page title displays cruise phase after level off at new cruise altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Early Descent

An early descent is a descent started prior to the T/D. The VNAV descent page becomes active.

During cruise, setting an altitude below the current altitude in the MCP altitude window and pushing the altitude selector activates the DES NOW function when the airplane is within 50 nm of the T/D or if the MCP altitude is set below the highest descent altitude constraint in the VNAV descent profile.

The autothrottle sets thrust to maintain the target descent rate; then annunciates HOLD. Pitch maintains the commanded speed. Thrust levers can be manually positioned to adjust the descent rate.

Another method to accomplish an early descent: set a lower MCP altitude, page forward to the VNAV DES page and line select DES NOW, and execute.

1 Descend Now (DES NOW)

The DES NOW prompt is shown on the descent page when the cruise phase is active. Selecting the DES NOW prompt and executing initiates a VNAV SPD descent of approximately 1250 feet per minute at ECON speed.

Upon reaching the planned descent path, VNAV commands pitch to capture the path and to maintain ECON speed, and sets IDLE thrust.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Navigation Data
Reference Navigation Data Page

The reference navigation data page displays data about waypoints, navaids, airports, and runways. Use this page to inhibit FMC position updates from radio navaids. The navaids are always available for manual tune, autotune and the ND.

1 Identification (IDENT)

Valid entries are any waypoint, navaid, airport, or destination runway from the navigation database. Pilot defined waypoints such as latitude/longitude are also valid entries when in the active route.

Entry changes to dashes when page is exited and then reselected.

2 LATITUDE

Displays latitude of entered identifier.

3 Magnetic Variation (MAG VAR), LENGTH

MAG VAR - displays magnetic variation when entered identifier is a navaid.

LENGTH - displays runway length when entered identifier is a runway.

4 NAVAID INHIBIT

Valid entries are: VOR, VOR/DME, VORTAC, or DME identifiers from the navigation database.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Entries not allowed when RAD NAV INHIBIT displays ON in large font, green letters.

Inhibits use of entered navaids for updating by both FMCs.

Entries clear at flight completion. "ALL" displays.

Deleting or overwriting removes a previous inhibit navaid.

5 VOR ONLY INHIBIT

Valid entries are VOR identifiers from the navigation database.

Entries not allowed when RAD NAV INHIBIT displays ON or VOR in large font, green letters.

Inhibits use of only VOR portion of entered navaid for updating by both FMCs. DME–DME position updating is not inhibited.

Entries clear at flight completion. "ALL" displays.

Deleting or overwriting removes a previous inhibit VOR.

6 INDEX

Push – displays the INIT/REF INDEX page.

7 Frequency (FREQ)

Displays frequency of entered identifier when it is a navaid.

8 LONGITUDE

Displays longitude of entered identifier.

9 ELEVATION

Displays elevation of entered identifier when it is a navaid, airport, or runway.

10 RAD NAV INHIBIT

The default state of RAD NAV INHIBIT is ON; all radio updating (DME/DME, VOR/DME, LOC) is inhibited. "ALL" displays in NAVAID INHIBIT and VOR ONLY INHIBIT left and right lines. Entries are not allowed.

Push – alternately selects RAD NAV INHIBIT: OFF, VOR, or ON.

OFF - all radio updating available to the FMC. OFF displays in large font, green letters. VOR and ON display in small font, white letters.

VOR - all VOR/DME updating inhibited. DME/DME updating is operable. VOR displays in large font, green letters. OFF and ON display in small font, white letters.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ON - all radio updating inhibited. ON displays in large font, green letters. OFF and VOR display in small font, white letters.

Note: When GPS is operable, radio updating is available, but is not used by the FMC for position updating.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Fix Information Page

Four identical FIX INFORMATION pages are used to create waypoint fixes and waypoints for the ND. Some of the created waypoints can be copied into the route. The page can be cleared by selecting the ERASE FIX prompt or by using the DEL key.

Magnetic/True Bearing

Magnetic or true fix bearings depend on airplane location. Refer to FMC Polar Operations, Flight Management Navigation, section 31.

1 FIX

Valid entries are airports, navaids, place bearing distance, place bearing/place bearing, along track, latitude/longitude, and waypoints from the navigation database. The selected fix displays on the ND and is highlighted by a green circle.

2 Bearing/Distance (BRG/DIS), ETA, DTG, ALT

Valid entries are XXX/YYYY:

- leading zeros can be omitted for distance entries
- distance (up to 9999 nm) only entries must start with a slash (/)

Distances from the fix display on the ND as a circle around the fix.

When the circle intersects the active route, the ETA, DTG, and predicted altitude at the closest intersection display.

Bearings from the fix display on the ND as radial lines from the fix.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When the bearing intersects the active route, the ETA, DTG, and predicted altitude at the closest intersection display.

ETA – displays the estimated time of arrival to the intersection point.

DTG – displays the distance to go to the intersection point.

ALT – displays the predicted altitude at the intersection point.

Push - copies the fix place/bearing/distance into the scratchpad. This fix can be placed in the route on a LEGS or RTE page as a waypoint.

3 Bearing/Distance (BRG/DIS) – Dashes

When entering a bearing or distance from the fix, a bearing or distance circle from the fix displays on the ND. ETA, DTG, and predicted altitude also display.

When entering a bearing and distance from the fix, a bearing and distance circle from the fix display on the ND. ETA, DTG, and predicted altitude do not display. Line selection to the scratchpad and entry into the flight plan results in the creation of a waypoint.

4 ABEAM

Displays ABEAM prompt.

Note: The ABEAM prompt is only available when entering a FIX that is contained in the navigation data base (NDB). When entering a FIX in coordinates form, the ABEAM prompt will not be available.

Push - displays bearing and distance from the fix perpendicular to the nearest segment of the flight plan path, and ETA, DTG, and altitude at the intersection point.

Second push - copies the fix place/bearing/distance into the scratchpad. This fix can be placed in the route on a LEGS or RTE page as a waypoint.

5 ERASE FIX

Push – removes all fix data from the page and the ND.

6 Route Intersection Point Copied

Pushing the line select key for one of the BRG/DIS entries copies the fix place/bearing/distance definition into the scratchpad. This fix can be placed into the route on a LEGS page as a waypoint.

7 Bearing/Distance From (BRG/DIS FR)

Displays the bearing and distance of the airplane from the fix.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

8 Predicted Distance to ETA or Altitude (PRED ETA-ALT)

Valid entry is altitude, flight level, or time. Time entry must be followed by “Z”.

Entering an altitude or flight level displays the predicted along track distance and altitude or flight level on this line. The predicted airplane position displays on the ND route line as a green circle with the entered altitude/flight level.

Entering a time displays the predicted along track distance and the time. The predicted airplane position displays on the ND route line as a green circle with the entered ETA.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Route and Waypoint Data
Route Data Page

The route data page displays data for each waypoint on the ACT RTE X LEGS page. This page also allows access to the WIND page. This page is available only for the active route.

The ETA and calculated fuel remaining at the waypoint display for each waypoint. Manual entry is not possible.

1 ETA

Displays ETA for waypoint.

2 Waypoint (WPT)

Displays identifier for waypoint.

3 LEGS

Push –displays RTE LEGS page.

4 WIND (W>/>)

W> - indicates waypoint winds have been entered.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

> - winds not entered.

Push – selects WIND page for the selected waypoint.

5 FUEL

Displays the FMC calculated fuel remaining at the waypoint.

Note: ETA and estimated fuel calculations assume a direct flight across route discontinuities.

6 WIND DATA REQUEST

Push – transmits a data link request for wind and descent forecast data.

Flight crew may enter up to four altitudes on any wind page to qualify the request.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Wind Data

The FMC uses wind data to improve performance prediction accuracy. Wind data includes altitude and direction/speed.

The FMC applies the first entered wind data to all waypoints in the flight plan. Wind data entered at another waypoint (at the same altitude) changes wind data downtrack from the second entered waypoint either to the end of the track, or to the next entered wind. The wind data before the second entered waypoint does not change. Therefore, enter wind data for waypoints closest to the airplane, then enter wind data for waypoints downtrack from the airplane.

For example: at FL 350, 100°/085 is entered at waypoint OED. All waypoints in the route have the OED wind data. Then, additional wind data entered at OAK changes the wind data at OAK and through the end of the route.

Entered wind data are mixed with sensed wind data for performance predictions. The FMC uses entered winds for predictions far ahead of the airplane and sensed winds close to the airplane. The FMC mixes these winds for predictions in between. Sensed winds display on the progress page 2/4.

Inaccurate forecast wind and temperature information degrades the accuracy of the recommended altitude displayed on the cruise page.

The FMC adjusts ECON climb speed and top of climb using entered and/or sensed wind speed. FMC calculated ECON climb speed may fluctuate if top of climb is near a waypoint with approximately a 45 degree or larger track change and if a significant wind velocity has been entered or is predicted for that waypoint. This fluctuation does not occur when using a manually entered climb speed or speed intervention.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Wind Page

The wind page is used to enter forecast winds and temperatures at waypoints for up to four altitudes to enhance VNAV performance.

This data can be uplinked or manually entered.

Wind speed and direction are entered for the specific altitudes.

OAT can be entered for any one altitude. The FMC calculates the temperature for the entered altitudes using the standard lapse rate.

Altitudes are entered first. The altitudes can be entered in any order and are sorted and displayed in ascending order.

1 Page Title

Displays ACT XXXXX, where XXXXX is the waypoint at which winds have been entered.

When a route is being modified, MOD in shaded white as shown in the page title.

2 Altitude (ALT)

Enter altitude or flight level for wind entries. Altitude data entry possible only on line 1L.

After data entry, data is sorted by altitude and placed in lines 1 through 4. Dashes display on right side of line for wind direction and speed entry.

When all four lines have data, one must be deleted before new data can be entered.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Altitude/Flight Level Data

Displays the altitude or flight level for wind or OAT entries.

Data entered on 1L displays on lines 1 through 4. Data entry is not possible in lines 2L through 4L.

OAT entries made using the ALT/OAT line display in large font. Calculated OAT based on standard lapse rate display in small font.

4 ERASE

Push – removes modified data.

5 Direction and Speed (DIR/SPD)

Displays dashes after altitude/flight level entry in the ALT line. Enter wind direction and speed for the altitude.

Displays entered wind direction and speed for related altitude.

Values propagate in both directions for the first wind entered and downtrack for other entered winds. Propagated values display in small white font.

Manual entries display in shaded white until executed, then in large white font.

6 Altitude/Outside Air Temperature (ALT/OAT)

Valid entries are altitude or flight level/and OAT. OAT is a one-to-three digit entry, including the sign; a plus sign is optional, a minus sign is mandatory. Valid range is -99 to 60.

The altitude for OAT does not have to be one of the wind altitudes. The FMC uses standard lapse rate to calculate and display the temperature at the other altitudes.

Manual entries display in shaded white until executed.

7 Route Data (RTE DATA)

Push – displays the RTE DATA page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Position Report Page

The position report page displays data for a position report. A position report can be data linked from the page.

The page contains reference data only. Manual entries are inhibited.

1 Position (POS)

Waypoint used to report position. This is the previous active waypoint.

2 Estimate (EST)

The active waypoint displays in magenta.

3 NEXT

Waypoint after active waypoint.

4 Temperature and Wind (TEMP WIND)

TEMP displays the OAT in degrees C.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

WIND displays the wind direction and speed.

5 PROGRESS

Push – displays the PROGRESS page.

6 Actual Time of Arrival and Altitude (ATA ALT)

ATA displays the actual time of arrival for the POS waypoint.

ALT displays the current airplane altitude.

7 ETA

Displays the estimated time of arrival for the active waypoint.

8 Position Fuel (POS FUEL)

Displays FMC calculated fuel remaining at the POS waypoint.

9 REPORT

Push – transmits a data link downlink of the data on this page.

The data link transmission of a position report requires the data link option be enabled, operational, and not in the voice or no–communications mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

In–Flight Position Update

FMC position update can be accomplished on the POS REF 2/3 page in flight.

1 UPDATE ARMED

Pushing the ARM prompt arms the position update function. ARM changes to ARMED. Each of the position update sources have a NOW prompt.

2 INERTIAL NOW

Push – to update the FMC position from the inertial position.

3 GPS NOW

Push – to update the FMC position from the GPS position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 RADIO NOW

Push – to update the FMC position from the navigation radio position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Progress Pages

Progress Page 1

The progress page displays general flight progress data. The FMC Communication section of Chapter 5, Communications describes position reports.

The page title displays the company flight number entered on the RTE page.

Page one of the progress pages displays general data about:

- waypoints (active and next)
- destination data
- FMC speed
- T/C, T/D, etc.

1 TO

Active waypoint displays in magenta.

Can not be modified.

2 NEXT

Waypoint after TO waypoint displays in white.

Can not be modified

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Destination (DEST)

Any waypoint or airport in navigation database, or any waypoint (except along track or latitude/longitude) in the active flight plan can be entered. The line titles are:

- DEST – performance predictions to destination. Default display
- DIR TO FIX – when entered waypoint is not in flight plan. Data is based on flying present position direct to the waypoint
- EN ROUTE WPT – when entered waypoint is in flight plan. Line data are based on flying the flight plan route to the waypoint
- MOD – a modification has been made on another page. Performance predictions include modification.

Remove entries with DELETE key or change all CDUs to a different page.

4 Selected Speed (SEL SPD)

The FMC active command speed displays in magenta.

The active speed mode is the same as on the active VNAV page, unless changed by the MCP or a limit. The speed modes are:

- ECON SPD – economy speed
- LRC SPD – long range cruise speed
- SEL SPD – selected speed manually entered on the CDU
- EO SPD – engine out speed
- 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
- MCP SPD – MCP speed entered on the MCP IAS/MACH indicator
- VREF +80 – for engine out operations during takeoff
- RTA SPD – RTA speed is active

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

9 TO T/D

Data line displays ETA and DTG to line title point.

Data line displays NOW when the airplane is past the climb/descent point when STEP CLB or T/D displays in the line title.

Data line displays NONE when the line title is STEP CLB and the step has not been entered on the CRZ page or the FMC calculates a step climb is not advised.

Line titles are:

- TO T/C - top of climb
- TO STEP CLB – step climb data
- TO T/D – top of descent data
- TO E/D – end of descent data
- LEVEL AT – time and distance to level off in Drift Down mode

10 Position Reference (POS REF)

Push – displays position reference page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Progress Page 2

Progress page two contains:

- wind data
- fuel data
- static air temperature
- true airspeed
- track error data

1 Headwind (H/WIND), Tailwind (T/WIND)

Displays headwind (H/WIND) or tailwind (T/WIND) component.

Wind component data is relative to the airplane.

2 Crosstrack Error (XTK ERROR)

Displays crosstrack (XTK) error in nautical miles left or right of the active route.

3 TAS

Displays airplane true airspeed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 LEFT FUEL USED

Displays fuel used by left engine sensed by fuel flow meters.

5 Fuel Quantity TOTALIZER, CALCULATED

The fuel remaining line displays two independent fuel quantities, TOTALIZER and CALCULATED. TOTALIZER is the total sum of individual fuel tank quantities computed by the Fuel Quantity Indicating System (FQIS). When the fuel quantity is manually entered on the PERF INIT page, the manually entered quantity displays in 6R, CALCULATED.

HL7202 - HL7205, HL7782 - HL8347
When no manual fuel quantity entry is made on the PERF INIT page, CALCULATED displays the FMC calculated fuel quantity remaining. Before engine start, the CALCULATED value is set equal to the TOTALIZER. The displayed totalizer quantity can be between 99% and 101% of the actual fuel. After engine start, the CALCULATED fuel quantity is decreased by the fuel flow sensing system (FUEL USED). Sensed fuel flow tolerances may allow up to 88 lbs per hour CALCULATED fuel quantity variation.

HL7532 - HL7766
When no manual fuel quantity entry is made on the PERF INIT page, CALCULATED displays the FMC calculated fuel quantity remaining. Before engine start, the CALCULATED value is set equal to the TOTALIZER. The displayed totalizer quantity can be between 99% and 101% of the actual fuel. After engine start, the CALCULATED fuel quantity is decreased by the fuel flow sensing system (FUEL USED). Sensed fuel flow tolerances may allow up to 161 lbs per hour CALCULATED fuel quantity variation.

After fuel jettison or after all engines are shut down, CALCULATED resets to the totalizer system fuel quantity.

6 WIND

Displays current wind direction and speed referenced to true north.

7 Crosswind (X/WIND)

Displays left (L) or right (R) crosswind component relative to airplane heading.

8 Vertical Track Error (VTK ERROR)

Displays vertical path (VTK) error above (+) or below (-) vertical path.

9 Static Air Temperature (SAT)

Displays outside static air temperature.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

10 RIGHT FUEL USED

Displays fuel used by right engine sensed by fuel flow meters.

11 FUEL USED Total (TOT)

Displays sum of the LEFT and RIGHT fuel used values.

12 USE

Push – selects method to calculate fuel quantity, either TOTALIZER or CALCULATED.

When USE is selected, it is used for performance computation and predictions. The other fuel calculation method remains available for USE selection.

EICAS message FUEL DISAGREE and USE prompts display when TOTALIZER and CALCULATED values disagree by a significant amount for 5 minutes.

13 Select <SEL>

<SEL> shows which method is used to calculate fuel quantity, either TOTALIZER or CALCULATED. <SEL> displays next to the fuel quantity being used. TOTALIZER or CALCULATED selected by the USE prompt.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

RTA Progress Page 3

Progress page three is used to enter data for required time of arrival (RTA). RTA can be entered or changed during preflight or in flight. Creating an RTA changes CRZ page title to RTA CRZ. RTA operates only in cruise.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 FIX

Valid entry is a waypoint in the active or pending active route. Waypoints defined by coordinates must be down selected to the scratchpad, then selected to the FIX line.

Entry by flight crew or data link.

Entry displays boxes in 1R and RTA in the line title and ALT/ETA in 2R line title.

When RTA active, deletion of FIX terminates RTA and resumes ECON. Display returns to boxes.

When RTA not active, deletion of FIX erases a pending RTA MOD. Display returns to boxes.

Displays boxes when an active or modified route exists.

Displays blank if engine out has been selected.

2 Required Time Of Arrival Speed (RTA SPD)

Displays FMC computed cruise speed to accomplish RTA.

Displays blank if no RTA fix or time entered.

3 Maximum Speed (MAX SPD)

Valid entry is Mach .100 to .990; displays in large font.

Deletion of entered value displays default Mach .850 in small font.

4 Displays ERASE when modification pending

Push - displays previous unmodified page, or if no previous active values, deletes RTA in 1R.

5 Required Time Of Arrival (RTA)

Boxes display after entry of RTA FIX in 1L.

Valid entry is time from 0000.0 to 2359.9. Decimal entry of .0 is optional.

Suffix to RTA indicates:

- no suffix – arrive at entered time
- A – arrive at or after entered time
- B – arrive at or before entered time

Entry before takeoff causes recommended T/O time to display in small font.

Deletion terminates RTA and returns ECON as cruise mode.

6 Altitude/ETA (ALT/ETA)

Displays predicted altitude and ETA at RTA fix after entry of FIX in 1L.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Blank until performance data is entered.

7 Recommended Takeoff (RECMD T/O)

Displays T/O in line title and dashes until FIX entered.

Displays RECMD T/O in line title on the ground when a performance calculated takeoff time to met an entered FIX displays in the data line.

Displays NOW when no takeoff time has been entered and the current time is later than the calculated time to meet an RTA at ECON speed.

Blanks in flight.

Valid entry is time from 0000.0 to 2359.9. Decimal entry of .0 is optional.

8 PRIOR RTA

Displays when an RTA fix and time exists, and the RTA fix is deleted or another cruise speed mode is selected prior to sequencing the RTA fix.

Push -

- displays previous RTA fix and time
- initiates RTA flight plan modification

9 Cruise Speed Segment

Displays cruise speed segment start and end waypoints when entered on the Legs page. Valid entries on the Legs page are: Mach, LRC or L, RTA or R, or ECON or E. The cruise speed segment shown ends at AVE and ECON airspeed is resumed. If an end waypoint has not been entered, the cruise speed segment ends at the T/D.

Entry of RTA or R after an RTA fix or entry of ECON or E before an RTA results in the scratchpad message INVALID ENTRY.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

RNP Progress Page 4

HL7532 - HL7766

Navigation Precision Scales not installed

Progress page four displays concise RNP information. Some of the information on page 2 has been repeated to display all related RNP information together.

1 Leg Direction

Leg segment data in line title:

- courses – magnetic (xxx°) or true (xxx° T)
- arcs – distance in miles, ARC, turn direction (example: 24 ARC L)
- heading leg segments – xxx° HDG
- track leg segments – xxx° TRK
- special procedural instructions from database - HOLD AT, PROC TURN, or PROC HOLD (FMC exits hold when crossing the fix after entry)

Calculated great circle route leg directions may be different than chart values.

Dashes display for an undefined course.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Waypoint Identifier

Displays the next waypoint.

3 Required Navigation Performance and Actual Navigation Performance (RNP /ACTUAL)

Display same as 5L POS REF 2/3. Manual entry displays in large font; propagated to 5L POS REF 2/3 page.

4 Crosstrack Error (XTK ERROR)

Displays present crosstrack error from the desired LNAV course. L or R indicates left or right of course. Blank if error is greater than 99.99 NM.

5 Lateral RNP (Approach)

Displays the lowest applicable RNP (initial, intermediate, or final segment) for the selected approach.

Entry not allowed at 6L. Manual entry at 2L displays in large font.

Displays RNP from navigation database, if available. If not available, displays the default RNP for the approach flight phase from the FMC. Both display in small font.

6 Distance To Go

Displays the distance remaining to the next waypoint.

7 Glidepath

Displays the FMC computed glidepath for the approach.

8 Waypoint Speed/Altitude

Displays waypoint speed or altitude constraints in large font. Displays FMC predicted value in small font when no restrictions have been specified.

9 Vertical Error (VTK ERROR)

Displays present vertical error from the FMC computed glidepath.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

RNP Progress Page 4

HL7202 - HL7205, HL7782 - HL8347

Navigation Precision Scales installed

Progress page four displays concise RNP information. Some of the information on page 2 has been repeated to display all related RNP information together.

1 Leg Direction

Leg segment data in line title:

- courses – magnetic (xxx°) or true (xxx° T)
- arcs – distance in miles, ARC, turn direction (example: 24 ARC L)
- heading leg segments – xxx° HDG
- track leg segments – xxx° TRK
- special procedural instructions from database - HOLD AT, PROC TURN, or PROC HOLD (FMC exits hold when crossing the fix after entry)

Calculated great circle route leg directions may be different than chart values.

Dashes display for an undefined course.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 Waypoint Identifier

Displays the next waypoint.

3 Required Navigation Performance and Actual Navigation Performance (RNP /ACTUAL)

Display same as 5L POS REF 2/3. Manual entry displays in large font; propagated to 5L POS REF 2/3 page.

4 Crosstrack Error (XTK ERROR)

Displays present crosstrack error from the desired LNAV course. L or R indicates left or right of course. Blank if error is greater than 99.9 NM.

5 Lateral RNP (Approach)

Displays the lowest applicable RNP (initial, intermediate, or final segment) for the selected approach.

Entry not allowed at 6L. Manual entry at 2L displays in large font.

Displays RNP from navigation database, if available. If not available, displays the default RNP for the approach flight phase from the FMC. Both display in small font.

6 Distance To Go

Displays the distance remaining to the next waypoint.

7 Glidepath

Displays the FMC computed glidepath for the approach.

8 Waypoint Speed/Altitude

Displays waypoint speed or altitude constraints in large font. Displays FMC predicted value in small font when no restrictions have been specified.

9 Vertical Navigation Performance

Displays both vertical RNP and ANP for the current leg.

Valid display range for vertical ANP is 0 to 999 feet.

Manual entries are allowed and display in large font.

Valid entries are 10 to 999 feet and may be suffixed with an optional "/".

Entries clear at flight completion.

Values from the navigation database display in small font.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

10 Vertical Error (VTK ERROR)

Displays present vertical error from the FMC computed glidepath.

11 Vertical RNP (Approach)

Displays the lowest applicable vertical RNP for the approach.

Manual entries (entered in 2R) display in large font.

Values from the navigation database display in small font.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The descent phase starts at the top of descent point and continues to the end of descent point. Planning for the descent phase starts during cruise.

The approach phase starts when the airplane is in the descent phase and flaps are out of up. In general, the approach starts no later than sequencing the final approach fix.

Alternates are available from preflight through approach phase of flight and can be selected or updated at any time. Diversion to an alternate can be accomplished during all phases of flight.

The only automatic page change in the descent/approach phases is the VNAV selected page change from cruise to descent at the top of descent.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Descent

During descent, LNAV is managed using the RTE LEGS and PROGRESS pages, as in the cruise phase. VNAV descent management is accomplished primarily on the DES page.

During descent, the specific page listed below is used to:

- DESCENT FORECAST page – enter forecast wind data to aid descent planning
- OFFPATH DES page – analyze descent performance with and without the use of speedbrakes
- ALTN page – manage the selection of alternate airports and diversions.

Altitude Intervention

If an unplanned level-off is required, setting the altitude window to the required altitude causes the airplane to level at the set altitude. VNAV PTH changes to VNAV ALT. The descent can be continued by setting the altitude window to a lower altitude and pushing the altitude selector. If the altitude window is set to an altitude below other altitude constraints, each altitude constraint can be deleted by each push of the altitude selector or, all waypoint altitude constraints between the current airplane altitude and the altitude window setting, can be deleted by selection of the DES DIR> prompt on the DES page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Descent Page

The descent page is used to monitor and revise the descent path. Descent speeds are economy (ECON) and fixed speed (SEL). The default VNAV descent mode is ECON. A fixed speed descent is flown when speed intervention is used or a speed is entered on the DES page. The descent page blanks with DES as the title until an altitude constraint below the cruise altitude is entered.

This page title includes the VNAV speed mode. The ECON mode controls descent speed at the economy speed until reaching a lower speed restriction. The fixed speed mode controls descent speed at the fixed speed until a lower speed restriction is reached.

HL7202 - HL8046, HL8076 - HL8347

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL8075

1 Page Title

The page title shows active (ACT) or modified (MOD) descent. Usually, the title shows ECON for economy descent. Fixed speed descents modify the title.

The page title shows the type of descent:

- ACT ECON DES – speed based on a cost index
- ACT MCP SPD DES – MCP speed intervention is selected
- ACT XXXKT DES – fixed CAS descent speed profile
- ACT M.XXX DES – fixed Mach descent speed profile

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- ACT LIM SPD DES – speed based on an envelope limiting speed
- ACT END OF DES – airplane has sequenced E/D constraint.

Fixed descent speeds are for:

- a flight crew entered selected speed (SEL SPD)
- a speed transition
- a speed restriction associated with an altitude constraint
- waypoint speed constraints.

2 End Of Descent At (E/D AT)

Shows the end of descent altitude and waypoint.

The end of descent point is a waypoint in the descent phase with the lowest altitude constraint.

The altitude shows in magenta when altitude becomes the FMC altitude target.

Page blanks if no E/D point exists.

3 Economy Speed (ECON SPD), Selected Speed (SEL SPD)

Both CAS and Mach values shows.

The FMC commanded speed is magenta. Initially, Mach is magenta and CAS is white. Below CAS/Mach transition altitude, CAS is magenta and Mach is white.

Valid entries are CAS or Mach.

ECON SPD shows in the line title when speed is based on cost index.

SEL SPD shows in the line title when flight crew enters speed or when transitioning into a selected speed segment (waypoint speed constraint, SPD RESTR, or SPD TRANS).

4 Speed Transition (SPD TRANS)

The transition speed is usually 10 knots less than the destination airport limiting speed from the navigation database. When no airport limit speed exists, the default speed of 240 knots shows. The transition altitude is the point the transition speed is active for the destination airport. When no altitude exists in the navigation database, the default of 10,000 feet shows.

Speed shows in magenta when it is the FMC speed target.

Blanks below SPD TRANS altitude.

Deleting causes the airplane to fly economy or selected speed if not limited by a waypoint constraint or speed restriction.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 Speed Restriction (SPD RESTR)

Speed restrictions at altitudes higher than E/D altitude and not associated with specific waypoints are manually entered on this line.

Valid entry is a CAS and altitude (example 240/8000). Entry may be deleted.

Magenta when it is FMC command speed.

6 Off Path Descent (OFFPATH DES)

Push –

- shows the OFFPATH DES page.

7 AT XXXXX

Shows the next waypoint constraint from the RTE LEGS page.

XXXX is:

- the waypoint identifier
- HOLD AT XXXXX
- AT VECTORS
- AT (INTC).

The constraint is speed/altitude. Blanks when no constraint exists.

Can be deleted on this page.

VNAV commands the lesser of constraint speed or present performance speed.

Speed and/or altitude shows in magenta when they are the FMC target values.

8 FORECAST

Push –

- shows the DESCENT FORECAST page.

9 Descend Direct (DES DIR)

Push –

- deletes all waypoint altitude constraints between the airplane altitude and the MCP altitude. FMC cruise altitude is not affected

Shows in descent phase with altitude constraint between airplane and E/D.

10 Descend Now (DES NOW)

Push –

- starts a 1250 feet per minute descent schedule until intercepting the planned descent path
- activates the FMC descent phase.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347
Shows when the descent phase is not active and aircraft is airborne.

HL7532 - HL7598
Shows when the descent phase is not active.

HL8075
11 Waypoint/Altitude (WPT/ALT)

Line title appears at all times. Data line shows "-----/-----" when a descent profile does not exist in the flight plan. With a descent profile in the flight plan, data line shows the same waypoint/altitude restriction shown on the AT line (1R); it may be overwritten by pilot entry. Valid entry is any navigation database waypoint, latitude/longitude, or waypoint from the flight plan.

HL8075
12 Flight Path Angle, Vertical Bearing, and Vertical Speed (FPA, V/B, V/S)

- FPA - shows the current airplane flight path angle whenever the airplane descends (data blanks if the airplane levels or climbs).
- V/B - shows vertical bearing from current position to the shown waypoint and altitude (data blank if WPT/ALT line shows "-----/-----").
- V/S - shows required vertical speed to maintain the vertical bearing (data blank if WPT/ALT line displays "-----/-----").

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

1 Transition Level (TRANS LVL)

Displays the transition level.

The transition level can be specified by the arrival procedure. The default transition level is FL 180.

Above transition level, altitudes are in flight levels. Below transition level, altitudes are in thousands of feet.

Valid entry is an altitude or flight level.

2 Altitude (ALT)

Enter altitude of forecast wind data.

Altitudes and flight levels can be entered in any order. Entries are not sorted.

Execute not necessary.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 FORECAST REQUEST

Push – transmits a data link request for descent wind data.

4 Thermal Anti–Ice On Altitude (TAI/ON ALT)

Enter the altitude where anti–ice is first turned on during the descent.

5 Wind Direction/Speed (WIND DIR/SPD)

Enter the wind direction/speed for the specified altitude. Initial entry must have wind direction and speed, subsequent entries may have one or the other.

Execute not necessary.

6 Descent (DES)

Push – displays the DES page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Offpath Descent Page

The offpath descent page allows the analysis of descent performance off the present route of flight, direct to a selected waypoint. Data entered on the page shows clean and drag descent ranges on the page and on the ND. The ranges are based on an entered waypoint and altitude constraint. The range can be used to determine if the altitude constraint can be met in a direct descent to the waypoint.

The FMC puts the last descent waypoint with an altitude constraint into DES TO.

The ECON SPD, SPD TRANS, SPD RESTR, and DES data are the same as the DES page.

1 Descend To (DES TO)

The waypoint for a direct–to descent. Usually, this is the E/D waypoint from the active route. Manual entry of waypoints on or off of the route are allowed. The DTG calculations are for a descent direct to the selected waypoint.

When within 150 feet of the DES TO altitude for a waypoint other than the E/D waypoint, the display automatically changes the DES TO waypoint to the E/D waypoint from the DES page.

A waypoint is entered for direct–to analysis.

2 Distance To Go (DTG)

Displays the straight line distance to the entered waypoint.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Speed/Altitude (SPD/ALT)

Displays the speed/altitude constraint for the entered waypoint.

A manual waypoint entry displays boxes for manual speed and altitude entry.

4 TO CLEAN

Distance to the clean descent circle. The distance is negative when a clean descent is no longer possible.

A clean circle assumes no drag devices are used for descent.

A direct descent to the DES TO waypoint at a SPD/ALT constraint is possible when the airplane is outside the clean circle. The clean circle displays on the ND when the DISPLAY prompt is ON.

5 TO DRAG

Distance to the drag descent circle. The distance is negative when a drag descent is no longer possible.

A drag circle assumes speedbrakes are UP for descent.

A direct descent to the DES TO waypoint at a SPD/ALT constraint is possible when the airplane is outside the drag circle. The drag circle displays on the ND when the DISPLAY prompt is ON and the airplane is inside the clean circle.

6 DISPLAY

Push – alternates between ON and OFF.

ON – displays the clean and drag circles on the ND. The drag circle does not display until the airplane position is inside the clean circle.

OFF – removes the clean and drag circles from the ND.

Selected state is large green font, otherwise small white font.

Automatically changes to OFF within 150 feet of the waypoint constraint altitude.

Engine Out Descent

There are no specific engine out pages for descent. Use the two engine descent planning features and pages.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach

During approach, roll and pitch modes usually change to the approach guidance supplied by navigation radios. The FMC continues to calculate and show present position and can supply LNAV and VNAV approach guidance for certain types of approaches when radio navigation is not used.

The RTE LEGS and PROGRESS pages are used to manage the airplane until other approach guidance becomes active. Other pages which support approaches are:

- ARRIVALS page – to select arrival and approach procedures
- APPROACH REF page – to specify approach flap settings and set the approach VREF
- HOLD page – to manage holding patterns

Holding is described in this section but it can be used during any phase of flight.

Accessing the arrivals page more than 400 NM from the departure airport, more than halfway along the active route, beyond the top of climb and within two minutes of top of descent, or beyond the top of descent, displays arrivals for the destination airport. Prior to these points, accessing the arrivals page displays arrivals for the departure airport.

Sequencing any of the above points also causes the FMC to send landing altitude data to the cabin altitude controller. Until an arrival approach has been selected into the active flight plan, the destination airport altitude is used by the cabin altitude controller.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Arrivals Page

The arrivals page allows selection of a runway, approach, approach transition, standard terminal arrival route (STAR) or profile descent, and an arrival transition to the destination airport. The INDEX key accesses the DEP/ARR INDEX and provides arrival/departure data for any other airport in the navigation database. Route 1 and route 2 have separate arrival pages.

Airports are using multiple RNAV/ILS approaches to the same runway. ICAO has developed a naming convention which adds an additional character to the approach name; Z, Y, X,... in the approach title following the guidance source. The primary approach is identified as the “Z” approach; all subsequent procedures (normally with different missed approach paths) use the alpha characters in reverse order beginning with Y. This change requires approach names with up to eight characters, rather than the current maximum of six, to be encoded in the navigation database.

Selecting Options

Selecting a runway, approach, approach transition, STAR/profile descent, or arrival transition displays <SEL> inboard of the selection and displays MOD in the page title. The other options within the same category are removed from the list. When the modification is executed, <SEL> changes to <ACT>. Selecting another page and returning to ARRIVALS displays all options; the applicable <SEL> or <ACT> prompts display.

When a STAR is selected followed by selection of an approach or runway and a transition exists in the navigation database, the transition waypoints with associated speed/altitude constraints are inserted into the flight plan linking the STAR to the approach or runway. If more than one transition exists, selection of the applicable transition is made under TRANS on the left side of the page. Some STARs serve more than one runway. If a STAR and runway are selected and subsequently a different runway is selected, and if the STAR is compatible with the new runway, the transition waypoints are inserted into the flight plan linking the STAR to the runway.

If a different STAR, runway, or STAR-runway combination is desired, selecting another page and returning to the ARRIVALS displays all options.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Arrivals Page – IFR Approaches

HL8075

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL8046, HL8076 - HL8347

1 Page Title

The destination airport identifier displays in the title.

Airports with more than 5 runways or STARs produce multiple arrivals pages.

2 Standard Terminal Arrivals (STARS), Profile Descents (PROF DES)

STARS display in a list under the STAR line title. Profile descents display below STARS under the PROF DES line title.

NONE displays when no STARS in the database.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Push -

- selects STAR or PROF DES for entry into the route, <SEL> displays
- all other arrival procedures no longer display and transitions for the selected procedure display
- deletes a previously selected procedure
- displays ERASE prompt

3 STAR Transitions (TRANS)

Displays list of transitions for the selected arrival procedure.

Push -

- selects transition for entry into the route
- all other transitions no longer display

4 INDEX

Push – displays the DEP/ARR INDEX page.

5 Route 1 (RTE 1)

Displays the active route number (RTE 1 or RTE 2).

6 APPROACHES

Displays the destination airport approaches.

Selection and execution of an ILS approach autotunes the ILS receivers and displays the course. Selection and execution of a back course (BAC) approach autotunes the ILS and displays the front course. BAC approaches cannot be flown in the MCP LOC or APP mode.

Push -

- selects approach for entry into the route; <SEL> displays; TRANS replaces RUNWAYS
- displays profile descents for the selected approach; deletes all other approaches and runways
- displays INTC prompt for the selected approach
- displays ERASE prompt

7 Approach Transitions (TRANS)

Displays a list of transitions to the selected approach.

Approach transitions include IAFs, feeder fixes, and fixes providing routing to the FAF.

When transition not selected, approach will be a straight–in approach starting at a waypoint 4 to 8 miles outside the FAF. Waypoint may be a charted fix or CFXXX (XXX is the runway number).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Push –

- selects transition for entry into the route
- deletes all other transitions
- displays INTC prompt for selected transition

8 Final Approach Fix Intercept (XXXXX INTC)

Selecting the prompt displays a modified RTE LEGS page with an intercept course to the approach transition fix (usually the IAF) for the selected approach.

Arrivals Legs Page

1 Glide Path Display

Displays the glide path angle used by VNAV on final approach to the runway. If the runway was selected as part of a published approach, the displayed angle will be close to the published glide path angle, but may differ slightly.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Arrivals Page – VFR Approaches

1 RUNWAYS

Displays list of runways for destination airport.

Push -

- selects runway for entry into the route; <SEL> displays
- deletes previously selected approach
- displays runway extension; and, VFR APPR when enabled in the navigation database
- no longer displays other runways and approaches
- displays approach intercept fix for selected runway

Arrivals Page With Runway Selected

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 VFR Approach (VFR APPR)

Displays when a VFR approach is in the navigation database for selected runway.

Push – following a discontinuity, creates a straight-in VFR approach beginning with a transition waypoint, FAXXX at 8 NM from the runway threshold with an airspeed /altitude constraint of 170 kts/2,000 feet above runway elevation.

The VFR approach ends with a runway altitude constraint of 50 feet.

Displays RWY EXT 8.0 NM and FPA of 3.0 degrees.

2 Runway Extension (RWY EXT)

Allows entry of end of descent target for VNAV guidance.

Creates a runway extension fix along runway centerline for LNAV guidance.

Entry deletes VFR APPR prompt.

3 Approach Intercept

Selecting an arrival runway displays an approach intercept waypoint on the approach course for the selected runway.

Push – modifies the flight plan, displays the RTE LEGS page, and activates the intercept course to function.

Arrivals Page With VFR Approach Selected

1 Runway Extension (RWY EXT)

Following selection of a runway, the RWY EXT 8.0 waypoint, FAXXX, displays as part of the VFR APPR. Distance cannot be changed.

2 Flight Path Angle (FPA)

Displays descent flight path angle to 50 foot runway waypoint. Default is 3.0 degrees.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Valid entry is 2.4 to 3.7 degrees.

VFR Approach Path

The VFR approach is a level path until the VNAV descent path is intercepted. The descent path begins at the FAXXX waypoint altitude and terminates at the runway threshold at 50 feet. Default values display in RWY EXT and FPA.

Arrivals Page With Manually Entered Runway Extension

1 Runway Extension (RWY EXT)

Valid entries are from 1.0 to 25.0 miles from the runway threshold.

Entry allowed if VFR APPR is not selected. Entry removes VFR APPR prompt. Example shows 6 NM entered.

Makes waypoint RXYYY, where YYY is the runway; example: RX32R. Makes a route discontinuity before and after the waypoint.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Procedure Hold (in lieu of procedure turn) Legs Page

1 Inbound Waypoint

A conditional waypoint ("INBD") is created at the end of the procedure turn. This waypoint displays on the ND as a small circle. The next line displays inbound heading and distance to the holding fix. The procedure hold is not displayed on a Hold page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Approach Reference Page

The approach reference page displays approach planning data and approach reference speed (VREF) selection.

1 Gross Weight (GROSS WT)

FMC calculated airplane gross weight usually displays.

Manual entry is allowed in case the FMC calculated gross weight is unavailable or invalid, or to allow previewing recommended approach speeds at other than the calculated FMC gross weight. The manually entered gross weight becomes the FMC calculated gross weight when a different page is selected and the APPROACH REF page is reselected. Permanent changes to gross weight result in recalculation of all performance data and may only be made on the PERF INIT page.

Displays boxes when gross weight is not available from the FMC.

Valid entry is XXX.X.

2 Landing Reference (LANDING REF)

Landing reference is selectable between QNH and QFE. Usually, QNH is the operating mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Selecting QFE sets the cabin pressurization schedule, and the destination landing altitude indication to zero altitude. With the landing reference set to QFE, changing the barometric setting from STD to QFE changes the PFD altitude tape background color to green. With QFE selected and climb phase active, changing the barometric setting from QFE to STD causes the landing reference to toggle from QFE to QNH and the green background color is removed.

For QFE operations, refer to Supplementary Procedures, Flight Instruments, Displays.

Toggles between QFE and QNH. The active mode displays in large green font. The inactive mode displays in small white font.

3 Runway Length

The displayed runway reference changes based on distance along the planned FMC route. The destination airport is the reference when the present position is more than halfway or more than 400 NM from the origin airport along the planned route. The origin airport is the reference when the present position is less than halfway or less than 400 NM from the origin airport along the planned route.

Displays the length in feet and meters of the referenced runway.

4 INDEX

Push – displays the INIT/REF INDEX page.

5 FLAPS VREF

A gross weight is necessary for VREF speed calculation. Push the applicable line select key to select the correct VREF speed. The three VREF speeds are based on landing flap setting.

The displayed VREF speeds change based on distance along the planned FMC route and are a function of displayed gross weight, airport altitude and flap settings. The destination airport is the reference when the present position is more than halfway along the planned route. The origin airport is the reference when the present position is less than halfway from the origin airport along the planned route.

Displays the calculated reference speed for flaps 20°, 25°, and 30°.

The display is blank until a gross weight is displayed.

6 FLAP/SPEED

The flap position and VREF speed is entered for landing.

The VREF speed displays on the PFD.

Deletion of the data removes VREF from the PFD.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

7 Thrust Limit (THRUST LIM)

Push – displays the THRUST LIM page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Airport Diversions

ALTN page 1/2 data aids the flight crew in finding a suitable alternate airport. The page displays four airports in an ETA sequence. Each airport on the list has an XXXX ALTN page with more data. Select the XXXX ALTN page with a caret. ALTN LIST page 2/2 may contain a list of uplinked alternate airports.

Three alternate airport uplinks can be received. ALTN LIST page 1/2 can get an uplink for the entire page or for just the ALTN INHIB line. ALTN LIST page 2/2 can receive an uplink of alternate airport names.

Alternate Page 1/2

The first alternate page displays alternate airport data. An alternate airport can be selected to change the flight plan destination.

The source of alternate airports can be:

- an uplink directly to this page
- automatic selection from the ALTN LIST page
- automatic selection from the navigation database
- manual entry

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate airports automatically selected from the alternate list or the navigation database display in small font. All four alternates display on the ND in cyan. The alternate airport symbols display when the ND is in the plan mode. The selected alternate airport displays at all times on the ND map. Other alternates display on the ND when the ARPT switch is on.

1 Alternate Airports

Displays the identifier of the four alternate airports in ETA order in flight; and, in distance order on the ground.

Valid manual entry is an airport from the navigation database.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

A manual entry into a field displaying a small font value overwrites the small font value, but does not delete it from the Alternates Candidates list. After predictions are complete, the overwritten small font value is placed on the list according to ETA order. A manual entry into a field displaying a large font value overwrites the large font value. Manual entries display in large font.

The DELETE function key can be used to remove manually entered alternate airports from the ALTN page.

2 Alternate Request (ALTN REQUEST)

Push – transmits a data link request for a preferred list of alternates (up to four).

Uplinked airports display in ETA order but are assigned a preference number by the transmitting site. The scratchpad displays the message ALTN UPLINK when the alternate airport data arrives.

3 Weather Request (WXR REQUEST)

Push – transmits a data link request for alternate airport weather data.

Uplinked weather is sent to the flight deck printer.

4 ETA

ETA is calculated based on the routing, altitude, and speed displayed on the XXXX ALTN page. ETA is blank when the airplane is on the ground.

Displays the alternate airport ETA.

Blank when airplane is on the ground.

5 FUEL

Predicted arrival fuel is calculated based on the routing, altitude, and speed displayed on the XXXX ALTN page. The message UNABLE FUEL displays in the FUEL column if the predicted arrival fuel is less than zero.

Fuel values are blank when the airplane is on the ground.

Displays the alternate airport predicted arrival fuel.

6 Selected (<SEL>)

The selected alternate is identified with an <A> or <SEL> to the right of the airport identifier. Usually, the closest alternate is selected and identified with <A>. Manually selecting an alternate places <SEL> to the right of the airport identifier. The selected alternate identifier displays in the line title of the DIVERT NOW prompt.

The FMC selects the alternate airport with the earliest ETA. FMC selected alternates display <A> to the right of the airport identifier.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Entering a new airport into the list of four does not select the new airport.

Use the DELETE function key on a manually selected alternate to remove <SEL>. The automatic selection function selects a new alternate.

7 Alternate Select

Push - displays the XXXX ALTN page for the alternate airport adjacent to the > prompt.

8 Alternate Inhibit (ALTN INHIBIT)

An airport will not be one of the four alternate airports if entered into the alternate inhibit line.

One or two airports can be entered.

Alternate inhibits can be manually entered or uplinked. The inhibited airports may be uplinked with the ALTN UPLINK or separately. If uplinked separately, the scratchpad displays the message ALTN INHIBIT UPLINK.

Valid entries are airports from the navigation database.

9 DIVERT NOW

Selecting DIVERT NOW shows the route from the present position to the selected alternate using the route represented on the XXXX ALTN page for the diversion airport. The details of the route can be confirmed or modified before the diversion is executed.

Execution of the diversion:

- changes the route destination airport
- includes the route modification into the active flight plan
- deletes all parts of the original route that are not part of the diversion
- deletes all descent constraints in active route (the scratchpad message DESCENT PATH DELETED shows when DIVERT NOW is selected) if in active descent and VNAV engaged.

After a divert is executed the XXXX ALTN page is not updated until all CDUs are selected off of the XXXX ALTN page.

Push –

- makes an LNAV route modification for a divert to the selected alternate
- MOD XXXX ALTN page shows for the selected alternate
- SELECTED shows in place of DIVERT NOW
- blanks on ground
- blanks in the air when a diversion is not permitted.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate List Page 2/2

The second alternate page displays a list of previously uplinked alternate airports. The alternates on the ALTN 1/2 page are selected from this list or from the navigation database when a list does not exist.

1 Alternate Airports List

These four lines contain up to 20 airports from which alternates can be selected and displayed on ALTN page 1/2 when preferred uplinked airports do not use all four lines.

The list is uplinked directly to this page. No manual entry is allowed. Manual airport entries are accomplished on the ALTN 1/2 page.

2 Alternate List Request (ALTN LIST REQUEST)

Push – transmits a data link request for an alternate airport list uplink.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 Alternate List Purge/Confirm (ALTN LIST PURGE/CONFIRM)

When no list exists, alternate airports can be selected from the navigation database.

Selecting the PURGE prompt arms the purge function and displays a CONFIRM prompt before the list is deleted.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Push – deletes all airports from the list.

A new list must be uplinked after a purge.

XXXX Alternate Page

Each of the four alternate airports displayed on the ALTN page 1/2 has a related XXXX ALTN page. The XXXX ALTN pages display specific data about alternate airports, the route used for a diversion, and the conditions on which the ETA and fuel calculations are based. All data on the page is related to the alternate airport displayed in the page title.

Three route options to the airport can be selected:

- DIRECT TO – direct to alternate
- OFFSET – flight plan route with an offset
- OVERHEAD – flight plan route to a waypoint, then direct to alternate

The selected route option has an effect on ETA and fuel remaining. It is identified by <SEL>. Selection of a route option for one alternate selects the same route option for the other three alternates.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 VIA DIRECT TO

Push – selects DIRECT TO route option.

All flight plan waypoints are deleted.

2 VIA OFFSET

Push –

- with scratchpad empty, selects OFFSET route option
- with offset data in scratchpad, enters offset data. Does not select offset option.

Entry and exit to the offset is the same as for the RTE page offset. Flight plan waypoints are retained.

3 VIA OVERHEAD

Push –

- with scratchpad empty, selects OVERHEAD option
- with overhead data in scratchpad, enters overhead data. Does not select overhead route option

Displays active waypoint in flight plan.

The waypoints up to the selected or entered overhead waypoint are retained, then routing is direct to the alternate airport. All waypoints after overhead waypoint are deleted.

Enter any waypoint in the active or modified route.

4 Engine Out (ENG OUT)

This prompt performs the same function as described on the cruise page in the FMC Cruise section. It can be selected before or after the diversion is selected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 Alternate (ALTN)

Push – displays the ALTN 1/2 page.

6 Altitude (ALT)

Entry of any valid altitude or flight level into this line causes a recomputation of ETA and arrival fuel. Altitude entries do not become part of the diversion modification. Altitude entries apply to all four alternates.

Displays the altitude for which ETA and arrival fuel are calculated.

The scratchpad message UNABLE ALT displays if the entry is above maximum altitude or the top of climb point for divert is after top of descent point for divert.

7 Speed (SPD)

Entry of speed or Mach number into this line causes a recomputation of ETA and arrival fuel. Speed entries do not become part of the diversion modification. Speed entries apply to all four alternates.

Speed modes available are:

- ECON (economy)
- LRC (long range cruise)
- EO (engine out)
- EO LRC (engine out long range cruise)
- CO (company speed)
- any CAS or Mach

8 WIND

Entry of data causes recomputation of ETA and arrival fuel. A wind entry can be made for each of the four alternates. A wind entry applies to only one alternate.

Valid entry is a direction in degrees/speed in knots from 1 to 250.

9 Altitude/Outside Air Temperature (ALT/OAT)

Entry of data into these lines causes a recomputation of ETA and arrival fuel. A separate ALT/OAT entry may be made for each of the four alternates.

Displays the OAT for a specific altitude.

Valid entry is an altitude/temperature in degrees C.

10 Alternate Airport ETA/Fuel (XXXX ETA/FUEL)

Displays calculated airport ETA and arrival fuel based on the selected route, altitude, and speed displayed on this page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Holding

The FMC computes holding patterns with constant radius turns based on current wind and FMC commanded airspeed. The pattern size is limited to FAA or ICAO protected airspace. In LNAV, the AFDS tracks the holding pattern using up to a 30 degree bank angle. Strong winds or airspeed in excess of FAA or ICAO entry speeds may result in the airplane flying outside the protected airspace.

With LNAV active before sequencing the holding fix, holding pattern entries are determined by the following:

- airplane track, not heading or direction from which the active route approaches the holding pattern, determines the entry method used (parallel, teardrop, or direct entry)
- the airplane flies the initial outbound leg a computed distance from the holding fix, rather than a specific time. The computed distance is a function of the command airspeed and computed wind at the time the holding pattern becomes active
- teardrop entries use a 40 degree offset angle
- parallel and teardrop entries may cause the airplane to fly beyond the displayed holding pattern; however, the airplane remains in protected FAA or ICAO limits.

Holding Entry

Airplane track to the holding fix determines the entry type; direct, teardrop, or parallel. To make efficient use of the holding airspace, lateral guidance may direct the initial turn to the holding pattern prior to crossing the holding fix (fly-by). The holding entry path displays on the ND. For all holding entry types, lateral guidance directs the airplane to fly-by or fly-over the holding fix and to remain on the holding side of the inbound holding course. Depending on the entry track for a direct entry, the flight path may extend slightly beyond the displayed outbound holding turn. For teardrop and parallel entries, the flight path remains within the confines of the depicted holding pattern displayed on the ND. Remaining within the prescribed holding airspace requires the airplane to be at holding airspeed at the holding fix.

Hold Page (First Hold)

The hold page is used to enter a holding pattern in the route.

When the flight plan does not contain a holding pattern, pushing the HOLD function key displays the RTE X LEGS page with the HOLD AT line.

Two versions of the hold page are possible:

- an airway or procedure holding pattern
- a flight crew–entered holding pattern

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The holding page displays actual or default data about the holding pattern.

Entries modify the route. Modifications can be erased or executed.

Active holding patterns are magenta on the ND.

1 HOLD AT

Displays boxes to enter the holding fix: a RTE LEGS, database, or pilot-defined waypoint; a navaid or airport identifier; or a FAF already in the flight plan.

Entering a holding fix displays the RTE X HOLD page.

2 HOLD AT Present Position (PPOS)

Push -

- creates a holding pattern at present position
- execution establishes the holding fix at the position when EXEC is pushed and displays RTE HOLD

3 Holding FIX

Displays the holding fix.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Quadrant/Radial (QUAD/RADIAL)

Normally displays dashes.

Valid entry is X/XXX, XX/XXX, or /XXX. Example: NW/330.

Entry changes INBD CRS/DIR to agree.

5 Inbound Course/Direction (INBD CRS/DIR)

Displays inbound course and turn direction.

Valid entry is XXX (inbound course), XXX/X (inbound course/turn direction), /X or X (turn direction).

Entry changes QUAD/RADIAL to agree.

Displays magenta when the holding fix is the active waypoint.

6 Leg Time (LEG TIME)

Displays 1.0 MIN (minute) at or below 14,000 feet.

Displays 1.5 MIN above 14,000 feet.

Displays dashes when an entry made on LEG DIST line.

Valid entry is X, X.X, or .X.

When climbing/descending through 14,000 feet with VNAV active and the SPD/TGT ALT at 1R displays in large font, the FMC adjusts the leg time (1.0 MIN at or below 14,000 feet; 1.5 MIN above 14,000 feet).

7 Leg Distance (LEG DIST)

Normally displays dashes. Allows entry of leg distance for hold.

Entry displays dashed on LEG TIME line.

Valid entry is XX.X or X.X.

8 ERASE

Erases all FMC modifications.

9 Speed/Target Altitude (SPD/TGT ALT)

Dashes display or fix speed/altitude constraint from the RTE LEGS page.

Manual entries are in large font.

During cruise, entry of a target altitude lower than CRZ ALT modifies the DESCENT page and displays a T/D. After T/D, the DESCENT page remains active unless a new cruise altitude is entered.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Altitude, or speed and altitude may be entered.

Note: When descending to a HOLD with VNAV active and the entry altitude is expected to be above the clearance holding altitude, the clearance altitude must be entered in 1R to prevent the airplane from leveling when sequencing the holding fix.

10 FIX ETA

With no EFC TIME entry, displays time the airplane will next pass the holding fix.

With EFC TIME entry, displays time the airplane will pass the holding fix after the EFC time. The FMC uses this time to calculate downtrack ETAs and fuel values based on departing the holding fix at the new FIX ETA.

11 Expect Further Clearance Time (EFC TIME)

Normally displays dashes.

Valid entry is XXXX (time).

Entry changes performance predictions for the route after holding.

12 Hold Available (HOLD AVAIL)

Displays holding time available before requiring reserve fuel to reach the destination.

13 BEST SPEED

Displays the best holding speed for the airplane gross weight, altitude, and flap setting.

Note: May exceed ICAO limit speed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HOLD Page (Existing Hold)

When one or more holding patterns exist in the route, push the HOLD key to display the hold page for the first holding pattern. When the hold is the next LNAV event, active commands display in magenta. Holding parameters can be monitored and changed on this page. New holding patterns are added using the NEXT HOLD prompt.

Most holding patterns are part of a procedure or airway and remain active until the flight crew executes an exit from holding. This may be accomplished in one of two ways.

- on the ACT RTE LEGS page, deleting or bypassing the HOLD AT waypoint causes LNAV to command a direct to the next waypoint
- on the ACT RTE HOLD page, selecting and executing EXIT HOLD> causes LNAV to command the airplane to continue in the holding pattern until arriving at the holding fix, at which time the airplane exits the holding pattern

Following execution of the exit hold, only the remaining portion of the holding pattern back to the holding fix displays. Exit from the holding pattern may occur prior to crossing the holding fix (“fly-by”) if the course to the next waypoint is not closely aligned with the holding inbound course. The exiting flight path will remain within the confines of the protected holding airspace. The exit flight path displays on the ND. At high groundspeed and extreme exit track angles (angle between the course to the next route waypoint and the inbound course to the holding fix), a path discontinuity, typically in the shape of a “Z”, may display on the ND as the exit flight path. In all instances, LNAV provides appropriate lateral guidance to intercept the active leg to the next route waypoint.

The FMC automatically commands an exit from some holding patterns in procedures under the following conditions.

- for instrument approach holding patterns designed as a course reversal in lieu of a procedure turn, the airplane exits holding upon arrival at the holding fix inbound. Header at 1L displays PROC HOLD
- for some holding patterns in SIDs, the airplane exits holding when arriving at an altitude. Header at 1L displays HOLD AT

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 NEXT HOLD

Push – displays a new hold page for a new holding pattern entry.

2 EXIT HOLD

Push –

- arms a holding pattern exit
- EXIT ARMED displays in shaded white; when executed, airplane returns to the holding fix via the inbound course for holding pattern exit

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The CDUs can be used as an alternate navigation system if both FMCs fail. The CDUs calculate lateral navigation for the autopilot flight director system (AFDS). Pushing the LNAV switch engages the lateral steering commands. A master CDU is selected and uses ADIRU position data for navigation. VNAV is not available. Autothrottles may be available. The CDU can be used to tune the navigation radios.

During normal FMC operation, all system capabilities are contained within the FMCs. During alternate navigation operation, the CDUs use their own internal memory and computing capability. Active flight plan data from one CDU is copied to the other CDUs. Modifications display on the CDU used for the modifications. The other CDU displays the changes after execution.

All three CDUs receive inputs from the ADIRU. Usually, the left CDU provides information to the left ND map and the right CDU provides information to the right ND map. The center CDU is automatically selected after failure of the left or right CDU.

The autopilot selects a master CDU for lateral steering commands in this order:

- left CDU if functioning, then
- center CDU if functioning, then
- right CDU.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Navigation Waypoints

The CDUs do not have a performance or navigation database. The CDUs continuously copy the active route from the FMC. If both FMCs fail, the CDUs retain flight plan waypoints, except for conditional waypoints, offsets, holding patterns, and missed approach waypoints. Waypoints on the copied route can be referenced by either their identifier, or latitude and longitude.

New waypoints can only be entered in latitude and longitude. This includes waypoints the flight crew has deleted from the copied route.

Alternate Lateral Navigation

All CDU calculations are based on a great–circle course between waypoints. The CDU does not accept undefined waypoints or conditional waypoints. Complete departure or arrival/approach procedures cannot be manually entered or cross–loaded from the FMC if they contain undefined or conditional waypoints. The CDU makes a discontinuity at those waypoints. However, individual legs of a procedure can be manually entered or cross–loaded if they constitute a great–circle course.

Route Changes

Route changes are made on the ALTERNATE NAVIGATION LEGS page in almost the same manner as normal FMC operations. All courses between waypoints are direct routes. When the active waypoint is modified, the only navigational choice is present position direct to the modified active waypoint.

A route change to any one CDU displays on the other CDUs when the modification is executed.

Course Reference

The ADIRU supplies magnetic variation for present position. Only the active waypoint course can be referenced to magnetic north. All subsequent waypoint courses are true courses.

Alternate Navigation Radio Tuning

The radios must be manually tuned on left and right CDUs in alternate navigation. The left CDU tunes the left VOR, DME, ADF, and left and center ILS. The right CDU tunes the right VOR, DME, ADF, and right ILS. Manual tuning is accomplished on the ALTERNATE NAVIGATION RADIO page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Navigation CDU Pages

The alternate navigation system operates from three CDU pages:

- ALTERNATE NAVIGATION LEGS
- ALTERNATE NAVIGATION PROGRESS
- ALTERNATE NAVIGATION RADIO

Alternate Navigation Legs Page

This page displays data about each leg of the route. The route can be modified. Waypoint speed and altitude restrictions are not displayed because performance data is not available.

1 Page Title

If the ACT ALTN NAV LEGS page is modified, MOD ALTN NAV LEGS displays until the EXEC key is pushed.

2 Leg Direction

Displays course to the waypoint.

Course reference is M for magnetic, T for true.

Active waypoint leg direction can be magnetic or true. Subsequent waypoint leg directions are true.

3 Waypoint Identifier

Displays the waypoint by name or latitude/longitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Valid entries are waypoint names in the route or latitude/longitude for new waypoints.

4 Distance to Waypoint

Displays the great circle distance between waypoints.

5 Waypoint Coordinates

Displays the waypoint coordinates.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Navigation Progress Page

This page displays general data about flight progress.

1 LAST

Displays the identifier of the last waypoint.

2 TO

Displays the active waypoint on the route. The waypoint identifier displays in magenta. This distance and time to go display to the right of the waypoint.

3 NEXT

Displays the waypoint after the TO waypoint. NEXT data displays in white.

4 Destination (DEST)

Displays the identifier for the route destination waypoint or airport. Any waypoint on or off the route can be entered. Time and distance data temporarily displays for that waypoint.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display options:

- destination airport identifier; distance and time to go along track to the destination airport
- entry of an existing flight plan waypoint (identifier or latitude/longitude) causes the line title to change to ENROUTE WPT. Time and distance to go are from present position along the flight plan route to the entered waypoint
- entry of a waypoint not in the flight plan causes the line title to change to DIR TO ALTERNATE. Time and distance to go are from the present position direct to the new waypoint

5 Inertial Position (INERTIAL POS)

Displays ADIRU present position.

6 Cross Track Error (XTK ERROR)

Displays airplane left or right cross–track error in nautical miles from the active route track.

7 Altitude (ALT)

Displays airplane altitude when the LAST waypoint was crossed.

8 Time to Go (TTG)

Displays time to go to associated waypoint or destination.

9 Distance to Go (DTG)

Displays distance to go to associated waypoint or destination.

10 Ground Speed (GS)

Displays ADIRU groundspeed.

11 Track (TK)

Displays airplane track angle relative to the true or magnetic reference selected on the HEADING REFERENCE switch.

12 Desired Track (DTK)

Displays desired track angle relative to the true or magnetic reference selected on the HEADING REFERENCE switch.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alternate Navigation Radio Page

Navigation radios are tuned on this page and related parameters display. If both FMCs fail, access is by the NAV RAD key on the left and right CDUs only. Autotune is not available. The CDUs operate independently for navigation radio tuning:

- the left CDU tunes the left radios and center ILS
- the right CDU tunes the right radios

1 VOR

Displays last selected VOR frequency. Tuning status displays as manual (M).

Valid entry is VOR frequency or VOR frequency/course.

Entry tunes related DME frequency.

2 Course (CRS)

Displays selected VOR course.

Valid entry is VOR course or VOR frequency/course.

3 ADF

Displays ADF frequency. Tuning status displays as ANT or BFO.

Displays dashes if no ADF frequency entered on NAV RAD or ALTN NAV RAD pages after initial power up.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Valid entry is ADF frequency or ADF frequency suffixed with A or B. Suffix may be changed after entry.

4 ILS

Displays last selected ILS frequency, ILS frequency and course, or PARK.

Valid entries are:

- ILS frequency
- ILS frequency/front course
- front course only (a frequency must already be displayed)

Note: If the ILS was in autotune at the time of the FMC failure, the frequency and course are automatically copied to the ALTN NAV RADIO page.

Note: The ILS frequency displays PARK when no frequency is tuned. Deleting the ILS frequency parks a tuned ILS.

Note: ILS course and frequency must be entered on the left, center, and right ALTN NAV RADIO page.

The line title is L & C on the left CDU and R on the right CDU.

DME data for the ILS displays when the EFIS control panel ND mode selector is set to APP.

5 PRESELECT

Allows entry of two separate preselected frequencies and/or frequencies/courses. Valid entries are any of the entries that can be made on the other lines.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Navigation EICAS Messages

The following EICAS messages can display.

Message	Level	Aural	Message Logic
ADIRU ALIGN MODE	Memo		ADIRU is in align mode.

HL7202 - HL7734, HL7750 - HL8347

ADS-B OUT L, R	Advisory		Position data is not available to the transponder.

AIR DATA SYS	Caution	Beeper	Information from the air data sources is no longer being combined for display.
FMC	Advisory		Both FMCs have failed or FMC selector is in L with left FMC failed or in R with right FMC failed.

HL7202 - HL7205, HL8005 - HL8077, HL8226 - HL8347

FMC L, R	Advisory		Affected FMC has failed.

FMC MESSAGE	Advisory		A message is in the FMC scratchpad.

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

FMC RUNWAY DISAGREE	Caution	Beeper	Airplane is not on FMC origin runway when either engine's thrust is in the takeoff range.

GPS	Advisory		GPS has failed.
ILS ANTENNA	Caution	Beeper	Two or more ILS receivers are not using the correct antennas for best reception.

HL7202 - HL7205, HL7733 - HL8347

GPS L, R	Advisory		Left or Right GPS system failure.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
INSUFFICIENT FUEL	Advisory		When active route is not in a modified state, FMC estimated fuel at destination is less than the entered RESERVES fuel.
NAV ADIRU INERTIAL	Caution	Beeper	ADIRU is not capable of providing valid attitude, position, heading, track, and groundspeed.
NAV UNABLE RNP	Caution	Beeper	Navigation performance does not meet required accuracy during all phases of flight.
SINGLE SOURCE ILS	Caution	Beeper	Both PFDs and NDs are using the same source for ILS information.
TRANSPONDER L, R	Advisory		Affected transponder has failed.

HL7532 - HL7598

VNAV STEP CLIMB	Advisory		The airplane is 5 minutes past a step climb point and no climb has been started.

HL7202 - HL7205, HL7733 - HL8347

VNAV STEP CLIMB	Advisory		The airplane is 5 minutes past a step climb point and the difference between the CRZ ALT and the STEP TO altitude shown on VNAV cruise page is greater than 3,500 feet, and no climb has been started.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Messages

FMC messages indicate: degraded system operation, data input errors, or data link status. The messages are categorized as:

- alerting messages
- communications messages
- advisory messages
- entry–error advisory messages.

The scratchpad messages display according to their level of importance. A less important message replaces another message in the scratchpad when the CLEAR key is pushed or the condition is corrected.

The EICAS displays the advisory message FMC MESSAGE when there is an FMC alerting message. The EICAS displays the message •FMC when there is an FMC communications message. All FMC messages illuminate the CDU message (MSG) light. Clear the message or correct the condition to cancel the message.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Alerting Messages

FMC alerting messages:

- display in the CDU scratchpad
- cause the EICAS advisory message FMC MESSAGE to display
- illuminate the CDU message light (MSG).

Use the CLEAR key or correct the condition responsible for the message to remove the message. The message is temporarily removed from the scratchpad when manually entering data. The message returns when the data is removed from the scratchpad.

ALIGNMENT REINITIATED – ADIRU alignment has automatically restarted due to airplane motion, or if the flight crew–entered initial position fails the alignment comparison tests.

CHECK ALT TGT – VNAV activates when the airplane is between the MCP and FMC altitudes. VNAV maintains level flight.

CHECK AIRLINE POLICY – after loading a new airline modifiable information file, the FMC determines a parameter is invalid. The FMC uses the loaded value and notifies the flight crew of the difference. This is a maintenance function.

Note: If the scratchpad message is cleared, it does not display again for that load.

HL7202 - HL7205, HL7733 - HL8347

CONFIRM OAT – Upon engine start, a manual OAT has been entered on the THRUST LIMIT page and must be confirmed to be valid.

DESCENT PATH DELETED – VNAV active and all waypoint altitude constraints defining the descent profile deleted.

Note: This message shows when in active descent, before execution of the modification which deletes the descent path.

DISCONTINUITY – LNAV active and the route is not defined after the waypoint (except when the waypoint is before a manually terminated leg, such as FM, VM, HM legs).

- FM – a course from a fix to a flight crew entered manual route termination
- VM – a heading leg from a fix to a flight crew entered manual route termination
- HM – a holding pattern to a flight crew entered manual route termination.

DRAG REQUIRED – VNAV active and additional drag required or autothrottle off and less thrust required to maintain the VNAV descent path.

END OF OFFSET – LNAV active and two minutes prior to end of active route offset. AFDS maintains last heading if active route offset overflown.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

END OF ROUTE – LNAV active and end of active route overflown. AFDS maintains last heading.

HL7202 - HL7205, HL7733 - HL8347
ENTER CRZ ALT – The cruise altitude is required to restore the VNAV path.

ENTER INERTIAL POSITION – the flight crew–entered present position did not pass one of the ADIRU comparison checks, or the ADIRU is ready to change to navigate mode and has not received a present position entry. Use the CLEAR key to remove this message.

HL7202 - HL7205, HL7733 - HL8347
ENTER OAT – no valid temperature from the air data system during preflight initiation.

ENG OUT SID MOD – an engine failure is sensed after takeoff before the flaps are fully retracted; the FMC has automatically loaded an available engine out standard instrument departure as a route modification to the active route.

ILS TUNE INHIBIT - MCP - flight control computers inhibiting changes in ILS tuning and either a manual operation in the ILS tuning field attempted or a new arrival ILS approach activated.

INERTIAL/ORIGIN DISAGREE – the airplane is on the ground and one of these conditions exist:

- The inertial position entered on the POS INIT page differs from the position of the origin airport in the active route by more than 6 NM.
- A route is activated and executed containing an origin airport with a position that differs from the ADIRU inertial position by more than 6 NM.

INSUFFICIENT FUEL – applies to a pending activation route or to the active route in a modified state and estimated fuel at destination is less than the entered RESERVES value.

LIMIT ALT FLXXX – the flight crew– or FMC–selected altitude is greater than the VNAV limit altitude.

LNAV BANK ANGLE LIMITED - before entering or while flying a curved path or holding pattern, the FMC predicts the LNAV roll command will be limited by thrust or buffet based roll limits.

NAV DATA OUT OF DATE – the clock calendar date is after the active navigation database valid calendar cycle.

NAV INVALID–TUNE XXXX – RNAV or VOR approach procedures must have a specific navaid tuned. It is either not tuned or a valid signal is not being received.

NO ACTIVE ROUTE – LNAV selected and no active route activated.

NO ROUTE DATA – in ALTN NAV, LNAV selected and the CDU does not have an active lateral route.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

PERF/VNAV UNAVAILABLE – VNAV selected and gross weight, cost index, or cruise altitude are not entered.

RESET MCP ALT – 2 minutes prior to the top of descent point with VNAV active and MCP not set to altitude below cruise altitude.

RTA FIX DELETED – RTA fix has been deleted from the modified flight plan.

RW/ILS CRS ERROR –

- the airplane is within ILS automatic tuning range and the tuned ILS course does not match the course for the active arrival runway, or
- the FMC is not receiving valid course data from the same ILS the FMC is using for frequency data
- inhibited if scratchpad message ILS TUNE INHIBITED–MCP displayed.

RW/ILS FREQ ERROR –

- the airplane is within ILS automatic tuning range and the tuned ILS frequency does not match the frequency for the active arrival runway, or
- the FMC is not receiving valid frequency data from either ILS
- inhibited if scratchpad message ILS TUNE INHIBITED – MCP displayed.

SINGLE FMC L OPERATION – the right FMC is not operational.

SINGLE FMC R OPERATION – the left FMC is not operational.

TAKEOFF SPEEDS DELETED – selected V speeds are invalid.

THRUST REQUIRED – VNAV active, autothrottle disconnected, and additional thrust required to track VNAV descent path and maintain speed.

UNABLE FLXXX AT RTA FIX – predicted crossing altitude at RTA fix less than FLXXX, but predicted ETA within tolerance.

UNABLE HOLD AIRSPACE - the radius of the holding pattern calculated by the FMC exceeds the FMC maximum protected airspace limits.

UNABLE RTA – RTA not achievable within applicable arrival time tolerance.

UNABLE NEXT ALT – VNAV active and climb not sufficient to comply with waypoint altitude constraint.

VERIFY POSITION – the FMC calculation of airplane present position is based on conflicting data. The possible conflicts are:

- the primary and secondary FMC positions differ by more than the greater of RNP or 0.4 NM for 5 seconds, or
- the difference between the FMC and the navigation aid being used (GPS, DME, VOR, or inertial) positions is greater than 12NM for 5 seconds

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

- the FMC has detected an error in velocity between the ADIRU and the GPS.

HL7202 - HL7205, HL7733 - HL8347

Note: The error in velocity between the ADIRU and the GPS can be observed by erratic groundspeed and/or wind velocity on the ND.

VERIFY RNP – POS REF 2/3 – the default RNP has changed due to a change in flight phase and the flight crew entered RNP value exceeds the new default RNP value.

HL7202 - HL7205, HL7782 - HL8347

VERIFY VERT RNP – PROG 4 – the manually entered vertical RNP exceeds the default vertical RNP value for the current navigation phase of flight.

VIA OFFSET INVALID – flight conditions invalidate the modification with a divert to an alternate airport via OFFSET.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Communications Messages

FMC communications messages:

- display in the CDU scratchpad
- cause the EICAS communications message •FMC to display
- illuminate the CDU message light (MSG)
- cause the communications aural high–low chime to sound

ALTN UPLINK – Up to four company–preferred alternate airports and associated data has been received and is available for preview on the ALTN page.

ALTN INHIBIT UPLINK – uplink contains two airports for the ALTN page 1/2 ALTN INHIB line.

ALTN LIST UPLINK – a company list of up to 20 alternate airports has been received and is available on the ALTN LIST page.

DES FORECST 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.

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.

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.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Advisory Messages

FMC advisory messages display:

- on the CDU scratchpad
- and illuminate the CDU message light (MSG)

DELETE – DELETE key pushed.

HOLD AT XXXX – a waypoint not contained in the active route is entered into the HOLD AT box on the RTE LEGS page, after selection of the HOLD function key. Selection of HOLD AT XXXX into a RTE LEGS page waypoint line makes a holding fix at the XXXX waypoint.

INVALID ALTN UPLINK – a company–preferred list of alternate airports and associated alternate data has been received; the data is not valid and cannot be displayed.

INVALID ALTN LIST UPLINK – a company list of up to 20 alternate airports has been received; the data is not valid and cannot be displayed.

INVALID FLT NO UPLINK – a new flight number has been received; the data is not valid and cannot be displayed.

INVALID FORECAST UPLINK – descent forecast data has been received; the data is not valid and cannot be displayed.

INVALID PERF INIT UPLINK – performance initialization data has been received; the data is not valid and cannot be displayed.

INVALID ROUTE UPLINK – a new flight plan route or modification to the active flight plan route has been received; the data is not valid and cannot be displayed.

INVALID TAKEOFF UPLINK – takeoff data for up to six runways or runway–intersection pairs has been received; the data is not valid and cannot be displayed.

INVALID WIND DATA UPLINK – enroute wind data has been received; the data is not valid and cannot be displayed.

MAX ALT FLXXX – the altitude entry on any CDU page is above the performance calculated maximum altitude.

NOT ON INTERCEPT HEADING – LNAV selected and the airplane is outside active capture criteria and the present heading will not intercept the active leg.

ROUTE X UPLINK LOADING – a new flight plan route or modification to the active flight plan route has been received and is being loaded after flight crew selection of the LOAD prompt.

STANDBY ONE – the FMC requires more than 4 seconds to display data.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7733 - HL8347

STEEP DES AFTER XXXXXXX - flight plan has a descent path angle greater than 6 degrees in MOD or ACTIVE states.

TIMEOUT–RESELECT – communication between the FMC and the CDU has failed. The flight crew must reselect FMC on the CDU MENU page.

UNABLE CRZ ALT – performance predicts a zero cruise time at the entered cruise altitude.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

FMC Entry Error Messages

FMC entry–error messages:

- display in the CDU scratchpad
- illuminate the CDU message light (MSG)
- push the CLEAR key to remove the message before any data can be entered into the scratchpad

ARR N/A FOR RUNWAY – the runway/approach selected is not compatible with arrival selected.

CRS REVERSAL AT FA FIX – a conflict exists between the default final approach (FA) waypoint (result of a runway or VFR approach selection) and the flight plan before it.

ILS TUNE INHIBITED – MCP – ILS tuning is inhibited with the:

- autopilot engaged, and localizer or glideslope captured
- only the flight director is engaged and either the localizer or the glideslope is captured, and the airplane is below 500 feet radio altitude

Any attempt to manually change the ILS frequency or select another ILS approach on the CDU displays this message. To make the necessary changes:

- above 1500 feet radio altitude – deselect approach on the MCP
- below 1500 feet radio altitude – select TO/GA

or,

- disengage the autopilot
- turn both flight directors OFF, and
- turn at least one flight director ON

INVALID DELETE – deletion of selected data is not allowed.

INVALID ENTRY – entry format or range is incorrect for the selected field or the entered airway or TO waypoint does not coincide with the navigation database.

NOT IN DATABASE – data is not in the route or the navigation database.

ROUTE FULL – the route is filled to the allowable capacity. Allowable capacity is 150 waypoint entries.

RUNWAY N/A FOR SID – selected runway not compatible with SID.

TAKEOFF FLAPS DELETED – the FMC has deleted the takeoff flap setting on the TAKEOFF REF page. This occurs when the THRUST REDUCTION value is changed to the same value as the takeoff flap setting.

STANDBY ONE – the FMC temporarily prevents further CDU inputs.

UNABLE TO SEND MSG – the selected data link message cannot be transmitted.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

V–SPEEDS UNAVAILABLE – for certain high thrust/low gross weight or low thrust/high gross weight takeoff conditions, FMC V–speeds are not calculated. Adjust gross weight and/or takeoff thrust limit to enable V–speed calculations.

VERIFY RNP ENTRY – the entered RNP value is greater than the default RNP value for the present flight phase or, less than the present Actual Navigation Performance.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

CDU Annunciator Lights

These annunciator lights illuminate when certain conditions exists.

DSPY – a flight plan modification is pending and the RTE, RTE LEGS, RTE DATA, or RTE HOLD page not containing the active leg or route segment is displayed, or a VNAV page (CLB, CRZ, or DES) not corresponding to the active VNAV mode is displayed.

OFST – an offset path has been entered and executed.

MSG – an FMC message is waiting to display or is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 12.10
Fuel System 12.10.1
Fuel Jettison System. 12.10.2
Fuel Indications 12.10.3
Normal Fuel Indications 12.10.3
Expanded Fuel Indications 12.10.4
Fuel Jettison Indications 12.10.5
EICAS Fuel Synoptic Display 12.10.6

System Description 12.20
Introduction 12.20.1
Fuel Tank Locations and Capacities 12.20.1
Fuel Tank Locations 12.20.1
Fuel Tank Capacities 12.20.1
Fuel Quantity 12.20.2
Fuel Temperature 12.20.2
Nitrogen Generation System (NGS) 12.20.2
Fuel Pumps. 12.20.2
Fuel Pump Operations 12.20.3
Suction Feed. 12.20.4
Fuel Crossfeed and Fuel Imbalance 12.20.4
Fuel System Schematic 12.20.5
APU Fuel Feed. 12.20.6
Fuel Jettison 12.20.6
Fuel Jettison Schematic 12.20.7

EICAS Messages 12.30
EICAS Alert Messages 12.30.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Fuel System

1 Fuel PUMPS Switches

ON – the fuel pump is commanded on.

2 Forward and Aft Fuel Pumps Pressure (PRESS) Lights

Illuminated (amber) – fuel pump output pressure is low.

3 Center Fuel Pumps Pressure (PRESS) Lights

Illuminated (amber) –

- fuel pump output pressure is low with the pump commanded on
- illumination is inhibited when the center tank fuel pump switch is off

4 Fuel CROSSFEED Switches

On (bar visible) – the crossfeed valve is commanded open.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 Fuel Crossfeed VALVE Lights

Illuminated (amber) – the crossfeed valve is not in the commanded position.

Fuel Jettison System

1 Fuel Jettison NOZZLE Switches

ON – in flight, with the Fuel Jettison Arm switch in ARMED, and the total fuel quantity is greater than the fuel -to-remain:

- the center tank fuel jettison isolation valves, the main tank jettison pumps, and the fuel jettison nozzle valves are commanded by the fuel jettison to jettison fuel
- when both CENTER PUMPS switches are off, fuel will not be jettisoned from the center tank

2 Fuel Jettison Nozzle VALVE Lights

Illuminated (amber) – the jettison nozzle valve is not in the commanded position.

3 Fuel Jettison ARM Switch

ARMED –

- arms the fuel jettison system
- sets the fuel–to–remain to the maximum landing weight (MLW) quantity

4 Fuel Jettison FAULT Light

Illuminated (amber) –

- a fuel jettison system fault has occurred
- the fuel jettison system is inoperative

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

5 FUEL TO REMAIN Selector

PULL ON –

- changes the mode from MLW to MAN
- rotate (spring loaded to 12 o'clock position) –
  - (first detent) – decreases (DECR) or increases (INCR) the MAN fuel–to–remain quantity at the slow set rate
  - (second detent) – decreases (DECR) or increases (INCR) the MAN fuel–to–remain quantity at the fast set rate

Off– sets the fuel–to–remain to the FMC maximum landing weight (MLW) fuel quantity.

Fuel Indications
Normal Fuel Indications

1 Normal Fuel Indications

Total fuel quantity (pounds x 1000).

- (white) - FMC estimated fuel at the destination is sufficient.
- (amber) - FMC estimated fuel at the destination is less than the entered reserves fuel.

Fuel temperature (degrees Celsius).

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Expanded Fuel Indications

1 Expanded Fuel Indications

The expanded FUEL QUANTITY display (left main, center, and right main tank quantities) appears for any of the following conditions:

- one or both crossfeed valves open
- one or more fuel tank quantity indications are inoperative
- the FUEL IN CENTER alert message is displayed (center tank quantity is amber)
- the FUEL QTY LOW alert message is displayed (low main tank quantity is amber)
- the FUEL IMBALANCE alert message is displayed
- the airplane is on the ground and one or both engine(s) off
- the FUEL FLOW ENG L, R alert message is displayed

2 Fuel Imbalance Indications

A fuel imbalance pointer is displayed on the expanded fuel quantity display next to the low tank quantity for the following imbalance conditions.

A solid white pointer is displayed if:

- main tank fuel differs more than 1000 pounds
- main tank fuel differs more than 200 pounds and a crossfeed valve is open.

A solid amber fuel imbalance pointer replaces the white pointer if the FUEL IMBALANCE message is displayed.

The difference in fuel quantity which causes the FUEL IMBALANCE message to be displayed varies with total main tank fuel quantity.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The fuel imbalance pointer flashes if fuel balancing is going in the wrong direction.

When fuel is back in balance within 200 pounds between the main tanks – FUEL BALANCED replaces FUEL QTY on the expanded fuel quantity display and flashes for 5 seconds.

Fuel Jettison Indications

1 Fuel Jettison Indications

Fuel to remain (MLW displayed - white):

- fuel jettison system is ARMED
- the fuel to remain defaults to the fuel quantity that results in maximum airplane landing weight (including any difference between TOTALIZER and CALCULATED fuel) when jettison is complete
- the fuel to remain display replaces the fuel temperature display - magenta

Fuel to remain (MAN displayed - amber):

- fuel jettison system is ARMED
- the FUEL TO REMAIN selector is pulled on
- the quantity to remain can be changed by rotating the FUEL TO REMAIN selector to the slow or fast rate position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Fuel Synoptic Display

The EICAS fuel synoptic is displayed by pushing the FUEL Synoptic switch on the Display Select panel. Display Select panel operation is described in Chapter 10, Flight Instruments, Displays.

Fuel flow bars are displayed from a configuration of valve positions, switch positions, and pump status. Actual fuel flow and fuel pressure is not sensed or displayed, therefore fuel flow bars do not represent actual system operation.

The EICAS fuel synoptic display of valve, pump, and fuel flow bars are not included in the MMEL or the DDG. The EICAS fuel synoptic display of valve, and pump positions and status is not required for any flight crew normal or non-normal procedure.

1 APU DC Fuel Pump

Status of the APU DC fuel pump.

2 Main Tank Jettison Fuel Pumps

Status of the main tank jettison pump.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Center Tank Jettison Fuel Valves

Position of the center tank jettison valve.

4 Fuel Jettison NOZZLE Valves

Position of the fuel jettison nozzle valve.

5 Fuel temperature

Minimum (MIN) FUEL Temperature (TEMP) - white

- refer to Chapter 11, Flight Management, Navigation, Section 40, for description of minimum fuel temperature
- minimum fuel temperature display is invalid - blank

FUEL Temperature (TEMP) - temperature of the left main tank fuel

- normal temperature range - white
- high temperature - amber with "+"
- low temperature - amber with "-"
- fuel temperature display is invalid - blank

6 Fuel jettison indications

Fuel TO REMAIN lbs (kg)

- maximum landing weight (MLW) - white
- manual (MAN) - amber

Jettison (JET) TIME minutes (MIN) - white

7 Engine Fuel Valves

Position of the engine fuel valve.

8 Spar Fuel Valves

Position of the spar fuel valve.

9 FUEL BALANCED

When fuel balance is re-established, the fuel balance indication flashes for five seconds when the fuel is within 200 lbs (100 kgs) of balanced fuel - white

10 CROSS FEED Fuel Valves

Position of the cross feed fuel valve.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

11 Fuel imbalance pointer

Points toward the main tank with the lower quantity

- main tank fuel differs more than 1,000 lbs (500 kgs) - white
- a cross feed switch is on and main tank fuel differs more than 200 lbs (100 kgs) - white
- if EICAS advisory message FUEL IMBALANCE is displayed - amber
- if fuel balancing is going the wrong direction - flashing amber

12 Main Tank Fuel Pumps

Status of the main tank fuel pump.

13 Center Tank Override/Jettison Fuel Pumps

Status of the override/jettison fuel pump.

14 Configuration for fuel flow bars

- pressure flow - green
- suction flow - amber

Position of fuel system valves are displayed as:

- open - green circle with bars in-line with flow
- closed - white circle with bars across flow
- valve in transit - green circle with white bars
- failed open - amber valve open symbol with amber X
- failed closed - amber valve closed symbol with amber X
- valve position data is not available - white circle with no bars
- valve not in commanded position - amber valve symbol with amber X

Operating status of the main tank fuel pumps, center tank override/jettison fuel pumps, jettison fuel pumps, and the APU DC fuel pump is displayed as:

- powered and low pressure is not detected - green
- not powered or pump status is not available - white
- pump switch is ON and low pressure is detected or pump is failed - amber with amber X
- power or pump pressure is invalid - gray

Fuel quantity is displayed as:

- normal indication - white
- if EICAS advisory message FUEL IN CENTER is displayed - amber
- if EICAS advisory message FUEL LOW CENTER is displayed - amber
- if EICAS caution message FUEL QTY LOW is displayed - amber

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- if EICAS advisory message INSUFFICIENT FUEL is displayed - amber
- invalid fuel quantity indication - blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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, for a description of the engine fuel system.

Fuel Tank Locations and Capacities

Fuel Tank Locations

Fuel Tank Capacities

HL7532 - HL7766

Tank	Gallons	Pounds *
Left Main	9,560	64,100
Right Main	9,560	64,100
Center	26,100	174,900
Total	45,220	303,100
*Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.		

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL7782 - HL8347

Tank	Gallons	Pounds *
Left Main	10,300	69,000
Right Main	10,300	69,000
Center	27,290	182,800
Total	47,890	320,800
*Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.		

Fuel Quantity

Fuel quantity is measured by sensors in each tank. Total fuel quantity is displayed on the primary EICAS display. Tank quantities and total fuel quantity are displayed on the FUEL synoptic display.

Expanded fuel indications showing the left main, center, and right main tank quantities are displayed when non-normal conditions occur.

Fuel Temperature

Fuel temperature is displayed on the primary EICAS display. The temperature is normally displayed in white. It is displayed in amber when the fuel temperature approaches the fuel freeze temperature entered in the flight management system CDU. During jettison, the TO REMAIN quantity replaces the EICAS display fuel temperature indication.

Fuel temperature and minimum fuel temperature are also displayed on the fuel synoptic display.

Nitrogen Generation System (NGS)

HL7202 - HL7205, HL7782 - HL8347

The NGS converts bleed air to nitrogen-enriched air to reduce flammability of center wing tank fuel during all phases of flight and for a brief period after landing. To reduce bleed air demand NGS is shut down for engine out operation. NGS is also shut down when the Equipment Cooling switch is off or a Cargo Fire Arm switch is ARMED.

Fuel Pumps

Each fuel tank contains two AC–powered fuel pumps. A single pump can supply sufficient fuel to operate one engine under all conditions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The two center tank fuel pumps are override/jettison pumps. The pumps have higher output pressure than the left and right main tank fuel pumps. The center tank override/jettison pumps override the main tank pumps so the center tank fuel is used before wing tank fuel.

The center tank fuel pumps will shut off automatically after 15 seconds of continuous low pressure. Automatic center tank fuel pump shutoff is inhibited during jettison.

When the main tank fuel pump switches are off, the switch PRESS lights illuminate and the EICAS advisory messages FUEL PUMP (L, R, FWD, or AFT) display. When the center fuel pump switches are off, the switch PRESS lights and pump pressure EICAS messages are inhibited.

On the ground, both center fuel pumps operate only when two electrical power sources are available. With only one power source available and the center fuel pump switches on, the switch PRESS light on the non–powered side is illuminated and the pump pressure EICAS message is inhibited.

The left main tank contains a DC–powered fuel pump. It has no controls or indicators, other than the fuel synoptic display. The DC pump operates automatically to provide fuel to the APU when AC power is not available and the APU selector is ON.

Surge tanks are provided in each wing, outboard of each main tank. Fuel in the surge tanks and fuel remaining in the refueling manifold is drained into the main tanks.

Fuel Pump Operations

During flight, the FUEL IN CENTER message displays when both center fuel pump switches are off with fuel in the center tank. The FUEL LOW CENTER message displays when one or both center pump switches are ON and center tank quantity is low.

If a center pump has low output pressure, the fuel pump switch PRESS light illuminates and the message FUEL PUMP CENTER (L or R) displays.

Center Tank Fuel Scavenge System
HL7202 - HL7205, HL7751 - HL8347

The fuel scavenge system uses the main tank fuel jettison pumps to transfer the fuel remaining in the center tank when the center tank pumps are not operating.

To ensure the non-normal procedure FUEL LEAK may be accomplished, fuel scavenge is inhibited for 45 minutes after the FUEL CENTER PUMPS switches are Off.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Center Tank Fuel Scavenge System
HL7532 - HL7750

When the main tank pumps are operating the fuel scavenge system transfers the fuel remaining in the center tank into the main tanks.

Suction Feed

When main tank fuel pump pressure is low, each engine can draw fuel from its corresponding main tank through a suction feed line that bypasses the pumps. As the airplane climbs, dissolved air is released from the fuel in the tank due to the decrease in air pressure. This air may collect in the suction feed line and restrict fuel flow. At high altitude, thrust deterioration or engine flameout may occur as a result of the fuel flow reduction.

The dissolved air in the fuel tank will eventually deplete after reaching cruise altitude. The depletion time is dependent upon airplane altitude, fuel temperature, and type of fuel. Once the dissolved air is depleted, the engine should effectively operate on suction feed.

Fuel pressure can be provided from a main tank with operating fuel pumps to both engines by opening the fuel crossfeed valve(s). Continued crossfeed use will result in a progressive fuel imbalance.

Fuel Crossfeed and Fuel Imbalance

The fuel crossfeed system enables fuel to be supplied to either engine from any fuel tank. With both crossfeed valves closed, the left and right fuel tank to engine systems are isolated. With at least one crossfeed valve open in any phase of flight, fuel feed to either engine can be supplied from the opposite fuel tank.

If the fuel quantity in left and right main tanks differ by an excessive quantity, the EICAS alert message FUEL IMBALANCE is displayed.

If a fuel crossfeed valve position does not agree with the switch position, the CROSSFEED switch VALVE light illuminates and the EICAS advisory message FUEL CROSSFEED is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Fuel System Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

APU Fuel Feed

APU fuel is supplied from the left fuel manifold. APU fuel can be provided by any AC fuel pump supplying fuel to the left fuel manifold or by the left main tank DC fuel pump.

On the ground, with the APU switch ON and no AC power available, the DC pump runs automatically. With AC power available, the left forward AC fuel pump operates automatically, regardless of fuel pump switch position, and the DC fuel pump turns off.

In flight, the DC fuel pump operates automatically for quick left engine relight with the loss of both engines and all AC power.

Fuel Jettison

The fuel jettison system allows jettison from all fuel tanks. Fuel is jettisoned through jettison nozzle valves inboard of each aileron. Jettison pumps in the main tanks and override/jettison pumps in the center tank pump fuel overboard through the jettison nozzle valves.

Fuel jettison is initiated by pushing the FUEL JETTISON ARM switch to select ARMED. The jettison system automatically sets the fuel–to–remain to the MLW fuel quantity. The TO REMAIN quantity replaces fuel temperature on the EICAS display.

Pull on and rotate the FUEL TO REMAIN selector to manually decrease or increase the TO REMAIN quantity.

Main tank jettison begins when:

- the FUEL JETTISON NOZZLE switches are pushed ON
- the jettison nozzle valves open, and
- the main tank jettison pumps operate.

If the center tank override/jettison pumps are on, center tank fuel also jettisons. Center tank fuel will not jettison if the center tank override/jettison pumps are off.

The nozzles cannot open on the ground, regardless of switch positions.

In flight, jettison time displays in minutes on the fuel synoptic when the FUEL JETTISON ARM switch is ARMED. Jettison time increases with an increase in altitude. Jettison automatically stops when a value just above the TO REMAIN quantity is reached. The system shuts off the main tank jettison pumps and closes the center tank jettison isolation valves.

When the airplane is heavy and loaded near the forward CG, fuel is jettisoned from the center tank first to keep CG within limits; main tank jettison pump operation is delayed. The computed jettison time is automatically adjusted to reflect the increased jettison time.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7783
At least 11,500 pounds of fuel remains in each main tank after jettison is complete.

HL7202 - HL7205, HL8005 - HL8347
At least 8,500 pounds of fuel remains in each main tank after jettison is complete.

Fuel Jettison Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Alert Messages

Message	Level	Aural	Message Logic
FUEL AUTO JETTISON	Caution	Beeper	Total fuel quantity is less than or equal to the selected TO REMAIN quantity and a nozzle valve is open, or the fuel jettison automatic shutoff is failed.
FUEL CROSSFEED AFT, FWD	Advisory		Crossfeed valve is not in the commanded position.
FUEL DISAGREE	Advisory		Totalizer fuel quantity and FMC calculated fuel quantity disagree.
FUEL FLOW ENG L, R	Advisory		Engine fuel flow is abnormally high.
FUEL IMBALANCE	Advisory		Fuel imbalance between the main tanks is excessive.
FUEL IN CENTER	Advisory		Both center fuel pump switches are off with fuel in the center tank.
FUEL JETT NOZZLE L, R			Jettison nozzle valve in not in the commanded position.
FUEL JETTISON MAIN	Advisory		Fuel jettison from the main tanks is inoperative.
FUEL JETTISON SYS	Caution	Beeper	Fuel jettison system is inoperative.
FUEL LOW CENTER	Advisory		One or both CENTER PUMPS switches are ON and center tank quantity is low.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
FUEL PRESS ENG L, R	Caution	Beeper	Engine is on suction feed.
FUEL PRESS ENG L+R	Advisory		Fuel pressure to both engines is low on the ground with the engines shut down.
FUEL PUMP CENTER L, R	Advisory		Center fuel pump output pressure is low.
FUEL PUMP L AFT, FWD	Advisory		Left aft or forward fuel pump output pressure is low.
FUEL PUMP R AFT, FWD	Advisory		Right aft or forward fuel pump output pressure is low.
FUEL QTY LOW	Caution	Beeper	Fuel quantity is low in either main tank.

HL7532 - HL7766

FUEL SCAVENGE SYS	Advisory		Either main tank is less than 14,000 lbs and the center tank quantity is greater than 500 lbs for 15 minutes.

HL7202 - HL7205, HL7782 - HL8347

FUEL SCAVENGE SYS	Advisory		Either main tank is less than 18,000 lbs and the center tank quantity is greater than 500 lbs for 15 minutes.

FUEL TEMP LOW	Advisory		Fuel temperature is approaching minimum.
FUEL VALVE APU	Advisory		APU fuel valve is not in the commanded position.
INSUFFICIENT FUEL	Advisory		FMC-estimated fuel at destination is less then entered RESERVES fuel.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 13.10
Hydraulic Panel 13.10.1
Hydraulic System Indications 13.10.3
Status Display 13.10.3
Hydraulic Synoptic Display 13.10.4
Miscellaneous Hydraulic System Controls 13.10.5
Engine Fire Panel 13.10.5
Flight Control Hydraulic Power Switches 13.10.5

System Description 13.20
Introduction 13.20.1
Left and Right Hydraulic Systems 13.20.1
Left and Right Hydraulic System Primary Pumps 13.20.1
Left and Right Hydraulic System Demand Pumps 13.20.1
Center Hydraulic System 13.20.2
Center Hydraulic System Primary Pumps 13.20.2
Center Hydraulic System Demand Pumps 13.20.2
Center Hydraulic System Non–Normal Operation 13.20.3
Ram Air Turbine (RAT) 13.20.3
Hydraulic Systems Schematic 13.20.4

EICAS Messages 13.30
EICAS Alert Messages 13.30.1

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Hydraulic Panel

1 RAM AIR TURBINE (RAT) Switch

Push – deploys the RAT.

2 Ram Air Turbine Pressure (PRESS) Light

Illuminated (green) –

- the RAT is deployed
- center system primary flight control hydraulic pressure is greater than 1500 psi

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Ram Air Turbine (UNLKD) Light

Illuminated (amber) – the RAT is not in the stowed position.

4 Left/Right Engine (L/R ENG) PRIMARY Pump Switches

ON – the engine–driven hydraulic pump pressurizes the related left or right hydraulic system when the engine rotates.

Off (ON not visible) – the engine–driven hydraulic pump is turned off and depressurized.

5 C1/C2 Electrical (C1/C2 ELEC) PRIMARY Pump Switches

ON –

- the electric motor–driven hydraulic pump operates
- pressurizes the center hydraulic system

Off (ON not visible) – the electric motor–driven hydraulic pump is turned off.

6 Primary Pump FAULT Lights

Illuminated (amber) –

- low primary pump pressure
- excessive primary pump fluid temperature, or
- pump selected OFF

7 DEMAND Pump Selectors

ON – the pump runs continuously.

AUTO – the pump operates when system and/or primary pump(s) pressure is low, or when control logic anticipates a large system demand.

OFF – the pump is off.

Note: If both air-driven pumps are selected to ON, only air-driven pump C1 operates. The two air-driven pumps cannot operate simultaneously when selected to ON.

8 Demand Pump FAULT Lights

Illuminated (amber) –

- low demand pump output pressure
- excessive demand pump fluid temperature, or
- demand pump is selected OFF

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Hydraulic System Indications

To view the status display, push the STAT display switch on the display select panel. To view the hydraulic synoptic, push the HYD synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

Status Display

1 Hydraulic Display

QTY –

- displays system reservoir quantity as a percentage of the normal service level (1.00 is the normal service level)
- LO (amber) – displayed when the reservoir quantity is low
- OF (white) – displayed when the reservoir is over–full (inhibited in flight)
- RF (white) – displayed when the reservoir requires refilling (inhibited in flight)

PRESS – displays hydraulic pressure in pounds per square inch of the pump with the highest pressure.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Hydraulic Synoptic Display

MULTIFUNCTION DISPLAY

AIR – air–driven pump
ELEC – electric–driven pump
ENG – engine–driven pump
ISLN – isolation valve
LO – reservoir quantity low
OF – reservoir quantity over–full
OVHT – pump overheat indication
RAT – ram air turbine pump
RF – reservoir requires refilling
SOV – shutoff valve

Status of the hydraulic pumps, system valves and RAT are displayed as:

- pressurized - wide green line
- unpressurized - thin white line
- flow direction- green arrow head
- hydraulic system valves not in the commanded position-amber X in the circle
- hydraulic system valves with valve sensor data not valid - valve symbol is low intensity white
- for hydraulic pumps that are commanded on and the pump pressure low-amber X in the box symbol

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- for hydraulic pumps that are commanded on and the pump sensor indicates normal pressure - green flow line through the pump
- for the activated RAT and pressure low- amber X in the box
- for the activated RAT and pressure sensor data not valid - RAT symbol is low intensity white

Miscellaneous Hydraulic System Controls
Engine Fire Panel

1 Engine Fire Switches

Pull –

- closes the engine–driven pump hydraulic supply shutoff valve
- depressurizes the engine–driven pump

Flight Control Hydraulic Power Switches

Note: No flight crew normal or non–normal procedures require operation of the flight control shutoff switches. These switches are for ground maintenance use only.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Flight Control Hydraulic Power Shutoff Switches

NORM – hydraulic system power is available to the flight control actuators.

SHUT OFF – hydraulic system power to the flight control actuators is shut off.

Note: In flight, the center system flight control shut off valves are isolated from electrical power and cannot be closed.

2 Flight Control Hydraulic Power VALVE CLOSED Lights

Illuminated (amber) – any time the valves are not fully open.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The airplane has three independent hydraulic systems: left, right, and center. The hydraulic systems power the:

- flight controls
- leading edge slats
- trailing edge flaps
- landing gear
- wheel brakes
- nose and main gear steering
- thrust reversers

Flight control system components are distributed so that any one hydraulic system can provide adequate airplane controllability.

Hydraulic fluid is supplied to each hydraulic pump from the associated system reservoir. The reservoirs are pressurized by the bleed air system.

Left and Right Hydraulic Systems

The left and right hydraulic systems are identical. They differ only in the components they power.

The left hydraulic system powers:

- flight controls
- the left engine thrust reverser

The right hydraulic system powers:

- flight controls
- normal brakes
- the right engine thrust reverser

Left and Right Hydraulic System Primary Pumps

The left and right hydraulic systems each have a primary pump. The left and right primary pumps are engine–driven by the related left and right engines.

Left and Right Hydraulic System Demand Pumps

The left and right hydraulic systems each have a demand pump. The demand pumps are electric motor–driven. The demand pumps provide supplementary hydraulic power for periods of high system demand. The demand pumps also provide a backup hydraulic power source for the engine–driven primary pumps.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The pumps are controlled by the DEMAND L and R pump selectors. In the AUTO position, the L and R demand pumps operate for takeoff, landing, and when system or primary pump pressure is low. In the ON position, the demand pump runs continuously.

Note: In the AUTO position the right demand pump operates continuously when the airplane is on the ground.

Center Hydraulic System

The center hydraulic system powers:

- flight controls
- leading edge slats
- trailing edge flaps
- landing gear actuation
- alternate brakes
- nose gear steering
- main gear steering

Center Hydraulic System Primary Pumps

Two electric motor–driven primary pumps are the primary hydraulic power sources for the center hydraulic system. The PRIMARY C1 and C2 pump switches control pump operation.

On the ground:
With only a single ground power source, including the APU, the C2 pump does not run if the C1 pump is selected. The pump is not load shed if one engine generator is operating, or the following sources are operating:

- primary external power and secondary external power
  or
- APU generator and primary external power

In flight:
The C2 pump may be load shed by the electrical load management system when the following conditions exist:

- all other electric pumps are running
- there is a single source of electrical power
- generator capacity is exceeded

The pump starts automatically when the conditions that shed the pump no longer exist.

Center Hydraulic System Demand Pumps

The center hydraulic system has two air–driven demand pumps. The demand pumps provide supplementary hydraulic power for periods of high system demand. The demand pumps also provide a backup hydraulic power source for the center system electric motor–driven primary pumps.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The pumps are controlled by the DEMAND C1 and C2 pump selectors. In the AUTO position, a demand pump operates when system and/or primary pumps pressure is low, or when system logic anticipates a large demand. In the ON position, the demand pump runs continuously. Selecting both demand pumps ON results in only pump C1 operating. Both pumps cannot operate simultaneously when ON is selected for both pumps.

Center Hydraulic System Non–Normal Operation

If center hydraulic system quantity is sensed to be low and airspeed is greater than 60 knots the:

- alternate brakes are isolated from the center system and remain operable using reserve fluid
- nose gear actuation and steering are isolated and inoperative
- leading edge slats are isolated and not allowed to operate in the primary (hydraulic) mode

The leading edge slats are reconnected to the center hydraulic system and allowed to operate in primary mode when:

- center hydraulic fluid quantity recovers to normal for 5 seconds, and
- the system determines that both engines have been running for more than 30 seconds

Nose gear actuation and steering are reconnected when:

- airspeed decreases below 60 knots, or
- hydraulic pressure to the center system flight controls is low, or
- the landing gear is selected down, both engines are normal, and both engine–driven pumps are providing pressure

Ram Air Turbine (RAT)

The RAT, when deployed, provides hydraulic power only to the primary flight control components connected to the center hydraulic system. The RAT provides hydraulic and electrical power throughout the flight envelope. In flight, the RAT deploys automatically if:

- both engines are failed and center system pressure is low, or
- both AC transfer busses are unpowered, or
- all three hydraulic system pressures are low

The RAT can be deployed manually by pushing the RAM AIR TURBINE switch. The hot battery or APU battery bus must be powered. The RAT is deployed by a compressed spring. Once deployed, the RAT cannot be stowed in flight.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Hydraulic Systems Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Alert Messages

Message	Level	Aural	Message Logic
HYD AUTO CONTROL C	Advisory		Both center demand pump AUTO functions and all center hydraulic system indications are inoperative.
HYD AUTO CONTROL L, R	Advisory		Demand pump AUTO function and all left or right system indications are inoperative.
HYD OVERHEAT DEM C1, C2, L, R	Advisory		Demand pump temperature is high.
HYD OVERHEAT PRI C1, C2, L, R	Advisory		Primary pump temperature is high.
HYD PRESS DEM C1, C2, L, R	Advisory		Demand pump output pressure is low when commanded on.
HYD PRESS PRI C1, C2	Advisory		Primary pump output pressure is low.
HYD PRESS PRI L, R	Advisory		Primary pump output pressure is low.
HYD PRESS SYS C	Caution	Beeper	Center hydraulic system pressure is low.
HYD PRESS SYS L	Caution	Beeper	Left hydraulic system pressure is low.
HYD PRESS SYS L+C	Caution	Beeper	Left and center hydraulic system pressures are low.
HYD PRESS SYS L+R	Caution	Beeper	Left and right hydraulic system pressures are low.
HYD PRESS SYS L+C+R	Caution	Beeper	All hydraulic system pressures are low.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
HYD PRESS SYS R	Caution	Beeper	Right hydraulic system pressure is low.
HYD PRESS SYS R+C	Caution	Beeper	Right and center hydraulic system pressures are low.
HYD QTY LOW L, R, C	Advisory		Hydraulic quantity is low.
HYD QTY LOW L+C	Caution	Beeper	Left and center hydraulic system quantities are low.
HYD QTY LOW L+C+R	Caution	Beeper	All three hydraulic system quantities are low.
HYD QTY LOW L+C+R	Caution	Beeper	All three hydraulic system quantities are low.
HYD QTY LOW L+R	Caution	Beeper	Left and right system quantities are low.
HYD QTY LOW R+C	Caution	Beeper	Right and center system quantities are low.
RAT UNLOCKED	Advisory		RAT is not stowed and locked.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 14.10
Landing Gear Panel 14.10.1
Nose Wheel Steering Tiller 14.10.2
Brake System 14.10.3
Rudder/Brake Pedals 14.10.3
Parking Brake Lever 14.10.3
Brake Accumulator Pressure Indicator 14.10.4
Landing Gear System Indications 14.10.5
Landing Gear Position Indications 14.10.5
Gear Synoptic Display 14.10.6

System Description 14.20
Introduction 14.20.1
Air/Ground Sensing System. 14.20.1
Landing Gear Operation. 14.20.1
Landing Gear Retraction. 14.20.1
Landing Gear Extension 14.20.2
Landing Gear Alternate Extension 14.20.2
Semi-Lever Gear. 14.20.3
Nose Wheel and Main Gear Aft Axle Steering 14.20.3
Brake System 14.20.3
Normal Brake System. 14.20.4
Alternate Brake System 14.20.4
Antiskid Protection 14.20.4
Autobrake System. 14.20.5
Parking Brake 14.20.6
Brake Temperature Indication 14.20.7
Tire Pressure Indication 14.20.7
Brake System Schematic 14.20.8
Tail Skid. 14.20.9

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Messages 14.30

Landing Gear EICAS Messages 14.30.1

Brakes 14.30.1

Landing Gear 14.30.1

Tail Skid 14.30.2

Tires 14.30.2

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Gear Panel

1 Landing Gear Lever

UP – the landing gear retracts.

DN – the landing gear extends.

2 AUTOBRAKE Selector

OFF – deactivates and resets the autobrake system.

DISARM –

- disengages the autobrake system
- releases brake pressure

1, 2, 3, 4, MAX AUTO – selects the desired deceleration rate.

RTO – automatically applies maximum brake pressure when the thrust levers are retarded to idle above 85 knots.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

3 Alternate Gear (ALTN GEAR) Switch

NORM – the landing gear lever operates normally.

DOWN – the landing gear extends by the alternate extension system.

Note: Alternate extension may be selected with the landing gear lever in any position.

4 Landing Gear Lever Lock Override (LOCK OVRD) Switch

Push – releases the landing gear lever from down lock.

Nose Wheel Steering Tiller

1 Nose Wheel Steering Tiller

Rotate –

- turns the nose wheels up to 70 degrees in either direction
- overrides rudder pedal steering
- main gear aft axle steering is slaved to nose wheel steering

2 Tiller Position Indicator

Shows tiller displacement from the straight–ahead, neutral position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Brake System
Rudder/Brake Pedals

1 Rudder Pedal Adjust Crank

Adjusts the rudder pedals forward or aft.

Note: To avoid inadvertent rudder pedal movement, the crank handle should be stowed when not in use.

2 Rudder/Brake Pedals

Push the full pedal –

- turns the nose wheel up to 7 degrees in either direction
- does not activate main gear steering

Push the top of the pedals – actuates the wheel brakes.

Refer to Chapter 9, Flight Controls for the description of rudder operation.

Parking Brake Lever

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 Parking Brake Lever

Pull – sets the parking brake when both brake pedals are simultaneously depressed.

Release – simultaneously depress both brake pedals.

Brake Accumulator Pressure Indicator

1 BRAKE SOURCE Light

Illuminated (amber) – both active brake hydraulic sources (right and center/reserve hydraulic systems) have low pressure.

2 BRAKE Accumulator (ACCUM) Pressure Indicator

Indicates brake accumulator pressure.

Amber Band - brake accumulator pressure is low.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Gear System Indications
Landing Gear Position Indications

1 GEAR Position Indication (Normal Display)

DOWN (green) – all landing gear are down and locked.

Crosshatched (white) – one or more landing gear are in transit.

UP (white) – all landing gear are up and locked (blanks after 10 seconds).

Empty box (white) – all landing gear position indicators are inoperative.

2 Expanded GEAR Position Indication (Non–Normal Display)

DN (green) – the associated landing gear is down and locked.

Crosshatched (white) – the associated landing gear is in transit.

UP (white) – the associated landing gear is up and locked.

Empty box(es) (white) – the associated landing gear position indicators are inoperative.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Gear Synoptic Display

The landing gear synoptic is displayed by pushing the GEAR synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

1 Brake Temperature

Indicates a relative value of wheel brake temperature:

- values range from 0.0 to 9.9
- white – normal range
- amber – high range

2 Brake Symbol

Blank box indicates any brake less than 3.0.

Solid white box indicates hottest brake on each main gear within range of 3.0 to 4.9.

Solid amber box indicates brake overheat condition on each wheel within range of 5.0 to 9.9.

3 Gear Door Status

Crosshatched – the door is not closed.

CLOSED (white) – the door is closed.

Empty box(es) (white) – the associated landing gear door position indicators are inoperative.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Fault Indication (amber)

BRAKE – indicates brake deactivation on the associated wheel.

ASKID – indicates antiskid fault on the associated wheel.

5 Tire Pressure Indication

Displays individual tire pressures:

- white – normal range
- amber – abnormal high or low range

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

The airplane has two main landing gear and a single nose gear. The nose gear is a conventional steerable two–wheel unit. Each main gear has six wheels in tandem pairs. To improve turning radius, the aft axle of each main gear is steerable.

Hydraulic power for retraction, extension, and steering is supplied by the center hydraulic system. An alternate extension system is also provided.

The normal brake system is powered by the right hydraulic system. The alternate brake system is powered by the center/reserve hydraulic system. Antiskid protection is provided with both systems, but the autobrake system is available only through the normal system. A brake temperature monitor system and tire pressure indication system displays each brake temperature and tire pressure on the GEAR synoptic display.

Air/Ground Sensing System

In–flight and ground operation of various airplane systems are controlled by the air/ground sensing system.

The system receives air/ground logic signals from sensors located on each main landing gear beam. These signals are used to configure the airplane systems to the appropriate air or ground status.

Landing Gear Operation

The landing gear are normally controlled by the landing gear lever. On the ground, the lever is held in the DN position by an automatic lever lock. The lever lock can be manually overridden by pushing and holding the landing gear lever LOCK OVERRIDE switch. In flight, the lever lock is automatically released through air/ground sensing.

Landing Gear Retraction

When the landing gear lever is moved to UP, the landing gear begins to retract. The landing gear doors open and the main gear wheels tilt to the retract position. The EICAS landing gear position indication display changes from a green DOWN indication to a white crosshatch in–transit indication as the landing gear retract into the wheel wells. After retraction, the landing gear are held up by uplocks. The EICAS landing gear position indication changes to UP for 10 seconds and then blanks. With the landing gear retracted and all doors closed, the landing gear hydraulic system is automatically depressurized.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

If any gear is not up and locked up after the normal transit time, the EICAS caution message GEAR DISAGREE is displayed. The EICAS gear position indication changes to the expanded non–normal format, with the affected gear displayed as in–transit or down, if the gear never unlocked from the down position. The EICAS advisory message GEAR DOOR is displayed if any hydraulically actuated door is not closed after normal transit time.

Landing Gear Extension

When the landing gear lever is moved to DN, the landing gear doors open, the gear are unlocked, and the in–transit indication is displayed on the EICAS landing gear position indication.

The gear free–fall without hydraulic power to the down and locked position. The downlocks are powered to the locked position, all hydraulically actuated gear doors close, and the main gear trucks hydraulically tilt to the flight position. When all gear are down and locked, the EICAS gear position indication displays DOWN.

The EICAS caution message GEAR DISAGREE is displayed if any gear is not locked down (side and drag brace on the same main gear not locked, or nose gear drag brace not locked) after the normal transit time. The EICAS gear position indication changes to the expanded non–normal format, with the affected gear displayed as in transit (or UP if the gear never unlocked from the up position).

If only one brace on a main gear is locked (either drag or side brace not locked) after the normal transit time, the EICAS caution message MAIN GEAR BRACE L or R is displayed for the affected gear. The EICAS gear position indication changes to the expanded non–normal format, with the affected gear displayed as in transit. The EICAS advisory message GEAR DOOR displays if any hydraulically actuated door is not closed after the normal transit time.

Landing Gear Alternate Extension

The alternate landing gear extension system uses a dedicated DC powered electric hydraulic pump and center hydraulic system fluid to extend the landing gear. Selecting DOWN on the ALTERNATE GEAR switch releases all door and gear uplocks. The landing gear free–fall to the down and locked position. The landing gear lever position has no effect on landing gear alternate extension.

The EICAS landing gear position indication displays the expanded gear position indication when the alternate extension system is used. During alternate extension, the EICAS message GEAR DOOR is displayed because all the hydraulically powered gear doors remain open.

Following an alternate extension, the landing gear can be retracted and gear doors closed by the normal system, if it is operating. Select DN then UP to retract the landing gear using the normal system.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Semi-Lever Gear

HL7202 - HL7205, HL7782, HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

The Semi-Lever Gear (SLG) consists of an additional hydraulic actuator that connects the forward end of each main gear truck to the shock strut. During takeoff, the actuator locks to restrict rotation of the main gear truck and allow takeoff rotation about the aft wheel axle, thereby improving airplane performance capability. During landing, the SLG hydraulic struts act as dampers to reduce the landing loads on the MLG and aircraft structure.

Nose Wheel and Main Gear Aft Axle Steering

The airplane is equipped with nose wheel steering and main gear aft axle steering.

Nose wheel steering is powered by the center/reserve hydraulic system. Main gear aft axle steering is powered by the center hydraulic system.

Primary steering control is provided by a nose wheel steering tiller for each pilot. Limited steering control is available through the rudder pedals. The tillers can turn the nose wheels up to 70 degrees in either direction. A pointer on the tiller assembly shows tiller position relative to the neutral setting. The rudder pedals can be used to turn the nose wheels up to 7 degrees in either direction. Tiller inputs override rudder pedal inputs.

Main gear aft axle steering is automatically enabled when the nose gear steering angle exceeds 13 degrees. The main gear aft axles turn proportionally in the opposite direction to reduce turn radius and tire scrubbing.

The EICAS warning message CONFIG GEAR STEERING, accompanied by the takeoff configuration aural alert, is displayed if the main gear aft axles are not centered and locked when takeoff thrust is applied. The EICAS advisory message MAIN GEAR STEERING is displayed if the main gear steering actuators are not locked in the centered position when commanded to the center position.

Brake System

The airplane has two brake systems: normal and alternate. Each main gear wheel has a multiple disc carbon brake operated by either system. The nose wheels have no brakes.

The brake systems use the right and center/reserve hydraulic systems. The EICAS advisory message BRAKE SOURCE displays and the BRAKE SOURCE light illuminates if both the right and center/reserve hydraulic system pressures are low.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Normal Brake System

The normal brake system is powered by the right hydraulic system. The brake pedals provide independent control of the left and right brakes.

Brake Accumulator

The brake accumulator is located in the normal brake system. The brake accumulator extends parking brake holding time, stabilizes normal brake hydraulic system pressure during initial application and antiskid cycling, and supplies hydraulic pressure for several braking applications or parking brake application if right and center hydraulic systems are lost.

The brake accumulator is pressurized by the right hydraulic system. Accumulator pressure is shown on the Brake Accumulator Pressure indicator.

Alternate Brake System

Alternate brake system selection is automatic. If the right hydraulic system pressure is low, the center hydraulic system automatically supplies pressure to the alternate brake system.

Reserve Brakes and Steering

The fluid below the standpipe in the center hydraulic reservoir is used by the primary C1 pump as a reserve hydraulic source to power the alternate brakes and nose wheel steering.

Antiskid Protection

Antiskid protection is provided in the normal and alternate brake systems. Antiskid protection is also provided when the brake system is being supplied pressure only from the brake accumulator.

The normal brake system provides each main gear wheel with individual antiskid protection. When a wheel speed sensor detects a skid, the associated antiskid valve reduces brake pressure until skidding stops.

The alternate brake system provides antiskid protection to tandem wheel pairs for the forward and middle axle wheels. The aft axle wheels remain individually controlled.

Touchdown and hydroplaning protection is provided using airplane inertial ground speed. Locked wheel protection is provided using a comparison with other wheel speeds.

The EICAS advisory message ANTISKID is displayed if an antiskid fault affecting the brake system in use is detected, the parking brake valve is not fully open with the parking brake released, or the system is completely inoperative.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autobrake System

The autobrake system provides automatic braking at preselected deceleration rates for landing and full pressure for rejected takeoff. The system operates only when the normal brake system is functioning. Antiskid system protection is provided during autobrake operation.

EICAS memo messages display the selected autobrake settings:

- AUTOBRAKE 1 through 4
- AUTOBRAKE MAX
- AUTOBRAKE RTO

The EICAS advisory message AUTOBRAKE is displayed if the autobrake system is disarmed or inoperative, or autobrake solenoid valve pressure is high when not commanded on.

Rejected Takeoff

Selecting RTO (rejected takeoff) prior to takeoff arms the autobrake system. The RTO mode can be selected only on the ground. The RTO autobrake setting commands maximum braking pressure if:

- the airplane is on the ground
- groundspeed is above 85 knots, and
- both thrust levers are retarded to idle

Maximum braking is obtained in this mode. If an RTO is initiated below 85 knots, the RTO autobrake function does not operate.

Taxi Brake Release

During each taxi brake application, the antiskid system releases the brakes of one axle pair of each main landing gear (if wheel speeds are less than 45 knots). The system sequences through the axle pairs at each brake application, thereby reducing the number of brake applications by each brake. This extends service life and reduces brake sensitivity during taxi.

All active brakes are applied for a heavy brake application, landing rollout, RTO, or when setting the parking brake.

The taxi brake release system operates only with the normal brake system.

Landing

Five levels of deceleration can be selected for landing. However, on dry runways, the maximum autobrake deceleration rate in the landing mode is less than that produced by full pedal braking.

After landing, autobrake application begins when:

- both thrust levers are retarded to idle, and
- the wheels have spun up.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Autobrake application occurs slightly after main gear touchdown. If MAX AUTO is selected, deceleration is limited to the AUTOBRAKE 4 level until pitch angle is less than one degree, then deceleration is increased to the MAX AUTO level. The deceleration level can be changed (without disarming the system) by rotating the selector.

To maintain the selected airplane deceleration rate, autobrake pressure is reduced as other controls, such as thrust reversers and spoilers, contribute to total deceleration. The system provides braking to a complete stop or until it is disarmed.

Autobrake – Disarm

The autobrake system disarms and the EICAS caution message AUTOBRAKE FAIL is displayed if any of the following occur:

- autobrake fault
- normal antiskid system fault
- loss of inertial data from the ADIRU
- the autobrake is applied after loss of normal brake hydraulic pressure

The autobrake system disarms and the EICAS advisory message AUTOBRAKE DISARMED is displayed if any of the following occur:

- pedal braking applied
- either thrust lever advanced after landing
- speedbrake lever is moved to the DOWN detent after the speedbrakes have deployed on the ground
- DISARM or OFF position selected on the AUTOBRAKE selector

When the autobrake system disarms after landing, the AUTOBRAKE selector automatically moves to the DISARM position, and removes power from the autobrake system.

When the autobrake system disarms during takeoff, the AUTOBRAKE selector remains in the RTO position, but automatically moves to OFF after takeoff.

Parking Brake

The parking brake can be set with the normal or alternate brake system pressurized. If the normal and alternate brake systems are not pressurized, parking brake pressure is maintained by the brake accumulator.

The parking brake is set by fully depressing both brake pedals, pulling the parking brake lever up, then releasing the pedals. This mechanically latches the pedals in the depressed position and commands the parking brake valve to close.

The parking brake is released by depressing the pedals until the parking brake lever releases.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When the parking brake is set, the EICAS memo message PARKING BRAKE SET is displayed. If the parking brake is set and either engine is set to takeoff thrust, the takeoff configuration aural alert sounds and the EICAS warning message CONFIG PARKING BRAKE is displayed.

Brake Temperature Indication

Wheel brake temperatures are displayed on the GEAR synoptic display. Numerical values related to wheel brake temperature are displayed adjacent to each wheel/brake symbol. These values range from 0.0 to 9.9 in increments of 0.1. The values tend to increase after the brakes are used.

Normal range values of 0 to 4.9 are white. For values of 3.0 to 4.9, the brake symbol for the hottest brake becomes solid white. Values of 5.0 and above are amber. For values of 5.0 and above, the EICAS advisory message BRAKE TEMP is displayed.

Tire Pressure Indication

Individual tire pressures, from 0 to 400 PSI, are displayed inside the individual wheel symbols on the GEAR synoptic display.

The EICAS advisory message TIRE PRESS is displayed if any tire pressure is above or below the normal range, or there is an excessive pressure difference between two tires on the same axle.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Brake System Schematic

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Tail Skid

HL7532 - HL7573, HL7782, HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275

The airplane is equipped with a tail skid system. The tail skid extends for takeoff and landing and retracts during flight. It helps protect the pressurized part of the airplane from contact with the runway. The tail skid uses the main landing gear actuation system.

The EICAS advisory message TAIL SKID is displayed when the tail skid is not in the correct position.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Landing Gear EICAS Messages

The following EICAS messages can be displayed.

Note: Configuration warning messages are covered in Chapter 15, Warning Systems.

Brakes

Message	Level	Aural	Message Logic
ANTISKID	Advisory		A fault is detected in the antiskid system.
AUTOBRAKE	Advisory		Autobrake is disarmed or inoperative.
AUTOBRAKE 1, 2, 3, 4, MAX, RTO	Memo		Indicates selected autobrake level.
BRAKE SOURCE	Advisory		Normal and alternate brake system pressures are low, and reserve hydraulic source for alternate brake system is low.
BRAKE TEMP	Advisory		Temperature of one or more brakes is excessive.
PARKING BRAKE SET	Memo		The parking brake lever is up and the parking brake valve is closed
RESERVE BRAKES/STRG	Advisory		Alternate brakes from the reserve hydraulic source, normal nose gear extension, or nose wheel steering may not be available.

Landing Gear

Message	Level	Aural	Message Logic
GEAR DISAGREE	Caution	Beeper	Gear position disagrees with landing gear lever position.
GEAR DOOR	Advisory		One or more gear doors are not closed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
MAIN GEAR BRACE L, R	Caution	Beeper	Affected main gear is down with one brace unlocked.
MAIN GEAR STEERING	Advisory		Main gear steering is unlocked or not centered.

Tail Skid

HL7532 - HL7573, HL7782, HL7783, HL8208 - HL8218, HL8250, HL8274, HL8275

Message	Level	Aural	Message Logic
TAIL SKID	Advisory		Tail skid position disagrees with landing gear lever position.

Tires

Message	Level	Aural	Message Logic
TIRE PRESS	Advisory		One or more tire pressures are not normal.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Controls and Indicators 15.10
Engine Indication and Crew Alerting System (EICAS). 15.10.1
EICAS Messages 15.10.1
EICAS Event Record Switch 15.10.3
Display Select Panel (DSP) 15.10.3
Status Display Switch 15.10.4
Alerts on PFD. 15.10.7
Master WARNING/CAUTION Reset Switches and Lights 15.10.7
Traffic Alert and Collision Avoidance System (TCAS) 15.10.8
TCAS Controls (Transponder Panel) 15.10.8
TCAS Controls (EFIS Control Panel) 15.10.9
TCAS Traffic and Alert Message TRAFFIC Display 15.10.9
TCAS PFD Vertical Guidance 15.10.11
Ground Proximity Warning System (GPWS) Controls 15.10.12
RAAS Runway Override Control. 15.10.12
Ground Proximity Panel 15.10.13
Radio Altitude/Barometric Altitude Control 15.10.14
GPWS Look–Ahead Terrain Alerting Display and Annunciations 15.10.15
Predictive Windshear (PWS) Display and Annunciations 15.10.20

System Description 15.20
Introduction 15.20.1
Engine Indication and Crew Alerting System (EICAS). 15.20.1
Crew Alerting and EICAS Message Design Philosophy 15.20.1
EICAS Messages 15.20.2

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Aurals, Master WARNING/CAUTION Switches and Lights, and GND PROX Light 15.20.4
Flight Deck Panel Annunciator Lights 15.20.11
Airspeed Voice Annunciations and Alerts 15.20.11
Takeoff V1 Airspeed 15.20.11
Stall Warning 15.20.11
Airspeed Low 15.20.11
Overspeed Warning 15.20.11
Tail Strike Detection System 15.20.11
Takeoff And Landing Configuration Warning System 15.20.11
Takeoff Configuration Warnings 15.20.11
Landing Configuration Warning 15.20.12
Speedbrake Lever Extend Beyond ARM During Climb 15.20.12
Configuration Warning System Non-normal Operation 15.20.13
MCP Selected Altitude Alert 15.20.13
Approaching MCP Selected Altitude 15.20.13
Departing MCP Selected Altitude 15.20.13
Departing MCP Selected Altitude Alert Inhibits 15.20.13
Crew Alertness Monitor 15.20.14
Traffic Alert and Collision Avoidance System (TCAS) 15.20.14
Resolution Advisories (RA) and Display 15.20.15
Traffic Advisories (TA) and Display 15.20.15
Proximate Traffic Display 15.20.16
Other Traffic Display 15.20.16
TCAS PFD Vertical Guidance 15.20.16
TCAS ND Messages 15.20.17
TCAS Voice Annunciations 15.20.18
TCAS Normal Operation 15.20.20
TCAS Non–Normal Operation 15.20.20
Ground Proximity Warning System (GPWS) and Predictive Windshear (PWS) 15.20.21
Introduction 15.20.21

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Runway Awareness and Advisory System (RAAS). 15.20.21
Look-ahead Obstacles and Peaks Terrain Alerting System 15.20.22
Look-ahead Terrain Alerting System 15.20.24
Predictive Wind Shear (PWS) and Immediate Windshear Alerting Systems 15.20.26
Bank Angle Voice Annunciations 15.20.29
Immediate Alerting System 15.20.29
Altitude Voice Annunciations During Approach 15.20.30
GPWS Non-Normal Operation. 15.20.31
Alert Inhibits 15.20.32
Alert Messages Inhibited During Normal System Operation 15.20.32
Alert Messages Inhibited By Other Alert Messages 15.20.32
Voice Annunciation Inhibits. 15.20.32
ND Display Alert Inhibits and Automatic Display 15.20.33
Alerts Inhibited Before Engine Start and After Shutdown 15.20.34
Alerts Inhibited During Engine Start 15.20.35
Alerts Inhibited During Takeoff. 15.20.36
Alerts Inhibited During Landing 15.20.40
EICAS Event Record. 15.20.41

EICAS Messages. 15.30
EICAS Alert Messages 15.30.1
EICAS Memo Messages 15.30.3

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Engine Indication and Crew Alerting System (EICAS)
EICAS Messages

1 Checklist Icon

Displayed (white) –

- when checklist with procedural steps, notes, or other information of which the crew must be made aware exists for respective message
- no longer displayed when checklist complete
- no longer displayed when inhibited by checklist of another message

2 RECALL Indication

Displayed (white) –

- when CANC/RCL switch pushed
- remains displayed for one second after switch released

3 Warning Messages

Displayed (red) –

- highest priority alert messages
- red alert messages remain displayed and cannot be canceled by pushing the CANC/RCL switch.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Caution Messages

Displayed (amber) –

- next highest priority alert messages after warning messages
- amber alert messages can be canceled or recalled by pushing the CANC/RCL switch

5 Advisory Messages

Displayed (amber) –

- lowest priority alert messages; indented one space
- amber alert messages can be canceled or recalled by pushing the CANC/RCL switch

6 Communication Messages

Displayed (white) –

- prefaced with white dot
- COMM low messages indented one space
- cannot be canceled by pushing the CANC/RCL switch

7 Memo Messages

Displayed (white) –

- reminder of selected state of controls or systems
- cannot be canceled by pushing the CANC/RCL switch
- EICAS alert messages have display priority over memo messages; some or all memo messages not displayed on current EICAS message page if insufficient message lines are available below alert messages

8 STATUS Cue

Displayed (cyan) –

- new status message exists
- no longer displayed when status display selected
- inhibited from beginning of first engine start until 30 minutes after lift-off

9 Page (PG) Number

Displayed (white) –

- more than one page of alert or memo messages exists
- indicates number of page selected

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

10 ENGINE Exceedance Cue

Displayed (cyan) –

- engine parameter on secondary engine display is exceeded
- displayed until displayed parameter returns to normal operating range

EICAS Event Record Switch

1 EICAS EVENT Record (RCD) Switch

Push – records up to five EICAS events into memory.

Display Select Panel (DSP)

1 Cancel/Recall (CANC/RCL) Switch

Push (when EICAS caution or advisory messages displayed) –

- displays the next page of EICAS messages when additional pages exist
- cancels caution and advisory messages when last page displayed; warning, memo, and communications messages remain displayed
- cancels red box for any engine parameter previously exceeded when displayed parameter no longer exceeds the limit

Push (when no EICAS caution or advisory messages displayed) –

- redisplays all caution and advisory EICAS messages, when non-normal condition exists
- displays first page of messages when multiple pages exist
- redisplays red box for parameters previously exceeded

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Status Display Switch

1 Status (STAT) Display Switch

Push – displays status display on selected MFD.

Subsequent pushes –

- displays next page of status messages when additional pages exist
- lower center MFD blanks when last page of status messages displayed
- inboard MFDs return to NAV display after last page of status messages displayed

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7532 - HL7783, HL8208 - HL8218, HL8250 - HL8252

1 Status Display

Displays hydraulic, APU, and oxygen system indications and status messages.

2 Status Messages

Status messages indicate equipment faults requiring MEL reference for dispatch.

3 Page (PG) Number

Displayed –

- additional pages of status messages exist
- displays number of page selected

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

HL7202 - HL7205, HL8005 - HL8077, HL8226, HL8274 - HL8347

MULTIFUNCTION DISPLAY

1 Status Display

Displays hydraulic, APU, and oxygen system indications and status messages.

2 Status Messages

Status messages indicate equipment faults requiring MEL reference for dispatch.

3 Status Page Indications

Dashed lines are displayed if information is not available.

Elapsed time:

- displays in hours and minutes
- begins advancing at lift-off
- stops advancing at touchdown
- resets to zero:
  - at initial power-up, or
  - when both Fuel Control switches moved to Run, or
  - at lift-off

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Page (PG) Number

Displayed –

- additional pages of status messages exist
- displays number of page selected

Alerts on PFD

1 Alert

The following crew alert messages are displayed in red:

- ENG FAIL
- PULL UP
- WINDSHEAR

Master WARNING/CAUTION Reset Switches and Lights

1 Master WARNING/CAUTION Reset Switch

Push –

- extinguishes master WARNING lights
- extinguishes master CAUTION lights

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- silences the aural that accompanies the EICAS warning messages:
  - CABIN ALTITUDE
  - CONFIG GEAR, if displayed because landing gear not down and locked, any thrust lever below thrust required for level flight, and radio altitude less than 800 feet
  - FIRE

  HL7202 - HL8046, HL8076 - HL8347
  - OVERSPEED
  - PILOT RESPONSE (as configured by the airline)
  - STABILIZER

2 Master WARNING Light

Illuminated (red) –

- new EICAS warning message displayed, or
- ENGINE FAIL, PULL UP, or WINDSHEAR alert displayed on PFD

3 Master CAUTION Light

Illuminated (amber) – new EICAS caution message displayed

Traffic Alert and Collision Avoidance System (TCAS) TCAS Controls (Transponder Panel)

1 TCAS Airspace Selector

Left switch controls Captain TCAS display. Right switch controls First Officer TCAS display.

ABV (above) – altitude reporting traffic from 2,700 feet below to 7,000 feet above current altitude displayed.

N (normal) – altitude reporting traffic from 2,700 feet below to 2,700 feet above current altitude displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

BLW (below) – altitude reporting traffic 7,000 feet below to 2,700 feet above current altitude displayed.

2 TCAS Absolute/Relative (ABS/REL) Altitude Selector

Left switch controls Captain TCAS display. Right switch controls First Officer TCAS display.

ABS (absolute) – absolute altitude displayed in TCAS traffic symbol data tags.

REL (relative) – relative altitude displayed in TCAS traffic symbol data tags.

3 Transponder Mode Selector

TA ONLY (traffic advisory) –

- transponder and TCAS TA modes enabled
- all aircraft that would have been predicted as a RA are predicted as a TA

TA/RA (traffic advisory/resolution advisory) – transponder and TCAS TA and RA modes enable.

TCAS Controls (EFIS Control Panel)

1 ND Traffic (TFC) Switch (inner)

Push –

- TCAS traffic displayed on ND
- range information displayed when in the expanded APP or VOR modes

TCAS Traffic and Alert Message TRAFFIC Display

Displayed when TFC selected and respective ND is in MAP, MAP CTR, VOR, or APP mode.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Displayed automatically when:

- a RA or TA is occurring, and
- TFC not selected on either ND, and
- respective ND is in MAP, MAP CTR, VOR or APP mode

1 Traffic Targets

Indicates relative position of traffic.

- filled red square indicates a resolution advisory (RA)
- filled amber circle indicates a traffic advisory (TA)
- filled white diamond indicates proximate traffic
- unfilled white diamond indicates other traffic
- number is relative or absolute altitude of traffic in hundreds and thousands of feet; not displayed when altitude unknown
- vertical motion arrow indicates traffic climbing or descending at 500 feet per minute or greater; not displayed for vertical motion less than 500 feet per minute

2 TCAS Mode Annunciations

TFC (cyan) –

- TCAS traffic display enabled
- TCAS traffic displayed in MAP, MAP CTR, APP, and VOR modes

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

TA ONLY (cyan) –

- TCAS cannot provide RAs
- all traffic that would have been RAs are predicted as TAs

3 OFFSCALE Message

Displayed (red) – RA is beyond selected map range

Displayed (amber) – TA is beyond selected map range

4 TRAFFIC Alert Message

Displayed: (red) – RA is occurring.

Displayed: (amber) – TA is occurring, and RA is not occurring.

5 TCAS No Bearing Messages

RA (red) – data tag displayed for no-bearing RA.

TA (amber) – data tag displayed for no-bearing TA.

Data tag contains distance, altitude, and vertical motion arrow.

6 TCAS/Weather Radar Range Arcs

Displayed when TCAS or weather radar selected; replace range scale tics.

7 TCAS Three Mile Ring

Displayed when TCAS selected and range selected is less than 80 miles.

TCAS PFD Vertical Guidance

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

1 RA Pitch Region To Avoid (red outlined)

Displayed: (red) - RA is occurring.

Note: For a single RA, only one red outlined RA pitch region, either above or below, is displayed at a time. For two or more RAs, two red outlined RA pitch regions may be displayed.

To ensure vertical separation, the center of the airplane symbol must be outside the red outlined RA pitch regions to avoid.

2 RA Vertical Speed Region to Avoid (red)

To ensure vertical separation, vertical speed must be outside the red RA vertical speed region to avoid.

3 Vertical Speed Pointer

Red – present vertical speed does not ensure RA traffic is avoided.

White – present vertical speed ensures RA traffic is avoided.

Ground Proximity Warning System (GPWS) Controls
RAAS Runway Override Control
HL8043 - HL8077

1 RAAS RUNWAY Override (OVRD) Switch

Push (OVRD illuminated) – inhibits RAAS.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Ground Proximity Panel

1 Ground Proximity (GND PROX) Glideslope (G/S) INHIBIT (INHIB) Switch

Push – inhibits GLIDE SLOPE alert when pushed below 1,000 feet radio altitude.

2 Ground Proximity (GND PROX) Light

Illuminated (amber) –

- GPWS DON’T SINK, GLIDE SLOPE, SINKRATE, TERRAIN, TOO LOW FLAPS, TOO LOW GEAR, TOO LOW TERRAIN immediate alert is occurring
- inhibited for GLIDE SLOPE, or TOO LOW FLAPS, or TOO LOW GEAR alert when respective inhibit or override switch is pushed

3 Ground Proximity (GND PROX) FLAP Override (OVRD) Switch

Push (OVRD visible) –

- inhibits TOO LOW FLAPS alert
- EICAS advisory message GND PROX SYS will be displayed when airspeed greater than 250 knots for more than 60 seconds

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

4 Ground Proximity (GND PROX) GEAR Override (OVRD) Switch

Push (OVRD visible) –

- inhibits TOO LOW GEAR alert
- inhibits CONFIG GEAR alert
- EICAS advisory message GND PROX SYS will be displayed when airspeed greater than 290 knots for more than 60 seconds

5 Ground Proximity (GND PROX) Terrain (TERR) Override (OVRD) Switch

HL7202 - HL7205, HL7574 - HL8347
Push (OVRD visible) – inhibits look–ahead obstacle and terrain alerts and display.

HL7532 - HL7573
Push (OVRD visible) – inhibits look–ahead terrain alerts and display.

Radio Altitude/Barometric Altitude Control

1 Minimums (MINS) Selector (outer)

RADIO – sets RADIO display on PFD and Captain's control sets RADIO reference for GPWS minimums voice annunciation; BARO not displayed.

BARO – sets BARO pointer and BARO display on PFD and Captain's control sets BARO reference for GPWS minimums voice annunciation; RADIO not displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

2 RADIO Altitude/Barometric (BARO) Altitude Control (middle)

Rotate –

- when RADIO selected on MINS selector, sets RADIO altitude displayed on PFD
- When BARO selected on MINS selector, sets BARO pointer and BARO display on PFD
- Captain's control sets radio or barometric altitude reference for GPWS minimums voice annunciation

GPWS Look–Ahead Terrain Alerting Display and Annunciations

GPWS Terrain Display Selection

GPWS Terrain Display Select Switch

1 Terrain (TERR) Display Select Switch

Push –

- terrain data displayed in MAP, MAP CTR, VOR, and APP modes
- deselects weather radar display regardless of switch position

Second push – deselects terrain data display.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Terrain Display

HL7202 - HL7205, HL7574 - HL8347

HL7532 - HL7573

HL7202 - HL7205, HL7574 - HL8347

1 OBSTACLE and TERRAIN Annunciation

OBSTACLE (amber) – obstacle caution alert is occurring.

OBSTACLE (red) – obstacle warning alert is occurring.

TERRAIN (amber) – look–ahead terrain caution alert is occurring.

TERRAIN (red) – look–ahead terrain warning alert is occurring.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Displayed in all ND display modes.

HL7532 - HL7573

1 TERRAIN Annunciation

TERRAIN (amber) – look–ahead terrain caution alert is occurring.

TERRAIN (red) – look–ahead terrain warning alert is occurring.

Displayed in all navigation display modes.

HL7202 - HL7205, HL7574 - HL8347

2 Obstacle and Terrain Display

When airplane is higher than 2,000 feet above terrain, density based on obstacle height, peaks height, and airplane altitude:

- solid green – highest obstacles or peaks displayed
- high density green – intermediate height obstacles or terrain peaks displayed
- low density green – lowest obstacles or terrain peaks displayed

When airplane is lower than 2,000 feet above terrain, color and density based on obstacle height, terrain height, and airplane altitude:

- dotted green – obstacles or terrain from 2,000 feet below to 500 feet (250 feet with gear down) below airplane altitude
- dotted amber – obstacles or terrain 500 feet (250 feet with gear down) below to 2,000 feet above airplane altitude
- dotted red – obstacles or terrain more than 2,000 feet above airplane altitude
- dotted magenta – no terrain data available
- solid amber – look–ahead terrain caution alert is occurring
- solid red – look–ahead terrain warning alert is occurring

Note: In areas without obstacle or terrain data, look–ahead terrain alerting and display functions not available. GPWS immediate alerts function normally.

HL7202 - HL7205, HL7733 - HL8347

Note: Terrain within 200 feet of the nearest airport runway elevation is not displayed.

HL7574 - HL7598

Note: Terrain within 400 feet of the nearest airport runway elevation is not displayed.

Displayed automatically when:

- a look–ahead obstacle or terrain alert occurs, and
- TERR not selected on either ND, and
- respective ND is in MAP, MAP CTR, VOR, or APP mode

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Display updates with a display sweep similar to weather radar display.

HL7532 - HL7573
2 Terrain Display

Color and density vary based on terrain height and airplane altitude:

- dotted green: terrain from 2,000 feet below to 500 feet (250 feet with gear down) below airplane altitude
- dotted amber: terrain 500 feet (250 feet with gear down) below to 2,000 feet above airplane altitude
- dotted red: terrain more than 2,000 feet above airplane altitude
- dotted magenta: no terrain data available
- solid amber: look–ahead terrain caution alert is occurring
- solid red: look–ahead terrain warning alert is occurring

Note: In areas without terrain data, look–ahead terrain alerting and display functions not available. GPWS immediate alerts function normally.

Note: Terrain more than 2,000 feet below airplane altitude or within 400 feet of the nearest airport runway elevation is not displayed.

Displayed automatically when:

- a look–ahead terrain alert occurs, and
- TERR not selected on either ND, and
- respective ND is in MAP, MAP CTR, VOR, or APP mode

Display updates with a display sweep similar to weather radar display.

3 Terrain Mode Annunciation

TERR (cyan) – terrain display enabled.

HL7202 - HL7205, HL7574 - HL8347
4 Highest Elevation of Obstacle or Terrain Displayed

Color (amber, green, or red) same as color of corresponding obstacle or terrain displayed.

HL7202 - HL7205, HL7574 - HL8347
5 Lowest Elevation of Obstacle or Terrain Displayed

Color (amber, green, or red) same as color of corresponding obstacle or terrain displayed.

The highest and lowest elevations of the obstacles and terrain displayed are inhibited for obstacles and terrain further than 320 nm. The highest and lowest elevations of obstacles and terrain displayed are also inhibited for some obstacles and terrain that are directly abeam of the airplane heading and closer than 320 nm.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Terrain Navigation Display Annunciations

1 Terrain Status Annunciation

TERR FAIL (amber) – Look–ahead terrain alerting and display failed.

TERR OVRD (amber) – TERR OVRD switch pushed.

TERR POS (amber) – Look–ahead terrain alerting and display unavailable due to GPS position uncertainty. During time between GPS position failure and display of TERR POS message, ADIRS provides position for look–ahead terrain alerting and display.

2 Terrain Mode Annunciation

TERR TEST (cyan) – GPWS operating in self–test mode.

3 Terrain Range Status Annunciation

TERR RANGE DISAGREE (amber) –

- terrain display enabled, and
- terrain output range disagrees with range selected by EFIS control panel

MAP/TERR RANGE DISAGREE (amber) –

- terrain display enabled, and
- terrain output range disagrees with range selected by EFIS control panel, and
- map display output range disagrees with range selected by EFIS control panel

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Predictive Windshear (PWS) Display and Annunciations

1 PWS Radials

Displayed (amber) –

- PWS alert is occurring
- extend from PWS symbol to help locate windshear event

2 PWS Symbol

Displayed (red and black) –

- PWS alert is occurring
- displays windshear location and approximate geometric size (width and depth)

Symbol, radials, and weather radar returns displayed automatically when:

- PWS alert occurs, and
- WXR is not selected on either ND, and
- respective ND is in MAP, MAP CTR, VOR, or APP mode

When terrain display is selected and PWS alert occurs, weather radar display replaces terrain display.

3 WINDSHEAR Annunciation

WINDSHEAR (amber) – PWS caution alert is occurring.

WINDSHEAR (red) – PWS warning alert is occurring.

Displayed in all navigation display modes.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Introduction

Warning systems consist of:

- engine indication and crew alerting system (EICAS)
- airspeed alerts
- tail strike detection system
- takeoff and landing configuration warning system
- MCP selected altitude alerts
- crew alertness monitor
- traffic alert and collision avoidance system (TCAS)
- windshear alerts
- ground proximity warning system (GPWS)

Engine Indication and Crew Alerting System (EICAS)

EICAS consolidates engine and airplane system indications and is the primary means of displaying system indications and alerts to the flight crew.

EICAS is normally displayed on the upper center display.

Crew Alerting and EICAS Message Design Philosophy

Time Critical Warning

Time critical warnings alert the flight crew to a non-normal operational condition requiring immediate crew awareness and immediate corrective action. Time critical alerts include aural alerts, messages and indications on the PFD, Master WARNING/CAUTION lights, voice annunciation alerts, and stick shakers.

Warnings

Warnings alert the flight crew to a non-normal operational or system condition requiring immediate crew awareness and corrective action.

Cautions

Cautions alert the flight crew to a non-normal operational or system condition requiring immediate crew awareness. Corrective action may be required.

Advisories

Advisories alert the flight crew to a non-normal operational or system condition requiring routine crew awareness. Corrective action may be required.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Messages

Systems conditions and configuration information is provided to the crew by four types of EICAS messages:

- EICAS alert messages are the primary method to alert the crew to non-normal conditions
- EICAS communication messages direct the crew to normal communication conditions and messages
- EICAS memo messages are crew reminders of certain flight crew selected normal conditions
- EICAS status messages indicate equipment faults which may affect airplane dispatch capability

An EICAS alert, communications, or memo message is no longer displayed when the respective condition no longer exists.

EICAS Alert Messages

From after engine start until engine shut down, EICAS alert messages are the primary means to alert the crew to non-normal conditions which may impact other operations during the flight.

There is a non-normal procedure for each EICAS alert message. The procedure for every EICAS alert message is included as a checklist in the QRH. Procedures for some EICAS alert messages have steps to reconfigure airplane systems. A rectangular symbol [] prefaces an alert message that has procedural steps. The rectangular symbol [] also prefaces EICAS alert messages for checklists that have notes or information of which the crew must be made aware.

EICAS alert messages are grouped into three priority levels: warning, caution, and advisory. Prioritization is an aid to flight crew decision making when more than one EICAS alert message is displayed.

EICAS warning messages are displayed red and EICAS caution and advisory messages are displayed amber. Red EICAS alert messages remain displayed and cannot be canceled by pushing the CANC/RCL switch. Amber EICAS alert messages can be canceled and recalled by pushing the CANC/RCL switch.

EICAS Communication Messages

EICAS communication messages direct crew attention to normal communication conditions which may require crew attention. There is a crew action for each EICAS communications message.

EICAS communications messages are grouped into three priority levels: high, medium, and low. Prioritization is an aid to flight crew decision making when more than one message is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS communications messages are displayed in white below EICAS alert messages. Communication messages can not be cancelled by pushing the CANC/RCL switch.

EICAS Memo Messages

EICAS memo messages are crew reminders of certain flight crew selected normal conditions. They are displayed in white at the bottom of the last page of EICAS alert messages on the primary EICAS display.

Pushing the CANC/RCL switch when the last page of EICAS alert messages is displayed ensures all current memo messages have been displayed.

EICAS Status Messages

All EICAS status messages are listed in the Dispatch Deviation Guide (DDG) or airline equivalent and provide a cross reference to the Minimum Equipment List (MEL) for dispatch capability.

Display and Manipulation of EICAS Messages

If more than one EICAS alert message is displayed, the messages are displayed in a list which is grouped by priority level. EICAS warning messages are displayed in red at the top of the message list.

EICAS caution messages are displayed in amber below the lowest warning message. EICAS advisory messages are displayed in amber below the lowest caution message and are indented one character so they may be distinguished from EICAS caution messages.

The most recent EICAS alert message is displayed at the top of its priority group and all messages move down one display line. If a message is no longer displayed because the respective system non-normal condition no longer exists, all messages previously displayed move up one display line.

If there are more messages in the list than can be displayed on one page, multiple pages are created and numbered sequentially. The page number is normally displayed at the bottom of each list. Multiple pages of EICAS caution and advisory messages can be displayed one page at a time by pushing the CANC/RCL switch. If there are more EICAS warning messages in the list than can be displayed on one page, no page number is displayed and it is not possible to display other pages. In all other cases, pushing the CANC/RCL switch displays the next page of EICAS caution and advisory messages. EICAS warning messages are displayed at the top of each page.

Pushing the CANC/RCL switch when the last page of the list is displayed causes all EICAS caution and advisory messages to be no longer displayed.

EICAS alert messages for new system non-normal conditions are displayed on the page being viewed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

For example, if page three is displayed and an EICAS caution message is displayed because a new system non-normal occurs, the message is displayed immediately below any EICAS warning messages. If the CANC/RCL switch is subsequently pushed to redisplay page one, the message is displayed as the first EICAS caution message on page one.

When no EICAS caution or advisory messages are displayed, pushing the CANC/RCL switch redisplays page one of the EICAS caution and advisory messages for all system non-normal conditions and the RECALL message is displayed briefly.

The most recent EICAS communication message is displayed at the top of its priority group and all messages move down one display line. If a message is no longer displayed because the respective communication condition no longer exists, all messages previously displayed move up one display line.

The most recent EICAS memo message is displayed at the top of the memo messages.

The STATUS cue is displayed on primary EICAS when a new EICAS status message is displayed. When the STAT switch is pushed, the status display is displayed on the secondary EICAS display. The most recent status message is displayed at the top of the message list.

The STAT switch controls the display of single and multiple pages of status messages in a manner similar to the way the CANC/RCL switch controls the display of EICAS alert messages.

Aurals, Master WARNING/CAUTION Switches and Lights, and GND PROX Light

Aurals, two master WARNING and CAUTION lights, and the GND PROX light call attention to the following alerts:

- in the following table, parentheses () describe crew action to silence the aural or extinguished the light while the alert is occurring.

Aural	Light	Calls Attention To:
Bell (Silence by pushing Master WARNING/CAUTION Reset switch)	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message: FIRE APU FIRE CARGO AFT, FWD FIRE ENG L, R FIRE WHEEL WELL

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Aural	Light	Calls Attention To:

HL7202 - HL8046, HL8076 - HL8347

Siren	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message: AUTOPILOT DISC CONFIG DOORS CONFIG FLAPS CONFIG GEAR STEERING CONFIG PARKING BRAKE CONFIG RUDDER CONFIG SPOILERS CONFIG STABILIZER

HL8075

Siren	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message: AUTOPILOT DISC CONFIG DOORS CONFIG FLAPS CONFIG GEAR STEERING CONFIG PARKING BRAKE CONFIG RUDDER CONFIG SPOILERS CONFIG STABILIZER OVERSPEED

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Aural	Light	Calls Attention To:

HL8075

Siren (Silence by pushing Master WARNING/CAUTION Reset switch)	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message: CABIN ALTITUDE PILOT RESPONSE STABILIZER

HL7202 - HL8046, HL8076 - HL8347

Siren (Silence by pushing Master WARNING/CAUTION Reset switch.	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message: CABIN ALTITUDE OVERSPEED PILOT RESPONSE STABILIZER

Voice annunciation VEE ONE	None	Airspeed at V1 during takeoff
Voice annunciation ENGINE FAIL	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red ENG FAIL on both PFDs
Beeper	Master CAUTION lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	New EICAS caution message, except: ENG SHUTDOWN ENG SHUTDOWN L ENG SHUTDOWN R
High-low chime	None	New EICAS medium level communication message

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Aural	Light	Calls Attention To:
Voice annunciation: DON'T SINK, DON'T SINK TOO LOW, TERRAIN	GND PROX light	GPWS immediate alert.

HL8043 - HL8077

C-chord	None	Approaching MCP selected altitude.

Voice annunciation TRAFFIC, TRAFFIC	None	Amber TRAFFIC message and TCAS TA traffic display on ND

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Aural	Light	Calls Attention To:
Voice annunciation: CLIMB, CLIMB CLIMB, CLIMB NOW, CLIMB, CLIMB NOW CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB DESCEND, DESCEND DESCEND, DESCEND NOW, DESCEND, DESCEND NOW DESCEND, CROSSING DESCEND, DESCEND, CROSSING DESCEND INCREASE CLIMB, INCREASE CLIMB INCREASE DESCENT, INCREASE DESCENT LEVEL OFF, LEVEL OFF MAINTAIN VERTICAL SPEED, MAINTAIN MAINTAIN VERTICAL SPEED CROSSING, MAINTAIN MONITOR VERTICAL SPEED	None	Red regions to avoid on PFD Red TRAFFIC message and TCAS RA traffic display on ND
Voice annunciation CLEAR OF CONFLICT	None	Red regions to avoid on PFD, Red TRAFFIC message, and TCAS RA traffic display on ND are no longer displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Aural	Light	Calls Attention To:

HL7202 - HL7205, HL7574 - HL8347

Voice annunciation: OBSTACLE, OBSTACLE, PULL UP TERRAIN, TERRAIN, PULL UP	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red PULL UP on both PFDs Red OBSTACLE or TERRAIN message and obstacle or terrain display on ND
Voice annunciation: CAUTION OBSTACLE CAUTION TERRAIN	GND PROX light	Amber OBSTACLE or TERRAIN message and obstacle or terrain display on ND

HL7532 - HL7573

Voice annunciation TERRAIN, TERRAIN, PULL UP	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red PULL UP on both PFDs Red TERRAIN message and terrain display on ND
Voice annunciation CAUTION TERRAIN	GND PROX light	Amber TERRAIN message and terrain display on ND

Voice annunciation: WINDSHEAR AHEAD GO AROUND, WINDSHEAR AHEAD	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red WINDSHEAR on both PFDs Red WINDSHEAR message and PWS display on ND
Voice annunciation MONITOR RADAR DISPLAY	None	Amber WINDSHEAR message and PWS display on ND

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Aural	Light	Calls Attention To:
Siren, followed by voice annunciation WINDSHEAR, WINDSHEAR, WINDSHEAR	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red WINDSHEAR on both PFDs
Voice annunciation PULL UP	Master WARNING lights (Extinguish by pushing Master WARNING/CAUTION Reset switch)	Red PULL UP on both PFDs
Siren (If caused by Thrust lever at idle, silence by pushing Master WARNING/CAUTION Reset switch)	Master WARNING lights (If caused by Thrust lever at idle, extinguish by pushing Master WARNING/CAUTION Reset switch)	EICAS warning message CONFIG GEAR for: • Thrust lever at idle, and • radio altitude less than 800 feet, and • gear not down and locked.
Voice annunciation: SINK RATE TERRAIN	GND PROX light	GPWS immediate alert
Voice annunciation: GLIDE SLOPE TOO LOW, FLAPS TOO LOW, GEAR	GND PROX light (Inhibited by pushing the respective GND PROX OVRD switch)	GPWS immediate alert
Altitude voice annunciations	None	Altitude voice annunciations during approach

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Flight Deck Panel Annunciator Lights

Flight deck panel annunciator lights are used with EICAS messages to:

- help locate and identify affected systems and controls
- reduce potential for error

Airspeed Voice Annunciations and Alerts

Takeoff V1 Airspeed

The voice annunciation VEE ONE sounds when airspeed reaches V1 during takeoff.

Stall Warning

Warning of an impending stall is provided by left and right stick shakers, which independently vibrate the left and right control columns.

Airspeed Low

The EICAS caution message AIRSPEED LOW is displayed and the box around the current airspeed indication on the PFD is highlighted amber if airspeed is below minimum maneuvering speed.

Overspeed Warning

The EICAS warning message OVERSPEED is displayed if airspeed is greater than VMO/MMO. The message remains displayed until airspeed is reduced below VMO/MMO.

Tail Strike Detection System

The tail strike alert system detects ground contact which could damage the airplane pressure hull. A two inch blade target and two proximity sensors are installed on the aft body of the airplane. The EICAS caution message TAIL STRIKE is displayed when a tail strike is detected.

Takeoff And Landing Configuration Warning System

The takeoff and landing configuration warning system alerts the crew that the airplane is not configured for normal takeoff or normal landing.

Takeoff Configuration Warnings

The respective EICAS warning message CONFIG is displayed if:

- airplane is on the ground, and
- FUEL CONTROL switches are in RUN position, and
- either engine thrust is in takeoff range, and

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- airspeed is less than V1, or airspeed is less than 80 knots for EICAS warning message CONFIG GEAR STEERING, and
- any of the following configurations exist;
  - an entry, forward cargo, or aft cargo door not closed, latched, and locked, or
  - flaps or slats not in takeoff position, or
  - main gear steering not locked, or
  - parking brake set, or
  - rudder trim not centered, or
  - SPEED BRAKE lever not in DOWN detent, or
  - stabilizer trim not in green band

If thrust is decreased below takeoff range and airspeed is less than V1 but the airplane is still not configured for takeoff, the Master WARNING lights are extinguished and the siren is silenced. The CONFIG message remains displayed until airspeed is less than V1 and for 10 seconds.

Landing Configuration Warning

The landing configuration warning system alerts the crew the landing gear is not extended for landing. The EICAS warning message CONFIG GEAR is displayed if:

- the airplane is in flight, and
- any landing gear is not down and locked, and
- any of the following configurations exist;
  - either thrust lever below a nominal glideslope thrust, and below 800 feet, or
  - FLAP lever in landing position

If the message is displayed because a thrust lever below a nominal glideslope thrust at low radio altitudes, the message remains displayed until the Thrust levers are advanced or landing gear is down and locked.

If the message is displayed because the FLAP lever is in landing position, the message remains displayed until the landing gear is down and locked.

Speedbrake Lever Extend Beyond ARM During Climb

In flight, the EICAS warning message CONFIG SPOILERS is displayed if:

- the SPEEDBRAKE lever is extended beyond ARMED, and
- climb or higher thrust is set on either thrust levers

The message remains displayed until:

- the SPEEDBRAKE lever is DOWN or at ARMED, or
- both thrust levers are set below climb thrust

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Configuration Warning System Non-normal Operation

If the takeoff and landing warning system fails, the EICAS advisory message CONFIG WARN SYS will be displayed. If the takeoff and landing configuration system fails, CONFIG messages may or may not be displayed. If the messages are displayed with the CONFIG WARN SYS message, the CONFIG messages may not be correct.

MCP Selected Altitude Alert

Altitude alerting is provided when approaching or departing the altitude selected in the MCP altitude window.

Approaching MCP Selected Altitude

HL8043 - HL8077
At 900 feet prior to reaching the selected altitude a c-chord sounds and a highlighted white box is displayed around the selected altitude and the current altitude on the PFD. The highlights are no longer displayed when within 200 feet of the selected altitude.

HL7202 - HL8042, HL8208 - HL8347
At 900 feet prior to reaching the selected altitude a highlighted white box is displayed around the selected altitude and the current altitude on the PFD. The highlights are no longer displayed when within 200 feet of the selected altitude.

Departing MCP Selected Altitude

When departing the selected altitude by 200 feet, the EICAS alert message ALTITUDE ALERT is displayed, and a highlighted amber box is displayed around the current altitude. The message and amber highlight is no longer displayed when:

- subsequently reapproaching to within 200 feet of the selected altitude, or
- a new MCP altitude is selected, or
- departing more than 900 feet from the selected altitude.

Departing MCP Selected Altitude Alert Inhibits

Departing MCP selected altitude alerts are inhibited when:

- glideslope captured, or
- landing flaps selected and landing gear down and locked.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Crew Alertness Monitor

The FMC continuously monitors switch action on the MCP, EFIS control panel, display select panel, CDUs, and radio transmitter microphone switches. When a predefined time elapses after the last switch action was detected, the EICAS alert message PILOT RESPONSE is displayed.

The message is inhibited:

- below 20,000 feet, during climb, and
- when flaps are not up

Traffic Alert and Collision Avoidance System (TCAS)

TCAS alerts the crew to possible conflicting traffic. TCAS interrogates operating transponders in other airplanes, tracks the other airplanes by analyzing the transponder replies, and predicts the flight paths and positions. TCAS provides TCAS ND messages, voice annunciations, PFD vertical flight path guidance, and traffic displays of the other airplanes to the flight crew. Neither ND messages, voice annunciations, PFD vertical guidance, nor traffic display is provided for other airplanes that do not have operating transponders. TCAS operation is independent of ground–based air traffic control.

TCAS identifies a three–dimensional airspace around the airplane where a high likelihood of traffic conflict exists. The dimensions of this airspace are contingent upon the closure rate with conflicting traffic.

TCAS provides:

- resolution advisory (RA) and display
- traffic advisory (TA) and display
- proximate traffic display
- other traffic display.

TCAS messages and TCAS traffic symbols can be displayed on the ND in the map, map centered, VOR, and approach modes. TCAS messages and TCAS traffic symbols cannot be displayed on the ND in the VOR–centered, approach–centered, or plan modes.

TCAS messages TRAFFIC, TA ONLY, and TCAS TEST may be displayed in all ND modes.

TCAS processing priorities may reduce display of certain air traffic on the ND. Reduced display of air traffic does not affect system collision avoidance alerting capability.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Resolution Advisories (RA) and Display

An RA is a prediction that another airplane will enter the TCAS conflict airspace within approximately 15 to 35 seconds. If altitude data from the other airplane is not available, no RA can be provided.

When TCAS predicts an RA:

- the TCAS red message TRAFFIC is displayed on the ND
- a TCAS voice annunciation sounds
- TCAS PFD vertical guidance is displayed

When the TCAS cyan message TFC is displayed on the ND, and the RA is within the display range of the ND, the TCAS RA Traffic aircraft symbol and its accompanying data tag are displayed on the ND.

The TCAS RA Traffic aircraft symbol is a filled red square. The RA data tag contains the altitude and the vertical motion arrow.

For no–bearing RAs, the red RA label is displayed below the red message, TRAFFIC, and the RA data tag information is displayed to the right of the label. The RA red data tag contains the distance, altitude, and the vertical motion arrow.

When the RA is further from the airplane than the ND range currently displayed, the TCAS red message OFFSCALE is displayed on the ND.

Traffic Advisories (TA) and Display

A TA is a prediction another aircraft will enter the conflict airspace in 20 to 48 seconds. TAs assist the flight crew in establishing visual contact with the other aircraft.

When TCAS predicts a TA:

- the TCAS amber message TRAFFIC is displayed on the ND
- the TCAS voice annunciation TRAFFIC, TRAFFIC sounds once

When the TCAS cyan message TFC is displayed on the ND and the TA is within the display range of the ND, the TCAS TA Traffic aircraft symbol and its accompanying data tag are displayed on the ND.

The TA Traffic aircraft symbol is a filled amber circle. The TA data tag contains the altitude and vertical motion arrow.

For no–bearing TAs, the amber TA label is displayed below the TRAFFIC message, and the TA data tag information is displayed to the right of the label. The TA labels are displayed below the RA labels. The TA data tag contains the distance, altitude, and vertical motion arrow.

When the TA is further from the airplane than the ND range currently displayed, the TCAS amber message OFFSCALE is displayed on the ND.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Proximate Traffic Display

Proximate traffic is another airplane that is neither an RA or a TA but is within:

- six miles
- 1,200 feet vertically.

When the TCAS cyan message TFC is displayed on the ND, and the Proximate Traffic aircraft is within the ND display range, the TCAS Proximate Traffic aircraft symbol is displayed on the ND.

The TCAS Proximate Traffic aircraft symbol is a filled white diamond. When TCAS is receiving and processing altitude data from the Proximate Traffic aircraft, the proximate traffic data tag is displayed on the ND. The proximate traffic data tag contains the altitude and vertical motion arrow.

Other Traffic Display

Other Traffic aircraft are an aircraft that are within the ND display limits but neither a RA, a TA, nor proximate traffic aircraft. When TCAS is not receiving and processing altitude data from the Other Traffic aircraft, the Other Traffic aircraft becomes Proximate Traffic aircraft automatically when within six miles.

When the TCAS cyan message TFC is displayed on the ND and the Other Traffic aircraft are within the ND display range, the TCAS Other Traffic symbol is displayed on the ND.

The TCAS Other Traffic symbol is a hollow white diamond. When TCAS is receiving and processing altitude data from the Other Traffic aircraft, a data tag like that described in Proximate Traffic Display is displayed.

TCAS PFD Vertical Guidance

When TCAS predicts an RA, TCAS vertical guidance is displayed on the PFD for a maneuver to ensure vertical separation. Traffic avoidance is ensured by adjusting or maintaining a pitch attitude and vertical speed outside the red RA regions.

If the traffic airplane also has TCAS and a mode S transponder, TCAS vertical guidance is coordinated with the traffic aircraft TCAS.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

TCAS ND Messages

ND Message	Color	Description
TFC	Cyan	TCAS traffic display enabled. Inhibited if following TCAS messages are displayed: TCAS FAIL, TCAS OFF, TCAS TEST
TRAFFIC	Amber	TA is occurring.
OFFSCALE	Amber	TA is occurring at range greater than current ND range. Replaced by red OFFSCALE when RA is also occurring at range greater than current ND range.
TRAFFIC	Red	RA is occurring.
OFFSCALE	Red	RA is occurring at range greater than current ND range.
TA ONLY	Cyan	TCAS can not provide RAs. All traffic that would have been RAs are predicted as TAs.
TCAS FAIL	Amber	TCAS failed, or TCAS information cannot be displayed on ND.
TCAS OFF	Amber	TFC switch pushed to display traffic but TCAS not selected on transponder panel.
TCAS TEST	Cyan	TCAS in test mode. Message is displayed on all ND modes and ranges.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

TCAS Voice Annunciations

Voice Annunciation	Condition	Response
TRAFFIC, TRAFFIC	New TA, initial voice annunciation.	Attempt to visually locate the traffic.
MONITOR VERTICAL SPEED	New RA, initial voice annunciation. Present pitch attitude and vertical speed are outside the red RA regions.	Continue to keep pitch attitude and vertical speed outside the red RA regions.
MAINTAIN VERTICAL SPEED, MAINTAIN	New RA, initial voice annunciation. Present pitch attitude and vertical speed are outside the red RA regions.	
MAINTAIN VERTICAL SPEED CROSSING, MAINTAIN	New RA, initial voice annunciation. Present pitch attitude and vertical speed are outside the red RA regions. Airplane will pass through the altitude of the traffic.	
CLIMB, CLIMB	New RA, initial voice annunciation. Present pitch attitude and vertical speed are within the red RA regions.	Increase pitch attitude and vertical speed to remain outside the red RA regions.
CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB	New RA, initial voice annunciation. Present pitch attitude and vertical speed are within the red RA regions. Airplane will climb through the altitude of the traffic.	

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Voice Annunciation	Condition	Response
DESCEND, DESCEND	New RA, initial voice annunciation. Present pitch attitude and vertical speed are within the red RA regions.	Decrease pitch attitude and vertical speed to remain outside the red RA regions.
DESCEND, CROSSING DESCEND DESCEND, CROSSING DESCEND	New RA, initial voice annunciation. Present pitch attitude and vertical speed are within the red RA regions. Airplane will descend through the altitude of the traffic.	
LEVEL OFF, LEVEL OFF	Present pitch attitude and vertical speed are within the red RA regions.	Reduce vertical speed to zero. Adjust pitch attitude and vertical speed to remain outside the red RA regions.
INCREASE CLIMB, INCREASE CLIMB	Existing RA, TCAS requires change in vertical rate. Present pitch attitude and vertical speed are within the red RA regions.	Adjust pitch attitude and vertical speed to remain outside the red RA regions.
INCREASE DESCENT, INCREASE DESCENT		
DESCEND, DESCEND NOW, DESCEND, DESCEND NOW	Existing RA, previous TCAS vertical guidance was to climb. Present pitch attitude and vertical speed are within the red RA regions.	Decrease pitch attitude and vertical speed to remain outside the red RA regions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Voice Annunciation	Condition	Response
CLIMB, CLIMB NOW, CLIMB, CLIMB NOW	Existing RA, previous TCAS vertical guidance was to descend. Present pitch attitude and vertical speed are within the red RA regions.	Increase pitch attitude and vertical speed to remain outside the red RA regions.
CLEAR OF CONFLICT	TCAS PFD vertical guidance is no longer displayed and traffic changes to a TA symbol. Separation is increasing and the RA will not occur. However, the voice annunciation will not sound if TCAS can no longer predict the track of the RA aircraft.	Attempt to visually locate the traffic.

TCAS Normal Operation

TCAS is controlled from the transponder panel. TA/RA is normally selected. However, it is sometimes necessary to select TA ONLY to prevent nuisance RAs.

TA ONLY is selected during engine out operations to prevent RAs when adequate thrust is not available to follow the RA commands.

TCAS Non–Normal Operation

The EICAS advisory message TCAS is displayed and the amber TCAS FAIL message is displayed on both NDs if TCAS is failed.

The EICAS advisory message TCAS OFF is displayed and the amber TCAS OFF message is displayed on both NDs if the TFC switch is pushed when the airplane is below 400 feet radio altitude. TCAS remains in standby mode.

The respective EICAS advisory message TCAS RA CAPTAIN or TCAS RA F/O is displayed if RA guidance cannot be displayed on the respective PFD. The ND traffic displays and voice alerts are unaffected.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

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

Introduction

GPWS and PWS provide:

HL8043 - HL8077
- runway awareness and advisory system annunciations on the ground and in flight

HL7202 - HL7205, HL7574 - HL8347
- look-ahead obstacle and terrain alerts for potentially hazardous flight conditions involving impact with the obstacles and the ground

HL7532 - HL7573
- look-ahead terrain alerts and immediate alerts for potentially hazardous flight conditions involving impact with the ground
- predictive windshear alerts and immediate windshear alerts

HL7202 - HL7205, HL7733 - HL8347
- bank angle voice alerts
- altitude voice annunciations during approach

Runway Awareness and Advisory System (RAAS)

HL8043 - HL8077

In flight RAAS voice annunciations are enabled or inhibited based on an algorithm that numerically subtracts the landing runway touchdown zone elevation in the GPWS database from the pressure altitude of the airplane. The term "above field elevation" is used in the system description for these altitudes.

The RAAS provides voice annunciations to assist flight crew awareness of airplane position during ground operations, approach to landing, and go-around. The airports in the RAAS airport database include details for every runway on the airport.

Note: RAAS voice annunciations are based upon RAAS database runway details. RAAS voice annunciations are not based upon the runway intended or planned. RAAS voice annunciations do not take into account airplane performance factors such as airplane weight, wind, runway condition, slope, air temperature, or airport altitude. The absence of RAAS voice annunciations does not ensure that a runway is appropriate for takeoff or landing. RAAS voice annunciations do not ensure that a runway is inappropriate for takeoff or landing. Flight crew is responsible to use other means available to ensure correct runway selection and the performance calculations are accurate for the conditions.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Look-ahead Obstacles and Peaks Terrain Alerting System

HL7202 - HL7205, HL7574 - HL8347

Look-ahead obstacles and peaks terrain alerts are provided by monitoring obstacle and terrain proximity using a world-wide terrain data base and an obstacle data base. The obstacle data base is not yet world-wide. Terrain data is not designed to be an independent navigation aid.

Proximate obstacle and terrain data may be displayed on the ND. If there is a potential obstacle or terrain hazard, look-ahead alerts are provided based on estimated time to impact.

Estimated time to impact is based on airplane position, altitude, present track, vertical path, and ground speed. FMC VNAV and LNAV path is not considered in the estimated time to impact.

Altitude used for look-ahead terrain mode alerts are a weighted combination of radio altitude, barometric altitude, GPS, and previous flight path. Weighting is reduced for an altitude source which becomes less reliable.

Note: Obstacles or terrain ahead of the airplane may exceed available climb performance. A GPWS caution or warning does not guarantee obstacle or terrain clearance.

When the TERR switch is pushed on, the TERR symbol is displayed on the ND and obstacle and terrain contours may be displayed.

When obstacle and terrain contours are displayed, the altitudes of the highest and lowest displayed obstacle or terrain are displayed below the TERR symbol. The color of each altitude corresponds to the altitude of the respective contour.

The highest and lowest elevations of the obstacles and terrain displayed are inhibited for obstacles and terrain further than 320 nm. The highest and lowest elevations of obstacles and terrain displayed are also inhibited for some obstacles and terrain that are directly abeam of the airplane heading and closer than 320 nm.

When the airplane is higher than 2,000 feet above the terrain, obstacles and terrain peaks are displayed using solid, high density, and low density contours of green. The highest obstacles or terrain is represented by solid green, and the lowest obstacles or terrain displayed is represented by low density green.

When the airplane is lower than 2,000 feet above the terrain, all obstacles and terrain within 2,000 feet of airplane barometric altitude is displayed on the navigation display.

When an obstacle or terrain alert occurs, the respective message is displayed on the ND. When an OBSTACLE alert occurs while a TERRAIN alert message is displayed, the OBSTACLE alert message replaces the TERRAIN alert message. Both messages will not be displayed at the same time.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

The terrain display is correlated to GPS position, or to ADIRU position if GPS position is intermittently unavailable.

Terrain and weather radar cannot be simultaneously displayed on the ND. When one pilot selects terrain and the other pilot selects weather radar, each display updates on alternating sweeps.

GPWS Look-Ahead Obstacle and Peaks Terrain Alerts

Voice Annunciation	PFD and ND Display and Light	Description
OBSTACLE, OBSTACLE, PULL UP	Red PULL UP on both PFDs Master WARNING lights Red OBSTACLE message on both NDs Solid red obstacle on ND	20 to 30 seconds from projected impact with obstacle. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.
TERRAIN, TERRAIN, PULL UP	Red PULL UP on both PFDs Master WARNING lights Red TERRAIN message on both NDs Solid red terrain on ND	20 to 30 seconds from projected impact with terrain. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.
CAUTION OBSTACLE	Amber OBSTACLE message on both NDs Solid amber obstacle on ND GND PROX light	40 to 60 seconds from projected impact with obstacle. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Voice Annunciation	PFD and ND Display and Light	Description
CAUTION TERRAIN	Amber TERRAIN message on both NDs Solid amber terrain on ND GND PROX light	40 to 60 seconds from projected impact with terrain. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.
TOO LOW, TERRAIN	Amber TERRAIN message on both NDs GND PROX light	Descent below unsafe altitude while too far from any airport in the terrain database. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.

Look-ahead Terrain Alerting System

HL7532 - HL7573

Look-ahead terrain alerts are provided by monitoring terrain proximity using a world-wide terrain data base. The data base contains detailed terrain data near major airports, and data in lesser detail for areas between airports. Terrain within 2,000 feet of airplane altitude is displayed on the navigation display. Terrain data is not designed to be an independent navigation aid.

Proximate terrain data may be displayed on the ND. If there is a potential terrain hazard, Look-ahead alerts are provided based on estimated time to impact.

Estimated time to impact is based on airplane position, altitude, present track, vertical path, and ground speed. FMC VNAV and LNAV path is not considered in the estimated time to impact.

Altitude used for look-ahead terrain mode alerts are a weighted combination of radio altitude, barometric altitude, GPS, and previous flight path. Weighting is reduced for an altitude source which becomes less reliable.

Note: Terrain ahead of the airplane may exceed available climb performance. A GPWS caution or warning does not guarantee terrain clearance.

When the GPWS Terrain switch is pushed on, the TERR symbol is displayed on the ND and terrain contours may be displayed.

When the airplane is higher than 2,000 feet above the terrain, terrain more than 2,000 feet below airplane altitude is not displayed...

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When the airplane is lower than 2,000 feet above the terrain, all obstacles and terrain within 2,000 feet of airplane altitude is displayed on the navigation display.

Note: The GPWS terrain database, GPWS look-ahead terrain alerts, and terrain display do not account for man-made obstructions.

The terrain display is correlated to GPS position, or to ADIRU position if GPS position is intermittently unavailable.

Terrain and weather radar cannot be simultaneously displayed on the ND. When one pilot selects terrain and the other pilot selects weather radar, each display updates on alternating sweeps.

GPWS Look-Ahead Terrain Alerts

Voice Annunciation	PFD and ND Display and Light	Description
TERRAIN TERRAIN PULL UP	PULL UP message on both PFDs Master WARNING lights Red TERRAIN message on both NDs Solid red terrain on ND	20 to 30 seconds from projected impact with terrain. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.
CAUTION TERRAIN	Amber TERRAIN message on both NDs Solid amber terrain on ND GND PROX light	40 to 60 seconds from projected impact with terrain. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.
TOO LOW, TERRAIN	GND PROX light	Descent below unsafe altitude while too far from any airport in the terrain database. Pushing the GND PROX TERR OVRD switch to OVRD inhibits the alert.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Predictive Wind Shear (PWS) and Immediate Windshear Alerting Systems

Windshear alerts are enabled during takeoff, approach, and landing:

- PWS provides windshear alerts when an excessive windshear condition is detected ahead of the airplane
- immediate windshear alerts are provided when an excessive downdraft or tailwind is occurring

PWS Alerting System

The weather radar scans for windshear when the airplane is on the ground and in flight. Weather radar uses radar imaging to detect disturbed air ahead of the airplane. When weather radar scans for windshear, the weather radar antenna scan sweep is reduced.

Prior to takeoff, PWS alerts can be enabled by selecting WXR for display on either EFIS control panel. However, windshear scanning and PWS alerts are enabled even when WXR is not selected for display.

Weather Radar and PWS

WXR Display State	Airplane on ground	Airplane in air
WXR selected for display	Scans for windshear; PWS alerts enabled.	Scans for windshear below 2300 feet radio altitude; PWS alerts only provided below 1200 feet radio altitude.
WXR not selected for display	Scans for windshear when thrust levers are advanced for takeoff; PWS enabled.	Scans for windshear below 2300 feet radio altitude; PWS alerts only provided below 1200 feet radio altitude.

Note: PWS is enabled to provide windshear alerts 12 seconds after weather radar begins scanning for windshear.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

When windshear is not predicted, weather radar returns are displayed only when WXR is selected for display.

PWS Alerts

Voice Annunciation	PFD and ND Display and Light	Description
WINDSHEAR AHEAD, WINDSHEAR AHEAD	Red WINDSHEAR on both PFDs Master WARNING lights Red WINDSHEAR message on both NDs RED windshear symbol on ND	Windshear predicted close to and directly ahead of airplane. Enabled during takeoff, below 1,200 feet radio altitude. Windshear position displayed by PWS symbol on the ND in MAP, MAP CTR, VOR, or APP modes only.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Voice Annunciation	PFD and ND Display and Light	Description
GO AROUND, WINDSHEAR AHEAD	Red WINDSHEAR on both PFDs Master WARNING lights Red WINDSHEAR message on both NDs RED windshear symbol on ND	Windshear predicted within 1.5 miles and directly ahead of the airplane. Enabled during approach, below 1,200 feet radio altitude. Windshear position displayed by PWS symbol on the ND in MAP, MAP CTR, VOR, or APP modes only.
MONITOR RADAR DISPLAY	Amber WINDSHEAR message on both NDs RED windshear symbol on ND	Windshear predicted within 3 miles and ahead of the airplane. Enabled during takeoff and approach, below 1,200 feet radio altitude. Windshear position displayed on PWS on ND in MAP, MAP CTR, VOR, or APP modes only.

Note: Weather radar provides windshear alerts for windshear events containing some level of moisture or particulate matter.

Note: Weather radar detects microbursts and other windshears with similar characteristics. Weather radar does not provide alerting for all types of windshear. The flight crew must continue to rely on traditional windshear avoidance methods.

Immediate Windshear Alerts

Voice Annunciation	PFD Display and Light	Description
(Siren) WINDSHEAR, WINDSHEAR, WINDSHEAR	Red WINDSHEAR on both PFDs Master WARNING lights	Excessive windshear detected by GPWS. Enabled below 1,500 feet radio altitude. GPWS windshear detection begins at rotation.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Bank Angle Voice Annunciations

HL7202 - HL7205, HL7733 - HL8347

HL8075

The voice alert BANK ANGLE sounds if bank angle exceeds 35°, 40°, and 45°. The voice alert BANK ANGLE also sounds at low altitudes during takeoff and landing for bank angles as small as 10°.

HL7202 - HL7205, HL7733 - HL8046, HL8076 - HL8347

The voice alert BANK ANGLE sounds if bank angle exceeds 35°, 40°, and 45°.

Immediate Alerting System

Voice Annunciation	PFD and ND Display and Light	Description
DON'T SINK	GND PROX light	Altitude loss with flaps and/or gear up after takeoff or go-around.
GLIDE SLOPE	GND PROX light	Excessive deviation below glide slope. Volume and repetition rate increase as deviation increases. Pushing the GND PROX G/S INHIB switch inhibits the alert when pushed below 1,000 feet radio altitude.
PULL UP	Red PULL UP message on both PFDs Master WARNING lights	Follows SINK RATE alert when descent rate becomes severe, or follows TERRAIN alert with flaps and/or gear not in landing configuration when excessive terrain closing rate continues.
SINK RATE	GND PROX light	Excessive descent rate.
TERRAIN	GND PROX light	Excessive terrain closing rate.
TOO LOW, FLAPS	GND PROX light	Unsafe terrain clearance with flaps not in landing configuration at low altitude and airspeed. Pushing the GRND PROX FLAP OVRD switch to OVRD inhibits the alert.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Voice Annunciation	PFD and ND Display and Light	Description
TOO LOW, GEAR	GND PROX light	Unsafe terrain clearance with gear not in landing configuration at low altitude and airspeed with gear not down. Pushing the GRND PROX GEAR OVRD switch to OVRD inhibits the alert.
TOO LOW, TERRAIN	GND PROX light	Follows DON'T SINK alert with gear and/or flaps up after takeoff or go-around for altitude loss at low altitude, or unsafe terrain clearance with gear and/or flaps not in landing configuration at low altitude and airspeed. Pushing the GRND PROX FLAP OVRD switch to OVRD inhibits the alert, when the alert is due to flaps not in landing position. Pushing the GRND PROX GEAR OVRD switch to OVRD inhibits the alert, when the alert is due to gear not down.

Altitude Voice Annunciations During Approach

GPWS provides altitude voice annunciations during approach:

HL7532 - HL7752

- 500 feet – FIVE HUNDRED
- 100 feet – ONE HUNDRED
- 50 feet – FIFTY
- 40 feet – FORTY
- 30 feet – THIRTY
- 20 feet – TWENTY
- 10 feet – TEN

HL7202 - HL7205, HL7764 - HL8347

- 2,500 feet – RADIO ALTIMETER
- 1,000 feet – ONE THOUSAND
- 500 feet – FIVE HUNDRED
- 400 feet – FOUR HUNDRED

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

- 300 feet – THREE HUNDRED
- 200 feet – TWO HUNDRED
- 100 feet – ONE HUNDRED
- 50 feet – FIFTY
- 40 feet – FORTY
- 30 feet – THIRTY
- 20 feet – TWENTY
- 10 feet – TEN

Minimums Voice Annunciation

GPWS provides the voice annunciation MINIMUMS at the altitude set by the Captain's MINS selector on the EFIS Control Panel.

GPWS Non-Normal Operation

Altitude Voice Annunciations During Approach Non-Normal Operation

If there is a fault in voice annunciations during the approach system, the EICAS advisory message ALT CALLOUTS is displayed and GPWS annunciations during the approach are inhibited.

RAAS Non-Normal Operation
HL8043 - HL8077

If the RAAS Runway Override switch is in OVRD, the EICAS advisory message RUNWAY OVRD is displayed and RAAS voice annunciations and ND messages are inhibited.

If GPS position is uncertain, the EICAS advisory message RUNWAY POS is displayed and RAAS voice annunciations and ND messages are inhibited.

If there is a fault in RAAS or the airport is not in the GPWS RAAS database, the EICAS advisory message RUNWAY SYS is displayed and RAAS voice annunciations and ND messages are inhibited.

Windshear Alert Non-Normal Operation

If there is a fault in the immediate windshear system or in the PWS system, the EICAS advisory message WINDSHEAR SYS is displayed and the voice alert WINDSHEAR and the PFD alert WINDSHEAR are inhibited.

Look-Ahead Alert Non-Normal Operation

If there is a fault in look-ahead terrain alert, the respective terrain status annunciation TERR is displayed.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Immediate Alert Non-Normal Operation

If there is a fault in any immediate alert, the respective alert is inhibited. If a fault occurs in any immediate alert other than windshear, there is no indication to the flight crew of which alerts are inhibited. GPWS will continue to provide immediate alerts for which no fault has occurred.

Alert Inhibits

Alerts are inhibited when they are operationally unnecessary or inappropriate. Alerts are inhibited during normal system operation, and during part of the takeoff and landing to prevent distracting the crew.

GPWS immediate windshear alert inhibits all PWS, TCAS, and other GPWS alerts.

When TA/RA is selected on the transponder panel and a GPWS or PWS warning alert occurs, TCAS automatically inhibits RA mode. During the inhibit, all aircraft that would have been predicted as an RA are predicted as a TA. When GPWS and PWS warning alerts are no longer occurring, the RA mode inhibit ends.

Alert Messages Inhibited During Normal System Operation

Certain EICAS alert messages are time delayed, even though related flight deck panel annunciator lights are illuminated. Time delay inhibits prevent normal in–transit indications from being displayed as EICAS alert messages. For example, valves are generally only sensed open or closed, not in–transit. When a valve is in–transit, the message indicating the valve has failed to open or close is inhibited to allow the valve time to move to the commanded position. If the valve is not in the commanded position at the end of the inhibit time delay, the respective EICAS alert message is displayed.

Alert Messages Inhibited By Other Alert Messages

Some EICAS alert messages are inhibited if another related alert message is displayed. For example, individual hydraulic pump pressure messages are inhibited if a hydraulic system pressure message is displayed.

Voice Annunciation Inhibits

Voice annunciations for warning alerts inhibit new voice annunciations for caution alerts.

All voice annunciations are prioritized to aid flight crew decision making when more than one alert could occur.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

ND Display Alert Inhibits and Automatic Display

Alert displays on the NDs are prioritized to aid flight crew decision making when more than one alert occurs. The displays are also prioritized when neither ND is in MAP, MAP CTR, VOR, or APP mode.

Immediate windshear alert inhibits the automatic display of a new TCAS, look-ahead terrain, or PWS alerts.

TCAS traffic can be displayed concurrently with either TERR and WXR display.

New TCAS TRAFFIC TA or RA alerts:

- When both NDs are in MAP, MAP CTR, VOR, or APP mode and a new TCAS TA or RA alert occurs, TFC is selected automatically for both NDs and TCAS traffic is displayed on both NDs.
- When only one ND is in MAP, MAP CTR, VOR, or APP mode and a new TCAS TA or RA alert occurs, TFC is selected automatically for that ND and TCAS traffic is displayed. The ND not in MAP, MAP CTR, VOR, or APP mode is armed for TCAS display and TFC will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected.
- When neither ND is in MAP, MAP CTR, VOR, or APP mode and a new TCAS TA or RA alert occurs, both NDs are armed for TCAS display and TFC will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected.

New look-ahead terrain alerts:

- When both NDs are in MAP, MAP CTR, VOR, or APP mode and a new look-ahead terrain alert occurs, TERR is selected automatically for both NDs.
- When only one ND is in MAP, MAP CTR, VOR, or APP mode and a new look-ahead terrain alert occurs, TERR is selected automatically for that ND. The ND not in MAP, MAP CTR, VOR, or APP mode is armed for TERR display and TERR will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected. TERR is disarmed by selecting WXR prior to selecting MAP, MAP CTR, VOR, or APP mode.
- When neither ND is in MAP, MAP CTR, VOR, or APP mode and a new look-ahead terrain alert occurs, both NDs are armed for TERR display and TERR will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected. TERR is disarmed for either ND by selecting WXR prior to selecting MAP, MAP CTR, VOR, or APP mode on the respective ND.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

New PWS alerts:

- When both NDs are in MAP, MAP CTR, VOR, or APP mode and a new PWS alert occurs, WXR is selected automatically for both NDs.
- When only one ND is in MAP, MAP CTR, VOR, or APP mode and a new PWS alert occurs, WXR is selected automatically for that ND. The ND not in MAP, MAP CTR, VOR, or APP mode is armed for WXR display and WXR will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected. WXR is disarmed by selecting TERR prior to selecting MAP, MAP CTR, VOR, or APP mode.
- When neither ND is in MAP, MAP CTR, VOR, or APP mode and a new PWS alert occurs, both NDs are armed for WXR display and WXR will be selected automatically when MAP, MAP CTR, VOR, or APP mode is selected. WXR is disarmed by selecting TERR prior to selecting MAP, MAP CTR, VOR, or APP mode.

Alerts Inhibited Before Engine Start and After Shutdown

Alert Inhibited	For Message	Inhibit Occurs
Master CAUTION lights Beeper	For all EICAS caution messages	On the ground, and both FUEL CONTROL switches in CUTOFF
Respective EICAS messages: BLEED OFF ELEC BACKUP GEN ELEC DRIVE, ELEC GEN OFF ENG OIL PRESS HYD PRESS PRI	For EICAS caution messages: ENG SHUTDOWN L ENG SHUTDOWN R ENG SHUTDOWN	On the ground, and both FUEL CONTROL switches in CUTOFF

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alerts Inhibited During Engine Start

HL7532 - HL7766

Alert Inhibited	Inhibit Begins	Inhibit Ends
All new EICAS caution and advisory messages, except: APU LIMIT APU SHUTDOWN ENG AUTOSTART ENG FUEL VALVE ENG SHUTDOWN ENG START VALVE ENG STARTER CUTOUT OVERHEAT ENG	ENGINE START /IGNITION selector to START	Engine reaches idle RPM, or start is aborted, or five minutes elapse.

HL7202 - HL7205, HL7782 - HL8347

Alert Inhibited	Inhibit Begins	Inhibit Ends
All new EICAS caution and advisory messages, except: APU LIMIT APU SHUTDOWN ENG AUTOSTART ENG FUEL VALVE ENG SHUTDOWN ENG START VALVE ENG STARTER CUTOUT OVERHEAT ENG	ENGINE START selector to START	Engine reaches idle RPM, or start is aborted, or five minutes elapse.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alerts Inhibited During Takeoff

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
EICAS advisory message TCAS OFF	Messages are inhibited	On ground	400 feet radio altitude
TCAS TA voice alerts	TCAS TAs		Approximately 500 feet radio altitude
All TCAS RAs	TCAS RAs are inhibited When RA selected on panel, TCAS switches automatically to TA only mode and TCAS message TA ONLY is displayed on ND.		Approximately 1,000 feet radio altitude
TCAS DESCEND RAs	Alerts are inhibited		Approximately 1,100 feet radio altitude
Red ENG FAIL on PFD	Engines not producing commanded thrust and rate of thrust increase insufficient; same condition as EICAS messages ENG THRUST L, R	Engine start	65 knots airspeed
EICAS caution message ENG THRUST L, R	Messages are inhibited		Six knots before V1
STATUS cue	All EICAS status messages		30 minutes after lift-off.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

All EICAS communication messages except: CABIN ALERT Hi-Lo Chime	Messages are inhibited	Either engine in takeoff thrust range	400 feet radio altitude or 20 seconds after lift-off, whichever occurs first, or on the ground and thrust on both engines reduced below takeoff thrust range

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

All EICAS communication messages	Messages are inhibited	Either engine in takeoff thrust range	400 feet radio altitude or 20 seconds after lift-off, whichever occurs first, or on the ground and thrust on both engines reduced below takeoff thrust range

EICAS warning message CONFIG GEAR STEERING	Message is inhibited	80 knots airspeed	Landing

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
Master CAUTION lights Beeper If the Master CAUTION lights illuminate before reaching 80 knots airspeed, they continue to be illuminated when 80 knots airspeed is exceeded and cannot be extinguished until the inhibit ends. If new EICAS caution messages are displayed during the inhibit, the beeper will sound when the inhibit ends.	New EICAS caution messages displayed during inhibit.	80 knots airspeed	400 feet radio altitude or 20 seconds after lift-off, whichever occurs first. If rejected takeoff initiated above 80 knots, inhibit continues until airspeed is less than 75 knots.
All EICAS advisory messages	Messages are inhibited		400 feet radio altitude or 20 seconds after lift-off, whichever occurs first, or if takeoff thrust not selected on both engines. If rejected takeoff initiated above 80 knots, inhibit continues until airspeed is less than 75 knots.
New PWS caution alerts	Messages are inhibited	80 knots airspeed	400 feet radio altitude
New PWS warning alerts	Messages are inhibited	100 knots airspeed	50 feet radio altitude
New red ENG FAIL on PFD	EICAS caution message ENG THRUST L, R	Six knots before V1	Landing

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
Master WARNING lights Bell If the Master WARNING lights illuminate and fire bell sounds before reaching V1, they continue to be illuminated and sound when V1 is exceeded. If new FIRE messages are displayed during the inhibit, the bell will sound when the inhibit ends.	New EICAS warning messages FIRE displayed during inhibit.	V1 or rotation, which-ever occurs first.	400 feet radio altitude or 25 seconds after inhibit began, whichever occurs first.
Master WARNING lights Siren If the Master WARNING lights illuminate and siren sounds before reaching V1, they continue to be illuminated and sound when V1 is exceeded If new EICAS warning messages are displayed during the inhibit, the siren will sound when the inhibit ends.	New EICAS warning messages displayed during inhibit, except FIRE		
EICAS warning messages CONFIG, except CONFIG GEAR STEERING, for takeoff configuration warnings	Messages are inhibited		Landing
Master WARNING lights Siren	EICAS warning message CONFIG GEAR	Gear unlock for retraction	825 feet radio altitude or 150 seconds after inhibit began, whichever occurs first.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
All PWS alerts	Messages are inhibited	1,200 feet radio altitude	Approach

Alerts Inhibited During Landing

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
All PWS alerts	Alerts are inhibited	2,300 feet radio altitude	1,200 feet radio altitude
TCAS INCREASE DESCENT RAs		Approximately 1,500 feet radio altitude	Go-around at approximately 1,500 feet radio altitude
TCAS DESCEND RAs		Approximately 1,100 feet radio altitude	Go-around at approximately 1,100 feet radio altitude
All TCAS RAs	Alerts are inhibited When RA selected on panel, TCAS switches automatically to TA only mode and TCAS message TA ONLY is displayed on ND	Approximately 1,000 feet radio altitude	Go-around at approximately 1,000 feet radio altitude

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

All EICAS communication messages, except: CABIN ALERT	Messages are inhibited	800 feet radio altitude	75 knots airspeed
STATUS cue	All EICAS status messages		

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Alert Inhibited	For Message	Inhibit Begins	Inhibit Ends
HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285			
All EICAS communication messages	Messages are inhibited	800 feet radio altitude	75 knots airspeed
STATUS cue	All EICAS status messages		
TCAS voice alerts	TCAS TAs	Approximately 500 feet radio altitude	Go-around at approximately 500 feet radio altitude
New PWS caution alerts	Alerts are inhibited	400 feet radio altitude	80 knots airspeed
EICAS alert message WINDSHEAR SYS	Message is inhibited		
EICAS advisory message TCAS OFF			Go-around at 400 feet radio altitude
Master CAUTION lights Beeper	All EICAS caution messages, except: AUTOPILOT AUTOTHROTTLE DISC NO AUTOLAND SPEEDBRAKE EXTENDED	LAND 2 or LAND 3 displayed on PFD, and 200 feet radio altitude	80 knots ground speed, or 40 seconds elapse, or 800 feet radio altitude
New PWS warning alerts	Alerts are inhibited	50 feet radio altitude	100 knots airspeed

EICAS Event Record

Pushing the EICAS EVENT RCD switch records currently displayed engine indications and additional EICAS maintenance information. Up to five events may be recorded by the first five pushes. The system also records out of limit parameters and related conditions automatically when a system parameter is exceeded.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

EICAS Alert Messages

Message	Level	Aural	Message Logic
AIRSPEED LOW	Caution	Beeper	Airspeed is below minimum maneuvering speed.
ALTITUDE ALERT	Caution	Beeper	Airplane has deviated from MCP selected altitude.
ALTITUDE CALLOUTS	Advisory		Altitude and minimums voice annunciations during approach are no longer provided.

HL7202 - HL7783, HL8006 - HL8042, HL8208 - HL8218, HL8250, HL8274, HL8275, HL8346, HL8347

CONFIG DOORS	Warning	Siren	Passenger entry, service exit, forward cargo, or aft cargo door is not closed, not latched, and not locked when either engine's thrust is in the takeoff range on the ground.

HL8005, HL8043 - HL8077, HL8226, HL8251, HL8252, HL8285

CONFIG DOORS	Warning	Siren	An entry, forward cargo, main deck cargo, or aft cargo door is not closed, latched, and locked when either engine's thrust is in the takeoff range on the ground.

CONFIG FLAPS	Warning	Siren	Flaps or slats are not in a takeoff position when either engine's thrust is in the takeoff range on the ground.
CONFIG GEAR	Warning	Siren	Any landing gear is not down and locked when either thrust lever is closed below 800 feet radio altitude or when flaps are in a landing position.
CONFIG GEAR STEERING	Warning	Siren	Main gear steering is unlocked when either engine's thrust is in the takeoff range on the ground.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
CONFIG PARKING BRAKE	Warning	Siren	Parking brake is set when either engine's thrust is in the takeoff range on the ground.
CONFIG RUDDER	Warning	Siren	Rudder trim is not centered when either engine's thrust is in the takeoff range on the ground.
CONFIG SPOILERS	Warning	Siren	Speedbrake lever is not DOWN when either engine's thrust is in the takeoff range on the ground; or, speedbrake lever extended beyond ARMED in flight, and climb thrust or greater set on either thrust lever.
CONFIG STABILIZER	Warning	Siren	Stabilizer is not within the greenband when either engine's thrust is in the takeoff range on the ground.
CONFIG WARNING SYS	Advisory		A fault is detected in the configuration warning system.
GND PROX SYS	Advisory		Ground proximity alerts are no longer provided.
OVERSPEED	Warning	Siren	Airspeed has exceeded Vmo/Mmo.
PILOT RESPONSE	Warning	Siren	After caution message PILOT RESPONSE displayed, FMC does not detect crew activity in monitored area within a specified time.
PILOT RESPONSE	Caution	Beeper	After advisory message PILOT RESPONSE displayed, FMC does not detect crew activity in monitored area within a specified time.
PILOT RESPONSE	Advisory		FMC does not detect crew activity in monitored area within a specific time.

HL8043 - HL8077

RUNWAY OVRD	Advisory		Runway Override switch is in OVRD.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Message	Level	Aural	Message Logic
HL8043 - HL8077			
RUNWAY POS	Advisory		RAAS not operating because GPS position accuracy is inadequate.
HL8043 - HL8077			
RUNWAY SYS	Advisory		RAAS failed, or RAAS unavailable because airport is not in the RAAS database.
TAIL STRIKE	Caution	Beeper	A tail strike has been detected.
TCAS	Advisory		TCAS has failed.
TCAS OFF	Advisory		TCAS is in standby mode.
TCAS RA CAPTAIN, F/O	Advisory		TCAS cannot display RA guidance on the affected PFD.
TERR OVRD	Advisory		Ground proximity terrain override switch is in OVRD.
TERR POS	Advisory		Terrain position data has been lost. Look-ahead terrain alerting and display unavailable because GPS has failed. During time between GPS failure and display of TERR POS message, IRS provides position for look-ahead alerting and display.
WINDSHEAR SYS	Advisory		Windshear alerts may not be provided.

EICAS Memo Messages

Message	Level	Aural	Message Logic
VMO GEAR DOWN	Memo		GEAR DOWN is selected on the Misc System Controls (MSC) maintenance page.

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.

Intentionally
Blank

Boeing Proprietary. Copyright © Boeing. ECCN: 9E991. See title page for details.